

FINAL EIR SOUTHEAST ROSEVILLE
SPECIFIC PLAN 1987 AMENDMENT

TECHNICAL APPENDIX

SCH # 87040605

PREPARED FOR
CITY OF ROSEVILLE

JANUARY 4, 1988

PREPARED BY
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**SOUTHEAST ROSEVILLE SPECIFIC PLAN 1987 AMENDMENT
TECHNICAL APPENDIX**

List of Persons and Agencies Commenting on EIR

Planning Commission Hearing Minutes

December 14, 1987
November 30, 1987
November 16, 1987
October 26, 1987
October 19, 1987

Project Review Commission Hearing Minutes

October 1, 1987
September 22, 1987

Comments and Response Documents

December 14, 1987
October 26, 1987
October 19, 1987
October 13, 1987
September 25, 1987

List of Plants

New York State Power Lines Project - Final Report



**LIST OF PERSONS AND AGENCIES COMMENTING
ON THE DRAFT EIR**



LIST OF PERSONS AND AGENCIES COMMENTING ON THE DRAFT EIR

Letters of Comment Received

Jerry Jackson, Roseville Public Works Department
Ed Mahany, Roseville Parks and Recreation Department
Roseville City Clerk
Maynard E. Bean, Roseville
Town of Loomis
Noel A. Bonderson, Placer County APCD
Michael Dean, Roseville City Attorney
David Dockman, Roseville Electric Utility
Dorothy M. Alexander, Roseville
Eleanor Holladay, Roseville
Gordon Hutchings, Roseville
Thomas D. McMahan, Placer County Planning Department
R. W. Foust, Transportation Planning, County of Sacramento.
Sandra Harris, Granite Bay
Dr. Ron Feist, PhD., Superintendent Eureka Union School District
California Office of Planning and Research
Brian J. Smith, Chief, Environmental Branch, Caltrans District 3
Gordon F. Snow, Projects Coordinator, Department of Fish and Game

Comments Received During Public Hearings

Dr. Jay Beaumont	Epidemiologist, U.C. Davis
Dr. Dan Bracken	Physicist, Power Line Effects, Portland OR
Robin Kain-Speddan	City of Roseville Risk Analyst
Lawrence Angelo	Atty rep Roseville re: Civil Suits
Steve Robbins	Atty rep Southfork Partnership
Dr. Garrin Winton	Epidemiologist, U.C. Davis
David Manhart	PRC Member
David Wade	Planner rep Southfork Partnership
Jack Peers	Traffic Engineer
Marge Heartney	Sierra Club, Mother Lode Chapter
Judith LaMarr	Cleaner Air Partnership, Sacramento
Noel Bonner	Placer County Air Pollution Control District
David Young	SACOG
Bob Languell	R.C. Fuller Associates
Ron Feist	Eureka School District Superintendent
Larry Pagel	Roseville Public Works
Dan Dameron	Roseville Planning Department
Ed Mahany	Roseville Parks & Recreation Director



Roland Bergthold	Roseville
Bill Zisk	Roseville
Steve Dillon	Roseville Planning Director
Dick Roberts	Folsom Lake Estates
Richard Fuller	R.C. Fuller Associates
Morgan Evans	Roseville
John Hendricks	Granite Bay
Robert Townley	Roseville
Harriet Wilson	Rocklin
Robert Coyle	Granite Bay
John Hendrick	Granite Bay
Sandy Harris	Granite Bay
Lee Hora	Granite Bay
Richard Grace	Granite Bay
Cindy Johnson	Granite Bay
Claudia Darle	Granite Bay
Marilyn Eddy	Roseville
Walt Bader	Auburn Folsom Road, Placer County
Rick Chavez	Engineer, Morton & Pitalo rep Southfork
David Dockham	Roseville Electric Department
C. Lee Lowry	Geotechnical Engineer rep Southfork
Dennis Youngdahl	Geotechnical Engineer rep Southfork
H. John McAleer	Historian - Barn Study

Roseville Project Review Commission

Mel Hamel
 James Smith
 Dan MacClain
 David Manhart
 Dennis Azevedo
 Jack Wallace
 Clair Alway

Roseville Planning Commission

Frederic Lohse
 Pauline Roccucci
 Chris Hayes
 Bill Huffman
 David Watts
 Jim Gray
 Audrey Huisking



PLANNING COMMISSION HEARING MINUTES



CITY OF ROSEVILLE

PLANNING COMMISSION MEETING

December 14, 1987

P.C. Present: Frederic Lohse, Pauline Roccucci, Chris Hays,
Bill Huffman, David Watts

P.C. Absent: Jim Gray, Audrey Huisking

Staff Present: Dan Dameron, Planner
Larry Pagel, Senior Civil Engineer
Nancy Christie, Secretary

E.I.R. -- SOUTHEAST ROSEVILLE SPECIFIC PLAN -- SOUTH OF DOUGLAS
BLVD., EAST OF ROCKY RIDGE DRIVE -- CERTIFICATION OF A DRAFT
ENVIRONMENTAL IMPACT REPORT

Mr. Huffman said that he had reviewed the tapes from the meeting he had missed and felt adequately prepared to continue hearing the item tonight.

Mr. Dan Bracken, 7538 SE 28th Ave., Portland, OR, an expert on electrical and magnetic field radiation, went over principles of high and low voltage current configurations.

Dr. Jay Beaumont, Davis CA, an expert in epidemiology from the UC Davis Medical School, who was with the Center for Disease Control in Atlanta, reviewed aspects of several relevant studies on the effect of electric current on cancer.

In particular, the Savitz Study of 1986, a landmark work in this area was looked at in some detail. He said that the exposure determination was based on measurements of magnetic field radiation (not a significant impact) and on wiring configuration. The results for the wiring configuration showed a relative risk between 1.2 and 2.9, although a revised study shows it to be more like 1.5.

Mr. Watts asked if the study surveyed more apartments or single family homes.

Dr. Beaumont reviewed the process used in conducting the study. He said that few studies have been done in this area and that the studies that have been done are inconsistent. Also no animal studies have been done in this area. The conclusion points toward the fact that there may be a risk, but the evidence is not conclusive.

Mrs. Roccucci asked if there was any study on the effect of this radiation on plants.

Dr. Beaumont said that there had been no studies in this area.

Mr. Hays asked if there might even be a greater risk in the home from exposure to appliances than from outside power lines.

Dr. Beaumont said that there might be.

Mr. Dameron commented that Staff is concerned about the unknown aspect of exposure and feels that it would be unwise to locate parks there and risk finding them unusable say in 10 years.

Dr. Beaumont said that that concern was entirely justifiable.

Robin Kain-Speddan, Risk Analyst for the City of Roseville, noted that several studies are underway at this time. She said that safety is the big issue and went over some of the accidents involving power lines and towers and the public. She said that there is no central source for information on accidents and that possibly this information has been suppressed by utilities. She noted that in one of the accidents the precautions taken by the utility included a 10' fence with a double row of barbed wire on the top. She added that many suits are settled out-of-court to avoid publicity. She stated that the City might lose its risk insurance if exposure to these high-tension lines were added.

Mr. Hays asked if the lines could be put underground.

Ms. Kain-Speddan said that it would not be possible to put these lines underground.

Mr. Dameron commented on the proposed use of the powerline easement for parking for park uses. He asked if the parking lot or just the towers themselves should be fenced.

Ms. Kain-Speddan responded that the parking lot should be fenced. She added that people very possibly will congregate in the parking areas.

Mr. Dameron said that the responses from Risk Management will be included in the document.

Mr. Lawrence Angelo, 7919 Folsom, Sacramento, the Council for the City on Civil Suits, said that any public usage of the powerline easement would create increased risks for the city. In particular, the liability risks would increase because of: a dangerous condition on public property, the fact that negligence in the maintenance or use of this easement was a risk because ownership was not a necessary pre-requisite to being sued. He added that accidents of this type with powerlines tend to be catastrophic and involve large awards.

He noted that it is true that other agencies have located parks near power lines, but the question to look at is whether it is a risk that can be avoided.

Mr. Hays asked Mr. Dameron what the alternative to locating park facilities under the power line and what the risk associated with

that alternative would be.

Mr. Steve Robbins, Southfork Partnership, Roseville, said that they had surveyed 13 other park districts. Of the 13, 6 do have facilities under power lines and they pay no higher payments to J.P.A.

Dr. Garrin Winton, 9043 Sky View Ln., Granite Bay, a physician and epidemiologist also at U.C. Davis, cited a number of court cases where children of younger ages can't differentiate between a jungle gym for children and the power line tower which looks like a larger jungle gym.

Mr. David Manhart, 1411 Del Mar Ct., Roseville, expressed concern about rushing through the review process. He asked that alternative uses be considered and looked at more thoroughly. He urged that this Commission make a finding regarding the usage of this area.

Mr. Wade, 735 Sunrise, Roseville, said that parking was being considered for only 2 1/2 acres of an approximate total of 65 acres.

Mr. Lohse surveyed Commission on whether this section of the E.I.R. was adequately covered.

Mr. Dameron said that Staff feels that adequate information has been provided.

Traffic

Mr. Jack Peers, Lafayette, CA., submitted information on two areas that the Commission had additional questions, reduced building in the Broken Spur property and information on the intersection of Old Auburn and Cirby.

Mr. Watts asked that figures on intersection impacts along South Cirby and Cirby be included.

Mr. Peers said that analysis had only been done for the links -- all were LOS 'A'. He noted however, that it would be safe to say that the intersections would easily be LOS 'C' or better.

He noted that there were some LOS 'D' intersections which were potentially unmitigatable, except perhaps by installation of an urban intersection of the type shown earlier.

Mr. Lohse asked what the impact on the entire analysis would be if there was buildout, but no Roseville Parkway.

Mr. Peers said that there would be a tremendous effect on many links and intersections.

Mr. Pagel said that development agreements would ensure that the developers would provide their share of funding for this roadway,

it does not guarantee implementation.

Air Quality

Mr. Dameron commented that at the request of both the Project Review and Planning Commissions a number of experts were here to speak to this issue.

Marge Hartney, Roseville, thanked the Commission for taking the time to look at this issue in more detail. She presented a statement from the Sierra Club with their comments on the proposed E.I.R. She asked that in the review of the specific plan itself, the Commission consider that highest density areas are located near likely public transit and that light rail right-of-way be provided early.

Judith LaMarr, 1823 11th St., Sacramento, from the Cleaner Air Partnership, presented a short slide show on cleaner air. She noted their policy recommendations including: that the City upgrade its trip reduction ordinance, implement flexible fuel options at service stations, educate the public on air quality and participate in the partnership.

Noel Bonner, Placer County Air Pollution Control Officer, spoke on the controls and enforcement procedures used to monitor air quality in the South Placer County area. He said that air quality monitoring is done at the DeWhitt Center in Auburn and at Sierra College. He noted that it is possible that they will be implementing new controls on other stationary emissions generators.

Mr. David Young, S.A.C.O.G., said that currently the Sacramento Area is violating government requirements for clean air and that the E.P.A. had been requiring them to meet those standards by this year and that it is now classified by the E.P.A. as a serious non-attainment area. Both ozone and carbon monoxide are in violation and they are facing a Federal construction ban--this would only be on large stationary sources.

Mr. Young said that a new Air Quality Plan is being developed by a technical committee. A draft of the plan will be shown this summer. He added that 35 different traffic control measures are being looked at at this time. The technical committee will review them, however these measures will be expensive.

Mr. Huffman asked Mr. Young what mitigation measures would be particularly appropriate given the E.I.R. at hand. Also he asked if there were any 'hot spots' in the plan area.

Mr. Bonner said that the mitigation measures from the 1982 plan are in process. A major correction was requiring smog certificates every other year. He noted that any intersection with a LOS of 'E' or 'F' would be bad.

Mr. Dave Wade commented that the draft E.I.R. will include

additional information and that the revised Air Quality Plan will be incorporated into the plan when it is available.

Mr. Bob Langwill, R.C. Fuller, said that they had demonstrated in their modelling that many intersections are over the air quality limits.

Public Services and Facilities

Mr. Dameron said that Staff considers this section complete.

Water

Mr. Watts said that the system will require additional capacity. He asked if the Broken Spur property would continue to be serviced by San Juan Suburban.

Fire Protection

Mr. Watts asked if there was a cooperative agreement for backup support from regional sources.

Schools

Mr. Ron Feist, Superintendent of the Eureka School District, 5477 Eureka Road, reviewed information on a potential new site for an intermediate school on the north side of Douglas. He noted that at this time a combination school and park site is being worked out with developers in the N.E.R.S.P.

Mr. Lohse asked him if the wording in the draft E.I.R. was adequate in relation to this situation.

Mr. Feist responded that it was.

Parks and Recreation

Mr. Dameron said that Staff originally had had concerns about this section. They have taken action to look at additional alternatives.

Mr. Ed Mahaney, City Parks and Recreation Director, said that the E.I.R. adequately addresses these needs.

Mr. Huffman asked that in relation to the use of the land in the powerline easement for parking areas, who would own that land.

Mr. Wade said that this will be worked out in the Plan phase.

Mr. Mahaney added that the Parks & Recreation Commission will review this issue in depth.

Mrs. Rocucci asked that the oak woodland issue also be discussed.

Visual and Aesthetic Resources

Mr. Roland Bergthold, 1029 Audrey Way, Roseville, asked that adequate measures be taken to preserve the oak woodland.

Mr. Steve Robbins, Southfork Partnership, noted that currently an 8 acre woodland preserve has been proposed. Mr. Mahaney would like 13 acres. He assumes that the final version will presumably be between 8 and 13 acres. He added that another separate grove will be incorporated into a neighborhood park. On the vernal pool issue, Alternative #2 is now being worked out.

Mr. Bergthold asked what the Citywide vernal pool policy is.

Mr. Lohse said that City Council is being urged to develop a Citywide plan quickly.

Mr. Dameron said that Staff is working on this.

Mr. Lohse said that agricultural and urban reserve information should be incorporated as well.

Fiscal

Consensus was that the E.I.R. is adequate.

Archaeological

Mr. Watts noted that the coverage on the old barn was excellent.

Growth Inducting Impacts

Consensus was that the E.I.R. is adequate.

Alternative Analysis

Consensus was that the E.I.R. is adequate.

Cumulative Impacts

Mr. Bill Zisk, 205 Toma Street, Roseville, noted that the cumulative effect of drainage is of great concern.

Mr. Dameron said that Staff is of the opinion that the E.I.R. is complete and adequate.

Mr. Pagel concurred.

Mr. Huffman asked if the draft E.I.R. would come to City Council as a re-worked complete document, or as the original with addenda.

Mr. Lohse stated a strong preference for the changes to be incorporated into a revised document.

Other Commissioners concurred.

MOTION

Mr. Watts made the motion, which was seconded by Mr. Hays, to certify that the draft E.I.R. is complete and adequate and that it is in compliance with C.E.Q.A.

The voting was as follows:

Mr. Huffman, Mr. Watts, Mr. Hays, Mrs. Rocucci: Yes

Mr. Lohse: No

The motion passed.

Mr. Lohse attributed his 'no' vote to concerns about traffic and the fact that the General Plan definition of and minimum intersection service guidelines of LOS 'C' were being compromised. He added that air quality concerns are major aspects of this review. He said that the study and review of these sections was not adequate in dealing with the projected City growth.

Mr. Huffman complimented the preparers of the draft E.I.R., R.C. Fuller, on their responsiveness and completeness.

REPORTS FROM PLANNER

Mr. Dameron reminded the Commission that two special meetings were planned for January, both on Mondays.

The meeting was adjourned at 11:00 p.m.

NOT APPROVED BY P.C. AS YET

CITY OF ROSEVILLE

PLANNING COMMISSION MEETING

November 30, 1987

P.C. Present: Jim Gray, Pauline Roccucci, Chris Hays,
Bill Huffman, Audrey Huisking, David Watts

P.C. Absent: Frederic Lohse

Staff Present: Steve Dillon, Planning Director
Larry Pagel, Senior Civil Engineer
Dan Dameron, Planner
Nancy Christie, Secretary

MINUTES OF OCTOBER 8, OCTOBER 19, OCTOBER 22 AND OCTOBER 26, 1987

The minutes for the meeting of October 8, 1987, stand approved as submitted.

The minutes for the meeting of October 19, 1987, stand approved as submitted.

The minutes for the meeting of October 22, 1987, stand approved as submitted.

The minutes for the meeting of October 26, 1987, stand approved as submitted.

Mr. Watts commented to Mr. Zisk that upon consulting with the City Attorney it was his determination that the process of approving the minutes is closed to public input.

SPECIAL EXCEPTION USE PERMIT -- 625 RIVERSIDE AVENUE

This item was continued from the Planning Commission meeting of November 12, 1987, due to a 3-3 tie vote on a motion to approve the use permit with conditions.

Mr. Watts consulted the Commissioners as to whether to reopen the public hearing on this item. The consensus was not to reopen the public hearing.

Mr. Huffman made a statement for the record that he has listened to the tapes of the meeting of November 12, 1987, has been to the property to view it, and is prepared to cast a vote on this item.

Mr. Gray made the motion, which was seconded by Mr. Watts, to ratify the Negative Declaration, adopt the following finding of fact:

The City's early warning flood detection system should allow the establishment, maintenance or operation of the use

applied for , with the recommended conditions, to exist consistent with the health, safety, peace, morals, comfort and general welfare of persons residing or working in the neighborhood of said use, and should not be detrimental or injurious to property and improvements in the neighborhood or the general welfare of the City.

and approve the special use permit as recommended by the Planning Department with the following conditions:

1. No grading or fill shall be permitted on the property.
2. The structure shall meet all building and fire codes.
3. Property owner and operator shall execute an agreement in a form approved by the City Attorney, holding the City harmless from any flood-related damage that may occur in the future.
4. The City shall have authority to have any vehicles removed from the site based on anticipated flooding conditions.
5. Electric service to the building shall be converted to underground service unless waived by the Electric Utility Director.
6. All openings into the water or sewer system shall be above the 100-year flood water surface elevation or be sealed during floods to the satisfaction of the Water and Sewer Department.
7. All mechanical equipment shall be placed above the base flood elevation or be flood proofed.
8. Prior to occupancy, the structure shall be anchored to resist flotation and lateral movement. The anchoring shall be certified to in the "as built" condition by a registered professional engineer in one of the following methods, whichever anchoring system is stronger:
 - a. An anchoring system designed to withstand at a minimum, horizontal forces of 15 pounds per square foot and uplift 9 pounds per square foot; or,
 - b. By anchoring the unit's system in compliance with the Department of Housing and Development Mobile Home construction and Safety Standards.
 - c. Based upon the calculations prepared by Gill and Pullver, to withstand a 100-year flood..
9. A 10-foot landscape planter shall be provided along Riverside Avenue. Trees placed 30 feet on center shrubs and ground cover shall be planted subject to approval of the Planning Department.

- X
10. Record a 12.5-foot p.u.e. along the eastern property line.
 11. Prior to issuance of a building permit, the applicant must bring the non-conforming pole sign on site into conformance with the Sign Ordinance or receive approval of a variance from the Project Review Commission.
 12. An area for public parking shall be designated to the satisfaction of the Planning Department.

The voting went as follows:

Yes: Huffman, Watts, Gray, Hays
No: Huisking, Rocucci

The motion passed 4-2.

E.J.R. — SOUTHEAST ROSEVILLE SPECIFIC PLAN — SOUTH OF DOUGLAS
BLVD., EAST OF ROCKY RIDGE DRIVE -- CERTIFICATION OF A DRAFT
ENVIRONMENTAL IMPACT REPORT

Mr. Dillon began by reviewing the progress made so far on the review of this draft EIR and asking for a special meeting on December 14, 1987.

Mr. Gray stated that he would not be able to attend this meeting. After a short discussion, Commission consensus was to schedule the special meeting for December 14, 1987.

Mr. Dillon addressed the audience assembled and noted that the issue of the preservation of the oak woodland would not be addressed at this point in the review process. He asked the Commissioners for responses/comments on the material submitted in response to the meetings of October 19 and October 26.

Mr. Watts commented that the materials submitted in response to the October 19 requests was generally excellent, especially the old barn responses.

Mr. Jack Peers, E.J.R. traffic consultant, continued with a presentation on the traffic and circulation chapter. He began by going over design and functionality aspects of urban interchanges with the comment that these represent a type of interchange which may be implemented in the plan area in the next 20 years.

Mr. Peers showed overlays to contrast existing road systems in the plan area with the new and expanded capacity roadways of 20 years ahead and at full build-out.

Mr. Huffman asked if Eureka Road or Roseville Parkway would have freeway access.

Mr. Peers said that Eureka Road (Atlantic) would be an interchange. The present Atlantic limited interchange is scheduled to be rebuilt in 1989.

He reviewed diagrams showing the screenline analysis of roadways in the plan area. Level of Service "C" is obtained when the ratio of the total volume to the total capacity is 3:4 at peak times. He noted that the only change in capacity between the previously approved S.E.R.S.P. and the revised plan is that Eureka Road just west of Sierra College is 6 lanes instead of 4.

Mr. Hays asked what the effect of having a 6-lane Eureka west of Sierra College going to a 2-lane Eureka east of Sierra College would be.

Mr. Peers showed that the need for traffic lanes east-west in this area is for a total of 10 lanes divided among the three east-west roads including Eureka Road and the Roseville Parkway.

Mr. Hays asked if the Parkway would need to be six lanes.

Mr. Peers said that right-of-way for six lanes is being held open.

Mr. Watts asked if the City standard of LOS "C" would be maintained at all intersections in the area.

Mr. Peers said that it would.

Mr. Watts asked if one mall site in the larger area is assumed.

Mr. Peers said that only one site either in this plan area or another would be assumed. The other potential site would be urban reserve.

Mr. Huffman asked where funding for roadways would come.

Mr. Peers said that general transportation funding is 1% of total building cost and is paid at the time building permits are issued. He noted that an assessment district is under discussion.

Mr. Dillon asked about reciprocal traffic movements in areas surrounding the Plan area had been included in the calculations.

Mr. Peers said that they had.

Mr. Huffman asked if the Cirby/Old Auburn Road intersection had been looked at.

Mr. Peers said that it was not shown on the map because there was no change in that intersection.

Mrs. Huisking asked if the possible extension of Cirby Way across the McCormick property had been looked at.

Mr. Dillon replied that the future of this possible extension is not known.

Mr. Gray noted the reduction from LOS "B" to "C" of the Roseville Parkway/Eureka Road intersection. He asked why with the addition of two lanes does the intersection still drop a service level.

Mr. Peers said that these factors are not directly related and that the level of service at any intersection is a function of redistribution of traffic in the whole area.

Mr. Watts asked that alternatives for reduction of density be looked at.

Mr. Gray said that some guidelines or specifics for lower density comparisons would be needed.

Mr. Peers said that they could model reduced densities fairly easily either by categories of parcel usage or other comparison.

Mrs. Rocucci asked if it would not be better to look at the whole Roseville analysis in terms of land use when doing traffic work for this specific plan EIR.

Mr. Peers said that requiring such a broad analysis would seem unreasonable. He noted that they have been talking with the City about ways to increase their ability to model and look at alternatives more creatively.

Mr. Watts asked to see the specific plan and traffic analysis with a reduced population of the Broken Spur portion.

Mr. Peers said that this could be accomplished.

Mr. Dick Roberts, Folsom Lake Estates, asked if the need was for traffic to go to Auburn-Folsom Road.

Mr. Peers said that the traffic flow across the specific plan area from many points outside on all sides of the plan area looked at.

Mr. Dillon asked if there was any further discussion on this area from the Commission.

Commission consensus was that there was none.

Mr. Watts noted that the time was 9 pm, the agreed upon time to end the meeting.

Mr. Dillon suggested that some discussion of the powerline issue begin as two experts were here to testify this evening and that this would facilitate finishing on Dec. 14.

After a short discussion, it was agreed to go until 9:30 pm.

Mr. Wade gave a brief overview of the proposed parks in relation to the power line easements. He said that the plan has a need for 76 acres of park by City mandate. He showed those areas designated as parks on the map and went over their placement. He noted that only in a few cases have the power line easements been used at all and then almost exclusively for parking areas.

Mr. Huffman asked who owns the easements and whether these proposed uses have been verified as allowed by these owners. He requested that a list of owners be submitted.

Mr. Watts said that the Western Area Power Administration has such a list. He asked Mr. Wade if all restrictions in their document had been complied with.

Mr. Wade commented that these guidelines are not as restrictive.

Mr. Watts asked if the power line easements, described as attractive nuisances, will be fenced off.

Mr. Wade responded that the open space under the easements is not intended to be accessible to the general public.

Mr. Huffman asked him to be more specific.

Mr. Wade noted that it was not appropriate to discuss fencing at this point.

Mr. Dillon commented that fencing needs to be looked at in terms of its adequacy as a mitigation measure. He cautioned that it was too early to look at the park proposal yet; that it was not sufficiently analyzed by Staff and that it would be premature to focus in on it at this point. He suggested that attention be placed on the potential environmental health liability of locating park facilities under the powerlines.

Mr. Dick Fuller, preparer of the draft EIR, presented two experts to look at health effects of powerline radiations, Dr Dan Braken, Portland OR, a physicist and Jay Beaumont of Berkeley who would look at the physiological effects.

Dr. Braken stated that he was a physicist with over 14 years experience in studying the effects of electromagnetic field radiation. He said that in looking at the effects of the powerline radiation, that two fields are present, one electrical and one magnetic.

Dr. Braken went on to refer to a study conducted in New York State to look at the biological effects of power line fields. He went over aspects of determining exposure to magnetic field effects and factors which influence the amount of exposure an individual is likely to have. He looked at the concept of wiring

codes and their usage to determine if a residential usage would have a high or low current configuration. This is a necessary step in determining exposure over a number of years.

At this point, the meeting was adjourned to December 14, 1987.

APPROVED BY P.C.
December 10, 1987

ROSEVILLE PLANNING COMMISSION MINUTES

November 16, 1987

P.C. Present: Fred Lohse, Jim Gray, Audrey Huisking,
Chris Hays, Pauline Roccutti, David
Watts

P.C. Absent: Bill Huffman

Staff Present: Steven H. Dillon, Planning Director
Daniel E. Dameron, Associate Planner
Larry Pagel, Ass't Public Works Dir.
Nancy Sekany, Recording Secretary

Audience: 28 -- 7:00 p.m.

SOUTHEAST ROSEVILLE SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORT

Chairman Lohse called the meeting to order. He said he wished to announce that we would not be dealing with the park issue tonight. That will be discussed on the meeting of November 30th. There is information that the Planning Commission was given last Friday and the Commissioners have not had an adequate chance to review it.

Mr. Dillon said he would appreciate it if the Planning Commission would look over those comments and if additional information is needed or clarification is required, staff can proceed to get it.

Chairman Lohse said the issues we will be discussing tonight will be employment, jobs/housing link, and traffic. We will go until 9:00 p.m. That is the time limit.

Roll call was taken.

Chairman Lohse said the first item to be discussed is employment.

Mr. Dillon said Jack Peers will get into traffic and other issues related to it.

Jack Peers said they have done a number of traffic studies as well as the traffic work for the Southeast Roseville Specific Plan. He thought that what he would do is to talk about three items: the issues that seem to be most important in terms of their consideration is the land use, level of service and how they have interpreted and clarified it, and the traffic and transportation impacts that the E.I.R. discusses.

Mr. Peers said the land use is fairly uncontroversial. When we talk of levels of service, that will be a dialogue. At that point, the Commission might want to open discussions from the audience. As for transportation, he would like to make his comments and then allow public input.

Land Use -- Mr. Peers referred to a graph which showed the estimated growth of population. The numbers that we will be using is in the tens

of thousands: prior to the present -- the historical population, then after the present, it gives the projected population. In the year 2010, it appears that the population will be somewhere around 92,000 people. The growth is assuming about 5% a year. The compounded growth will be about 6% a year. Those assumptions were the result of studies done by S.A.C.O.G. The buildout levels are based on the buildout of the specific plans. The in-fill growth was considered and so were the employment projections. Historically, the current population growth in Sacramento County has been about 4% a year. In 1981, there was a growth increase but in 1982, it leveled out. The 1985 estimate was made individually by Angus McDonald.

Mr. Hays asked Mr. Dameron if these numbers are the numbers that will be used in the other specific plans.

Mr. Dameron said yes, we have been using pretty much the same numbers all along and they match up to the Angus McDonald figures. The population and employment are going up at about the same rate. It means in the Roseville area, we are presuming that 50% of the population will be active in the work force.

Mr. Peers said with regard to jobs/employment ratio, the figures will be 1.69 which means 1.7 jobs for each person in Roseville who is looking for a job. If we go beyond that, in the Auburn/Grass Valley area, our jobs to labor force is fairly balanced at 1.403. The SERSP will house 6,700 people and the number of employed in about 20 years from now will be about 2,700. There are many people who will want to work then and there will be jobs available. There will be more residents who are looking for work outside the Roseville area.

Mr. Hays asked about now.

Mr. Peers said there are about 30,000 people and the employment number is about 21,000.

Mr. Dillon asked if you were assuming that everyone who lives in Roseville is working in Roseville.

Mr. Peers said this just doesn't happen. Not everyone who lives in Roseville will work there because people have a variety of interests and job opportunities. You can cut down the commute but you don't end up having employees who work exclusively in that area.

Mr. Dillon said he wonders about the significance of having enough jobs for the number of people who are living there. How does it affect the traffic?

Mr. Peers said the closer we can get to a 1-1 ratio in any community, the better it is. But it won't happen exactly that way.

Mr. Dillon said he wondered if the road system is overutilized one way or the other.

Mr. Peers said Roseville now has more jobs than people who want to work.

Mrs. Huisking asked if it is important to note the percentage of blue-collar workers versus the percentage of white-collar workers.

Mr. Peers said blue-collar and white-collar workers is not a good way to describe the use of the car. In downtown Sacramento where people travel into the areas where the State workers work, the majority of the people are driving to work alone, then there are some who car-pool, and a few are using in some form of public transportation. The way people are spread out with regard to where they live, public transportation does not work well in California. With our style of living in California, even when public transportation is available, it is not that effective.

As for what will happen in the future, according to our estimates, in South Placer 20 years from now, the jobs/housing ratio will pretty much be balanced. It would be best that every community have a 1-1 ratio.

Mr. Peers said the numbers that were given is presently for 20 years. He does have numbers for the full buildout. For the other areas, such as Rocklin, Loomis and Grass Valley, it will be approximately 253,000 people. Roseville is 92,000 population.

Mr. Dillon asked about job intensity.

Mr. Peers said, for the non-residential, they had three categories: business-professional, industrial and retail. He gave the approximate densities for each. Angus McDonald came up with these figures and he referred to these as the reasonable figure.

Mr. Dillon said the E.I.R. uses 12 employees per acre as an average for industrial.

Mr. Peers said those are the more reasonable set of numbers that we can get so far from the economists. The definition of zoning gives a wide variety of densities.

Mr. Dillon asked, what if the densities are higher?

Mr. Peers said monitoring and checking regularly is going to be necessary.

Mr. Peers said the numbers that we are using is an engineering process rather than a scientific process. Those averages are comfortable numbers from an economist's point of view.

Mr. Watts said, obviously, the first 5 years, you must be more comfortable with than the numbers that are given for 10 and 20 years.

Mr. Peers said he is not the author of the numbers that they came up with. Angus McDonald would be able to give a better answer.

Chairman Lohse asked about the monitoring of those figures and if it would be advisable to include this in the E.I.R.

Mr. Peers said it would be advisable. The City has been doing that monitoring regularly.

Chairman Lohse asked if he feels that it is important that this should be done on a continuing basis for the next 20 years.

Mr. Gray said this was suggested on Page I-16.

Mr. Hays referred to I-19, top paragraph. He questioned the statement regarding the 50% of jobs per capita.

Mr. Peers said over the last 20 years, there has been a steady increase of people in the job market. That is because of the increased number of women working. Half of everyone living in Roseville will be working, not necessarily in Roseville, but they will be working. About 25% of the residents in Roseville will be employed in Roseville.

Mr. Hays asked about "indirect jobs".

Mr. Peers said you have a steel worker who is working in the community, then you have a service job that supports that job. There is banking, for example. There are not just production type jobs. There are service employment jobs, such as school teachers, janitors, restaurants, etc. The need for that basic industry creates other services that are needed.

Level of Service:

This deals with the issue of the policy and interpretation of the City as it stands at the present time.

Mr. Peers referred to the Highway Capacity Manual. It is the most recent piece of information by way of the Transportation Research Board. It is the main source of research. It has been continually updated. When we deal with levels of service, that is one entire chapter. He does want to raise the point that when we talk about intersection capacity, we talk about issues that are quite complicated. In 1981, the same author developed a report called Circular 212. At that time, they suggested two techniques for calculating the capacity planning technique and the operational technique. These are the levels of delay that will occur. When the latest edition came in, there were changes. They said we can calculate the planning technique. But using the operational technique, you come up with two items to consider. One is capacity of the intersection level of delay. There can be a great deal of difference in the capacity of an intersection and the level of service. You can have situations where unusually low capacities take place at times during the day. This has no bearing on the capacity of the intersection. Since they have used that information, if we are below capacity, we find that we normally have levels of service of C or better. When we talk about over-capacity to near-capacity, the level is going to be lower. We have been quite conservative in our analysis.

Mr. Hays asked about Sunrise/Douglas.

Mr. Pagel said it is 110-second cycle, not 140 cycle. The average is a 120-second cycle.

Mr. Peers said we do not have regular flows along an intersection such as Sunrise/Douglas. Sometimes you have a short delay. However, if the flow is heavy, you may have a long delay.

Mr. Lohse said what we are talking about in terms of averages is if we go through the intersection at 3:00 a.m., we will have very little delay. However, at 5:00 p.m., there will be a considerable delay. When we first stated a level of service, the Planning Commission determined that the level of service should be C. How did we get away from this?

Mr. Peers said he has had long and continuous discussions with the Planning and Public Works staffs. There are definitely intersections that will not operate at level of service "C" during peak hours. He feels that level of service "C" can be maintained most of the time, and, if it is not, he has made recommendations of mitigation measures that will revert the level of service back to "C". We have not taken any discounts at all for carpooling or public transportation in any of the E.I.R.'s. This type of mitigation (use of public transportation, for example) would improve the intersections by about 5%.

Mr. Hays asked about TSM (Transportation System Management) and if that is a State agency which sets the standards.

Mr. Peers said TSM was started during the 1973 gas crunch. They went to the larger employers and encouraged them to work with their employees to set up public transportation and encourage car pooling. They set up matching programs. This way people could voluntarily car pool.

Mr. Pagel said the City currently has a TSM Ordinance. The City has set up a list of people who you could contact and ride to work with, someone who lives near you.

Mr. Dillon said he would like to relate the level of service to a volume-to-capacity ratio.

Mr. Peers said the capacity that we use from the planning technique is very broad. When we can get more detail, then we can include the volume-to-capacity ratio.

Chairman Lohse said he still sees that we are allowing a lower level of service than the Planning Commission intended for us to have. He feels the original intention of the Planning Commission is not being carried out.

Chairman Lohse referred to J-20. He asked if those levels of service indicated are without the roads being widened, etc.

Mr. Peers said some of the roadways will have been widened but not all the improvements will be completed.

Mr. Peers said, with the construction of an urban interchange, these levels of service will improve which have been extended beyond "C". The intersections should be monitored and then when the higher levels of service are present, then the urban interchanges should be considered.

Mr. Hays asked if we should be anticipating additional road systems.

Mr. Peers said there are two uncertainties -- one is the development of the urban reserve. The problem with adding that urban reserve or doing any analysis of it, we are assuming that the specific plans will be built out. He can make recommendations up to sixteen (16) years from now, but the further he gets away from that, the less comfortable he feels. There is another uncertainty that he is uncomfortable with and that is the on-again, off-again beltway line. Also, there is a possible State Highway (No. 102) that is being considered and it would be parallel with I-80.

Mr. Peers said, whenever urban interchanges are added, it should bring those intersections about to level of service "C". By putting in the Roseville Parkway and the urban interchanges, the traffic situation should change.

Chairman Lohse asked if we have any urban interchanges in this area and where they are located. Also, should these urban interchanges be put where there is bare land.

Mr. Peers said the answer is no, there are not any urban interchanges of the type he is talking about in this area. There is one in Phoenix and one in Florida. They are comparatively recent. They are beneficial because they do not take a lot of right-of-way. There is a grade separation; however, they are very expensive. They cost anywhere between 3-1/2 to 5 million dollars. Therefore, he would not recommend that they go in an area that does not need them now. But that is why he thinks intersections should be monitored. We should be planning now to assure that the right-of-way is there. We should have the capital improvement programs available for when they are necessary.

Mr. Peers said he does not know what type of funds will be available in twenty (20) years from now. But without the urban interchanges, we will have some failed intersections. He said it is very much part of the planning process to deal with what will happen twenty years from now. It is important to establish the planning mechanism to pay for these improvements at the time they are needed. There are fees being charged now to assure that funds will be available.

Mr. Hays referred to Page J-16. He wanted to know if the last paragraph is referring to the situation with the six lanes.

Mr. Peers said he is painting a bleak picture here. 5% is a very dramatic rate of growth.

Ms. Roccucci said, under our General Plan, we are using the level of service "C". We could also look at other proposals that could be used. We are looking at bigger and better roads and urban interchanges but, looking at the other factors, maybe our housing ratio needs to be considered as a scenario.

Mr. Peers said this E.I.R. deals specifically with the S.E.R.S.P.

Ms. Rocucci said she thought Jack Peers was working on all the specific plans.

Mr. Peers said that is true, but the estimates that we make are only as good as the assumptions that we put into the plan. A 5-year plan is much more realistic than a plan that you are working with that is 20 years down the road.

Mr. Pagel mentioned the urban interchange. He asked if there is a need for an urban interchange at the intersection of Parkway and Eureka and, if so, should this be included in the development agreement?

Mr. Peers said the Southeast Roseville area is principally residential. What he is suggesting is that the right-of-way be there so it is a reasonable alternative, if it becomes necessary. The Planning Commission and City Council, at that time, can grapple with that idea. There are many things they can do in the future. Maybe they will slow growth but he feels the right-of-way should be available.

Mr. Pagel said he did not know that we have the right-of-way at this time.

Mr. Peers said he feels we have been rather careful to assure that we do. It may be necessary to remove landscaping to improve the circulation.

Mr. Pagel said at one time, the City Council was considering an urban interchange at the intersection of Sunrise/Douglas. But it was decided that this should not be done because of the fact that major problems only exist during a couple of hours of the day.

Mr. Peers said, in the future, if the impacts are more than we anticipate, this needs to be monitored. If the impacts are less, the problems will not be as great.

Chairman Lohse said we have not had an opportunity to have some input from the audience.

Mr. Peers said what we have talked about are the general issues.

Chairman Lohse said we will get into the specifics.

Morgan Evan, 425 Cirby, said she belongs to the Sierra Club. It is difficult to separate her concerns from traffic and she is concerned about air quality.

Chairman Lohse said air quality has been addressed. Also, it will be dealt with at a future meeting. The preparers of the E.I.R. are doing a more in-depth analysis of air quality which will be discussed at a future meeting.

Mrs. Evans asked if they have arranged to do a supplemental analysis of air quality. They would like to have a report on this air quality issue.

Chairman asked Richard Fuller to answer this question.

Bob Langwell, representing Fuller & Associates, said they are not preparing a supplemental analysis on air quality. What they have prepared in the E.I.R. is what is required by C.E.Q.A. They are preparing an analysis on the concerns of the Planning Commission.

Mrs. Evans said, if this supplemental analysis is not prepared, a law suit will be filed. She stated that she recalls a meeting she went to in August at which she remembers one of the Planning Commissioners saying they would like some hard facts on air quality. Also, a comment was made that we could not be in a much better position than Los Angeles because of the way the mountains hold the air pollution in.

Mr. Watts would like to hear from staff.

Mr. Dillon said he is not sure what Mrs. Evans is talking about. If the Planning Commission feels they want more information, staff could get that for them. He does not know what additional information the Sierra Club wants.

John Hendricks said he lives in the Granite Bay area and represents the Granite Bay Plan. He would like to see us cut back in residential development. Many people make an east/west commute. Those buyers who now work along the I-80 corridor probably live in that area and the buyers who work along the 50 corridor probably live in that area. He lives near Eureka Road. They would like to see the business professional limited along Douglas. He would like to see the area be developed so it will make it a desirable place to live for the residents of the area. He feels that Placer is bearing a great deal of the traffic and he thinks that Sacramento should be bearing more of the responsibility.

Chairman Lohse asked where he feels that the traffic stops at the Placer County line.

Mr. Hendricks mentioned some of the road systems that he was referring to when he made that statement.

Chairman Lohse asked if the Granite Bay people have some solutions for lessening the impacts.

Mr. Hendricks said he feels they are doing what he feels Roseville should do -- lessen the development activity.

Roland Bergthold, 1029 Audrey Way, said when the specific plans were first being considered for Roseville, and when the City first embarked on the processes, it was anticipated that the plans would be workable. He feels that what is being demonstrated by the E.I.R.'s is that the amount of growth that is being anticipated will not be workable. He wonders if there is sufficient data to cause the City to re-think this plan. The intersection of Sunrise/Douglas has worsened. There will be other intersections that will do the same. He does not think these expensive urban interchanges will happen. The cost, as Larry Pagel said, for 2 or 3 hours a day, is not feasible. He thinks we should

re-look at the amount of development activity which is intended to take place. Also, we should re-look at the number of jobs that will be available. He also feels that is excessive. We should re-plan land use so the housing/land use is equal.

Mr. Watts said he knows that Mr. Bergthold was on the Planning Commission at one time. He asked Mr. Bergthold if the improvements which were talked about at that time have been made.

Mr. Bergthold said they have been made and the situation is not very good. He does not think we have seen anything yet as to what will happen on Sunrise/Douglas. From past experience, it seems that the plans have not been conservative enough.

Robert Townley, Cirby Way, said he thinks a foot bridge could be put in his area for the children. But he has not seen anything dealing with Cirby Way. It is becoming quite a traffic problem. Also, there are some confusing signs. Some of the speed signs are not consistent. He is concerned about the traffic leading into Old Auburn Road. There has been a tremendous increase in traffic from Hazel and also Old Auburn coming in and out. People are avoiding Douglas which is causing problems in that area. He feels we will have a real problem in the near future.

Mr. Townley asked if the City has some specific plans for Cirby.

Mr. Pagel said there will be four (4) lanes east of Sunrise and eventually, it will go to six lanes from Sunrise and Foothills. This is planned in the long term, in the next twenty years.

Mr. Townley said he think the Planning Commission is well aware of what the problems are.

Mr. Dillon said we will pick up on the circulation issue at the next Special Planning Commission meeting on November 30. We will discuss circulation and perhaps get into the park issue.

Adjournment:

The meeting was adjourned at 9:30 p.m.

APPROVED BY P.C.
November 30, 1987

CITY OF ROSEVILLE

PLANNING COMMISSION MEETING

October 26, 1987

P.C. Present: Frederic Lohse, Pauline Roccucci, Chris Hays,
Jim Gray, Audrey Huisking, David Watts

P.C. Absent: Bill Huffman

Staff Present: Steve Dillon, Planning Director
Larry Pagel, Senior Civil Engineer
Dan Dameron, Planner
Nancy Christie, Secretary

DRAFT ENVIRONMENTAL IMPACT REPORT — SOUTHEAST ROSEVILLE SPECIFIC PLAN

Mr. Lohse began by saying that some of the information and responses requested from the meeting of October 19 had not yet been prepared or submitted.

Mr. Dillon noted that this information would be presented in an addendum and is scheduled for discussion on November 16.

Mr. Hays explained that although he had not been present for the October 19 meeting, he had listened to the recording of the meeting and felt prepared to continue with the discussion.

EMPLOYMENT AND ATMOSPHERIC CONDITIONS

Mr. Bob Langwill, R.C. Fuller Assoc., Carmichael, reviewed aspects of this section.

Mr. Hays noted that on page 25 of the Comments and Responses document, the point is made that the air quality of the region is deteriorating - that hot spots may occur and that a complete air quality analysis on each project should be required. He asked about the feasibility of requiring such an in-depth analysis on smaller projects.

Mr. Langwill responded that at this point in the planning stage, some projection of traffic levels is possible. Their biggest concern is the air quality at intersections, but they can't really project exact air quality conditions. Once the intersection is in place, monitoring can begin and they can implement air quality improvement measures.

Mr. Hays asked if their recommendation would be to require an air quality analysis for each individual project.

Mr. Langwill responded that their recommendation would be to model each major intersection — the big changes will occur as

large projects come on line.

Mr. Lohse referred to page G-2 in the Draft EIR, noting the impact for senior citizens and those with respiratory problems from the high levels of CO compounded with the inversion phenomenon. He asked if the EIR adequately states the hazards of air pollution in relation to the human population.

Mr. Langwill noted that this is an area where there is a lot of controversy as to what levels are actually hazardous and how much is tolerable. Their policy in preparing the EIR is to compare predicted levels with standards and guidelines developed by the State and Federal Government.

Mr. Lohse stated that the area already exceeds air pollution standards. He commented that not enough coverage is given to this issue, especially needed is further quantifying of when these levels reach problem proportions.

Mr. Hays asked Mr. Langwill to comment on the inversion effect and how it affects air quality in this region.

Mr. Langwill noted that it is basically a temperature phenomenon where the winds go overhead at a certain altitude and air in the valley is trapped.

Mr. Hays asked if there was a correction or remedy for this.

Mr. Langwill said that there was not, only to reduce pollutants.

Mrs. Huisking asked if they could expect problems similar to the Los Angeles area.

Mr. Langwill noted that this region would be prone to have similar conditions, but that it would not be possible to predict the extent of future conditions.

Mrs. Roccucci asked if statistics were available on tendencies of inversion and air quality over the last 20 years and whether a summary and information could be developed.

Mr. Langwill noted that they could contact the Air Resources Board and see if the data is available.

Mr. Hays asked if the air quality factor was looked at on a regional basis.

Mr. Langwill noted that the Sacramento Area Council of Governments (SACOG) monitors this and models it on a full basin scale. However, it is hard to determine who contributes what to the situation. There are some big violators and they have worsened the air quality conditions for the entire region. Vehicular traffic is the main source, and TSM measures and traffic management is the best mitigation.

Mr. Watts asked why the EIR made no mention of mass transit as a mitigation measure.

Mr. Langwill noted that this will be added to the final document, along with van polls, etc. He added that Roseville's TSM ordinance is better than most communities.

Mr. Lohse stated his concern over the tendency to look at the air quality problem as just being a small part of a larger problem. He noted that on page G-13, a table of projections of air qualities for 1979-1995 developed in a 1983 study is given. He asked how the actual 1987 levels compare with those 1983 projections for the year 1987 levels.

Mr. Langwill commented that he did not have the information to respond at this time but that this comparison would be developed and added to the comments and responses document.

Mr. Watts asked about nitrates.

Mr. Langwill responded that the records show no nitrate violations as of yet.

Mrs. Harriet Wilson, 5615 Shotts Lane, Rocklin, noted that based on a class taken at Sacramento State University, the information was given that potential for air pollution in the Sacramento Valley was much worse than in Los Angeles because there was no sea breeze available here.

Mr. David Manhart, 1411 Vinman Ct., Roseville, (a member of the Project Review Commission), commented that on Page G-7, the summary of impacts says that much of the impacts can't be mitigated. He suggested specific TSM measures be given at this level and that specific input from SACOG in this area be incorporated.

Mr. Lohse commented that this section will not be considered complete until the information identified as being needed is submitted.

NOISE

Mr. Hays asked if consideration had been given to impacts outside the specific plan area such as industrial uses in the summary of impacts on page H-5.

Mr. Langwill noted that commercial projects on Douglas would contribute to noise, but that they were required to add mitigations such as walls, etc. Traffic will be the largest noise impact and that has been addressed. The adjacent TreeLake project in Placer County has been included in the impacts.

Mr. Robert Coyle, Barton Road, Granite Bay, asked about the differences in short and long term impacts.

Mr. Langwill explained that a construction noise impact would be considered short term because it would not be a constant factor in one location over a period of years. Traffic noise from a large project would be a long term impact.

Mr. Lohse asked if there was a way to enforce more effectively the restrictions on construction times. He noted that this specific plan should have strong rules on when building can occur.

Mr. Steve Robbins, Legal for the Southfork Partnership, noted that the restrictions on construction times were no problem, but he requested that they be tailored to the specifics of each site.

Mr. John Henrick, 9075 Penny Lane, Granite Bay, said that noise typically carries a long way and tends especially to affect adjacent, higher altitude properties.

Mr. Lohse asked him if they had presented their concerns on noise to other government bodies such as the Sacramento County Board of Supervisors, and Placer County Planning Commission.

Mr. Henrick said that they had.

CULTURAL SETTING/LAND USE

Mr. Dillon began by saying that staff's main concern was the use of the powerline corridor. This area is scheduled to be addressed on the meeting of Nov. 16.

Mr. David Wade, preparer of the specific plan, reviewed the intent of land use. He presented an overlay showing proposed land uses over the existing natural features of the plan, giving specifics of the proposed densities in relation to those features.

Mr. Dillon noted that the significant changes in proposed land uses were summarized on page J-9. In the old plan R1-5 is 10%, R7-15, 65% and R-16 and more approx.25%. In the new plan the R1-5 is now 40%, R7-15 is 14% and R-16 and more is 46%.

Mr. Wade noted that this change was due to the fact that it was a difficult density range to build in, and because of market research.

Marg Hartley, 425 Cirby Way, Roseville, asked if in relation to the blue oak woodland whether a distribution of units could be made in that area so that a large common area would be possible and preservation of the oaks more certain.

Mr. Wade commented that they were preparing specific plans on how to save the blue oak area. These will be presented on the 16th.

Mr. Henricks commented that the surrounding areas of Rocklin and Granite Bay have much lower densities, more like one house per 1.3 acres, and felt that the juxtaposition of the higher density

zones would have an adverse effect on the quality of life for these neighboring communities.

Ms. Sandy Harris, 5770 Riva Dr., Granite Bay, commented that the annexation and shift of housing units into the Broken Spur area has resulted in a change of density from 157 units to over 900 total units in that area, totally changing the character of that area. She also noted that County plans to widen Eureka Road are perhaps 10 years down the line. She added that the County intention is to have no additional commercial on Douglas Blvd. between Sierra College Blvd. and Auburn-Folsom Road.

Mr. Dillon commented that the traffic analysis would go over these plans in detail and that Placer County information was incorporated in that analysis.

Mr. Lee Hora, 6340 Farlende Dr., Granite Bay, noted that the Granite Bay Citizen's Assoc. had not been given adequate copies of relevant documents, nor had they been sufficiently informed on intended plans for this area.

Mr. Richard Grace, Eureka Road, Granite Bay, commented that the Roseville concept of low density was considered high density by Granite Bay standards.

Mr. Wade noted that the proposed density for the Broken Spur property was the same as the County's existing Tree Lake project.

Mrs. Cindy Johnston, Eureka Road, Granite Bay, told the Commission that she regularly rides horses through the Broken Spur property on the way to Folsom Lake. She asked the Commissioners to consider the implementation of equestrian trails as a design element for this section of the specific plan.

Mrs. Claudia Darle, 8122 Quartz, Granite Bay, commented on traffic and noise impacts on Eureka Road which have worsened significantly in the three years that they have lived in the area.

Mr. Hays noted the concerns members of the audience from the Granite Bay community had expressed regarding the density differential. He responded that this situation is noted on page 27 of the Comments and Responses document.

POPULATION

Mrs. Roccucci asked if the interrelation between traffic, jobs, population and air quality had been sufficiently examined especially in view of the projected 92,000 full population for Roseville. She asked if it was possible to look at whether this population was too much, whether it should be less.

Mr. Watts asked if the shift of population from the center of the plan area to the outer boundaries would tax the City's ability to provide services.

Mr. Dillon responded that specific concerns would be addressed in the review of the appropriate areas.

EMPLOYMENT

Mr. Dillon noted the importance of maintaining a proper jobs/housing balance.

HOUSING

Mr. Dillon commented that this section addresses whether the goals of the City's General Plan are being adequately met by this specific plan. He noted that plans for the first 5 years are consistent. The reduction of mid-range densities will not be a significant impact on affordable housing in the City.

Mr. Lohse noted that a goal of the Affordable Housing Task Force is to 'average' the need and to apportion what affordable housing is available taking the city as a whole.

Mr. Dillon responded that each project will be required to follow the guidelines developed by the City.

Mr. Hays noted the importance of affordable housing as a citywide issue and expressed concern about the accuracy of the projected needs and the commitment of everyone concerned in developing this plan to meeting those needs.

Mr. Watts asked what assurance the City would have that the guidelines adopted by the City would be agreed upon and enacted in the individual projects within the plan.

Mr. Dillon responded that the Commission had two choices. They could either define the land use at this time or wait.

Mr. Lohse commented on the problem of completing the review of the draft EIR before the recommendations of the Affordable Housing Task Force are made.

Mr. Steve Robbins noted that this property has an obligation to the City in regard to affordable housing and that this will not be ignored.

Mr. Lohse stated that he felt that the discussion of this area is not sufficient because of unclear impacts on mitigation and a lack of methodology.

Mr. Langwill noted that they can support this section with quantitative data.

Mr. Lohse asked to see specific information on several strategies to develop affordable housing developed and included within the EIR document.

Mr. Gray concurred.

Mr. Hays asked for a definition of affordable housing.
Mrs. Huisking agreed.

Mrs. Roccucci noted that the draft EIR should present more visible efforts to encourage the development of affordable housing.

Mr. Dillon noted that more specific information on definition of and strategies to enact affordable housing should be included. He added that the increase in the percentage of multiple units (R15 or more) was a significant factor between the old and new plans. He added that the new plan is basically better in its potential to provide affordable housing.

Mr. Gray asked how income eligibility is determined.

Mr. Dillon responded that it is based on the median income; that less than 50% of that is considered very low income, 50-80% is considered low income. He noted that it was very difficult to provide housing for low income (in the \$12,500/yr range) however, Section 8 reaches this group. He stated that in relation to additional information to be submitted to supplement the draft EIR, the plan could be evaluated on projections, the alternative of evaluating the potential of City subsidies for affordable housing, and the adequacy of developer fees for this purpose.

Mr. Dillon spoke to the Granite Bay audience. He noted that Roseville's sphere of influence boundaries currently extend to Barton Road. He stated that the present City Council position is to consider pulling back to the current City boundaries. He commented that there are no plans to annex additional property at this time. He added that they were welcome to request copies of literature on the draft EIR and to ask questions.

The meeting was adjourned to 6pm, Tuesday, October 27 at Fall Creek Landing for a joint City/County Planning Commission meeting.

Approved by P.C.
November 30, 1987

CITY OF ROSEVILLE

PLANNING COMMISSION MEETING

October 19, 1987

P.C. Present: Frederic Lohse, Pauline Roccucci, Jim Gray
Bill Huffman, Audrey Huisking, David Watts

P.C. Absent: Chris Hays

Staff Present: Steve Dillon, Planning Director
Dan Dameron, Planner
Larry Pagel, Senior Civil Engineer
Nancy Christie, Secretary

A. Discussion E.I.R. Processing

Mr. Dillon reviewed the proposed schedule for the Planning Commission review of Draft EIRs for the remainder of 1987, which would include special meetings on October 26, November 16 and November 30.

The Commission consensus was that this schedule was acceptable.

Mr. Lohse suggested that the Commission set 9:30 pm as the limit for the special meetings.

Mr. Gray suggested that these meetings be cut off at the conclusion of the section currently being discussed at 9 pm.

Mr. Watts agreed that 9 pm would be better.

After a short discussion, Commission consensus was for a 9 pm limit on the special meetings.

Discussion then centered on the order of presentation and method for conducting the review.

Mr. Dillon pointed out the checklist that Staff had prepared to help the Commissioners record their comments on the adequacy of the Draft EIR. He suggested that as it followed the order of presentation of areas in the EIR document itself that this might be a useful tool in organization the formal review. He noted that Staff did not have a lot to add in addition to the Comments and Responses document prepared by RC Fuller Associates but added that specific comments could be given upon request from the Commission in response to new concerns that may come up in the review.

Mr. Watts expressed a preference for using the checklist order as a way to review the document.

Mr. Gray agreed.

S.F.R.S.P. -- Draft E.I.R.

Mr. Lohse suggested then that the review would proceed with Staff comments, applicant's presentation, audience input and Commission consultation.

Mr. David Wade, Wade Associates, 735 Sunrise, Roseville, the preparer of this specific plan, gave a short overview of the plan's major features.

Mr. Huffman asked Mr. Wade if he had also prepared the two other major specific plans (Northwest and North Central) about to undergo ETR review in the immediate future.

Mr. Wade responded that he had. He went on to show a series of aerial photographs viewing the plan area and its general topological characteristics. Subsequent slides showed the design of the landscape easement along Douglas, the "gatehouse" buildings at the entrance to the specific plan area and the landscaped median boulevard design of major roadways in the plan area. He noted that these major elements for this plan were intended to set a design standard for future projects in the City.

Mr. Wade commented on the densities and organization of land use, noting that the plan had 102 acres of Business/Professional, 3600 dwelling units. Densities range from the business and commercial near Douglas, moving to multiple density residential, to lower density residential to single family as one went south from Douglas. Two K6 schools were contained within the plan area, Maidu Regional Park and open areas around Strap Ravine and Linda Creek. Major water and sewer lines run from east to west.

Mr. Lohse asked why the amended plan doesn't contain as much middle density housing -- halfplex or duplex.

Mr. Wade responded that they have found that the market preference is for single family. Consequently, density was raised near the Douglas Corridor and additional single family was created.

Mr. Huffman asked where the third school site from the original plan had gone.

Mr. Wade answered that the 7-8 school site had been required to be moved from its original site because of State restrictions on school sites within 400' of a power line easement. In a meeting with Ron Feist, Superintendent of the Eureka School District, it was decided for reasons of demographics that a replacement school site outside of the specific plan area would be preferable.

Mr. Fuller, 5908 Fair Oaks, Carmichael, began a review of the Summary of Impacts and Mitigation Measures. He noted that open space areas within the plan include the 100 year flood plain dedicated to the City, which could be used for recreation, etc.

The vernal pools on this site have been designated by the consulting biologist as not significant. In some areas the pools are maintained. Impacts to vegetation and wildlife can't be fully mitigated. On air quality, potential "hot spots" have been identified and mitigation measures which include complementary land uses and traffic reduction measures identified. Noise impacts are mitigated through setback requirements, berming and limits on land usage.

Mr. Fuller noted that some uncertainty remains in land use determinations because of potential restraints in use of the power line easement both for recreation and for schools. The issue of affordable housing is awaiting input from the Affordable Housing Task Force and will be reworked when that information is available.

SECTIONS I-JJJ

Mr. Huffman asked Mr. Wade if he anticipated any future additions to the specific plan area.

Mr. Wade responded that none were planned.

Mr. Dillon commented that there had been at one point some discussion on annexing two small areas near the immediate plan area.

GENERAL PLAN CONSISTENCY

Mr. Dillon noted that potential problems remained in the areas of traffic circulation and housing. These will come up for discussion in the appropriate sections.

NATURAL ENVIRONMENTAL SETTING

Mr. Dillon commented that complete geographic surveys will be required of each project before approval is considered.

Mr. Roland Bergtheld, 1029 Audrey Way, Roseville, noted that flooding had been a big concern in the review conducted by the Project Review Commission. He suggested that an alternative which has not received enough attention is to use the run-off to recharge the water table, ie. to keep it on site and not have it enter the creeks.

Mr. Lohse asked Mr. Fuller to incorporate this alternative within the EIR comments and responses document.

Mr. Watts asked if this had been proven effective.

Mr. Fuller noted that this technique is possible and can be done in certain sections.

Mr. Dillon asked if the recharge impact could be calculated.

Mr. Fuller responded that these areas can get full in major storms and that it was not likely that they could be a total solution. Specific information on this alternative will be added in the Hydrology Section.

Mrs. Marilyn Eddy, 2230 Clarion Dr., Roseville, noted that they were quite concerned about additional run-off as they have quite a bad drainage situation already.

Mr. Pagel responded that Morton & Pitalo had done an excellent job of responding to the hydrology concerns in the Comments and Responses document pages 11-13. He added that each project would be required to submit a complete drainage study which would include the cumulative run-off effects before building could begin.

Mr. Gray noted however, that each project should be analyzed primarily on its cumulative impact rather than on simple impacts generated only by that project.

Mr. Watts added that much more specific information will be needed as each project completes its respective drainage study.

Mr. Rick Chavez of Morton & Pitallo noted that those calculations could be done, but that the overall picture was very complex and that calculations for individual projects might not be too meaningful in view of the other, larger variables involved.

Mr. Gray reminded everyone that the Nolte Study had not been accepted by the City yet.

Mr. Bill Zisk, 205 Thomas Street, Roseville, requested tht he have an opportunity to make comments on this section before the final recommendation of the Commission is voted upon. He noted that as Mr. Gray had said, the Nolte Study had not been reviewed formally by the city. He questioned whether it was appropriate for this study to be cited as the authority for mitigation measures. He also expressed concerns that the cumulative impacts would not be looked at adequately.

Mr. Gray commented that on a project by project basis all drainage concerns would have to be answered well enough or that project would not be approved.

Commission consensus was that this area is an extremely difficult area, and that all possible alternatives needed to be explored in detail. The main document of the EIR should include the last paragraph on page 13 in its final form.

VEGETATION AND WILDLIFE

Mr. Dillon commented that the principal recommendation of the Project Review Commission in regard to this section was that the EIR document include one of two alternatives presented for a wildlife preserve in the Broken Spur area. He added that the

biologist would be there next meeting to discuss this in more detail.

Mr. Bergthold suggested that the proposed land uses be superimposed on a transparency over the features map. He was especially concerned about the impact of development on the large oak woodland area and the fact that this impact is dramatically understated in the draft EIR. He added that it appears that many adverse items have been somewhat "buried" in the Technical Appendix section.

Mrs. Marge Hartney, Ruby Way, Roseville, expressed concern over the potential loss of so many oak trees. She agreed that the overlay as proposed by Mr. Bergthold would give immediate clarity to impacts on vegetation.

Mr. Dillon noted that the EIR doesn't emphasize the adverse effects of removal of oak trees and the impact to the oak woodlands as much as the treatment of vernal pools and that preservation of this does tend to be downplayed in the EIR. He suggested that a way to correct this would be to identify this area as a "habitat", and reference impacts on the oakwood land specifically.

Mr. Lohse asked Mr. Dillon if the final EIR document would be a consolidation of the draft EIR, Technical Appendix and Comments and Responses document.

Mr. Dillon said that it could be done that way, or be left as the draft EIR with the various addendum documents.

Mr. Lohse expressed a strong preference for one final document.

Mr. Fuller noted that the biologist statement that addressed a potential removal of several thousand oak trees was in response to an unmitigated situation. The draft EIR acknowledges the City's policy on tree preservation and lists adequate alternatives to mitigate these impacts.

Mrs. Roccucci agreed that she felt that the EIR needs to expand the mitigations for the oak woodlands.

Mr. Wade commented that special work has been done to minimize adverse effects to the oak trees. These measures include special construction techniques to be employed. In addition, there will be a tree replanting program for the oak woodland.

Mr. Dillon noted that as long as adequate alternatives and mitigations are given, actual implementation can be assured at the project phase.

Mr. Lohse asked that the overlay map as mentioned earlier be prepared — especially for this area — and be included as part of the EIR.

Mr. Lohse commented that as it was 9 pm, no further section would be started. He added that a final vote for adequacy will come at the end of the review of the draft EIR.

The meeting is adjourned to October 26, 1987, at 7 pm.

PROJECT REVIEW COMMISSION HEARING MINUTES



CITY OF ROSEVILLE

PROJECT REVIEW COMMISSION MEETING

October 1, 1987

P.R.C. Present: Mel Hamel, James Smith, Dennis Azevedo,
David Manhart, Clair Alway, Jack Wallace,

P.R.C. Absent: Dan MacClain

Staff Present: Steve Dillon, Planning Director
Denny Jones, Senior Planner
Dan Dameron, Planner
Dave McIntyre, Senior Civil Engineer
Nancy Christie, Secretary

MINUTES OF SEPTEMBER 22, 1987

Mr. Wallace made the motion, which was seconded by Mr. Azevedo,
to approve the minutes of September 22, 1987.

The motion was approved unanimously.

SITE REVIEW MODIFICATION -- WASHINGTON AND ALL AMERICAN

Withdrawn.

USE PERMIT -- SOUTH SIDE OF JUNCTION BOULEVARD, WEST OF HIGHWAY
65

Mr. Jones began by saying that the applicants had reworked the
design presented two weeks ago, incorporating many of the stated
concerns of the Commission. He noted that the ratio of parking
spaces to units was 2.5 and that a recreation area and tot lot
had been provided in the center of the project.

The applicant Larry Schlichting, 118 Alta Ave., Roseville, said that
they had worked with Staff to incorporate the information given
at the previous Commission meeting. He said that they had reduced
the number of units from 54 to 50. He commented that they had not
incorporated the pool into the revised plan because of increased
costs which would by necessity have to be passed on to the
homeowner.

Mrs. Alway asked what the projected cost of a unit would be.

He answered \$85,000.

She stated that because the project is in a rather remote area,
far from City neighborhood pools and with the temperatures during
the summer being what they are, a pool would be a necessity. She
agreed that the play area would be a help for the younger
children, but that children ages 8-14 could barely use it because
it was so small.

21. Any HVAC equipment shall be located on the ground and screened from view.
22. A bus shelter shall be installed on Junction Boulevard as required by the Public Works Department.
23. C, C & R's shall be recorded with the final map in a form acceptable to the City Attorney. The C, C & R's shall include provisions for enforcement of off-street parking and maintenance of the property line fence along the west and south property lines.

OTHER CONDITIONS:

24. Hours of project construction shall be limited to the following:
7:00 a.m. to 8:00 p.m. (Monday through Friday)
8:00 a.m. to 8:00 p.m. (Saturday, Sunday and holidays)

~~The motion was approved unanimously.~~

~~Mr. Jones noted to the applicants that they could appeal this decision to the Planning Commission.~~

CERTIFICATION OF THE DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED AMENDMENT TO THE SOUTHEAST ROSEVILLE SPECIFIC PLAN

Mr. Dillon began by saying that the responses requested from the meeting of September 22 had been submitted and the information given seemed appropriate and complete.

Land Use

Mr. Dillon commented that on page 5 of this section, Staff disagrees with conclusions regarding mitigations to reduce exposure to electromagnetic hazards to residents in the area. This is based on additional information submitted by SMUD and PG&E.

Mr. Dillon noted the response from Parks & Recreation giving limitations on the possible usages of the power line easement for recreational or park areas, as well as the memo from the Risk Management Department which recommended not locating City recreation facilities of any kind under the electrical transmission lines.

