

**PRELIMINARY UPDATE AND
DOCUMENT REVIEW OF
SEISMIC HAZARDS
508 ± ACRES
BEDFORD CANYON
CORONA, CALIFORNIA**

**PROJECT NO. 31558.3
FEBRUARY 5, 2003**

Prepared For:

Bluestone Communities
4100 Newport Place, Suite 730
Newport Beach, California 92660

Attention: Mr. Ralph Emerson

February 5, 2003

Bluestone Communities
4100 Newport Place #730
Newport Beach, California 92660

Project No. 31558.31

Attention: Mr. Ralph Emerson

Subject Preliminary Update and Document Review of Seismic Hazards on the 508 ± Acre Project, Bedford Canyon Development Project, Corona, California.

At your request we have conducted a review of available geologic and geotechnical reports, maps, and other documents pertaining to the anticipated seismic hazards at the ±508 acre Bedford Canyon Development project located in the city of Corona, California. The purpose of this research was to augment and update our original feasibility study conducted for the site by this firm in February and March of last year.

We have noted that the far southwestern portion of the site will most likely be included within an Earthquake Fault Zone by the State of California. This will mandate that prior to any development in this zone a fault study must be conducted, which would include the excavation of a subsurface trenches. This requirement should be included as a mitigation in the environmental impact report and the study should be conducted along with the preliminary geotechnical report for the project in support of the rough grading plan.

In addition, there is a modest potential for a series of other smaller faults at the site to undergo seismic activity, or sympathetic movement, as well as secondary settlement. These faults will require a similar study.

The cost for these trenches will vary greatly depending on the amount of evidence for recent seismic activity, if any, is uncovered. If active traces are found, additional trenches will be required to delineate the fault(s) across the site.

We appreciate this opportunity to be of continued assistance to you on this important project. Should you have any questions regarding this report, please contact us.

LOR Geotechnical Group, Inc.

TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION	1
REVIEW OF PAST/CURRENT FAULT STUDIES	2
DISCUSSION OF FINDINGS	4
CONCLUSIONS	6
 APPENDIX A	

INTRODUCTION

During November and December of 2002, a Preliminary Update and Document Review of the Seismic Hazards was performed by LOR Geotechnical Group, Inc., for the proposed residential and commercial development of $508 \pm$ acres within Bedford Canyon wash in the city of Corona, California. This review was conducted to augment the original geotechnical feasibility study conducted by this firm for the site in February and March of last year by providing a review of data that was not readily available during our original study, to review two new tentative studies conducted around the site, and to determine the impact of this data on the proposed site development.

The scope of our services included:

- Review of the recently revised State of California Earthquake Fault map for the Corona Quadrangle;
- Review of a fault study currently being conducted by the firm of Geosoils Inc., on the property adjacent the site to the south;
- Review of stereo aerial photograph pairs of the site and surrounding regions dated 1931 through 2000;
- Interviews with the current and past County Geologist;
- Interviews with personnel from the California Geological Survey;
- Supplementary geologic field reconnaissance mapping of the compiled data, and;
- Preparation of this report and the attached map summarizing our findings and providing conclusions and recommendations for future site studies and site design.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1 within Appendix A. To orient our investigation, CAD drawings illustrating the site boundaries and proposed lot layout, was provided by AEI-CASC Engineering, Inc., undated, for our use. This map was utilized as a base map for this review and is attached to this report as a 500 scale Plate, Enclosure A-2, within Appendix A.

REVIEW OF PAST/CURRENT FAULT STUDIES

As noted in our original feasibility investigation the far southwestern end of the site is currently located adjacent to, but not within, the Earthquake Fault zone along the Elsinore fault zone which lies just southwest of the site, as shown on the Corona South Quadrangle map prepared by the State of California Geological Survey. At this time the State Geological Survey is in the process of updating the Corona South Quadrangle map of Earthquake Fault Zones.

On November 1, 2002, a preliminary map was released for public review. According to this map the State will widened the old Earthquake Fault Zone, to incorporate a small fault running across the far southwestern end of the site. This new fault lies in the same position as the fault labeled fault "I" in our original study, and which we recommended that further studies should be conducted.