Mr. Hamel said that the Commission had recently approved a tennis club to be built partially under the power line easement.

Mr. Dillon agreed that this was the case but noted that this restriction is part of a developing awareness and that this project was approved before the concern was known.

Mr. Fuller, R.C. Fuller Associates, 5908 Fair Oaks, Carmichael, stated that the EJR would be revised to reflect these potentially restricted land uses. He noted however that at the present time, without a decision from City Council, it was difficult to determine whether parks within the power line easement would be restricted.

Mr. Steve Robbins, Southfork Partnership, noted several inaccurate assumptions in the risk management memo.

Mr. Hamel expressed his concern that if the City were to accept the acres for park usage under the power lines, it might at some point, be precluded from this usage -- so where would the parks be.

Mr. Azevedo asked the percentage of park acreage included within the easements.

Mr. Fuller responded that it was 60%.

Mr. Azevedo commented that this situation was well addressed in the EIR and that City Council would be addressing this situation.

Mr. Hamel suggested that if the Commission felt strongly on a point it would be possible to send a memo summarizing Commission concerns to City Council.

Mr. Dillon responded that this should be a separate memo. He commented that Staff had no further comments on this section.

Mr. Manhart asked in regard to the traffic section what the effect of the Sunrise/Douglas intersection not being able to be at LOS C would have in the future if that condition continued.

Mr. Dillon responded that LOS C is not a specific enough standard. The City Council will have to determine which factors really determine the acceptability of the level of service of an intersection and how to set specific standards.

Mr. Peers stated that right now the intersection is in the D/E

range. In the short term with the improvements being initiated now it will improve somewhat. However, the long term picture is that it will worsen again. He said a primary mitigation will be to keep alternative routes at LOS C so that it will be possible to avoid this intersection.

Mr. Wallace suggested that proposed improvements to the Atlantic interchange will help somewhat.

Mr. McIntyre commented that exact arrangements for traffic circulation plans are still to be developed at the Planning Commission and City Council levels of review.

Steve McDonnell noted that the original study is of the interpretation that there is the ability to finance all improvements with development at build-out levels.

Mr. Dillon commented that this interpretation should be referenced in the EIR.

Housing

Mr. Dillon stated that final conclusions regarding affordable housing in the Specific Plan area are pending the findings of the Affordable Housing Task Force.

Mrs. Alway commented that in the memo from the City Attorney, he disagreed with the DEIR's conclusion that it is not possible to determine the SERSP's share of affordable housing or whether it is consistent with the general plan housing element at this time.

Mr. Dillon responded that the findings are not that it can't be done but that it is being worked on.

Electricity

Mr. Dillon reported that Staff is satisfied with this response.

Mr. Smith said that he feels this section is inadequate because it doesn't say where they are going to get enough extra power for 60,000 additional residents.

Schools

Mr. Ron Feist, District Superintendent, Eureka Union School District, began by saying that the annexing of the Broken Spur property, with the changes in the housing mix, would result in 300-350 more students than the old plan. This change could cause the need for another elementary school site for the Eureka School District. With the final response from the State of a definite 'no' for the test site for the junior high under the power lines, the present revised plan involves moving the elementary school to the former junior high site (staying the State mandated 350' away from the power lines).

Mr. Feist noted that alternative locations for the junior high include an area on the North side of Douglas (Exhibit D) or another site, (Exhibit E). Currently they are working with Mr. Mahaney to combine the school site with a park to gain the required acreage. He noted that none of these alternatives is voted on or approved by the School Board. He added that their planning objective is to get enough schools to cover the peak enrollment increase (over the next 5-6 years, approx. an increase from 1,430 to 4,000 students) without building too many and having schools close.

Mr. Hamel commented that the alternative in Exhibit E would require that almost all the students would be bussed.

Mr. Feist agreed and said that the choice was a lot of crossing guards or bussing.

Mr. Dillon noted that the EIR on page 6 of this section should say, "may be mitigated".

Air Quality

Mr. Dillon began by saying that the change from the old to the new Specific Plan area had not made a significant change in the areas and number of 'hot spots'. The draft EIR lists a number of standard mitigation measures.

Mrs. Alway commented that as the area is low, the smoke tends to hang. Each separate plan tends to be a bit hazy on the issue of air quality because not really able to adequately mitigate the impacts.

Mr. Bill Zisk, 205 Toma Street, Roseville, asked how the increased drainage (est. 45% for this Plan, 65% for the Northeast Plan) will affect downstream areas. He said that the cumulative effect of the impacts is not adequately addressed.

Mr. Manhart stated that he had requested at least some suggested mitigations for cumulative effects and he doesn't see those in the letter from Morton and Pitallo. He asked how, if the current channels were at maximum levels already, would the increased run-offs from new development going to be handled.

Mr. McIntyre commented that the letter shows the peaks and how to evaluate peaks in terms of cumulative effects and the overall drainage strategy.

Mr. Robbins suggested that the language from the NorthEast Roseville Specific Plan dealing with cumulative impacts be added to this plan as an additional alternative.

Mr. McIntyre agreed, noting that a detailed regional study such as the one being requested takes several years to prepare. He said that the combination of the draft EIR and supplemental

letter are adequate in quantifying the data available at this time.

Mr. Bergtold commented that if the Corps of Engineers has already determined that the only way to have the creeks handle the flow is to channelize, then it seems a shame to lose the natural creeks and see Roseville go the way of the Los Angeles style rivers.

Commission concensus was to accept the adequacy of the hydrology section with the addition of the NorthEast Roseville Plan language as an alternative as suggested by Mr. Robbins.

MOTION

Mr. Wallace made the motion, which was seconded by Mr. Smith, to recommend certification that the Southeast Roseville Specific Plan EIR is complete and adequate and in compliance with C.E.Q.A. regulations.

The motion was approved unanimously.

The memorandum to be sent separately to City Council will address specific Commission concerns on the following areas:

- Traffic
- Source of Utilities
- Utilization of acreage within the power line easement for parks
- Air Quality
- Vernal Pools
- Drainage
- Oak Wood Preservation

COMMISSION COMMENTS

Mr. Wallace requested that a letter be forwarded to City Council pointing out the proliferation of illegal signs in the City.

The meeting was adjourned at 10:30 p.m.

CITY OF ROSEVILLE

PROJECT REVIEW COMMISSION MEETING

September 22, 1987

P.R.C. Present: Mel Hamel, James Smith, Dan MacClain,
David Manhart, Jack Wallace,

P.R.C. Absent: Dennis Azevedo, Clair Alway

Staff Present: Steve Dillon, Planning Director
Dave McIntyre, Senior Civil Engineer
Nancy Christie, Secretary

DRAFT ENVIRONMENTAL IMPACT REPORT — SOUTHEAST ROSEVILLE SPECIFIC PLAN

Mr. Dillon began by stating that the City Council adopted the existing Southeast Roseville Specific Plan in February of 1985. The Plan encumbers 637.4 acres south of Douglas Blvd. between Rocky Ridge Drive and Sierra College Blvd. The Specific Plan calls for the development of 3798 units of residential development along with approximately 136 acres of non-residential land use. Construction of the initial phases of this Plan are currently under way.

In August of 1980, the City annexed approximately 367 acres of property east of Sierra College Blvd. and south of Eureka Road. This parcel is known as the Broken Spur property and is contiguous with the existing Southeast Roseville Specific Plan area. The primary property owner in the Southeast Plan Area, Southfork Partnership, recently purchased this property. The current request is to modify the Southeast Plan to incorporate the property.

The Broken Spur parcel has an existing land use of .43 units per acre. It would yield 167 residential units. The property owner is proposing to reallocate 783 units from the existing Plan Area onto the property. This will be accomplished by reducing mid-range densities in the existing Plan. No additional units are requested to be allocated to the Plan Area. The amended Specific Plan would yield a total of 3,965 dwelling units.

Mr. Dillon reminded the Commissioners that the purpose of this review would be to determine the adequacy of the Environmental Impact Report prepared for this project. The Commission must determine if all of the relevant issues have been adequately analyzed and addressed, looking at the comprehensiveness and accuracy of the document in identifying possible impacts upon the environment, and defining and discussing appropriate mitigation measures required.

The applicant, Mr. R.C. Fuller, 5908 Fair Oaks, Carmichael, began by giving a brief overview of the document. He noted that it has

been presented in two volumes, the EIR itself and an accompanying technical appendix. The EIR for the Southeast Roseville Specific Plan covers a large area with many different land uses. He noted that while this diminished somewhat the tendency toward being able to address specific situations, this was made up for by the increased mitigation potential and greater flexibility.

Mr. Fuller noted that the focus of this current EIR was on the addition of the annexed property and impacts arising from the old specific plan to the new plan as proposed. He added that this EIR was prepared by a team, of which Bob Langwill was the Project Coordinator, Jack Peers is the traffic consultant and Dick Morton of Morton & Pitallo is the Project Engineer.

Mr. Dave Wade, 735 Sunrise Ave., Roseville, the preparer of the current plan gave a brief overview of the major features of the plan. He noted that the major roads were Eureka Road which would be connected with the already existing County Road and the partially constructed E. Roseville Parkway. A major feature of the plan is a large power line easement which crosses the property. He noted the major drainages were kept open, and that Linda Creek passes through the new area.

Mr. Wade explained that the plan had been oriented to group office/business uses in the northern area, along Douglas Blvd. A buffer of apartment areas separates this area from the primarily residential uses in the south and east. He added that small commercial clusters have been provided at strategic areas in the plan. Three school sites and 92 acres of park usage have been designated, as well as a fire station.

Mr. Bergtold, 1029 Audrey Way, Roseville, asked Mr. Wade to give information on an apparent inconsistency between the specific plan and the City's General Plan. He observed that one of the school sites was located too close to the power line easement.

Mr. MacClain commented to Mr. Bergtold that one aspect of this Commission's review was to note such inconsistencies and to see that adequate alternatives for the resolution of such conflicts are presented in the document..

Mr. Dillon stated that specific solutions and resolutions will be addressed in the course of the review and approval process by the Planning Commission and the City Council. He added that when the plan was first brought up, no restrictions existed for the placement of schools near the power lines. These restrictions are new and come from the State.

Mr. Bergtold also noted that the plan as presented retains no natural habitat areas. He questioned this inconsistency with the clearly stated goal to provide such areas in the City's General Plan.

Mr. Fuller answered that some aspects of the plan are still not fully mitigated, and that alternatives and solutions are needed

in certain areas. He directed the Commissioners to a Table of Impacts in the document and noted that these impacts had been divided into three categories: less than significant impacts with existing mitigation measures; significant impacts with proposed specific mitigation measures; significant impacts not fully mitigated with identified measures. Mr. Fuller noted that by law the City must make findings regarding mitigation measures for areas identified in this third category.

Mr. Wallace asked why if the 'Broken Spur Property' had been annexed in 1980 it had not been included in the original Southeast Roseville Specific Plan.

Mr. Dillon replied that the property was not owned by the current owners and was not included originally as part of the project. The Planning Staff could have suggested that it be included in the original Southeast Roseville Specific Plan but as it was being proposed as a separate land use with a different density, it remained separate.

Mr. Smith asked if it was unusual to create islands of County land within the City.

Mr. Dillon responded that the annexation was approved by the City Council on a split vote. He added that the City's sphere of influence in this area reaches as far east as Barton Road. It is possible that that island will ultimately be annexed also, but City policy is not to aggressively annex property.

Mr. Smith expressed concern on how these islands will ultimately be developed.

After a short discussion, the Commissioners decided to review the EIR section by section, giving special attention to areas where Staff feels that additional analysis or clarification is needed.

GENERAL PLAN CONSISTENCY Pages C-11 through C-30

Mr. Dillon noted that State planning law dictates that a Specific Plan must be consistent with a jurisdiction's adopted General Plan. Where inconsistencies exist, the Specific Plan must be amended to be consistent with the General Plan or visa-versa. He noted three areas where inconsistencies and suggested mitigations have not been adequately examined by the EIR, traffic circulation, preservation of open space and inclusion of affordable housing.

Mr. Fuller suggested that in response to these concerns, specific alternatives and additions of mitigation measures be addressed in the context of the review of each relevant section.

Mr. Manhart asked how the allocation of land use was made in regard to C14, #4.

Mr. Dillon responded that this was based on the ability to implement the necessary infrastructure.

GEOLOGY Pages D-1 through D-4

Mr. Dillon commented that the geological survey contained in the EIR only partially covers the Plan Area. The EIR indicates that a complete geological survey of the existing Plan Area was not prepared. Only the property proposed to be added to the Plan has been surveyed. Although it is unlikely that geological constraints exist on the unsurveyed portion of the Plan, this determination cannot be made until adequate information has been generated. If survey work exists it should be added to the EIR so that a complete analysis of potential impacts can be performed.

Mr. Fuller responded that in the original Southeast Roseville Specific Plan, the geological survey was to be done property by property prior to building on a given site. In the new area, the survey was done as one unit with more thorough work being done than was actually required.

Mr. Dillon commented to Mr. Fuller that a statement to this effect should be incorporated in the EIR as to how the geological survey on the remaining areas will be done.

Mr. MacClain asked Mr. Dillon if he felt that Staff's questions on this section were adequately addressed.

Mr. Dillon responded that they were.

After a short discussion, Commission decision was to accept the adequacy of this section provided that the above-identified information on the provision for geological survey in the previous area of the plan is incorporated.

HYDROLOGY

Mr. Dillon began by saying that although the EIR states that the project will minimally increase run-off into the City-wide flood drainage system, this increase has not been quantified. A number of generic mitigation measures are suggested, but the EIR should specifically quantify this increased run-off and should provide a mitigation measure which requires that a comprehensive drainage be prepared for each watershed in the Plan Area prior to development of individual projects in the subject shed.

Mr. Fuller noted that on page E6, the estimated increase in run-off is given as from 146.4 feet to 147.3, or approximately 0.9 feet as a result of total development of the watershed. He added that this area represents approximately 1% of the total Linda Creek watershed area.

Mr. McIntyre acknowledged that Public Works is aware that until these comprehensive drainage studies are prepared, contribution of run-off from the specific plan area cannot be determined from the available information. He questioned, however, whether the percentage of 1% given above is correct or whether it should be 10%.

Mr. Morton of Morton & Pitalo, stated that they would provide a more complete analysis of the run-off impacts downstream using the available information from the Nolte and Williams Studies. He added that they would check on the accuracy of the percentage quoted above.

Mr. Manhart asked if a master plan comprehensive drainage study is being prepared for the whole area.

Mr. McIntyre responded that such a plan is in preparation, but that it will take at least two years to prepare and that at this point what is being required is a detailed drainage study for each individual project or smaller use.

Mr. Wallace noted that more detail is needed on the potential impacts of run-off. He reiterated the need to determine the correct percentage, 1% or 10%.

Mr. McIntyre added that Public Works would specifically require the ETR to add the clause in this section that a comprehensive drainage report is to be prepared for each project in the Southeast Roseville Specific Plan and be submitted to the Public Works Department for review.

Mr. Bergtold asked if the goal of the City was not to increase the level of run-off downstream.

Mr. Dillon stated that the goal of the City was not to have a cumulative total increase in the run-off.

Mr. Bill Zisk, 205 Toma St., Roseville, asked if any calculations had been prepared to show the run-off level before completion to the level after buildout, ie. the overall percentage of change of runoff from the natural state to full build-out.

Mr. Morton commented that he did not have an immediate answer to that question.

Mr. Dillon asked if an answer could be supplied with other information.

Mr. Morton responded that it could.

Mr. McIntyre noted that the Nolte Study and the Williams Report (which contains guidelines on how to manage water in the system) are the two studies available at this time.

Mr. Dillon commented to Mr. Morton that alternatives to show

various ways to handle increased run-off should be shown. These can be addressed at this level or when a developer comes in with a specific project. However, no projects will be built before their respective comprehensive drainage study is completed.

Mr. Manhart commented that in addition, a review of alternatives for flood mitigation should be included.

Mr. Wallace said that he feels that with the additional information to be provided by Mr. Morton, and the inclusion of the clause as given by Mr. McIntyre, the EIR is sufficient in this section.

Mr. Bergtold asked if the run-off could be improved by keeping the land in its natural condition and by increasing plantings there.

Mr. Dillon asked if this was a valid assumption.

Mr. Fuller commented that in other areas they have found that drainage can actually be improved through development.

Mr. Wallace told Mr. Bergtold that his question refers to the "no development" option in the EIR and that this would be looked at as a given alternative by both the Planning Commission and the City Council.

Mr. Dillon asked if the soil in the broken spur area was mehrton.

Mr. Fuller responded that it was not.

After a brief conference, Commission determination was that this section, Hydrology, would be adequately covered by the EIR with the additions discussed and the inclusion of information in the letter forthcoming from Mr. Morton.

VEGETATION AND WILDLIFE

Mr. Fuller commented that the EIR included a list of plant species which may occur in the subject area. None of the species listed is on the endangered list or would merit State concern for preservation. In regard to the Vernal Pools, Larry Stromberg, Ph.D. consulting biologist for the EIR, noted that the vernal pools in the Specific Plan area are not as well-developed as in other areas of Roseville, and that there was no need to save them.

Mr. Dillon presented Staff's concerns that much of the large oak woodland existing on the central portion of the Broken Spur property would be destroyed if developed at the density and with the housing type proposed in the Specific Plan. The measures listed in the EIR to mitigate this impact do not appear to be sufficient to reduce the impact to a less than significant level. He noted that while some alternatives are discussed in the EIR,

Staff feels that additional discussion of alternative densities and housing types, creation of permanent open spaces, and clustering need to be provided.

Mr. Fuller responded that they will discuss the given alternatives in greater depth.

Mr. Hamel asked how significant the vernal pools were in relation to the Northeast Roseville Specific Plan.

Mr. Fuller stated that the pools in the Northeast Plan area were larger and more significant, but that the pools in the North Central area were the most important of the vernal pools in the area.

Mr. Bergtold pointed out that the technical appendix lists two measures for preserving 16-22 acre areas which could preserve some vernal pools and woodland. He asked why this was not included in the body of the EIR.

Mr. Fuller responded that this was not included because when they looked at these questions in a City-wide context, better alternatives presented themselves.

Mr. Dillon commented that this should be included in the EIR main text, with an explanation of why not a practical alternative because of impacts (economic or otherwise).

Mr. Hamel added that this issue should not be put off until the consideration of the last Specific Plan to be reviewed.

Mr. Wallace agreed, recommending that the City initiate a consistent program or policy. He suggested, in addition, that a letter be forwarded to the Planning Commission and the City Council drawing their attention to the alternatives.

After a brief discussion, Commission concensus was to include these two alternatives (from the Technical Appendix, Biotic Survey Section, pages 12-14) in the body of the EIR.

TRAFFIC AND CIRCULATION

Mr. Jack Peers, Traffic Engineer for the EIR, 3685 Mt. Diablo Blvd., Lafayette, presented a review and summary of the findings in this section along with correlations to Staff's specific concerns. He noted that the traffic study must take into account levels of projected growth in the Specific Plan area in conjunction with growth in the entire area, looking at the cumulative impacts. He stated that the projection of a full build-out (in 20 - 30 years) would produce a quadrupling of the overall traffic.

Mr. Peers reviewed several of the maps in this section, showing the existing road system, cumulative road system with new roads and where they will be, and future roads with their improvements.

Placer County anticipates that Eureka Road will be 4 lanes East of Sierra College Blvd., and City plans call for Eureka to be 6 lanes between Douglas and Sierra College Blvd. He noted that the traffic survey developed traffic projections from a number of different land use alternatives, including the 'no action' alternative, as well as land uses in the surrounding areas of the City and Counties of Placer and Sacramento.

He commented that City General Plan Policy was to have a LOS C at all critical intersections throughout the City and that all screenlines must be LOS C or better. Where there would be problems with an intersection with LOS in the D area, localized improvements at critical times are listed as mitigating factors.

Mr. Hamel asked if any consideration is being given to extending Highway 65 into this area from the freeway.

Mr. Peers replied that there were two problems in this. First, the Cal Trans timeline shows no activity in regard to Highway 65 east of Freeway 80 and secondly because the projected cost to amend the interchange would be 20-25 million.

Mr. Hamel asked if right-of-way for Roseville Parkway east of Sierra College Blvd. had been set aside.

Mr. Peers states that provisions had been made for right-of-way.

Mr. Dillon asked what the effect would be on traffic circulation in the Specific Plan area if the County did not enact their projected improvements of Douglas and Eureka.

Mr. Peers said that of course the City could not act alone in this and that they would have to work with the County in seeing that the improvements were enacted. He said that the first priority of the County is to widen Douglas Blvd. to 4 lanes as far east as Barton Road. They have major funding already and are making progress on securing the remainder.

Mr. Wallace asked why the LOS at the Roseville Parkway and Taylor Road intersection is lower with the shift of housing from the old Specific Plan to the new.

Mr. Peers commented that this was due to a variety of complex factors rather than a single obvious one.

Mr. Smith asked if the location of the proposed mall was being taken into account.

Mr. Peers said that they had worked with projections for the three most likely locations for the mall, one of which would be in Rocklin and two in Roseville. In any event, of these three locations, the two remaining non-mall sites would undoubtedly be high commercial usage. He noted however, that as much as 35% of traffic in a major retail center is not generated by the center

but is in the area already.

Mr. Peers went on to Figures J19 and J20, showing traffic conditions at full buildout (at least 20 to possibly 30 years away). He noted five intersections with LOS D or E. However, the Southeast Roseville Specific Plan would account for only approx. 8% of the cumulative 400% growth.

Mr. Peers next reviewed the four major concerns enumerated by Staff:

- 1) Even with the indicated improvements, major intersections in the vicinity are predicted to operate at less than a level of service LOS C. The EIR concludes that traffic impacts cannot be mitigated to a less than significant level for some intersections and roadways.
- 2) The new definition of LOS C appears to be more liberal than that used when the General Plan Policy was developed.

Mr. Peers commented that the 1981 Traffic Circular #212 is the document which determines the level of service ratings for an intersection. One of the elements in this determination is the delay factor. This can be mitigated by changing the cycle length. If at the time of implementation, an intersection is at the mid D LOS, certain mitigations can be taken to reduce the delay factor to the LOS C. In addition, in 1985 new standards were developed which can cause some difference in determining the LOS of intersections. Definitions of LOS and other terms used in presenting this data are given on p.5 of the Technical appendix.

Mr. Dillon responded that Staff's concerns are to make a determination of consistency in applying these guidelines.

Mr. Peers noted that screenlines can be maintained at LOS C. The intersections can be held at LOS mid D (determined with the Planning estimate procedures which are very conservative)

Mr. Dillon noted that the EIR should be amended to clarify the differences between the two standards.

Mr. Peers said that he would write out a clarification of the differences in more detail to clarify the LOS question, Staff concerns 1 and 2.

- 3) The emphasis of the traffic analysis has appeared to shift from specific intersections to screen lines. The EIR indicates that several intersections will operate at less than a LOS C. It is indicated, however, that the LOS over screenlines averages a LOS C. This appears to deviate from the intent of the LOS policy in the General Plan.

- 4) The study contains specific intersection levels of service for development of the Plan until the year 2005. The buildout analysis, however, discusses screenlines, but no specific intersections. This information should be generated as a point of

comparison as well as making it possible to judge consistency with adopted General Plan LOS policy.

Mr. Peers responded that this was not the case, but that in projections of more than 20 years it is difficult to get specific about the future conditions of given intersections.

Mr. Dillon commented that the EIR should state clearly if the LOS of certain intersections is not known, then specific land use cannot be committed to.

Mr. Peers noted however, that the EIR gives specific mitigation measures to bring each intersection into an acceptable LOS range.

Mr. Wallace asked how proposed County developments are able to be figured into traffic projections.

Mr. Dillon responded that both the City and the County reciprocate in sending project EIRs.

Mr. Peers added that they had talked with Placer County and the city of Rocklin in their 2005 and 30 year projections to incorporate their projections, also Sacramento County, and these have been calculated in. Also zoning alone doesn't guarantee potential... building and market conditions also determine this and they incorporate this information also.

Mr. Maynard Bean, Sierra College Blvd, stated that they have lived there for 40 years. He noted the increasing traffic on Sierra College and asked if there will be a left turn lane in Sierra College.

Mr. Peers noted that the County will make that determination. He added that the County intends to build a 5 lane road where there are frequent driveways. He told Mr. Bean to talk with the Public Works Department of Placer County for more information.

Mr. Manhart observed that the intersection of Sunrise and Douglas seems to be a perennial problem intersection. He asked if easements in that area just not adequate to provide for any real 'fix'.

Mr. Peers added that in addition, the intersection is too close to Freeway 80.

Mr. Smith asked if Caltrans had improvements on the drawing board for the Douglas interchange.

Mr. Peers answered that there were none, although the Atlantic interchange will be improved.

Mr. Walt Bader, 610 Auburn Ravine Rd., asked if the probable buildout levels of 2005 and 2015 could be quantified at all.

Mr. Peers gave a brief overview of how these projections are

prepared.

Mr. Wallace asked if going back to higher density, less development was listed as a way to mitigate the LOS.

Mr. Peers responded that changes in the LOS were due to cumulative and diverse impacts rather than simple changes of density. Among the ways to mitigate impacts at an intersection were: Move the bus turnouts, restrict pedestrian movements, restripe, add turning lanes. On another level, TSM's could be applied.

ADJOURNMENT

Mr. Smith made the motion, which was seconded by Mr. Manhart, to adjourn the meeting to October 1.

The motion was approved unanimously.

COMMENTS AND RESPONSE DOCUMENTS



SERSP Comments generated during the Planning Commission Meeting of December 14, 1987.

The following written comments were presented by Marge Heartney, the Roseville representative of the Mother Lode Chapter of the Sierra Club. Following is a summarization of the comments and prepared responses. A copy of the complete comments follows this response section.

Comment: Integration of transit roadway, air quality and housing goals is necessary to mitigate the air quality impacts of the project area. Without describing the financial and institutional problems in the development of a transit system for the plan area, the EIR is inadequate in its analysis.

Response: The DEIR is in concurrence with the Sierra Club position that a substantial reduction of air quality impacts may be achieved through integration of transit, roadway, air quality, and housing goals. The EIR quantifies the air quality impacts of the project, and identifies specific measures which should be implemented. These measures include recommendation that project developers be required to provide transit facilities including bus stops, benches, shelters, turn outs, etc. Provision of these types of facilities will provide the necessary infrastructure to allow the regional transit companies to serve the plan area. The financial and institutional aspects of operating regional mass transit programs are beyond the scope of this EIR.

Comment: The EIR should discuss the health impacts of air pollution.

Response: Following preparation of the DEIR, additional information regarding the health implications of air quality was requested and provided to the Planning Commission. A copy of this information follows this section. In summary, carbon monoxide more readily combines with hemoglobin in the human body than does oxygen, and thus prevents oxygen from entering the bloodstream. The consequences of breathing prolonged high CO concentrations is comparable to suffocation. Elderly people or people with heart conditions and/or respiratory ailments are more susceptible to complications resulting from higher CO concentrations. Ozone is a pollutant of concern because high levels of ozone can contribute to damage and deterioration of the air sacs within the lungs, decrements in pulmonary function, and impairment of disease resistance mechanisms. Further, high levels of ozone have been linked to negative responses in plant communities, including reduced yields of domestic crops, and defoliation of coniferous forests in areas of southern California. Similar to CO, elderly people and people with respiratory ailments are most likely to suffer from elevated levels of ozone. However, because of the damaging properties of ozone on the air sacs of the lungs, athletes and persons participating in vigorous physical activity may also be affected by ozone.



Comment: The EIR does not reference the ERA post '87 attainment policy or the Air Quality Plan update.

Response: Neither of these documents has been finalized or adopted. Both are in the preliminary stages of preparation and are not anticipated to be completed for several months. Roseville is a participating municipality in the Sacramento Air Quality Plan, and may be expected to share in the implementation of measures identified by these documents when adopted.

Comment: New entitlements are being granted within the SERSP beyond the 1982 Air Quality Plan assumptions.

Response: The SERSP includes the identical number of residential dwellings as the existing SERSP and zoning. No change in entitlements is proposed, only a shifting in densities. Proposed commercial and professional area changes only minimally, and is proposed to reduce the travel characteristics of future residents by providing facilities and services in close proximity to the residential neighborhoods.

Comment: The following mitigation measures should include additional mitigation measures.

Response: An extensive list of additional measures was provided in the comment letter. This letter, and list, follows this page. These measures should be considered in evaluation of the Specific Plan.

Comment: The Cleaner Air Partnership presented a list of five (5) policy recommendations which should be considered by the City of Roseville.

Response: A copy of the recommendations is attached, and should be reviewed by policy-makers and responsible individuals.





Sierra Club

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Mother Lode Chapter

P.O. BOX 1335, SACRAMENTO, CALIFORNIA 95806

Sierra Club Comments on Southeast Roseville Specific Plan EIR
Marge Heartney, Roseville Representative
Roseville City Hall, December 14, 1987

The Sierra Club wishes to comment upon the Environmental Impact Report for the Southeast Roseville Specific Plan, and specifically to discuss the :

- adequacy of analysis of impact;
- adequacy of mitigation measures and
- consistency of the Southeast Roseville Specific Plan with City policies.

With regard to the adequacy of the analysis of environmental impacts we have identified several areas of concern.

- The integration of transit, roadway, air quality and housing goals and policies has not been achieved. The lack of integration of these elements of the plan also affect the ability to mitigate the air quality impacts of the project area.

Pages C-13 and C-16 refer to housing goals and the failure of the city to meet housing goals. It appears that a greater amount of higher density housing is needed in Roseville to meet its housing goals. While much of the housing needed in Roseville will be higher density housing, the EIR does not identify an adequate transit system, the funding or institutional arrangement for providing service. Transit service is necessary to provide mobility for higher density housing, commercial and industrial uses while meeting air quality and traffic level of service goals. These land uses should be limited to corridors where convenient transit services will be provided.

If the EIR for the Southeast Roseville Specific Plan were to integrate transit, roadway, air quality and housing goals and policies, it would be clear that the major mitigation measure for all of these impacts is the development of an efficient and effective transit system for Roseville. Without describing the financial and institutional problems in the development of a transit system for the plan area, the EIR is inadequate in its analysis.

- Health impacts of air pollution. Page G-2 refers to the health impacts of air pollution. The chief health impact of carbon monoxide is upon those with heart conditions; the EIR does not recognize this impact. Ozone has significant health impacts for the young, the elderly, exercising athletes and those with respiratory disorders such as asthma, emphysema, chronic bronchitis and related problems.
- Air quality policy. On Page G-4, the EIR refers to Roseville's "proximity to the greater Sacramento metropolitan area," and refers to the impact of pollutants downwind on Roseville. While it is true that pollutants downwind do and will create unhealthy air in Roseville, it is also true that Roseville is a part of the metropolitan area and its air basin, a fact which is recognized in the 1982 Air Quality Plan published by the Sacramento Area Council of Governments, and Roseville's participation in the update of that plan currently underway. Roseville's growth increases the number of vehicle trips in the air basin, and contributes substantially to the degradation of the air quality in the region due to uncontrolled transportation emissions.

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- ERA post '87 attainment policy is not referenced in the analysis of the air quality impacts of the Specific Plan. Roseville is affected by this policy, and the EIR should recognize the requirements imposed. This policy requires full mitigation of all post 1987 emissions and a three percent annual reduction of 1987 level emissions.
- The Air Quality Plan Update is now underway and Roseville must come up with new air quality mitigation measures for that Plan. The Specific Plan is inadequate if it does not analyze air quality impacts in light of the requirements of the air quality plan update.
- New entitlements are being granted in the Specific Plan beyond the 1982 Air Quality Plan assumptions. Approval of a new increment of growth without full mitigation is not permitted under current federal law.
- The analysis of carbon monoxide emissions is not related to the violations that will occur. Discussion is about carbon monoxide violations in other jurisdictions. Carbon monoxide violations are site specific and can be predicted from traffic modeling. Mitigation measures can be designed to reduce the congestion which would cause the carbon monoxide violations. Such mitigation is not indicated in the carbon monoxide violation analysis. This renders the carbon monoxide emission impacts analysis inadequate.

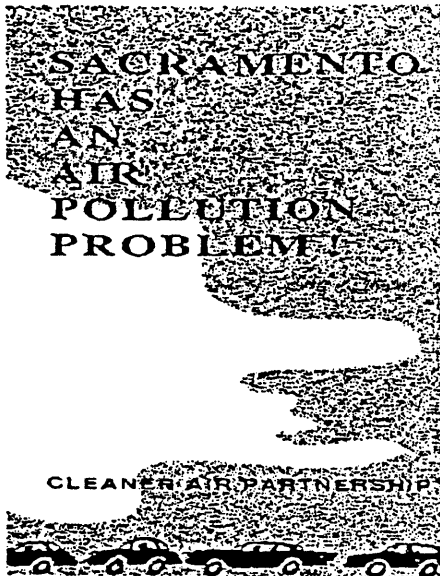
The mitigation measures identified in the air quality, and transportation sections of the EIR are inadequate:

- Monitoring equipment and stations and personnel for the Air Pollution Control District to monitor CO and ozone violations must be included as mitigation measures for the plan since such monitoring activities are not being conducted and should be funded from the growth activities envisioned by this plan;
- A monitoring plan by the Air Pollution Control District for baseline and emissions growth should be outlined in the EIR and a schedule for reports to the City, SACOG, the Air Resources Board on emissions monitoring should also be included;
- An agreement and plan for coordination and cooperative action by City and Placer Air Pollution Control District to reduce emissions should be included as a mitigation measure in the EIR, to be completed before permits are approved within the plan area;
- Funding for transit capital and operating costs and an institutional arrangement for the provision of transit service to the plan area should be obtained before permits are approved within the plan area;
- Roseville's ordinances related to trip reduction activities by developers and employers should be upgraded, consistent with the highest requirements in the region, and fully monitored and enforced before new entitlements are granted;
- A full time Roseville City transportation management coordinator, or plan area transportation management association coordinator, should be required to implement a ten year transportation system management plan for the plan area, as a mitigation measure;
- Roseville should have a year-round public education program on trip reduction and alternative transportation, or contribute on a pro-rata basis to a regional public education program, before new entitlements are granted;
- Clean fuels measures should be required, such as methanol compatible tanks in any new service stations permitted in the plan area;
- The Specific Plan and its EIR should recognize the need to amend the plan to full conformity with AQP Update when that Update has been completed.

We are also concerned with consistency with City Policies:

- Agricultural lands: the Specific Plan should honor the General Plan agricultural lands policy fully.
- Tree ordinance: we endorse the compliance with the tree ordinance and the policies referred to on Pages F14-15.
- Vernal Pools: Page F-15. Preservation of vernal pools is a critical environmental impact, and the program for vernal pool preservation should be determined before any entitlements are granted.

THANK YOU FOR THIS OPPORTUNITY TO COMMENT ON THE EIR



CLEANER AIR PARTNERSHIP Policy Recommendations

1 UPGRADE TRIP REDUCTION ORDINANCES AND REGULATIONS

WE RECOMMEND that elected officials direct their staff to assign adequate funding, staffing, and management responsibility, so that trip reduction requirements are applied consistently and equitably, and trip reduction measures are fully monitored, enforced, evaluated, and reported. An effort is required to equalize regulations so that the same standards and definitions apply countywide. We also recommend that the cities in Sacramento County find an expeditious and cost effective way to adopt and implement trip reduction programs for themselves and other large employers in their jurisdiction in a manner which is consistent with the County's programs.

2 METHANOL IMPLEMENTATION

WE RECOMMEND that local elected officials direct city and county staff to participate fully in methanol conversion evaluation, as a joint effort with the Partnership and private sector interests, and to bring feasible methanol implementation measures to the legislative bodies for review at the earliest possible date.

In addition, we recommend that local elected officials direct city and county staff to evaluate methanol implementation related state and federal legislation and bring recommendations to the legislative bodies for support of methanol implementation related legislation in a timely manner.

We recommend that the methanol strategy, and other alternative fuel and vehicle options, be fully evaluated in the Air Quality Plan Update, and that feasible targets, plans and milestones be included in the Air Quality Plan to obtain the benefits of clean fuels as soon as possible.

3 AN EMISSIONS ACCOUNTING SYSTEM

WE RECOMMEND that local elected officials direct city and county staff to participate fully in the development of a transportation emissions accounting system and that the specifications for such a system, to apply county wide, be submitted to the legislative bodies by December, 1988.

4 PUBLIC EDUCATION ON SMOG AND THE SMOGGY SEASON

WE RECOMMEND that local elected officials participate in authorizing and funding a multi-year regional public education program that will:

- coordinate existing programs and resources
- include a new regional smoggy season education campaign
- include an evaluation to determine the impact of the public education program
- include developing information on how best to reduce transportation emissions in the smoggy season through broad public participation

5 CLEANER AIR PARTNERSHIP CONTINUATION

WE RECOMMEND that elected officials endorse the continuation of the Partnership that local governments participate in the joint public-private funding of the Partnership's activities to:

- continue to develop recommendations, through workshop consultation with private sector interests, on new air quality measures to close the gap between the current plan and the goal;
- obtain the private sector point of view on new transportation emission control measures;
- respond to local, state, and federal policy proposals affecting Sacramento's ability to obtain clean air as quickly as possible so that elected officials and the business community receive guidance regarding the impact of these proposals on clean air in Sacramento.

The following summary has been excerpted from the State of California, Air Resource Board publication:

**Ambient Air Quality Standard for Ozone:
Health and Welfare Effects
STAFF REPORT
September, 1987**

III. SUMMARY OF INFORMATION ON EFFECTS

A. EFFECTS ON PUBLIC HEALTH

In order to provide a basis for conclusions about health effects of ozone exposure the staff has reviewed the available scientific research on effects of ambient levels of ozone and has compiled the most relevant information in a technical support document. This section summarizes the most important results of health-effects studies, providing information on the published reports that are referred to in the recommended action. The different categories of health effects under review included epidemiological studies, field studies, and studies using controlled human and animal exposures. When viewed as a whole, this information helps to provide an adequate basis for designating a level below which no adverse effects to health are expected. Understanding how information from one type of study relates to that of another is facilitated by the current state of knowledge of pathological processes. Results from actual ozone exposure studies confirm that the same pathological mechanisms are involved in ozone-induced injury in humans and other mammals.

The initiating phase of ozone-induced injury involves chemical reactions between ozone and essential biological substances common to all living creatures. Ozone can damage living cells and tissues by altering their protein, lipid and carbohydrate components or products. Such changes have been shown to lead to cell damage and cell death (Menzel, 1970, 1980). Cell death and dysfunction occur in cell types necessary for such essential functions as respiration and defense against microbial pathogens after brief low-level exposures to ozone.

Effects Occurring After Short-term Exposure

The principal effects summarized in this section are: (1) injury and damage to cells lining the air spaces of the lung; (2) decrements in pulmonary function; and (3) impairment of host defense mechanisms.

Studies involving brief, short-term exposures of six hours or less have shown that injury to cells which act to transfer respiratory gases to and from the blood (Type 1 alveolar cells) occurs in animals exposed to 0.5 ppm ozone and less. These effects occur in rats exercised in 0.20 ppm ozone for 3.75 hours. At 0.35 and 0.50 ppm, the damage to these important cells is apparent after one-hour of exposure (Mautz, et al., 1985).

Two studies using vitamin E deficient weanling rats continuously exposed to 0.1 ppm for 7 days reported injury to respiratory cells (Chow, et al., 1981; Plopper et al., 1979). Both studies reported very mild lesions in non-vitamin E deficient rats exposed to 0.1 ppm, however, the number of rats was small and concurrent biochemical analysis showed no difference from unexposed control animals. While these studies show an adverse effect with vitamin E deprived animals at low levels, less weight has been placed upon them in light of the fact that vitamin E deficiency in the United States is rare (Farrell, 1980).

Evidence of damage to cells lining the lung is indicated by a reduced ability of the lung surface to regulate liquid levels in air spaces

(alveoli). Increases in the permeability of the lung lining occur after a one day exposure at 0.11 ppm in rats (Gunth, et al., 1986); after a four-hour exposure at 0.20 ppm in guinea pigs, at 0.50 ppm in mice (Hatch et al. 1986); and also after a six-hour exposure at 0.50 ppm in rats (Alpert, et al. 1971a). An increase in the lung permeability also occurs in human subjects exposed to 0.40 ppm ozone for two hours with intermittent exercise (Kehrl, et al. 1987). This effect is likely to occur in humans exposed to somewhat lower levels of ozone, since there is some indication that increased permeability is associated with changes in pulmonary function; although there is no clear relationship between the magnitude of individual pulmonary function decrement and the magnitude of individual increased clearance (Kehrl, et al., 1987; Utell, et al. 1985).

A considerable body of studies of normal human subjects demonstrates that decrements in maximum pulmonary air flow result from short-term ozone exposure. Averaged decrements for an entire group have been reported at concentrations as low as 0.30 ppm for subjects exposed for two hours while resting (Kagawa and Tsuru, 1974a). As the exercise level increases, more individuals respond to lower levels of ozone. Thus, after light exercise during a two-hour exposure, responses were seen at levels as low as 0.20 ppm (Gliner, et al., 1983). After moderate exercise during a two-hour exposure, decrements occur at levels as low as 0.15 ppm (Kagawa, 1983a, 1984). After heavy, intermittent exercise, decreases in several measures of pulmonary function are observed at levels as low as the national standard (0.12 ppm) (McDonnell, et al., 1983). Studies at still higher levels of exercise confirm the observation that as exercise level increases there is a greater response at lower levels of ozone and more individuals who respond.

Controlled exposure studies of exercising children also found decrements in pulmonary function at levels as low as 0.12 ppm (McDonnell, et al., 1985b, c; Koenig, et al., 1987). Results from field studies (Avol, et al., 1985a, b; Avol, et al., 1987) and epidemiologic studies of children (Lippman, et al., 1983; Lippman and Liroy, 1985; Bock, et al., 1985; Liroy, et al., 1985; Spektor, et al., 1987) are consistent with results obtained from controlled exposure studies with children. Two phenomena indicate cause for concern. One is the

lack of increase in symptoms in exposed children. This is of special concern, since symptoms usually act at a warning and can induce protective avoidance behavior. The second is that although the sensitivity of children appears to be similar to that of adults, they are at greater risk of exposure because of differences in their activities and activity levels. The majority of children are much more likely to exercise in an outdoor environment repeatedly throughout the day than adults.

The maximum pulmonary air flow tests that are so useful in humans are impractical in animals. Instead, animal studies have used other tests of pulmonary function to detect changes with short-term exposures to ozone. Exposures for two hours to ozone concentrations between 0.22 and 0.50 ppm induced changes in tidal volume, lung compliance, and pulmonary resistance, as well as breathing frequency and diffusion capacity (Amdur, et al., 1978; Inoue, et al., 1979; Watanabe, et al., 1979; Murphy, et al., 1964; Mautz, et al., 1986; Yokoyama, 1969; Eustis, et al., 1981). In the majority of these studies there was no attempt to establish a level of no effect, but these effects in animals occur at concentrations similar to those causing pulmonary flow decrements in humans.

Impairment of disease resistance mechanisms also occurs after brief, low-level ozone exposures. Increased mortality from pneumonia occurs in animals exposed to 0.08 ppm ozone for three hours and subsequently infected (Coffin, et al., 1967). Ozone-induced damage and dysfunction of bacteriocidal cells (alveolar macrophages) is apparently responsible for this increased mortality. Increased fragility of alveolar macrophages can be indirectly induced after exposure to 0.1 ppm ozone for less than three hours (Gardner, et al., 1970). In addition, a decrease in macrophage enzymes associated with host defense occurs after a three-hour exposure at 0.25 ppm (Hurst, et al., 1970). A decrease in the ability of macrophages to engulf bacteria is evident at 0.5 ppm ozone after a three-hour exposure (Coffin, et al., 1968).

In summary, short-term studies of effects on pulmonary function and lung permeability indicate that similar pathological phenomena occur in both humans and animals at similar concentrations and durations of exposure for low-level

ozone exposures. Additional animal studies also show that the pulmonary function and permeability changes occur at about the same concentration of ozone as does the injury to the lining of the lung (0.20 to 0.50 ppm) and the impairment of host defense mechanisms (0.08 to 0.50 ppm).

Results from studies of animals exposed three to eight hours per day for durations of one week to one month indicate that continued ozone exposure results in continued alterations in lung cells, function and structure. After exposure for eight hours per day for one week, at levels as low as 0.20 ppm, monkeys, mice and rats have similar lesions, in similar anatomic areas of the lung (Schwartz, et al., 1976; Zitnik, et al., 1978; Dungworth, et al., 1975b; Castleman, et al., 1977). Injured Type 1 respiratory cells are replaced by thicker Type 2 cells, and ciliated cells lining the airways of the lung are damaged. There is some evidence of alveolar thickening. An increase in inflammatory cells, including both neutrophils and macrophages, is evident. Studies of animals continuously exposed for durations of one week to one month produced results similar to those studies of animals intermittently exposed.

An important aspect of extended short-term tests is the attenuation of effects. Results from many studies of human and animal subjects indicate that repeated daily exposure produce an eventual reduced response to ozone, as measured by some tests, such as pulmonary function measurements. This reduction in response has historically been referred to as "tolerance" or "adaptation". Such terms imply a lessened harm after repeated exposure. However, research with animals has demonstrated that lung injury continues, even though a particular measure of response may be reduced. Recent scientific literature refers to this phenomenon as "attenuation". The mechanisms responsible for this attenuation are not known. Studies of human subjects indicate that attenuation of lung function response to one level of ozone does not induce attenuation to higher levels (Gliner, et al, 1983). In addition, for most subjects, attenuation does not continue for more than three to seven days (Horvath, et al., 1981; Kulle, et al., 1982b; Linn, et al., 1982b). Evidence from animal studies indicates that attenuation of some measured parameters does not correspond to a reduction in others. Effects which cannot be prevented by prior exposure include effects on the pulmonary

host defense system (Gardner, et al., 1972); excessive proliferation (hyperplasia) of Type 2 cells (Evans, et al., 1971, 1976a,b); increased susceptibility to respiratory disease (Gardner and Graham, 1977); decreased enzyme activity (Chow, 1976; Chow, et al., 1976b) and the inflammatory response (Gardner, et al., 1972).

Effects Occurring After Longer-term Exposure

The morphological effects observed after extended short-term exposures are also seen after longer-term exposures. These effects seen over both time periods include nasal, tracheal, and bronchial lesions, Type 1 alveolar and ciliated cell damage and death, Type 2 alveolar cell proliferation and inflammation and hyperplasia in the broncho-alveolar regions (centriacini). Additional morphologic effects seen after longer-term exposures are distal airway remodeling and thickened pulmonary arteriolar walls (P'an, et al., 1972; Fujinaka, 1985). Studies of pulmonary pathology have implicated such changes as precursors to the development of chronic lung disease.

Additional evidence from studies of pulmonary biochemistry tend to support this association. An increase in the connective tissue component, collagen, occurs in rats exposed to 0.50 ppm for six months (Last and Greenberg, 1980) and in monkeys exposed eight hours per day for one year to 0.63 ppm ozone (Last, et al., 1984b). The occurrence of these effects after long-term, low level exposure to ozone suggests that ozone can initiate changes associated with the development of chronic lung disease. In addition, connective tissue alterations are also suggested by studies reporting an increase in the synthesis of collagen. An increase in the synthesis of collagen is observed in rats after 50 days of exposure to 0.50 ppm (Last, et al., 1983). Increased collagen synthesis also occurs at levels as low as 0.125 ppm after one year of exposure (Filipowicz and McCauley, 1986). This increase in synthesis rate apparently occurs without a corresponding increase in total collagen, thus implying concurrent degradation. Such observations may be especially important because current research implicates the continued synthesis and degradation of connective tissue components in the development of emphysema.

Although chronic exposure information is not available from controlled human exposure studies, some information is available from epidemiological studies. A number of chronic-exposure epidemiology studies have reported an association between oxidant air pollution and chronic pulmonary effects (Detels, et al., 1979, 1981; Rokaw, et al., 1980; Hodgkin, et al., 1984). However, because the level of total suspended particulates is highly correlated with the level of oxidant, separating out a chronic effect due to oxidant alone is difficult. In addition, these studies cannot provide very precise quantitative information because of limited exposure data and other study limitations.

Other studies, reporting a lack of association between chronic oxidant exposure and respiratory effects, have additional limitations because of the similarities of exposure levels or conditions between the exposed and control groups.

Although these chronic exposure studies do not provide sufficient information for precise quantitative use, they do suggest the need for protection in view of the association between long-term oxidant pollution exposure and respiratory changes.

B. EFFECTS ON PUBLIC WELFARE

An extensive discussion of the nature of ozone injury to plants, materials, and an analysis of ozone's economic and ecologic effects in California is embodied in two volumes prepared for the first part of this review of the state standard for ozone: the Staff Report and the Technical Support Document for the Effect of Ozone on Vegetation and Possible Alternative Air Quality Standards. These volumes, published and discussed at length in a public meeting in March, 1987, form a part of the record of this review and are incorporated by reference into the present discussion of the effects of ozone. The contents and conclusions in these volumes are briefly summarized here.

1. Effects on Crops

Analyses of ozone crop injury studies were performed to construct ozone dose-yield loss functions for 22 major crops representing about four-fifths of California's total agricultural production; these loss characteristics were used in conjunction with actual and modeled air quality data to calculate statewide crop losses both for current conditions and for various scenarios of reduced ozone exposure. The calculated crop production for each ozone exposure scenario was run through CARM (California Agricultural Resources Model, an economic research model maintained by U. C. Davis) to calculate the economic impacts of changed yield and its effects on consumer and producer benefits. The results indicate that, in the absence of human-caused ozone, California's growers and consumers would derive about \$333,000,000 annually in economic benefits compared to present (ambient 1984 ozone exposure) conditions. Analysis of air quality data and potential ozone reductions indicate that up to half of this benefit could be realized by attainment of (and compliance with) appropriate growing season-averaged ozone standards.

2. Effects on Non-crop Vegetation

A thorough review of scientific literature and consultation with professionals working with ozone injury to native plants showed natural vegetation, especially coniferous trees, to be highly susceptible to ozone injury. Severe forest injury and tree death has been documented in the forests of the San Bernardino and San Gabriel mountains in southern California, and ozone injury has been broadly observed on the western slopes of the Sierra Nevada and sporadically reported elsewhere in the state. While the data do provide evidence of damage to both timber and ecologic resources, including the forests of Yosemite, Sequoia, and Kings Canyon national parks, insufficient quantitative data were available to prepare economic estimates of either the direct impact to forest and range resources or secondary effects on natural ecosystems. However, the qualitative findings are a major cause for concern about long-term damage to California's native vegetation.

3. Effects on Materials

The intense chemical reactivity of ozone results in significant damage to a wide range of materials, including rubber, elastomers, plastics, paint, and metals. In areas that experience high ambient concentrations, ozone can significantly shorten material lifespans, increases maintenance costs, and progressively damage both functional and cosmetic aspects of materials and products. Economic consequences of ozone damage are of two types: accelerated maintenance and replacement costs; and avoidance costs involved in substituting less ozone sensitive materials in various processes and products. A partial accounting of annual ozone materials damage costs produced estimates of \$1.5 to \$3.9 billion damage nationwide. (EPA, Air Quality Criteria for Ozone and Other Photochemical Oxidants, 1986).

SERSP Comments generated by the Planning Commission during the meeting of October 26, 1987.

Comment: The EIR should include a discussion of the relationship between pollutant levels and the incidence of health risk.

Response: Because of the complexity of the information which has been collected which relates air quality to health, this response has not been completed in time to be included with this packet. This information will be forthcoming.

Comment: As a potential mitigation for air quality impacts, the EIR should recognize extension of the light rail transit (LRT) system to the Roseville vicinity.

Response: The following mitigation measures will be incorporated into the EIR:

- o The City should initiate long range planning to facilitate eventual extension of the LRT system to Roseville. Because an extensive corridor would be required, the City should identify potential routes which could be utilized as well as areas for parking and support facilities prior to loss of such areas to ongoing development. Although premature at this time, some preliminary planning should be considered to examine proposed development of the City roadway network to serve and promote use of such a mass transit facility in the City.

Comment: The EIR should provide current discussion of the projected CO emissions for the Sacramento Metropolitan area.

Response: Contrary to information provided in the Planning Commission meeting of 10/26/87, the information contained in Figure G7 of the EIR is accurate. This table contains predictions of future carbon monoxide emissions in Sacramento County through the year 1995 which were prepared as a part of the 1982 Sacramento Air Quality Plan. There is no readily available information to indicate that actual CO emission reductions are substantially different from the estimates developed in the Air Quality Plan.

Comment: Provide a comparison between the potential for air pollution in the Sacramento Region and that which has occurred in Los Angeles.

Response: Geographically, the Sacramento Metropolitan area and the Los Angeles area share a common setting; they are located in basins which are largely surrounded by mountains. One of the consequences of this geographic characteristic is that each area experiences a common meteorological phenomena known as a temperature inversion. Most predominant during the summer and



fall, these inversions result in the air within the basin becoming "trapped" beneath a warmer layer. This situation is further complicated by the surrounding mountain ranges which restrict horizontal movement of the trapped air. Pollutants generated during an inversion tend to remain "trapped" in the local air until the normal temperature gradient is restored, allowing the surface air to disperse into the atmosphere. Although both the Sacramento and Los Angeles areas suffer these inversions, it is not realistic to compare the air quality impacts of continued growth in the Sacramento region with conditions in the Los Angeles region. One may assume that, because of the similarity in the inversion conditions which occur, if pollutant levels were to increase in the Sacramento region to magnitudes comparable to those generated in L.A., similar air quality violations could be expected. However, it is unlikely that the level of pollutants generated in the Sacramento region could match those levels observed in Los Angeles. This presumption is based on the historic development of the L.A. basin. Much of the growth in the Los Angeles area occurred prior to development of emission control devices and establishment of the more stringent ambient air quality standards which are enforced today. Hydrocarbons and nitric oxides (NOX) are the principal contributors to ozone formation, and major components of the Los Angeles air pollution problem. Vehicular emissions represent the most significant source of these pollutants. Consequently, air quality improvement programs have focussed on reducing mobile source emissions, and significant reductions in mobile source pollutants have been achieved through the mandated state inspection program. Generally speaking, new cars are as much as 90% cleaner than cars manufactured prior to 1979, and as older vehicles are slowly removed from the transportation fleet, continued reduction in vehicular emissions may be expected. Examination of the Report on Reasonable Further Progress, produced for the Sacramento area, indicates that total hydrocarbon emissions alone have been reduced between 20 and 25 percent in the Sacramento region since preparation of the 1979 air quality management plan. It should be noted that, although the ozone formation process is thought to be well understood, and the reduction of hydrocarbons and nitric oxides (NOX) is believed to be the key to reduced ozone formation, substantial reductions in these pollutants have not resulted in corresponding reductions in the number of violations of the ozone standard.

Comment: Include a mitigation measure in the noise section which specifies working hours for contractors.

Response: The following noise mitigation measure shall be included in the EIR:

- o Recognizing that extended working hours may create annoying noises to area residents, it is recommended that construction activities be restricted to recognized working hours. Generally these hours are recognized as 7am-7pm Monday through Friday, and 8am-8pm on weekends. Should complaints result from



construction during these periods, more stringent restrictions should be placed on individual activities or on construction in individual projects. A condition which specifies acceptable construction periods can be included on the final map or as a component of the development agreement.

Comment: The EIR should discuss the City of Roseville definition of "affordable housing".

Response: The City of Roseville Specific Plan provides a clear definition of "affordability", based upon household income, for both homeowner and renter categories. According to the **General Plan:**

"For households purchasing their units, maximum housing costs for moderate and above-moderate income households should not exceed the maximum percentage of gross income allowed by mortgage lenders in qualifying home buyers currently in the 35% range. Low-income households should not spend more than 30% of their gross income in principal, interest, taxes and insurance."

For renting households, the **General Plan** specifies that:

- "1. Very-low and low-income households should not spend more than 30% of their gross income on housing costs. This figure has been adopted by the federal government and is being implemented in their housing programs.
2. Medium-income households should not spend more than 35% of their gross income on housing costs.
3. Moderate and above-moderate income households are determined not to require rental housing assistance and the household should pay whatever it feels it can afford toward rent."

Income categories are defined as:

Very Low Income: Household income is 50% or less of the medium income for households of similar size.

Low Income: Household income is between 50% to 80% of the medium income for households of similar size.

Middle Income: Household income is between 80% to 100% of the medium income for households of similar size.

Moderate Income: Household income is between 100% to 120% of the medium income for households of similar size.

Above-Moderate Income: Household income is greater than 120% of the medium income for households of similar size.



Because the definition of "affordable" housing is based upon gross income, the actual value of affordable housing is subject to change as more current income data continually becomes available. The following information represents the most current information.

Median Household Income by Family Size for the Sacramento SMSA as of February 6, 1987.*

<u>Family Size</u>	<u>Very Low Income</u>	<u>Low Income</u>	<u>Middle Income</u>	<u>Moderate Income</u>	<u>Above-Moderate Income</u>
1	\$11,050	\$17,700	\$22,125	\$26,550	\$26,550
2	12,650	20,250	25,312	30,374	30,374
3	14,200	22,270	27,837	33,404	33,404
4	15,800	25,300	31,625	37,950	37,950
5	17,050	26,900	33,625	40,350	40,350
6	18,350	28,450	35,562	42,674	42,674

* SOURCE: U.S. Department of Housing and Urban Development

Using the definition of affordable housing and the most recent median income information, the following table presents the current rent rates and purchase prices which would constitute affordable housing.

Affordable Rent and Purchase Prices as of February 6, 1987

Family Size	<u>Very Low Income</u>	<u>Low Income</u>		<u>Middle Income</u>		<u>Moderate Income</u>	
	<u>Max. Affordable Rent-30% of Gross Income</u>	<u>Max. Affordable Rent-30% of Gross Income</u>	<u>Max. Affordable Rent-30% of Gross Income</u>	<u>Max. Affordable Rent-35% of Gross Income</u>	<u>Max. Affordable Rent-35% of Gross Income</u>	<u>Max. Affordable Rent-35% of Gross Income</u>	<u>Max. Affordable Rent-35% of Gross Income</u>
	1	\$276	\$442	\$48,000	\$ 645	\$ 70,000	\$ 774
2	316	506	55,000	738	79,500	886	95,500
3	355	557	60,500	812	87,500	974	105,000
4	395	632	68,500	922	99,500	1,107	119,000
5	426	672	72,500	981	105,500	1,077	126,500
6	459	711	77,000	1,037	111,500	1,245	134,000

* Assumes 10% interest rate and 10% down payment

Comment: The EIR should discuss strategies for providing affordable housing in the City.

Response: The Housing Element discusses several methods of implementing the affordable housing policies of the **General Plan**. These include measures to promote preservation of older housing throughout the City, discourage conversion of affordable housing to more expensive residential uses, discourage conversion of residential areas to business/professional uses, target specific neighborhoods for redevelopment programs, require the provision of affordable housing in development agreements, promote development of affordable housing through density bonuses, evaluate the existing General Plan to identify undeveloped areas

which could be rezoned to higher residential densities, relax the processing and fee structure requirements for affordable housing projects, and promote financing programs and mechanisms to provide financing at affordable rates within the City.

According to John Sprague, a current objective of the Affordable Housing Task Force is development of more aggressive programs to provide affordable housing. Because implementation of several of these potential programs is uncertain or controversial at this time, it would be inappropriate for the EIR to identify or discuss such programs until the task force has completed its' work and made formal recommendations to the City Council.

Comment: Discuss the impacts of shifting the residential densities in the Southeast Specific Plan on affordable housing within the Plan area.

Response: As proposed, the Amended Southeast Roseville Specific Plan includes a shift in residential densities, providing increased number of units in the low and high density ranges at the expense of moderate density housing. Although the specific impacts of this shift on affordable housing would be difficult to determine, several broad impacts can be identified.

- 1) As proposed, the Specific Plan includes shifting 1,169 units from R-7 through R-15 densities to single family residences of R-5 or less. Transfer of additional units to low density single family housing will essentially remove these units from consideration as affordable housing.
- 2) According to John Sprague, most purchase housing which would be affordable to low income or moderate income families occurs in the R-7 to R-15 densities. As proposed, amendment of the Specific Plan will reduce the housing available in these densities by 50%. By removing these units from the purchase range of families in the low income and moderate categories, this action could increase the competition for higher density rental housing while forcing potential homeowners in this price range to look elsewhere for purchase housing.
- 3) The proposed Specific Plan would increase the number of high density units in the R-16+ densities by 850 dwellings (21%) from the adopted Specific Plan. However, this gain may be offset by the greater decrease in the overall number of units at densities of R-7 or greater, which decrease from 3,554 units (90%) to 2,385 (60%) of the 3,965 units proposed.



SERSP Comments generated by the Planning Commission during the meeting of October 19, 1987.

Comment: Recommendations in the DEIR should specify that future drainage studies prepared for individual projects within the Plan area include a cumulative assessment of drainage conditions.

Response: As requested, the Final EIR will include the following mitigation Measure:

- o Future drainage studies prepared for individual drainages within the Plan area should include a cumulative assessment of impacts.

Comment: A map which depicts the proposed project on an overlay of the existing vegetation conditions should be prepared.

Response: A large scale map has been prepared by the project planner and has been presented at the planning commission meeting. Smaller versions of this map are being prepared for inclusion in the EIR.

Comment: Infiltration should be investigated as a potential mitigation for runoff impacts.

Response: As requested, the project geotechnical consultants were requested to investigate the potential for infiltration systems in the vicinity. As indicated in the attached letters from Lowry Associates and Youngdahl & Associates, soils in the area do not have the capability to absorb runoff from the Plan area, and consequently, structures to promote infiltration would not be effective in this locale.

Comment: The preservation alternatives identified by the biologist in the appended biotic report should be presented in the Vegetation/Wildlife section of the DEIR.

Response: The following section concerning vernal pool habitat will be included in the Vegetation/Wildlife Section of the EIR:

The appended Biotic report includes a detailed discussion of the location and quality of vernal pool resources within the Plan area. The report indicates that the area of vernal pools, riparian habitat, and abandoned orchard is less than 10 acres total. More specifically, the total surface area of all the vernal pools in the Plan area is approximately 29,315 square feet, or .67 acres. Subsequent review of the raw field data revealed an error in the biotic report in that there are 34 pools in the Plan area instead of 38 as indicated in the original report. In addition to the vernal pool resources of the site, the Specific Plan area east of Sierra College Boulevard includes



approximately 100 acres of native high quality oak woodland habitat.

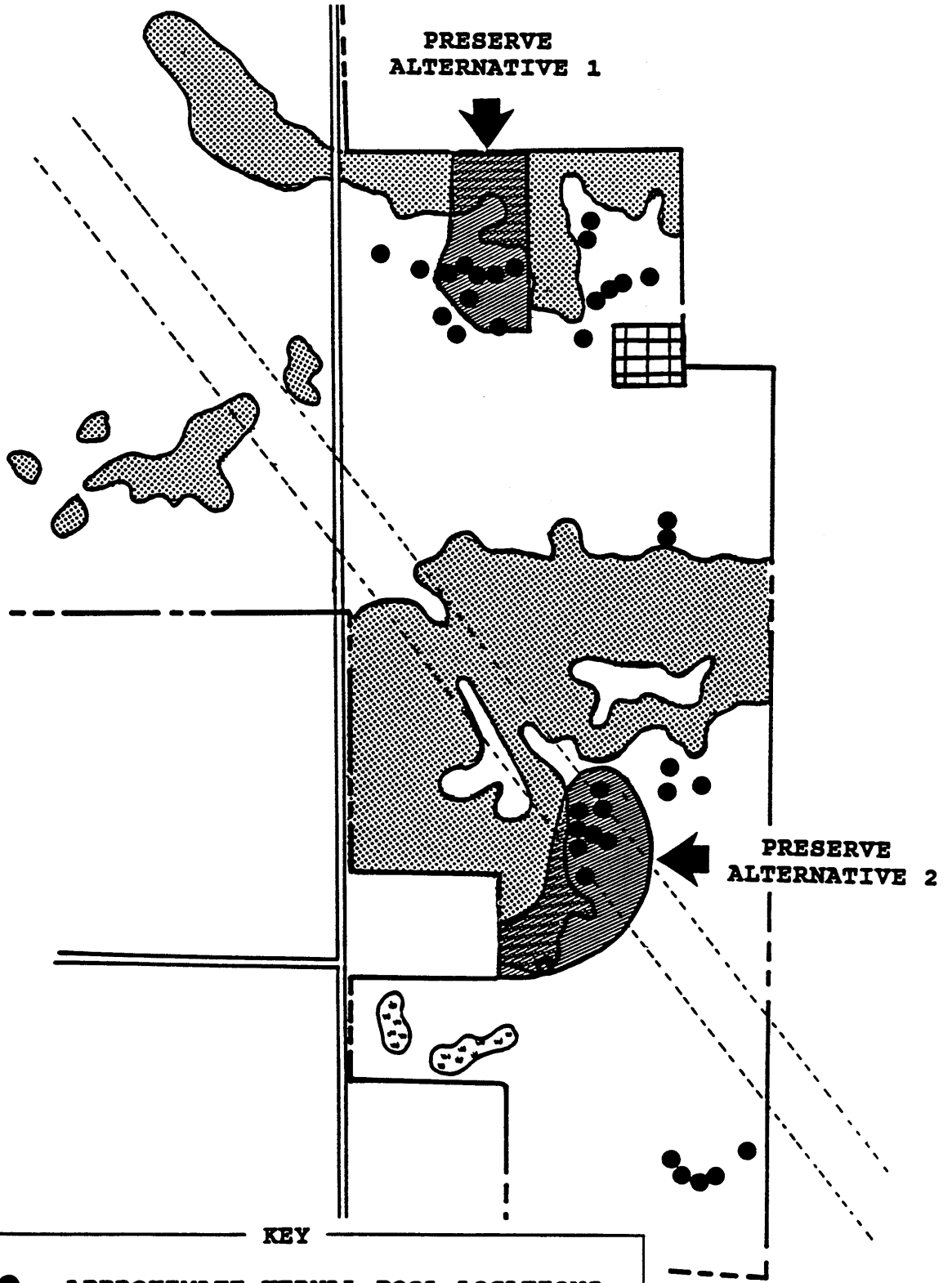
The biologist has identified two alternatives which would provide area for preservation of vernal pool and oak woodland resources within the Plan area. Each of these alternatives consists of designation of a preserve site within the Plan area. Either of these alternatives is recommended as being substantial enough to reduce the impacts to vernal pools and oak woodland habitat to less than significant levels. The identified alternatives, labeled as Preserve 1 and Preserve 2, are shown in Figure A.

Preserve 1 includes establishment of a + 17 acre preserve in the northern portion of the area east of Sierra College Boulevard. This preserve would provide approximately six acres of vernal pool preservation area as well as eleven acres of native oak woodland habitat. This preserve would be located between the proposed commercial parcel at the intersection of Sierra College Boulevard/Eureka Road and the project entry road from Eureka Road. The majority of the site included in this recommended preserve is currently designated for development as single family housing, 3.8 units per acre. In addition, implementation of this preserve alternative would require modification of the commercial parcel which, as presently proposed, extends into the vernal pool watershed.

The second recommended preservation alternative, Preserve 2, would be located in the south-central portion of the Plan area on the east side of Sierra College Boulevard. This preserve would encompass approximately 22 acres; sixteen acres of which would protect blue oak woodland habitat, and six acres which would harbor vernal pool habitat. Within the currently proposed Specific Plan, the majority of the area included within this preserve site is designated to be developed as single family housing at a density of approximately 3.6 dwellings per acre. Approximately one-third of this preserve site is traversed by the powerline easement and would not be developed. This preserve site also contains a turn of the century farm site which includes a barn of mortise, tenon, and wooden peg construction. Because of its traditional construction, this structure has been determined to be of historical significance.

As evaluated by the biologist, implementation of either of the recommended preserves would represent an acceptable level of protection for both vernal pool and oak woodland resources within the Specific Plan area. From a broader perspective, Preserve 2 would have the additional advantage of including the historic barn. Similarly, from the development perspective, the developer has indicated that Preserve 2 would be the preferred of the two recommended alternatives. However, as currently proposed, the Specific Plan does not incorporate either of the recommended alternatives.





KEY

●	APPROXIMATE VERNAL POOL LOCATIONS
[stippled shape]	OAK WOODLAND
[hatched shape]	ALMOND ORCHARD
[wavy line]	RIPARIAN



Comment: The DEIR should describe vegetation impacts to the native oak woodland habitat, and should discuss measures which may be implemented to mitigate these impacts.

Response: As discussed in the previous response, and shown in Figure A, the area proposed for addition to the existing Specific Plan includes approximately 100 acres of high quality native oak woodland. The proposed Specific Plan designates development of single family housing, 3.1 to 3.8 units per acre, throughout the woodland area. Although the developer has proposed measures to protect and incorporate existing trees into the project, development of the woodland area would require removal of trees and disruption of the overall habitat. According to the biologist, the oak woodland on the site does not represent a unique habitat. Consequently, elimination, modification, and/or fragmentation of the woodland would not be considered biologically significant. However, blue oak woodland is being lost in the foothills of the Sierra Nevada and Central Valley at an accelerating rate. Preservation of a portion of this native habitat would be consistent with City policy. In an effort to most efficiently preserve and protect the natural resources of the site, each of the vernal pool preservation areas identified by the biologist include oak woodland habitat as well.

Extensive preservation measures for individual trees are presented in the EIR on pages F-13 through F15. Proposed practices such as minimally graded lots and utilization of natural drainageways can reduce disruption of the natural environment. However, even with implementation of these measures, loss of trees will be inevitable with development of the area. Additional measures which could be implemented to reduce impacts on the oak woodland could include designation of wooded areas as parks or preserves, or development of less intense land uses in wooded areas. Because of the extensive acreage of the Plan area which supports oak woodland habitat, it is not realistic to preserve the entire woodland, and consequently some of the area will be subject to development. Examples of less intense or alternative land uses which should be considered in the wooded areas include cluster housing or planned development (PD). These types of land uses afford the developer a greater amount of flexibility in roadway placement and lot line designation. As necessary on a lot-by-lot basis, adjustments could be implemented to avoid individual trees or desirable natural characteristics. Implementation of PD measures generally results in irregularly shaped lots of varying sizes, but allow retention of a greater amount of the native vegetation. Another approach which can be implemented to reduce impacts and protect natural features would be to place development restrictions on lots within the wooded portion of the site. For example, construction on any designated lot would be restricted to a specified "building pad" zone. Zones would be selected to avoid sensitive areas and/or to protect larger blocks of contiguous woodland area which could cover portions of several lots. These zones would be designated on the subdivision map and subsequent development restricted to them.



Comment: The EIR should evaluate the historic value of the barn located on the property, and if appropriate, recommend measures for preservation of this structure.

Response: A qualified historian has evaluated the site and determined that the barn structure is of historic significance. Attached is a copy of the findings of the survey.

In summary, mortise and tenon, the technique used in building the barn, has been common in Europe since the medieval period. It was extensively utilized by the English, German, and Scandinavian countries. Mortise and tenon peg barns and structures exist in greater numbers on the east coast, midwest, and in Canada as the early immigrants who settled these areas transported familiar construction methods. By the time California was being populated in the 1850's, the more time consuming mortise and tenon was lost to the speedier butt joint method. The result is that there are very few mortise and tenon pegged barns or structures in California. The historian is aware of three other such barns in northern California, all of which are in State ownership. There are undoubtedly other such structures which exist, but their numbers are few which adds to the significance of the barn in the Southeast Roseville Specific Plan area.

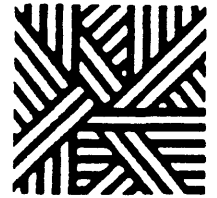
In light of the findings of the historic survey, it is recommended that the barn be preserved. Preservation of the barn on the original site would enhance the historic value of the structure. Preliminary examination indicates that the barn is structurally sound, but will require some maintenance/restoration work such as new siding, gutters, etc. Because the barn is basically a useful structure, it would be appropriate to utilize it in community. The structure could function as a park facility, staging facility for horse or bicycle trips on area trails, community center, interpretive center, maintenance building, etc. Realizing that the current Specific Plan does not designate any such uses for the site, relocation of the facility rather than destruction should be considered. Since the structure is the actual element of historic concern, it could be relocated and still retain its historic character.

Since mitigation has not been proposed for the structure, the EIR will be changed to reflect that destruction of the barn would constitute a significant impact.





LOWRY & ASSOCIATES



October 22, 1987

Coker-Ewing
Attention: Bill Cramer
2150-B Douglas Boulevard
Roseville, CA 95661

SE ROSEVILLE SPECIFIC SITE PLAN
EAST OF SIERRA COLLEGE BOULEVARD
(Johnson Ranch 392)
Eureka Road
Roseville, California
L & a No. 87-87

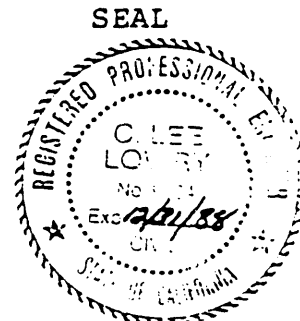
At the request of Rick Chavez with Morton & Pitalo, Inc., we have been asked to review our Preliminary Geotechnical Report for Johnson Ranch 392 (L & a No. 87-87), located in Roseville, California. The purpose of our review was to determine if storm and surface drainage water could be routed to permeable soil layers below grade that would transport runoff water to recharge ground water tables and lessen runoff from the property.

It is our opinion that the decomposed granite of the Rocklin Pluton; and the cemented silty sands, sandy silts and clays of the Ione Formation are of low permeability and not conducive to ground water transportation. These formations cover approximately 90-95 percent of the site. The Modesto Formation located within an existing stream channel is of higher permeability, but is of limited extent. In our opinion, this formation is not capable of transporting expected flows of surface water drainage generated by rainfall by any means other than surface flows. This has been evidenced by formation of a small creek in the area.

Thank you for this opportunity to be of service.


LOWRY & associates

C. LEE LOWRY
Registered Geotechnical Engineer
No. 539



JOS:CLL:jm

xc: (1)
(1) Morton & Pitalo, Inc./Rick Chavez

 **YOUNGDAHL
& ASSOCIATES INC.**
GEOTECHNICAL ENGINEERS & CONSTRUCTION LABS.
Project No. 87270
26 October 1987

Coker-Ewing Company
2150 B Douglas Blvd.
Roseville, CA 95678-3899

Attention: Mr. Bill Cramer

Subject: **SOUTHEAST ROSEVILLE SPECIFIC SITE PLAN
1987 AMENDMENT**
All Parcels South of Douglas Blvd. and
West of Sierra College Blvd.
Roseville, California
**PERMEABILITY STUDY OF ON-SITE WELLS FOR
STORM DRAIN DISCHARGE**

Gentlemen:

At your request, YOUNGDAHL & ASSOCIATES, INC., has reviewed our Geotechnical Investigation Reports and Grading Reports in order to address the bedrock conditions and permeability characteristics associated with potential utilization of dry-wells as storm drain discharge points on the subject site.

During our review of existing in-situ lithologic conditions, we noted that shallow bedrock conditions exist across a major portion of the site. In several areas within existing stream channels, the water flows have exposed this material at the surface.

The northwestern portion of the site is capped, with the Mehrten Formation composed of andesitic mud flows. These ancient conglomerates, sandstones and breccia are strongly cemented with a silicate matrix which is responsible for the low permeability of this caprock unit. Below this caprock and over most of the remainder of the property, the Valley Springs Formation is predominant. This unit is underlain by the Ione Formation which is exposed within the central area of the site and extends easterly to Sierra College Blvd.

Sedimentary rock at the Valley Springs Formation is composed of silts and sands within a matrix of cemented clays. Therefore, a majority of the ground water within this unit is contained in fractures.

During construction of existing developments, a number of these fractures were intersected in underground excavations. Ground water conditions were encountered within fractures and gravel backfill was utilized to act as french drains.

A potential recharge to these fractures from dry wells would be damaging to development. Some cobble deposits are located within the flood plains of the creeks at the northeast portion of the site. These materials are overlying the fractured bedrock and all infiltration drains laterally through the material.

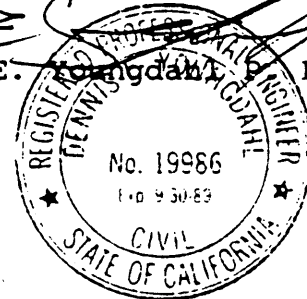
On this site, the oldest unit, the Ione Formation is composed of quartzose sandstone and kaolinitic clays. The clay content is very high which results in low rates of infiltration. All three geologic units have infiltration rates which are much lower than the minimum discharge from storm drain systems during average recorded precipitation.

Due to a low permeability potential and possible damage to existing developments, we recommend that dry wells are not feasible as discharge facilities for storm drainage.

Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,
YOUNGDAHL & ASSOCIATES, INC.


Dennis E. Youngdahl, P. E.



DEY/TJK/gm

Copies: 4 to Coker-Ewing
2 to Morton, Pitalo, Inc.

November 8, 1987

Mr. Robert Languell
R.C. Fuller Associates
5908 Fair Oaks Boulevard
Carmichael, California 95608

RE: Historic barn (Bithell/Eike Barn) located within the
SE Roseville Specific Plan

Dear Bob:

On October 25, 1987 at your request I inspected a barn located within the SE Roseville Specific Plan area in order to check its construction methods and condition, and to determine its historic significance. You also requested suggestions for adaptive uses for the barn. In addition, I spent some archival research time to corroborate in the written documents a construction date and individuals responsible for the barn's construction. I also was able to talk with Gordon Hutchings whose stepfather, Villard Bithell, once owned the property and is credited with the barn's construction.

DESCRIPTION

The barn, which I will call the Bithell/Eike Barn, consists of a rectangular structure approximately 48 feet by 35 feet in width and length. The structure has a high gable end roof covered with corrugated metal. Exterior siding is board and bat (twelve inch board and two inch bat).

The barn is divided into three separate sections. The center section of the barn contains a large open area. On each side of the center section are smaller sections containing built-in feeding troughs. At the rear of the barn (east side) is a "lean-to" that contains a bunk area (double-walled interior with three and one-half tongue and groove pine siding) and an additional feeding area. This "lean-to" appears to have been constructed at the same time as the barn. On the north side of the barn is a covered, but open, "lean-to" that appears to be a later addition to the barn. The barn rests on a granite rock pier foundation. A cement slab was added to the center section of the barn at a later date. The barn still retains original hand-forged hinges on the main doors. With the exception of some dry-rot around the base of the exterior siding the barn is in remarkably good condition.

SIGNIFICANCE

The real significance of the barn rests in its structural framing. The framing consists of six inch by six inch wood upright beams in the center portion of the barn with four inch by four inch uprights along the north and south sections. The wood framing members are secured by wooden pegs known as mortise and tenon construction.

Mortise and tenon construction is significant as it has been used since the medieval days in Europe and was used extensively by the English, German and Scandinavian countries. This type of construction was also important in ship construction.

Mortise and tenon peg barns and structures exist in greater numbers on the east coast, midwest and in Canada as the early immigrants from England and Northern Europe who settled in these areas transported familiar constructions methods. By the time California was being populated by settlers in the 1850's to the turn of the century construction methods had changed. The more time-consuming mortise and tenon construction was lost to the speedier butt joint method. The result is that there were very few mortise and tenon pegged barns or structures in California.

I know of three other barns of this construction in Northern California and all three are in the ownership of the State of California. Olompoli State Historic Park in Marin County contains an 1880's pegged barn; Shasta State Historic Park contains a pegged barn which also dates from the 1880's; and Ahjumawi State Park near Burney Falls has a mortise and tenon pegged barn. The barn at Ahjumawi State Park is currently being stabilized and restored.

No doubt more mortise and tenon pegged barns exist, but their numbers are few which adds to the significance of the Bithell/Eike Barn.

THE ARCHIVAL RECORD

In my conversations with Mr. Hutchings he stated that the barn was constructed by his stepfather Villard J. Bithell and his wife Sophia in 1906. Mr. Hutchings stated that they hired a man by the name of Louis Eike to do the actual construction of the barn. In researching records it would seem to indicate that the actual construction date of the barn was after 1910. It should be noted that a construction date is only one element that determines historic significance of a structure, and in the case of the Bithell/Eike Barn the method of construction is the major contributor of significance. With the names of Bithell and Eike to work with, my direction was really to find out why in 1906 or even after 1910 they would use a mortise and tenon construction method versus the standard butt joint method.

My archival research was mostly directed to city directories and census records. I do not footnote my citations, but they are available if needed.

VILLARD AND SOPHIA BITHELL

Villard James Bithell was a native of California, born in 1885, and was 69 years of age when he passed away in 1954. At the turn of the century he was living in Oakland, attending school. He lived in Oakland until 1910, having various occupations ranging from a company clerk to an accountant for a mining company. Up to 1910 Villard Bithell had different addresses in Oakland, but from 1905 to 1909 he lived at 1157 Castro Street with his father Zack.

Sophia's maiden name was Eike and she also resided in Oakland at the turn of the century. Sophia's younger brother was Louis Eike, the man that is credited with the construction of the barn. Sophia had different occupations, but primarily she worked as a waitress in the years up to 1910. By 1907 Sophia was living at 1013 Castro Street and one might assume that Villard and Sophia met in the neighborhood.

The 1910 U.S. Census lists Villard and Sophia as husband and wife residing at 1225 Linden Street, Oakland, California. Both were 25 years old and Villard was working as an accountant while Sophia was not working at this time. Louis Eike, Sophia's brother, was residing at their residence, was 22 years old, and listed his occupation as a machinist. After 1910 the Bithells were no longer living in Oakland and one assumes that they had moved to the Placer County property. The assumption is that the barn was constructed after 1910, after the Bithells married and moved from Oakland to Placer County.

THE EIKE FAMILY

The question as to why a mortise and tenon pegged barn was constructed in Roseville after 1910 rests in the Eike family background. Sophia and Louis Eike were the daughter and son of Hanson and Christina Eike who arrived in the United States from Norway in 1880. The Eikes first settled in Iowa and later moved to California. In addition to Sophia and Louis, the Eike's had three other children all born in the United States.

Hanson Eike listed his occupation as a ship's carpenter, no doubt gaining work at Oakland's shipyards. His son Louis in his early years listed his occupation as a sailor, later as a machinist. Hanson Eike's background in Norway, his stay in the midwest, and his occupation as a ship's carpenter, certainly would have made him familiar with a mortise and tenon construction. His son Louis, who built the barn, no doubt learned these construction principles from his father and this accounts for their use in the barn.

The interesting aspect is that Louis Eike transmitted to California after 1910 a construction method primarily found in the midwest and on the east coast. This undoubtedly can be traced back to his Scandinavian background.

ADAPTIVE USE

The Bithell/Eike Barn's condition allows for many adaptive uses. If the barn and surrounding area was included in a greenbelt/horse trail/hiking trail connection then the barn could serve as a staging area for horseback riders. It could offer overnight or short-term boarding of horses along with other equestrian needs. Often horseback riding associations are willing to take on the responsibility of stabilizing and restoring a structure with little cost to the owner.

The barn itself could serve as a community center for any residential development. It could be a center for public meetings, events, parties or local fundraisers that would support the community.

The barn could also be used for interpretation of mortise and tenon construction, rarely seen in California. Additional research would add to the interpretive background of the barn.

A final resort would be to move the barn. The siding and beam members can be numbered and removed to a different site. However, moving a structure from its' original site does impact its' historic significance, but is preferable to demolition.

SUMMARY

At this point the exact date of the barn's construction is not known. Research indicates, however, that the barn was constructed after 1910. Regardless of the date of construction, the Bithell/Eike Barn is significant in that it is a well-preserved example of mortise and tenon construction which is very rare in California.

If additional information is needed on the Bithell/Eike Barn please feel free to contact me at 916-457-4889.

Sincerely yours,

H. John McAleer

H. John McAleer

299 Coloma Way
Sacramento, CA 95819

COMMENTS AND RESPONSES
SOUTHEAST ROSEVILLE SPECIFIC PLAN
1987 AMENDMENT DRAFT EIR

**PREPARED FOR
CITY OF ROSEVILLE**

OCTOBER 13, 1987

**PREPARED BY
R.C. FULLER ASSOCIATES
5908 FAIR OAKS BOULEVARD
CARMICHAEL, CALIFORNIA 95608**



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**COMMENTS AND RESPONSES
SOUTHEAST ROSEVILLE AMENDED SPECIFIC PLAN
DRAFT ENVIRONMENTAL IMPACT REPORT**

I. INTRODUCTION

This Comments and Responses document has been prepared in accordance with the requirements of the City of Roseville and the California Environmental Quality Act (CEQA). The purpose of this document is to address comments made on the **Southeast Roseville Specific Plan 1987 Amendment Draft Environmental Impact Report** dated August 13, 1987, which is appended by reference.

This document is composed of five sections: **I. INTRODUCTION, II. LIST OF PERSONS, ORGANIZATIONS, AND PUBLIC AGENCIES COMMENTING ON THE DRAFT EIR, III. COMMENTS AND RESPONSES, IV. LETTERS OF COMMENT, and V. APPENDIX.** The format utilized is as follows:

- o Within the **LIST OF PERSONS, ORGANIZATIONS, AND PUBLIC AGENCIES COMMENTING ON THE DRAFT EIR** section, each letter received is identified. The commentor and his/her agency or affiliation is identified, as is the date of the letter. Following this identification, information is presented in three columns. The first column is a reference number. Each comment has been assigned a unique reference number. The second column is the page number where a summary of the comment and the response to that comment is located. The third column is a brief description of the comment.
- o Section III, the **COMMENTS AND RESPONSES** section, contains the responses for each comment received. In order to minimize redundancy, same or similar comments have been collectively grouped and responded to in a single comprehensive reply. The format of this section includes the collective comment, a list of the commentors and specific comment reference numbers, and the response.
- o The full text of each letter of comment is included within the **LETTERS OF COMMENT** section. The reference number for each comment is located within a circle in the left margin of the letter.
- o The **APPENDIX** contains materials referred to in the responses.



**II. LIST OF PERSONS, ORGANIZATIONS, AND PUBLIC AGENCIES
COMMENTING ON THE DRAFT EIR**

Cmnt Resp

page Comment Summary

**Roseville Planning Staff Report for PRC meeting of September 22,
1987.**

- | | | |
|----|----|---|
| 1 | 7 | DEIR should identify actions to make Plan consistent |
| 2 | 10 | Affordable Housing requirement should be calculated |
| 3 | 10 | Geology, entire area should be surveyed |
| 4 | 11 | Hydrology, increase in runoff not quantified and DEIR
should include drainage study as mitigation |
| 5 | 14 | Vegetation, DEIR should identify less intense land uses |
| 6 | 15 | Land Use, DEIR should include mitigation for powerline |
| 7 | 10 | Affordable Housing requirement should be calculated |
| 8 | 16 | Traffic, clarification of LOS C and consistency |
| 9 | 16 | Traffic, buildout analysis may be inappropriate |
| 10 | 17 | Utilities, DEIR needs to indicate additional easements |
| 11 | 19 | Schools, DEIR must address school needs |
| 12 | 19 | Parks, DEIR incorrectly assesses City-wide park need
and does not identify appropriate park mitigation |
| 13 | 20 | Parks, should discuss powerline recreation potential |
| 14 | 21 | Fiscal, there is an error in the Park Tax Fee |
| 15 | 22 | Growth Inducing Impacts require finding |

**Letter from Jerry Jackson, Assistant Director of Public Works
dated August 6, 1987.**

- | | | |
|----|----|---|
| 16 | 22 | Informational comment re: water service |
|----|----|---|

**Letter from Ed Mahany, Director of Parks and Recreation dated
August 21, 1987.**

- | | | |
|----|----|--|
| 17 | 23 | Parks, clarify calculation of park land increase |
| 18 | 22 | Parks, informational comment re: funding |
| 19 | 22 | Parks, informational comment |
| 20 | 23 | Hydrology, what floodplain will be dedicated |
| 21 | 23 | Parks, confused by parks "not in accordance" |



Cmnt #	Resp page	Comment Summary
22	23	Parks, clarification of park land acreage proposed
23	23	Parks, dissatisfaction with proposed park sites
24	22	Informational comment
25	22	Informational comment
26	22	Informational comment
27	22	Park/School site must be minimum 20 acres
28	22	Policy 22 & 23 missing
29	22	Informational comment
30	22	Informational comment
31	22	Informational comment
32	22	Informational comment
33	22	Informational comment
34	23	Parks, proposed parks are inadequate in type and amount
35	23	Parks, where are neighborhood/community parks
36	23	Parks, only a single school/park site
37	23	Parks, is merit to using powerlines for trails
38	22	Informational comment
39	22	Informational comment
40	22	Informational comment
41	22	Hydrology, concurs with dedication of floodplain
42	14	Vegetation, mitigation should include creative designs
43	27	Vegetation, vernal pools could be protected in parks
44	22	Parks, concurs with need for pathways
45	23	Parks, disagrees with statistics in Table I1
46	23	Parks, increase in park land should be 69.33 acres
47	23	Parks, where will pathways connect
48	22	Utilities, concern that new sewer line needed?
49	22	Informational comment
50	22	Informational comment
51	22	Informational comment re: other parks with ball fields
52	22	Informational comment, concurs with acreage deficit
53	23	Parks, acreage calculations for neighborhood/ community parks are transposed
54	23	Parks, developer should contribute to City-wide parks
55	22	Informational comment re: pathways in Maidu Park
56	23	Open Space, will it be public or private
57	23	Hydrology, what floodplain will be dedicated to City



Cmnt #	Resp page	Comment Summary
58	23	Visual, park land may have limited visual value
59	21	Fiscal, where does \$462.2 thousand come from
60	21	Fiscal, discrepancy in Park Tax Fee
61	26	Archaeology, Maidu park should receive artifacts

Letter from City Clerk dated August 24, 1987.

62 22 Informational comment. DEIR placed in Central File

Letter from Roseville Fire Department dated August 27, 1987.

63 22 Informational comment. No comments on DEIR

Letter from Maynard E. Bean, dated August 31, 1987.

64 15 Land Use, concern re: powerlines on schools and homes

Letter from Town of Loomis, dated September 1, 1987.

65 22 Informational comment. Loomis will not be impacted

Letter from Noel A. Bonderson, Placer County APCD, dated September 1, 1987.

66 25 Air Quality, DEIR adequately addresses impacts
67 25 Air Quality, important to identify CO hot spots
68 25 Air Quality, projects should conform to ambient air quality standards prior to approval
69 25 Air Quality, dust controlled should be required
70 25 Air Quality, stationary sources must comply with APCD

Memorandum from Roseville Michael Dean, City Attorney dated September 3, 1987.

71 14 Hydrology, is reference to Sutter County in error
72 11 Hydrology, explain increase in runoff
73 14 Hydrology, flood control district not formed yet
74 10 Affordable Housing, DEIR should calculate requirements



Cmnt Resp

page Comment Summary

Memorandum from David Dockman, Assistant Electric Utility Director, dated September 10, 1987.

- 75 23 Informational comment, extension of electricity
- 76 23 Informational comment, req'd facilities and easements

Letter from Dorothy M. Alexander, dated September 14, 1987.

- 77 14 Vegetation, Oak trees should be protected

Letter from Eleanor Holladay, dated September 14, 1987.

- 78 23 Administrative comment, inadequate review period

Letter from Gordon Hutchings, dated September 14, 1987.

- 79 14 Land Use, oaks and historic barn should be protected

Letter from Thomas D. McMahan, Placer County Planning Director, dated September 14, 1987.

- 80 26 Land Use, opposed commercial at S.C. Blvd/Eureka Rd.

Letter from R. W. Foust, Senior Civil Engineer, Transportation Planning, County of Sacramento.

- 81 26 Land Use, DEIR should address Beltway Connector

Letter from Sandra Harris, dated September 14, 1987.

- 82 27 Land Use, Plan incompatible with Granite Bay area
- 83 29 Traffic, needs to address hazardous/toxic waste
- 84 25 Air Quality is worsening
- 85 27 Land Use, should provide lower density east of S.C.
- 86 27 Utilities, water should be more closely examined

Letter from Dr. Ron Feist, PhD., Superintendent Eureka Union School District, dated September 22, 1987.

- 87 23 Schools, DEIR identifies new impact
- 88 23 Schools, proposal for school facilities



Cmnt Resp
page

Comment Summary

Memorandum from Robyn Kain-Spedden, Administrative Analyst II, City of Roseville, dated September 25, 1987.

- 89 23 Powerline towers are inherent liability exposures
- 90 23 Trees would have to be trimmed under powerlines
- 91 23 Building construction would expose workers to pwrlines
- 92 23 Lights would expose workers to powerlines
- 93 23 Kite flying would be a dangerous activity
- 94 23 Consideration of possible health effects
- 95 23 Towers represent "attractive nuisance"
- 96 23 SMUD is routinely served with liability claims
- 97 23 Towers represent "attractive nuisance"
- 98 23 SMUD requires indemnification
- 99 23 Opposed to any activity under powerlines

Letter from State Office of Planning and Research, dated October 2, 1987.

- 100 22 DEIR has completed CEQA review to State Agencies

Memorandum from Brian J. Smith, Chief, Environmental Branch, Caltrans District 3, dated September 23, 1987.

- 101 29 Traffic volumes should be updated.
- 102 29 Roadways improvements will have to be required including HOV lanes and soundwalls within the next 20 years
- 103 29 Not Caltran's policy to widen I-80 to 10 lanes

Memorandum from Gordon F. Snow, Projects Coordinator, Department of Fish and Game, dated September 22, 1987.

- 104 27 Plan incorporates protection of 100 yr. floodplain. Other riparian areas are unprotected.
- 105 27 No mitigation for vernal pools identified.
- 106 27 should require 50 foot setbacks on all streams



III. COMMENTS AND RESPONSES

Comment: The DEIR needs to identify mitigation for areas of inconsistency between the proposed Specific Plan and the existing General Plan.

Planning Staff, 1;

Response: The Specific Plan is suggested to be "Potentially Inconsistent" with four, and "Inconsistent" with two policies of the General Plan, as follows:

- o Policy 17 of the Land Use Element establishes several criteria concerning the location of commercial sites within the City. One of these criteria specifies that commercial sites within predominantly residential areas should be a minimum of ten acres in size, and must contain a retail food market. The proposed commercial parcel at the intersection of Sierra College Boulevard and Eureka Road is 6.6 acres in size, and future commercial tenants have not been identified. The determination as to whether this policy is inconsistent or consistent depends upon the definition of "predominantly residential", and the requirement that a retail food market be required. As proposed, the commercial site is located at a major intersection and is adjacent to a 16 acre wholesale/retail nursery. The property on the south side of the commercial site is not within the Specific Plan area, and development has not been proposed. Immediately across Sierra College Boulevard from the site, a park is proposed within the transmission line corridor. Otherwise, proposed surrounding uses are residential in nature. A finding by the City may be required to determine that the area is not predominantly residential or an amendment to the General Plan may be appropriate. Another possibility is to require that the commercial site be increased to 10 acres in size.

- o Policy 21 of the Land Use Element identifies guidelines for the location of school sites. The Specific Plan has been determined to be "Potentially Inconsistent" because the



proposed elementary site is located on Eureka Road, which could be considered an arterial roadway. City General Plan policies specify that "Schools should be located in an area that is safe and easily accessible away from major street arterials". The Eureka Union School District has indicated that the proposed site is at a desirable location. In order to determine that the school facility location is consistent with City General Plan policy, the General Plan would have to be amended to allow location of school sites adjacent to arterial roadways, or more appropriately, to allow the acceptability of school sites to be ultimately determined by the school districts.

There was concern at the time of writing of the DEIR, that one proposed site was too near the existing power line corridor. The current proposal by the Eureka District is to redesignate this site from a 7-8 facility to an elementary school, thus allowing location of the smaller facility farther from the lines and in accordance with State guidelines.

The consistency of Specific Plan with the General Plan was further in question because it was not clear that an adequate number of school sites were proposed. Subsequent correspondence with the School District has indicated that adequate sites have been identified. The details of this situation are discussed in a letter from Dr. Ronald Feist, Superintendent of the Eureka Union School District, dated September 22, 1987, and referenced as comments 87 and 88 of this document.

Finally, as originally proposed, the proposed school site was not co-located with a park facility as specified by the General Plan. Since writing of the DEIR, a joint use facility is proposed in conjunction with the new school site.

- o The Specific Plan was determined to be potentially inconsistent with Policy 1 of the Circulation Element which specifies that roadways and intersections within the City must maintain a Level of Service (LOS) of C. The ability to maintain a LOS C at the intersection of Sunrise and Douglas Boulevards is questionable. This less than LOS C situation is predicted to



exist with or without implementation of the Southeast Specific Plan. Nonetheless, the continued operation of this intersection below LOS C represents an existing, and likely continuing, inconsistency with the General Plan policy. According to the consulting traffic engineer, specific intersection improvements can be made which will bring the LOS back to C as traffic increases and the LOS declines. However, it is questionable if the C level can be maintained at ultimate traffic volumes. A finding by the City may be required to acknowledge this potential inconsistency.

- o Policy 5 of the Open Space and Conservation Element specifies that lands in agricultural production should not be developed prior to less agriculturally valuable areas. None of the Plan area is currently in agricultural production, and therefore, no inconsistency with the General Plan technically exists. However, a portion of the area is under Williamson Act contract, and as such, is categorized as having agricultural value. The "potentially inconsistent" recommendation was made in response to the concern that Williamson Act lands, regardless of their current use, might be considered agriculturally viable by the City.

- o Policy 11 of the Open Space and Conservation Element specifies that adequate park and recreation facilities be provided for all existing and future neighborhoods. As calculated by the Park and Recreation Department, approximately 93 acres of park land will be required to serve the Southeast Roseville Specific Plan area. The developer has dedicated approximately 24 acres to Maidu Park as a function of the adopted Specific Plan, leaving a currently required balance of 69 acres. Since preparation of the DEIR, the Specific Plan has been modified to include the additional 69 acres. However, the proposed park acreage is not appropriately distributed between City-wide, Community, and Neighborhood park areas as specified by City policy. A joint use facility has been incorporated into the current plan which would allow for co-location of a future park with the designated school site. Finally, the suitability of areas within the powerline easement for use as park land is in question. The DEIR clearly recognizes that the recreation



potential of such areas is limited. The City has not adopted policy concerning the suitability of such areas for recreational uses.

- o Policy 13 of the Open Space and Conservation Element specifies that co-located park and school facilities should be developed. Since preparation of the DEIR, the Specific Plan has been modified, and subsequently designates a park/school joint use facility in conjunction with the proposed school site on Eureka Road.

Comment: The DEIR should include calculations to show what the Specific Plan's obligation to the City's Affordable Housing Program will be.

Planning Staff, 2,7; Michael Dean, City Attorney, 74;

Response: Mr. John Sprague, the City staff person responsible for preparation of the City's Affordable Housing program was contacted concerning this comment, and has indicated that the information included in the DEIR is as correct as possible at this time. The currently implemented affordable housing policies are not appropriate for application on a Specific Plan scale, and cannot be used to determine the housing obligations for the respective Specific Plan areas. The program currently under development will specifically address the affordable housing needs for the individual Specific Plan areas.

Comment: Geology surveys need to be completed for the entire Plan area, not just the area being added to the existing Specific Plan area.

Planning Staff, 3;

Response: At the time of approval of the already adopted Specific Plan, it was agreed that the appropriate surveys would be conducted on a project by project basis as individual portions



of the Plan area were developed. This policy has been adhered to by the developer and surveys have been completed for all areas where development has been completed. Further, since preparation of the DEIR, surveys have been completed on the remainder of the area within the Specific Plan, and have been delivered to planning staff.

Comment: The DEIR does not quantify the increase in runoff which will result with development of the Plan area. The DEIR should explain the increase in runoff predicted. The DEIR should include a mitigation measure which requires preparation of a comprehensive drainage study for each watershed within the Plan area prior to development within the subject shed.

Planning Staff, 4; Michael Dean, City Attorney, 72;

Response: The DEIR identifies the increase in water surface elevation which is expected to result from development of the Southeastern portion of the City, including the Plan area, as calculated in the Nolte study. Additional discussion is presented in the appended letter from the project engineer, Morton & Pitalo, dated September 25, 1987. The following response is from that letter.

The "Nolte study," which is the most rigorous study prepared to date for the City of Roseville, does not contain specific data for the increased runoff from this particular project. The study does contain data from which one can extrapolate information which may be accurate and also may be highly erroneous. The problem basically is that discussions typically center around increases in the "peak" runoff. Peak runoff is something that can be affected by increases in impervious areas (i.e., when the runoff can no longer infiltrate into the soil) and the time it takes for the runoff (from time of concentration) from several different locations to travel to the area being studied. Thus, one has to be very careful in extracting conclusions regarding "peak" runoff since its impact at one location may be far different than from another location downstream.



An example would be to review the Nolte study and the material quoted in the environmental impact report. On Linda Creek, just upstream of its confluence with Cirby Creek, the Nolte study indicates that the water surface elevation will be raised 0.9 foot for the 1% storm, from the existing condition to the ultimate buildout of the entire upstream basin. In addition, the report indicates the Q_{100} flow rate for the existing condition is 2750 cfs, while the Q_{100} flow rate for the future condition is 3990 cfs. One could argue that the increased runoff at this point is 1240 cfs, or that the runoff has increased 45% over the runoff exhibited for the existing condition.

However, if you extend this reasoning downstream and examine Dry Creek, just downstream of its confluence with Cirby Creek, the flow rate under the existing condition is reported to be 15,800 cfs, while the Q_{100} for the future condition is 17,250 cfs. The difference for this particular example is an increase in peak flow, in Dry Creek at this location, of 1450 cfs over existing conditions, or a net increase of only 8.4%, while the drainage basin draining into this location is increased from 16.5 square miles to 77.33 square miles. Obviously, if each increase in runoff was additive, at every location, there would be serious repercussions.

However, the peak flows are time dependent - as you travel downstream, you combine with flows from other areas which may travel to that point faster, or slower, than the flow from your particular basin. If the basins are of similar size, oftentimes the individual peaks, at a downstream location, are similar and therefore you seem to get a higher total increase in peak runoff. Whereas as you move further downstream, the larger basins that you connect with often have much slower travel times to a particular point and therefore the peak flow from the subbasin can reach the larger tributaries and travel through before the initial, larger upstream peak hits the area in question. It is for this reason that it has been stated in the past, it is better to accelerate the flow so that it will travel through problem areas and it will "beat" the peak flow from the larger drainage basins of Dry Creek.



It is our understanding that the EIR for this project is charged with assessing the impact of the 1987 amendment to the Southeast Roseville Specific Plan. If one looks at this interpretation strictly and considers the density changes from the original specific plan on the west side of Sierra College Boulevard, to the new densities on the west side of Sierra College Boulevard and the east side of development, under the original specific plan, have now been downzoned to single family developments.

The proposed densities for the specific plan on the east side of Sierra College Boulevard have increased from the existing zoning of two acres per unit to a residential zoning of between 3.1 and 3.8 units to the acre. Thus, what we would see in the Linda Creek drainage basin is a possible decrease in runoff from the existing plan (on the west side of Sierra College Boulevard) and an increased runoff for the specific plan area on the east side of Sierra College Boulevard.

It appears that the increased runoff from this proposed amendment to the specific plan will be small because of the offsetting factors discussed above. If one were to examine the runoff coefficients contained in the City of Roseville storm drain manual for the parcels in question, you would find that the peak runoff potential under the new proposed plan, at a point fairly close to the project, would increase somewhere between 5% and 10%. Using the same City of Roseville storm drain manual for the condition of increased peak runoff relatively close to the project, the manual would indicate potential increases in peak flows similar to those stated in the Nolte study at the confluence of Linda Creek with Cirby Creek.

As mitigation for this proposed project, each individual project within the Southeast Roseville Public Works Department, must prepare a drainage study, as required by the City of Roseville Public Works Department, to address each project's impact on storm drainage in the City. As a result of this study, measures could be implemented to speed up, or slow down, the flow depending upon the conditions for the particular watershed under study and the existing City policy for each watershed.



Comment: Is the reference in the hydrology section of the DEIR to "Sutter County" in error? Has a flood control district to serve the southern Placer County area been formed?

Michael Dean, City Attorney, 71, 73;

Response: The reference to Sutter County is correct. Although runoff from this Specific Plan area will not directly affect Sutter County, runoff from other parts of the City do eventually drain into Sutter County. Sutter County has formally requested that upstream municipalities implement measures to reduce flooding impacts. In response to Sutter County's request, as well as a growing awareness of local flooding problems, several of the municipalities in southern Placer County have met to discuss an area-wide program to reduce and solve drainage issues. Although a flood control district has been proposed, it has not been formally created to date.

Comment: The DEIR should examine alternative land uses which could be utilized to reduce the impacts to the native oak woodland areas. Less intense development densities should be considered in this area. Measures should also be identified to protect the historic barn in the area.

Planning staff, 5; Ed Mahany, Director of Parks and Recreation, 42; Dorothy M. Alexander, 77, 79;

Response: As discussed in the DEIR, lower density development generally results in impacts of proportionally less magnitude. As a result of the proposed density transfer, the impact of implementation of the proposed Specific Plan on the oak woodland of concern will be greater than that which would occur with development under existing land use designations. Conversely, impacts to areas west of Sierra College Boulevard where the density is being lessened will be of a lesser magnitude. The opportunity always exists to reduce impacts through development of less intense land uses. Similarly, implementation of other types of housing, such as cluster housing or implementation of



the planned unit development (PUD) concept can be used to reduce impacts. Substantial preservation can be achieved through designation of park or open space designations to areas of greatest sensitivity. Because of the indirect impacts associated with the unavoidable change in character of the vicinity, the impact on the oak woodland cannot be mitigated to less than significant levels.

Comment: The DEIR should include mitigation measures to reduce the exposure of future residents to electromagnetic fields produced by the powerlines which transect the Plan area.

Planning staff, 6; Maynard E. Bean, 64;

Response: As discussed in the DEIR, there is no conclusive evidence that the electric transmission corridor represents a health hazard to the community, and therefore, no basis for the determination of or the need for mitigation measures. The most obvious mitigation measure would be the location of potentially sensitive human activity at a given distance from the lines. This is accomplished to some degree by the existing easement corridor. The adequacy of the existing separation cannot be evaluated as insufficient data exists. Similarly, how much additional distance would be required, if any, for the juxtaposition of a given powerline or lines to a given land use of uses is problematic, and cannot be determined on any rational basis yet known. The California Department of Education has, in given instances, notably within the Plan area, recommended a separation of 400 feet from the edge of the easement to classrooms. Based upon the current evidence, this is a very conservative recommendation. Application of such a policy to all areas adjacent to power line easements would certainly have serious economic consequences not so severely felt in the isolated instance of schools. It therefore appears that substantial additional information would need to be generated before any specific recommendations could be made.



Comment: Clarification on Service Level C and consistency with the General Plan is needed.

Planning Staff, 8;

Response: Comments concerning the traffic analysis are responded to in an appended letter from Fehr & Peers Associates. The following response is excerpted from their letter.

For the City of Roseville, the Level of Service "C" shall be used in determining the capacity of the freeway, arterial and collector street system. This shall mean that the average travel condition in all of the City's principal travel corridors (as defined by Screenlines A through O in the 1982 Roseville Circulation Study) shall be at the middle of the range defined as Level of Service C, or better. Individual street segments may operate at the low end of Level C as long as alternative routes are available within the corridor which operate at better than mid-C. This guarantees that everyone travelling within the corridor will have an opportunity to travel under mid-C conditions or better if they choose to deviate slightly from their ordinary travel route. It also means that individual intersections may be projected to operate at Level D or E, as long as either: 1) the intersection is predicted to operate "under capacity" using long-range planning assumptions (as defined in the Transportation Research Board, 1985 Highway Capacity Manual, page 9-21), and can, therefore, be expected to operate at Level C when the volumes actually materialize and final operational improvements are installed, or 2) there are alternate routes available in the corridor along which all intersections operate at Level C or better.

Comment: The buildout analysis in the traffic study may be inappropriate.

Planning Staff, 9;

Response: Comments concerning the traffic analysis are responded



to in an appended letter from Fehr & Peers Associates. The following response is excerpted from their letter.

The following table presents data on historic and projected residential absorption rates in Roseville. The McDonald forecasts were prepared in May 1986 by Angus McDonald Associates and the City for use in the City's Capital Improvements Plan and in the Specific Plan EIRs. This is the data used (with minor refinements) in the Southeast Plan EIR for the plan itself and for cumulative development. The historic McDonald Associates data was prepared for and used in the 1982 Roseville Circulation Study. This data indicates that residential absorption between the present and the year 2005 will be about 900 units per year, or more than ten times the absorption rate experienced over the past 5 or 6 years.

For comparison, SACOG forecasts are also presented. These show an absorption rate of about 1100 units per year. However, because SACOG estimates a higher historic absorption rate than McDonald, the SACOG future rate is about 5 times as high as the SACOG historic rate.

The 2005 population forecasts from both sources agree fairly well; each estimates about 73,000 to 78,000 total population by 2005. However, SACOG projects that the number of people per dwelling unit will decline in the future, while McDonald estimates that the ratio will remain constant at 2.6. Therefore, SACOG estimates a higher dwelling unit growth.

Comment: The DEIR should describe additional easements and facilities which will be required to serve the Plan area. The DEIR should also include a mitigation measure which specifies that a revised development agreement should be executed to facilitate utility development.

Planning staff, 10;

Response: A description of the needed electrical easements and facilities is provided in a letter from David Dockman, Assistant Electric Utility Director. This information is provided as



**CITY OF ROSEVILLE
RESIDENTIAL ABSORPTION RATES**

	<u>McDonald Associates¹</u>	<u>SACOG</u>
Historic Absorption		
<u>Dwelling Units</u>		
1979	--	9460
1980	10,500	--
1984	--	10,610
1986	11,000	--
 <u>Growth (1979/80 to 1984/86)</u>		
Total	500	1150
Per Year	83	230
 Projected Absorption		
<u>Dwelling Units</u>		
1984	--	10,610
1986	11,000	--
2005	28,045 ²	33,200 ³
Buildout	34,690	--
 <u>Growth (1984/86 to 2005)</u>		
Total	17,045	22,590
Per Year	897	1076
 Projected/Historic Absorption	 10.8	 4.7

¹ Angus McDonald Associates, May 1986. (Basis for EIRs on Northeast, Southeast, North Central and Northwest Specific Plans, and 1986/1987 Roseville Capital Improvements Plan.)

² Per McDonald Associates forecast, projected 2005 population is 73,320, with 2.6 people per dwelling unit. Projected 2005 population from individual 1986/1987 Roseville Specific Plans is 77,760, with 2.6 people per D.U. (29,900 dwelling units).

³ Projected 2005 population 78,580, with 2.36 people per dwelling unit.



comments numbered 75 and 76 of this document. As requested, the following mitigation measure should be added to the DEIR:

- o The property owners within the Specific Plan area should execute a revised development agreement with the infrastructure improvements, easements, land dedications, and other contributions to be made in return for land use.

Comment: The DEIR should indicate that the proposed amount of acreage for the school sites is inadequate, and that this represents a significant impact.

Planning staff, 11;

Response: As described in the letter from Dr. Ronald Feist, Phd., Superintendent, Eureka Union School District, dated September 22, 1987, two proposals for the location of school facilities have been developed, either of which will provide adequate school sites in the vicinity. The Specific Plan has been modified accordingly, and now includes a joint use park/school site which fulfills the requirements of the School District and the Park Department. This information is presented as comments 87 and 88 in the appended letters of comment.

Comment: The DEIR inaccurately indicates that the lack of City-wide park acreage proposed by the Plan is less than significant, and does not identify appropriate mitigation measures. The DEIR does not indicate any mitigation for the projected shortfall in the proposed park acreage, nor does it clearly indicate mitigation for park acreage proposed within the powerline easements which have low utility and desirability as park land.

Planning staff, 12

Response: The DEIR accurately states that adequate City-wide park facilities have been developed to serve the southeastern portion of the City. Maidu Park provides adequate facilities to serve in excess of 30,000 people. City-wide park facilities are



proposed to serve the northern and western portions of the City. The DEIR does not state that the developer should be relieved of the City-wide park obligation, but simply that adequate City-wide park facilities exist to serve the southeastern portion of the City, and implementation of this Specific Plan will not generate the need for additional City-wide park acreage in the vicinity. Since preparation of the DEIR, the Specific Plan has been modified to include the required acreage of park land and a joint use park/school facility. However, since the type of park acreage proposed does not conform to the neighborhood park, community park, and City-wide park descriptions as recognized by the City, recreational impacts are still suggested to be significant and not fully mitigated. Further, the City has not clearly indicated whether areas within the powerline will be acceptable, partially acceptable, or entirely unacceptable. The DEIR clearly identifies the limited potential for recreational use of the powerline easement, and states that depending upon the acceptability of the powerline corridor as park land, additional mitigation may be required. Adequate mitigation could consist of acceptance of the proposed park land as proposed in the Specific Plan; acceptance of the proposed park land plus additional acreage, facilities, or fees; or designation of all park land entirely removed from the powerline corridor.

Comment: The DEIR should discuss the utility of the powerline easements as recreational area. What activities can occur? What about the desirability of the area? Do the power utilities place any limitations on use of the area? What type of liability would the City incur?

Planning staff, 13;

Response: The restrictions on use of lands within powerline easements are established by the State of California and the respective power utilities. Specific regulations would have to be obtained from the concerned utility companies. Generally, restrictions prohibit the construction of permanent structures or facilities. However, improvements can generally include extensive facilities including turf fields, trails, playground



equipment, picnic areas, small lakes, and structures without foundations. For example, an equestrian center with show ring, a park situated around a man-made lake, a physical fitness trail, and a community orchard are all proposed within the powerline easement in the Treelake Village development located immediately east of the Specific Plan area. Generally speaking, any activity which has the potential to interfere with the transmission facilities, or place the participant in a dangerous situation, are prohibited. The desirability of use of such areas has both pros and cons, and will largely be a subjective evaluation by individual participants. The liability which the City might incur as a result of use of these areas is beyond the scope of this DEIR. However, a memorandum from Robyn Kain-Spedden, Administrative Analyst II for the City of Roseville, includes some information concerning liability issues. This memorandum is referenced as comments 89 through 99 in the Letters of Comment section of this document.

Comment: According to the Park Department, Table M-3 contains an error relating to the Park Tax Fee. The amount should be \$882,058 instead of \$1,382,700. How was the 462.2 thousand dollar figure (pertaining to the park and recreation budget) derived in the fiscal analysis?

Planning Staff, 14; Ed Mahany, Director Parks and Recreation, 59, 60;

Response: The purpose of the Table is to identify the one-time fiscal benefits which would be derived from the City as a direct result of development fees assessed with development of the Plan area. The discrepancy between the \$1,382,700 identified in the DEIR and the \$882,058 identified in the comment, is the approximate \$432,000 credit granted for completion of Johnson Ranch Road. Since the road has been completed at developer's expense, the City has in fact already received the \$432,000 in question. Therefore, the comment would be correct to state that approximately \$882,000 is still forthcoming in the form of Park Tax fees. However, the total benefit derived from Park Tax Fees will be the \$1,382,700. As discussed in the Fiscal Report, the



projected future budget of \$462.2 figure was derived using the current expenditures per park relationship.

Comment: The DEIR does not specify whether growth inducing impacts will be significant and if mitigation measures exist to lessen these impacts.

Roseville Planning Staff Report for PRC meeting of September 22, 1987, 15;

Response: As discussed in the DEIR on page 0-1, "Specific growth inducing impacts associated with the Amended Southeast Roseville Specific Plan are largely limited to on site impacts.". Implementation of the proposed Specific Plan will increase the number of residences and businesses on the site, and subsequently the number of employment opportunities, the need for extension of services, the improvement of transportation facilities, etc. in the vicinity. However, this growth is within the limits established by the General Plan and therefore is not anticipated to create any unanticipated growth inducing impacts. Further, since development is already proposed for the majority of the area immediately surrounding the Plan area, off site impacts in the vicinity are anticipated to be minimal. Based on these conditions, the growth inducing impacts of the Specific Plan are suggested to be less than significant. However, the aggressive growth proposed by Roseville on a City-wide scale, coupled with the predicted imbalance of the jobs/housing ratio, could induce growth in other areas surrounding the City and should be considered a significant cumulative impact.

Comment: The following comments on the DEIR were generated by numerous commentors and provide additional information on several topics.

Jerry Jackson, Assistant Director of Public Works, 16; Ed Mahany, Director of Parks and Recreation, 18, 19, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 38, 39, 40, 41, 44, 48, 49, 50, 51, 52, 55; City Clerk, 62; Roseville Fire Department, 63; Town of Loomis, 65;



David Dockman, Assistant Electric Utility Director, 75, 76; Eleanor Holladay 78; Dr. Ron Feist, PhD., Superintendent Eureka Union School District, 87, 88; Robyn Kain-Spedden, Administrative Analyst II, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99; State Office of Planning and Research, 100;

Response: Since these comments are informational in nature, no response is required. Each comment is included in its entirety in the Letters of Comment section of this document.

Comment: There is currently a discrepancy between the designated park acreage within the proposed Specific Plan and that desired/required by the Park and Recreation Department. As shown below, this acreage is calculated based on the requirements for space for three types of parks recognized by the City: City-wide, Community, and Neighborhood parks.

City-wide Park	5.0 acres/1000 residents	51.5 acres
Community Park	1.5 acres/1000 residents	15.5 acres
Neighborhood Park	2.5 acres/1000 residents	<u>25.8 acres</u>
		92.8 acres

As shown, the Park and Recreation Department has calculated that approximately 93 acres of park land will be required to serve the amended Southeast Roseville Specific Plan area. In addition, the Park Department has indicated that area within the powerline corridor may not be suitable for park development. However, some of this area may be utilized for trails and possibly vernal pool preserve areas.

Ed Mahany, Director of Parks and Recreation, 17, 20, 21, 22, 23, 34, 35, 36, 37, 45, 46, 47, 53, 54, 56, 57, 58;

Response: Since preparation of the DEIR, the proposed Specific Plan has been modified, as shown below to include the amount of park land determined necessary by the City (to \pm 0.1 acre).



SERSP Proposed Park land

Park Type	Size	Location
City-wide Park	23.5 acres	Maidu Park (Joint Use with school site)
Community Park	47.7 acres	Powerline corridor east of Sierra College Boulevard
Neighborhood Parks	9.0 acres	Powerline corridor west of Sierra College Boulevard
	12.5 acres	Joint park/school site on north side of Eureka Road

Although adequate acreage of park land (\pm 0.1 acre) is now proposed, there is a discrepancy as to the suitability of the proposed parcels to meet the requirements of the three types of parks identified by the City. As shown below, breakdown of the proposed acreage does not agree with the calculated need for park types as calculated by the City.

	<u>City Requirement</u>	<u>Proposed</u>	<u>Net</u>
City Wide Park	51.5 acres	23.5 acres	-28.0 acres
Community Park	15.5 acres	47.7 acres	+32.2 acres
Neighborhood Park	<u>25.8 acres</u>	<u>21.5 acres</u>	<u>- 4.3 acres</u>
	92.8 acres	92.7 acres	- 0.1 acres

As proposed, roughly 56.7 acres (61%) of the proposed park land is located within the powerline corridor. In addition to the existing joint use facility in Maidu Park, a second such facility has been incorporated into the current plan which would allow for co-location of a future park with the designated school site on Eureka Road. Finally, the suitability of areas within the powerline easement for use as park land is in question. The DEIR clearly recognizes that the recreation potential of such areas is



limited. The City has not adopted policy concerning the suitability of such areas for recreational uses. Pathways within the Specific Plan area are proposed to connect the trail system in Maidu Park to the proposed park in the Treelake Village project located east of the City. Such a connection is proposed to utilize the powerline corridor.

As discussed in the DEIR, in addition to the designated park land within the Specific Plan area, a considerable amount of open space and floodway is proposed. All area within the 100 year floodplain will be dedicated to the City as required. Open space will include both public and private areas. Realizing that the visual characteristics of the park may be compromised by development of facilities, these areas as well as the floodplain and open space, will help to maintain some of the native character of the area.

Comment: The air quality of the region is deteriorating. The DEIR has adequately modelled air quality impacts and includes numerous mitigation measures. Modelling in the DEIR indicates that CO hotspots may occur and a complete air quality analysis should be submitted on individual projects. Individual projects and future stationary sources should demonstrate compliance with the ambient air quality standards prior to approval. Dust control should be required of all development and no unpaved streets or parking areas should be allowed in new developments.

Sandra Harris, 84; Noel A. Bonderson, Placer County APCD, 66, 67, 68, 69, 70;

Response: Air quality monitoring and mitigation will be implemented as required by the APCD to ensure that projects are in compliance with air quality standards. Dust control will be provided on all construction sites, and unpaved roadways and/or parking areas are not proposed.



Comment: Any artifacts located during the archaeological investigation of the prehistoric site located within the Plan area should be provided to the Maidu Park museum.

Ed Mahany, Director, Parks and Recreation, 61;

Response: The proponent is in agreement with this suggestion.

Comment: Placer County is opposed to location of a commercial center at the intersection of Sierra College Boulevard and Eureka Road. In light of the commercial development proposed within the County along Douglas Boulevard, it is felt that a center at the proposed location is un-necessary and would be incompatible with the residential land use in the vicinity.

Thomas D. McMahan, Planning Director, Placer County, 80;

Response: The proposed commercial center is intended to serve the needs of the local community and allow them to avoid accessing Douglas Boulevard which is expected to become a major arterial roadway. The proposed commercial parcel at the intersection of Sierra College Boulevard and Eureka Road is 6.6 acres in size, and future commercial tenants have not been identified. As proposed, the commercial site is located at a major intersection within the Plan area, and is adjacent to a 16 acre wholesale/retail nursery. The property on the south side of the commercial site is not within the Specific Plan area, and development has not been proposed. Immediately across Sierra College Boulevard from the site, a park is proposed within the transmission line corridor. Otherwise, proposed surrounding uses are residential in nature.

Comment: The DEIR should recognize the Beltway corridor which has been proposed to traverse the Plan area.

R. W. Foust, Senior Civil Engineer, Transportation Planning, County of Sacramento, 81;



Response: Alternative 1-1 of the proposed Beltway connector was identified as the most desirable alignment for the roadway between I-80 and Highway 50. This alignment traverses the Plan area. However, Placer County has gone on record as opposing the connector, and implementation in the near future is not likely. Continued growth in the region, including that within the proposed Specific Plan area, will make implementation of the Beltway more and more difficult.

Comment: The proposed Specific Plan is not compatible with the character of the Granite Bay community. A lower density should be proposed on the east side of Sierra College Boulevard. The ability of the San Juan Water District to provide adequate service to the area should be more closely examined.

Sandra Harris, 82, 85, 86;

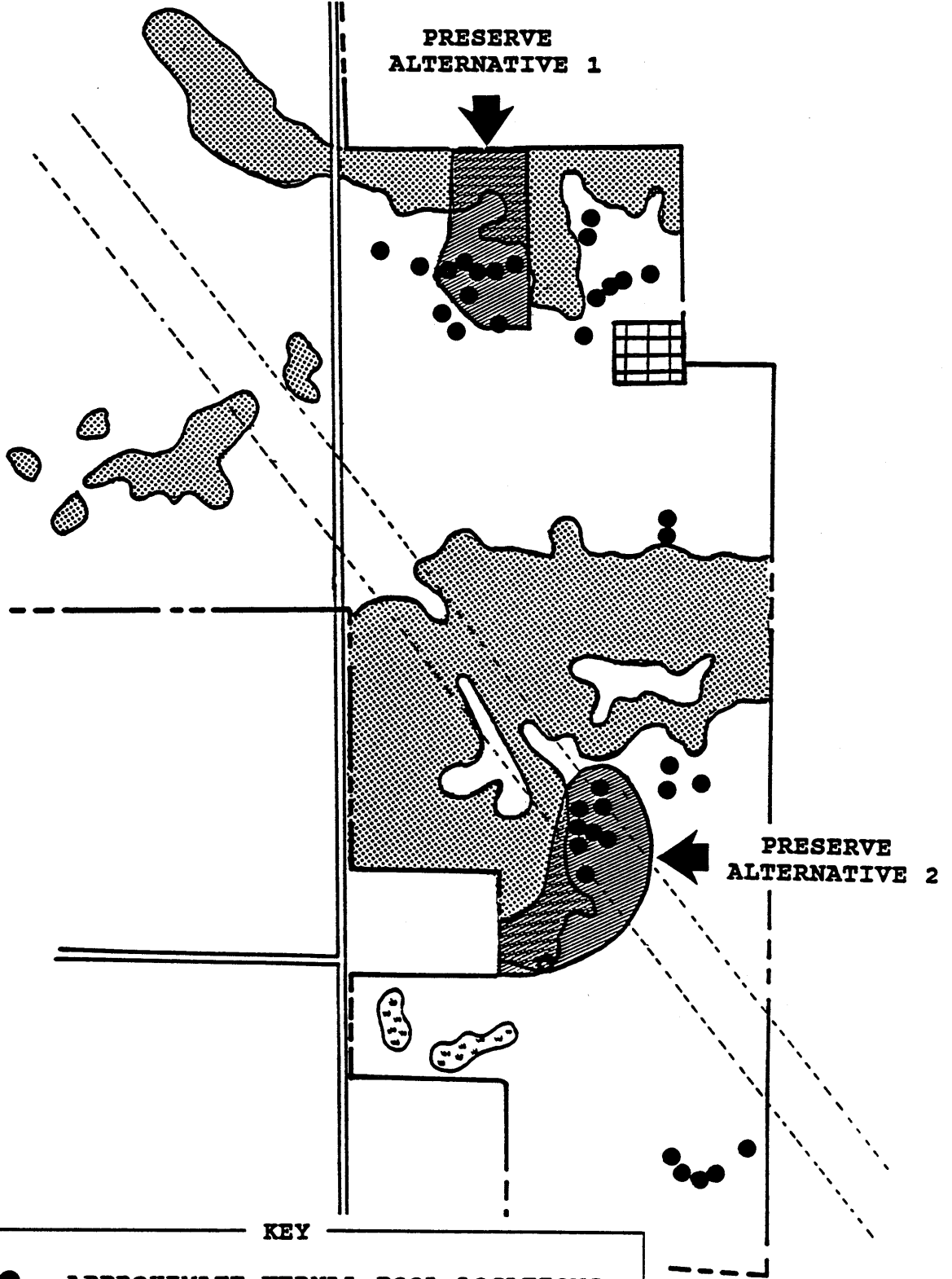
Response: Comments noted. Letters from the San Juan Water District and the City of Roseville Public Works Department are appended the DEIR which discuss the agreement between the two entities regarding the provision of water to the area.

Comment: Although the Plan incorporates measures to protect areas within the 100 year flood plain, other riparian areas and vernal pools are not proposed for protection. A 50 foot setback should be required from all waterways. Vernal pools could be protected within park areas.




Gordon F. Snow, Projects Coordinator, Dept. of Fish & Game, 104, 105, 106; Ed Mahany, Director, Parks and Recreation Dept., 43;

Response: Two alternative combinations of vernal pool preserve and blue oak woodland preservation are included in the biotic study prepared for the DEIR. Either of these alternatives are recommended as being substantial enough to reduce the impacts of the project on these resources to less than significant levels. The proposed alternatives are presented in the following figure.





KEY

●	APPROXIMATE VERNAL POOL LOCATIONS
	OAK WOODLAND
	RIPARIAN
	ALMOND ORCHARD



Preserve Alternative 1 would require establishment of a vernal pool preserve in the northwest portion of the site between the commercial parcel and the project entry road from Eureka Road. This alternative would require adjustment of the boundary of the 15.77 commercial parcel to accommodate inclusion of pools in the preserve. This vernal pool preserve would be approximately six acres and the blue oak woodland preserve would be approximately 10 to 11 acres in size. Preserve Alternative 2 is proposed in the south-central portion of the Plan area and would consist of approximately 22 acres, 16 of which would be blue oak preserve and 6 would be vernal pool preserve. The developer favors implementation of preserve alternative 2, however, the details of such a mitigation measure need to be worked out with the City prior to their inclusion in the Specific Plan.

Comment: The traffic volumes presented in the DEIR need to be updated. Roadway improvements will be required within the next 20 years and will likely have to include HOV lanes and soundwalls. It is not Caltrans's policy to widen I-80 to 10 lanes between Roseville and Sacramento. Continually increasing traffic volumes on area roadways may present other impacts, such as transport of hazardous wastes, through the area. These impacts need to be examined.

Brian J. Smith, Chief, Environmental Branch, Caltrans District 3, 101, 102, 103; Sandra Harris, 83;

Response: The volume of traffic predicted to be generated by the Specific Plan has not changed, although it is recognized that more current information on existing conditions is available. Since the impacts and mitigation measures are focused on providing facilities to serve the builtout plan area, volumes for future conditions, and ultimate mitigation will not change. Nonetheless, the City of Roseville does recognize that impacts and mitigation measures will have to be identified on an individual project basis as development continues. In order to facilitate efficient transportation planning, the City proposes to retain a traffic consultant to model City-wide traffic conditions on a systematic basis. This City-wide traffic



management program is proposed to allow the City to manage growth of the transportation system as necessary with development of the City.

The Specific Plan as proposed is not proposed to include land uses which would require shipment of hazardous waste materials which would endanger the community. However, as noted, increased traffic from throughout the region on area roadways could include shipments of hazardous wastes. It is assumed that such shipments, if they occur, will be in accordance with pertinent State and local laws.



IV. LETTERS OF COMMENT



PLANNING DEPARTMENT STAFF REPORT

PROJECT REVIEW COMMISSION MEETING
SEPTEMBER 22, 1987

ITEM III-A: DRAFT ENVIRONMENTAL IMPACT REPORT - SOUTHEAST ROSEVILLE
SPECIFIC PLAN.

REQUEST

Certification of the Draft Environmental Impact Report for the proposed amendment to the Southeast Roseville Specific Plan.

Applicant: R.C. Fuller Associates
Property Owner: Southfork Partnership

BACKGROUND

The Roseville City Council adopted the existing Southeast Roseville Specific Plan in February of 1985. The Plan encumbers 637.4 acres south of Douglas Blvd. between Rocky Ridge Drive and Sierra College Blvd. The Specific Plan calls for the development of 3798 units of residential development along with approximately 136 acres of non-residential land use. Construction of the initial phases of this Plan are currently under way.

In August of 1980, the City annexed approximately 367 acres of property east of Sierra College Blvd and south of Eureka Road. This parcel is known as the Broken Spur property and is contiguous with the existing Southeast Plan Area. The primary property owner in the Southeast Plan Area, Southfork Partnership, recently purchased this property. The current request is to modify the Southeast Plan to incorporate the property.

The Broken Spur parcel has an existing land use of .43 units per acre. It would yield 167 residential units. The property owner is proposing to reallocate 783 units from the existing Plan Area onto the property. This will be accomplished by reducing mid-range densities in the existing Plan. No additional units are requested to be allocated to the Plan Area. The amended Specific Plan would yield a total of 3,965 dwelling units.

It is the Project Review Commission's responsibility to review the adequacy of the Environmental Impact Report prepared for this project. The Commission must determine if all of the relevant issues have been adequately analyzed and addressed. In reviewing the Draft EIR, emphasis should be placed on determining the comprehensiveness and accuracy of the document in discussing possible impacts upon the environment. Are the impacts adequately defined and analyzed? Have mitigation measures been developed for the various impacts? Are these measures sufficient and can they reasonably be implemented? Have any issues been omitted? Is further analysis necessary?

To aid in the Commission's analysis staff has pointed out some areas where it is felt additional analysis is necessary. Also enclosed are copies of comments received to date from other agencies and departments. Finally, staff has prepared a review checklist to allow Commission members to make notes while reviewing the document. Staff does not anticipate action on the EIR at the September 24, 1987 meeting. The EIR consultant will need to respond to staff concerns, issues indicated in the enclosed letters and any concerns which may come up during public hearings. These items should be addressed before the Commission considers certification of the document. Staff is hopeful that this action could occur at the October 1, 1987 Commission meeting.

EVALUATION

It is staff's opinion that the E.I.R. has been prepared in compliance with CEQA. There are, however, a number of areas where staff feels that additional analysis or clarification is needed. This includes the following:

A. GENERAL PLAN CONSISTENCY (pages C-11 through C-30)

1 The EIR indicates that the proposed Specific Plan is inconsistent or potentially inconsistent with policies in the General Plan Land Use, Circulation and Open Space Elements. State planning law dictates that a Specific Plan must be consistent with a jurisdiction's adopted General Plan. Where inconsistencies exist the Specific Plan must be amended to be consistent with the General Plan or visa-versa. The EIR has not indicated how these inconsistencies will be corrected. Mitigation should be examined in each case where an inconsistency has been identified.

2 The EIR indicates that Specific Plan consistency with the Housing Element cannot be determined until the City adopts its affordable housing implementation program. This program is currently being formulated by the Affordable Housing Task Force. It is staff's opinion that the Specific Plan's share of the affordable housing need should be calculated now using currently adopted General Plan requirements. From this the Plan's consistency with existing policy could be determined.

B. GEOLOGY (pages D-1 through D-4)

3 The geological survey contained in the EIR only partially covers the Plan Area. The EIR indicates that a complete geological survey of the existing Plan Area was not prepared. Only the property proposed to be added to the Plan has been surveyed. Although it is unlikely that geological constraints exist on the unsurveyed portion of the Plan, this determination cannot be made until adequate information has been generated. If survey work exists it should be added to the EIR so that a complete analysis of potential impacts can be performed.