We contacted Mr. Jerry Treiman of the State of California Geologic Survey, who informed us that he has added this fault, and others, based on a study currently underway by the firm of GeoSoils Inc., on the "Retreat" project adjacent the subject site to the south. Mr. Treiman also informed us that the preliminary map is scheduled for final release on May 1, 2003.

Within the time-frame of our original feasibility investigation we were unable to find complete documents regarding the fault hazard study for the Eagle Glen project which borders the site to the north. The city of Corona informed us that these projects were annexed by the city after approval of the fault hazard reports by the County of Riverside. At this time we have conducted a search of the archived fault hazard reports on file at the County of Riverside, and interviewed Mr. Steven Kupferman, the previous County Geologist at the time of the Eagle Glen projects and Mr. Wayne Harrison, the current County Geologist.

Mr. Kupferman informed us that he reviewed the fault hazard reports conducted for the various tracts of the Eagle Glen project which lies north and northwest of the site. These were originally started by the firm of Leighton and Associates in 1988, and then finished by the firm of GeoSoils, with Mr. Edward Lamont and Mr. Edward Burrows

as the lead geologists in 1997. In addition, GeoSoils utilized Mr. Roy Shlemon for age dating techniques.

Mr. Harrison provided us access to the reports mentioned above, with the exception of the Leighton report, which could not be located. In addition, Mr. Harrison provided a copy of fault hazard evaluation currently underway by the firm of GeoSoils for the "Retreat" project within the County of Riverside, adjacent the southwestern portion of the subject site.

All of these reports noted the presence of a the main Elsinore fault zone running along the base of the hills in a series of semi-parallel fault strands, as well as various smaller subsidiary faults running farther away from the hills. The reports documented the steps leading to the creation of non-building zones along the main fault. However, they had relatively minimal discussion on the smaller faults which lie away from the base of the hills.

In the reports for the Eagle Glen project, GeoSoils noted active faulting along the main fault, which they show as passing just to the southwest of the subject site. In regards to the smaller, shorter, faults which cross the subject site and lead onto the Eagle Glen project, shown on our previous report as faults "F", "G" and "H", it was their opinion that these are inactive faults. This was supported by the age of materials noted in a trench excavated by the firm of Leighton and Associates, overlying one of these smaller faults which, according to Mr. Roy Shlemon, are on the order of 100,000 years or greater in age.

In the reports for the "Retreat" project, GeoSoils also noted active faulting along the main fault zone, but made no mention of the smaller, shorter, faults which cross the subject site and lead onto the "Retreat" project. The report made no mention of, with the exception of showing one small fault on their map labeled as an "inactive" fault as to the activity of those faults.

We contacted and interviewed Mr. Ed Burrows, the project geologist for GeoSoils Inc., about these studies. Mr. Burrows informed us that they have found evidence of numerous faults at both the Eagle Glen and "Retreat" projects. However, they have encountered great difficulty in using standard dating methods to determine the activity

rating of these features, especially the smaller faults located farther away from the main break. This is due to the age of surficial materials along this area, which have been given preliminary ages on the order of 200,000 years or greater by Dr. Roy Shlemon, a consultant to GeoSoils. In addition, Mr. Burrows provided several reports which were prepared by GeoSoils for the "Retreat" project, but were not on file at the County. We also interview Mr. Roy Shlemon PhD, a consultant for GeoSoils Inc., for further details.

DISCUSSION OF FINDINGS

The reports and documents reviewed as part of this study and our original feasibility study indicate that the site lies adjacent to the main strand of the Elsinore fault, which is considered to be an active fault. The major type of movement along this fault is termed "right-lateral-strike-slip with a thrust component", which means that when this fault ruptures the land on the northeast side of the fault will move to the southeast, while the Santa Ana Mountains will move to the northwest. This motion does not appear to occur over a single definite plane, but is spread out over a zone of smaller fault splays. In our original study we noted evidence that one of the splays appeared to cut along the far southwest corner of the site. This fault was referred to as fault "I" in our original study and is illustrated on Plate 1. Since the date of that report, the State of California has classified this fault as an active fault and placed a zone which extends 500 feet away from this feature within an Earthquake Fault zone, mandating fault studies prior to development.