C. HYDROLOGY (pages E-1 through E-9)

4 The EIR indicates that the project will minimally increase run-off into the City-wide flood drainage system. This increase has not been

quantified. A number of generic mitigation measures are suggested, but a specific drainage plan for the Southeast Area has not been developed. It is not the EIR's job to develop this specific program. The EIR, however, should list a mitigation measure which requires that a comprehensive drainage study be prepared for each watershed in the Plan Area prior to development in the subject shed. This is the same condition that was applied to the Northeast Plan Area.

D. VEGETATION AND WILDLIFE (pages F-1 through F-16)

5 The EIR correctly points out that the Specific Plan will result in a reduction of natural vegetation and wildlife habitat. Of main concern is the large oak woodland existing on the central portion of the Broken Spur property. Much of this woodland would be destroyed if developed at the density and with the housing type proposed in the Specific Plan. Trees will need to be removed for roads, driveways, building pads and yards. The EIR lists a number of tree preservation measures which should be applied to the project. These measures do not appear to be sufficient to reduce the impact to a less than significant level. The EIR should examine land use alternatives which could further reduce the impact. These could include alternative densities and housing types as well as setting the area aside in permanent open space or as parkland. Could such measures reduce the impacts to a less than significant level.

E. LAND USE (pages I-1 through I-11)

Within the Land Use Chapter of the EIR is a discussion about power line corridors. The Specific Plan proposes parkland within these easements as well as residential land use immediately adjacent to the corridors. There is a considerable amount of information which implies that the electromagnetic fields created by high voltage transmission lines may contribute to human illnesses, such as cancer, in ways which are not yet understood. There is neither sufficient evidence to support or disprove this inferred relationship.

6 The State Board of Education, as a precautionary measure, no longer approves school sites within 400 feet of high voltage transmission line corridors. The EIR indicates that the location of residential land use adjacent to, and parkland within the corridors is a potential impact. No potential mitigation measures, however, have been discussed. Although this is not a clear cut issue, the EIR should attempt to present some mitigation alternatives which could reduce or eliminate the indicated impact. This could include such measures as the inclusion of residential setbacks, specific construction techniques and the elimination of park acreage within the power line corridor.

F. HOUSING (pages I-16 through I-18)

7 As mentioned in the General Plan Consistency Section, the Specific Plans affordable housing obligation should be calculated consistent with adopted General Plan Policy.

G. TRAFFIC AND CIRCULATION (pages J-1 through J-30)

The traffic study in the EIR identifies a number of roadway improvements

that will be needed as a result of the Specific Plan as well as other future development in the City. Even with the indicated improvements major intersections in the vicinity are predicted to operate at less than a level of service (LOS) C. The EIR concludes that traffic impacts cannot be mitigated to a less than significant level for some intersections and roadways.

8 There are several areas of the traffic study which require clarification. The first is the LOS C required by General Plan Policy. As was brought out at the September 8, 1987 traffic circulation workshop, the definition of LOS C has changed over time. The new definition of LOS C appears to be more liberal than that used when the General Plan Policy was developed. In addition, the emphasis of the traffic analysis has appeared to shift from specific intersections to screen lines. The EIR indicates that several intersections will operate at less than a LOS C. It is indicated, however, that the LOS over screenlines averages a LOS C. This again appears to deviate from the intent of the LOS policy in the General Plan. Clarification on this issue from the traffic consultant is needed.

9 A final issue relates to the depth of the buildout analysis. The study contains specific intersection levels of service for development of the Plan until the year 2005. The buildout analysis, however, discusses screenlines, but no specific intersections. This information should be generated as a point of comparison as well as making it possible to judge consistency with adopted General Plan LOS policy. If it is not practical to project the long term LOS for intersections, then mitigation should indicate that development relying on future improvements cannot occur until financing of future improvements are determined.

H. ELECTRICITY (pages K-7 through K-9)

10 The analysis on electrical needs does not indicate if any additional easements or other electrical facilities will be needed to service the amended Plan Area. This should be indicated. In addition, a mitigation measure should be included which specifies that property owner(s) within the Plan Area will execute a revised development agreement with the infrastructure improvements, easement, land dedications, and other contributions to be made in return for land use. This is similar to the mitigation listed for water and wastewater.

I. SCHOOLS (pages K-16 through K-20)

11 The Eureka Union School District has indicated that the revised densities proposed in the Specific Plan will yield more students which may necessitate the need for an additional elementary school site in the area (see enclosed memo from Eureka Union School District dated 9/14/87). The EIR must address this need, indicate that the lack of a school site is a significant impact and list appropriate mitigation.

J. PARKS (pages K-21 through K-26)

12 The EIR indicates that the lack of City wide park acreage proposed by the Plan is less than significant because the Plan Area is next to Maidu

12

Park. This is not true. The City-wide park standards were developed to service the needs of the entire City. Just because the Southeast Area is next to a City-wide facility does not mean it has no City-wide obligation. The Parks and Recreation Department indicates that over 450 acres of City-wide park will be needed to service Roseville's build out population. If the Southeast Plan does not dedicate it's share there may not be a local shortfall, but on a City-wide basis the acreage available will be less than needed. Somewhere within the City-wide system there will be a shortfall.

The EIR does not indicate any mitigation for the projected shortfall in park acreage. In addition, it does not clearly list mitigation for acreage proposed under the powerline easements which has low utility and desirability as parkland. The Park chapter analysis appears to be constructed in a slightly slanted manner which tends to promote the Plan Proponents view that the park acreage indicated on the map is sufficient, that power line easements make good park land and that the landscape easements along roadways should be counted towards meeting the park acreage requirement. It is not the purpose of the EIR to forward a particular view, but rather to give an unbiased analysis of the situation. The above issues will need to be worked out as part of the review of the Specific Plan itself. The acreage proposed in the Plan is less than required by General Plan Policy and has limited utility. This should clearly be stated as a significant impact. Appropriate mitigation should be formulated.

13

The EIR should also look closely at what exact activities can occur in a power line easement. What can and cannot occur? Do the power companies place any limitations on use within the easements? How desirable of an environment is it? What would happen if future studies on power lines and their effects on health indicate that the easements should not be used for park facilities? What type of liability would the City incur? What effect would the loss of this acreage have on meeting City park needs and how would this shortfall be met?

K. FISCAL (pages M-1 through M-2)

14

The Parks and Recreation Department has pointed out that Table M-3 contains an area relating to the Park Tax Fee (see enclosed memo from Parks and Recreation Department dated 9/14/87). In actuality only \$882,058 is available for park development and not the \$1,382,700 indicated on the table.

L. GROWTH INDUCING IMPACTS (page O-1)

15

The EIR indicates that the project could generate growth inducing impacts. It does not specify, however, if these impacts are significant and if mitigation measures might exist.

RECOMMENDATION

As indicated, the Planning Department does not anticipate any formal action on the EIR at the September 22, 1987 Commission meeting. Staff recommends that the Commission continue action on this item until the October 1, 1987 Project Review Commission meeting to allow the EIR consultant to respond to the concerns indicated in the Staff Report, those indicated in the enclosed letters and any additional issues which may come up at the public hearing. If a satisfactory response to the concerns is developed by the consultant, it is hoped that certification of the document could occur at the October 1st meeting.



CITY OF ROSEVILLE

318 VERNON STREET • ROSEVILLE, CALIFORNIA 95678 • PHONE (916) 781-0200

August 6, 1987

Mr. Richard Fuller
R. C. Fuller & Associates
5908 Fair Oaks Boulevard
Carmichael, California 95608

WATER SERVICE, SOUTHEAST ROSEVILLE SPECIFIC PLAN EXTENSION

Dear Mr. Fuller:

Mr. William Cramer has requested statements from City staff regarding water service to Broken Spur, a proposed extension to the Southeast Roseville Specific Plan.

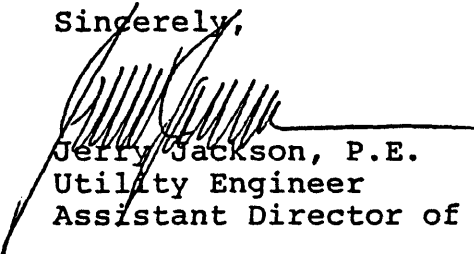
16

In general, City and San Juan Suburban Water District staff consider Sierra College Boulevard as the boundary between districts. The City, with few exceptions, will serve areas on the west of Sierra College and San Juan, without exceptions, will serve areas on the east side. This arrangement has practical advantages in that new pressure zones can be avoided and both agencies can better loop water systems. This arrangement was reaffirmed during a meeting between City and San Juan staff on August 5, 1987.

Regarding the transfer of approximately 700 dwelling units from the west side of Sierra College to the extended Southeast Roseville Specific Plan (Broken Spur) on the east side, City staff neither supports nor opposes the proposal as it relates to water service. Water saved by this transfer can be utilized for other developments in the City.

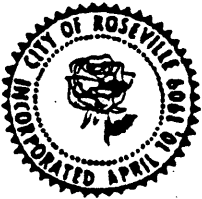
Please call if you need additional comments regarding water service to the Broken Spur area.

Sincerely,


Jerry Jackson, P.E.
Utility Engineer
Assistant Director of Public Works

cc: Mr. William Cramer, Coker-Ewing
Mr. Jack Hansen, San Juan Suburban Water District
City of Roseville Planning Department ✓

js



CITY OF ROSEVILLE

AUG 21 1987

316 VERNON STREET • ROSEVILLE, CALIFORNIA 95678 • PHONE (916) 781-0200

Rec'd By _____

Filed By _____ App. _____

ENVIRONMENTAL IMPACT REPORT

TO: Director of Parks & Recreation

FROM: Planning Department
316 Vernon Street
Roseville, CA 95678
(916) 781-0276

PROPOSED PROJECT: Draft Southeast
Roseville Specific Plan EIR

Date Sent: 7-14-87
Date of Reply:

- A. Please review the attached EIR as it relates to your Department, Agency, or District.
- B. Comments and recommendations should include whatever supportive information, facts, data, etc. are available.
- C. Please return comments to the Planning Department by:
September 14, 1987.

COMMENTS

SEE ATTACHED

Your cooperation and contribution of data is essential in the EIR review process. If you have any questions on the above project, do not hesitate to contact the Planning Department. Thank you.

Daniel E. Dameron
Associate Planner

INTERDEPARTMENTAL COMMUNICATION

TO: Planning Department

DATE: September 14, 1987

FROM: Director of Parks and Recreation

SUBJECT: REVIEW COMMENTS ON DRAFT SOUTHEAST ROSEVILLE SPECIFIC PLAN

PAGE REFERENCE	PERTINENT COMMENTS
(17) A-2 A-3 2nd Para.	It's acknowledged that there will be 3,965 dwelling units and 10,309 persons in Southeast Plan area. I don't understand = "Park acreage is proposed to increase by 56.1 acres?"
(18) A-4 E (Line 7)	Parks are generally funded from general fund, residential park tax, state bond, some federal grants, plus dedication via developers.
(19) B-3 B-5	Project impact on Parks and Recreation is acknowledged.
(20) B-6 Hydrology	Under Hydrology and Water Quality = What creek floodplain area will be dedicated to the City?
(21) B-10	Under Parks and Recreation = impact is acknowledged. Under Parks and Recreation = mitigation measures statement is confusing. It says "...the proposed acreage of park land is not in accordance with that required by City Ordinance." I am assuming the 56.9 acres of park under the power line is the only park acreage. See my Exhibit (A) for the distribution of the 69.33 acres of park land the City should get dedicated. The specific plan has 56.1 acres.
(22) C-6	I noticed that Parcels 45, 47, 50, and 51 of proposed specific plan totaled 80.2 acres. My Exhibit (A) had 92.7 acres to be considered.
(23) C-8	Amended specific plan area: I do not agree with this plan. A more effective distribution and service of park facilities for the people in different areas are noted on my Exhibit (B).
(24) C-12	I concur with Policy 4.
(25) C-14	I concur with Policy 4.
(26) C-15	I concur with Policy 7.

- 27 C-18 Policy 21, NO. 2, regarding elementary school site: The actual school site may be less than 10 acres when the total school/park exceeds 10 acres. (Should not have equals.) We already have experience at the seven acre 4-6 grade school site adjacent to a five plus acre park turf area, etc. There should not be reference of the total secondary intermediate school/park total equaling only 15 acres. It's at least 20 acres with the park (turf, etc.) including 10 of the 20 acres.
- C-19 It's difficult to figure the K-3 school. The size enrollment would effect the size of school land and acreage.
- 28 C-19 Policy 22 and 23 missing.
- 29 C-19 I agree with Policy 24 and 25.
- 30 C-24 I agree with Policy 2.
- 31 C-25 I agree with Policy 4.
- 32 C-26 I agree with Policy 4.
- 33 C-27 I agree with Policy 10.
- 34 C-27 Reference Policy 11: There isn't adequate amount of park acreage. The City needs and is entitled to 69.33 acres as per my Exhibit (A). The amended specific plan shows only 56.70 acres in a power easement, which has questionable usage if exclusively used for all park and recreation facilities. Neighborhood parks should serve the population area near them and not be removed by 3,000+ feet in some cases.
- 35 C-27 Reference Policy 12. Where does the specific plan provide for neighborhood and community parks?
- 36 C-27 Reference Policy 13: The only collocated park/school site is at Maidu Regional Park.
- 37 C-27 Reference Policy 14: There is merit to using the major utility easements for bike paths, etc. To just connect one recreation area to another may not be practical or economical.
C
- 38 C-28 There is no Policy 15.
- 39 C-28 I concur with Policy 16.

- 40 C-29 I concur with Policy 1 (d).
- 41 D-16 I concur with the last mitigation measure on 100 year floodplain. According to the map on Page E-5, a lot of floodway will be dedicated in areas that were to be private when the first Southeast Plan was approved three years ago.
- 42 F-13
F-14 Mitigation measures for preserving the trees should include creative designing to leave the trees in undisturbed clusters. Minimize a building under or alongside the tree.
- 43 F-15 I concur with the addressing of vernal pools. There may be certain areas under the power line easement and along the oaks that are restricted to open space and preservation of the vegetation and wildlife. It could be a combination of private and public lands. Entrance would be regulated. It would be fenced off.
- 44 G-12 I concur with mitigation measure on inclusion of pedestrian and bicycle pathways.
- 45 I-6 I disagree with park statistics on Table 11.
- 46 I-10
2nd
Para. Increase of park land use should be 69.33 acres.
- 47 I-11 Mitigation measures - first paragraph: How and where will additional segments of pedestrian/bicycle pathway connect to county pathway networks?
- 48 K-8 I am assuming that there will not be another sewer trunk line going through Maidu Regional Park as a result of the Southeast Plan.
- 49 K-21 Acknowledge information.
- 50 K-22 Information noted.
- 51 K-23 Neighborhood parks in Roseville (Cresthaven, Crestmont, Lincoln Estates, plus new parks of Diamond Oaks, Kaseberg, and Lexington Greens) also have or will have active use soccer/softball and turf areas. Other material and information noted.
- 52 K-24 I concur with first paragraph on 69 acre deficit.

- 53 K-24 Under mitigation measures and breakdown of requirements: Comparison of my Exhibit (A) and the EIR statistics show that the City requirement for community parks should be 15 acres and neighborhood parks should be 26 acres. This section needs to be redone and reevaluated.
- 54 K-25 Maidu Regional Park was not planned to serve just the east side of Roseville. The other established part of the City (prior to 1980) did not have the space to accommodate such a large park. Maidu was a start in meeting needs of City-wide park for that population plus southeast area. Because Maidu Park is located near the southeast population service area doesn't mean that area shouldn't put up its share of City-wide park acreage. Other specific plan areas will be required to dedicate their share of the requirement. Ninety thousand population will require 454 acres of City-wide park.
- 55 K-26 Para. 4 There is currently a 10' bicycle/pedestrian path along the whole perimeter of Maidu, except at Rocky Ridge. A 10' path will be put there after construction of the Community Center building.
- 56 K-26 Para. 6 Is the 76 acres of open space going to be private or public?
- 57 L-5 Para. 2 Mitigation measures: Exactly what floodplain areas will be dedicated to City?
- 58 L-5 Para. 4 Designating area as park land to help mitigate the visual and aesthetic resources may be only so effective due to building the park and by compacted uses of the people in the park.
- 59 M-2 M-3 Where does the \$462.2 thousand expenditures for parks and recreation come from (Table M-1)?
- 60 M-5 Table M-3 = Park Tax Fee: I interpret this to be residential park tax to be collected. Should be noted that the City allowed \$432,000 credit for Johnson Ranch Road completion. This means only \$882,058 will be available for development, not \$1,382,700.
- 61 N-6 Para. 1 & 2 I agree with first mitigation measure. However, the City should receive the artifacts being moved. The artifacts should go to the Maidu Park Museum.

SOUTHEAST ROSEVILLE SPECIFIC PLAN - (PROPONENT DRAFT)

P-9 Circulation and open space comments noted.
P-10

- P-11 Acknowledged, but disagree with totals that were allocated to parks.
- P-19 No. 5 on trees = good policy.
- P-23 No. 5-7 policy on pedestrian and bikeway is good.
- P-28
Para. 4 What streambed areas will be dedicated to City if these streambed areas are to be retained in private ownership?
- P-28 There is reference that most of the power line easement will be developed with City park facilities. I do not think City staff is saying this: There are other locations in the Southeast Plan area being studied for parks. The amenities under the power lines are not necessarily inducive to park development.
- P-29 Reference playfields: It is noted that a portion of the 24.75 acres of school facilities will contain turf covered areas for recreation. The amount and size of this turf area is important to the feasibility of doing recreation on the turf. In other words, there will be certain size areas needed for effective recreation, not just turf. What might be good for the school may not be good for the community recreation use.
- P-29 No. 2 policy on use of power easement is ok.
- P-30
P-31 It is my understanding that Eureka School District is thinking of changing locations for school sites in Southeast Plan area.
- P-31
Para. 1 Under Parkland: I acknowledge the comment, but disagree with the amount of park acreage and the designated location under the power lines.
- Para. 2 23.44 acres were added to Maidu.
- P-32 Under General = No. 3 ok.
Under Schools = I concur with No. 3.
Under Parks = I concur with No. 1, 2 and 3.
- P-40 I think the C C & R conditions on landscape maintenance obligations is good idea.
- P-41
P-42 I concur with conditions noted under B. Maintenance (private areas and public areas).

- P-44 Under D. Land Dedication = I agree with this condition.
- P-46 Under Pedestrian Path and Bikeways = Paths should be at least 10' wide when used by both pedestrians and bikers.
- P-55 Policy 4. This has merit.
- P-59 It is my understanding that Eureka School District is thinking of changing locations for schools sites in the Southeast Plan area.
- P-59 Under Policy 21 (c) = See comments I made for Page C-18, C-19.
- P-61 I agree with Policy 23.

SOUTHEAST ROSEVILLE SPECIFIC PLAN - TECHNICAL APPENDIX

BIOTIC SURVEY

- P-12-14 I agree with recommended mitigations.

FISCAL IMPACT ANALYSIS OF SOUTHEAST DEVELOPMENT

- P-1 I don't agree with the 80.2 acres of parkland.
Para. 1
- Para. 3 Where do they get \$462,200 for maintenance and operation?
- P-5 Where do they get 80.2 acres?
P-7 Where do they get \$462.2?
- P-14 Under Parks and Recreation = Where do they get \$462,200?
- P-16 Reference Table 5 = see my comments for Page M-5.

GENERAL CONCERNS TO BE RESOLVED:

The following are some locations of parks to effectively serve the respected areas:

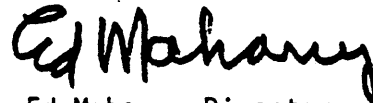
- (a) City acquire Parcel 24 = (former K-3 school) 5.53 acre site being abandoned by Eureka School District.
- (b) City consider positioning a park site adjacent to new location of K-3 5.53 acre site in Broken Spur area.
- (c) City consider positioning a park site adjacent to new K4-6 school site at Parcel 28.

- (d) Eureka School District needs to determine all above school sites in southeast area. The 7-8 grade site is being considered for the Northeast Plan area.

The total City needs on active sports, etc., is underway. The findings of the sport facilities will necessitate some meetings with youth groups, etc.

- (e) Received topo maps for area under power easement on September 11, 1987. Had no chance or limited chance to walk the power easement sites and study their feasibility for parks.
- (f) Received EIR on August 21, 1987. Comments due to Planning on September 14, 1987 =
- 6 working days - August
 - 8 working days - September
 - 14 working days to review EIR, plus had to do plans and projects for other parts of City.
- (g) Why don't I have a copy of the Planning Department Critical Path sheet on processing EIR for Southeast, Northwest and North Central Plans?
- (h) The Parks and Recreation Commission should have a chance to participate in the Parks and Recreation Department's staff recommendations on the review of the Southeast Plan. When can this happen in Planning Department's Critical Path approach process?
- (i) There are a lot of questions of using the power line easement.
1. What kind of conditions will the utility company impose on the kinds of active recreation activities to be done under the lines?
 2. Are there any plans for expansion? There was expansion planned for the northeast line.
 3. There will need to be controls in keeping children from climbing up the towers.
 4. Who's responsible if and when a utility line breaks and the electricity electrocutes someone in the park/power easement?
 5. Are there any vernal pools in the power line easements?

Respectfully,



Ed Mahany, Director
Parks and Recreation

To: Roseville Planning Dept
 c/o Daniel E Dameron, Associate Planner

FROM: Ed Mahany, Director Parks + Recreation

SUBJ: Review Comments on Notice of Propagation (NOP)
of Draft Environmental Impact Report on the
Revised Southeast Roseville Specific Plan

POP = 10,309 x 9000

5/4/87

GEN PLAN STANDARDS	NEIGHBORHOOD PARK	COMMUNITY PARK	REGIONAL PARK	TOTAL
	2.5 ACRES Per 1000 pop	1.5 ACRES per 1000 pop	5.0 acres per 1000 pop	9.0 ACRES per 1000 pop
POP S/E PLAN	10,309 pop x 2.5 AC 25.772 ACRES Need per 1000	10,309 pop x 1.5 AC 15.463 ACRES Needed per 1000	10,309 pop x 5.0 AC 51.545 ACRES Need Per 1000	10,309 pop x 9.0 AC 92.781 AC Need for 1000
1985	Dedicated to Maidu Reg Park - 9.04 AC Dedicated to Maidu Reg Park - 14.40 AC <u>TOTAL CREDIT - DEDICATED = 23.44</u> ★			
W NEEDED FOR S/E PLAN AREA	25.772 AC	15.463 AC	28.10 AC	69.33 AC
				EXHIBIT (A)

★ Page 12 Section 2, Dev of the Property B. Dedication of
 Land DEV AGREEMENT BY & BETWEEN THE CITY OF
 ROSEVILLE & THE SOUTH FORK DISTRICT



CITY OF ROSEVILLE

316 VERNON STREET • ROSEVILLE, CALIFORNIA 95678 • PHONE (916) 781-0200

ENVIRONMENTAL IMPACT REPORT

TO: City Clerk

FROM: Planning Department
316 Vernon Street
Roseville, CA 95678
(916) 781-0276

PROPOSED PROJECT: Draft Southeast
Roseville Specific Plan EIR

Date Sent: 7-14-87
Date of Reply:

62

- A. Please review the attached EIR as it relates to your Department, Agency, or District.
- B. Comments and recommendations should include whatever supportive information, facts, data, etc. are available.
- C. Please return comments to the Planning Department by:
September 14, 1987.

COMMENTS

Kept in Central File. 8/21/87

*H. Florence
City Clerk*

RECEIVED
AUG 24 1987

PLANNING DEPARTMENT

Your cooperation and contribution of data is essential in the EIR review process. If you have any questions on the above project, do not hesitate to contact the Planning Department. Thank you.

Daniel E. Dameron

Daniel E. Dameron
Associate Planner



CITY OF ROSEVILLE

316 VERNON STREET • ROSEVILLE, CALIFORNIA 95678 • PHONE (916) 781-0200

ENVIRONMENTAL IMPACT REPORT

TO: Fire Department

FROM: Planning Department
316 Vernon Street
Roseville, CA 95678
(916) 781-0276

PROPOSED PROJECT: Draft Southeast
Roseville Specific Plan EIR

Date Sent: 7-14-87
Date of Reply:

- A. Please review the attached EIR as it relates to your Department, Agency, or District.
- B. Comments and recommendations should include whatever supportive information, facts, data, etc. are available.
- C. Please return comments to the Planning Department by:
September 14, 1987.

COMMENTS

63

No Additional Comments

RECEIVED
AUG 27 1987
PLANNING DEPARTMENT

Your cooperation and contribution of data is essential in the EIR review process. If you have any questions on the above project, do not hesitate to contact the Planning Department. Thank you.

Daniel E. Dameron
Daniel E. Dameron
Associate Planner

August 31, 1987

City of Roseville Planning Department
316 Vernon Street, Roseville, Calif. 95678
Draft Inivromental Impact Report
Southeast Roseville Specific Plan
Dated August 14, 1987

64

Dear Sir:

I would like to make a comment on an item that is on the Southeast Roseville Specific Plan Map. It is the School Site No. (57) 10.71 Acres. According to the map that site is partially under and along the High Voltage Power Lines.

These Lines have the potential of exposing the children to the electromagnetic radiation emitted by the lines, with a potential of causing Leukemia and Cancer in the children. (American Health Magazine) July And August 1986.

Also in the (News and World Report) March 30, 1987, is a report about a Court order against the Houston Light & Power Co. They had built a Power line within 200 feet of the school. After the Parents brought suit, the Texas Court ordered HI&P to pay more than 25 million dollars to the local School District for (Callous Disregard) of their Childrens health. And for siting the High Power Lines close to the School and Playground. The Court also ordered the Utility to relocate the line at an additional cost that may exceed 40 million dollars. Coupled with similar cases still pending here in California and in Florida, the verdict Jolted the Utility Industry!

Under these circumstances the School Site should probably be moved to another location, since the Power Lines are already there.

Also what about the homes? Are any to be built under or too near the lines? I understand there is already a law on the books against that.

Sincerely

Maynard E. Bean

Maynard E. Bean
9350 Sierra College Blvd.
Roseville, Calif. 95661

Town Of Loomis

P. O. Box 1327
LOOMIS, CA 95650
(916) 652-9204

RECEIVED
SEP 01 1987

PLANNING DEPARTMENT

August 31, 1987

Mr. Daniel E. Dameron
Associate Planner
City of Roseville
City Hall 316 Vernon St.
Roseville, Ca. 95678

Re: Southeast Roseville Specific Plan 1987
Amendment - environmental impact report

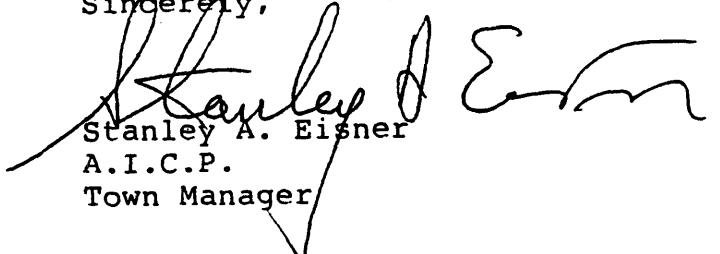
Dear Mr. Dameron:

65

The Town of Loomis staff has reviewed the draft E.I.R. referenced above and finds that the plan amendment will have no impact upon the Town.

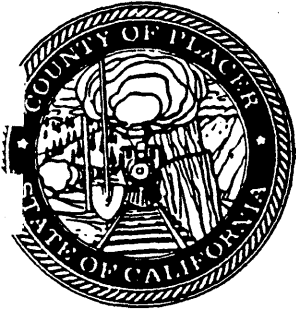
We appreciate having the opportunity to review and respond.

Sincerely,


Stanley A. Eisner
A.I.C.P.
Town Manager

SAE:sm

SEP 10 1987



PLACER COUNTY

PLANNING DEPARTMENT

HEALTH DEPARTMENT
AIR POLLUTION CONTROL DISTRICT

Air Pollution Control Officer
(916) 823-4443

MAILING ADDRESS: 11484 B AVENUE, AUBURN CA 95603
OFFICE ADDRESS: 11582 B AVENUE, AUBURN CA 95603

SERVING CITIES OF • AUBURN • COLFAX • LINCOLN • ROCKLIN • ROSEVILLE

September 8, 1987

City of Roseville
Planning Department
316 Vernon Street
Roseville, CA 95678

Re: Southeast Roseville Specific Plan 1987 Amendment - EIR
North Roseville Specific Plans - EIR

To Whom It May Concern:

The Placer County Air Pollution Control District (APCD) has the following comments on the draft EIR's:

- 66 1. Both EIR's adequately address the general air quality impacts associated with development of the Specific Plan areas.
- 67 2. It is important to note that air quality "hot spots" (due to mobile emissions) may occur upon development of individual parcels; therefore, a complete air quality analysis should be submitted on each major development for review and approval by the Placer County APCD.
- 68 3. All projects should demonstrate compliance with the California Ambient Air Quality Standards prior to approval by the decision makers.
- 69 4. Specific dust control measures should be made a part of individual parcel approval. No unpaved roads or parking lots should be allowed on any new developments.
- 70 5. All existing and new stationary sources shall be in compliance with the Placer County APCD Rules and Regulations.

If you have any questions, please contact me at (916) 823-4443.

Sincerely,

Noel A. Bonderson

Noel A. Bonderson
Air Pollution Control Officer

CITY OF ROSEVILLE
M E M O R A N D U M

September 3, 1987

To: Associate Planner Dameron
From: City Attorney
Subject: DEIR for Revised SERSP Specific Plan

Pursuant to your request dated July 14, 1987 (and not received until August 21, 1987, the following are our comments regarding the DEIR for the proposed SERSP 1987 amendment:

71 1. Page E-6. Is the reference to "Sutter County" in error? I assume it should read "Placer County".

72 2. Page E-6. How does the DEIR develop the information that there will be an increase in run-off as a result of the development? This appears to run counter to the conclusion of the Phil Williams report done for the City in approximately 1984. That report concluded that the run-off coefficients would change very little as a result of the soil types.

73 3. Page E-8. I do not believe that a "flood control district" has formally been formed yet. The various jurisdictions have taken preliminary steps to discuss this and coordinate grading ordinances and drainage plans.

74 4. Page I-18. I disagree with the DEIR's conclusion that it is not possible to determine the SERSP's share of affordable housing or whether it is consistent with the general plan housing element at this time. Since we know the number of units required by the housing element on a city-wide basis as well as the total number of units in the SERSP (both as it exists and as it is amended), long division will provide the number of affordable housing units (both low income and moderate income) required in the SERSPA, as amended. Additionally, once this is done, there should be some discussion as to whether the affordable housing will be required by phase, by some time period, or whether it will simply be left up to the developer. I recognize that the proposed affordable housing program being developed by the Planning Department may address some of these needs, but prefer strongly not to see any "blank check" devices utilized in a specific plan process.

September 3, 1987

5. Page J-29. I assume that the reference to "Watt Avenue" is in error and that you mean to refer to a different street located somewhere within the SERSPA.

In addition, somewhere in this same area, there should be a discussion of the SERSPA's obligation to help fund the City-wide East Roseville Parkway either through assessment district or other funding mechanisms.

Thank you for the opportunity to comment.


MICHAEL F. DEAN
City Attorney

MFD/lms

MEMORANDUM

Fines
RECEIVED
SEP 10 1987

PLANNING DEPARTMENT

TO: DAN DAMERON
ASSOCIATE PLANNER

FROM: DAVID DOCKHAM *David Dockham*
ASST. ELECTRIC UTILITY DIRECTOR

DATE: SEPTEMBER 9, 1987

RE: SOUTHEAST ROSEVILLE SPECIFIC PLAN
COMMENTS ON DRAFT E.I.R.

PAGE 22 (Proponent Draft)

75

Signalization is referenced for the major arterial streets. It should be noted electrical facilities will have to be extended to serve these signal lights and this service extension may be required long before development occurs in the area.

PAGE 35 (Proponent Draft)

The second and third paragraphs under "electricity" should be modified to read as follows:

76

Plan Area development will require construction of a 60kV to 12kV substation and a 60kV subtransmission line contained within a 25 foot wide powerline easement adjacent to the PG&E/SMUD transmission easement corridor. Parcel 26, near the intersection of East Roseville Parkway and Eureka Road, has been designated as the site for the 60kV to 12kV electrical substation and this property has been dedicated to the City pursuant to terms of the development agreement between the property owners and the City.

Electric subtransmission and distribution lines and equipment will generally be located within public rights-of-way or within public utility easements which will need to be acquired as development occurs. All distribution circuits will be installed underground. Electric equipment may be installed at grade. Electric facilities will be constructed in conjunction with development. Electric service extension charges will exist and be determined in accordance with City of Roseville electric policies and specifications.

3905 Old Auburn Rd
Roseville, Ca 95661
Sept 10, 1987

Steven H. Dillon
Planning Director
316 Vernon St.
Roseville, California

(77)

Dear Mr. Dillon I wish the native Oak trees to remain; they should not be cut. I have read the E.I.R. report and it sounds as if the trees will be protected. But will they when the contractor begins to build? I was very angry because the Oak trees on the South side of Old Auburn Road were cut down. This is across from my property and my way of life here in the rural area is being jeopardized.

Thank you
Donathy Merand Alexander

RECEIVED
SEP 14 1987

PLANNING DEPARTMENT

14 Sept 1987
2441 Baseline Rd.
Roseville, Calif 95678

Roseville Planning Dept.
Roseville Calif. 95678

RECEIVED
SEP 14 1987

Subject: Environmental PLANNING DEPARTMENT

Gentlemen:

(78) With regard to subject Report, wish to be put on record for the following:

1. Your letter was dated 14 August 1987.
2. Ganes letter was mailed 27 August 1987, and received 31 August 1987.
3. This did not give a 30-day review time.
4. Inasmuch as said report is at least 3" thick and only 10 working days to review this report, with at least 6 hours a day for review.

Most of the residents involved, ^{did} do not have 6 hours a day to review and make an intelligent reply. Did not have the time to spend several days in Library.

Would suggest in the future a full 30 day period be allowed for all interested parties to review, and request be notified of next public hearing on subject to enable me to make comments.

Sincerely
Eleanor Holladay

RECEIVED
SEP 14 1987

PLANNING DEPARTMENT

9605 Sierra College Blvd.
Roseville, Ca. 95661
Sept. 10, 1987

Daniel Dameron, Assoc. Planner
Roseville Planning Dept.
316 Vernon Street
Roseville Ca. 95678

Subject: Comments on Southeast Specific General Plan Revision EIR

Dear Mr. Dameron

I live on the 15 acre ranch that appears on the plan maps as the small notch within the 367 acre area east of Sierra College Blvd. The 367 acres shown on the maps was the family ranch which my stepfather purchased in 1906 from the Jenkins brothers.

My comments pertain primarily to this portion of the proposed planning revisions, and are based upon my many years experience as an environmental planner for the California Dept. of Transportation.

Throughout the text of the EIR are frequent statements and moral imperatives concerning the desirability of preserving as many of the oaks and vernal pools as possible. Many of the large oaks qualify as heritage oaks.

Of the 367 acres there are approximately 100 acres that comprise a high-quality oak forest. This is not surprising because no cutting of live trees was ever allowed on this portion of the ranch.

These woods are exceptionally beautiful. Over the decades many people have stopped at the ranch and asked permission to walk through these woods, especially in the spring time.

Contained within these oaks are the majority of the large mature oaks. There is no evidence of any fires occurring here for the last 300 years. Consequently there are plant species not generally seen such as dry land ferns and pitcher plant vines. These were apparently missed in the field survey. There is also an excellent vernal pool within the oak forest that was missed also.

In addition to these natural features, there is an excellent example of 19th century architecture in the form of a large and well preserved barn. The barn was built in 1906 by post and beam method with mortise and tenon and wooden peg joinery. There are also many forged items such as large hinges and other hardware.

This barn is the best preserved example of its type that I have seen and I know of no other like it in northern California. It is definitely worth saving as a heritage item.

If the proposed increased density is allowed in this 100 acre area, most if not all of these features will be destroyed. Four houses to the acre plus roads and utilities leaves no room for mature oak trees and vernal pools.

Thus the proposed density increase directly contradicts the

79

stated aim and purpose of the EIR concept, both in principle and in practice.

I strongly urge that the zoning for this 100 acre woodlot be left as it is and that steps be taken to preserve the oaks, vernal pool and the barn. The barn and associated woods would make a perfect horse oriented feature for the future homeowners and thus become an asset for the community at large. The city should carefully examine this issue to make sure that community values and opportunities are not being lost in the rush to develop.

If I can answer any questions for you or guide anyone interested through this unique area, please call me at 791-4690.

Sincerely,



Gordon Hutchings

p.s. If you wish to call me at work, I can be reached during the day at Caltrans, 445-6891



COUNTY OF PLACER

OFFICE OF THE PLANNING COMMISSION

11414 B AVENUE

TELEPHONE (916) 823-4721

AUBURN, CA 95603

THOMAS D. MCMAHAN, PLANNING DIRECTOR

September 14, 1987

RECEIVED
SEP 14 1987

PLANNING DEPARTMENT

Mr. Daniel E. Dameron
Associate Planner
City of Roseville
316 Vernon St.
Roseville, CA 95678

Subject: DRAFT ENVIRONMENTAL IMPACT REPORT (DEIR) ON THE REVISED
SOUTHEAST ROSEVILLE SPECIFIC PLAN

Dear Mr. Dameron:

80

The Placer County Planning Department has reviewed the subject Draft Environmental Impact Report. We are concerned with the creation of a new commercial center on the southeast corner of Sierra College Blvd. and Eureka Road. It is felt there is adequate commercial being planned at the intersection of Douglas Blvd. and Sierra College Blvd. to accommodate future need. Your consideration of a single family residential designation at the intersection would be suggested to be consistent with adjacent properties east of Sierra College Blvd.

Thank you for the opportunity to comment on this DEIR.

Sincerely,

THOMAS D. MCMAHAN
Planning Director

BY: David Mirtoni
Senior Planner

DM:wk

DOUGLAS M. FRALEIGH, Director
TERRY TICE, Deputy Director
W.C. WANDERER, JR., Deputy Director



COUNTY OF SACRAMENTO

DEPARTMENT OF PUBLIC WORKS

HIGHWAYS AND BRIDGES DIVISION . . . James C. Ray, Chief
ROOM 201 • 827 SEVENTH STREET
SACRAMENTO, CALIFORNIA 95814
(916) 440-5966/6291

September 14, 1987

Mr. Steve Dillon, Planning Director
City of Roseville
316 Vernon Street
Roseville, CA 95678

RE: DEIR - Southeast Roseville Specific Plan

Dear Steve:

81

Reference is made to my memo of April 30, 1987, regarding the NOP of the DEIR for the subject document. Your final DEIR does not address the concern that I raised in paragraph 2 of my memo regarding consideration of the Beltway Freeway.

Alignment Alternative 1-1 of SACOG's Beltway Connector Study (the preferred alignment from the Technical Advisory Committee) traverses the lands within the Southeast Roseville Specific Plan. This matter must be acknowledged in the DEIR and be brought to the attention of the City Council during the hearings on this plan.

Thank you for the opportunity to comment on this document.

Very truly yours,

JAMES C. RAY

A handwritten signature in cursive script that reads "R W Foust".

R. W. Foust
Senior Civil Engineer
Transportation Planning

RWF:llw

RECEIVED
SEP 14 1987

PLANNING DEPARTMENT

COUNTY OF SACRAMENTO

Inter-Department Correspondence

Date April 30, 1987

To : Anne De Stefano
Adminstrative Services

From : R. W. Foust *Randy*
Highways & Bridges Division

Subject : N.O.P. OF D.E.I.R. - SOUTHEAST ROSEVILLE SPECIFIC PLAN

I have reviewed the subject document and offer the following comments:

This project will result in significant traffic impacts to the major roadway network in the City of Roseville, the County of Placer, and the County of Sacramento. As such, a comprehensive traffic analysis report should be prepared to identify the resulting traffic impacts and necessary mitigation of those impacts.

In addition, the project as proposed in the subject document provides no consideration to the Beltway connector between I-80 and U.S. Highway 50. The preferred alignment alternative for the Beltway connector, as outlined in the Routes 65/148 Beltway Alternatives Study - Final Report, December, 1986, traverses the subject property. This should be fully acknowledged in the environmental document and the subsequent planning process.

If you have any questions, please call.

Thanks.

RWF:mm

September 9, 1987

Mr. Daniel Dameron
Associate Planner
Planning Department
316 Vernon Street
Roseville, CA 95678

RECEIVED
SEP 14 1987

PLANNING DEPARTMENT

Re: Draft Environmental Impact Report
for Southeast Roseville Specific Plan

Dear Mr. Dameron:

The area known to Granite Bay residents as Broken Spur and which abuts our community is beautiful rolling land currently zoned 2.3 acres residential.

82 The proposed land use modification is completely incompatible with the Granite Bay area which has a rural fabric and which we wish to preserve. The piece of property should never have been annexed to Roseville and to rezone it to higher density is putting Roseville in the unattractive position of being an unfriendly neighbor.

Our concerns are as follows:

83 1. Traffic in the area needs to be addressed. Sierra College is becoming more and more a route traveled by large trucks and the local fire departments are unequipped to handle hazardous/toxic type accidents which can occur. To keep widening roads doesn't solve problems, it creates them.

84 2. The air quality in the whole area is getting out of hand and the Sacramento area air quality is rated as the 7th worst in the country. A drive west on Douglas Boulevard is alarming as the layer of smog hanging over Roseville is becoming darker and darker.

85 3. The pattern of development calls for a lower density to act as a buffer zone between development on the west side of Sierra College and Treelake Village on the east.

86 4. Availability of water and the ability of San Juan Suburban Water Company to deliver it is a serious question. Many of San Juan's current water customers are very concerned about the management and their credibility at this time and the company's policies are currently under study by a citizen's group.

We hope the City of Roseville will consider their neighbors in the Granite Bay area and work with us to preserve the beautiful South Placer area and the existing good neighbor relationship.

Very truly yours,

Sandra H. Harris

Sandra H. Harris
5911 Reba Drive
Granite Bay, CA 95661

cc: Harry Crabb
Mel Hamel
Granite Bay Mac

Mike Lee
Fred Yeager

RONALD L. FEIST, Ed.D.
District Superintendent
District Office — 791-4939

EUREKA UNION SCHOOL DISTRICT

JANET A. SCHIMPF
Principal
Cavitt — 791-4152

5477 EUREKA ROAD
ROSEVILLE, CALIFORNIA 95661
PLACER COUNTY

RONALD G. WALKER
Principal
Eureka — 791-1115

DAVID R. FREEMAN
Principal
Greenhills — 791-4230

TRUSTEES

LYNDA L. LEITNER
President

WILLIAM R. MURCHISON
Clerk

GARRY G. GENZLINGER

JOHN TANNER

REVÉ TAYLOR

September 22, 1987

Dr. Mel Hamel, Chairperson
Public Review Commission
City of Roseville
316 Vernon Street
Roseville, California 95678

Dear Dr. Hamel and Members of the PRC:

Because of the State's new policy of not approving a school site within 400' of a major high voltage line and the redesign of the S.E.R.S.P., the Eureka School District had to look at new options for school sites. The 7-8 grade school cannot be located as identified on the S.E.R.S.P. maps. All the new demographic information available to the District was reviewed and updated by study area (please see Appendices A & B).

As pointed out in my September 14, 1987 letter to Mr. Dameron, with the change of the S.E.R.S.P., the new projection for Eureka students within the City limits is now 1783. By City and State standards this equates to 37.8 school site acres to accommodate the projected students. Because the Eureka District's philosophy is of joint school and park sites, the total 37.8 acres will probably not be needed, but three workable school sites must be reserved to accommodate the 1783 projected students.

Exhibit C attached shows workable locations for the three (K-3) and three (4-6) school sites to serve the Eureka students. Greenhills and Eureka are current schools. Three out of the four proposed school sites are established and approved by the State.

The K-3 site in the S.E.R.S.P. along Eureka Road (the old 7-8 site) is the new one that must be reserved via the E.I.R. process. The City Parks Department has expressed interest in making this a joint school/park site.

87

88

Public Review Commission
Page Two
September 22, 1987

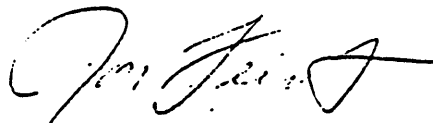
The major problem for Eureka is the location of a 7-8 grade site west of Sierra College Boulevard. As you can see by Exhibit D, a location north of Douglas Boulevard is the best available option to the Eureka District. This site will permit a good balance of students between the current and future 7-8 school. Plus it is fairly centrally located to the students the site would serve. Discussions are currently underway with the Developers, City Parks staff, and the Eureka District to establish this 7-8 school/park site in the N.E.R.S.P. There is a need for additional land to make this option work. So far, the N.E.R.S.P. Developers have not agreed to reserve more land.

Because of our problems with the power lines, the Developers of S.E.R.S.P. have proposed a 7-8 site adjacent to Broken Spur along Eureka Road. As you will see in Exhibit E, this option causes a major imbalance in enrollment, a problem that could be solved by splitting the Treelake Village Project (1093 homes), but this is not desirable. Also, the adjacent to Broken Spur location is very close to the new high school being proposed on Eureka Road. This site should serve only as a back-up plan.

I hope this letter and exhibits will be of some help in understanding the revised plans for Eureka School sites in the City of Roseville.

Sincerely,

EUREKA UNION SCHOOL DISTRICT



Dr. Ronald L. Feist
District Superintendent

RLF:lrt
Enclosures

cc: Board of Trustees
Mr. Daniel Dameron, Associate Planner
Mr. Ed Mahaney, Parks Director
✓ Mr. Robert Coker, Coker-Ewing
Mr. Sam Miller, AKT Development

EUREKA UNION ELEMENTARY SCHOOL DISTRICT
Projected Students by Study Area & Grade Levels

GRADE LEVELS

<u>STUDY AREA</u>	<u>K-3</u>	<u>4-6</u>	<u>7-8</u>
34	95	85	71
35	76	68	56
36	95	85	70
37	38	34	28
38	109	97	80
39	600	534	468
40	38	35	29
41	180	161	142
42	97	80	71
43	174	155	135
44	318	282	246
45	<u>38</u>	<u>34</u>	<u>29</u>
	1,858	1,650	1,425

TOTAL ALL LEVELS 4,933

SEP 25 1987

MEMORANDUM

Rec'd By _____
Filed By _____ App. _____

DATE: September 23, 1987

TO: Ed Mahany, Parks and Recreation Director

FROM: Robyn Kain-Spedden, Administrative Analyst II *RKS*

SUBJECT: Proposed Park Areas

You submitted a request for review of risk and liability concerns regarding park facilities under high voltage electric transmission lines.

An on-site review of the Eureka Road - East Roseville Parkway area show that two sets of electrical towers each with six tiers of electrical lines are contained in the easement area. Numerous trees are scattered throughout the easement area.

LIABILITY EXPOSURES

- 89 There appear to be several inherent liability exposures in locating recreation facilities under electrical transmission lines. First, the mere existence of the towers is an invitation to climb. Preventative measures would include fencing each tower with at least 8 foot high fencing and barbed wire strung along the top and signs prohibiting any climbing or contact.
- 90 Second, trees are located under and near the lines. Trees historically have been used as climbing devices. It would be imperative that trees either be removed or kept trimmed at a low level as a prevention against electrical contact.
- 91 Third, buildings are sometimes constructed as part of a recreation facility. Locating buildings near or under transmission lines can be dangerous when these buildings are serviced by tradespeople, that is, roofers, painters, etc. It is possible that the equipment used by these persons could accidentally contact an electrical line.
- 92 Fourth, recreation facilities sometimes require night time lighting. Light towers can be as high as 90 feet tall. The same considerations discussed in regard to buildings is relevant here. In addition, the frequency of activity around the lights would conceivably be greater, as the lights require routine maintenance in bulb replacements.
- 93 Fifth, most recreation areas are cleared of brush and debris and planted for grassy areas. The general public tends to associate open park areas as a place to fly a kite. Even though the towers are obviously present, many persons just do not think that their kite will get caught in the lines or the towers.

94 Sixth, as noted in the North Roseville Specific Plans EIR, (pages I-5 through I-7) consideration needs to be given to the affect of electrical and magnetic fields generated by transmission lines on human beings. No research exists which conclusively relates cancer or other diseases by exposure to electrical or magnetic fields. Yet, "...there has been evidence that these fields may affect the human body in ways not yet fully understood, and the potential for adverse effects has not been disproven." A recreation facility should not generate long term exposures, however, this element should be carefully considered.

95 In general, the towers and transmission lines can be classified as an "attractive nuisance". This term is applied to those situations or areas which persons are sometimes attracted to out of curiosity without being totally aware of the hazards they face. An attractive nuisance is a liability to an agency, especially if the property is either owned or under the direct control of the City.

LIABILITY CLAIMS AND SUITS

96 Some persons may think that the liability situations described above may be far-fetched. However, I contacted the City's liability adjustors and the Risk Management office for Sacramento Municipal Utility District (SMUD) and found the opposite to be true (except for the sixth consideration). SMUD has been served with claims for injuries resulting from kite flying and persons working on buildings and accidentally contacting lines with their equipment. Sometimes they are successful in defending against such claims but sometimes they are not.

97 The City's liability adjustor is familiar with lawsuits involving personal injury where multi-million dollar awards are ordered by juries to the injured party. Many times compassion is an overriding factor in jury awards instead of common sense prevailing in obvious situations where danger exists. This is where the "attractive nuisance" liability is raised as the public entity "knew or should have known" of the hazards associated with the situation.

INDEMNIFICATION

98 It is proposed that land under transmission lines be used for recreational facilities. In disucssing this issue, I became aware that some of these lines are in fact owned by SMUD. When speaking with SMUD, it was quite evident that they do not approve of electrical easements being used for recreational facilities. Should any entity want to use an easement for that purpose,

Ed Mahany
September 22, 1987
Page 3

authorization is needed from SMUD. If approved, the party requesting permission must indemnify SMUD against all losses and cost of defending a lawsuit.

Personal injuries which result from electrical contact with transmission lines are usually catastrophic and thus, very expensive. Medical costs alone tend to be enormous and the punitive award sought is usually a much higher dollar value. Accordingly, the amount of assets exposed to risk is very high. I am hesitant to recommend providing an indemnification agreement in this type of situation due to the liability exposures and the value of a loss should it occur.

CONCLUSION

99

I do not recommend recreation facilities of any kind under the electrical transmission lines as such facilities would invite the general public to exposures which could harm them. We cannot control the activities which occur in our recreational facilities at all times. Posting signs prohibiting kite flying will not be very effective unless someone is there to enforce the rules. Sadly enough, common sense is not a defense that a public entity can always rely upon.

I hope the above addresses your concerns. I appreciate you bringing this to my attention. If you have any questions, please contact me at extension 202.

RKS:tw

OFFICE OF PLANNING AND RESEARCH

1400 TENTH STREET
SACRAMENTO, CA 95814

October 1, 1987

RECEIVED
OCT 02 1987Dan Dameron
City of Roseville
316 Vernon Street
Roseville, CA 95678

PLANNING DEPARTMENT

Subject: Southeast Roseville Specific Plan 1987 Amendment
SCH# 87040605

Dear Mr. Dameron:

100

The State Clearinghouse submitted the above named draft Environmental Impact Report (EIR) to selected state agencies for review. The review period is closed and the comments of the individual agency(ies) is(are) enclosed. Also, on the enclosed Notice of Completion, the Clearinghouse has checked which agencies have commented. Please review the Notice of Completion to ensure that your comment package is complete. If the package is not in order, please notify the State Clearinghouse immediately. Your eight-digit State Clearinghouse number should be used so that we may reply promptly.

Please note that recent legislation requires that a responsible agency or other public agency shall only make substantive comments on a project which are within the area of the agency's expertise or which relate to activities which that agency must carry out or approve. (AB 2583, Ch. 1514, Stats. 1984.)

These comments are forwarded for your use in preparing your final EIR. If you need more information or clarification, we suggest you contact the commenting agency at your earliest convenience.

Please contact Keith Lee at 916/445-0613 if you have any questions regarding the environmental review process.

Sincerely,

A handwritten signature in black ink, appearing to read "David C. Nunenkamp".

David C. Nunenkamp
Chief
Office of Permit Assistance

cc: Resources Agency

Enclosures

SEE NOTE below
 SCH # 87040605

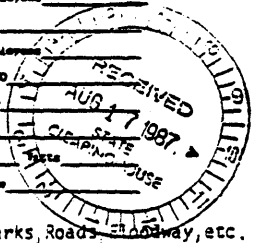
1. Project Title: Southeast Roseville Specific Plan 1987 Amendment
 2. Lead Agency: City of Roseville
 3. Contact Person: Dan Dameron
 3a. Street Address: 316 Vernon Street
 3b. City: Roseville
 3c. County: Placer
 3d. Zip: 95678
 3e. Phone: (916)781-0276
 PROJECT LOCATION 4. County: Placer
 4a. City/Community: City of Roseville
 4b. Assessor's Parcel No. _____
 4c. Section 7, 8, 9, 16 Twp. T.10N Range R.7E
 5a. Cross Street: Sunrise/Douglas/Eureka
 5b. For Part. Nearest Community: _____

6. Vistas 2 million: a. State Hwy # I-80 b. ALP parts _____ c. Railways _____ d. Expressways _____

7. DOCUMENT TYPE
 01. CEQA
 02. NEP 06. NCE
 03. Early Cons 07. NCC
 04. Reg Cons 08. NCD
 04. X Draft EIS
 Supplement/ Subsequent EIS (Prior SCH No.: _____)
 NEPA 09. NCE 11. Draft EIS
 10. FOUO 12. EA
 13. Joint Comment
 14. Final Comment
 15. Other

8. LOCAL ACTION TYPE
 01. General Plan Update
 02. New Element
 03. X General Plan Amendment
 04. Master Plan
 05. Amendment
 06. X Specific Plan
 07. Community Plan
 08. Redevelopment
 09. Annex
 10. Land Division (Subdivision, Parcel Map, Tract Map, etc.)
 11. Sea Port
 12. State Reg Plan
 13. Channel Ag Preserve
 14. Other

9. DEVELOPMENT TYPE
 01. X Residential: Units 3,798 Acres ± 700
 02. X Office: Sq. Ft. _____ Acres ± 106 Employees _____
 03. X Shopping/Commercial: Sq. Ft. _____ Acres ± 40 Employees _____
 04. Industrial: Sq. Ft. _____ Acres _____ Employees _____
 05. Water Facilities: MGD _____
 06. Transmission: Type _____
 07. Water: MGD _____
 08. Power: Type _____
 09. Waste Treatment: Type _____
 10. CCJ Related
 11. X Other: Schools Parks, Roads, Highway, etc. ± 158 acres



10. TOTAL ACRES: _____ 11. TOTAL JOB CREATED: _____

12. PROJECT ISSUE DISCUSSED IN DOCUMENT
 01. X Aesthetics/Visual 08. X Flooding/Drainage 15. Septic Systems 22. X Water Quality
 02. X Agricultural Land 09. X Geology/Seismic 16. X Sewer Capacity 23. X Water Supply
 03. X Air Quality 10. X Jobs/Housing Balance 17. Soil 24. X Wetland/Estuarine
 04. X Archaeological/Historic 11. Minerals 18. X Soil Erosion 25. X Wildlife
 05. Channel Zone 12. X Noise 19. X Solid Waste 26. X Visual
 06. X Damages 13. X Public Services 20. X Traffic/Impervious 27. X Growth Inducing
 07. Fire Hazards 14. X Schools 21. X Traffic/Circulation 28. Impassible Landuse
 29. X Cumulative Effects
 30. Other

13. FUNDING (approx) Federal \$ _____ State \$ _____ Total \$ _____

14. PRESENT LAND USE AND ZONING: Plan area includes already developed, under construction and undeveloped property. Zoning includes residential, business/professional, and commercial.

15. PROJECT DESCRIPTION: Project consists of addition of 367 acres to existing Plan area with subsequent redistribution of residential densities.

16. SIGNATURE OF LEAD AGENCY REPRESENTATIVE: Tomil E. Romero DATE: 8/13/87

CLEARINGHOUSE CONTACT: Rutler
 STATE REVIEW BEGAN: 8/17
 DEPT. REVIEW TO AGENCY: 9/24
 AGENCY REVIEW TO SCH: 9/29
 SCH COMPLIANCE: 0/1

W/C	N/C	W/C	N/C
	• RESOURCES		• REG. WQCB <u>5 (sects)</u>
	• FISH & GAME		• CALTRANS # <u>3</u>
	• DEPT WATER RESOURCES		• DEPT TRANS PLANNING
	• PARKS & REC / OHP		• AESTHETICS
	• AM HERIT COMM		• AIR QUAL CONTROL
	• CONS/DEV COMM		• HIGHWAY & COM DEV
	• HISTORICAL COMM		• LAND USE SERVICES
	• ENERGY COMM		• PLANNING AG
	• STATE LANDS COMM		• PUBLIC WORKS COMM
	• AIR RESOURCES BD		• PUBLIC WORKS
	• SOLID WASTE BD		• REGULATIONS
	• RES CONT BD:		• SERVICES
	• QUAL (4th Fl)		• SCHOOLS
	• TRS (3rd Fl)		• STATE HIGHWAY DIVISION MTN CONS
	• TRN GRANTS (2d Fl)		• STATE HIGHWAY DIVISION RIVER BD
			• STATE HIGHWAY DIVISION PLNG AGCY
			• STATE HIGHWAY DIVISION CONSERVANCY
			• STATE HIGHWAY DIVISION PR
			• STATE HIGHWAY DIVISION OPR

87040605

Memorandum

To : State Clearinghouse
Office of Planning & Research
Attention Keith Lee
1400 10th Street
Sacramento, CA 95814

Date : September 23, 1987
File : 03-Pla-80
Southeast Roseville
Specific Plan
SCH 87040605

From : DEPARTMENT OF TRANSPORTATION - Telephone ATSS 457-4498
District 3, P. O. Box 911, Marysville, CA 95901

Subject : Review Draft for Southeast Roseville Specific Plan

Caltrans, District 3, has reviewed the draft EIR for the Southeast Roseville Specific Plan, a 1,004-acre area south of Douglas Boulevard on both sides of Sierra College Boulevard.

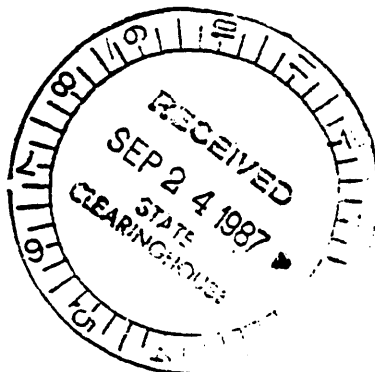
101 We note that the average daily traffic volumes shown in Figure J5 are 1984 data. These figures should be updated to 1985 or 1986 data.

102 The District Route Concept Report for Interstate 80 identifies the addition of 6-8 lanes on the segment through Roseville by 2005. High-occupancy vehicle (HOV) lanes should be considered at the time of the widening. Soundwalls will have to be considered concurrent with lane additions. Ramp metering should also be considered within the next 20 years.

103 The document lists mitigation measures required for full Citywide buildout which include widening Interstate 80 to 10 lanes. It is not Caltrans' policy to construct 10-lane freeways. We recommend strategies be considered which would decrease corridor traffic and spread peak period usage. Reliever routes such as Route 102 (Metro Bypass) would provide an alternative to freeway widening. The Sacramento Beltway route would provide a north-south reliever route for Interstate 80, Sunrise and Sierra College Boulevards. The final EIR should identify these routes.

If there are any questions on these comments, please contact Mrs. Jeannie Baker, telephone (916) 741-4498.

Brian J. Smith 1/26
Brian J. Smith
Chief, Environmental Branch



Memorandum

To : 1. Gordon F. Snow, Projects Coordinator
Resources Agency
2. Daniel E. Dameron, Associate Planner
City of Roseville Planning Department
316 Vernon Street
Roseville, CA 95678

Date : September 22, 1987

From : Department of Fish and Game

Subject : Draft Environmental Impact Report (DEIR) for the Southeast
Roseville Specific Plan (Plan), Placer County (SCH 87040605)

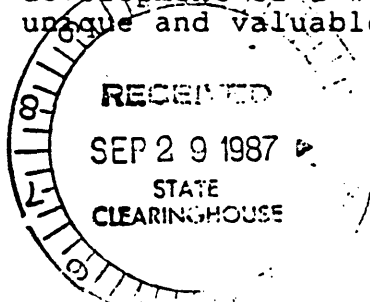
The Department of Fish and Game (Department) has reviewed the DEIR for the Plan. The Plan is intended to provide planning direction for approximately 1,000 acres located in the southeast portion of the City of Roseville, Placer County. The initial Plan, incorporating about 637 acres was approved by the Roseville City Council in February 1985.

Significant resources of the Plan area include the wetland habitats consisting of cottonwood, willows, box elder, etc., that are associated with both perennial and intermittent streams and the vernal pool wetlands located within the grassland areas.

104 The Plan does incorporate, consistent with City standards, protection of the 100-year flood zone for major streams. Many of the remaining stream environments in the project area that support wetland habitat are provided no protection.

105 The Plan provides no protection measures for the many vernal pools within the Plan area. The DEIR does provide some clear direction for mitigation but these measures are not incorporated in the Plan. The Department finds this Plan inadequate in its treatment of streamside and vernal pool wetland resources, and we therefore consider the DEIR to be inconsistent with the requirements of the California Environmental Quality Act (CEQA) regarding adequacy of mitigation for project impacts.


We believe that many of the measures identified in the DEIR and Technical Appendix clearly address our specific concerns regarding vernal pools. We recommend that the City, in conjunction with Placer County, consider developing a positive, enforceable program to preserve vernal pools. The areas identified in the DEIR provide a starting point for vernal pool protection and management, so as to bring the DEIR into conformance with the requirements of CEQA. We would welcome the opportunity to participate in the development of a workable program to allow protection of this unique and valuable resource.



106

We also recommend that protection of all streamside wetland habitat environments be pursued through the incorporation of 50-foot setback buffers along intermittent streams and 100-foot setback buffers along perennial streams. These areas must be designated as permanent open space and delineated as such on all future project development maps.

Thank you for the opportunity to review this project. If the Department can be of further assistance, please contact James D. Messersmith, Regional Manager, Region 2, 1701 Nimbus Road, Suite A, Rancho Cordova, CA 95670, telephone (916) 355-0922.


for Pete Bontadelli
Acting Director

V. APPENDIX





Fehr & Peers Associates, Inc.
Transportation Consultants

3685 Mt Diablo Blvd
Suite 200
Lafayette, CA 94549
415 284-3200

September 24, 1987

Mr. Bob Languell
RC Fuller Associates
5908 Fair Oaks Blvd.
Carmichael, CA 95608

Subject: Response to comments on Traffic and
Transportation - Southeast Roseville
Specific Plan EIR.

Dear Bob:

This letter presents our responses to the comments on traffic and transportation made at the September 22 PRC hearing on the Southeast Roseville Specific Plan EIR.

1. Absorption Rate for New Development - (Request from Mr. Bader)

The attached table presents data on historic and projected residential absorption rates in Roseville.

The McDonald forecasts were prepared in May 1986 by Angus McDonald Associates and the City for use in the City's Capital Improvements Plan and in the Specific Plan EIRs. This is the data used (with minor refinements) in the Southeast Plan EIR for the plan itself and for cumulative development. The historic McDonald Associates data was prepared for and used in the 1982 Roseville Circulation Study. This data indicates that residential absorption between the present and the year 2005 will be about 900 units per year, or more than ten times the absorption rate experienced over the past 5 or 6 years.

For comparison, SACOG forecasts are also presented. These show an absorption rate of about 1100 units per year. However, because SACOG estimates a higher historic absorption rate than McDonald, the SACOG future rate is about 5 times as high as the SACOG historic rate.

The 2005 population forecasts from both sources agree fairly well; each estimates about 73,000 to 78,000 total population by 2005. However, SACOG projects that the number of people per dwelling unit will decline in the future, while McDonald estimates that the ratio will remain constant at 2.6. Therefore, SACOG estimates a higher dwelling unit growth.

CITY OF ROSEVILLE
RESIDENTIAL ABSORPTION RATES

<u>Historic Absorption</u>	<u>McDonald Associates¹</u>	<u>SACOG</u>
<u>Dwelling Units</u>		
1979	--	9460
1980	10,500	--
1984	--	10,610
1986	11,000	--
<u>Growth (1979/80 to 1984/86)</u>		
Total	500	1150
Per Year	83	230
 <u>Projected Absorption</u>		
<u>Dwelling Units</u>		
1984	--	10,610
1986	11,000	--
2005	28,045 ²	33,200 ³
Buildout	34,690	--
<u>Growth (1984/86 to 1005)</u>		
Total	17,045	22,590
Per Year	897	1076
 Projected/Historic Absorption	 10.8	 4.7

¹ Angus McDonald Associates, May 1986. (Basis for EIRs on Northeast, Southeast, North Central and Northwest Specific Plans, and 1986/1987 Roseville Capital Improvements Plan.)

² Per McDonald Associates forecast, projected 2005 population is 73,320, with 2.6 people per dwelling unit. Projected 2005 population from individual 1986/1987 Roseville Specific Plans is 77,760, with 2.6 people per D.U. (29,900 dwelling units).

³ Projected 2005 population 78,580, with 2.36 people per dwelling unit.

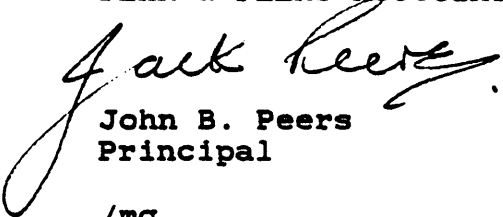
2. Clarification of General Plan Policy on Service Level C

Our suggested clarification of Policy 1 of the Circulation Element of the City's General Plan is as follows:

Policy 1: For the City of Roseville, the Level of Service "C" shall be used in determining the capacity of the freeway, arterial and collector street system. This shall mean that the average travel condition in all of the City's principal travel corridors (as defined by Screenlines A through O in the 1982 Roseville Circulation Study) shall be at the middle of the range defined as Level of Service C, or better. Individual street segments may operate at the low end of Level C as long as alternative routes are available within the corridor which operate at better than mid-C. This guarantees that everyone travelling within the corridor will have an opportunity to travel under mid-C conditions or better if they choose to deviate slightly from their ordinary travel route. It also means that individual intersections may be projected to operate at Level D or E, as long as either: 1) the intersection is predicted to operate "under capacity" using long-range planning assumptions (as defined in the Transportation Research Board, 1985 Highway Capacity Manual, page 9-21), and can, therefore, be expected to operate at Level C when the volumes actually materialize and final operational improvements are installed, or 2) there are alternate routes available in the corridor along which all intersections operate at Level C or better.