As noted on the geologic map within our original report, our faults "F", "G", and "H" were reported to extend across the subject site, then offsite onto the Eagle Glen project. While we were unable to note evidence of the existence of these faults in our study, these features were addressed by the firm of Leighton and Associates for the Eagle Ranch project. This project was later taken over by GeoSoils. In their study Leighton did excavate a trench across the area where our fault "G" was shown on the map prepared by the State of California. They found no evidence of faulting in this trench and they concluded that these faults are inactive, or do not exist.

In addition to these faults, our feasibility report noted that along with the right lateral motion on the Elsinore fault there appears to have been a large amount of "stretching"

or extension of the region east of the Mountains. This type of motion is typically accompanied by the development of one or more seismic features known as grabens in which the fault motion is not lateral but vertical along an inclined plane.

In our feasibility report, we noted the presence of three of these grabens, which are bounded on both sides with faults. Fault "A" appears to be the southern fault of the northern most of these features exposed on the subject site, with the northern most fault obscured possibly by the freeway. Faults "B" and "C" are the middle graben, while faults "D" and "E" are the southern most. Two of these features were also noted by Gray, and one was noted by Weber, in past regional studies conducted by the State of California and the USGS.

Faults with lateral movement, like the main break of the Elsinore fault, tend to have relatively straight surface traces. However, one aspect of faults with vertical, up or down motion, like faults "A" through "E", is that the surface trend of the fault can be very irregular and difficult to follow for long distances. While our mapping of the subject site did not extend southeast onto the "Retreat" project, it appears that one or two of these grabens, perhaps faults "B" and "C" and faults "D" and "E" may extend onto this property, and were documented as doing so by the past regional studies by the State of California and USGS.

One of these faults was noted on the geologic map prepared by GeoSoils for their study of the "Retreat" project currently underway. This fault appears to line up with our fault "E". To investigate this fault GeoSoils excavated one fault trench across the fault and mapped a road cut slope which cross the fault. They reported that in their trench there was approximately 5 feet of colluvial materials overlying the fault which did not appear to be faulted. Therefore, they labeled this fault "inactive" on their map. However, they did not give an estimate of the age of the colluvium.

The County of Riverside, in a review letter dated November 27, 2001, did express concern on the "minimal" amount trenches across this fault, as well as a general lack of data to support the "inactive" determination and the potential for sympathetic movement or differential settlement. GeoSoils has responded by providing more indirect evidence, that it is their opinion that these smaller faults have not had any

activity in the last 100,000 years, based on a lack of strong aerial photograph lineament on any faults.

CONCLUSIONS

The past studies conducted by other geotechnical firms on the faults labeled as "F" and "G" indicate that these faults do not exist as active faults. It is our recommendation that no further studies will be required on these features. The inclusion of the far southwestern portion of the site within an Earthquake Fault Zone by the State of California due to the presence of the fault labeled as fault "I", will mandate the City of Corona to require that prior to any development in this zone a fault study must be conducted, which would include the excavation of a minimum of two trenches, one 800 feet in length with another approximately 300 to 400 feet in length.

There appears to be a modest potential for the faults "A" through "E", to undergo seismic activity, or sympathetic movement, as wells as secondary settlement. Therefore, it is our opinion that a subsurface investigation, consisting of the excavation of a minimum of two moderately shallow, backhoe trenches excavated within the older alluvial materials above the canyon, on the order of 100 to 150 feet in length, and two longer, moderately deep, trenches on the order of 200 to 250 feet should be excavated within the alluvial materials of the main canyon.

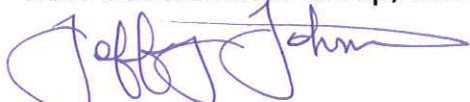
In summary, it is our opinion that the potential for fault hazards at the site may effect the eventual outcome of the lot placement at the site. Therefore, the subsurface investigation discussed above should be conducted to aid in the future preliminary planning of the project and included as a mitigation in the environmental impact report. In addition, this study should be conducted along with or prior to the preliminary geotechnical report for the project in support of the rough grading plan.