Sincerely,

FEHR & PEERS ASSOCIATES, INC.


John B. Peers
Principal

/mg

87-115

cc: Mr. Fred Barnett (City of Roseville)
Mr. Steve Dillon (City of Roseville)
Mr. W. Cramer (Coker/Ewing)

September 25, 1987
87-0018



MORTON & PITALO, INC.
Civil Engineering, Planning, Surveying
1430 Alhambra Blvd., Suite 200
Sacramento, Ca. 95816
916/454-9600

R.C. Fuller Associates
5908 Fair Oaks Boulevard
Carmichael, CA 95608

SUBJECT: SOUTHEAST ROSEVILLE SPECIFIC PLAN - 1987 AMENDMENT

Gentlemen:

This letter is in response to the comments raised at the Project Review Commission hearing for the EIR. It is our understanding that a question was raised regarding increased runoff as a result of this proposed project and that a discussion centered around the increase in water surface elevation at the confluence of Linda Creek with Cirby Creek, which is approximately 0.9 foot.

The "Nolte study," which is the most rigorous study prepared to date for the City of Roseville, does not contain specific data for the increased runoff from this particular project. The study does contain data from which one can extrapolate information which may be accurate and also may be highly erroneous. The problem basically is that discussions typically center around increases in the "peak" runoff. Peak runoff is something that can be affected by increases in impervious areas (i.e., when the runoff can no longer infiltrate into the soil) and the time it takes for the runoff (from time of concentration) from several different locations to travel to the area being studied. Thus, one has to be very careful in extracting conclusions regarding "peak" runoff since its impact at one location may be far different than from another location downstream.

An example would be to review the Nolte study and the material quoted in the environmental impact report. On Linda Creek, just upstream of its confluence with Cirby Creek, the Nolte study indicates that the water surface elevation will be raised 0.9 foot for the 1% storm, from the existing condition to the ultimate buildout of the entire upstream basin. In addition, the report indicates the Q_{100} flow rate for the existing condition is 2750 cfs, while the Q_{100} future condition is 3990 cfs. One could argue that the increased runoff at this point is 1240 cfs, or that the runoff has increased 45% over the runoff exhibited for the existing condition.

However, if you extend this reasoning downstream and examine Dry Creek, just downstream of its confluence with Cirby Creek, the flow rate under the existing condition is reported to be 15,800 cfs, while the Q_{100} for the future condition is 17,250 cfs. The difference for this particular example is an increase in peak flow, in Dry Creek at this location, of 1450 cfs over existing conditions, or a net increase of only 8.4%, while the drainage basin draining into this location is increased from 16.5 square miles to 77.33 square miles. Obviously, if each increase in runoff was additive, at every location, there would be serious repercussions.

However, the peak flows are time dependent - as you travel downstream, you combine with flows from other areas which may travel to that point faster, or slower, than the flow from your particular basin. If the basins are of similar size, oftentimes the individual peaks, at a downstream location, are similar and therefore you seem to get a higher total increase in peak runoff. Whereas as you move further downstream, the larger basins that you connect with often have much slower travel times to a particular point and therefore the peak flow from the subbasin can reach the larger tributaries and travel through before the initial, larger upstream peak hits the area in question. It is for this reason that it has been stated in the past, by the City of Roseville, that on some basins, particularly the Linda Creek basin, it is better to accelerate the flow so that it will travel through problem areas and it will "beat" the peak flow from the larger drainage basins of Dry Creek.

It is our understanding that the EIR for this project is charged with assessing the impact of the 1987 amendment to the Southeast Roseville Specific Plan. If one looks at this interpretation strictly and considers the density changes from the original specific plan on the west side of Sierra College Boulevard, to the new densities on the west side of Sierra College Boulevard and the east side of Sierra College Boulevard, one finds that several parcels zoned for multi-family development, under the original specific plan, have now been downzoned to single-family type developments.

The proposed densities for the specific plan on the east side of Sierra College Boulevard have increased from the existing zoning of two acres per unit to a residential zoning of between 3.1 and 3.8 units to the acre. Thus, what we would see in the Linda Creek drainage basin is a possible decrease in runoff from the existing plan (on the west side of Sierra College Boulevard) and an increased runoff for the specific plan area on the east side of Sierra College Boulevard.

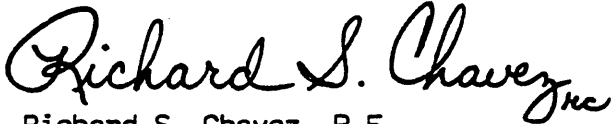
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R.C. Fuller Associates
September 25, 1987
Page 3

As mitigation for this proposed project, each individual project within the Southeast Roseville Specific Plan must prepare a drainage study, as required by the City of Roseville Public Works Department, to address each project's impact on storm drainage in the City. As a result of this study, measures could be implemented to speed up, or slow down, the flow depending upon the conditions for the particular watershed under study and the existing City policy for each watershed in question.

Very truly yours,

MORTON & PITALO, INC.

A handwritten signature in cursive script that reads "Richard S. Chavez". The signature is written in dark ink and includes a small "rc" at the end.

Richard S. Chavez, P.E.

RSC/rc

**Southeast Roseville Specific Plan
1987 Amendment Supplemental Information
September 25, 1987**

Comments identified in the Roseville Planning Department Staff Report dated September 22, 1987.

Comment: The DEIR needs to identify mitigation for areas of inconsistency between the proposed Specific Plan and the existing General Plan.

Response: The Specific Plan is suggested to be "Potentially Inconsistent" with four, and "Inconsistent" with two policies of the General Plan, as follows:

- o Policy 17 of the Land Use Element establishes several criteria concerning the location of commercial sites within the City. One of these criteria specifies that commercial sites within predominantly residential areas should be a minimum of ten acres in size, and must contain a retail food market. The proposed commercial parcel at the intersection of Sierra College Boulevard and Eureka Road is 6.6 acres in size, and future commercial tenants have not been identified. The determination as to whether this policy is inconsistent or consistent depends upon the definition of "predominantly residential", and the requirement that a retail food market be required. As proposed, the commercial site is located at a major intersection and is adjacent to a 16 acre wholesale/retail nursery. The property on the south side of the commercial site is not within the Specific Plan area, and development has not been proposed. Immediately across Sierra College Boulevard from the site, a park is proposed within the transmission line corridor. Otherwise, proposed surrounding uses are residential in nature. A finding by the City may be required to determine that the area is not predominantly residential, or an amendment to the General Plan may be appropriate. Another possibility is to require that the commercial site be increased to 10 acres in size.

- o Policy 21 of the Land Use Element identifies guidelines for the location of school sites. The Specific Plan has been determined to be "Potentially Inconsistent" because the sites are located on Eureka Road, which could be considered an arterial roadway. City General Plan policies specify that "Schools should be located in an area that is safe and easily accessible away from major street arterials". The Eureka Union School District has indicated that the proposed sites are at desirable locations. In order to determine that the school locations are consistent with City General Plan policy, a finding could be made that Eureka Road is not a major street arterial, or the General Plan could be amended to allow the acceptability of school sites to be ultimately determined by the school districts. There was concern at the time of writing

of the DEIR, that one proposed site was too near the existing power line corridor. The current proposal by the Eureka District is to redesignate this site from a 7-8 facility to an elementary school, which would allow the District to situate the smaller facility farther from the lines and in accordance with State guidelines. The consistency of the school site issue was further in question because it was not clear that an adequate number of school sites were proposed. Subsequent correspondence with the School District has indicated that adequate sites have been identified. The details of this situation are discussed in the appended letter from Dr. Ronald Feist, Superintendent of the Eureka Union School District, dated September 22, 1987. Finally, as originally proposed, the school sites were not co-located with park facilities as specified by the General Plan. Since writing of the DEIR, the Parks Department has expressed interest in developing a joint school/park site at the proposed school site on Eureka Road within the Southeast Roseville Specific Plan area.

- o The Specific Plan was determined to be potentially inconsistent with Policy 1 of the Circulation Element which specifies that roadways and intersections within the City must maintain a Level Of Service (LOS) of C. The ability to maintain a LOS C at the intersection of Sunrise and Douglas Boulevards is questionable. This less than LOS C situation is predicted to exist with or without implementation of the Southeast Specific Plan. Nonetheless, the continued operation of this intersection below LOS C represents an existing, and likely continuing, inconsistency with the General Plan policy. According to the consulting traffic engineer, specific intersection improvements can be made which will bring the LOS back to C as traffic increases and the LOS declines. However, it is questionable if the C level can be maintained at ultimate traffic volumes. A finding by the City may be required to acknowledge this potential inconsistency.
- o Policy 5 of the Open Space and Conservation element specifies that lands in agricultural production should not be developed prior to less agriculturally valuable areas. None of the Plan area is currently in agricultural production, and therefore, no inconsistency with the General Plan technically exists. However, a portion of the area is under Williamson Act contract, and as such, is categorized as having potential agricultural value. The "potentially inconsistent" recommendation was made in response to the concern that Williamson Act lands, regardless of their current use, might be considered agriculturally viable by the City. A finding by the City is suggested to clarify this situation.
- o Policy 11 of the Open Space and Conservation Element specifies that adequate park and recreation facilities be provided for all existing and future neighborhoods. As calculated by the Park and Recreation Department, approximately 93 acres of parkland will be required to serve the Southeast Roseville Specific Plan area. The developer dedicated approximately 24



acres to Maidu Park as a function of the adopted Specific Plan, leaving a currently required balance of 69 acres. As proposed, the Amended Southeast Roseville Specific Plan designates 57 acres as parkland, leaving a deficit of approximately 12 acres. However, area designated as Open space and floodway, bicycle pathways, landscaped corridors, or the racquet club are not included in this total. These areas account for 100+ additional acres which will be informally available for recreational use. A second aspect of the parkland issue concerns the appropriateness of providing additional City-wide park land in the vicinity. Based on the City standard of 4 acres of City-wide park per 1000 residents, Maidu Park is capable of serving the recreational needs of approximately 30,000 people. As discussed in the DEIR, this capacity should more than fulfill the need for City-wide recreational facilities in the southeastern portion of the City, especially since additional City-wide facilities are being formulated in the north Roseville Specific Plan areas. This does not imply that the developer should not be responsible for City-wide facilities, simply that the need for such facilities has been fulfilled in the southeast portion of the City. A final point of contention concerns the adequacy of the proposed parkland. The majority of parkland proposed in the Southeast Roseville Specific Plan is located within the powerline corridor. As discussed in the DEIR, this area is not suitable for all activities which might be desired by the Park Department, namely construction of permanent structures or pursuit of activities which require overhead open space, such as baseball or kite flying. Any alternative proposals for refining the parkland requirements proposed in the Specific Plan are appropriate to an overall evaluation of the Plan in its regional context. However, it is clear that a City determination is required as to the utility of power line easement land in meeting park requirements and needs.

- o Policy 13 of the Open Space and Conservation Element specifies that co-located park and school facilities should be developed. Since it may be desirable, but not mandatory, that every new school site in the City be located in conjunction with a park, the Specific Plan can be consistent with the General Plan even though school sites are proposed without adjacent park facilities. The inconsistent recommendation regarding this policy in the DEIR is in error. Nonetheless, the Plan provides for a joint use facility at the elementary school located adjacent to Maidu Park. Further, as discussed in the response to Policy 21 of the Land Use Element, since preparation of the DEIR, the Park Department has expressed interest in development of a park co-located with the proposed school site on Eureka Road.

Comment: The geologic survey of the property is incomplete. A Geotechnical survey should be completed for the entire Specific Plan area, including the area within the already adopted Southeast Specific Plan area.



Response: At the time of approval of the already adopted Specific Plan, it was agreed that the appropriate surveys would be conducted on a project by project basis as individual portions of the Plan area were developed. This agreement has been adhered to by the developer and surveys have been completed for all areas where development has occurred. A complete geotechnical survey of the remaining portion of the Plan area has been completed, and the report is anticipated to be available within a few weeks.

Comment: The DEIR does not quantify the increase in runoff which will result with development of the Plan area. The DEIR should include a mitigation measure which requires preparation of a comprehensive drainage study for each watershed within the Plan area prior to development within the subject shed.

Response: The increase in runoff which will result from implementation of the proposed Specific Plan instead of the adopted land use designations will be negligible. However, as discussed in the DEIR, runoff will increase as the area changes from an undeveloped rural setting to an urban environment, regardless of which Specific Plan is ultimately developed. The magnitude of this increase was estimated as a part of the Supplemental Flood Study prepared for the City by Nolte and Associates. According to the Nolte study, the magnitude of increased runoff resulting from development of the Linda Creek Watershed will result in an approximate 0.9 foot increase in the water surface elevation on Linda Creek as measured just upstream of the confluence with Cirby Creek. Since the Specific Plan area represents approximately ten percent of the Linda Creek watershed, the contribution of the Plan area to increased flows in Linda Creek is assumed to represent approximately ten percent of the 0.9 foot increase, or a one-tenth of one foot increase in the water elevation at this location during a 100 year storm. This is based on the most accurate study data prepared for the watershed. Additional information has been prepared by the project engineer and is being transmitted under a separate cover.

A drainage plan has been prepared for the Plan area, and is described in the Specific Plan document. However, as requested, the following mitigation measure should be included in the DEIR:

- o A comprehensive drainage study should be prepared for each watershed in the Plan area prior to development within the subject shed.

Comment: The DEIR should identify additional measures to reduce the impact of development of the Specific Plan area on the oak woodland area located east of Sierra College Road.

Response: As discussed in the DEIR, lower density development generally results in impacts of proportionally less magnitude. As a result of the proposed density transfer, the impact of implementation of the proposed Specific Plan on the oak woodland



of concern will be greater than that which would occur with development under existing land use designations. Conversely, impacts to areas west of Sierra College Boulevard where the density is being lessened will be of a lesser magnitude. The opportunity always exists to reduce impacts through development of less intense land uses. Similarly, implementation of other types of housing, such as cluster housing or implementation of the planned unit development (PUD) concept can be used to reduce impacts. Substantial preservation can be achieved through designation of park or open space designations to areas of greatest sensitivity. Because of the indirect impacts associated with the unavoidable change in character of the vicinity, the impact on the oak woodland cannot be mitigated to less than significant levels.

Comment: The DEIR should include mitigation measures to reduce the exposure of future residents to electromagnetic fields produce by the powerlines which transect the Plan area.

Response: As stated in the DEIR, there is no conclusive evidence that the electric transmission corridor represents a health hazard to the community, and therefore no basis for the determination of or the need for mitigation measures. The most obvious mitigation is the location of potentially sensitive human activity at a given distance from the lines. This is partially accomplished by the easements as now constituted, as lines are not located at the edge of the easement. How much additional distance would be required, if any, for the juxtaposition of a given powerline or lines to a given land use or uses is problematical, and cannot be determined on any rational basis yet known. The California Department of Education has, in given instances, notably within the Plan area, recommended a separation of 400 feet from the edge of the easement to classrooms occupied for several hours per day by students. Based upon the current evidence, this is a very conservative recommendation. Application of such a policy to all areas adjacent to power line easements would certainly have serious economic consequences not so severely felt in the isolated instance of schools. It therefore appears that substantial additional information would need to be generated before any specific recommendations could be made.

Comment: The DEIR should calculate the affordable housing obligation of the Specific Plan.

Response: Mr. John Sprague, the City staff person responsible for preparation of the Affordable Housing Program, has been contacted concerning this comment, and has indicated that, the information in the DEIR is as correct as possible at this time. The currently adopted affordable housing policies are not appropriate for application on a Specific Plan basis, and cannot be used to determine the housing obligations for the respective Specific Plan areas. The new program currently under development



will specifically address the affordable housing needs for the individual Specific Plan areas, however, this information is not anticipated to be available for quite some time.

Comment: The DEIR should describe additional easements and facilities which will be required to serve the Plan area. The DEIR should also include a mitigation measure which specifies that a revised development agreement should be executed to facilitate utility development.

Response: A description of the needed electrical easements and facilities is provided in the appended letter from David Dockman, Assistant Electric Utility Director. As requested, the following mitigation measure should be included in the DEIR:

- o The property owners within the Specific Plan area should execute a revised development agreement with the infrastructure improvements, easements, land dedications, and other contributions to be made in return for land use.

Comment: The DEIR should indicate that the proposed amount of acreage for the school sites is inadequate, and that this represents a significant impact.

Response: As described in the appended letter from Dr. Ronald L. Feist, District Superintendent, Eureka Union School District, dated September 22, 1987, two proposals have been identified, either of which could provide adequate school sites in the vicinity. Accordingly, an additional site is not required within the Specific Plan.

Comment: The DEIR inaccurately indicates that the lack of City-wide park acreage proposed by the Plan is less than significant because the Plan area is next to Maidu Park.

Response: This is an accurate statement. As discussed in the DEIR, Maidu Park is of adequate size to serve more than 30,000 people. It would be inefficient to develop additional City-wide park facilities in the vicinity, particularly since it is the goal of the City to develop additional City-wide parks in the North Roseville Specific Plan areas. Future residents of the southeastern area of the City will have adequate City-wide facilities without the development of additional City-wide facilities in this area. The DEIR does not state that the developer should be relieved of the park obligation, but simply that the anticipated impact of additional residents in the southeastern portion of the City would be mitigated by the existing facilities in this vicinity.

Comment: The park discussion presented in the DEIR appears to be presented in a slanted manner which tends to promote the



Proponents view that the proposed park acreage is sufficient.

Response: The DEIR clearly indicates in the Summary section and the Park and Recreation Section that impacts to Parks and Recreation must be considered significant because the parkland acreage proposed is not of the appropriate type or adequate amount to meet the requirements of the City. On page K-25, the DEIR indicates that the area within the powerline easements are of questionable value and probably not capable of fulfilling the requirements of a community park. The final paragraph on page K-25 indicates that mitigation for the shortcomings could be achieved through in-lieu fees or other arrangements which would provide for development of additional facilities. Such arrangements could require dedication of additional park land, development of specific facilities, or other measures which would fulfill the City obligation. It is the unbiased and objective evaluation of the DEIR preparer that the "other" recreation amenities, including the landscaped corridors, bicycle pathways, the 12 acre racquet club, and 76 acres of open space, will supplement the formally designated public parkland and are deserving of discussion. The DEIR does not propose these facilities in-lieu of additional parkland, but clearly identifies these as amenities in addition to the proposed public park facilities. The restrictions on use of lands within powerline easements are established by the respective power utilities. Specific regulations would have to be obtained from the appropriate utility companies. Generally, restrictions prohibit the construction of permanent structures or facilities. However, improvements can include extensive facilities including turf fields, trails, playground equipment, picnic areas, small lakes, and structures without foundations. For example, an equestrian center with a show ring, a park situated around a man-made lake, a physical fitness trail, and a community orchard are all proposed within the powerline easement in the Treelake Village development located east of the Plan area. Restrictions on the use of these areas generally require that vegetation be kept clear of the transmission lines, and plantings which could interfere with the power lines are prohibited. Obvious activities, such as kite flying, which could pose danger to participants are not permitted. Depending on the height of the lines, participants are often reluctant to participate in such sports as baseball. Similarly, depending upon conditions, some utilities would likely discourage such activities in order to avoid damage to the transmission facilities. The desirability and liability associated with use of such areas are beyond the scope of this DEIR.

Comment: According to the Park Department, Table M-3 contains an error relating to the Park Tax Fee. The amount should be \$882,058 instead of the \$1,382,700.

Response: The purpose of the Table is to identify the one-time fiscal benefits which would be derived from the City as a direct result of development fees assessed with development of the Plan area. The discrepancy between the \$1,382,700 identified in the



DEIR and the \$882,058 identified in the comment, is the approximate \$432,000 credit granted for completion of Johnson Ranch Road. Since the road has been completed at developer's expense, the City has in fact already received the \$432,000 in question. Therefore, the comment would be correct to state that approximately \$882,000 is still forthcoming in the form of Park Tax fees. However, the total benefit derived from Park Tax Fees will be the \$1,382,700.

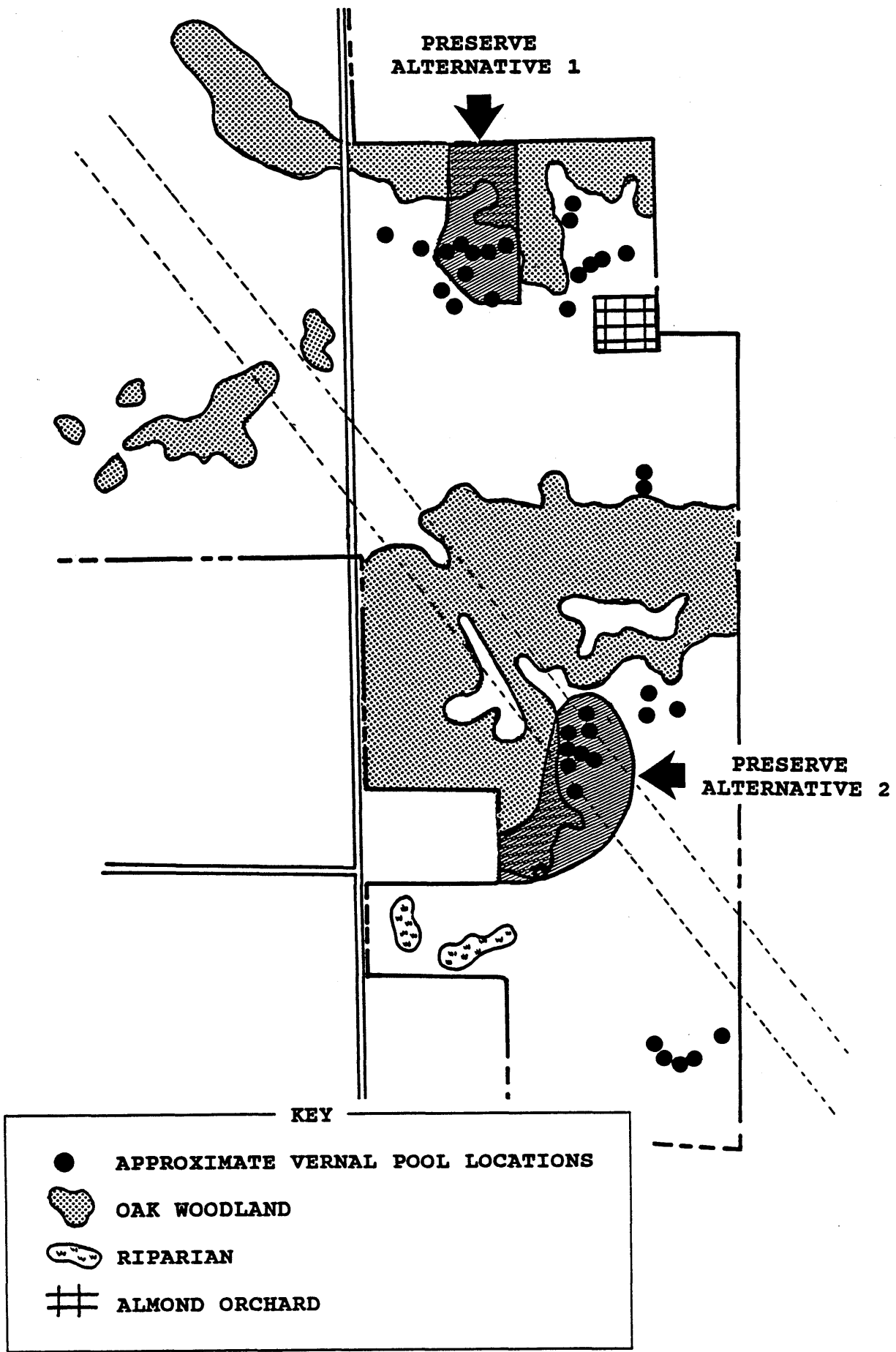
Comment: The DEIR does not specify whether growth inducing impacts will be significant and if mitigation measures exist to lessen these impacts.

Response: As discussed in the DEIR on page O-1, "Specific growth inducing impacts associated with the Amended Southeast Roseville Specific Plan are largely limited to on site impacts.". Implementation of the proposed Specific Plan will increase the number of residences and businesses on the site, and subsequently the number of employment opportunities, the need for extension of services, the improvement of transportation facilities, ect. in the vicinity. However, this growth is within the limits established by the General Plan and therefore is not anticipated to create any unanticipated growth inducing impacts. Further since development is already proposed for the majority of the area immediately surround the Plan area, offsite impacts in the vicinity are anticipated to be minimal. Based on these conditions, the growth inducing impacts of the Specific Plan are suggested to be less than significant. However, the aggressive growth proposed by Roseville on a City-wide scale, coupled with the predicted imbalance of the jobs/housing ratio, could induce growth in other areas surrounding the City and should be considered a significant cumulative impact.

Comment: During the PRC meeting of September 22, 1987, question was raised concerning potential mitigation for the impacts to vernal pools and native oak woodland in the "Broken Spur" portion of the Specific Plan area. A complete inventory of the native vegetation and vernal pool species is included in the Biotic study included in the Technical Appendix. Two preservation alternatives were suggested by the biologist who conducted the biotic inventory, and these alternatives are described in detail within the biotic report. A comment received indicated that these alternatives should be presented in the body of the DEIR, and as such, are described in this compilation of supplemental information.

Two alternative combinations of vernal pool preserve and blue oak woodland preservation were recommended as being substantial enough to reduce the impacts of the project on these resources to less than significant levels. Both of the proposed preserve alternatives are presented in the following figure.





Preserve Alternative 1 would require establishment of a vernal pool preserve in the northwest portion of the site between the commercial parcel and the project entry road from Eureka Road. This alternative would require adjustment of the boundary of the 15.77 commercial parcel to accommodate inclusion of pools in the preserve. This vernal pool preserve would be approximately six acres and the blue oak woodland preserve would be approximately 10 to 11 acres in size. The advantages of this proposal include 1) the pools are relatively rich in species and large in size; 2) most of the pools are primarily supplied direct rainfall and alteration of the area hydrology outside of the preserve would have little effect on pool water balances; 3) the tributary area is small and the gain in preservation per unit area is relatively high; 4) the blue oak woodland provides a buffer on the northern side of the vernal pool preserve; and 5) surrounding buffers would be created by the project access road and the proposed commercial site. The disadvantages of this preserve when compared with alternative 2 include: 1) no portion of the preserve is situated within the powerline corridor, and as a result this alternative would require greater modification of the proposed Specific Plan; and 2) The drainage in this preserve carries less water than the one within preserve alternative 2. Preserve Alternative 2 is proposed in the south-central portion of the Plan area and would consist of approximately 22 acres, 16 of which would be blue oak preserve and 6 would be vernal pool preserve. The advantages of this proposal are that : 1) the pools are relatively well protected because the watershed is almost entirely included within the preserve; 2) as in preserve 1, most of the pools receive their water from direct rainfall; 3) approximately 10 acres is within the powerline easement and thus reduces the impact of implementation on the proposed Specific Plan; 4) the blue oak woodland provide a buffer on the western side of the pools; 5) the natural drainage channel carries more water than that in preserve alternative 1; and 6) with the construction of barriers, the site can be easily protected. Disadvantages of alternative 2 when compared to alternative 1 include: 1) the vernal pools are not as large or rich; and 2) a total greater acreage would be required for implementation of this alternative.

Comments concerning the traffic analysis are responded to in the following letter from Fehr and Peers Associates.



September 25, 1987
87-0018



MORTON & PITALO, INC.
Civil Engineering, Planning, Surveying
1430 Alhambra Blvd., Suite 200
Sacramento, Ca. 95816
916/454-9600

R.C. Fuller Associates
5908 Fair Oaks Boulevard
Carmichael, CA 95608

SUBJECT: SOUTHEAST ROSEVILLE SPECIFIC PLAN - 1987 AMENDMENT

Gentlemen:

This letter is in response to the comments raised at the Project Review Commission hearing for the EIR. It is our understanding that a question was raised regarding increased runoff as a result of this proposed project and that a discussion centered around the increase in water surface elevation at the confluence of Linda Creek with Cirby Creek, which is approximately 0.9 foot.

The "Nolte study," which is the most rigorous study prepared to date for the City of Roseville, does not contain specific data for the increased runoff from this particular project. The study does contain data from which one can extrapolate information which may be accurate and also may be highly erroneous. The problem basically is that discussions typically center around increases in the "peak" runoff. Peak runoff is something that can be affected by increases in impervious areas (i.e., when the runoff can no longer infiltrate into the soil) and the time it takes for the runoff (from time of concentration) from several different locations to travel to the area being studied. Thus, one has to be very careful in extracting conclusions regarding "peak" runoff since its impact at one location may be far different than from another location downstream.

An example would be to review the Nolte study and the material quoted in the environmental impact report. On Linda Creek, just upstream of its confluence with Cirby Creek, the Nolte study indicates that the water surface elevation will be raised 0.9 foot for the 1% storm, from the existing condition to the ultimate buildout of the entire upstream basin. In addition, the report indicates the Q_{100} flow rate for the existing condition is 2750 cfs, while the Q_{100} future condition is 3990 cfs. One could argue that the increased runoff at this point is 1240 cfs, or that the runoff has increased 45% over the runoff exhibited for the existing condition.

However, if you extend this reasoning downstream and examine Dry Creek, just downstream of its confluence with Cirby Creek, the flow rate under the existing condition is reported to be 15,800 cfs, while the Q_{100} for the future condition is 17,250 cfs. The difference for this particular example is an increase in peak flow, in Dry Creek at this location, of 1450 cfs over existing conditions, or a net increase of only 8.4%, while the drainage basin draining into this location is increased from 16.5 square miles to 77.33 square miles. Obviously, if each increase in runoff was additive, at every location, there would be serious repercussions.

However, the peak flows are time dependent - as you travel downstream, you combine with flows from other areas which may travel to that point faster, or slower, than the flow from your particular basin. If the basins are of similar size, oftentimes the individual peaks, at a downstream location, are similar and therefore you seem to get a higher total increase in peak runoff. Whereas as you move further downstream, the larger basins that you connect with often have much slower travel times to a particular point and therefore the peak flow from the subbasin can reach the larger tributaries and travel through before the initial, larger upstream peak hits the area in question. It is for this reason that it has been stated in the past, by the City of Roseville, that on some basins, particularly the Linda Creek basin, it is better to accelerate the flow so that it will travel through problem areas and it will "beat" the peak flow from the larger drainage basins of Dry Creek.

It is our understanding that the EIR for this project is charged with assessing the impact of the 1987 amendment to the Southeast Roseville Specific Plan. If one looks at this interpretation strictly and considers the density changes from the original specific plan on the west side of Sierra College Boulevard, to the new densities on the west side of Sierra College Boulevard and the east side of Sierra College Boulevard, one finds that several parcels zoned for multi-family development, under the original specific plan, have now been downzoned to single-family type developments.

The proposed densities for the specific plan on the east side of Sierra College Boulevard have increased from the existing zoning of two acres per unit to a residential zoning of between 3.1 and 3.8 units to the acre. Thus, what we would see in the Linda Creek drainage basin is a possible decrease in runoff from the existing plan (on the west side of Sierra College Boulevard) and an increased runoff for the specific plan area on the east side of Sierra College Boulevard.

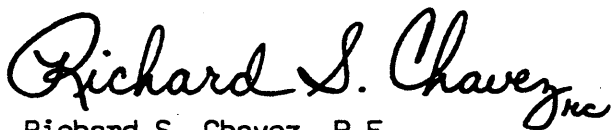
It appears that the increased runoff from this proposed amendment to the specific plan will be small because of the offsetting factors discussed above. If one were to examine the runoff coefficients contained in the City of Roseville storm drain manual for the parcels in question, you would find that the peak runoff potential under the new proposed plan, at a point fairly close to the project, would increase somewhere between 5% and 10%. Using the same City of Roseville storm drain manual for the condition of increased peak runoff relatively close to the project, the manual would indicate potential increases in peak flows similar to those stated in the Nolte study at the confluence of Linda Creek with Cirby Creek.

R.C. Fuller Associates
September 25, 1987
Page 3

As mitigation for this proposed project, each individual project within the Southeast Roseville Specific Plan must prepare a drainage study, as required by the City of Roseville Public Works Department, to address each project's impact on storm drainage in the City. As a result of this study, measures could be implemented to speed up, or slow down, the flow depending upon the conditions for the particular watershed under study and the existing City policy for each watershed in question.

Very truly yours,

MORTON & PITALO, INC.

A handwritten signature in cursive script that reads "Richard S. Chavez" with a small "INC" written below the end of the name.

Richard S. Chavez, P.E.

RSC/rc

APPENDIX





Fehr & Peers Associates, Inc.
Transportation Consultants

3685 Mt Diablo Blvd
Suite 200
Lafayette, CA 94549
415 284-3200

September 24, 1987

Mr. Bob Languell
RC Fuller Associates
5908 Fair Oaks Blvd.
Carmichael, CA 95608

Subject: Response to comments on Traffic and
Transportation - Southeast Roseville
Specific Plan EIR.

Dear Bob:

This letter presents our responses to the comments on traffic and transportation made at the September 22 PRC hearing on the Southeast Roseville Specific Plan EIR.

1. Absorption Rate for New Development - (Request from Mr. Bader)

The attached table presents data on historic and projected residential absorption rates in Roseville.

The McDonald forecasts were prepared in May 1986 by Angus McDonald Associates and the City for use in the City's Capital Improvements Plan and in the Specific Plan EIRs. This is the data used (with minor refinements) in the Southeast Plan EIR for the plan itself and for cumulative development. The historic McDonald Associates data was prepared for and used in the 1982 Roseville Circulation Study. This data indicates that residential absorption between the present and the year 2005 will be about 900 units per year, or more than ten times the absorption rate experienced over the past 5 or 6 years.

For comparison, SACOG forecasts are also presented. These show an absorption rate of about 1100 units per year. However, because SACOG estimates a higher historic absorption rate than McDonald, the SACOG future rate is about 5 times as high as the SACOG historic rate.

The 2005 population forecasts from both sources agree fairly well; each estimates about 73,000 to 78,000 total population by 2005. However, SACOG projects that the number of people per dwelling unit will decline in the future, while McDonald estimates that the ratio will remain constant at 2.6. Therefore, SACOG estimates a higher dwelling unit growth.

CITY OF ROSEVILLE
RESIDENTIAL ABSORPTION RATES

<u>Historic Absorption</u>	<u>McDonald Associates¹</u>	<u>SACOG</u>
<u>Dwelling Units</u>		
1979	--	9460
1980	10,500	--
1984	--	10,610
1986	11,000	--
<u>Growth (1979/80 to 1984/86)</u>		
Total	500	1150
Per Year	83	230
 <u>Projected Absorption</u>		
<u>Dwelling Units</u>		
1984	--	10,610
1986	11,000	--
2005	28,045 ²	33,200 ³
Buildout	34,690	--
<u>Growth (1984/86 to 1005)</u>		
Total	17,045	22,590
Per Year	897	1076
 Projected/Historic Absorption	 10.8	 4.7

¹ Angus McDonald Associates, May 1986. (Basis for EIRs on Northeast, Southeast, North Central and Northwest Specific Plans, and 1986/1987 Roseville Capital Improvements Plan.)

² Per McDonald Associates forecast, projected 2005 population is 73,320, with 2.6 people per dwelling unit. Projected 2005 population from individual 1986/1987 Roseville Specific Plans is 77,760, with 2.6 people per D.U. (29,900 dwelling units).

³ Projected 2005 population 78,580, with 2.36 people per dwelling unit.

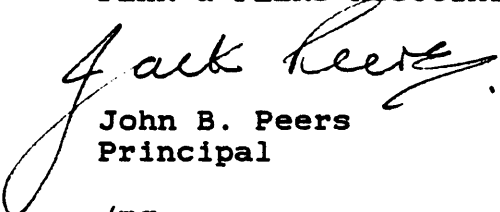
2. Clarification of General Plan Policy on Service Level C

Our suggested clarification of Policy 1 of the Circulation Element of the City's General Plan is as follows:

Policy 1: For the City of Roseville, the Level of Service "C" shall be used in determining the capacity of the freeway, arterial and collector street system. This shall mean that the average travel condition in all of the City's principal travel corridors (as defined by Screenlines A through O in the 1982 Roseville Circulation Study) shall be at the middle of the range defined as Level of Service C, or better. Individual street segments may operate at the low end of Level C as long as alternative routes are available within the corridor which operate at better than mid-C. This guarantees that everyone travelling within the corridor will have an opportunity to travel under mid-C conditions or better if they choose to deviate slightly from their ordinary travel route. It also means that individual intersections may be projected to operate at Level D or E, as long as either: 1) the intersection is predicted to operate "under capacity" using long-range planning assumptions (as defined in the Transportation Research Board, 1985 Highway Capacity Manual, page 9-21), and can, therefore, be expected to operate at Level C when the volumes actually materialize and final operational improvements are installed, or 2) there are alternate routes available in the corridor along which all intersections operate at Level C or better.

Sincerely,

FEHR & PEERS ASSOCIATES, INC.


John B. Peers
Principal

/mg

87-115


cc: Mr. Fred Barnett (City of Roseville)
Mr. Steve Dillon (City of Roseville)
Mr. W. Cramer (Coker/Ewing)

MEMORANDUM

RECEIVED
SEP 10 1987

PLANNING DEPARTMENT

TO: DAN DAMERON
ASSOCIATE PLANNER

FROM: DAVID DOCKHAM 
ASST. ELECTRIC UTILITY DIRECTOR

DATE: SEPTEMBER 9, 1987

RE: SOUTHEAST ROSEVILLE SPECIFIC PLAN
COMMENTS ON DRAFT E.I.R.

PAGE 22 (Proponent Draft)

Signalization is referenced for the major arterial streets. It should be noted electrical facilities will have to be extended to serve these signal lights and this service extension may be required long before development occurs in the area.

PAGE 35 (Proponent Draft)

The second and third paragraphs under "electricity" should be modified to read as follows:

Plan Area development will require construction of a 60kV to 12kV substation and a 60kV subtransmission line contained within a 25 foot wide powerline easement adjacent to the PG&E/SMUD transmission easement corridor. Parcel 26, near the intersection of East Roseville Parkway and Eureka Road, has been designated as the site for the 60kV to 12kV electrical substation and this property has been dedicated to the City pursuant to terms of the development agreement between the property owners and the City.

Electric subtransmission and distribution lines and equipment will generally be located within public rights-of-way or within public utility easements which will need to be acquired as development occurs. All distribution circuits will be installed underground. Electric equipment may be installed at grade. Electric facilities will be constructed in conjunction with development. Electric service extension charges will exist and be determined in accordance with City of Roseville electric policies and specifications.

RONALD L. FEIST, Ed.D.
District Superintendent
District Office — 791-4939

JANET A. SCHIMPF
Principal
Cavitt — 791-4152

RONALD G. WALKER
Principal
Eureka — 791-1115

DAVID R. FREEMAN
Principal
Greenhills — 791-4230

EUREKA UNION SCHOOL DISTRICT

5477 EUREKA ROAD
ROSEVILLE, CALIFORNIA 95661
PLACER COUNTY

TRUSTEES

LYNDA L. LEITNER
President

WILLIAM R. MURCHISON
Clerk

GARRY G. GENZLINGER

JOHN TANNER

REVÉ TAYLOR

September 22, 1987

Dr. Mel Hamel, Chairperson
Public Review Commission
City of Roseville
316 Vernon Street
Roseville, California 95678

Dear Dr. Hamel and Members of the PRC:

Because of the State's new policy of not approving a school site within 400' of a major high voltage line and the redesign of the S.E.R.S.P., the Eureka School District had to look at new options for school sites. The 7-8 grade school cannot be located as identified on the S.E.R.S.P. maps. All the new demographic information available to the District was reviewed and updated by study area (please see Appendices A & B).

As pointed out in my September 14, 1987 letter to Mr. Dameron, with the change of the S.E.R.S.P., the new projection for Eureka students within the City limits is now 1783. By City and State standards this equates to 37.8 school site acres to accommodate the projected students. Because the Eureka District's philosophy is of joint school and park sites, the total 37.8 acres will probably not be needed, but three workable school sites must be reserved to accommodate the 1783 projected students.

Exhibit C attached shows workable locations for the three (K-3) and three (4-6) school sites to serve the Eureka students. Greenhills and Eureka are current schools. Three out of the four proposed school sites are established and approved by the State.

The K-3 site in the S.E.R.S.P. along Eureka Road (the old 7-8 site) is the new one that must be reserved via the E.I.R. process. The City Parks Department has expressed interest in making this a joint school/park site.

Public Review Commission
Page Two
September 22, 1987

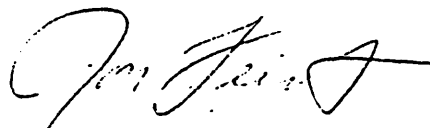
The major problem for Eureka is the location of a 7-8 grade site west of Sierra College Boulevard. As you can see by Exhibit D, a location north of Douglas Boulevard is the best available option to the Eureka District. This site will permit a good balance of students between the current and future 7-8 school. Plus it is fairly centrally located to the students the site would serve. Discussions are currently underway with the Developers, City Parks staff, and the Eureka District to establish this 7-8 school/park site in the N.E.R.S.P. There is a need for additional land to make this option work. So far, the N.E.R.S.P. Developers have not agreed to reserve more land.

Because of our problems with the power lines, the Developers of S.E.R.S.P. have proposed a 7-8 site adjacent to Broken Spur along Eureka Road. As you will see in Exhibit E, this option causes a major imbalance in enrollment, a problem that could be solved by splitting the Treelake Village Project (1093 homes), but this is not desirable. Also, the adjacent to Broken Spur location is very close to the new high school being proposed on Eureka Road. This site should serve only as a back-up plan.

I hope this letter and exhibits will be of some help in understanding the revised plans for Eureka School sites in the City of Roseville.

Sincerely,

EUREKA UNION SCHOOL DISTRICT



Dr. Ronald L. Feist
District Superintendent

RLF:lrt
Enclosures

cc: Board of Trustees
Mr. Daniel Dameron, Associate Planner
Mr. Ed Mahaney, Parks Director
✓ Mr. Robert Coker, Coker-Ewing
Mr. Sam Miller, AKT Development

EUREKA UNION ELEMENTARY SCHOOL DISTRICT
Projected Students by Study Area & Grade Levels

GRADE LEVELS

<u>STUDY AREA</u>	<u>K-3</u>	<u>4-6</u>	<u>7-8</u>
34	95	85	71
35	76	68	56
36	95	85	70
37	38	34	28
38	109	97	80
39	600	534	468
40	38	35	29
41	180	161	142
42	97	80	71
43	174	155	135
44	318	282	246
45	<u>38</u>	<u>34</u>	<u>29</u>
	1,858	1,650	1,425

TOTAL ALL LEVELS 4,933

RONALD L. FEIST, Ed.D.
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WILLIAM R. MURCHISON
Clerk

GARRY G. GENZLINGER

JOHN TANNER

REVÉ TAYLOR

September 14, 1987

Mr. Daniel E. Dameron
Associate Planner
City of Roseville
316 Vernon Street
Roseville, California 95678

Dear Mr. Dameron:

Thank you for giving the Eureka District an opportunity to respond to the Draft E.I.R. for the Southeast Roseville Specific Plan (S.E.R.S.P.).

Because the S.E.R.S.P. has been changed to spread the housing units out over more acres, the housing mix contains more single family houses in the new plan. Single family houses generate more students as identified on pages 16-19 of the E.I.R. The new S.E.R.S.P. will generate 300-350 more students than the old plan. This change could cause the need for another elementary school site for the Eureka School District in the City of Roseville. The following chart outlines the present planning in the city that relates to the Eureka District's needs for school sites.

<u>Name of Project</u>	<u>Projected Number of Students</u>		<u>Acres/ Student</u>	<u>Site Acreage Required</u>	
S.E.R.S.P.	1238	K-6	879	.02	17.6
		7-8	359	.024	8.6
N.E.R.S.P. (Eureka Dist. only)	463	K-6	329	.02	6.6
		7-8	134	.024	3.2
Old Johnson Ranch	82	K-6	58	.02	1.2
		7-8	24	.024	0.6
	1783 students			37.8 acres	

The Eureka District has been working with all parties to try to establish school sites to work within the 37.8 acres. The following is the most up to date Eureka proposal on school sites in the City of Roseville:

<u>Site Location</u>	<u>School Acres</u>	<u>Park Acres</u>	<u>Proposed Grade Levels</u>
1. Maidu School/Park Site	7.0	3.0	4-6
2. N.E.R.S.P. Jr. High/Park Site (South of Road A North Johnson Ranch)	9.0	12.0	7-8
3. S.E.R.S.P. School/Park Site (North of Eureka 400' east of Power Lines between Sierra College & E. Roseville Pkwy)	9.0	?	K-3
4. Broken Spur School/Park Site	<u>8.0</u>	?	K-3
	33.0 acres		

The Broken Spur site would be utilized as the last site if growth is fairly rapid and the other K-3 sites (City and County) are not able to accommodate the students. As stated on pages 16-20, "Therefore, the present school site designations for the Specific Plan are deficient by 12.75 acres which represents a potentially significant unmitigated impact." The Broken Spur site would be the back-up plan for mitigating this impact and should be included in the S.E.R.S.P.

If the Eureka District cannot obtain the 7-8 site in the N.E.R.S.P. (North of Douglas), we will need to keep the option open to locate the site in or adjacent to Broken Spur that we have discussed with the developer.

Mr. Daniel Dameron
Page Three

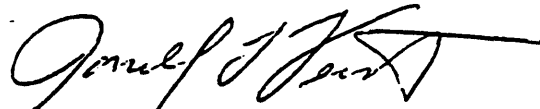
S.E.R.S.P.
September 14, 1987

I have been working closely with the City of Roseville Parks Department on all of the proposed Eureka school sites. If you have questions, please give me or the Parks Department a call.

Thanks for your help in establishing school sites.

Sincerely,

EUREKA UNION SCHOOL DISTRICT



Dr. Ronald L. Feist
District Superintendent

RLF:lrt

cc: Board of Trustees
Mr. Bob Coker - Coker-Ewing
Mr. Bill Kramer - Coker-Ewing

PLANT LIST



Following is a list of plant species identified within the SERSP during the Biotic Survey of the area. The list was compiled by Dr. Laurence P. Stromberg, Ph.D., Consulting Plant Ecologist.

APPENDIX: Partial list of seed plants encountered.

Achyrrachaena mollis
Aesculus californicus
Agoseris heterophylla
Aira caryophylla
Alchemilla occidentalis
Allocarya greenii
Allocarya stipitatus micranthus
Amsinkia intermedia
Astragalus didymocarpus
Avena fatua
Brassica kaber
Briza minor
Brodiaea minor
Bromus diandrus
Bromus mollis
Callitriche heterophylla
Capsella bursa-pastoris
Carduus pycnocephalis
Carex spp.
Ceanothus cuneatus
Centauria solstitialis
Centaurium floribundum
Cerastium vulgatum
Chlorogalum pomeridianum
Clarkia spp.
Claytonia perfoliata
Collinsia heterophylla
Crassula aquatica
Crassula erecta
Cryptogamma acrosticoides
Daucus pusilus
Delphinium variegatum
Deschampsia danthonioides
Dichelostemma pulchellum
Distichlis spicata
Dodecatheon hendersonii
Eleocharis palustris
Elumus glaucus
Epilobium paniculatum
Erodium botrys
Erodium cicutarium
Eryngium vaseyi
Eschscholtzia californica
Gallium aparine
Geranium dissectum
Geranium molle
Gratiola ebracteata
Hemizonia fitchii
Heteromeles arbutifolia
Hieracium albiflorum
Holocarpa virgata

Hordeum geniculatum
Hordeum leporinum
Hypochoeris glabra
Isoetes howellii
Juncus balticus
Juncus bufonius
Juncus oxymuris
Lactuca serriola
Lasthenia chrysostoma
Layia platyglossa
Lepidium nitidum
Lilaea scilloides
Limnanthes douglasii
Linanthus androsaceus
Lupinus bicolor
Marah fabaceus
Medicago polymorpha
Melilotis indicus
Microseris douglasii
Mimulus guttatus
Navaretia bakeri
Nemophila menzesii
Orthocarpus erianthus
Paspalum digitatum
Picris echioides
Pilularia americana
Pinus sabiniana
Plagiobothrys canescens
Plagiobothrys nothofulvus
Plantago hookeriana
Plantago lanceolata
Poa annua
Poa scabrella
Pogogyne zizyphoroides
Polypogon monosplenensis
Populus fremontii
Psilocarphus brevisissimus
Quercus chrysolepis
Quercus douglasii
Quercus wislizenii
Ranunculus aquatilis
Ranunculus bonariensis
Ranunculus muricatus
Raphanus stativa
Rubus procerus
Rumex crispus
Rumex pulcher
Sanicula bipinata
Sanicula crassicaule
Saxifraga californica
Scirpus acutus
Senecio vulgaris
Soliva sessilis
Sonchus asper

Spergularia arvensis
Stellaria media
Sysimbrium
Taeniathrum asperum
Toxicodendron diversilobum
Trichostemma lanatum
Trifolium depauperatum
Trifolium dubium
Trifolium variegatum
Tunica polifera
Veronica peregrina
Vulpia macrostachya
Xanthium strumarium
Zygadenus venosus

**NEW YORK STATE POWER LINES PROJECT
FINAL REPORT**



Panel's Final Report

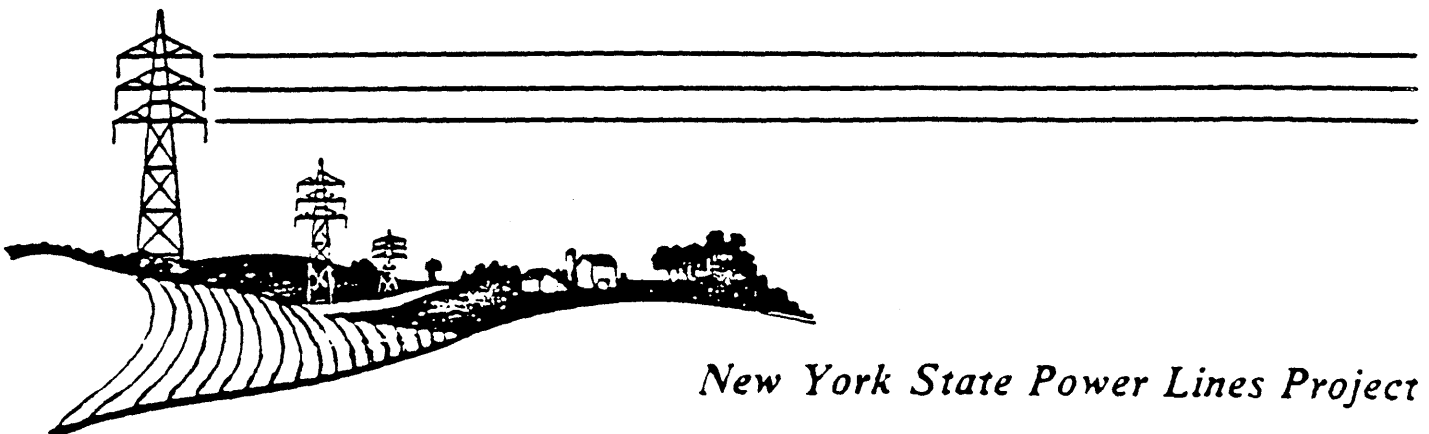
**BIOLOGICAL EFFECTS OF
POWER LINE FIELDS**

**NEW YORK STATE POWER LINES PROJECT
SCIENTIFIC ADVISORY PANEL FINAL REPORT**

Prepared by:

A. Ahlbom, E.N. Albert, A.C. Fraser-Smith,
A.J. Grodzinsky, M.T. Marron, A.O. Martin,
M.A. Persinger, M.L. Shelanski and E.R. Wolpov

1 July 1987



New York State Power Lines Project



BIOLOGICAL EFFECTS OF POWER LINE FIELDS

NEW YORK STATE POWERLINES PROJECT

SCIENTIFIC ADVISORY PANEL FINAL REPORT

PREPARED BY:

A. Ahlbom, E.N. Albert, A.C. Fraser-Smith, A.J. Grodzinsky,
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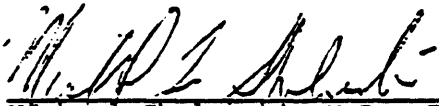
1 JULY 1987

NEW YORK STATE POWERLINES PROJECT

prepared by

THE NEW YORK STATE POWERLINE PROJECT SCIENTIFIC ADVISORY PANEL

DATE OF SIGNATURE



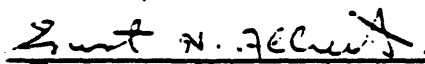
Michael Shelanski, M.D., Ph.D.
Chairman

July 1, 1987



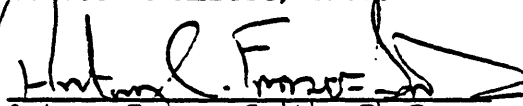
Anders Ahlbom, Ph.D.

June 10, 1987



Ernest N. Albert, Ph.D.

June 29, 1987



Antony Fraser-Smith, Ph.D.

June 26, 1987



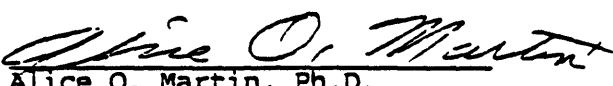
Alan J. Grodzinsky, Ph.D.

June 29, 1987



Michael T. Marron, Ph.D.

June 29, 1987



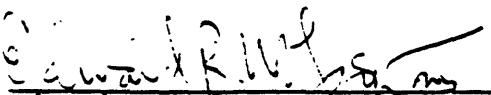
Alice O. Martin, Ph.D.

July 1, 1987



Michael Persinger, Ph.D.

June 30, 1987



Edward R. Wolpow, M.D.

June 29, 1987

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Phase relationship between electric and magnetic fields for projects in the New York State Overhead Powerlines Program. (Document distributed to all contractors in March, 1984). pp. 3-5.
- Appendix 2 - Graham, C. and H.D. Cohen. Influence of 60-Hz fields on human behavior physiology biochemistry. 102 pp., 1985.
- Appendix 3 - Basu, P.K. Biological effects of extremely low frequency electric and magnetic fields on the ocular tissues: An in vitro study. 112 pp., 1986.
- Appendix 4 - Cohen, M.M. In vitro genetic effect of electromagnetic fields. 100 pp., 1986.
- Appendix 5 - Gundersen, R., B. Greenbaum, and E. Goodman. Effects of 60-Hz electromagnetic fields on calcium efflux and neurotransmitter release. 46 pp., 1986.
- Appendix 6 - Livingston, G.K., O.P. Gandhi, I. Chatterjee, K. Witt and J.L. Roti Roti. Reproductive integrity of mammalian cells exposed to 60-Hz electromagnetic fields. 45 pp., 1986.
- Appendix 7 - Sulzman, F.M. and D.E. Murrish. Effects of electromagnetic fields on primate circadian rhythms. 65 pp., 1986.
- Appendix 8 - Thomas, J.R. and J. Schrot. Investigation of potential behavioral effects of exposure to 60-Hz electromagnetic fields. 75 pp., 1986.

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- Appendix 9 - Winters, W.D. Biological functions of immunologically reactive human and canine cells influenced by in vitro exposure to 60-Hz electric and magnetic fields. 105 pp., 1986.
- Appendix 10 - Carsten, A.L., R.D. Benz, J.W. Baum, and A.V. Kuehne. Mutagenicity and toxicity of 60-Hz magnetic and electric fields. 196 pp., 1987.
- Appendix 11 - Gona, A.G., and M.C. Yu. Effects of 60-Hz electric and magnetic fields on the developing rat brain. 40 pp., 1987.
- Appendix 12 - Ossenkopp Final Report:
Part I: Ossenkopp, K-P. and D.P. Cain. ELF low intensity magnetic fields and epilepsy: Final Report. 31 pp., 1986.

Part II: Ossenkopp, K-P. and M. Kavaliers. ELF low intensity magnetic fields and morphine-induced analgesia: Final Report. 21 pp., 1987.
- Appendix 13 - Rodan, G.A. Effect of 60-Hz electric and magnetic fields on neural and skeletal cells in culture. 38 pp., 1987.
- Appendix 14 - Salzinger, K. Behavioral effects of ELF. 137 pp., 1987.
- Appendix 15 - Savitz, D.A. Childhood cancer and electromagnetic field exposure. 178 pp., 1987.
- Appendix 16 - Stevens Final Report:
Part I: Stevens, R.G. Epidemiological studies of cancer and residential exposure to electromagnetic fields. 50 pp., 1986.

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Part II: Stevens, R.G., W.T. Kaune, N.J.
Callahan, R.K. Severson and D.B. Thomas.
Residential magnetic and electric fields measured
over 24-H periods. 109 pp., 1987.

Appendix 17 - Wolpaw, J.R., R.F. Seegal, R.I. Dowman and S.
Satya-Murti. Chronic effects of 60-Hz electric
and magnetic fields primate central nervous system
function. 165 pp., 1987.

Appendix 18 - Report of Site Visit to Winters' laboratory by
R.N. Buick and J.M. Trent. pp. 1-5, 1984.

Evaluation of Winters' final report by R.N. Buick.
pp. 6-10, 1984.

Evaluation of Winters' final report by J.M. Trent.
pp. 11-15, 1986.

"The Effects of Low-Level Electromagnetic Fields
on Cloning of Two Human Cancer Cell Lines (Colo
205 and Colo 320" With appendicies, by M.M. Cohen.
pp. 16-51, 1987.

Molecular Genetic Analysis of Tumor Cells Exposed
to Electromagnetic Fields by J.M. Trent. pp. 52-
60, 1987.

Evaluation of M.M. Cohen's final report by R.N.
Buick. pp. 61-64, 1987.

Evaluation of M.M. Cohen's final report by J.M.
Trent. pp. 65-69, 1987.



I. NON-TECHNICAL SUMMARY

In our industrialized society everyone is exposed to 60-Hz (50-Hz in Europe) electric and magnetic fields which originate from electrical wiring, appliances and a variety of other conveniences of modern life. The New York State Power Lines Project was established to conduct research and to review the scientific literature to determine whether health hazards of these fields are possible. Particular attention was directed to the fields generated by 765-kV overhead transmission lines. The research program, supported by contributions assessed from all New York State electric utilities, provided support to 16 different research groups studying human, animal and isolated cell sensitivity to electric and magnetic fields. Most of the research studies reported no effects of concern. Of the few effects, some warrant further consideration.

No effects were found on reproduction, growth or development. Several studies showed no evidence of genetic or chromosomal damage that might lead to inherited effects or cause cancer. While most measurements of behavior and brain function did not demonstrate changes, some did show changes that were small but consistent. Some of these appear to result from changes in body rhythms, and might interfere with normal sleep patterns. There were also changes in pain responses and in the ability of rats to learn.

A more serious concern comes from a study of cancer in children suggesting that children with leukemia and brain cancer are more likely to live in homes where there are elevated 60-Hz magnetic field levels than are children who do not have cancer. Although much more research is needed before the question whether the magnetic fields actually cause or promote cancer can be resolved, the basis for such an hypothesis is now established. At this time no risk assessments can be made because only four studies of this question have been made and the two which report an association are from the same geographic region. More research on cancer as a function of magnetic fields is needed, both in homes and for on-the-job exposure.

II. EXECUTIVE SUMMARY

Under a negotiated agreement between the New York State Public Service Commission and the Power Authority of the State of New York (now the New York Power Authority), a five million dollar research program has been conducted over the past five years to determine whether there are health hazards associated with electric and magnetic fields produced by 60-Hz power transmission (especially 765-kV) lines. The project has been administered by the New York State Department of Health. Scientific direction came from a panel of nine experts who identified priority research areas, evaluated project applications, selected those to be funded, monitored the course of research and prepared this final report. Sixteen research projects were funded and completed, plus two extension projects solicited by the panel and performed at contract laboratories after completion of the original projects.

Considerable resources were allocated to construction of exposure facilities and dosimetry (See Appendix 1), because a frequent problem in previous work has been poor definition of the actual fields studied. Assistance in the dosimetry was provided by a contract from the US Department of Energy, which was used to secure the services of experienced personnel from the Aerospace Corporation (now at W/L Associates) and the National Bureau of Standards. Detailed dosimetry was done at each exposure facility at least at the beginning and end of the study, and usually more frequently. The panel decided at the onset of the project to investigate and monitor both magnetic and electric field effects. Dose-response relations were investigated in the general range of 10 micro Tesla (μT) to 1 milli Tesla (mT) (0.1 to 10 G) and 1 to 50 kV/m, because these levels bracket those existing under a 765-kV line.

The research was undertaken in seven general subject areas as follows:

1. Genetic, cytogenetic, teratogenic and reproductive studies: Three studies were performed in this area: one in which two strains of mice were exposed either to fields of two different intensities or control (unexposed) conditions for three generations (Carsten, Appendix 10) and two projects in which human lymphocytes (Cohen, Appendix 4; Livingston, Appendix 6) and Chinese hamster fibroblasts (Livingston, Appendix 6) in tissue culture were exposed.

The Carsten studies revealed no significant effects in the incidence in mice of dominant lethal mutations, fertility as measured by impregnation, gestation time, litter loss, litter size, weight gain or average generation time. None of the studies on sister-chromatid exchange, chromosome breakage, mitotic rate, cell-cycle duration, rate of cell proliferation, DNA content or reproductive integrity as measured by a standard colony assay (clonogenicity) showed significant differences between exposed and controls.

2. Cell biology studies: Investigations were performed on osteoblastic cell lines (Rodan, Appendix 13), because electric and magnetic fields have been reported to alter bone growth. However, no effects of fields were found on rate of growth or ligand-receptor interactions as measured by parathyroid hormone activation of adenylate cyclase. Small but significant stimulation of ^3H -thymidine incorporation into DNA by electric fields was observed.

Because of the exposure of the eyes to the environment and known effects of other forms of electromagnetic irradiation on ocular tissues, a study was done on corneal and lens cell and organ cultures (Basu, Appendix 5). Little effect was found on DNA and protein synthesis,

ATPase activity, cell viability or growth characteristics, lens hydration or corneal wound healing.

In a study of cells of the immune system, canine and human leukocytes in culture exposed to fields did not show significant changes in functional responses to mitogens, levels of DNA, RNA or protein synthesis or levels of cell surface ligand receptors and immunoglobulins (Winters, Appendix 9).

3. Proliferation of cancer cells in culture: Although not a part of the original contract, Winters (Appendix 9) performed studies using soft agar cloning assays to assess the proliferative response of normal cells and human colon carcinoma cells to fields, and reported that for the cancer cells, but not the normal cells, magnetic or combined magnetic and electric fields caused increased cell proliferation, increased numbers of surface transferrin receptors, increased resistance to natural-killer-cell activities and increased expression of tumor cell-surface antigens. The observation that normal cells did not grow in soft agar is consistent with the conclusion that exposure to the fields did not cause cells to become cancerous. The observations with the cancer cells, however, suggested to the investigators the possibility that magnetic fields stimulate the rate of cancer cell growth. Even if this observation were confirmed, however, extrapolation to the behavior of cancer cells in humans it is not justified because behavior of cells in soft agar is not predictive of their behavior in the whole organism. Furthermore, there is no basis to extrapolate between growth of cells which are already malignant and initiation or promotion of cancer in the whole organism.

Because this experimental design was not part of the original contract (which was to perform immunologic studies), outside consultants expert in this research area were asked to site visit and review the experimental design and data (Drs. J. Trent and R. Buick, Appendix 18). In their report these experts indicated that the conclusions drawn by the contractor were not justified by the experimental data.

However, because the reported results generated consideration attention and concerns, the panel solicited a replication of the study by Cohen and Hamburger (Appendix 18). Using the same cell lines as Winters (but a slightly different field geometry), Cohen and Hamburger concluded that neither magnetic or magnetic plus electric fields affected clonogenicity in soft agar of either cell line. Attempts to demonstrate altered oncogene expressions were not successful (Trent, Appendix 18).

4. Neurobiology: Three projects investigated various nervous system effects. To pursue reports from other laboratories that fields cause specific and severe pathological changes in the cerebellum of developing animals, Gona (Appendix 11) performed studies in which rat pups were exposed pre- and postnatally to electric or magnetic fields or both. He found no significant morphological or ultrastructural changes of the cerebellum or cerebrum, no differences in DNA, RNA, protein or cerebroside content and no differences in time of eye opening, motor activity or body weight between exposed and control animals. The cerebellum of the developing animal is a sensitive structure whose development and maturation in many animals and humans are similar. A lack of morphological and biochemical changes argues against major direct effects of the fields on the processes of cell differentiation,

migration or synaptogenesis. Specific questions of neuronal connectivity are not answered by these studies, but the apparently normal behavior of the offspring suggests that major connections are intact.

Gundersen (Appendix 5) found no effects of 60-Hz electrical fields of up to 30 kV/m (air equivalent) and circularly polarized magnetic fields of 100 μ T (1 G) on calcium efflux from dissociated spinal cord neurons, but did find small (up to 26%) but statistically significant increases in frequency of miniature end plate potentials (events reflecting spontaneous transmitter release) induced by linearly but not circularly polarized magnetic fields. Gundersen and colleagues speculate that the changes in frequency are related to alteration of intracellular calcium concentration.

Wolpaw and Seegal (Appendix 17) studied a variety of electrophysiological and neurochemical indicators in awake monkeys exposed to fields for prolonged periods of time. No significant effects were found in measures of general well-being, demeanor, weight, blood chemistries or performance of a simple motor task. There were no effects on early or mid-latency components of the auditory, visual and somatosensory evoked potentials, although late components of the somatosensory evoked potentials were decreased, as has been reported by others. Exposure to combined electric and magnetic fields were associated with a significant decrease in the concentration of two neurotransmitter metabolites, homovanilic acid (HVA) and 5-hydroxyindoleacetic acid (5-HIAA), in cerebral spinal fluid. There was an eventual return of HVA to normal while there was a long-term suppression of the 5-HIAA levels. The mechanism and significance of

this effect is unknown, but the investigators believe that the changes in somatosensory evoked potential in the absence of alterations of auditory or visual evoked potentials could be due to changes in central opiates. Both the 5-HIAA and the somatosensory evoked potential results point to spinal cord localization of the effect.

5. Behavior: Four studies were principally behavioral (Ossenkopp, Salzinger, Sulzman and Thomas). All studies demonstrated significant alterations of behavior.

In his original project Ossenkopp (Appendix 12) looked for effects of magnetic fields on susceptibility to seizures in rodents. Magnetic fields at some [100-150 μ T (1.0 - 1.5 G)], but not all flux densities significantly reduced mortality from drug-induced seizures, and in kindled animals there was a significant decrease in the duration of the after discharge in exposed animals. At the request of the New York Panel this contract was extended to a study of effects of magnetic fields on morphine-induced analgesia, studied in rats. While no significant effects were observed on daytime analgesia levels, there was a significant reduction in the analgesic effect of morphine at night in exposed animals which was a linear function of field strength. Additional studies showed that magnetic fields function as a weak environmental cue which could gain stimulus control over the expression of tolerance to morphine administration.