Bluestone Communities
February 5, 2003

Project No. 31558.31

We appreciate this opportunity to be of continued assistance to you on this important project. Should you have any questions regarding this report, please contact us.

Respectfully submitted,
LOR Geotechnical Group, Inc.



Jeffrey J. Johnston, CEG 1893
Engineering Geologist



JJJ:tg

Distribution: Addressee (6)
AEI-CASC Engineering, Inc. (2)

REFERENCES

California Geological Survey, State of California Earthquake Fault zones, Corona south quadrangle, Preliminary Review Map, released November 1, 2002.

GeoSoils, 2002, Fault Investigation, The Retreat Project, County of Riverside, unpublished consultants report, dated August 26, 2002, GeoSoils WO 3426-A1-OC.

GeoSoils, 2001, Response to County of Riverside's Geotechnical Report Review of Specific Plan 317, The Retreat Project, County of Riverside, unpublished consultants report, dated June 18, 2001, GeoSoils WO 3426-A1-OC.

GeoSoils, 2001, Preliminary Mass Grade Plan Review, Lotting Study 7, The Retreat Project, County of Riverside, unpublished consultants report, dated June 18, 2001, GeoSoils WO 3426-A2-OC.

GeoSoils, 1998, Geotechnical Review of Portions of the Eagle Glen Project, (Non conditional use permit) Tentative Tract 28476, City of Corona, County of Riverside, unpublished consultants report, dated March 31, 1998, GeoSoils WO 3181-A2b- OC.

GeoSoils, 1997, Geotechnical Review of conditional use permit rough grading plan tentative tract 28476, Eagle Glen Project, City of Corona, County of Riverside, unpublished consultants report, dated March 21, 1997, GeoSoils WO 3181-A2- OC.

Gray Jr., C.H., 1961, Geology of the Corona South Quadrangle and the Santa Ana Narrows Area, Riverside, Orange, and San Bernardino Counties, California and Mines and Mineral Deposits of the Corona South Quadrangle, Riverside and Orange Counties, California, California Division of Mines, Bulletin 178.

Gray, Jr., C.H., D. Morton, and E.H. Weber, 2002, Geologic Map of the Corona South 7.5' Quadrangle, Riverside and Orange Counties, California, v. 1.0, United States Geological Survey, Open File Report 02-21.

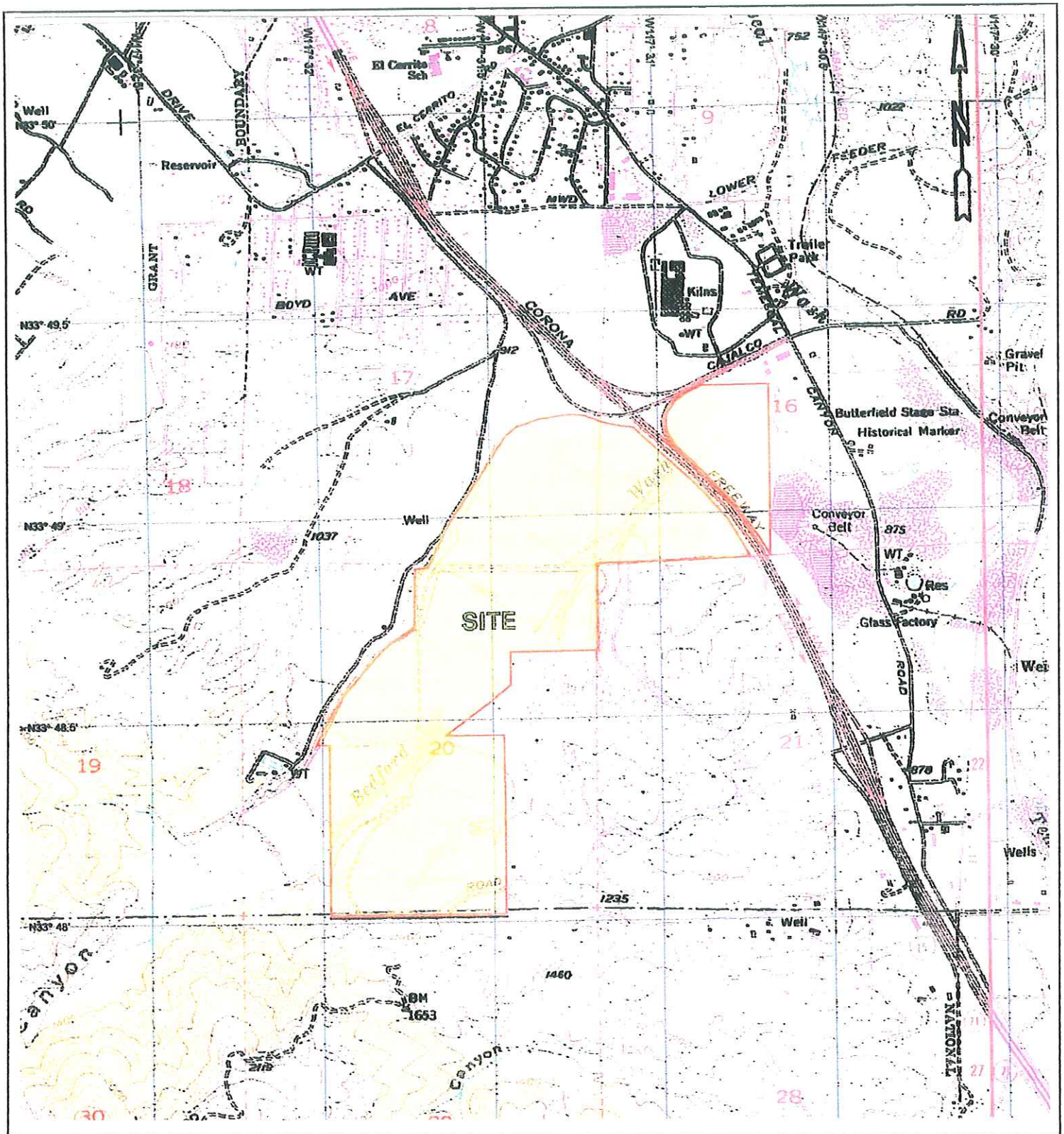
Hart, E.W. and W.A. Bryant, 1997, Fault-rupture hazard zones in California, California Dept. of Conservation Division of Mines and Geology Special Publication 42.

Weber Jr., F.H., 1977, Seismic Hazards Related to Geologic Factors, Elsinore and Chino Faults, Northwestern Riverside County, California, California Department of Conservation, Division of Mines and Geology, Open-File Report 77-4.

AERIAL PHOTOGRAPHS

<u>DATE</u>	<u>PHOTO NOS.</u>	<u>SCALE</u>
September 24, 1931	360 through 363	1" = 1,000'
January 30, 1962	503 and 504	1" = 2,000'
May 24, 1974	367 through 369	1" = 2,000'
April 10, 1980	385 and 386	1" = 2,000'
February 4, 1984	1130 through 1132	1" = 2,000'
January 21, 1990	8-7 and 8-8	1" = 2,000'
January 30, 1995	8-9 and 8-10	1" = 2,000'
March 11, 2000	8-8 through 8-10	1" = 2,000'

APPENDIX A



INDEX MAP

PROJECT:	BEDFORD CANYON, CORONA, CA	PROJECT NO.:	31558.31
CLIENT:	BLUESTONE COMMUNITIES	ENCLOSURE:	A-1
LOR Geotechnical Group, Inc.		DATE:	FEBRUARY 2003
		SCALE:	1" = 2000'



PLAT

PROJECT:	BEDFORD CANYON, CORONA, CA	PROJECT NO.:	31558.31
CLIENT:	BLUESTONE COMMUNITIES	ENCLOSURE NO.:	A-2
		DATE:	FEBRUARY 2003
		SCALE:	1" = 6000'

LOR Geotechnical Group, Inc.