These observations implicate effects on circadian rhythms, and this assumption was documented by the studies of Sulzman and Murrish (Appendix 7) who studied the circadian rhythms of squirrel monkeys and found that electric fields altered free-running circadian periods in an intensity dependent fashion. At higher intensities the alterations were

prolonged. Magnetic fields were held constant in these studies. Salzinger's study (Appendix 14) focused on behavioral alterations of rats exposed in utero and for the first eight days of life. He found the groups conditioned on the multiple random interval schedule to show a significant reduction on response rate relative to controls after exposure to electric plus magnetic fields. The difference in performance was maintained and even increased with further conditioning and extinction. This test is one designed to measure one kind of memory, and thus the results may be important.

Thomas (Appendix 8) found no significant effects of 60-Hz electric or magnetic fields on several behavioral tasks and on the behavioral effects of amphetamine and chlordiazepoxide. He did find, however, a significant effect of combining a low level 60-Hz magnetic field with a low level static magnetic field. Animals so exposed consistently exhibited changes in rate and pattern of responding to the same tests which were applied above, suggesting that static magnetic fields of the order of those of the earth may alter the effects of superimposed 60-Hz fields.

6. Multidisciplinary studies of human exposure: Graham and co-workers (Appendix 2) developed a system for controlled exposure of human volunteers in electric fields of 0-16 kV/m and/or magnetic fields of 0 to 40 μ T (0.4 G). The investigators first determined human perception of fields and found that individuals varied in their ability to detect fields, but 90% had thresholds above 9 kV/m. Perception was dependent upon body position, but not time of day. The second part was a double-blind study of healthy male volunteers in whom a variety of physiologic and behavioral tests were done before and after exposure to

fields at various intensities for 6-hour sham and actual exposure periods. No significant effects were observed on vital signs except for a small but statistically significant lengthening of the cardiac interbeat interval. Sleep, appetite, sexual activity, cognitive and physical functions were not changed, nor were several monitors of mood. There was a reduction in amplitude of late components of the evoked potential to a signal detection task and an attenuation of the normal reduction in amplitude of late components of the evoked response in the auditory oddball task. While most performance tests were unchanged, several were altered in small but significant ways.

7. Epidemiology of cancer incidence: Because Wertheimer and Leeper (1979; 1982) reported an association between residential exposure to magnetic fields and incidence of cancer in children and adults in Denver, Colorado, two epidemiological investigations were done to a) study incidence of cancers in children in the Denver, Colorado area (Savitz, Appendix 15) and b) study the incidence of adult nonlymphocytic leukemia in Seattle, Washington (Stevens, Appendix 16) as a function of residential exposure to electric and magnetic fields.

In the Savitz case-control study, all cases of childhood cancer (ages 3-14) between 1978 and 1983 were selected. Controls were identified through random digit dialing and matched by age and sex. Exposure was estimated by determination both of wiring configuration outside the home, as developed by Wertheimer and Leeper (1979), and by direct measurement of the fields. Wiring configuration was found to correlate with the field measurements, and the major factor contributing to magnetic fields was found to be distribution lines. There was a positive association between wiring configuration and increased cancer

risk. This held for all childhood cancers, especially for leukemias, and to a lesser degree, for brain tumors. There appeared to be a dose-response relation, in spite of the inexact measures of exposure. The relative risk was above 2 for the highest exposed group. No sources of bias were identified to explain the results although the somewhat limited response rate remains a concern.

In the study of adult non-lymphocytic leukemia (Stevens) similar procedures in general were used but no association between cancer and magnetic field exposure, as measured by wiring configuration, direct field measurement or an engineering-based code, was found in the 164 cases and 204 controls.

In conclusion, results of the New York funded projects document biologic effects of electric and magnetic fields in several systems. The variety of effects of magnetic fields have not been previously appreciated. Several areas of potential concern for public health have been identified, but more research must be done before final conclusions can be drawn. Of particular concern is the demonstration of a possible association of residential magnetic fields with incidence of certain childhood cancers. Further study of this possible association and mechanisms to explain it are important. The variety of behavioral and nervous system effects may not constitute a major hazard because most appear to be reversible, but they may impact temporarily on human function. Further research should also be done in this area.

III. HISTORICAL PREFACE

A. INTRODUCTION

In 1973, the New York State Public Service Commission received two applications for Certificates of Environmental Compatibility and Public Need for construction of 765-kV power transmission lines. One application (Case 26529) was submitted by the New York Power Authority for a line from the Canadian border near Massena, NY to Utica, NY. The other application (Case 26559) was submitted by two private corporations, the Rochester Gas and Electric Corporation and the Niagara Mohawk Power Corporation, for construction of a line from Rochester, NY to Oswego, NY.

In the face of substantial public concern about possible health hazards, effects on weather, and audible noise involved in the proposed lines, the Administrative Law Judges in the two cases ordered joint hearings on the issues of common interest. The findings of these hearings were embodied in an Opinion (No. 78-13) issued by the New York Public Service Commission on June 19, 1978, which approved construction of the proposed power lines, but with provisos based on the unrefuted inferences of risks. These provisos included the establishment of a research program to determine possible human health risks arising from the electric and magnetic fields of overhead power transmission lines, and a rule establishing a 350-foot right-of-way corridor surrounding each 765-kV power line within which residences are not allowed. The latter rule was based on the idea that the electric field at the edge of the corridor of a 765-kV power line should be no greater than the value of 1.6 kV/m found at the edges of the corridors of existing 345-kV power lines. No standard for magnetic fields was established.

The agreement subsequently signed by the New York Power Authority and the New York State Public Service Commission (February 7, 1980) provided for establishment of a \$5,000,000 research program, to be funded by contribution from the Power Authority and from New York State investor-owned utilities (listed in Table 1), to be directed by the Board of New York Powerline Project, administered by the New York State Department of Health under the guidance of an impartial scientific panel, and to be conducted by contract with independent investigators.

B. BOARD OF THE NEW YORK STATE POWERLINES PROJECT

By agreement of the New York State Power Authority and the Public Service Commission, the Board responsible for establishing the Powerlines Project was to consist of the Commissioner of the New York State Department of Health, the Chairman of the New York State Power Authority, and the Chairman of the New York State Public Service Commission. Dr. David O. Carpenter, then Director of the Wadsworth Center for Laboratories and Research of the New York State Department of Health, was given responsibility for the administration of the project for the Board.

C. SCIENTIFIC ADVISORY PANEL

The Scientific Advisory Panel members were selected for the Powerlines Project as a body of scientists and engineers with outstanding reputations in the fields of Anatomy, Physics, Biochemistry, Pharmacology, Genetics, Psychology, Neurology, Epidemiology, Electrical Engineering, and Bioengineering. While engineering members were selected to have a strong background in electromagnetic and nonionizing radiation, other members were selected for their prominence in their field whether or not they had previous interest in electromagnetic field effects. The duties of the Panel were to solicit, select and oversee the research contracts awarded under the

Powerlines Project. Panel members were screened for conflicts of interest, and all members were approved by the Board, representing the three state agencies. Members were chosen on the basis of their professional expertise in the above areas and their lack of financial or professional conflicts of interest.

The Scientific Advisory Panel originally selected included:

Ernest Albert, Ph.D.
Department of Anatomy
George Washington
University Medical Center
2300 I Street, NW
Washington, DC 20037

Antony Fraser-Smith, Ph.D.
Space, Telecommunications
& Radioscience Laboratory
Department of Electrical Engineering
Stanford University
Stanford, CA 94305

Alan J. Grodzinsky, Ph.D.
Department of Electrical Engineering
and Computer Science
Massachusetts Institute of Technology
Cambridge, MA 02139

Michael T. Marron, Ph.D.
Biomedical Research Institute
University of Wisconsin-Parkside
Kenosha, Wisconsin 53141
Present Address:
Office of Naval Research
Molecular Biology Program
800 North Quincy Street
Arlington, VA 22217

Alice O. Martin, Ph.D.
Department of Obstetrics & Gynecology
Northwestern University Medical School
333 East Superior Street
Chicago, IL 60611

Michael Persinger, Ph.D.
Neuroscience Laboratory
Department of Psychology
Laurentian University
Sudbury, Ontario
Canada P3E2C6

Michael Shelanski, M.D., Ph.D.
Department of Pharmacology
New York University Medical Center
550 First Avenue
New York, NY 10016
Present Address:
Department of Pathology
Columbia-Presbyterian Med. Center
630 West 168th Street
New York, NY 10032

James H. Stebbings, Sc.D.
Division of Epidemiology
School of Public Health
University of Minnesota
Minneapolis, MN 55455
Present Address:
Division of Biological &
Medical Research
Argonne National Laboratory
Argonne, IL 60439

Edward R. Wolpow, M.D.
Department of Neurology
Harvard Medical School
Boston, MA 02115

In addition, Dr. Arthur C. Upton, Department of Environmental Medicine, New York University Medical Center was appointed to the Panel, but resigned in 1981. Since the establishment of the Scientific Advisory Panel, Dr. Stebbings has resigned and has been replaced by:

Anders Ahlbom, Ph.D.
Department of Epidemiology
National Institute of Environmental Medicine
Box 60208
S-104 01 Stockholm, Sweden

The first responsibility of the panel was to examine the state of knowledge on health effects of electric and magnetic fields having frequencies and field strengths typical of the vicinity of power lines, and to identify the research areas most relevant to possible health hazards of electromagnetic fields.

D. NEGOTIATION OF RESEARCH CONTRACTS

After reviewing the literature, the Panel issued a request for pre-proposals for research studies in seven areas:

1. Genetic, Cytogenetic, Teratogenic, and Reproductive Studies;
2. Cell and Organ Culture Studies;
3. In Vivo Animal Physiology and Pathophysiology;
4. Animal and Human Neurobiology;
5. Animal and Human Behavior;
6. Multidisciplinary Human Studies with Controlled Exposure Conditions;
7. Epidemiology of Human Populations.

A total of 164 pre-proposals were reviewed by the Advisory Panel on October 31, 1981. About one-third of the authors were invited to submit

detailed proposals, which were reviewed by the Panel on February 19-21, 1982. By the end of 1982, twelve research contracts had been awarded, with four subsequently negotiated, giving a total of 16 research contracts. Table 2 presents the details of these contracts, with principal investigators and their affiliations, funding awarded, and extensions when granted. In addition, on January 1, 1986, a second contract was awarded to Dr. M.M. Cohen to replicate the experiments of one of the other contractors.

E. DOSIMETRY

One of the prime concerns of the Powerlines Project has been to have well documented exposure in the various studies. For this reason, considerable funds were allocated to develop state-of-the-art exposure facilities and much stress has been placed on accurate dosimetry of the electric and magnetic field distribution in the exposure apparatus employed by the different investigators.

The panel also decided that field exposures for animal and human studies should include both electric and magnetic fields. This decision was prompted by two considerations. The first was that although both electric and magnetic fields are present under power transmission lines, magnetic field effects had been ignored by most investigators up to the time of the initiation of this program. The second consideration was based on the notion that electric and magnetic fields, when applied simultaneously, may have quite different effects on living systems, than observed with only electric or only magnetic fields. At the time these considerations were made there was ample evidence that magnetic fields alone could produce effects, although they had not been systematically investigated.

Consultants were hired to advise the panel on construction and dosimetry in the exposure facilities. These consultants were Dr. Donald W.

Deno, General Electric, Pittsfield, MA, Dr. Stephen D. Umans, Massachusetts Institute of Technology, Cambridge, MA and Dr. Anthony R. Valentino, Argonne National Laboratory, Argonne, IL. The field distributions were monitored during site visits to the installations before, during and after the course of experiments by an engineering staff involving collaboration of the National Bureau of Standards and W/L Associates Ltd. of Gaithersburg, Maryland, to verify constancy of the field distributions. Table 3 lists the dates and site visit teams for each of the contractors.

F. REVIEW OF CONTRACTORS' PROGRESS

An ongoing responsibility of the Scientific Advisory Panel was to review the progress of the contractors. This was done in several ways. Three panel members were assigned primary responsibility for each project, one to be responsible for the engineering aspects (either Drs. Marron, Fraser-Smith or Grodzinsky) and two of the other panel members to be responsible for the biologic aspects of the study, one of whom was designated as lead biologist (Table 4). Assignments were made on the basis of the areas of expertise of individual panel members. Panel members were expected to follow the assigned projects closely, to participate in site visits as often as needed, and to request consultant assistance as needed. Assigned panel members have prepared critiques of each project upon completion and reviewed the draft final reports and recommended clarifications as needed. The main focus of this review was to ensure that the scientific results were presented in a clear, consistent format, that all pertinent data are properly incorporated in the report, that dosimetry of the electric and magnetic fields had been properly performed, and that the long-range implications of the study were clearly presented. The chapters of this final report were prepared by individual Panel members in their areas of expertise, and reviewed and revised by the entire Panel.

The Scientific Advisory Panel has met on at least an annual basis over the duration of this project to review progress in all studies and to re-direct efforts as needed. When the Panel meeting was held in the State of New York it was coupled with a public meeting, announced in advance, where questions about the program were answered by the Panel; when the Panel meeting was not held in New York State, Dr. Shelanski, the Chairman of the Panel, and Dr. Carpenter met with the public in Albany. At least one public meeting was held each year.

The public meetings were held on March 23, 1981, June 12, 1981, July 31, 1981 (in Massena, NY), February 19, 1982 (in New York, NY), April 27, 1982, March 28, 1983, March 26, 1984, May 3, 1985, May 30, 1986 and April 24, 1987. Meetings were held in Albany, NY unless otherwise stated. Starting in 1983, these meetings were announced by publication of a summary status report outlining the progress of the Powerlines Project, which was circulated to the entire mailing list of the project, including the media and interested public groups.

Table 1

Contributions of Support to the Powerlines Project

New York State Power Authority	\$ 650,000.00
Consolidated Edison	1,350,000.00
New York State Gas & Electric	498,407.06
Rochester Gas & Electric	236,518.73
Central Gas & Electric	149,222.61
Long Island Lighting Company	599,136.73
Orange & Rockland Utilities	137,198.48
Niagara Mohawk	<u>1,379,516.39</u>
TOTAL POWERLINES SETTLEMENT	\$ 5,000,000.00
Empire State Electric Energy Research Corporation contribution for replication study by Cohen	90,000.00
US Department of Energy support for dosimetry	198,600.00
Interest earnings and miscellaneous revenue	<u>99,863.00</u>
TOTAL FUNDS AVAILABLE	\$5,388,463.00

Table 2

Research Contract Awards by the New York State Powerlines Project

1. Prasanta K. Basu, M.B.
Department of Ophthalmology
University of Toronto
Toronto, Ontario, Canada

"Biological Effects of Extremely Low Frequency Electric and Magnetic Fields on Ocular Tissues: an In Vitro Study"

Term: 4/1/83 - 6/30/85

Extension: 12/1/85

Funding Awarded: \$176,956

2. Arland L. Carsten, Ph.D.
Medical Department
Brookhaven National Laboratories
Upton, New York

"Mutagenicity and Toxicity of Electric and Magnetic Fields"

Term: 10/1/82 - 9/30/85

Extension: 12/31/85

Funding Awarded: \$604,968

3. Maimon M. Cohen, Ph.D.
Department of Obstetrics and Gynecology
University of Maryland School of Medicine
Baltimore, Maryland
 - a. "In Vitro Genetic Effects of Electromagnetic Fields"
 - b. "The Effects of Low-Level Electromagnetic Fields on Cloning of Two Human Cancer Cell Lines (Colo 205 and Colo 320)". Separate contract awarded for replication of the results of the study of Dr. W.D. Winters.
Term: a. 11/2/82 - 6/30/85
b. 1/2/86 - 1/1/87

Extension: b. 2/28/87

Funding Awarded: a. \$213,177
b. \$82,200

Table 2 (continued)

4. Amos G. Gona, Ph.D.
Department of Anatomy
University of Medicine and Dentistry of New Jersey
Newark, New Jersey

"Effects of 60-Hz Electric and Magnetic Fields on the Developing Rat Brain"

Term: 9/1/82 - 8/31/85

Extension: 4/30/86

Funding Awarded: \$169,388

5. Charles Graham, Ph.D.
Life Sciences Department
Midwest Research Institute
Kansas City, Missouri

"Influence of 60-Hz Fields on Human Behavior, Physiology, and Biochemistry"

Term: 9/1/82 - 6/30/84

Funding Awarded: \$465,068

6. Ross W. Gundersen, Ph.D.
Life Sciences
University of Wisconsin-Parkside
Kenosha, Wisconsin

"Effects of 60-Hz Electromagnetic Fields on Calcium Efflux and Neurotransmitter Release"

Term: 7/1/82 - 6/30/85

Funding Awarded: \$159,757

7. Gordon K. Livingston, Ph.D.
Department of Pediatrics
University of Utah Medical Center
Salt Lake City, Utah
Present Address: Department of Environmental Health
University of Cincinnati Medical Center
Cincinnati, Ohio

"Reproductive Integrity of Mammalian Cells Exposed to 60-Hz Electromagnetic Fields"

Table 2 (continued)

Term: 7/1/82 - 9/30/84

Funding Awarded: \$192,044

8. Klaus-Peter Ossenkopp, Ph.D.
Department of Psychology
University of Western Ontario
London, Ontario, Canada

"ELF Low Intensity Magnetic Fields and Epilepsy"

Term: 7/1/82 - 12/31/85

Extension: 3/31/86

Funding Awarded: \$58,343

9. Gideon A. Rodan, M.D., Ph.D.
Department of Oral Biology
University of Connecticut School of Medicine
Farmington, Connecticut
Present Address: Merck, Sharp & Dohme
West Point, Pennsylvania

"Effect of 60-Hz Electric and Magnetic Field on Neural and Skeletal Cells in Culture"

Term: 1/1/83 - 3/31/85

Funding Awarded: \$135,032

10. Kurt Salzinger, Ph.D.
Department of Psychology
Polytechnic Institute of New York
Brooklyn, New York

"Behavioral Effects of ELF"

Term: 7/1/82 - 6/30/85

Extension: 3/31/86

Funding Awarded: \$292,271

Table 2 (continued)

11. David A. Savitz, Ph.D.
University of Colorado Health Sciences Center
Denver, Colorado
Present Address: Department of Epidemiology
University of North Carolina
Chapel Hill, North Carolina

"Childhood Cancer and Electromagnetic Field Exposure"

Term: 12/1/83 - 11/30/85

Extension: 9/30/86

Funding Awarded: \$355,905

12. Richard G. Stevens, Ph.D.
Battelle Memorial Institute
Pacific Northwest Laboratories
Richland, Washington

"Epidemiological Studies of Cancer and Residential Exposure to
Electromagnetic Fields"

Term: 12/1/83 - 6/30/86

Extension: 9/30/86

Funding Awarded: \$401,612

13. Frank M. Sulzman, Ph.D.
Department of Biological Sciences
State University of New York at Binghamton
Binghamton, New York
Present Address: Space Medicine Branch
National Aeronautics and Space Administration
Washington, D.C.

"Effects of Electromagnetic Fields on Primate Circadian Rhythms"

Term: 7/1/82 - 6/30/85

Extension: 1/31/86

Funding Awarded: \$192,436

14. John R. Thomas, Ph.D.
Naval Medical Research Institute
Bethesda, Maryland

Table 2 (continued)

"Investigation of Potential Behavioral Effects of Exposure to 60-Hz
Electromagnetic Fields"

Term: 11/15/82 - 11/14/84

Extension: 11/14/85

Funding Awarded: \$101,190

15. Wendell D. Winters, Ph.D.
Department of Microbiology
University of Texas Health Sciences Center
San Antonio, Texas

"Biological Functions of Immunologically Reactive Human and Canine
Cells Influenced by In Vitro Exposures to Electric and Magnetic Fields"

Term: 7/1/82 - 6/30/84

Extension: 11/30/84

Funding Awarded: \$142,668

16. Jonathan R. Wolpaw, M.D.
Wadsworth Center for Laboratories and Research
New York State Department of Health
Albany, New York

"Chronic Effects of 60-Hz Electric and Magnetic Fields on Primate
Central Nervous System Function"

Term: 7/1/82 - 6/30/85

Extension: 8/30/86

Funding Awarded: \$283,901

Table 3

History of Site Visits of Powerlines Project Contractors

BASU

May 1, 1986	Fulcomer ¹ , Misakian ¹ and Wisecup ²
May 8, 1985	Albert and Wisecup
March 18, 1985	Wisecup, Rosen ² and Dietrich ³
October 11, 1984	Fulcomer and Misakian
September 13, 1984	Albert, Wisecup, Rosen and Dietrich
January 25, 1984	Grodzinsky, Umans ⁴ and Dietrich
January 18, and February 7, 1984	Albert, Wisecup, and Rosen

CARSTEN

January 29, 1986	Fulcomer, Wisecup and Misakian
August 9, 1985	Wisecup, Rosen, and Dietrich
March 31, 1985	Martin, Albert and Fraser-Smith
March 21, 1985	Wisecup, Rosen and Dietrich
December 10, 1984	Martin and Fraser-Smith
October 26, 1984	Wisecup, Rosen and Dietrich
September 17, 1984	Martin, Albert and Fraser-Smith
July 27, 1984	Wisecup, Rosen and Dietrich
April 12, 1984	Wisecup, Rosen, Dietrich, Misakian and Fulcomer
March 5-6, 1984	Martin, Albert, Fraser-Smith, Wisecup, Rosen and Dietrich
March 28-29, 1983	Martin, Albert, Fraser-Smith, Deno ⁵ , Dietrich, Brudner ⁶ , Misakian, Rosen and Wisecup

COHEN

May 6, 1986	Rosen, Misakian and Fulcomer
July 17, 1985	Wisecup, Rosen, Misakian, Fulcomer and Dietrich
June 7, 1985	Marron and Martin
June 12, 1984	Misakian and Fulcomer ¹
August 27, 1984	Misakian and McKnight ¹
July 25, 1984	Wisecup, Rosen and Dietrich
March 6, 1984	Marron and Martin
November 15, 1983	Wisecup, Rosen and Dietrich
October 12, 1983	Wisecup, Rosen and Dietrich
July 22, 1983	Valentino ⁶
April 18, 1983	Grodzinsky, Martin, Shelanski, Umans, Brudner, Wisecup, Rosen and Dietrich

COHEN II

December 18, 1986	Rosen, Fulcomer, Wisecup and Misakian
September 11, 1986	Martin and Marron and Trent
May 6, 1986	Misakian, Fulcomer and Rosen

Table 3 (continued)

<u>Date</u>	<u>Team</u>
GONA	
April 11, 1986	Wisecup, Fulcomer and Misakian
March 21, 1985	Wisecup, Rosen, and Dietrich
December 11, 1984	Fraser-Smith, Albert, Wisecup, Rosen and Dietrich
May 9, 1984	Misakian, Albert, Wisecup, Rosen and Dietrich
January 9, 1984	Albert, Marron, Wisecup, Brudner, Rosen and Dietrich
September 26, 1983	Albert, Marron, Deno, Wisecup, Brudner, Rosen and Dietrich
GRAHAM	
February 20, 1986	Wisecup, Rosen and Dietrich
May 26, 1985	Dietrich
January 25, 1985	Wisecup, Rosen, Dietrich and Landay ²
May 2, 1984	Wisecup, Rosen, Dietrich and Klein ⁸
January 10, 1984	Marron and Shelanski
November 10, 1983	Marron, Shelanski, Wisecup, Rosen, Klein, Hebner ¹ , Misakian and Dietrich
March 17-18, 1983	Misakian and Fulcomer
January 23-24, 1983	Martin, Albert, Carpenter, Marron, Persinger, Shelanski, Wolpow, Valentino, Wisecup, Brudner, Rosen and Dietrich
September 30, 1982	Dietrich, Marron, Valentino and Wisecup
GUNDERSEN	
May 18, 1983	Fulcomer, Misakian, Wisecup, Rosen and Dietrich
January 26, 1983	Albert, Shelanski, Marron, Valentino, Wisecup, Rosen and Dietrich
October 8, 1982	Marron and Valentino
LIVINGSTON	
October 11, 1985	Marron, Martin and Trent
August 28, 1985	Misakian, Fulcomer, Wisecup, Rosen and Dietrich
April 16-17, 1985	Trent
April 24, 1984	Martin, Valentino and Klein
February 13, 1984	Martin, Valentino, Klein, Wisecup, Rosen and Dietrich
July 27, 1983	Wisecup, Misakian, Dietrich and Rosen
June 22-23, 1983	Martin and Valentino
April 1, 1983	Valentino
January 25, 1983	Albert, Marron, Martin, Shelanski, Valentino, Brudner, Wisecup, Rosen and Dietrich

Table 3 (continued)

<u>Date</u>	<u>Team</u>
OSSENKOPP	
April 25, 1984	Persinger, Albert, Carpenter, McDermott, ⁹ Wisecup, Rosen and Dietrich
July 14, 1983	Persinger, Fraser-Smith, Deno, Wisecup and Dietrich
RODAN	
July 26, 1984	Wisecup, Misakian, Rosen and Dietrich
April 17, 1984	Martin, Grodzinsky and Umans
September 16, 1983	Martin, Grodzinsky, Umans, Brudner, Wisecup, Rosen and Dietrich
September 6, 1983	Grodzinsky, Dietrich, Umans, Rosen, Wisecup and Brudner
SALZINGER	
July 22, 1985	Misakian, Fulcomer, Wisecup, Rosen and Dietrich
March 20, 1985	Wisecup, Rosen and Dietrich
June 27, 1984	Misakian and McKnight
April 11, 1984	Fraser-Smith, Wisecup, Rosen and Dietrich
March 6, 1984	Fraser-Smith, Wisecup, Rosen and Dietrich
July 13, 1983	Persinger, Fraser-Smith, Deno, Wisecup, Dietrich and Shelanski
SAVITZ	
August 18, 1986	Ahlbom
July 22, 1986	Wisecup, Rosen, Landau and Dietrich
March 20, 1986	Stebbing
May 17, 1985	Stebbing, Marron, Wisecup, Rosen, Landau and Dietrich
May 17-18, 1985	Stebbing and Marron
January 24, 1985	Stebbing, Wisecup, Rosen, Landau and Dietrich
July 23, 1984	Stebbing
May 22, 1984	Marron, Wisecup, Rosen and Dietrich
February 6-7, 1984	Stebbing, Marron and Brudner
STEVENS	
August 20, 1986	Martin and Ahlbom
June 11, 1986	Wisecup, Rosen and Dietrich
February 25, 1986	Wisecup, Rosen and Dietrich
June 14, 1985	Stebbing, Marron, Wisecup, Rosen, Landau and Dietrich
July 30 and	Wisecup, ⁸ Dietrich, Rosen, White ⁹ ,
August 17, 1984	Williams ⁸ , Marron and Stebbing
May 24, 1985	Marron, Wisecup, Rosen, Landau and Dietrich
May 23, 1985	Wisecup, Rosen and Dietrich
June 14, 1985	Stebbing, Marron, Wisecup, Rosen, Dietrich and Landau
October 5, 1984	Marron, ² Stebbing, Wisecup, Dietrich, and Wilson

Table 3 (continued)

	<u>Date</u>	<u>Team</u>
SULZMAN	April 9, 1986	Wisecup, Rosen, Misakian, Fulcomer and Dietrich
	March 19, 1985	Wisecup, Rosen and Dietrich
	October 23, 1984	Wisecup, Rosen and Dietrich
	March 20-21, 1984	Fulcomer and Misakian
	March 8, 1984	Marron, Valentino, Wisecup, Rosen and Dietrich
	March 29, 1983	Persinger, Marron and Valentino
	August 7, 1982	Marron and Valentino
THOMAS	July 16, 1986	Wisecup, Rosen and Dietrich
	October 15, 1984	Marron
	August 17, 1984	Stebbing, Marron, Wisecup, Rosen, Dietrich, Wilson and White
	April 19, 1984	Carpenter, Albert and Marron
	January 17, 1984	Misakian, Fulcomer, Wisecup, Dietrich and Rosen
	July 12, 1983	Albert, Persinger, Fraser-Smith, Zelingher ⁸ , Deno, Wisecup and Dietrich
	WINTERS	August 29, 1984
February 1, 1984		Martin, Marron, Shelanski, Wisecup, Klein and Dietrich
December 15, 1983		Wisecup, Rosen, Dietrich, Misakian and McKnight
May 4-5, 1983		Wisecup, Rosen, Dietrich, Misakian and Fulcomer
March 7, 1983		Grodzinsky and Umans
WOLPAW	April 8, 1986	Wisecup, Rosen, Misakian, Fulcomer and Dietrich
	March 14, 1985	Wisecup, Rosen and Dietrich
	October 22, 1984	Wisecup, Rosen and Dietrich
	March 19-20, 1984	Fulcomer and Misakian
	March 7, 1984	Marron, Valentino, Wisecup, Rosen and Dietrich
	March 28, 1983	Persinger, Marron and Valentino
	December 14, 1982	Wisecup, Rosen and Dietrich
August 6, 1982	Valentino and Marron	

Affiliations of members of site visit teams other than Scientific Advisory Panel members are: ¹National Bureau of Standards, ²W/L Associates, ³Electric Research and Management, ⁴Massachusetts Institute of Technology, ⁵General Electric Company, ⁶Argonne National Laboratory, ⁷The University of Arizona College of Medicine, ⁸Department of Energy, ⁹New York Power Authority, and ¹⁰The Ontario Cancer Institute.

Table 4

Assigned Responsibilities of Members of the Scientific
Advisory Panel for Review of Contractors' Projects

<u>Contractor</u>	<u>Assigned Panelists</u>
Basu	Albert, Grodzinsky and Wolpow
Carsten	Martin, Fraser-Smith and Albert
Cohen	Martin, Marron and Shelanski
Gona	Albert and Fraser-Smith
Graham	Shelanski, Marron and Persinger
Gundersen	Shelanski, Grodzinsky and Albert
Livingston	Martin, Marron and Shelanski
Ossenkopp	Persinger, Fraser-Smith and Stebbings
Rodan	Shelanski, Grodzinsky and Martin
Salzinger	Persinger, Fraser-Smith and Shelanski
Savitz	Stebbing, Ahlbom and Marron
Stevens	Stebbing, Ahlbom and Marron
Sulzman	Persinger, Marron and Wolpow
Thomas	Persinger, Fraser-Smith and Albert
Winters	Shelanski, Grodzinsky and Martin
Wolpow	Wolpow, Marron and Persinger

IV. ELECTROMAGNETIC FIELDS AND EXPOSURE OF HUMAN POPULATIONS

A. INTRODUCTION

Although there has been an increasing trend in recent years toward the long-distance transmission of electric power by high-voltage DC (HVDC) lines (Ellert and Hingorani, 1976), most of the electric power transmitted over long distances in the United States is still carried on AC lines. The AC electric power is normally generated and transmitted within a balanced three-phase voltage system, with the implication that the lines transmitting the power will have a basic configuration (called a single circuit) consisting of three conductors, in which the voltages have the same amplitude and frequency of variation (60-Hz in the United States and Canada and 50-Hz in Europe) but are out of step, i.e., differ in phase, by 120°. The conductors used in the lower-voltage circuits usually consist of a single wire, but for the higher-voltage circuits it is normal for a group of connected wires (known as a bundle) to be used for each conductor, in order to decrease the incidence of the electrical discharge known as corona. Thus a typical single-circuit 765-kv power line has three bundles, each of which is made up of four wires.

The transmission voltage used on these lines depends on the distance over which the power is transmitted and on the amount of power to be transmitted. Over long distances there is a very definite advantage in terms of reduced power loss in the lines to having as high a voltage as possible. Thus, as electric power has become more and more widely used, and as the required technology has been developed, there has been a steady increase in line voltage. In the early days of AC electric power transmission, the voltages used on the wires were typically 30-40 kilovolts

(kV), but by 1920 the majority of the lines were being operated at 132-kV and nowadays the voltages for long-distance transmission are typically either 500-kV or, most recently, 765-kV (Scherer and Vassell, 1985). Even higher transmission voltages are under study and the historical trend toward higher voltages suggests that they will surely receive widespread use in the future.

B. UNITS OF MEASUREMENT

Despite efforts at standardization, a variety of units continue to be used in electric and magnetic field measurements. We will use the Systeme International (SI) system, which is the basic system of units in use throughout the world. In this system the unit for electric field E is the volt per meter (V/m) and the unit for the magnetic flux density B is the tesla (T). In free space, or in air to a good approximation, the magnetic flux density is related to the magnetic field intensity H (units ampere per meter, or A/m) through the relation

$$B = \mu_0 H, \quad (1)$$

where the constant $\mu_0 = 4\pi \times 10^{-7}$ henry per meter.

As we have indicated by the use of a bold script, the electric and magnetic fields are vector quantities. Thus, at each point in space, the field quantities E and B have both a magnitude and direction, and in general both the magnitude and direction vary with time and with position. We will denote the magnitude of the vectors by using normal script, i.e., E denotes the magnitude of the electric field, and B the magnitude of the magnetic flux density.

Within the SI system of units, there are several different size representations of the basic volt per meter and tesla units of measurement that are relevant to this report. We have already quoted voltages in

kilovolts, where 1 kilovolt is 1000 volts, and the electric fields produced by power lines are frequently measured in kilovolts per meter (kV/m). The tesla unit for magnetic flux density is a large unit, and smaller denominations are frequently more convenient to use. The most common of these denominations are the millitesla (mT), microtesla (μT), and nanotesla (nT), representing one thousandth (10^{-3}), one millionth (10^{-6}), and one billionth (10^{-9}) of a tesla, respectively. Two other common units in use are the gauss (G), where $1 \text{ G} = 100 \mu\text{T}$ (or $1 \text{ G} = 10^{-4} \text{ T}$), and the gamma (γ), where $1 \gamma = 1 \text{ nT}$.

C. AMBIENT ELECTRIC AND MAGNETIC FIELDS

The earth has a quasi-static electric field at the surface that is typically directed downwards and has a magnitude of the order of 100 V/m during good weather which may change to an upwards directed field of the order of 5 kV/m during a local thunder storm (Volland, 1984). The earth's magnetic field is much less dependent on local conditions, but it tends to vary over the earth's surface. Its magnitude changes from maximum values in the range 60-70 μT (0.6-0.7 G) at high latitudes (there are two points of maximum in the northern hemisphere, and one in the southern hemisphere) to a minimum of about 23 μT (0.23 G) off the coast of Brazil. The magnitude is typically small, in the range of 25-40 μT (0.25-0.40 G), at low latitudes. Power line electric and magnetic field magnitudes may be compared with these typical quasi-static values for the earth, but it is important to remember that the latter values are effectively DC and their comparison with magnitudes of power line and other more rapidly oscillating fields may have little biologic significance.

Measurements have been made of the natural electric and magnetic field fluctuations in the lower part of the extremely-low frequency range (ELF;

frequencies in the range 3-Hz to 3-kHz), which includes the 60-Hz power line frequency, and there is a major study of global electromagnetic noise in the frequency range 10-Hz to 32-Hz currently in progress (Fraser-Smith and Helliwell, 1985). The data presented in the latter reference suggest that a typical amplitude range in the United States for naturally occurring magnetic field fluctuations at 60-Hz is 0.04-0.4 pT (measured in a 1-Hz bandwidth centered at 60-Hz), where the picotesla (pT) is 0.001 nT. These amplitudes are very small compared with the amplitudes of the 60-Hz magnetic fields normally encountered in the vicinity of power lines (cf Section G, below).

Data on the natural 60-Hz electric field amplitudes in the United States are provided by Maxwell and Stone (1963) and Maxwell (1966). Typical values lie in the range 0.1-0.6 mV/m. Once again, in the following section we will see that these amplitudes are very small compared with those normally encountered in the vicinity of power lines.

D. ELECTRIC AND MAGNETIC FIELDS IN THE HOME AND WORKPLACE

Fields in both the home and workplace have been characterized. Measurements by Gauger (1985), Miller (1974), and Norris et al. (1986) are summarized in Figs. 1 and 2. Also shown in the Figures are related values for the ambient fields discussed in the previous section, and field levels near the vicinity of power transmission and distribution lines. Magnetic fields in the home and workplace can be in the same range as those found near power lines although the distribution of fields within the home varies a great deal. On the other hand, electric fields beneath transmission lines are at least an order of magnitude greater than those experienced by the general population in all but a few specialized circumstances. Electric field strengths beneath distribution lines are similar to those found in the

ELECTRIC FIELD STRENGTHS (60 Hz)

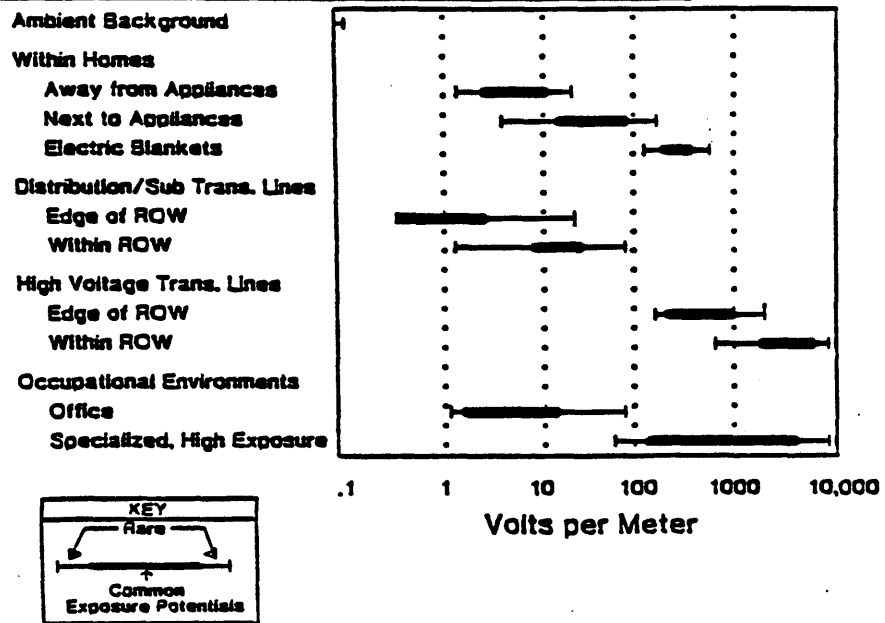


Figure 1. Electric fields measured in various locations.
 (Adapted with permission from WEST Associates, 1986)

MAGNETIC FLUX DENSITY (60 Hz)

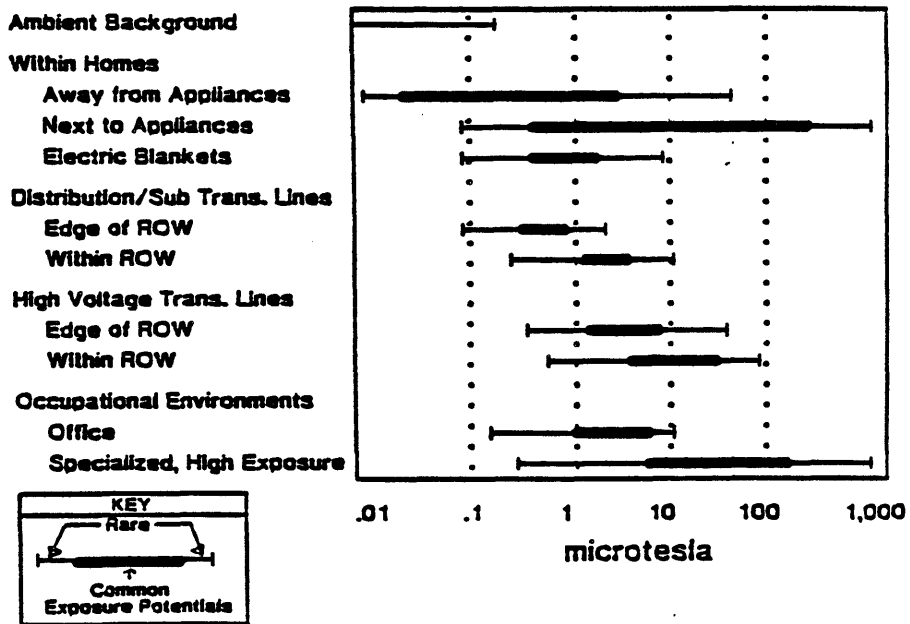


Figure 2. Magnetic flux densities measured in various locations (Adapted with permission from WEST Associates, 1986).

home near appliances. These figures are adapted from the WEST Associates Report (1986).

Measurements of fields in homes were made and reported in the two epidemiological studies supported by the New York State Power Lines Project (Appendices 15 and 16). Generally speaking, measurements made in these very detailed studies of electric and magnetic fields in the home agree with those reported in the studies cited above, at least within the fairly wide range of variability characteristic of such measurements.

The measurements performed by Kaune and associates as part of the Stevens' project (Appendix 16) were extensive and involved sampling both electric and magnetic fields in 43 different homes every two minutes during a 24-hr period. Each residence was completely characterized in terms of the electrical power distribution wiring that serviced the home and the neighborhood. One conclusion of this study is that residential magnetic fields are correlated with the external distribution wiring servicing the home as characterized by the wiring code developed by Wertheimer and Leeper (1979; 1982). Kaune and associates also present an improved prediction model for magnetic fields in the home that uses the total number of service drops, the distance to neighboring transmission lines, and the number of phase conductors in neighboring primary lines.

One additional conclusion of the study by Kaune and associates is that obvious sources of magnetic fields — lights, appliances, etc. — are not major contributors to residential fields in regions far from the appliances. The findings of both this study and the study by Savitz et al. (Appendix 15) support the original hypothesis of Wertheimer and Leeper (1979) that stray ground currents are a very important source of residential magnetic fields.

Standards for either population or occupational exposure to 60-Hz

electric fields have been adopted in several countries and six states within the US, including New York State. These are summarized in the World Health Organization Environmental Health Criteria Document (1984) are reproduced in Table 5. Note that only in Oregon is the standard codified as a law. The New York State standard was adopted as a temporary standard by the Public Service Commission pending the outcome of this Project, and reflects the situation beneath the existing 345-kV transmission lines. The only existing standard for exposure to power line frequency magnetic fields known to us is the Soviet standard summarized in the Table 6. The scientific basis for the Soviet standard is not known to us.

E. ELECTRIC AND MAGNETIC FIELDS NEAR TRANSMISSION LINES

The electric and magnetic fields produced in the vicinity of extra-high-voltage (EHV) power transmission lines have been carefully measured and well documented. One of the most general references is the "Transmission Line Reference Book," which is published by the Electric Power Research Institute (EPRI) and contains measurements made largely by the General Electric Company (EPRI, 1982). Useful results for 500-kV lines have been published by Bracken (1976) (525-kV line; electric field results only) and by Lambdin (1978) (510-kV line; electric and magnetic fields). However, the results of most interest to us are those pertaining to 765-kV lines and here, in addition to the EPRI (1982) handbook just cited, Allan and Salman (1974), Deno (1976), Driscoll (1975), Lee et al., (1979), Tell et al., (1977), and Zaffanella and Deno (1978) provide much pertinent information. In general, there is greater emphasis on the electric fields produced by the lines, but adequate data are available for the magnetic fields (Deno, 1976; Driscoll, 1975; EPRI, 1982; Zaffanella and Deno, 1978). Details of the recommended field measurement techniques have been published by a committee of the Institute of Electrical and Electronics Engineers (IEEE, 1978).

TABLE 5

MAXIMUM ELECTRIC FIELD LEVELS (kV/M) FOR HIGH VOLTAGE TRANSMISSION LINES

State	In RoW*	Edge RoW	Comments
Minnesota	8	-	
Montana	7	1	In RoW at road crossings
New Jersey	-	3	
New York	7	1.6	In RoW at road crossings
North Dakota	9	-	
Oregon	9	-	State Law

* RoW = Right of Way

TABLE 6

SOVIET STANDARD FOR EXPOSURE TO 50-HZ MAGNETIC FIELDS

Time (hr)	Field (A/m)	Flux Density (mT)	Flux Density (G)
1	6000	7.5	75
2	4900	6.1	61
3	4000	5.0	50
4	3200	4.0	40
5	2500	3.1	31
6	2000	2.5	25
7	1600	2.0	20
8	1400	1.8	18

There are important general differences between the electric and magnetic fields produced by power transmission lines which should be emphasized. The first of these differences concerns the sensitivity to the current flowing in the lines. Once a power transmission line is raised to its operating voltage, the amplitudes of the electric fields produced by the line are essentially independent of the currents flowing in the conductors comprising the line. On the other hand, the magnetic fields produced by the line depend primarily on the currents flowing in the conductors, and not on the line voltage. Thus a specification of line voltage alone is inadequate to define the magnetic field levels that a particular line is likely to produce.

Another important difference concerns the directions of the fields. The electric fields on the ground beneath an overhead power transmission line are necessarily very nearly vertical at all times, whereas the magnetic fields on the ground are largely confined to planes perpendicular to the lines (although there can be a small component parallel to the lines), where, due to the phase differences of the currents flowing in the individual line conductors, the horizontal and vertical components combine to give a total magnetic field vector that rotates at the power line frequency.

F. ELECTRIC FIELD MEASUREMENTS

In an investigation involving both measurements and computations of the electric field beneath 765-kV overhead power transmission lines, Tell et al. (1977) obtained the following results for a particular line, which can be considered typical: The maximum measured electric field strength beneath the 765-kV line was approximately 10 kV/m at 3 feet above the ground, with the two symmetrical points of maximum field being located just outside the

outer phase conductors. At the same locations, at a height of 6 feet above the ground, the field increased to 12.5 kV/m. The field strength decreased to 1 kV/m at approximately 170 feet from the center of the right of way (RoW; the center of the RoW also represents the central point of a cross-section of the line) and to 100 V/m at approximately 360 feet from the RoW center. Figure 3 shows a view of the line with an electric-field measurement in progress.

Note that the above measurements were made beneath the lowest point of the 765-kV line, which was 47 feet above the ground, when measured to the center conductor, and 48-49 feet above the ground when measured to the two outer conductors. The maximum electric field observed on the ground, or more specifically at the standard distance of 3 ft above the ground, increases as the height of the lines decreases, as would be expected (Driscoll, 1975; Deno, 1976). However, the minimum height that can occur, with present 765-kV line design, appears to be about 40 ft (Tell et al., 1977), and for this height the maximum electric field is about 12 kV/m.

The electric fields beneath power lines can be calculated by using well-established techniques and the computed values agree well with measured values. To illustrate, a comparison of calculated and measured electric field strengths is made in Figure 4, taken from Tell et al. (1977). It will be seen that there is good agreement between the values shown in the figure and even better agreement would probably have been possible if allowance had been made for deviations of the actual line heights from the assumed nominal value of 46 feet.

Some computed total electric field profiles for a typical 765-kV line with various line clearances in the range 30-70 ft are shown in Figure 5. It can be seen that decreasing the clearances of the line increases the electric field substantially in the vicinity of the line.

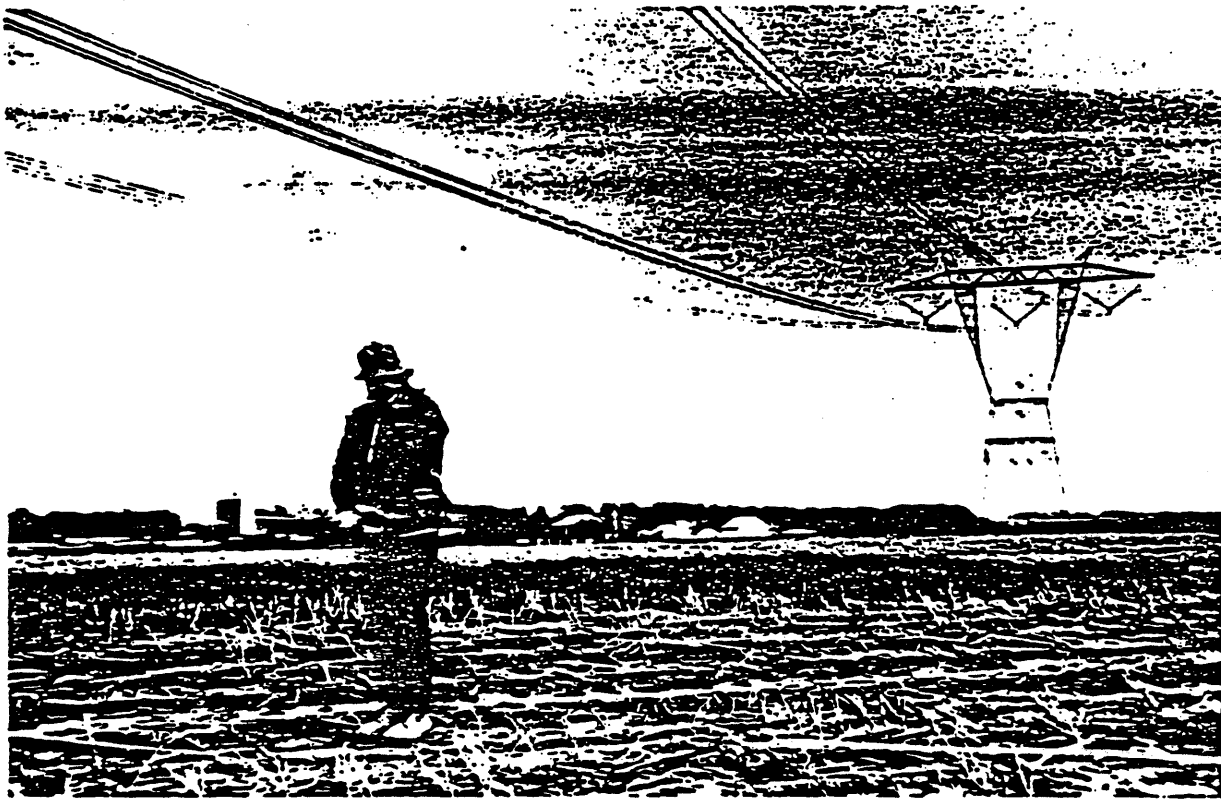


Figure 3. Photograph of an electric field measurement under a 765-kV overhead power transmission line (Tell et al., 1977).

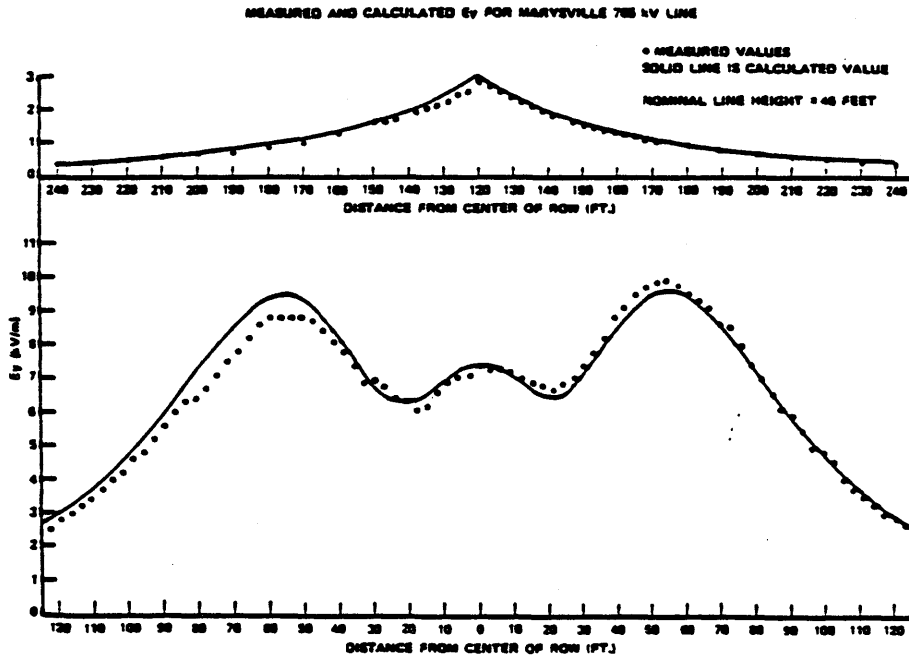


Figure 4. Measured and calculated values of the vertical component of the 60-Hz electric field beneath a 765-kV power transmission (Tell et al., 1977). The top panel shows the field variation in the distance range 120-240 feet to either side of the center of the right-of-way.

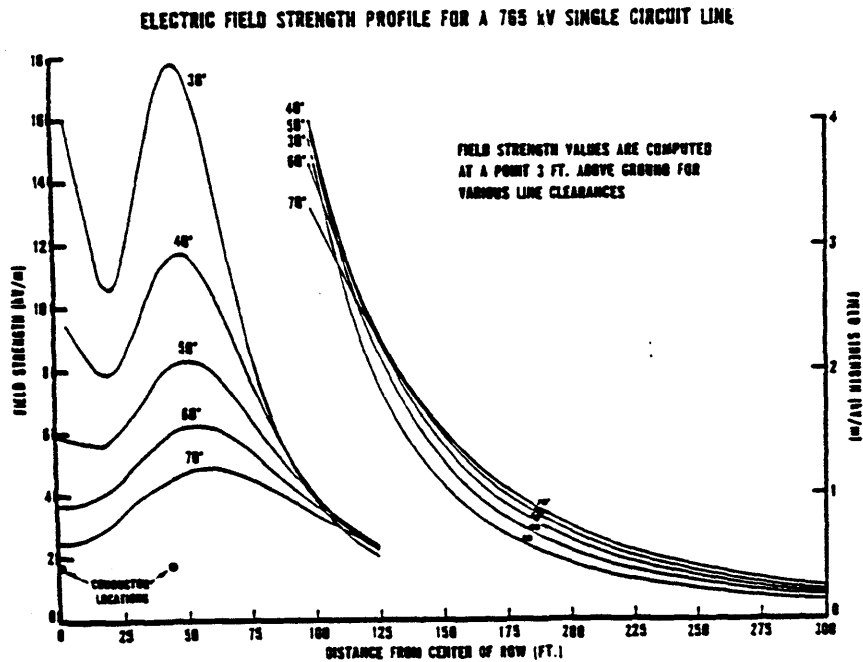


Figure 5. Variation of the total electric field as a function of height above the ground for a 765-kV overhead power transmission line. The left-hand vertical scale applied to the curves on the left, which cover distances out to 125 ft from the center of the line, and the right-hand scale applies to the curves on the right, which cover distances greater than 125 ft (Tell et al., 1977). The profiles are symmetrical about the center of the line, i.e., about the central conductor of the three-conductor line.

Figure 6 shows the variation of the computed maximum total electric field (which occurs just outside the outer conductors of the line) as a function of height above the ground for the simple single-circuit 765-kV line considered by Tell et al. (1977). The electric field obviously increases rapidly once the point of observation approaches the line itself. Close to the ground, however, the field varies very little with increasing height.

Finally, Figure 7 compares the magnitudes of the calculated vertical and horizontal electric field components produced 6 ft above the ground in the vicinity of a 765-kV line (Tell et al., 1977). The horizontal component, E_x , is so small in comparison with the vertical component, E_y , that the magnitude of the total field is indistinguishable from that of E_y . Deno (1976) shows the electric field vector loci at many different positions around a 765-kV line, and provides other additional data confirming the predominantly vertical nature of the electric field near the ground.

From these experimental and computed results, we can conclude the following: (1) the electric fields produced beneath 765-kV power lines are well understood and can be calculated accurately, (2) the magnitudes of the fields vary substantially depending on the height of the line above the ground, and with the position of the field point beneath the line, and (3) the fields are predominantly vertical and vary little with height near the ground. Further, it appears that the maximum electric field amplitude that is likely to be observed beneath a standard 765-kV line in normal operation is of the order of 10 kV/m. Comparing this latter value with the magnitude of the naturally-occurring electric noise that would probably be observed at the same location in the absence of the overhead line, we can also conclude that the power-line electric fields are substantially greater than the

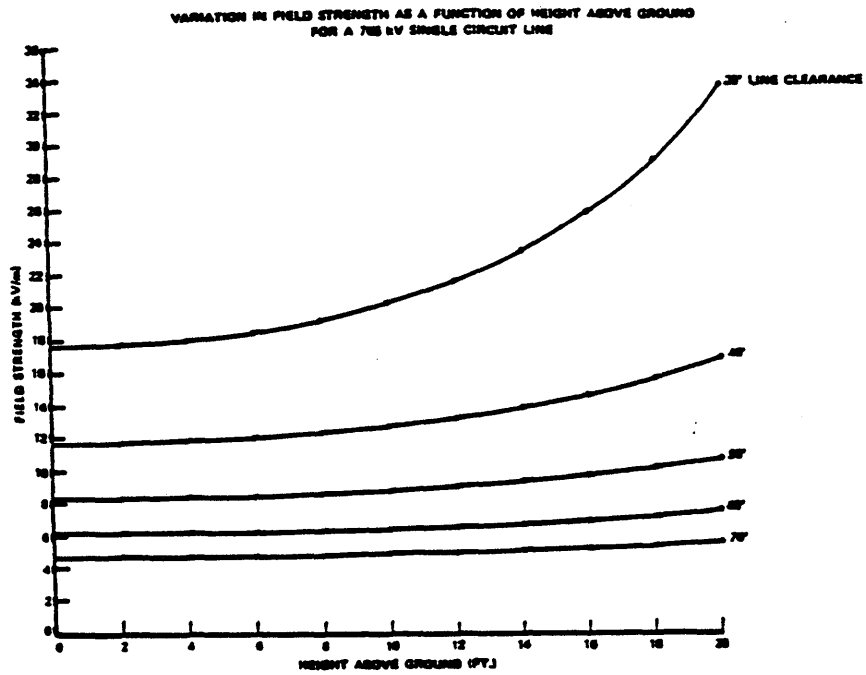


Figure 6. Computed variation of the total electric field as a function of height above the ground for a 765-kV single-circuit overhead power transmission line (Tell et al., 1977).

E_x , E_y AND $|\vec{E}|$ FROM 765 kV POWERLINES AT 6 FT. ABOVE GROUND

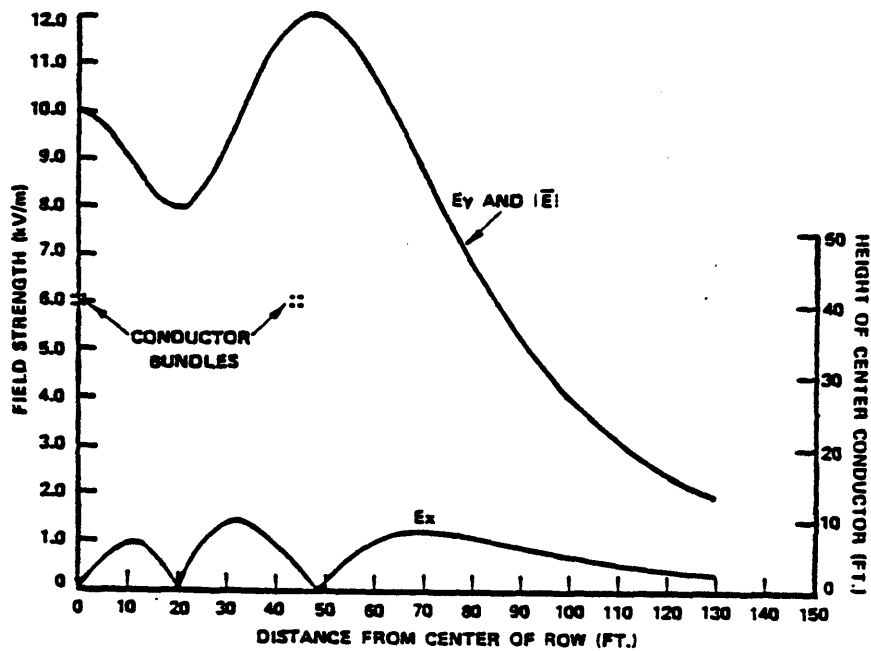


Figure 7. Variation of the magnitudes of the horizontal, vertical and total electric field at 6 ft above the ground beneath a 765-kV power line (Tell et al., 1977). The right-hand vertical scale gives the height of the conductor bundles. The left-hand scale applies to the curves.

natural fields: a 10 kV/m field is 7-8 orders of magnitude larger than the typical natural 60-Hz field of 0.1-0.6 mV/m described in Section 3.

G. MAGNETIC FIELD MEASUREMENTS

The magnetic fields produced by EHV power lines are more complex in terms of their spatial and temporal variations than the electric fields, and they have been less studied. However, there are adequate measurements and computational results available for us to describe their properties in general terms.

Figure 8 shows 4 different total magnetic flux density profiles for a 765-kV line carrying 4000 A. Once again, as might be expected, the largest fields near the ground occur for the line with the lowest height above the ground. In the example shown, the magnetic flux density reaches a maximum at a point just inside the outer conductor and its value is about 66 μT (0.66 G) for the line with a height of 42 ft. Interpreting the data in the figure more broadly, we see that the magnetic flux density is likely to exceed 20 μT (0.2 G) for all points within a distance of 100 ft from the center of the right-of-way.

The magnetic fields produced by a 765-kV overhead line appear to vary more with height of the measurement point above the ground than do the electric fields. To illustrate, taking a line 42 ft above the ground and carrying 4000 A, Driscoll (1975) shows the maximum flux density increasing from about 63.3 μT (0.633 G) at 1 meter above the ground to 78.5 μT (0.785 G) at 3 m above the ground, for a 24% increase. This is larger than the corresponding electric field increase for a 40-ft line height shown in Figure 6.

Deno (1976) and Zaffanella and Deno (1978) show many loci of the magnetic-flux-density vector ellipse in the vicinity of a 765-kV line. Near

MAGNETIC FIELD STRENGTH IN GAUSS (10^{-11} T)

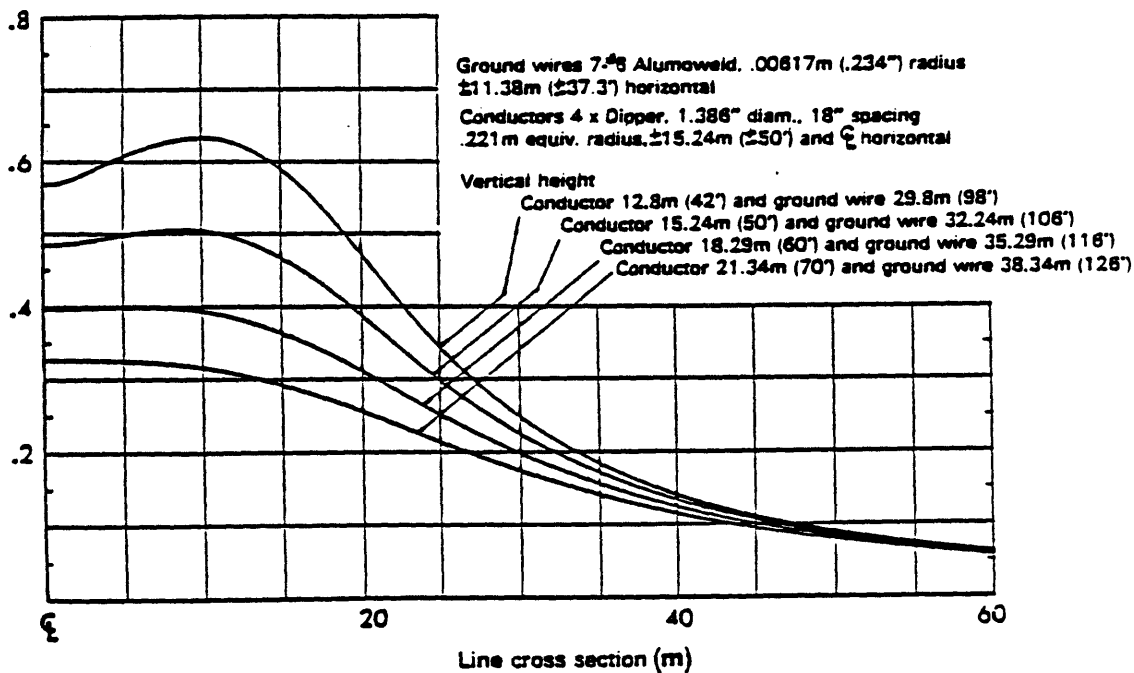


Figure 8. Magnetic field magnitudes at 1 meter above the ground for a 765-kV overhead power transmission line carrying 4000 A and with conductor heights at four different heights in the range 42-70 ft (Driscoll, 1975).

the ground at large distances from the line (distances greater than 60 meters) the vertical component of the flux density is substantially greater than the horizontal component, but just outside the outer conductors of the line the horizontal component can greatly exceed the vertical; directly beneath the center conductor the two components are comparable in size. In general, therefore, the magnetic flux density vector near the ground rotates in an ellipse with highly variable characteristics.

Deno (1976) and Zaffanella and Deno (1978) also compare a number of computed and measured magnetic flux density values for a variety of overhead power lines, with relatively good agreement observed.

As we have pointed out, the magnetic fields produced by power lines depend on the current that is flowing in the wires. We have only seen magnetic field data for currents less than or equal to 4000 A, and we will assume that that is a typical maximum current flowing in a 765-kV line. With that assumption, we may conclude the following: (1) the magnetic fields beneath 765-kV overhead power lines are well understood and can be calculated accurately, (2) the magnitude of the fields varies substantially depending on the height of the line above the ground and with position of the field point beneath the line, and (3) the fields have significant horizontal and vertical components near the ground, with the vertical predominating at large distances from the line. Further, it appears that the maximum magnetic flux density amplitude that is likely to be observed beneath a 765-kV line in normal operation is of the order of $70 \mu\text{T}$ (0.7 G). Comparing this latter value with the magnitude of the naturally-occurring magnetic noise that would probably be observed at the same location in the absence of the overhead line, we can also conclude that the power line magnetic fields are substantially greater than the natural fields: a $70 \mu\text{T}$

field is roughly 5-6 orders of magnitude larger than the typical natural 60-Hz field of 0.04-0.4 pT described in Section C.

H. SPECIFICATION OF FIELDS FOR STUDIES FUNDED BY THE POWER LINES PROJECT

The request for proposals issued in 1981 contained an appendix that provided specifications for exposure systems. This appendix is reproduced as part of Appendix 1 to this report, together with a document prepared later and distributed to all contractors explaining and altering the original specifications for the phase relationship between electric and magnetic fields. Exposure systems constructed with support from this Project all employed the phase-angle relationship described in Appendix 1.

During the past two years four studies have appeared that suggest biological systems may respond to power line fields differently depending on the intensity and, possibly, the direction of the ambient DC magnetic field (Blackman, et al., 1985; Thomas et al., 1986; Leal et al., 1986; and Smith et al., 1987). One of these (Thomas et al. 1986) was supported by funds from this Project. In future studies it would be important to carefully document the direction and levels of ambient DC magnetic fields. It should be noted that the earth's DC magnetic field does not vary substantially over time. If lack of information of the ambient DC magnetic field of past studies should ever prove to be a problem, it probably could be reconstructed to a good approximation from a measurement of the earth's field at the relevant laboratory's location.

V. EFFECTS OF ELECTRIC AND MAGNETIC FIELDS ON BIOLOGIC SYSTEMS

A. REPRODUCTION AND DEVELOPMENT

A review of the literature existing in 1981 on genetic, chromosomal, teratogenic and reproductive effects of 60-Hz electric and magnetic fields revealed no unassailable proof of induction of these types of biological damage. However, there were several reasons why studies in this area were designated of major importance for research sponsored by the New York State Power Lines Panel:

- ° If any biological damage of these types is associated with power line exposures, there could be a significant impact on public health.
- ° Some studies reported deleterious effects on fertility of rodents and on European electric-power-station workers. Although the results and conclusions of these studies could not be accepted by the panel because of serious methodologic flaws in their design and implementation, nonetheless, the question whether there is a basis for the concerns generated in the public mind by these publications needed to be explored.
- ° Theoretical considerations of effects of electric and magnetic fields make it unlikely, but not impossible, that damage to gametes and conceptuses could be produced by exposure to these agents.
- ° These biological variables are always included in investigations of potential deleterious agents by regulatory and scientific bodies because of their major impact on human populations.

To appreciate the rationale behind the studies of discussed in this section, it may be helpful to review some basic biological principles.

The phenotype, or total composition of an organism, may be assessed by various endpoints: anatomy (body structure), physiology (body function),

behavior, health and reproduction. The blueprint for the phenotype is contained in the genetic material (genotype, DNA), contained in the parental chromosomes in the egg and sperm which unite to form the zygote, the beginning of the next generation. The zygote (later called the embryo and fetus) is exposed to the maternal environment per se, and through the mother, is also exposed to agents of the outside world. These environmental agents interact with the genotype to produce the phenotype. There is a normal range of prenatal development for humans. Deviations from this range may be caused by abnormal genes (such as those for hemophilia or dwarfism), abnormal amounts of chromosomal material (for example, the chromosomal defect producing Down syndrome), impaired maternal health (such as diabetes, which increases the risk for spina bifida), or teratogens which reach the fetus through the maternal environment and act directly on the fetus (for example, thalidomide which causes limb reduction). Agents increasing the rate of gene mutations are said to be mutagenic, those causing chromosome damage are clastogenic, those acting directly on the fetus to cause abnormal development are called teratogenic. Miscarriages, stillbirths, and the production of physically malformed and mentally retarded individuals can result from any of these causes.

The question of concern to this Project is whether or not electric and/or magnetic fields act to disturb reproduction and development, thus increasing the background rate of abnormalities. This question is amenable to experimental investigation. For example, if early miscarriage rate is the endpoint of interest, it can be studied directly through epidemiologic investigation of human populations and/or by laboratory studies of animals. Ethical and legal considerations preclude exposing human fetuses to potentially harmful agents, therefore the only epidemiological approach available is to study the response of humans to "natural" exposures. However, evidence of induction of chromosome

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damage to cells in tissue culture by electromagnetic fields in laboratory studies can provide indirect evidence of reproductive loss because most (60%) first trimester miscarriages are caused by chromosomal abnormalities (Boue et al., 1975). Chromosomal abnormalities can also impair reproduction in the adult through effects on hormones or gametogenesis. If chromosomal damage cannot be demonstrated in the laboratory, it is not likely to occur in exposed humans. Animal studies are also valuable for testing the possibility of deleterious effects of environmental agents. The limitations of these approaches are cost and the possibility of different responses of humans and animals.

Although studies of humans have appeal because they directly examine the organisms of interest, it is usually very difficult to determine whether an environmental agent increases the rate of genetic mutation or of chromosomal aberrations (changes in number or structure of the chromosome) by conducting epidemiologic investigations in the human population. Even if exposure to some environmental factor induces such damage, it may not be expressed for several generations or the mutation or chromosomal aberration may be selected against so early in egg or sperm formation that it is not detectable in the human population studies. In addition other causes of gametic or fetal damage must be ruled out, such as age of the mother. Another difficulty in studying possible reproductive effects of electric and/or magnetic fields in humans directly is that one must rule out many other known or potential hazardous substances, such as defoliants, which may be associated with power lines. Furthermore, such studies usually require large numbers to be investigated in the necessary detail, and there is considerable difficulty in classifying exposures. The numbers of births that occur to women living close to overhead transmission lines may not be large enough to give an adequate sample size (due to low population density in those areas), making it unlikely that a small but significant increase in birth defects will be detectable.

For all these reasons, the Panel elected to pursue evidence for genetic chromosomal, teratogenic and reproduction effects in laboratory studies of whole animals and tissue cultured cells rather than epidemiologic surveys. If evidence of damage were found, epidemiologic studies might be warranted in the future, and could be more focused based on the types of damage found in laboratory studies. If no damage were found, expenditures on human studies might not be a high priority.

The principles used to select and design relevant studies were based on principles used to establish the safety of other environmental agents, in particular those to which pregnant women may be exposed. Experimental designs for such studies have been developed over the years by various investigators, governmental regulatory agencies, and scientific organizations. Although no comprehensive protocol has reached the status of an absolute standard, the Panel incorporated several of the well established protocols, guidelines and recommendations [current FDA protocols for drug safety testing, (Bloom, 1981; Wilson and Clarke-Fraser, 1979)] and well established principles of genetics as defined by experimental breeding. These criteria have indeed led to the detection of deleterious agents in the past.

1. Chromosomal (Cytogenetic) Damage; Sister Chromatid Exchange

Investigations of chromosomes from cells exposed in vitro are useful because agents known to damage chromosomes in the intact organism, e.g., ionizing radiation such as x-rays, will also show evidence of damage in vitro. However, if damage is shown in laboratory studies of exposed cells in tissue culture, it does not necessarily mean that exposed humans will also show evidence of chromosomal damage. It would mean that further studies on whole organisms are needed. Conversely, if no chromosome damage is detected in vitro, these results are reassuring, assuming exposures encompassing those to which

humans are subjected are actually delivered to cells in the laboratory. Studies of cell cycle can also be predictive of fetal effects because development is a carefully orchestrated sequence of cellular interactions, disruption of which can lead to birth defects.

The chromosomal endpoints chosen for investigation by the Panel were sister chromatid exchange (SCE) frequencies, chromosomal aberrations and micronuclei formation. SCE is a well established assay for mutagens and carcinogens, although it is not a perfect correlate. Micronuclei formation is correlated to exposure to established clastogens, e.g., ionizing radiation. Three different groups investigated SCE frequencies and found no effects:

- ° Brookhaven (Carsten and Benz, Appendix 10) analyzed chromosomes derived from blood samples of chronically exposed mice; no increases of SCE were found, but sample sizes were small; more slides may be scored in the future.
- ° University of Maryland (Cohen, Appendix 4) performed extensive studies on SCEs from human lymphocytes exposed in vitro; no effects were found. (See also Cohen et al., 1986a and b)
- ° University of Utah (Livingston, Appendix 6) found no effect on either SCE or micronuclei (an assay of chromosomal aberration) frequencies in either human blood lymphocytes or Chinese hamster ovary (CHO) cells.

These studies were all performed using well tested and monitored exposure apparatus, were done blinded to avoid scorer bias, and were replicated. Therefore, SCE can be said not to be induced by electromagnetic fields at the levels tested. This is reassuring and suggests that further SCE testing is not required. Micronuclei were also not increased in the CHO

study, and chromosomal aberrations were not detected in human or CHO cells. These results suggest that it is unlikely that electromagnetic fields damage human chromosomes. Single gene mutations were not investigated in cells, although they were in animals (see section V.A.3). Also mutation assays to detect DNA alterations, such as the Ames test, were not included among the New York projects, but such effects have not been found in other studies (Juittinen and Limatainen, 1986; Riverie, 1976). Most such studies are performed in bacterial cells or cell lines, and the focus of the projects supported here was on human cells (although a CHO cell line was used in one set of experiments by Dr. Livingston). Effects on isolated DNA were not pursued because ELF fields are not expected to produce enough energy to break DNA bonds and even if DNA damage occurred, there are interpretive difficulties in extrapolating to human health hazards.

2. Cell Cycle (Generation) Time

No exposure effects were found by the Brookhaven Laboratory on lymphocyte cell cycle time. However, sample sizes were small and only one cell type was examined. Nonetheless, this does not support the hypothesis that cell growth is affected by chronic exposure. The Utah group also studied cell cycle in CHO cells and concluded that exposure had no effect.

3. Teratogenesis, Growth and Development and Fertility

The need for an animal study to investigate effects of exposure on fetal development and fertility was met by the Brookhaven investigation. The goal was to investigate two different species, rat and mouse, in order to control for species variability because perfect correlation does not exist between animal and human responses. Because of funding and logistic difficulties (reconstructing special cages for rats), only a mouse study was completed. However, two strains of mice were used. This is desirable

because it is well known that some agents are only harmful to animals of certain genetic backgrounds, that is to say that strain specificity as well as species specificity exists. In addition, effects vary depending on the developmental stage. Several endpoints were investigated after exposure of both male and female gametes, including frequency of dominant lethal gene mutations (DLM test), multigenerational effects (litter sizes; postnatal growth as measured by weight) and induction of recessive lethal mutations on the X chromosome as inferred by sex-ratio deviations. Fertility was also measured by impregnation rates. The mouse study was multigeneration to simulate long-term exposures in humans, and to increase the likelihood of autosomal recessive gene expression. Exposures were for 20/24 hours per day, for the animals' lifetime. Mice were housed in three rooms with as identical environments as possible except for the presence of fields (high, low and no exposure, see Appendix 10 for details). Skeletal and other anatomic defects would only be revealed by dissection and were not within the scope of the time and funding limitations. However, large samples of mice have been preserved for future analysis.

If effects had been detected in the mouse study, further investigations could have been designed and implemented to focus on the mechanism of damage. However, because no effects were found, further testing of mice is not indicated for these same endpoints. Extrapolation of risks from results of animal studies to humans is tenuous given the complexities of human exposures (possible interactions with other agents to which humans are exposed), different physical sizes of the organisms, and lack of perfect correlation in biologic responses to the same agent. However, the fact that no damage has been detected in the two strains of mice in the Brookhaven study is reassuring even if this does not constitute definitive proof that humans are similarly not vulnerable to these fields.

4. General Review of Previous Work

a. Electromagnetic Fields and Growth and Development: Although animals are traditionally used to investigate fetal effects of environmental agents (see above), it is problematic whether animal models adequately simulate human exposures to electromagnetic fields because of differences in size, shape and orientation of the bodies, which in turn affect surface electric fields and internal current densities. Furthermore, if animals are exposed to intense fields practical difficulties arise because of shock, corona and other factors which may cause artifactual biologic effects (see review by WHO, 1984).

Of the numerous studies of the effects of 60-Hz fields on growth and development of rats, mice, swine and rabbits, most show no conclusive evidence for deleterious effects (see review by the WHO, 1984). There are, however, several studies reporting effects on mice, rabbits and swine which have received considerable attention, although in all cases they are tainted by the possibility of causes other than fields, as discussed below.

Knickerbocker (1967) reported decreased body weight in male offspring of exposed mice. Reports of fields effects on growth and development in mice were published by Marino et al. (1976; 1980). Three successive generations of mice were exposed 24 hours per day from mating through the 119th day of life of the third generation. In comparison to controls, mice exposed to vertical fields (15 kV/m) exhibited increased infant mortality in all three generations, while those exposed to horizontal fields (15 kV/m) showed increased infant mortality only in the first generation. Body weights were also measured but no consistent effects were found. The authors suggest that "the increased mortality must be ascribed to a nonspecific action of the electric field - the field produced a biological

stress...". However, the major criticism of these studies is that spark discharges from water bottles have not been ruled out and may constitute a source of stress to the animals and have affected fetal development through maternal deprivation.

The findings of Marino et al. (1976; 1980) have not been confirmed. Fam (1980) exposed mice to 240 kV/m 60-Hz fields for three months and found no developmental effects of any kind in the offspring. Konermann and Mönig (1986) found no developmental effects in rats exposed to fields. Sikov, et al. (1979; 1984) exposed Sprague-Dawley rats to 60-Hz fields at 100 kV/m, 20 hours per day throughout mating, pregnancy, and up to day 25 after birth using cages designed to eliminate effects of corona discharge and ozone production. Sikov et al. found no lasting differences in any aspect of reproduction and development, including body weights, fetal abnormalities, brain pathology, postnatal mortality, or a variety of behavioral and neurological tests. However, significant transient differences were found in motile behaviors and the righting reflex in 14-day rats. At 21 days of age the differences were no longer significant, raising the possibility of neurological repair of potential field-induced damage.

Other reports of field effects are on growth and development in rabbits (Hansson, 1981). He reported stunting of growth of wild rabbits reared outdoors in a 50-Hz field, but did not find effects when the same rabbits were exposed in a laboratory setting. Other aspects of, and problems with, this study are discussed below in Section D-1.

Phillips and colleagues (1981; 1983; Sikov et al., 1982; 1985) studied the effects of uniform, vertical 60-Hz electric fields on reproduction and development of Hanford miniature swine followed for three generations. They report an increased incidence of fetal malformations in the second but not

the third generation, but no consistent differences in litter size, fetal weight or weight of fetal organs. The authors suggest that the effect, if real, was probably secondary to some maternal alteration, possibly an epidemic which occurred during that period, and indicate that the change in incidence of malformations between generations make it impossible to unequivocally conclude that there was a cause-and-effect relationship (Sikov, 1985).

There is evidence that electric fields are involved in directing embryonic cell migrations which are crucial for fetal development. Epithelial layers in developing embryos generate small DC fields in the embryo, and patterns can be altered by exposing cells in vitro (Erickson and Nuccitelli, 1984).

Cameron et al., (1985) observed retardation of fertilization of Medaka fish eggs exposed to magnetic fields ($100 \mu\text{T}$), or electric ($300 \text{ mA}/\text{m}^2$) plus magnetic fields for 48 hours. The authors scored "stage", which they define. Regardless of "effect", all eggs hatched and no abnormalities were observed. However, their analysis does not compare the distribution of eggs at each stage for each treatment. Instead, they treat "stage", as a continuous variable leading to standard errors expressed as "0.2 of a stage", which is meaningless. Inappropriately plugging those numbers into analysis of variance may give significant differences between "mean stages" unless all eggs are at exactly the same stage.

Application of electrostatic pulsed fields (28.5 kV/m in air, pulse width $10 \mu \text{ sec}$ 300-Hz) to mice chronically (4 hrs/day) from the first to 17th day of pregnancy were reported to produce increased preimplantation resorptions, late resorptions, and dead fetuses in small samples (~20) (Lekarstvi, 1980). Hematomas were observed in the placentas and membranes

of the exposed groups. No malformation or weight differences were observed. No exposure details were provided, so other factors attending exposure, e.g., microshocks, cannot be ruled out to explain the defects. Nakagawa (1979) claimed that homogeneous static magnetic fields retarded gestation, number of live births, birth weight and growth in mice.

b. Electromagnetic Fields and Chick Embryogenesis: Delgado and colleagues (Delgado, et al., 1982; Ubeda, et al., 1983) studied the effects of magnetic fields on embryogenesis in chicken eggs. Pulses were applied at three frequencies, 10-, 100- and 1,000-Hz, with current adjusted to provide magnetic flux densities of 0.12, 1.2 and 12 μ T at each frequency. After 48 hours of incubation they reported that 13.4% of control but 78.5% of exposed embryos were abnormal. These effects were said to occur at a "window" of 100-Hz and 1.2 μ T, and fewer abnormalities were seen at 10-Hz or with lower (0.12 μ T) or higher (12 μ T) fields. At all frequencies the cephalic nervous system was most commonly affected. Staining with Alcian blue (pH 3) revealed the complete absence of glycosaminoglycans in the extracellular matrix in eggs exposed to 100-Hz, 1.2 μ T fields. These molecules are thought to be involved in normal cellular migration and development and could, by their absence, be a sole cause of the stunted development found by Delgado and coworkers. Ubeda et al. reported that pulse shape also influence the results.

Delgado's findings have not been confirmed by other laboratories. Neither Maffeo et al. (1984) or Martucci, et al. (1984) has found abnormalities in exposure of chick eggs while using experimental parameters similar to Delgado's. While differences in wave-forms, egg handling, or strain may be responsible for these discrepancies, there may be a larger problem in reproduction of Delgado's techniques. Even if Delgado's results

are replicated, extrapolation cannot be made from these studies to human fetuses, because developmental control is so different in these species. Experimental effects on chick embryos have not been found to be predictive of any human fetal effects of the same agent (Wilson, 1978).

c. Reproductive and Chromosomal Studies in Humans: With regard to studies on humans, the article by Knave et al. (1979) extensively describes the Swedish State Power Board study of reproduction. In addition to being based on a small sample, one of the serious biases inherent in their analysis is the lack of comparability of control and highly exposed groups, although matching for age, geographic location, and duration of employment was attempted. The fertility differences could easily be explained by the differences in educational level (social economic status) which is correlated with reproduction patterns, and differences in psychological performance demonstrated by the authors. More importantly, as the authors themselves point out, the differences in numbers of children and per cent of males was present 10-15 yrs. before the "experimental" group worked in the 400-kV substations, and therefore must be due to other factors. Other variables which must be included in fertility analyses are age at marriage, length of time married and contraceptive use. It is interesting that workers in high-voltage fields are said to be away from home more than "control" workers. This could also affect fertility, as could the stress of their jobs. The authors themselves admit that fertility effects are "thought to be related to factors other than exposure". Consequently, this study has not demonstrated fertility effects of occupational exposure.

In their more expanded study (Nordstrom et al., 1983) sample size was increased, and the authors now claim increased congenital malformations. Comparison of the types of "malformations" scored reveals many categories

that should not be included because they are not considered "major malformations" but rather variants or minor anomalies. Furthermore, based on what is known about these anomalies it is difficult to postulate how exposed sperm could contribute to their etiology. Specifically: a) hip joint deformities may merely result from breech deliveries (5-6%), b) hydroceles are very common in the first years of life, some may lead to inguinal hernias (1% of males) and c) retentia testis is also fairly common. Types b and c should not be considered major malformations, and if genetic, would have to be due to dominant gene mutations in sperm. This would be unusual as known mutagens such as ionizing radiation do not act through sperm.

If heart murmurs were included as "heart malformations" those should also be excluded, but we will assume for purposes of discussion the authors only refer to "major" cardiac anomalies. Turner's syndrome is the only chromosomal defect found in the study; the "multiple malformations" are not necessarily due to chromosomal syndromes or mutations. Thus chromosomal aberrations are not a likely mechanism to explain their observations. If analysis is restricted to major malformations, the comparisons among the 3 groups are: group 1 = 8/154 (5.2%), groups 2 + 3 = 2/364 (0.5%), group 4 (control) = 6/171 (3.5%). The differences are not startling. Casting further doubt that the etiology of any of the malformations is due to paternal exposure to fields is the lack of specificity in the classification of the "malformations".

No chromosomal aberrations or increased SCE frequencies were found in switchyard workers in Germany occupationally exposed for more than 20 years to 50-Hz AC (380-kV) fields compared to controls (Bauchinger et al., 1981). This contrasts with results on Swedish switchyard workers which attribute chromosomal aberrations to spark discharge (this hypothesis was supported by their in vitro work).

The claims for increases in chromosomal aberrations in peripheral blood cultures obtained from workers in high voltage electromagnetic fields were not conclusive in the early reports (Knaave et al., 1979). The frequencies of chromosome breakage were compared between 8 employees exposed to 400-kV and a "reference group" of 19. Several methodological problems made this study inconclusive. i) The sample size was very small. ii) In view of the many well established factors which increase the frequency of chromosomal aberrations (viral infection, age, drugs, x-rays, laboratory techniques) it is crucial to match controls carefully, and rule out these factors, or to examine a large enough sample to randomize these effects. The Nordstrom study did not correct for these biases; in fact, it was mentioned that smokers showed a higher frequency of aberrations. iii) It is not sufficient to state that "chromosome breakage" was increased without specifying the type of aberrations, laboratory techniques (aberration background frequencies vary over time in different laboratories) and methods for randomization and blinding.

The 1983 study by Nordstrom et al. removed some of these problems in that smokers were not included in either exposed or control groups, cultures were scored blindly and control and exposed cultures were processed concurrently. However, a big difference still exists among comparison groups in exposure to organic solvents, which are likely to be clastogenic. Although chromosomal rings and dicentrics characteristic of ionizing radiation exposure are listed among the exposed, they are not discussed and suggest exposure to other clastogens. The authors attribute breaks to spark discharge. Spark discharges are most likely to affect peripheral blood cells (fingertips) from which the chromosomes in the study were prepared, and the authors' speculation about testicular exposure effects are difficult to justify.

The claims of Wertheimer and Leeper (1986) that use of water beds and electric blankets affects fetal growth do not appear justified. A biased sample of births was selected by phoning parents who had published birth announcements. These two criteria (phone, publication) would eliminate lower socio-economic and non-English speaking families from the sample. The authors also note a bias toward older parents. The authors assume without proof that use of water beds and electric blankets is randomly distributed among the group selected, so comparisons still could be made between users and non-users. Further biases may result from the use of only 30% (1256/4271) of eligible cases.

The claim of "seasonal patterns in fetal growth and abortion rate for families using electrically heated beds" is not justified because:

- ° Numbers of abortions are used without knowing how many pregnancies occurred - therefore fetal loss rates cannot be and were not determined in this study. Furthermore induced abortions were not determined and excluded.
- ° The measures devised by the authors for "slow", "average" and "fast" fetal growth is clinically meaningless because it cannot be converted to birth weight differences, for which standard, clinical criteria exist.
- ° Information on water beds and electric blankets was very crude and not necessarily correlated with pregnancies in the sample (68% of the 42% of families publishing birth announcements were asked over the phone if they were "users" in the last 8 years, and what heat settings they preferred); there is subjective switching of categories between "users" and "non users" if the bed was only used part of the year before conception.
- ° The "seasonal categories" selected by the authors are September - June vs. July - August. This is totally arbitrary and creates uneven comparison categories. Results may differ if different groups are chosen.

The authors state that when using traditional, clinically relevant definitions of "low birth weight" there is no difference between "users" and "non-users". Attempts to discern temporal trends from such small samples (e.g., 6 defective) is tenuous given the well-known artifacts in temporal clustering of defective births examined in large series of births. High intensity fields might cause developmental defects by hyperthermia, but maternal homeostatic mechanisms would be expected to insulate against all but extreme variation.

In summary, proof of human fetal effects of electric or magnetic fields does not exist and such effects are unlikely, based on what information is available from studies of non-human organisms, and from knowledge of the mechanisms of action of established teratogens. There are no standard epidemiologic investigations of the effects of electromagnetic fields on fertility and birth defects. The few studies purporting to examine these questions show no convincing deleterious association with exposure. Indeed it would be difficult to conduct appropriate epidemiological studies which would answer this question because of the very large samples that would need to be studied. Clearly defined endpoints would have to be determined in standard fashion to remove bias. Such studies if done properly, are unlikely to be informative given the difficulties of obtaining "controls" free of exposure in a modern population, or of estimating "dose". Meanwhile, caution in exposure to magnetic fields is clearly warranted until more work on magnetic fields is done. Statements such as that made by Smith et al. (1984) that exposure of human fetuses to magnetic fields in clinical magnetic resonance imaging is completely safe at all stages of pregnancy are unjustified by either human or animal studies. If further studies are done they should focus on magnetic fields, since the few reported positive results implicate magnetic field, rather than electric field exposures.

B. CANCER

1. IN VITRO STUDIES: GROWTH (CLONOGENICITY) OF CANCER CELLS IN SOFT AGAR

a. Initial Results: Although not an objective of the original New York State research protocols, the results of Drs. Winters and Phillips (Appendix 9; Phillips et al., 1986a and b)) regarding clonogenicity of tumor cells in soft agar must be discussed because

- ° this work was made possible by funding under the New York program which was used to construct the exposure apparatus and to support Dr. Winters and his laboratory;
- ° public concern was generated by these investigators' claims that magnetic fields stimulate growth of tumor cells in soft agar.

It is important to note that these investigators did not find evidence of transformation of normal (non-malignant) cell lines after electromagnetic field exposure as measured by soft-agar cloning. Indeed, had they presented evidence that transformation of normal cells was induced by electromagnetic exposure, this might have been of some significance. Increased cloning in soft agar is far more meaningful if observed for normal cells than for tumor cells, since tumor cells already have the capability of division prior to exposure. The cloning assay was developed by Hamburger and Salmon (1977 a and b) for comparing the differential response of malignant cells to drugs.

The cloning in soft agar test would not have been the assay of choice in investigating the effects of electromagnetic fields on cancer induction and/or promotion for a variety of reasons (Croce, 1986) including:

- ° there is only loose if any association of clonogenicity with clinical parameters such as a) metastatic behavior, b) progression of disease and c) response to therapy or survival of cells derived from tumors;

- ° there is no correlation of clonogenicity of cells derived from tumors with tumor induction in mice, although there is some correlation with tumor induction for normal fibroblastic tissues;
- ° there is extreme variability inherent in the assay, meaning that to be meaningful, intraexperiment differences observed must exceed the normal interexperiment variation and experiments must be carefully done and replicated to guard against artifacts caused by i) lack of linearity between colony numbers and cell numbers plated, ii) cell cloning rather than colony formation and iii) general health of the culture.

These investigators exposed many cell lines, both normal and malignant to either electric, magnetic or electric and magnetic. These cells and unexposed controls were then plated in soft agar, and the number of clones that grew were scored. Winters and Phillips found their "dramatic effects" on one of their first 27 experiments that reported a "24-fold" increase in clonogenicity after exposure to magnetic fields. This was said to be a permanent effect based on subsequent subculture. Other increases reported after exposure were not startling given the obvious variability even among controls (See also Phillips et al., 1986a and b). Only 2 of 27 individual data sets in this set of experiments were found by outside experts to support the investigator's conclusions that effects were produced by electromagnetic fields. The outside experts concluded that "When the overall experience is taken into account, the data demonstrated sufficient inherent noise to rule out any conclusion (positive or negative)". Dr. Winters and Phillips may have ". . . prematurely reached a conclusion of significance from their preliminary data." (Trent and Buick, p. 5, paragraph 2, site visit report, 29 August 1984, Appendix 18). Thirteen of

these "preliminary" experiments persist unchanged as the basis for Tables 43 and 44 in Dr. Winters' final report and appear to be the foundation for most of the investigator's statements to the press and in legal testimony.

Table 45 of Winters' final report presents actual colony counts as means and standard deviations in addition to standardized values. Assuming these ten experiments are new and are replicates, the increases are not so dramatic as originally claimed: 19 of the 30 values after electric, magnetic and electric plus magnetic exposures are 2-fold or less increased above controls, and 7 are at or below control values. Of the 4 higher values (6.0, 4.8, 4.6, 3.4), three occurred after magnetic exposure, indicating that if any effect exists it follows magnetic exposure. However, the effect is within the range of normal variation for unexposed colo 205 and colo 320 cells. The question is whether statistical and biological significance can be equated. Even if these results are valid they cannot be extrapolated to cancer growth in humans, because ability of tumor cells to grow in soft agar has only loose, if any, to behavior of tumor cells in the intact organism.

Dr. Trent's evaluation of Dr. Winter's final report (Appendix 18) mentions that the one new Table (45) does allow independent assessment of variability. "However, despite statements to the contrary, there remains considerable experiment-to-experiment variability, and the interpretation that this reviewer would make is that a lack of rigid quality control may have contributed to this variation. The tabular summary presentation of data excludes independent review of the data. What analysis could be done "dampens the enthusiasm of significance". However using Table 45, Dr. Trent's reanalysis of the data showed an effect of magnetic fields, suggesting the existence of a small effect. The Panel agrees with Dr. Trent

that " . . .one must also consider the significance of this finding as indeterminate at present".

b. Replication of Initial Studies: A replication of the cloning in soft agar studies was performed by Drs. Cohen and Hamburger under an extension of the contract to Dr. Cohen after completion of his original study on chromosomes (Appendix 18). The two cancer cell lines used in this experiment were the same as those Drs. Winters and Phillips used (Appendix 9). These lines were not obtained directly from Drs. Winters and Phillips, but from the American Type Culture Collection, Rockville, MD. Drs. Winters and Phillips do not state the immediate source of their cells, but these all originally derived from the same two patients (Semple et al., 1978; Quinn et al., 1979). After being established, cell lines such as these are maintained in culture. Each time they are moved to new vessels for growth, they are said to be "passed". Therefore, the "fifth passage" would be a cell line closer in origin to the original patient source than the "tenth passage". Cell lines do exhibit changes over time, therefore this variable should be the same for control and exposed cultures to insure comparability. We have no information on the passage numbers of the cells used in the Winters-Phillips experiments. All the Cohen-Hamburger experiments were run within 15 passages, and were the same for control and exposed pairs.

The growth kinetics were established for both cell lines prior to running experiments. This was to insure that experiments were run in the logarithmic growth phase, so that linear responses could be expected between cell number and clone numbers. Otherwise, artifacts could be induced by different numbers of viable cells in the comparison groups at the beginning of the experiment before exposure, or artifactual responses not caused by "treatment". The number of cells used in each culture well was 5×10^5 , that number providing optimum clonogenicity response.

Each experiment of the Cohen-Hamburger project consisted of a set of 4 culture wells being exposed (2 wells of each of the 2 cell types) and a concurrent set of wells in the control incubator. Four agar plates were prepared from each well, and after 7 days, colonies of >40 cells each were scored in blind fashion to avoid scorer bias, either with an inverted microscope or a FAS image analyzer (similar to that used by Winters and Phillips). Eight different exposure regions were tested, with 2-3 replicates each (38 total experiments). The authors conclude that no consistent pattern of exposure effects occurs in their data. In order to see if a "time window" exists at which length of exposure (6,24,30 hrs) had an effect, a separate set of experiments was run on colo 320 DM (selected because it had "the most consistent cloning efficiency"). There was no evidence of such a phenomena.

c. Oncogene Studies: Molecular Genetic Analysis of Tumor Cells

Exposed to Electromagnetic Fields: In order to pursue further the possibility of effects of electromagnetic fields on tumor cells, colo 320 cells from Cohen's lab were shipped to Trent for investigation of the c-myc oncogene locus (Appendix 18). Colo 320 had been found to contain amplification and enhanced expression of the cellular oncogene c-myc. This means that multiple copies of the c-myc gene have been found in colo 320, and altered myc expression may contribute significantly to tumorigenesis (Alitalo et al., 1983).

No evidence of altered c-myc expression (via quantitative RNA dot blotting), c-myc gene copy number (via quantitative DNA slot blotting), or c-myc gene structure (via Southern blotting) was found. The pattern of c-myc in colo 320 reported previously was confirmed, but no field effects were detected.

Transitory effects that may have disappeared during inter-lab shipment cannot be ruled out, but the effect on clonogenicity reported by Phillips and Winters was said to be "permanent". If oncogenes caused that effect, they would have been expected to persist.

2. HUMAN EPIDEMIOLOGY

a. Introduction: Since 1979 several studies have indicated that children living in homes near power lines or other electric transmission facilities or in homes with elevated electromagnetic fields run a higher risk of cancer. There are also studies on adults reporting similar results. Several studies have reported that "electrical workers" might be at increased risk. The New York State Power Lines Project included two epidemiologic studies addressing this issue, one on adults and the other on children.

The objective of this section is to review the previous research within this area, to analyze the results of the two New York State Power Lines Project studies, and to pull together all of the epidemiologic information of relevance to this issue.

b. Previous Research

i. Residential studies: This review will start with the studies based on residential exposure. Before the two studies within the New York project were undertaken, information was available from seven previous studies; only five were published in scientific journals, but the remaining two were available as extended abstracts from a scientific meeting. A summary of characteristics of these reports is given in Table 7, which also includes descriptions of the two new studies.

A review of these studies must emphasize the potential systematic errors that might be present owing to the design or the conduct of the

investigation. It is essential, however, to recognize the two possible effects that a bias can have: 1) it may give rise to a spurious effect, i.e., to make a study show an apparent effect that does not exist in reality and 2) it may mask a true effect, so that it does not appear as an effect in the study. A study showing no effects should not be criticized on the basis of systematic errors of the first type and, similarly, a study showing strong effects should not be criticized on the basis of systematic errors of the second type.

The research in this area has frequently been criticized for using crude and operational definitions of exposure. Basically, three different approaches have been employed: a) identification and coding of nearby wires, transformers and substations combined with estimations of the resulting magnetic fields ("wiring configuration"), b) field measurements at one point in time, and c) identification of nearby transmission facilities and measurement of the distances to the home. For information on the approach used in each of the studies, refer to Table 7.

The first approach, the wire coding, has been criticized on two grounds. Firstly, the wire coding does not take into account magnetic fields generated by sources other than the transmission facilities, such as unbalanced return currents or currents used for appliances. Secondly, it has been claimed that the wire-coding systems and the procedures used for estimating the fields generate results with poor correlations to the true fields.

The second approach, the point-in-time measurement, has its drawbacks because of the variations over time of the magnetic fields, which in turn are a consequence of the variation in use of appliances, heating, etc. It appears that short- as well as long-term field variations are considerable; this seems also to be true for variations between different locations within the homes.

Table 7

Characteristics of Studies on Residential Exposure
to Low Frequency Magnetic Fields and Human Cancer

Study	Study Design	Diagnosis	Location	Exposure Assessment	Number of Cases
<u>Childhood Cancer</u>					
Wertheimer & Leeper, 1979	case-control	all	Colorado, USA	wire coding	328
Fulton et al., 1980	case-control	leukemia	Rhode Island	wire coding	110
Myers et al., 1985	case-control	all	Yorkshire, UK	calculated fields	376
Tomenius, 1986	case-control	all	Stockholm, Sweden	measured fields	699
Savitz, 1986	case-control	all	Colorado, USA	measured fields, wire coding	125
<u>Adult Cancer</u>					
Wertheimer & Leeper, 1982	case-control	all	Colorado, USA	wire coding	1,179
Coleman et al., 1985	case-control	leukemia	London, UK	distance	769
McDowall, 1986	cohort	all	East Anglia UK	distance	814
Stevens, 1986	case-control	leukemia	Seattle, USA	measured fields, wire coding, calculated fields	114

The third approach, using the distance between a home and an identified transmission facility as a proxy for exposure is simply a crude variant of the wire coding, using only one category for all kinds of transmission facilities.

Clearly, all these three approaches have certain limitations. However, as long as cases and controls are classified according to the same principles, these limitations represent what is termed random, or non-differential, misclassification of exposure, and they cannot give rise to spurious effects; they can only mask a true effect, if there is one. If a masking effect occurs, it is produced by means of a dilution either of the exposed group with a certain proportion of truly unexposed subjects, or of the unexposed group with a proportion of truly exposed subjects. Therefore, this source of bias seems to be of relevance for the studies showing no effects but not for the studies showing effects.

In addition to the problems mentioned above, Wertheimer and Leeper, (1979; 1982) used a design for data collection whereby the person who drew the map to be used for the wire coding knew whether the house belonged to a case or to a control. This source of bias, unlike the one discussed above, could give rise to spurious effects. The authors have made some attempts to evaluate the magnitude of this possible bias, but its importance remains unclear.

The study by Tomenius exhibits a different problem in that it is not stated in the report whether or not field measurements for cases and controls were made within the same time periods. If case and control measurements are not uniformly distributed over time, a bias could certainly arise in any direction because of time variation in electricity use.

In several of the studies (Wertheimer and Leeper, 1979; 1982; Fulton, et al., 1980; Tomenius, 1986) the homes, rather than the individuals, constituted the units of study. These were all case-control studies; indeed no one would

attempt to do this in a cohort study for it would be obvious in a cohort study that if homes were used as study units, everyone who had lived in more than one home would, mistakenly, be counted more than once. Given the rationale behind the case-control design, the use of homes rather than individuals is no more justified in such studies than in cohort studies. The question remains, however, of the impact which this feature of the study design has had on the results. It seems reasonable to assume that the point estimates of relative risks are not biased in any predictable direction, but that the confidence limits appear tighter than they should, because the study size appears bigger than it is. Fortunately, all reports, except the one by Fulton, et al., also give sufficient information to allow for the calculation of some individually based results.

In none of the studies did the available information allow for control of confounding from factors other than some basic demographic variables, and it has been suggested that, for example, a socioeconomic gradient in childhood cancer incidence together with a difference in the socioeconomic distribution between neighborhoods near power lines and other neighborhoods could explain the observed associations. Other confounders have also been proposed and are certainly tenable. However, to give rise to a relative risk of 2.0, the confounder would have to show quite a close association with the exposure in question and the relative risk associated with the confounder has to exceed 2.0 by a fair amount. It is not immediately clear if there are any risk factors, known at this time, which fulfill these criteria. Indeed, for childhood cancer the etiology is generally unknown and consequently only a few reasonably well-established risk factors are available as potential confounders.

Figures 9-12 summarize the results from the available studies, including the two studies performed within this project. For all studies, relative risks

ALL CHILDHOOD TUMORS

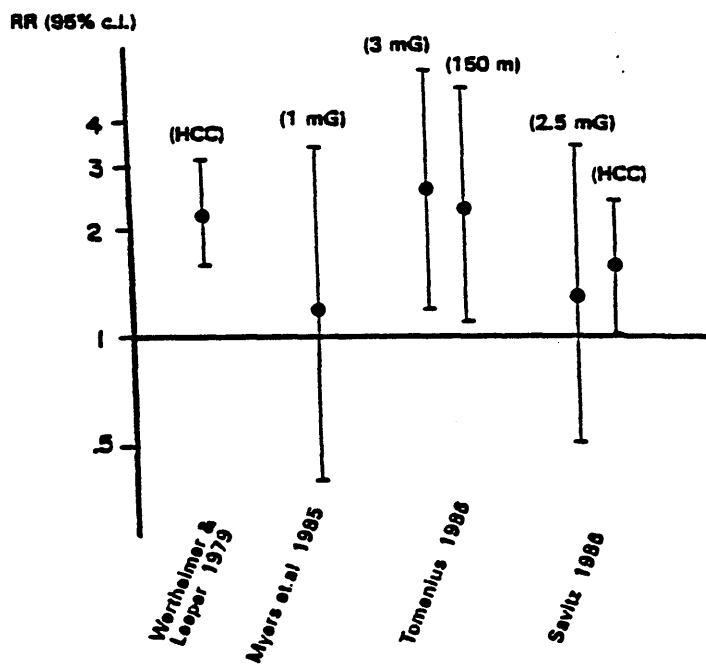


Figure 9. Results of childhood cancers in relation to magnetic fields. The studies from which the data are derived are listed at the bottom, and the method of measurement used indicated above the error bars. RR = relative risk; c.l. = confidence limits; mG = milli Gauss; HCC = high current configuration; 150 m = 150 meters from power line or transformer.

CHILDHOOD LEUKEMIA

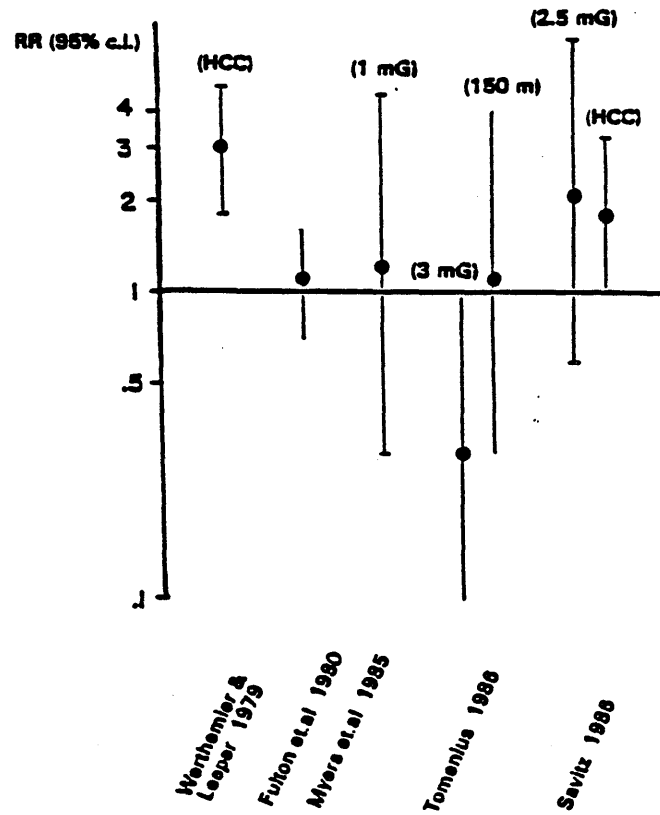


Figure 10. Results of reports of childhood leukemias in relation to magnetic fields. The studies from which the data are derived are listed at the bottom, and the method of measurement used indicated above the error bars. RR = relative risk; c.l. = confidence limits; mG = milli Gauss; HCC = high current configuration; 150 m = 150 meters from power line or transformer. Open-ended bars indicate that calculations were based on residences rather than individuals.

CNS TUMORS

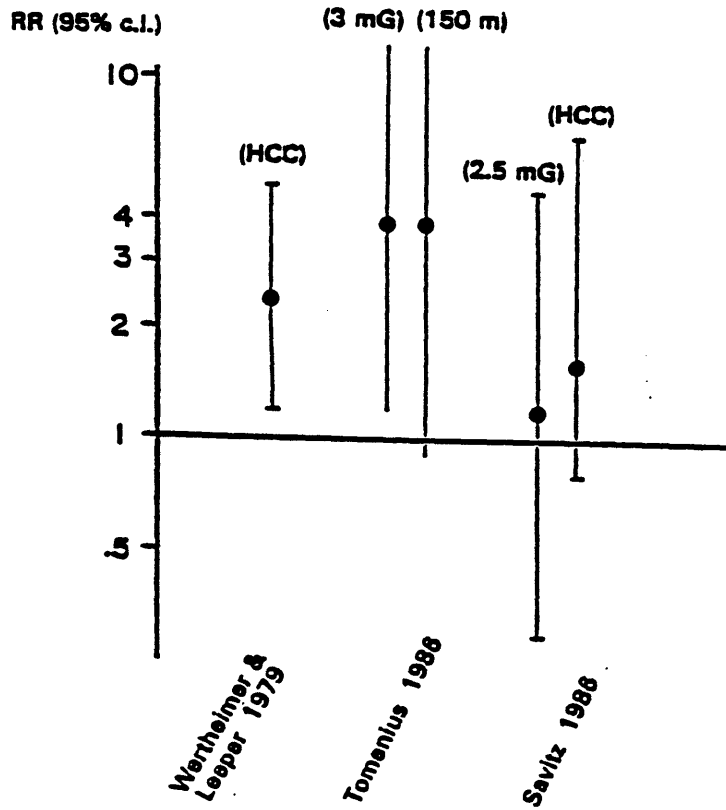


Figure 11. Results of reports of childhood CNS tumors in relation to magnetic fields. The studies from which the data are derived are listed at the bottom, and the method of measurement used indicated above the error bars. RR = relative risk; c.i. = confidence limits; mG = milli Gauss; HCC = high current configuration; 150 m = 150 meters from power line or transformer. Open-ended bars indicate that calculations were based on residences rather than individuals.

ADULT TUMORS

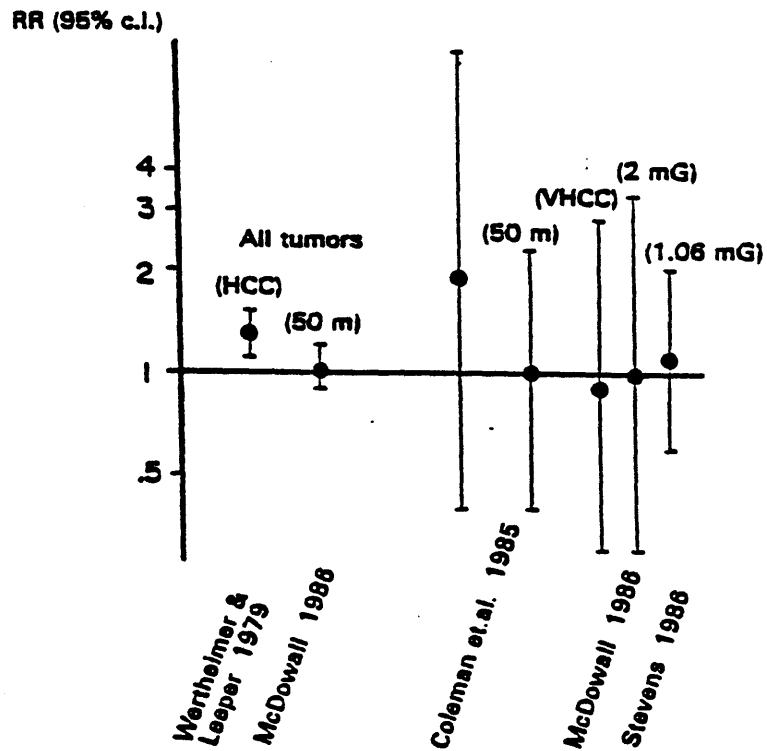


Figure 12. Results of reports of adult tumors in relation to magnetic fields. The studies from which the data are derived are listed at the bottom, and the method of measurement used indicated above the error bars. RR = relative risk; c.l. = confidence limits; mG = milli Gauss; HCC = high current configuration; VHCC = very high current configuration; 50 m = 50 meters from electric installation.

and 95% confidence limits are given for certain exposure measures at the time of diagnosis. For some of the studies, results based on more than one such measure are given. In studies where this information was not given, it has been calculated from absolute numbers presented in the reports. The open-ended bars indicate that the calculations are based on residences rather than individuals and that they are therefore uncertain and probably too narrow.

Figure 9 gives the results for the studies with data on all childhood tumors, regardless of site. Figures 10 and 11 give similar information for studies with information on childhood leukemia and childhood central nervous system tumors. Figure 12, finally, displays the results from the adult cancer studies. These results will be discussed later on, together with the findings from the two studies within this project.

ii. Occupational studies: Perhaps the earliest claim for deleterious effects of electricity in occupational health was made regarding craftsmen working with amber, where it was reported "The workmen polishing amber suffer considerably from electrical excitement, often experiencing severe nervous tremors of the hands and arms." (Williamson, 1932). Several subsequent reports have indicated that people employed in "electrical" occupations are at increased risk of developing leukemia. These studies have been reviewed by Savitz and Calle (1987). These occupations include telegraph and radio operators, power and telephone linemen, electrical and electronic engineers and electronic assemblers.

The majority of these reports are based on census information or some other kind of routinely collected register information. Hence, very limited information is available about the study subjects and only crude analysis, such as the PMR analysis, is usually presented. The major difficulty in the interpretation of the results is that so little information is available about

exposure to electromagnetic fields as well as to other possible risk factors such as solvents.

Despite the obvious limitations of these studies and the erratic findings, it is difficult to avoid the conclusion that there is a certain consistency between the results. It seems more likely that these occupations are at an increased risk of leukemia than that a random phenomenon is observed or that some sort of bias is operating. If these "electrical" occupations are in fact at increased risk, whether or not the explanation is known, then it seems warranted to include long-term exposure to magnetic fields on the candidate list.

c. Research Within The New York State Project

i. Childhood cancer study: The objective of the childhood cancer study within the New York State Power Lines Project (Savitz, Appendix 15) was to repeat the original study by Wertheimer and Leeper, and also to improve and evaluate certain aspects of the study design.

Two approaches were employed for exposure assessments, namely direct point-in-time measurements within the homes and coding of wires and other transmission facilities. In both instances all assessments were made without knowledge of whether a particular home was a case or a control home. The measurements were taken under high-power conditions, with lights and appliances turned on, and under low-power conditions, with as much of the electricity as possible in the houses turned off. The purpose of the low-power-condition measurements was to measure external contribution to the magnetic fields in the house. The combination of wire coding and field measurements provided an opportunity to evaluate wire coding against actual measurements. An important finding was a correlation between magnetic field measurements and wire codes. Although there was substantial overlap in measured fields across wire code

levels, there was a monotonic increase in mean field measurements over wire code levels.

Another important asset of this study is that information was collected through a questionnaire on a wide variety of potential confounders, such as socioeconomic status, smoking and x-rays. It turned out, however, that all results were basically unchanged when this information was used to control for potential confounding.

Also it is important to note that this study was designed as a population-based case-control study in the sense that eligible cases included all cases in the defined population and that the control group was selected according to a principle ensuring that it can be considered a random sample from the population. This means that, except for problems due to registration and location and non-response, the validity of the case series and the control series does not need to be questioned. On the other hand, one major difficulty with this study is the limited response rate. Of the cases, 71% were interviewed. The corresponding rate was estimated at 62% for the controls. There was also a second control group consisting of residences, and for this group the response rate was only 39%, indicating that no analysis should be based on this group. Because magnetic fields could only be obtained for interviewed subjects, the limited response rate affected not only the analyses including control for confounding, but all analyses using field measurements. Fortunately, wire coding could be performed even if an interview could not take place. Therefore, the rate of subjects with wire codes is higher but still limited.

Finally, when the results of this study are compared with those of the Wertheimer-Leeper study, it is of importance to note that there is no overlapping between the two studies, either with respect to study period or to subjects in the studies.

At the time of the diagnosis, low-power-condition magnetic fields (appliances turned off) as well as wire codes showed an association with cancer risk that was most pronounced for leukemia. High-power-condition magnetic fields (appliances turned on) did not show an association, nor did any exposure characterization at the time of birth. Some of the results are included in Figures 9-11.

Although we basically interpret this study as being positive, it is important to note that there are some internal inconsistencies. The results seem to depend upon what exposure measure is used, e.g., no effect at all is seen when the high-power-condition measurements were used, and in some instances there are considerable differences between the results based on the wire coding and the results based on the low-power condition measurements. Furthermore, although the highest exposure categories display the highest relative risks, there is no clear dose-response relationship over the remaining exposure categories.

ii. Adult cancer study: The adult cancer study in the New York State Power Line Projects (Stevens, Appendix 16) was a case-control study on leukemia in adults. The rationale for choosing leukemia was the hypothesis which arose from the publication of the occupational studies mentioned previously, which showed elevated leukemia risks among people employed in "electrical" occupations.

The design of this study shares many of the features of the childhood cancer study, described above. The study is a population based case-control study. Exposure was assessed by field measurements as well as by wire codes. A refined methodology for wire coding was also developed within this project, resulting in estimated field values. This study also collected information on other risk factors, to the control for confounding factors.

Some of the secondary findings, but not the main results, agreed with those of the childhood cancer study. Again, the comparison between field measurements and the wire codes showed reasonably good agreement. The results also showed that the control for other risk factors did not affect the estimated relationship between magnetic fields and leukemia incidence. As in the childhood cancer study, the response rates were low. In fact, response rates in this study were considerable lower than usual for a case-control study performed in this area by the Fred Hutchinson Cancer Research Center, which was responsible for the field work. As for the major results of the study, regardless of how exposure was characterized, no relationship with leukemia incidence was disclosed. Some findings are included in Figure 12, together with those from the previous studies.

d. Discussion and Conclusions

i. Childhood cancer: Figure 9 summarizes the results from available studies for all childhood cancers together, regardless of site or histopathology. In most instances the precision is limited, as shown by the wide confidence limits, and the range of the point estimates is wide, but none of the estimates is below unity. In fact, given the different study designs, time periods and geographical locations, the findings appear quite consistent.

The incidence rate of childhood cancer is approximately 1 per 10,000 per person year. If the association with magnetic fields seen by Savitz is causal with a relative risk of about 2, then, depending on level of exposure, the incidence rate for the exposed group would be increased to 2 per 10,000 per person year. With the wire-code distribution that Savitz saw in Denver (the figures at other localities are unknown and may vary), and the assumption of a causal effect, this would mean that 10-15% of all childhood cancer cases are attributable to magnetic fields.

For childhood leukemia, there is more randomness and the findings are less consistent, as seen in Figure 10. The study by Fulton et al. gave a point estimate very close to unity and the study by Tomeniis even indicates a considerable preventive effect of fields. The remaining three studies indicate positive effects, although the Myers study gave a relative risk as low as 1.3.

The childhood brain tumor findings are summarized in Figure 11. Only three studies provide information here, and the numbers are even smaller. Nevertheless, all three studies indicate some elevations.

Even before the study by Savitz was undertaken, available information indicated that children living near power transmission facilities or in homes with elevated magnetic fields might be at increased risk of cancer. However, so many methodological and theoretical concerns were raised against these studies that the findings had to be considered highly uncertain. The study by Savitz confirms the results of the previous studies to some extent and adds to the credibility of the hypothesis that exposure to extremely-low-frequency magnetic fields might be a cause of childhood cancer. It is important to bear in mind, however, that research in basic sciences has not revealed any mechanisms that could explain the role of the magnetic fields in the origin of cancer. Furthermore, the strengths of the magnetic fields observed in these studies are low, in the sense that one might be exposed to such fields almost anywhere in the environment; they are also low in the sense that they are approximately only 1/1000 of the strength of the fields usually used in experimental settings.

ii. Adult cancer: The adult cancer studies taken together do not indicate an excess risk either for all cancers together, or for leukemias.

Even if no data seem to indicate an effect on adult cancer of exposure to extremely-low-frequency magnetic fields, this does not, of course, rule out the possibility of an effect. Firstly, the dilutive effects might be more

pronounced in adults than in children and secondly, available results have no bearing on cancers other than leukemias.

C. CELL BIOLOGY

1. General Effects On Cells: The use of cell culture techniques allows the study of homogenous populations of a single cell type to assess toxicological and environmental influences. Both tissue-culture cells and free-living organisms in culture have been used to study the effects of electrical and magnetic fields on biological processes. Specific parameters that have been examined include the synthesis of DNA, RNA and protein, rate of cell growth, cell shape, direction of cell growth, genetic alterations and responsiveness to various stimuli. Without going into detail on experiments from many laboratories which can be found in a number of reviews, it is clear that biological effects can be induced by both DC and AC magnetic and electric fields. Some of these effects, such as the cathodal orientation of nerve cell processes in DC fields, are readily reproducible in different laboratories. Other observations have been characterized by being found in one laboratory and not in a second or by the necessity of having very precisely delimited experimental conditions before the phenomena can be seen. While such limiting conditions of pulse width, waveform or necessity of modulating high-frequency carriers with low frequency might be of some general interest in attempting to determine the mechanisms by which these effects occur, they are severely limited when one tries to relate these studies to potential effects of electric power on the public health.

To avoid some of these pitfalls, the New York State Power Lines Panel has restricted the studies they supported to AC fields at 60-Hz and to field intensities which are within approximately one order of magnitude of those which could reasonably be encountered in the ambient environment. The studies

commissioned have used cells derived from bone (Rodan, Appendix 13), from the nervous system (Gundersen, Appendix 5), from the anterior portion of the eye (Basu, Appendix 3) and from the canine and human immune system (Winters, Appendix 9). In each case, the design of the exposure system and its calibration were carefully monitored by the advisory panel with the assistance of DOE and NBS consultants. No attempt was made to use identical exposure systems in each situation but comparable fields were a goal of the design. This diversity was an attempt to avert a result that is specific to one experimental situation and reflected the feeling that significant findings should be obtained at similar field strengths in the face of experimental differences. Positive results from two or more sets of experiments under these conditions would be far more likely to represent specific effects of the fields rather than spurious results or effects of ill-defined confounding conditions.

While the bulk of the studies described in this section adopt in vitro approaches, three studies in particular - those of Winters, Rodan and Basu - focus on general aspects of cellular biology rather than specifically on the genetic and reproductive parameters. The studies of Winters were primarily on the immune system and the regulation of cell-surface molecules. Those of Rodan were on bone cells and those of Basu on the cells of the anterior portion of the eye. All three of the studies used normal cells. In addition, the studies of Winters and Rodan also used tumor cells. In the immunological studies, Dr. Winters found no changes in the synthesis of DNA, RNA or protein in normal canine leukocytes in response to electrical, magnetic or mixed fields. Furthermore, no changes were seen in the levels of transferrin receptors or in immunoglobulins. In human peripheral blood lymphocytes transient synthetic changes were observed. These findings argue that no normal immunological functions were perturbed by the fields. However, in vitro studies on the immune

system are limited by the fact that the immune system is normally under nervous system control and that this element is eliminated in the experimental model selected in this case. An important concern with the data in the Winters' study is the very low response in the mitogen assays with Concanavalin A and the fact that quantitative plaque-forming assays were not used for the immune response. These concerns suggest that strong conclusions on the effect of fields on the immune response should not be drawn from these data and that further study is indicated.

Similarly, Rodan saw no field-induced alterations in DNA synthesis or parathyroid hormone-induced cAMP level in cultured cells from fetal rat calvarium (also see Noda et al., 1987). This finding conflicts with the results of Luben et al. (1986) who reported an increased binding of parathyroid hormone to similar cells in the presence of fields. Though these are not the same assays, one would expect that specific binding of the hormone to the receptor would increase the levels of cAMP.

Basu observed that rabbit corneal stromal cells exhibited a modest increase in tritiated thymidine incorporation into DNA in the presence of 10 μ T (0.1 G) magnetic flux densities but none at 100 μ T (1.0 G). No differences were seen in plating efficiency, viability or protein synthesis. Mixed magnetic and electrical fields had no effect on human corneal stromal cells. Mixed fields also had small but statistically significant effects on wound healing in organotypic cultures. A study of the combined effects of 2.7 T magnetic flux density and pulses of radiofrequency waves on the ocular tissues of rats (Sacks et al., 1986) failed to reveal any abnormalities up to two years after exposure. That study was carried out to mimic the conditions of exposure of human beings in magnetic resonance imaging equipment.

Thus it appears that in normal cells freshly derived from tissue rather than tumor cells - there is little or no effect of magnetic fields in the range up to 100 μ T (1 G) and little or no effect from electrical currents up to 300 mA/m². On the other hand, both Winters and Rodan also included tumor cells in their studies. Winters used the colon tumor cell colo 205 and reported that under some exposure conditions there was an increase in clonogenicity in soft agar (See Section VB1), in the number of transferrin receptors on the cell surface, the amount of exposed tumor antigen and the susceptibility of the cells to killing by natural killer (NK) cells. In the case of the transferrin receptor the relative potency of the various exposures was MAGNETIC > ELECTRIC + MAGNETIC > CONTROL > ELECTRIC. In the case of susceptibility to NK cell killing the effects were ELECTRIC + MAGNETIC > MAGNETIC > CONTROL > ELECTRIC. As discussed previously, however, there were serious problems in the design of these studies.

When Rodan used osteosarcoma cells (ROS 17/2.8) he found significant increases (15-20%) in DNA synthesis on exposure to 60-Hz fields at 300 μ A/cm². He did not find effects on the cAMP response to parathyroid hormone in the tumor cells. It is important to note that this effect on DNA synthesis was not seen in three very similar studies in our series - Livingston, Carsten and Cohen. Therefore, it is clear that this response is limited either by cell type or exposure situation. While no transcriptional changes (RNA) were found in the New York State supported experiments, Goodman and Henderson (1986) have reported increased transcription in exposed dipteran (insect) salivary gland cells. Whether this is further reflected in changes in the proteins being synthesized in these cells is as yet unanswered.

Many studies show effects of fields in increasing (Physarum, Tetrahymena) or decreasing (Paramecium) the mitotic cycle time. It is tempting to view these

effects as being mediated by the cell membrane and specifically by the calcium ion. The calcium ion has been implicated in the control of cell division (Epel et al., 1974; Gilkey et al., 1978; Keith et al., 1985; Tsien et al., 1982) and it is interesting that the effects of fields on cell division in Paramecia are antagonized by verapamil, a calcium channel blocker. Similarly the effects of fields on the cathodal orientation of growing neuronal processes can be blocked by removing calcium from the culture medium. Calcium is also known to play a role in other cell surface events including a possible role in receptor clustering at the motor endplate of muscle in response to stimulation. While far from established fact, it is likely that membrane control of ionic calcium levels, whether from the extracellular medium or from intracellular stores, might be an important way in which electrical and magnetic fields affect cells.

2. Electrical Stimulation Of Bone Repair: Currently many orthopedic surgeons surmise that electrical stimulation procedures simplify the treatment of fracture nonunions. Though the procedures now in vogue appear to be relatively simple, the means by which they accomplish this remains a complex issue in the field of bone repair. Electrical stimulation has been hypothesized to initiate a delicate interplay between exogenous electrical energy and the complex mechanical, electromechanical and biological processes that naturally occur during bone formation. Understanding this interplay may aid in the selection and development of methods and technologies to stimulate the natural process of bone repair.

As an organ, bone shows complex interrelationships between physical and biological processes, the very architecture of bone being a response to the mechanical demands placed upon it. This is one manifestation of Wolff's Law which was defined almost 100 years ago. In addition, the known electrochemical and electromechanical properties of bone are thought to play an essential role

in its growth and remodeling. Recent studies suggest that an electrokinetic (streaming) mechanism is primarily responsible for the endogenous electrical potentials produced by mechanical strains in vivo (Frank and Grodzinsky, 1987; Gross and Williams, 1982; Pollack, 1984), hypothesized to be a signal that may modulate cellular response.

Several studies have also helped to quantify the endogenous bioelectric currents and potentials produced by injury to soft and hard tissues (Borgens, 1984; Friedenberg and Brighton, 1966). The existence of such endogenous potentials generated by electromechanical or electrochemical means has led to many animal experiments to discover whether exogenous electric currents could stimulate bone growth and healing. The early experimental work of several groups focused on the use of direct current (2-20 μA) applied by means of implanted electrodes (Lavine and Grodzinsky, 1987).

The three modalities most commonly used in the electrical stimulation of delayed union, nonunion, and congenital pseudarthroses involve currents delivered internally by means of implanted electrodes, or by externally mounted devices that inductively or capacitively couple currents to the appropriate site. The first attempts to use electrical stimulation to enhance bone healing were performed on cases of nonunion of fractures and congenital pseudarthrosis of the tibia using DC current with implanted electrodes. Electrical stimulation was used in congenital pseudarthrosis because the risk-benefit ratio was highly favorable to the patient. Of the semi-invasive methods, the electrode-sensitive method has been used in many cases of fracture nonunion (Brighton et al., 1981; Heppenstall, 1983), incorporating four stainless steel cathodes, each delivering 20 μA direct current via a commercially available power pack.

Inductive coupling was the first of the non-invasive methods to have extensive clinical use (Bassett, 1984). Time-varying magnetic fields ("PEMFs")

are produced by means of external coils driven by a time-varying current pattern. The magnetic fields penetrate the limb and induce electrical currents within the region of the fracture. Various pulse shapes have been studied (Bassett, 1984; Downes and Watson, 1984) and are used for different treatment modalities. The resulting currents are induced in an extremely complex manner both spatially and temporally, because of the highly complex, anisotropic, nonhomogeneous conduction, dielectric, and structural properties of wet, living bone. Because of these complexities, it is extremely difficult to model and compute the exact magnitude and distribution of the current that will be induced by the PEMFs at the site of treatment. While most investigators believe that PEMF treatment does not cause tissue heating, the question has been raised that local tissue heating may occur to an extent that would not be predicted by oversimplified models that are based on the assumption of electrically homogeneous tissue properties. About 70-85% percent of the nonunions, and about 65 percent of the congenital pseudarthroses treated in this manner have been reported to achieve union (Bassett, 1982; De Haas and Beaupre, 1986; Downes, and Watson, 1984; Mulier and Spaas, 1980).

The next commercially available non-invasive method was that of capacitive coupling (Brighton and Pollack, 1985), in which a time-varying electric field is applied to the limb by externally placed capacitor plates located on the skin overlying the treatment site. All of the commercially available techniques, both invasive and non-invasive, are reported to give about the same overall success rate for fractures of the tibia. All techniques emphasize the importance of high-quality orthopedic fracture care, a factor which has been suggested as partly responsible for some of the success attributed to this approach (Barker et al., 1984).

The exact mechanisms by which various electrical stimuli induce an osteogenic response are still unknown. Interpretation of some of the experimental data in animals which have been ascribed to electrical stimulation has sometimes been complicated by other variables, such as the presence of mechanical stresses resulting from the stimulation apparatus. The different experimental models used in different laboratories has further complicated the issue of repeatability.

It is likely that very different mechanisms would be associated with the invasive techniques as compared to the noninvasive methods, due to the presence of the implanted electrodes. When current is passed across an electrode/electrolyte interface such as that at an implanted electrode, chemical electron-transfer reactions must occur at the interface. (This enables the current to bridge the junction between electron transport in the external metallic circuit and ion transport in the tissue/fluid space within the limb). In establishing the mechanisms by which current from implanted electrodes elicits a biological response, it is essential to distinguish between the effect of the electrical current per se and the effect of these accompanying chemical reactions and reaction products.

Recent evidence suggests that electrode chemical reactions may be the primary stimulus for the osteogenic response observed in some studies. For example, the reaction at a stainless steel cathode results in consumption of dissolved oxygen and an increase in local pH (Brighton et al., 1981; Renooij, 1983). Brighton et al. (1981) summarized previous studies showing that low tissue oxygen tension and a slightly alkaline environment favor bone formation. Baranowski et al. (1983) used microelectrodes to measure pH and pO_2 in the tibial medullary canal of rabbits that received DC stimulation currents of 1-50 μA at that site. They found an association between decreased pO_2 , increased pH,

applied current, and osteogenesis in the vicinity of the implanted cathode. Direct observation of an osteogenic response induced by similar local changes in pH and pO_2 , but without applied currents, would further serve to validate this hypothesis.

The cellular mechanisms that may be associated with the noninvasive (capacitively and inductively coupled) techniques have been even harder to identify. An extensive number of in vitro studies have focused on the effect of electrical currents on bone and cartilage tissue and cell preparations. A wide range of cellular processes have been examined, including protein and glycosaminoglycan synthesis, cell proliferation and differentiation, growth of bone and cartilage rudiments, and accumulation of cyclic nucleotides (see Fukada et al., 1985 for a recent review). While many positive effects have been reported, a clear understanding of the basic mechanisms relating to osteogenesis has yet to emerge. Some of the physical mechanisms that may play a general role in cellular response to electrical currents have been reviewed (Robinson, 1985), and include modulation of membrane potential and membrane transport, current-induced motion of membrane-bound receptors and cytoskeletal elements, and other indirect effects of fields on membrane channels.

Resolution of the issue of mechanism is central to understanding the validity of the fundamental hypothesis that endogenous currents produced by deformation of bone in vivo act as a signal to bone cells.

D. NEUROBIOLOGY AND BEHAVIOR

1. Brain and Neuronal Development: An extensive literature has accumulated on putative biological effects of extremely-low-frequency electric fields, especially in the areas of animal behavior and physiology. In contrast, very little is known about extremely-low-frequency field effects on developing nervous systems, although theoretical arguments exist for such effects. Initial

reports, including those indicating adverse effects, need much further verification in order to determine how, if at all, neural development may be vulnerable to an environment increasingly filled with extremely-low-frequency fields.

Although possible mechanisms of biological interactions are only a matter of speculation at this time, cellular activities that are critical in neural development might be affected by extremely-low-frequency fields. Although extremely-low-frequency fields at environmental intensities possess too little energy to break covalent and hydrogen bonds so prominent in living organisms, they may well change the three-dimensional structure of ions and molecules existing as either temporary or permanent dipoles (Adey, 1981). Molecular conformation is of the utmost importance in biological membranes, in which the fluid-mosaic model of Singer and Nicholson (1972) stresses the importance of noncovalent interactions. Furthermore, neurons maintain at their membranes a 70 to 90 millivolt potential difference which - across a membrane only 75 Angstroms thick - represents field strengths of about 10^7 V/m. Such a potential difference, whose maintenance requires a significant portion of cellular energy, could be altered by exogenous electric fields. Also, magnetic fields may affect cellular activities involving paramagnetic ions, such as iron, or reactions with free radical intermediates. Animal tissues permit penetration of magnetic fields not much differently than air.

The field of neural development has attracted considerable attention in the recent past. It is a difficult field of study because of the unique complexity of the final products, especially in mammals. However, a number of basic mechanisms of neural development have been proposed. Some of these mechanisms may be vulnerable to extremely-low-frequency fields (Jacobson, 1978).

Neuronal proliferation, migration, and selective death are critical in

neural development, and may be regulated by receptor-mediated factors taken up at cell membranes (Liu, 1981). Steroids, including sex hormones, also play a role in neural development by acting via noncovalent interactions with cytoplasmic receptors, which are then translocated to the nucleus (McEwen, 1983). Long journeys of neurons and their processes may involve poorly understood interactions with extracellular guiding proteins, such as fibronectin and laminin (Liu, 1981). Formation of the correct synaptic connections seems to depend on the disposition of membrane macromolecules inserted via Golgi-derived coated vesicles and then left to find their appropriate location in the post-synaptic cell membranes (Altman, 1971).

Therefore, various activities in neural development depend upon conformation of molecules and their noncovalent interactions with each other - any or all of which may be affected by extremely-low-frequency fields. Experimental support for the effects of extremely-low-frequency fields on membrane associations in non-neuronal cells has come from a long series of work on fungi by Marron and colleagues (Marron, et al., 1983). These authors exposed Physarum polycephalum amoebae to sinusoidal 60-Hz fields, at 1 V/m, applied via stainless-steel electrodes placed directly in the growth media. Perpendicular magnetic flux densities were 0.1 mT (10 G). Centrifuged cells were placed into an aqueous liquid-liquid polymer two-phase system containing dextran and polyethyleneglycol (PEG). Cells were withdrawn from the PEG-rich upper phase and counted to determine their concentration. Exposed cells were then compared with control cells. This allowed analysis via cell concentrations independently of cell numbers. Exposed cells showed a significant change in their partitioning behavior between the two liquids. Presumably, this change in partitioning can result from either a change in membrane molecular composition or surface charge. Such an in vitro system, which had previously detected

mitotic delays and reduced oxidation in amoebae exposed to 60-Hz fields (Marron, et al., 1978) allows numerous advantages of experimental design which may be applied to work on extremely-low-frequency field effects on neural development.

The rat cerebellum was chosen as an experimental model for neural development because neuronal development here is very clearly outlined in the literature and development sequences are similar in man, monkey and rodents (Jacobson, 1978). In addition, Hansson had reported startling changes in the cerebellum of rabbits exposed in a switchyard to 50-Hz electric fields. Hansson (1981) could justifiably say in his report that "No morphological study has been published on the possible structural effects on the nervous system (by electric fields)." In an outdoor setting, Hansson exposed female albino rabbits to 14 kV/m lines, at 50-Hz. This is approximately equivalent to 1.5 - 2 kV/m in humans. Incidentally, this is also the electric field strength at the edge of a 365-kV line right of way. A second group was placed next to an open disconnecting switch (presumably to assess corona effects), a third group was surrounded by a Faraday cage, and a fourth group of rabbits was placed outside a measurable electric field. Exposure of females began some time (unspecified) after mating, and offspring were subsequently exposed for the first two and a half weeks after birth.

Exposed rabbits reached just over half the weights of animals kept away from any electric field, did not keep their coats clear, and "appeared slow in movement". This motor deficit led to histological analysis of the cerebellum and revealed ultrastructural changes of startling magnitude in the exposed rabbits: reduced arborization of dendrites, reduced number and size of Nissl bodies (rough endoplasmic reticulum), reduced numbers of microtubules and mitochondria, and increased microfilaments. No actual numbers or percentages for these changes were given. However, the most dramatic effect was the

existence in Purkinje cells of 500-1,200 lamellar bodies which were never found, in any number, in control animals. These lamellar bodies appeared to be stacks of tubular profiles of plentiful smooth endoplasmic reticulum. In contrast, only a few profiles of normally plentiful rough endoplasmic reticulum, as noted above, could be found.

Hansson suggested that malnutrition could be the ultimate problem. This explanation is plausible in light of the severe weight reduction noted in experimental animals, but food intake records were not available for substantiation. The outdoor exposure of these rabbits also raises serious questions regarding effects of uncontrolled temperature, humidity, etc. There is almost no quantification of results or, indeed, of the total number of animals or electron micrographs examined. The claim that "marked neuronal alterations were observed in several (other) parts of the brain and retina" was made without presentation of any evidence.

Hansson's work (1981) does represent a beginning in the study of the ultrastructure of developing nervous systems, in spite of its methodological difficulties. The cerebellar cortex, including Purkinje cells, represents an excellent model for studying possible neural developmental effects, since the basic outline of its development is well researched (Altman, 1972). In an effort to confirm Hansson's findings Albert, et al. (1984) exposed pregnant rats throughout gestation at 100 kV/m [see Kaune (1979) for exposure details]. They were unable to confirm Hansson's results (Albert et al., 1985a). Electron microscopic examination of Purkinje cells in these studies showed that lamellar bodies were found in both experimental and control groups, and were present in both cell bodies and dendrites. Some animals in both groups were totally devoid of lamellar bodies.

In their 1984 study Albert and colleagues used electron microscopy to quantify synaptic contacts in the developing rat cerebellum, but no statistically significant differences were found between exposed and controls. They also did not observe weight reduction or other changes in motor control. Hansson attributed the motor deficits he observed in exposed rabbits to the presence of lamellar bodies, but the Albert results in rats make this explanation unlikely. It is possible that the presence of lamellar bodies is an artefact resulting from excessive handling or is a function of variations in exposure conditions.

In order to resolve these discrepancies in results it would be necessary to standardize exposure conditions and periods of recovery. The issue of recovery is critical. Subtle cerebellar deficits were found by Sikov et al. (1984) to be recoverable within a week, for example, and slight morphological changes may be associated with such physiological deficits as decreased righting reflexes and geotropism.

Because of the potential significance of these studies, the New York Power Lines Project funded Gona to investigate the effects of 60-Hz fields on the development of rat cerebellum (Appendix 11). Gona and his co-workers exposed pregnant and postnatal Sprague-Dawley rats to electromagnetic fields at three field parameters: 100 kV/m and 1 mT (10.0 G), 100 kV/m and 100 μ T (1.0 G) and 1 kV/m and 1 mT (10.0 G).

Cerebellar Purkinje cells differentiate, migrate, and form their synaptic connections during postnatal life, so Purkinje cell differentiation and maturation were studied by exposing newborn pups for 1, 2 and 3 weeks. Since the cerebrum develops primarily during gestation, cerebral experimental studies were conducted by exposing pregnant dams continuously from days 5-20 of pregnancy. The pups from these prenatally exposed or sham-exposed dams were

then sacrificed 1, 2 and 3 weeks after birth. Gona studied several other parameters of body and brain development, including measurement of gross body and brain weight, biochemical analysis of brain, including DNA, RNA, total protein and cerebroside, and electron microscopic investigation of ultrastructural changes of the cerebellum.

In this investigation Gona, in contrast to Hansson, did not observe differences in weight, motor activity and eye opening time between the control and experimental groups at the combinations of electric and magnetic fields cited above.

Electron-microscopic examination of cerebellar neurons (particularly Purkinje cells) showed no abnormalities. However, Gona did see membranous stacks resembling lamellar bodies, but these were found in both control and exposed animals. A number of biochemical parameters were also measured by Yu, co-principal investigator with Gona, but no significant differences existed between exposed and sham exposed groups. One can conclude that cell numbers as judged by DNA content, cell size (DNA/protein ratio) and myelination (cerebroside levels) were unaffected by electromagnetic fields during pre- and postnatal development. It should be noted that Gona reported that some transient increase in cerebellar DNA concentration was observed at 100 kV/m and 100 μ T (1 G) on postnatal day 8 but not at other field parameters or ages. Further, at 1 kV/m and 1 mT (10 G) total protein at postnatal day 6 and DNA/protein ratio were lower. Both values reached normal levels by postnatal day 13 and 20 respectively, indicating no permanent effect. It appears that these may be chance findings or, like the cell degeneration normally seen in cerebella, may have some relation to DNA and protein levels since these macromolecules represent cell numbers and sizes.

On the basis of Gona's results, which morphologically are similar to those of Albert, et al. (1984), it is reasonable to conclude that there are no morphological alterations produced in Purkinje cells because of exposure to fields. It is more likely that Hansson observed artifacts since the animals were exposed outdoors under a substation where temperature and humidity varied widely over the lengthy duration of exposure.

2. Sensation and Perception

The association between sensation/perception and 60-Hz electromagnetic fields exists as two separate problems. The first issue is the sensation and perception of electromagnetic fields; the second issue is the effects of these fields upon sensations and perceptions. Both problems require the differentiation between the terms sensation and perception. Sensation refers to the proximal detection of a stimulus; perception refers to the response to a sensation that is based upon the learning or conditioning history of the organism. A stimulus may be sensed but not acknowledged depending upon its perceptual characteristics, whether positive, negative, or irrelevant.

For the New York State project, the initial question involved the simple question: Can people perceive electromagnetic fields? The answer is complicated. For human beings, introspection is the method of choice for the detection of a stimulus. However, a stimulus can influence human subjects without their awareness. Whether or not this is defined as "implicit detection" or an "effect" is an arbitrary definition. When non-human animals are used to test responsiveness, detection must be determined alternatively by one of two methods. Responding for reward is either contingent upon the presence (or absence) of the field or the field is used as a component of a learning sequence. In the former instance, if the animal responds during the presence of the field (but not when it is absent), detection is assumed to have occurred.

In the latter instance, detection is inferred when the field can elicit a behavior after the field is paired temporarily with an unconditioned stimulus that is known to elicit the behavior.

Detection of electromagnetic fields per se is often replete with confounding variables because both experimentally- and transmission line-generated forms are accompanied by a multitude of other stimuli that include infrasonics, vibrations, and ions, or blatant artifacts such as electric shocks. Human subjects often attribute their experiences to the detection of electromagnetic fields simply because the label is readily available to them. However, the degree to which these concomitants contribute to "power-line effects" in the field has not been addressed.

In the present project, the Graham experiments were the major sensory perception study. Human subjects were exposed for brief periods (less than 6 hours) on two successive days to electric fields between 0 and 16 kV/m and to magnetic flux densities 0 and 40 μ T (0.4 G). Detection of fields as defined by verbal (subjective) experience occurred at or above 9 kV/m when the subjects were seated. However, the threshold was variable and was influenced by a variety of expected psychophysical factors such as the rate of field strength intensification (gradual vs sudden offset), and habituation (after 3 to 21 minutes of continuous exposure). There was no detection of the magnetic field component when it was presented singly.

Despite testing on a wide variety of cognitive tasks that effectively sample all of the major psychological systems, only a few weak changes were noted. Performance on a task that required selective attention and estimations of time intervals were significantly (but weakly) facilitated during field presentations. In the former case, detection of mismatched (odd) stimuli was improved. The only significant electrophysiological change involved the P300

component of the evoked potential measure. This event occurs 300 msec after a modality-specific stimulus is delivered. It is frequently associated with the "meaningfulness" and infrequency of a stimulus. The occurrence of the effect is compatible with the enhancement of the specific type of selective attention (the increased accuracy of mismatched stimuli). The effect of the field was to maintain the "detection" of the mismatched stimuli particularly during the second day of exposure.

The results of these studies do not agree with results from other studies. Stollery (1986) passed 500 μ A of 50-Hz current by electrodes through 66 male volunteers for about six hours. Each subject served as his own control. Subjects were tested on a variety of memory, attention and verbal tasks. Although there was no significant differences for these measures between field and sham conditions on the first day, on the second day the field group required more time to solve complex problems on a syntactic reasoning test. According to Sweetland et al. (1986), a singular one-hour exposure to a NMR device reduces digit span and increases anxiety. However, in both of these studies, the mode of exposure was quite different from that employed in the Graham study.

From a practical point of view, the magnitude of the reported effects is extremely small for all three studies. In the Graham study, the alteration in the P300 amplitude and the accuracy in selective attention would be less than the peak to peak change in the normal phasic arousal that occurs every 90 minutes. There was no evidence that the normal absolute peak or trough of the values changed. Similarly the alteration in syntactic reasoning reported by Stollery (1986) is within the same magnitude. The magnitude of the reduction in digit span and the increased anxiety were comparable to what might occur during a test-retest of the same average subject on a "good day" and "bad day". However larger changes in the P300 components of auditory evoked potentials have

been produced by stronger 60-Hz magnetic fields [5 mT (50G)] presented near the temporal lobe (Kuzendorf, 1987)

The absolute 60-Hz detection thresholds from the Graham study are similar to those found for other species. A study by Stern et al. (1983) demonstrated that pigeons could accurately detect electromagnetic fields as cues for reward. The threshold for the 100% detection was about 8 kV/m, with a range between 4 kV/m and 10 kV/m. Rats have also been shown to discriminate field presence when gradients of this level are present. Detection of weak 60-Hz magnetic fields when behavioral criteria are used is not consistent for mammalian species. However, detection of weak power-line magnetic fields by birds is well documented.

The effects of 60-Hz fields upon the detection of intrinsic sensations is the second major problem of this research. Anecdotal reports of nociceptive threshold changes have been frequently associated with field exposures. This question is perhaps even more relevant than frank detection of fields since alterations in pain thresholds can significantly alter the quality of life in the human population. Pain detection can be influenced further by the person's personality profile.

Ossenkopp, Cain and their colleagues (Ossenkopp, et al., 1983; 1985) have demonstrated on several occasions that magnetic field (0.5-Hz) exposures can block the analgesic effects of morphine. Their typical paradigm is to expose the animal to a magnetic field for about an hour, inject the animal with morphine and then determine pain thresholds—usually under blind procedural conditions. The magnetic-field-induced blocking (1) is maximum when the animal is tested at night, (2) is similar to a few minutes of exposure to bright light during the dark cycle, and (3) is influenced by the amount of geomagnetic activity (magnetic storms) at the time of experimentation. The effect is

apparent with primary opiate receptors (μ , δ) but not with other opiate receptors (σ). The mechanism seems to be calcium-mediated (Kavaliers and Ossenkopp, 1986b).

For the present project, Ossenkopp and his group exposed mice to various intensities of 60-Hz fields; the magnitudes were similar to those that might be experienced very near power lines. An intensity-dependent effect of the 60-Hz magnetic field exposures on morphine analgesia was noted. Exposure to the power-line frequency during the night period reduced the effectiveness of the morphine analgesia for painful stimuli. As noted in the previous studies, the blocking effect of the 60-Hz field on the analgesic effects of morphine was not observed when the animals were tested during their daylight cycle. Similar results were obtained by Ossenkopp et al. (1985 a and b) in a study in which mice were exposed in a magnetic-resonance-imaging apparatus.

That brief (less than 10 hours) exposure to power-line-frequency electromagnetic fields has effects on sensation, perception and related behaviors suggests three major conclusions: (1) accurate detection of the presence of an electric field by subjective means begins around 9 kV/m but the threshold is quite variable depending upon a variety of physical parameters, (2) 60-Hz fields can influence pain thresholds, particularly if the noxious or nociceptive experiences occur during nocturnal periods (3) 60-Hz fields do not radically alter cognitive activities in a manner that is obviously associated with processes that might affect higher intellectual functioning. The caveat is that these conclusions apply to normal subjects.

3. Cellular Neuroscience and Calcium

Much of the literature on electrical field effects on the nervous system has focused on the physiologically important calcium ion. For example, Bawin and Adey (1976) claim that efflux of radiocalcium from chick neonatal cerebrum

is reduced by electric fields. These results were contradicted by Blackman et al. (1979; 1982) who claimed an increased efflux under similar conditions. Neither of these studies dealt with any physiological parameter which might be calcium dependent nor did they look specifically at intracellular ionic calcium - which is the "active" form of calcium in the cell though quantitatively only a very small fraction of the total cellular calcium. This differentiation is important since the calcium efflux studies measure the amount of radioactive calcium, previously introduced into the tissue, that washes out of the tissue after exposure to a given experimental protocol. The source of the calcium is not readily identified. It could be calcium which is exported from the inside of the cell or, more likely, may represent calcium bound to fixed charge sites in the extracellular matrix.

In the study of Gundersen (Appendix 5), spinal cord neuron-muscle cultures were exposed to circularly polarized fields of 100 μ T (1 G) and electrical fields of 30 kV/m (air equivalent) (See also Gundersen and Greenbaum, 1985). No changes were found in calcium efflux from these cultures with electric, magnetic or combined fields. These studies were not comparable to the Bawin and Adey studies in that Gundersen labeled for 72 hrs in contrast to the 20-minute period used by Bawin and Adey. In shortened labeling times much more of the calcium would be bound to extracellular cell surface glycoproteins and matrix and to peripheral intracellular compartments from which it might be more readily affected by the applied fields. Neither of these measures would give an adequate measure of intracellular calcium or of physiologically important calcium currents. On the other hand, Gundersen found that linearly polarized magnetic fields increased the frequency of miniature endplate potentials (mepps) at the neuromuscular junction while circularly polarized fields were without effects. The effect was seen at 60-Hz, but not at 70-Hz. These differences are

as great as 23% when perpendicularly polarized fields are used. These results reflect an increased quantal release of packets of acetylcholine from the presynaptic neuron. This release is known to be affected by calcium and it is possible that the effect might mirror calcium ion changes or changes in membrane responsiveness to calcium ion in the presence of magnetic fields.

The physiological implications of this increase in mepp frequency are hard to evaluate, though if a global phenomenon it would require an increased cellular synthesis of acetylcholine. As long as the number of mepps did not reach the threshold needed to trigger an action potential in the muscle, there would be no effect on muscular activity.

4. Biological Rhythms

A diurnal or approximately 24-hour variation in functional amplitude is characteristic of all systems within the human body. This variation is usually called the "circadian rhythm". It is not a singular phenomenon but a complex of separate rhythms that are normally phase-locked. In addition, they often share exogenous "zeitgebers" or timegivers that synchronize the daily peaks and troughs of the cycles. Three major types of dysfunctions can occur: (1) alterations of cycle duration, (2) shifting (lagging) of the peak of the cycles, or (3) an uncoupling between cycles.

Dysfunctions in circadian rhythms are important because they can profoundly affect psychological and biochemical processes. Alterations in phasic attention and concentration following sudden shifts in circadian rhythms increase the risk of industrial accidents. Subtle seasonal shifts in the amplitude or the hour of the daily peaks in circadian cycles are major correlates of a clinical subtype of psychological depression and are also frequently associated with a compromise in immunocapacity.

The effects of electromagnetic fields upon circadian cycles have focused upon two major areas: behavioral measures and the biochemical activity of the pineal organ. Typical behavioral measures have included diurnal variations in activity, body temperature, and consumptive activity. The biochemical activity of the pineal organ has been studied because of its well known role as a modulator of neuroendocrine function. One of its constituents, melatonin, is a special metabolite of serotonin. The two synthesizing enzymes for melatonin are uniquely found within the pineal organ. Both the concentration of melatonin and the activity of the synthesizing enzymes demonstrate a conspicuous diurnal variation.

The pineal organ has a ubiquitous control over the gonads, thymus, adrenal gland, and thyroid. A sudden decrease in (nocturnal) melatonin has been suggested as a factor that initiates puberty. Increases in melatonin level tend to promote periods of decreased vigilance or to extend the duration of normal sleep. Disruptions of melatonin are associated with dyssomnia.

The relevance of melatonin to the 60-Hz problem is highlighted by recent observations that the pineal organ is sensitive to near-natural magnetic fields in pigeons and rats (Semm, 1983). Moreover, sensors in the retina may mediate the effect of magnetic fields to pineal structures (Olcese, et al 1985) either via paraoptic fibers to the intrinsic pacemaker of the brain (the suprachiasmatic nucleus) or through more general descending sympathetic pathways. Recent evidence suggests that the magnetic-field effect upon melatonin synthesis may be amplified by weak ambient red light (Reuss and Olcese, 1986). This unusual observation may help explain why in the Ossenkopp study magnetic fields block morphine analgesia only at night when the animals are exposed to a 100 μ T (1 G) magnetic flux density.

The problem of effects of power line intensities on behavioral indices of circadian rhythms was studied by Sulzman and Murrish (Appendix 7). This study had several important characteristics. Three levels of electric field intensity were employed: 2.6 kV/m, 26 kV/m and 39 kV/m, each accompanied by a 100 μ T (1 G) magnetic field. This design allowed the possible detection of at least rudimentary intensity-dependent effects. In addition the animals were exposed for substantial periods (two weeks) to the fields during direct measurement of the behavior; this allowed potential detection of both acute and chronic changes. Finally, because the same animals ultimately received the different field conditions following an initial baseline period, residual effects could also be detected.

The physiological model involved the use of free-running circadian rhythms; this means that the primary zeitgebers, light/dark cycle, temperature and noise, were held more or less constant during the experiment. The advantage of free-running compared to entrained rhythms is the former's susceptibility to influence by subtle environment effects; both electric and magnetic fields have been shown to influence free-running rhythms in mice and man (Dowse and Palmer, 1969; Wever, 1974). Entrained rhythms, which means that the animals are exposed to a driving, light-dark cycle while the fields are applied, appear to be relatively resilient to significant disruption.

Specific behaviors measured by Sulzman and Murrish included oxygen consumption and feeding as defined by the number of lever presses per unit time during the day. The advantage of these two measures is their synchronicity and potential for "uncoupling". The disadvantage of these two measures is their dissimilarity to the activity and body temperature measures used by Wever. This prevents a direct comparison of the two studies despite the similarity of the human and squirrel monkey models.

The methods of analysis involved the use of both nonparametric and parametric statistics. The use of both methods reduced the risk of missing phenomena that were not linear or masking phenomena that were very weak. However, if a phenomenon was weak and non-linear it could have been still overlooked. The specific measurement was the absolute temporal shift in the peak of activity (acrophase) over real time during the period of exposure.

The results showed an intensity-dependent effect. None of the monkeys exposed to the 2.6 kV/m fields demonstrated any change in the free-running periods of lever pressing (feeding) or oxygen consumption. On the other hand, 33% of the monkeys exposed to the 26 kV/m fields and 75% of the monkeys exposed to the 39 kV/m electric fields showed a significant lengthening of period. Although the number of animals in each treatment was small and variable, the intensity-dependence appears reliable. Interestingly, even though the monkeys exposed to the lowest intensity did not show a significant increase in periodicity, the values were longer than the free-running periods during non-exposures.

Sulzman and Murrish also reported apparent chronic or long-term effects from exposures to the higher intensity electric fields. This conclusion was based upon the failure of the animals to return to pre-exposure free-running values when the animals were followed for several fortnights (post-exposure) under ambient fields. The validity of this observation was supported by the relative absence of its occurrence in the history of their laboratory. In addition, the "irreversibility" of magnetic field effects (in particular) has a relatively long history. It was most recently reported by Wolpaw and Seegal (Appendix 17) for monkeys that had been exposed chronically to either 3 kV/m, 10 μ T (0.1 G) or 30 kV/m 90 μ T (0.9 G) fields for 21 days. Whereas the metabolites of serotonin and dopamine were both suppressed in the cerebral spinal fluid,

only the latter returned to normal after removal from the fields. The metabolite of serotonin remained depressed.

The results of the Sulzman study differ from Wever (1974) in one important aspect: field exposures were associated with an increase in free-running rhythm duration rather than a shortening. However, Wever used a 10-Hz, 2.5 V/m square-wave field compared to sine-wave 60-Hz fields with both magnetic [100 μ T (1 G) and electric (26 kV/m or 39 kV/m) components. In addition Wever measured body temperature and activity in ambulatory humans (living in an underground bunker) while Sulzman and Murrish measured the oxygen consumption and lever pressing of relatively restrained monkeys.

Two other differences occurred between the two studies. First, Wever reported that a reduction in free-running rhythms occurred in all of his subjects; the effect was duration dependent (i.e., the greater the time of free-running, the greater the effect of the field). The present study showed that some animals did not show any significant changes, and those that did did not exhibit a duration dependence of their response. Secondly, Wever reported clear uncoupling of the two rhythms (activity and temperature) while Sulzman and Murrish reported no uncoupling.

The effects of 60-Hz electromagnetic fields on melatonin synthesis per se was not addressed in the New York State projects. However, several recent studies have indicated that a variety of field conditions inhibit melatonin production. Alteration in the normal geomagnetic field (Olcese and Reuss, 1986), application of a 100 μ T (1 G) field in the presence of red light (Reuss and Olcese, 1986), and electric fields of about 8 kV/m or greater have been shown to suppress pineal activity. Recently, even weaker electric fields (1 kV/m) were shown to suppress melatonin synthesis (see Wilson et al., 1986).

In summary, the major results of these studies concerning the effects of power-line fields on circadian-related systems suggest that long-term exposure to electromagnetic fields can shift or induce a lag in intrinsic rhythms. These shifts may be chronic once they appear. On the other hand, power-frequency electromagnetic fields tend to affect melatonin synthesis within minutes; however, the effect is transient and reversible within a few hours to days.

5. Seizures, Evoked Responses and Neurochemistry

Research into all aspects of epilepsy has expanded rapidly in recent years, and the extraordinary diversity and complexity of epilepsy research has been recently reviewed (Delgado-Escueta, et al., 1986). There is now an impressively long list of physical and chemical agents that can alter seizure likelihood and expression. The studies of Ossenkopp & Cain (Appendix 12) indicate that magnetic fields must be added to the list. Specifically, the mortality of pentylenetetrazol-induced seizures in rats is significantly decreased with flux densities of 100-150 μ T (1.0-1.5 G) for 1 hour and the development of kindled seizures and electrical after-discharge in rats are decreased with flux densities of 100 μ T (1.0 G).

The results do not indicate possible mechanisms producing these effects. Although these data suggest the possibility of salutary effects in human patients with epileptic disorders, it cannot be inferred that there are no conditions of exposure which would make seizures worse.

The fact that magnetic field exposure changes seizure susceptibility even after the exposure has been terminated argues for a mechanism involving alteration by the fields of brain hormones. Ossenkopp suggests that opioids may be responsible. His studies on alteration of morphine-induced analgesia by magnetic fields (Kavaliers and Ossenkopp, 1986 b and c) clearly point to the endogenous opioids under those conditions, and make the presumption of opioid

mechanisms in the epilepsy experiments more attractive. The epilepsy model is, however, inherently much more complex, in that the involvement of many more naturally occurring substances has been postulated. Investigations into electrical and chemical kindling have shown evidence for participation by a wide variety of substances including catecholamines, serotonin, dopamine, opioids, cyclic nucleotides and calcium-dependent proteases in the pathogenesis of the kindled focus.

The data from Ossenkopp & Cain, however, do not suggest a hazard to people, with or without seizure disorders, who are exposed to magnetic fields. The apparent beneficial effect is, however, an interesting clue to mechanisms of both seizures and field effects, and as such deserves further study.

Wolpaw and colleagues (Appendix 17) studied the effects of electric plus magnetic fields on 10 pig-tailed macaques (Macaca nemestrina). They demonstrated attenuation of the late components of the somatosensory evoked potentials (SEP) recorded from stimulation of the median nerve. Auditory (AEP) and visual (VEP) evoked responses were normal, but a smaller number of stimuli were required for the AEPs and VEPs than for the SEPs and the authors suggest that, since components of the late peaks of the evoked potentials relate to mechanisms of attention, abnormalities might have been noted only after a large number of stimuli (and therefore, in their studies, for SEPs only). They point to evidence for the importance of opioids in attention mechanisms and postulate a connection between these results of decreased amplitudes of late SEP components and the findings of Ossenkopp on field effects on morphine analgesia, also felt to relate to changes in endogenous opioids.

In the Wolpaw studies, a great many measures of well-being of the macaques were recorded, including weight, blood-cell counts, blood chemistries and tests of motor skill, and no significant effects of the fields were encountered. In

addition, there were no changes in the gross neuropathology in the brains of the 5 autopsied animals. The only consistent effect of the fields, except for the decrease in the late components of the SEP, was in the amount of homovanillic acid (HVA) and 5-hydroxyindoleacetic acid (5HIAA) in the cerebrospinal fluid (CSF). In both cases, there were significant decreases and since these substances are major metabolites of dopamine and serotonin, respectively, the question of effect of fields on metabolism of these important biological amines is raised. After a period of recovery following field exposure, the CSF HVA returned to normal, but the 5HIAA remained depressed. Wolpaw's studies leave unresolved the important question if the effects of fields on biologic amine metabolism correspond to abnormalities in learning or other behavior.

The electroencephalogram (EEG) per se was not studied in any of the New York projects. There is evidence that magnetic field intensities of current magnetic resonance imaging (MRI) equipment produce no changes in the EEG power spectrum in human subjects receiving brain MRI imaging (Bartels, et al., 1986).

6. Learning and Memory

Learning and memory are two complex processes that allow a person to adapt to the environment as a consequence of experience. Learning refers to the dynamic state during which time information is acquired, processed and consolidated. Memory refers to the capacity to display evidence that learning has occurred once the learning situation has been removed. Direct measurements of either learning or memory are difficult because they are manifested as performance variables. Performance can be influenced by motivation and emotional behaviors.

Two questions have been asked: (1) can electromagnetic fields affect learning and (2) can electromagnetic fields be integrated into a learning sequence? Two basic approaches have been employed to answer the first question.

One approach involves the consequences of short-term exposures to electromagnetic fields upon adult learning. A second approach involves exposure of the developing organism to fields and the later determination of learning or memory deficits. Answers to the second question utilize procedures by which the electromagnetic field is tested as a cue. The most typical model involves "state-dependent memory" whereby responses occur only in the presence of a field because they were acquired when the field was present.

Three separate projects addressed these problems. The Thomas and Liboff (Appendix 8) study evaluated the effects of brief exposures on adult learning; (2) the Salzinger study (Appendix 14) evaluated the effects of prenatal 60-Hz field exposures on adult learning, and (3) the second part of the Ossenkopp and Cain study (Appendix 12) determined the efficacy of the field as a learning cue.

The original Thomas protocol was composed of two phases. The first involved exposures to 50, 100, 300 or 500 μ T (0.5, 1, 3, or 5 G) 60-Hz magnetic flux densities with and without a 1 kV/m electric field for 30 minutes. Some of the exposure combinations were extended to one hour. The second phase involved intraperitoneal injections of either amphetamine (1 mg/kg) or chlordiazepoxide (10 mg/kg) just before the 30-minute exposures to the fields. This procedure allowed the potential discrimination of three potential levels of synergism or non-linear interaction: (a) between the magnetic field and the electric field, (b) between the magnetic field and the drugs, and (c) between the magnetic field, electric field and the drugs.

Selection of the specific parameters for the field conditions and injections had the following advantages and disadvantages. The four magnetic flux densities allowed the detection of potentially intensity-dependent behavioral responses. The single electric field value was a limiting feature of the study as well as the single dosage for each of the drugs. However, higher

electric field values may have compromised the design limits of the apparatus and the drug dosages were well within concentration range of maximum interaction with other substances.

As a consequence of some theoretical considerations and after there had been no obvious detection of field effects in the first two phases, a third phase of the study was conducted that involved reduction of the ambient static geomagnetic flux density from 40 to 26 μT (0.40 to 0.26 Gs) and the superimposition of a 60-Hz magnetic field of 50 μT (0.5 G). This design was considered to be important because of theoretical models and empirical studies with tissue preparations (Blackman et al., 1985).

The measurement involved an operant procedure with the animal learning to respond to obtain a reward that is presented as a function of the number of responses or the time of not responding. Operant procedures have the advantage of generating discrete, multiple measurements and data can be collected under relatively controlled conditions. A disadvantage is that a substantial amount of learning history is required for each animal before the treatment is begun, so that the behavior can become so conditioned that a particular procedure may be relatively insensitive to weak effects.

The specific method of measurement involved a multiple fixed ratio (FR) and differential reinforcement of low rate of responding (DRL) reinforcement schedule. In this instance, the FR was a FR 30 which means the animal had to display 30 responses (bar presses) before a reward was delivered and the DRL value was 18 which meant the animal could not respond for at least 18 seconds before a single response resulted in the delivery of reward. If the animal responded prematurely, the option for reward was delayed another 18 seconds. The animal had to further associate specific chamber cues (the color of a light plus the presence or absence of a tone) with the particular schedule. The FR

schedule generates high rates of responding while the DRL generates low rates of responding. An additional complexity of this procedure required the rat to not respond when all of the chamber cues were removed; a response at that time delayed the onset of the next schedule of reinforcement.

This multiple FR/DRL procedure is far superior to the single-schedule techniques that were used previously (de Lorge & Marr, 1974; Persinger, 1974). By the intrasession sequencing of schedules that facilitate high rates of responding, daily artifacts coupled with motivational factors can be reduced. In addition it allows for the differentiation of a general effect on behavior (both schedules being influenced) versus a specific effect on behavior (only one schedule being influenced). This distinction provides the first step for pursuit of mechanism. Whereas the FR schedule has been used to infer such conceptual processes as "perseveration" or schedule-induced "drive", the DRL is considered to be one of the best measures of the inferred process of "inhibition".

The selection of the FR/DRL schedule had a second major advantage that complemented the selection of two antithetic drugs along the stimulant-relaxant continuum. In addition to producing two distinct but common physiological states, these drugs influence behavior by separate but general agonist-receptor mechanisms. Thus not only the interaction between drugs and magnetic fields could be detected by this model but also the differential effects of this interaction on one of the two schedules could be detected.

The method of assessment of any treatment effect was intersession comparisons. This means that the behavior following a field exposure day (usually either a Tuesday or Friday) was compared to that of the other sessions. The advantage of this procedure is that a putative effect must exceed daily baseline oscillations. The primary measurement was response rate. The

advantage of using response rate (usually responses/minute) is its numerical values; its disadvantage is the effects of averaging and neglect of variable responding within the time frame. However variable responding can be observed by noting the inter-response times which are the times between responses. When the time between successive responses is plotted on the X axis and the numbers of responses with those times are plotted on the Y axis, a spectrum is obtained which allows the experimenter to perceive the composition of the temporal properties of the responses that composed the average measure (response rate). Both measures were used in this study.

The criterion for acceptance of a treatment effect was based upon the "systematic" change of behavior following field and/or drug treatments compared to baseline days. The advantage of a systematic change criterion is its reliability and simplicity. The disadvantage is that treatment effects that emerge as interactions from hidden factors are ignored. In addition, even an effect that occurs once every three times can be excluded. A systematic criterion usually excludes statistical analyses because the effects are blatantly observable.

The results of the exposures to the 60-Hz magnetic fields with and without the electric field and these conditions with and without either of the two drugs did not show either direct or interactive drug/field effects. The baseline and dispersion measures for the daily variations of responding for each of the two schedules were within acceptable ranges. The response rates and percentage change in response rates for the effects of the two drugs were comparable to results from the literature and indicated that the rates and the effects of drug dosage that were used in this study were representative of the normal population.

By far the most profound effect was the change in DRL behavior but not FR responding in rats that were tested after 30 minutes of exposure to a 60-Hz magnetic field plus a reduced orthogonal magnetostatic flux density of $26 \mu\text{T}$ (0.26 G) (about half of the background static earth's field). The major effect was an increase in response rate and a shortening of the inter-response time. This meant that the rats responded more quickly as if there had been an impairment of temporal discrimination; however an alternative hypothesis is a transient failure in some inhibitory process. The phenomenon was brief because it was present for at least an hour during the test period but not present 24 hours later (the next test period).

The empirical validity of the effect is suggested by its specificity to one schedule (DRL); this suggests the influence was not a general effect on behavior. The discriminative validity is also suggested because the effect was found only with the presentation of the 60-Hz field plus the reduced magnetostatic field and not with either the static field or the oscillating field when presented separately.

There are two levels of reliability. The first involves the occurrence of the effect in 5 of the 5 animals tested, although a conservative criterion would involve 4 of the 5 animals. Calculations from Appendix 8 showed that the mean relative increase in response rate following the 60-Hz plus reduced field exposure for all 5 exposures for each rat and for all 5 rats was 29%; the range of response facilitation (or "breakdown in inhibition") was 9% to 44%. Within each rat's performance the increase of response rate was similar to that of the group. In other words, the distributional characteristics within each animal were similar to the distribution of the group. This is a strong indicator of the robust nature of a phenomenon.

The lack of single source magnetic field effects upon DRL and FR schedules found in this study is similar to that reported by other major researchers over the last decade. Although the effect of the 60-Hz fields plus the reduction in the geomagnetic field appears to be new, it is not without conceptual replication (Blackman et al., 1985; Leal et al., 1986; Smith et al., 1987). In addition, Persinger (1974) showed that rats who were maintained on a DRL 20 schedule and who were exposed to an 0.5-Hz field also showed an increase in response rate over baseline values; the effect only lasted for about 24 hours despite continuous exposure. The type of equipment used to generate the fields was also shown to attenuate the local static field component. Both Rocard (1964) and S.W. Tromp in his classic text, Psychical Physics (1949), emphasized the importance of interaction between background magnetostatic field intensity and oscillating fields for their "detection" by human volunteers.

The Salzinger study (Appendix 14) emphasized the effects of preperinatal exposure to 60-Hz fields upon adult behavior in a specific operant paradigm. The term 'preperinatal' defines the time of exposure: about one day after conception to 8 days after birth. The pregnant mothers were exposed to either 30 kV/m electric fields plus 100 μ T (1 G) magnetic flux densities, 10 kV/m electric fields plus 33.3 μ T (1/3 G) magnetic flux densities or sham fields. Because there were only two exposure devices and the design was based on a reference group (groups that developed in one apparatus compared to other), the experimenters used either the full-field condition in one apparatus and no field in the other (sham condition) or the full field in one apparatus and the 1/3-field condition in the other.

The basic measure was behavioral. Each rat learned to press a lever for food reward that was delivered intermittently in time. The intermittent delivery was random, such that despite the animal's display of responses, only

one response was followed by food reward every so often. For example, if the schedule was a random interval (RI) 10 sec, the animal received a response contingent reward on the average every 20 seconds although the time between rewards varied between 1 and 40 seconds. This type of reinforcement schedule generates a relatively smooth and consistent response rate and has been used extensively in studies that require a "smooth baseline" or slope for measurement.

Salzinger's group utilized a sequence of random intervals that ranged from 10 sec to 180 sec. The change in random interval schedule was cued in the appropriate number of shifts such that there was little "carry-over" between random schedules (i.e., the animal's responses on the different schedules were similar to the behavior they would have displayed if they had been only trained on one of the schedules). This allowed a type of "dose-dependence" of schedules by comparing different rates of the presentation of rewards in time. The procedure effectively increases the operational number of measurements for each animal plus allows determination of any interactional or differential effects from power-line field treatments. This is useful for isolating mechanisms.

Salzinger began testing his preperinatal animals at 90 days of age. The occurrence of the significant field-attributed effects did not appear reliably until after the 20th session and remained relatively stable for at least another 30 sessions to the end of the study. The largest discrepancy between the sham-field animals and the field-exposed animals occurred with the shortest intervals of intermittent reinforcement (RI 10 and RI 20). However, the absolute magnitude of the effect was not greater than 20%. The response rates of animals exposed to extremely-low-frequency fields were about 20% less than that of the sham-field controls. A sensible explanation for the lag in the occurrence of the effect is not clear.

The possibility that electromagnetic fields could be used as "cues" for the occurrence of a physiological state was eloquently shown by Ossenkopp and Cain (Appendix 12). They preexposed mice to a 0.5-Hz magnetic field before daily morphine injections for about 10 days. Normal tolerance appeared. When the animals were exposed to a non-field condition before the morphine injection, sensitization to the drug returned. A similar dependence between the environment of morphine injection and the "learning" of tolerance has been blamed for some "accidental" drug overdoses. Ossenkopp and Cain found that a 60-Hz field could also act as a weak "cue" for the development of tolerance although it did not seem to influence the tolerance directly.

In summary, power-line-intensity electromagnetic fields do not appear to influence even the most complex operant schedules during adult learning situations. However, interactions between background geomagnetic field conditions and the 60-Hz magnetic component can influence behavior. The effect is transient and reversible. On the other hand, prenatal exposure to these fields produces more or less permanent changes in response activity. The meaning of the effect is obscure and its onset requires a long history of testing. Finally, 60-Hz fields can become cues that control the occurrence of behaviors, including those that involve tolerance to drugs.

7. Nerve Regeneration

Axonal growth is one of the most fascinating research areas in developmental neurobiology. Though the precise mechanism of axonal growth is still unclear, some biological aspects regarding the matter are being revealed. Axonal growth can be modulated by altering cationic flow through neuronal cell membrane. The neurite growth in pheochromocytoma cells (PC-12 cells) is affected by various extracellular concentrations of Ca^{++} and Mg^{++} (Koike, 1983). Higher concentration of Ca^{++} , however, may inhibit neurite growth as seen in

isolated molluscan neurons (Kostenko et al., 1983). Other monovalent cations, like K^+ and Na^+ , also play a very important role in modifying ionic flux through neuronal cell membranes of chick and mouse sympathetic ganglia and dorsal root ganglia (Skaper and Varon, 1980; 1981, 1983). Grinvald and Farber (1981) have demonstrated calcium action potentials at or near the growth cone of neuroblast cells. These findings indicate that axonal growth may be regulated by electrochemical phenomena (like ionic binding and membrane transport) involving neuronal cell membranes.

a. Cellular Growth: Axonal and/or neurite growth can also be modulated by artificially induced electromagnetic (especially DC) fields. It is now apparent that several cell types in addition to neuronal cells, respond directionally to electromagnetic fields. These cells under normal conditions of development travel from their point of origin to their final destination and apparently do so in response to endogenous electromagnetic fields. Examples of such cells are neurons (Jaffe and Poo, 1979), myoblasts (muscle cells) (Hinkle et al., 1981), fibroblasts (Erickson and Nuccitelli, 1984) and epithelial cells (Luther et al., 1983). As observed by Jaffe and Poo (1979), muscle and fibroblastic cells move towards the cathode more than the anode. Not surprisingly, the field strengths that can alter the directional migration rates of cells are very small (~ 7 V/m).

It should be made clear that migration of growth of neurites and other cells towards the cathode is a quantitative phenomenon involving static (DC) electric fields. It is also becoming apparent that minute electric fields stimulate neuronal cells to differentiate into neurons and promote neurite growth. Sisken and Smith, (1975) reported that not only do neurites of trigeminal ganglia grow towards the cathode but also that electric fields enhance neuronal survival time in cultures. Patel and Poo (1982) observed that

pulsed electromagnetic fields had effects on neurite growth similar to direct currents. The mechanisms underlying these observations are not fully known, but clearly calcium ions play an important role. This in part can be substantiated by eliminating extracellular calcium ions or adding calcium ion-channel blockers such as lanthanum.

Pilla (1979) has championed the view that pulsed electromagnetic fields perturb the electrochemical properties of cell membranes. With the application of pulsed electromagnetic fields, enhanced healing of recalcitrant bone fractures (Bassett et al., 1982), DNA uncoiling, inhibition of bone-cell responses to parathyroid hormone (Luben et al., 1982) and RNA transcription in salivary gland chromosomes (Goodman et al., 1983) have been reported. Albert et al. (1985b) have observed that 7-Hz pulse-train-type fields affect neuronal and neurite attachment and length of neurites. These appear to be an interplay between pulsed electric fields and exogenous nerve growth factor. Based on the above discussion, one can conclude that static and pulsed electromagnetic fields do affect cell growth, differentiation, survival and directional migration. Furthermore, calcium ions play an important role in this phenomenon. However, much more research needs to be conducted before the issue of mechanisms and hazards, if any, can be rationally discussed.

b. Peripheral Nerve Regeneration: Great interest has developed recently in the possibility of enhancing peripheral nerve regeneration by exogenous electric fields including extremely-low-frequency fields. While nerve regeneration differs at least in some respects from the original development of the peripheral nervous system, regeneration is thought to depend on some of the same processes, including directed axonal migration, Schwann cell direction, and interaction with muscle-fiber membrane proteins (Seil, 1983). During the last two decades investigators have cut a motor nerve, sutured it in place, and

attempted to monitor regeneration by histological analysis of the nerve or the performance of the reinnervated muscle. While some of the investigators, using various electromagnetic parameters, have had varying successes, their explanation of experimental conditions has often been so ambiguous as to defy analysis. Two recent reports - with quite different results - have more clearly specified experimental conditions, including the frequencies and wave-forms of fields used.

Ito and Bassett (1983) cut and re-sutured both sciatic nerves in female Sprague-Dawley rats. The animals were placed in body casts, and placed either inside magnetic coils (exposed animals) or at least three meters away (control animals). After prolonged exposures they studied both the histology of the nerve and performance of reinnervated muscles (gastrocnemius and soleus) for the success of regeneration. Distance traveled by viable axons past the cut stump was also recorded. Intracellular content was evaluated qualitatively. The mean load lifted by both hind legs was also determined by fixing the hind legs into a standard position and placing a load cell on the feet.

Ito and Bassett claim that, in comparison to control rats, animals exposed for either 12 or 24 hours per day had superior nerve regeneration. Experimental nerves had a greater migration of fibers past the distal stump; strangely, the actual distance was greater in rats given 12-hour daily exposures than in those given continuous exposures. While distances traveled by the regenerating nerves were significantly greater in both experimental groups than in controls, there was no significant difference between the experimental groups. Axon numbers and diameters were larger in the experimental rats, but the actual figures were not given. Similarly, interaxonal collagen was simply stated as having "appeared greater" in exposed animals. Functional tests showed no differences in mean loads until 12 weeks of exposure, when the exposed rats' hind limbs supported

more than double the mean loads of controls. The four rats that were not operated upon but were placed in casts had less ability to lift loads than untreated rats, but the differences were not significant.

While these results seem clear-cut, certain aspects of Ito and Bassett's technique are prone to error. However, these criticisms may be directed at all attempts to study nerve regeneration in an in situ system. Specific details and raw data on axon counting are not given, and the histological examination of each cross-section did not appear to be complete. Muscle testing was prone to errors in exact positioning of hind legs; and measured strengths may depend on factors other than the extent of nerve regeneration, such as animal size, age and pre-experimental activities. Cutting both sciatic nerves in each animal gives the investigators more data for each animal, but prevents one from having a control muscle or nerve in the same animal, which could be useful in both functional testing and neuronal histological evaluations. It might be more revealing to cut only one nerve and, instead, use the uncut nerve and muscle as a control rather than another animal.

A similar study by Orgel, et al. (1984) failed to find any enhancement of peripheral nerve regeneration by electromagnetic fields. These authors note, however, species differences and important differences in frequencies and wave-forms. In this study, rats were exposed to 15- or 72-Hz fields for a total of 12 weeks. To measure the extent of regeneration in the single nerve cut in each animal, Orgel et al. did histological analysis of the nerve as well as the ability of the nerve to conduct the retrograde transport of horseradish peroxidase (HRP), a substance whose reaction product can be visualized with light and electron microscopes. Also, electrophysiological recordings were made of the reinnervated muscles, comparing them with preoperative recordings.

In contrast to Ito and Bassett (1983), Orgel et al. found no significant

differences in nerve regeneration between either exposure group and controls or in axon diameters or densities, HRP transport to the spinal cord, or muscle compound action potentials.

Species differences, as well as differences in frequencies and wave-form, may explain the discrepancies between investigations as may the details of experimental techniques. In addition more needs to be learned about standardizing the actual field strengths of extremely-low-frequency fields experienced by the animals or tissues of interest.

VI. SUMMARY

In this section we focus on effects that have been found in the New York-funded projects and which seem worthy of further consideration because of their possible implications for human health.

A. MAGNETIC FIELDS

It is clear from the results of the studies sponsored by the Project, as well as from many other recent studies, that both 60-Hz electric and magnetic fields can affect certain biological systems. Magnetic field effects were found in a number of the projects in this program. However, the mechanisms responsible for these effects are unknown. Many effects have been observed at magnetic flux densities in the neighborhood of 100 μ T (1 G) or greater. These levels are similar in magnitude to the maximum magnetic flux density directly beneath power transmission lines. Lower magnetic flux density thresholds for most observed field effects have not been determined.

The epidemiological studies raise the possibility that magnetic flux densities one one-thousandth of those shown to have effects in laboratory studies may be a health concern. For several reasons, including the fact that a causal relationship between weak magnetic fields and cancer has not been established and that methodological uncertainties associated with quantifying magnetic field exposure levels exist, we cannot offer a recommendation based on the epidemiological studies. Except for houses close to power transmission lines, the major sources of magnetic fields in homes are the ground return currents from distribution systems and fields in the immediate proximity of appliances.

B. NEUROBIOLOGY AND BEHAVIOR

At the onset of this project there was serious question as to whether there were demonstrable neurobiological or behavioral effects of exposure to electrical and/or magnetic fields. Data accumulated by our contractors as well as a rapidly building literature on retinal magnetoreceptors in birds and mammals leave little doubt that such effects can be observed in well designed experiments.

In contrast, our knowledge of the mechanisms by which these effects are mediated has not advanced significantly. One hypothesis is that several of these effects are mediated via endogenous opioids. However, no data have been obtained to either support or deny this hypothesis. Other effects could be mediated or modulated by changes in the levels or intracellular localization of ionic calcium. The alterations in miniature end plate potential frequency by magnetic fields could be due to small changes in internal ionic calcium. Efflux of calcium from multicellular nervous system preparations reported by other laboratories reflects effects on extracellular calcium, and the physiologic relevance of this calcium store is unknown.

The reliable and specific effects of brief exposures to 60-Hz magnetic fields within a decreased geomagnetic background deserves further attention. Interactions between 60-Hz magnetic fields and the intensity and direction of the static background fields have been suspected by many authors and may be an important source of the variability in occurrence of magnetic field effects. The magnitude of the effect from exposure to the combination of 60-Hz magnetic fields and a reduced geostatic field suggests that geomagnetic fields may interfere with inhibitory behaviors. They would be displayed in situations that required dependence upon subjective estimates of timing and the suppression of impulsive responses.

Our studies have not shown any structural neuropathology in either developing or adult animals. We do not feel that there is a significant risk of structural change at the field intensities normally produced on the ground by power-lines.

Accepting that biological effects result from field exposure we are faced with deciding whether these effects might lead to adverse health effects. For most of the findings it must be emphasized that the changes are relatively small. However, some changes, such as the depression of hydroxyindole acetic acid levels in the cerebral spinal fluid seen by Wolpaw and Seegal, are extremely long lasting. The alterations in circadian rhythms are interesting in that such alterations can be associated with alterations in mood and behavior of subtle types. It is possible that these changes could underlie some of the rather "non-specific" changes which have been reported in the occupational literature in electrical switchyard workers. Certainly, circadian rhythms might be much more suitable parameters to monitor in occupational studies than the more vague subjective responses. A more dramatic effect of fields was the demonstration of a persistent deficit in the response rates of adult rats that had been exposed before and just after birth.

In our studies, no neurobiological effects were seen at field intensities lower than those encountered within the existing right-of-ways of 345- or 765-kV lines. Even those effects encountered were of reasonably small amplitude and could not be said with confidence to indicate health hazards. Our studies are limited in that many of them did not explore weaker magnetic fields or obtain adequate data to determine dose-response characteristics.

C. CANCER

Previous epidemiologic studies on adult and childhood cancer have been questioned because of serious methodological shortcomings. The results of the Savitz study on childhood cancer changes the situation considerably because it was designed to minimize flaws in previous studies, and because it was conducted under the supervision of a panel of independent scientists. Even though the Savitz study also has certain limitations, it indicates an excess risk for childhood cancer, in particular leukemias, associated with high current wiring configuration near the homes. Although this study basically confirms the results of the previous studies, the causal relationship is still no more than an hypothesis. However, the basis for this hypothesis is now stronger. The reasons why this is still only a hypothesis are 1) we still only have one well designed study, 2) there are unresolved questions in the Savitz study, and 3) there is no basic mechanism known to explain a causal relationship. If future research confirms a causal association between 60-Hz magnetic fields and childhood cancer public health considerations would have to be developed from 1) baseline risk of childhood cancer, 2) risk increase due to field exposure, and 3) distribution of exposure in the population.

On his own initiative, one of the Project investigators undertook studies of the effects of field exposure on the growth of cultured cells in soft agar as measured by the number of clones (colonies) formed. Normal cultured cells do not grow in soft agar unless they are "transformed," and field exposure did not produce transformation. However, the two cancer cell lines tested, which have the inherent ability to grow in soft agar, were reported by the investigator to form more clones after exposure.

Because of the possibility that these results were artifactual, that is, were related not to field exposure but to the inherent variability of the

cloning assay, clonogenicity of these same cancer cells lines was examined in a second laboratory. Dr. Hamburger, who participated in the replication study, was the originator of the cloning assay for evaluation of chemotherapeutic agents. In their final report Drs. Hamburger and Cohen report no consistent effects related to field exposure. In the replication study several significant findings are reported but these findings are not reproducibly observed and do not always occur in the same direction, that is in some experiments there are more clones in the control, in other experiments the converse is true.

We conclude that further replications of the influence of fields on the ability of cancer cells to form clones in soft agar are not warranted because: (1) electric and magnetic fields have not been observed to induce transformation in normal cells, (2) exposure of two cancer cell lines in two different laboratories do not provide convincing evidence of an effect of biological significance, and (3) extrapolations from the behavior of cancer cells in soft agar to intact organisms cannot be made. Extrapolation of possible field effects on cancer should be done with more relevant assays.

Previous studies were not strongly suggestive of either genetic mutations or chromosomal damage caused by electric or magnetic field exposure. Several independent investigations within the New York State Power Line Projects also failed to find evidence of genetic or chromosomal damage. In light of the epidemiology results future studies on chromosomes should focus on mechanisms of leukemiagenesis for example oncogenes and promotion. There is currently no convincing evidence for field effects on fertility or growth. Further animal studies would not seem warranted for these variables. Our studies on fetal development have shown no gross morphologic changes. However, the Salzinger results showed persistent changes in performance of rats that had been exposed in utero and immediately after birth. These results may reflect subtle but important alterations of nervous system development that are not reflected in gross morphology.

VII. RECOMMENDATIONS

Research sponsored by this project and related research has demonstrated variety of effects of electrical and magnetic fields. These findings do not readily translate into concrete regulatory recommendations on width of right-of-way, line heights, or location of lines near homes. They do, however, lead us to the recommendations which follow:

1. There should be a major research effort on means of power delivery and use that would reduce magnetic field exposures.
2. Further study should be made of the interactive effects of the earth's geomagnetic field and 60-Hz fields.
3. The determination of the existence of thresholds for biologic effects of magnetic flux densities should be pursued.
4. The experiments on field effects on learning ability should be replicated.
5. The possible association between cancer (especially leukemias) and magnetic fields must be further investigated. Several avenues of study should be pursued.
 - a. There should be further epidemiology study of residential exposure, conducted at more than one site with careful measurement of exposure.
 - b. Attempts should be made to correlate cytogenetic and diagnostic subgroups of cancers with exposures.
 - c. Further investigation of occupational exposure and cancer incidence should be conducted with improved documentation of actual exposures.

- d. Animal models should be developed and laboratory investigations designed to explore possible mechanisms of field-induced carcinogenesis. If an effect is documented, then the dose-response relationship should be investigated.
6. Further research on the biologic effects of electromagnetic fields is very important. It should be administered by an agency, preferably federal, which is credible by virtue of being clearly independent of partisan influence.

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IX: Appendix 1

Engineering Instructions for Contractors:

Exposure Systems and Dosimetry Section from RFP, 1981. pp. 1-2.

Phase Relationship Between Electric and Magnetic Fields for Projects in the New York State Overhead Powerlines Program. (Document distributed to all contractors in March, 1984). pp. 3-5.

APPENDIX: EXPOSURE SYSTEMS AND DOSIMETRY SECTION FROM RFP

FIELD DESCRIPTION. For all practical purposes the electric (E) and magnetic (B) fields associated with transmission lines may be considered to lie entirely in planes perpendicular to the lines. Deno (IEEE Trans PAS-95, 1600 (1976)) and Zaffanella and Deno (EPRI Report EL-302 (1978)) have described the field geometry of the 765 kV lines in some detail. These references should be consulted by those investigators unfamiliar with field computations.

Because 765-kV lines are three phase, the E and B fields near and under the lines have elliptical polarization instead of linear polarization. The vectors corresponding to the instantaneous value of the E or B field (giving intensity and direction of a field at a given point in space) rotate in a plane and describe an ellipse in this plane, which is perpendicular to the transmission line. Most previous studies of bioeffects of fields have employed linearly polarized fields.

E and B COUPLING. Although various investigators have established that 60 Hz electric fields alone and 60 Hz magnetic fields alone can each produce effects in living organisms, there may also be reason to suppose that simultaneous application of E and B fields might produce effects different from individual fields. (An example is the component of the Lorentz force involving a moving charge in a magnetic field: force = $qv \times B$, where the applied E field imparts a velocity to mobile charges. Such an effect would be maximized for field polarization such that E and B are always perpendicular to each other.

FIELD INTENSITIES. For animal and/or human studies, several field intensities should be examined, up to a maximum of $E = 30\text{kV/m}$ (rms) in air and $B = 1.0$ Gauss (rms). Fields as small as 30 V/m and 0.001 Gauss are of interest. When electric fields are generated by placement of electrodes in contact with growth medium the fields are more readily characterized in terms of current density. Since typical current densities inside a grounded man in a 10 kV/m field may be as high as 30 mA/m^2 , current densities in growth medium should be adjusted to a maximum of 300 mA/m^2 .

WHOLE ANIMAL STUDIES. Whole animal studies should use field exposure systems that are capable of producing linearly polarized E fields [$E = E_0 \sin(\omega t) \hat{y}$] and circularly polarized B fields [$B = B_0 \sin(\omega t + \delta) \hat{x} + B_0 \cos(\omega t + \delta) \hat{y}$], where the z direction is collinear with the transmission line conductors. Experiments designed to test the effect of simultaneous exposure to E and B fields are of particular interest; when both fields are present the phase angle, δ , should be adjusted to $0 \pm 5^\circ$.

IN VITRO STUDIES. In vitro cell, tissue, and organ culture studies may be conducted with E alone, B alone, or both. When both fields are present they should be either (1) adjusted in accordance with the whole animal exposure description above, or (2) applied in such a way so as to examine the role of polarization and time-phase angle between E and B. Studies of the second kind should examine a well established bioeffect such as the change in calcium efflux rates.

ELECTRIC-FIELD GENERATION. For whole animal studies E fields can be generated using, for example, a parallel plate system for a sinusoidal, linearly polarized field. Ideally, one of the plates is grounded and the animals are placed in good electrical contact with the ground plate (cf. the Battelle literature). Grounded subjects experience larger internal currents than subjects off-ground. Care must be taken to avoid corona

discharge in the design of the exposure system. Designers should be aware of the shielding effects due to neighboring test subjects (W. T. Kaune, Bioelectromagnetics 2, 33, 1981).

In vitro studies might be conducted using fields generated in air, in a similar manner to those for whole animal studies. Other techniques include (1) electrodes placed in contact with the growth medium (2) induction of a field in a toroidal container by replacing the coil on one arm of a transformer with the toroid, and (3) electrodes separated from the growth medium by either a dielectric or a conducting salt bridge. Several recently reported studies have employed the latter technique by placing a plug of agar gel with a conductivity similar to the growth medium, between the electrode and medium. Regardless of technique, the current density in the medium must be measured.

MAGNETIC FIELD GENERATION. Experimental systems should have the capability of producing magnetic fields uniform to within a few percent. In studies involving application of both E and B fields, the system should be capable of generating either a linearly polarized field perpendicular to the E field or a circularly polarized field in a plane containing the E field vector. (Circularly polarized B fields may be generated by means of two pairs of coils situated with perpendicular axes and driven 90° out of temporal phase).

CONTROLS. For experiments with separate controls, it is critical that the control subjects be housed in a manner that is identical in every detail to the experimental subjects with the exception that no fields will be present. The control housing must include all field generation apparatus and be capable of being converted to exposure housing by connection of field generation equipment; control field generators should be connected to a dummy impedance matching that of exposure chamber field driving equipment. Care must be taken to assure that noise and vibration characteristics of both sites are identical. Exposure and control sites must be routinely monitored for the presence of stray E or B fields; stray fields must be eliminated. Care must also be exercised in selecting control and exposure sites within a building to assure that they are identical in their electromagnetic characteristics. The experimental protocol should include a blind design and must call for replication of experiments with exposure and control housing reversed.

PHASE RELATIONSHIP BETWEEN ELECTRIC AND MAGNETIC FIELDS FOR
PROJECTS IN THE NEW YORK STATE OVERHEAD POWERLINES PROGRAM

The purpose of this document is (1) to set forth the rationale underlying selection of the phase relationship between electric and magnetic fields used in research projects conducted under the auspices of the New York State Overhead Powerlines Project and (2) to correct an error in the original specification of the phase relationship between the fields. The original specifications, which were included in the instructions to individuals preparing proposals are attached as an appendix to this document. The paragraph with the heading WHOLE ANIMAL STUDIES, which states the phase relationship, is in error.

When the Scientific Panel was preparing the request for proposals there was considerable discussion of the field specifications. The Panel took the position from the outset that field exposures for animal and human studies should include both electric and magnetic fields. This position was prompted by two considerations. The first was that although both electric and magnetic fields are present under power transmission lines, magnetic fields had been ignored by most investigators. The second consideration was based on the notion that electric and magnetic fields may have quite different effects on living systems. At the time these considerations were made there was ample evidence that magnetic fields alone could produce effects so we felt secure in adopting our two-field position. (For in vitro studies, however, it was decided that investigators could pursue experiments with E alone, B alone, or both.)

Although there was very little evidence that electric and magnetic fields might interact to produce effects substantively different from those they would produce separately (this situation is still true today), it was our discussion of this point that ultimately led to the specific phase relationship we adopted. Our general line of reasoning might be summarized in the following manner: Both electric and magnetic fields are present under transmission lines so experiments should explore the effects of both. Although certain in vitro studies might explore each type of field individually, it makes more sense in a short term project for studies on humans and animals to employ both fields, at least initially. Besides both fields together might produce different effects than those produced by the fields applied separately. Some phase relationship would have to be selected so that there could be some standardization of the exposure conditions between various investigators. But what is the best relationship? The fields beneath and near transmission lines themselves are hopelessly complex so it does little good to attempt to simulate them.

In considering the Lorentz force, $\vec{F} = q(\vec{E} + \vec{v} \times \vec{B})$, the velocity \vec{v} will, in general, be determined by both \vec{E} and \vec{B} . For the case when $|\vec{E}|$ is very large compared to $|\vec{v} \times \vec{B}|$, \vec{v} will be determined primarily by \vec{E} and hence the magnitude of the $|\vec{v} \times \vec{B}|$ term will be affected by the relative phasing of \vec{E} and \vec{B} . In this special case, $\vec{v} \times \vec{B}$ would be maximized if the electric field and magnetic field vectors were at right angles when they are at maximum intensity. This was the reasoning process that led us to specify the phasing spelled out in the original RFP (cf. section entitled WHOLE ANIMAL STUDIES in the Appendix). For the case that $|\vec{E}| \gg |\vec{v} \times \vec{B}|$, the $\vec{v} \times \vec{B}$ term may be of negligible importance in the Lorentz law. However, given the need to decide upon a phase specification for use by all investigators to facilitate comparisons between studies, it was felt that the above relationship was as good as any.

In retrospect, a further ambiguity regarding the phase specification in the RFP has been identified. The intent of the specification was to suggest an appropriate phase angle between E and B for fields inside the biological specimen. However, we failed to distinguish between two methods of applying or coupling the E-field to the specimen: resistive coupling and capacitive coupling.

For electrodes inserted in a conductive growth medium, in a manner similar to that used in many in vitro experiments, the induced current is in phase with the applied field. However for electric fields that are capacitively coupled to the subject, such as is the case in humans or animals exposed to electric fields generated between conducting plates in air, the induced current is 90° out of phase with the applied electric field. Our specification applied to fields with systems using resistive coupling and is incorrect by 90° for those employing capacitive coupling. These statements are of course strictly true only for objects that are very good conductors. Biological subjects are not homogeneous and have electrical properties that differ from region to region. Thus the true phase relationships for real subjects are unknown and are only approximated by the relationships outlined above. This fact notwithstanding, we feel that the 0° figure inside the medium or subject is a good target value and that deviations within biological samples is probably no greater than the tolerances we have accepted for adjusting external field phase relationships.

The Panel also discussed the question of polarization of the fields at length. In selecting linearly polarized vertical electric fields and circularly polarized magnetic fields we were guided by the power transmission line measurements reported by Don Deno (reference cited in the appendix). Practical considerations entered here too: it is far more complex and expensive to generate circularly or elliptically polarized electric fields than it is to generate similarly polarized magnetic fields.

Returning now to our original specification, the applied fields should have a spatial and temporal relationship given by the following equations:

$$\vec{E} = E_0 \sin(\omega t) \hat{y}$$

$$\vec{B} = B_0 \cos(\omega t + \delta) \hat{y} + B_0 \sin(\omega t + \delta) \hat{x}$$

where the unit vectors \hat{x} and \hat{y} define a plane perpendicular to the earth and δ is a phase angle. For fields that are generated in air and coupled capacitively to the test subject, δ should equal $\pi/2$. For electric fields produced by resistive coupling to the test subject, as is true for in vitro experiments which employ electrodes in contact with a conductive growth medium, δ should equal 0. Thus for air fields, for example, at $t = \pi/2\omega$, $\vec{E} = E_0 \hat{y}$ and $\vec{B} = B_0 \hat{y}$; both electric field and magnetic field vectors are colinear (vertical either parallel or antiparallel) and have assumed their respective maximum values.

When these matters were first discussed, it was our hope that we could sponsor some research involving examination of the phase angle. It was our thought then that it would probably be most efficient to perform such experiments in vitro, using test systems that had demonstrated effects at the initial phase angle. If electric and magnetic fields do work in concert to produce synergistic effects, it is possible that the effects will be altered by changes in the phase angle. It is very desirable that such a study be carried out if synergistic effects are observed.

