APPENDIX C

PUBLIC AND AGENCY COMMENTS ON THE DRAFT EA

APPENDIX C

PUBLIC AND AGENCY COMMENTS ON THE DRAFT EA

This Appendix includes a list of agencies, persons, and organizations commenting in writing and a reproduction of each comment letter received during the 30-day public review period. Letters are reproduced in the order shown on the list of commentors below:

A. List of Persons and Organizations Commenting in Writing

- George Leitmann, July 19, 2010.
- Terri Compost, July 19, 2010.
- William Kirkpatrick, Manager of Water Distribution Planning Division, East Bay Municipal Utilities District, July 19, 2010.
- Wanda C. Bronson, July 20, 2010.
- Emilie Strauss, July 24, 2010.
- Georgia Wright, July 26, 2010.
- Laurie Sarachan, July 25, 2010.
- Carole Schemmerling, July 27, 2010.
- Jennifer Mary Pearson, July 28, 2010.
- Stephanie Thomas, July 28, 2010.
- Charlene M. Woodcock, July 28, 2010.
- Mary Lee Noonan, July 29, 2010.
- Gale Garcia, July 28, 2010.
- Gene Bernardi, July 14, 2010.
- Barbara Robben, undated.
- Georgia Wright, Save Strawberry Canyon, July 27, 2010.
- Pamela Sihvola, Committee to Minimize Toxic Waste, July 26, 2010.

LETTER #GL

-----Original Message-----
> From: gleit@berkeley.edu [mailto:gleit@berkeley.edu]
> Sent: Monday, July 19, 2010 10:52 AM
> To: Abbott, Kim
> Subject: General Purpose Bldgs. Phase 2B
>
>
> Dear Mr. Kim,
> I write to you, after reading the proposal "Seismic Life-Safety,
> Modernization and Replacement of General Purpose Buildings, Pase 2B",
> to urge EPA to undertake an EIS rather just an EA. The proposal raises
> serious concerns, in the events of earthquake and fire, and these need
> serious consideration.
>
> George Leitmann
> Professor in the Graduate School
> College of Engineering
> Universty of California, Berkeley
>

GL-1

LETTER #TC

From: t compost [mailto:terricompost@yahoo.com]
Sent: Monday, July 19, 2010 11:15 AM
To: Abbott, Kim
Subject: Concerns about labs in Strawberry Canyon!

Mr. Kim Abbott, DOE Office of Science
NEPA Document Manager, LBNL
One Cyclotron Road
Berkeley, California 94720

Dear Mr. Kim Abbott,

I am very concerned about the future building plans and safety of current and future projects in the environmentally sensitive Strawberry Canyon. It seems essential that at the least, the DOE does a full Environmental Impact Study (EIS), not an Environmental Assessment (EA). **TC-1**

Frankly I find it disturbing that hazards such as radioactive and other hazardous wastes, are being created and stored on land that is highly vulnerable to landslides, fires and earthquakes. **TC-2** I am deeply disappointed that the canyon has already been contaminated with tritium and toxic underground plumes, **TC-3** (not to mention extensive invasion of the experimental erharta grass) a sign of the inability or lack of concern that prevents these labs from operating safely. **TC-4**

Planning these labs in a precious ecosystem in the watershed above Berkeley and the San Francisco Bay is pure folly. Please don't allow these irreparable mistakes continue. **TC-5**

Sincerely,
Terri Compost

LETTER #EBMUD

EAST BAY
MUNICIPAL UTILITY DISTRICT

REC'D JUL 20 2010

July 19, 2010

Kim Abbott, NEPA Document Manager
Department of Energy, Berkeley Site Office
Lawrence Berkeley National Laboratory
One Cyclotron Road, MS 90-1023
Berkeley, CA 94720

Re: Notice of Availability – Draft Environmental Assessment for the Lawrence Berkeley National Laboratory Seismic, Life Safety, Modernization and Replacement of General Purpose Buildings, Phase 2B Project, Oakland/Berkeley Hills

Dear Mr. Abbott:

East Bay Municipal Utility District (EBMUD) appreciates the opportunity to comment on the Draft Environmental Assessment (EA) for the Lawrence Berkeley National Laboratory Seismic, Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2B Project. EBMUD provided written comments on the Draft Environmental Impact Report (EIR) to the Lawrence Berkeley National Laboratory in March 2010 which were subsequently incorporated into the Final EIR issued in June 2010. EBMUD has no additional comments on the Federal EA for this project.

If you have any questions concerning this response, please contact David J. Rehnstrom, Senior Civil Engineer, at (510) 287-1365.

EBMUD-1

Sincerely,

William R. Kirkpatrick
Manager of Water Distribution Planning Division

WRK:AMW:djr
sb10_150.doc

cc: Jeff Philliber, Environmental Planner
Lawrence Berkeley National Laboratory
Environmental Planning Group
One Cyclotron Road, MS 76-234A
Berkeley, CA 94720

LETTER #WB

-----Original Message-----
From: Gordon/Wanda Bronson [mailto:gwbronson@comcast.net]
Sent: Tuesday, July 20, 2010 4:20 PM
To: kim.abbott@bso.science.doe.gov
Subject: Proposed developments in Strawberry Canyon

Dear Sir;

I strongly urge you have a full EIS performed on the site of the building being proposed to be erected in Strawberry Canyon. A number of potential environmental hazards have been identified by citizen groups such as the Save Strawberry Canyon organization; being a long- lived member of the neighborhood I share their concerns and believe we have the right to ask for proper and fact-based reassurance. **WB-1**

Sincerely,

Wanda C. Bronson
3456 Dwight Way
Berkeley, CA 94704

JULY 24, 2010

RE: SEISMIC LIFE SAFETY, MDA, REPLACEMENT OF GENERAL PURPOSE BLDG, PH 2B

Dear Mr. Abbott –

AS A LONG-TEME BERKELEY RESIDENT AND USER OF STRAWBERRY CANYON, I AM CONCERNED ABOUT PROPOSED CONSTRUCTION OF A GENERAL PURPOSE LAB IN BLACKBERRY CANYON AND A RETROFIT OF BUILDINGS 85/85A. ES-1

THERE ARE A NUMBER OF POTENTIALLY SIGNIFICANT IMPACTS THAT TRIGGERS PREPARATION OF AN EIS.

- ADDITIONAL ANALYSIS NEEDED TO DETERMINE IF BLACKBERRY CANYON IS ESPECIALLY PRONE TO SOIL MOVEMENT DURING EARTHQUAKES ES-2
- CONTAMINANTS MAY BE RELEASED BY GRADING THAT COULD DAMAGE THE WATERSHED/ENTER STRAWBERRY CREEK. ES-3
- PROPOSED PIER DESIGN WILL NOT PREVENT OR PROTECT THE (85/85A) STRUCTURES FROM SLIDES GENERATED BY MUDSTONE. ES-4
- WILDFIRES COULD RELEASE MANY TOXIC COMPOUNDS INTO THE AIR. IF THE FIRE WAS DRIVEN BY EAST WINDS (AS WAS TRUE IN THE OAKLAND FIRE) IT WOULD AFFECT WHERE I RESIDE ON HEARST AVE. ES-5

REC'D JUL 26 2010

• ALL ACTIVITIES OCCUR IN OR NEAR HABITAT FOR THE FEDERALLY-THREATENED ALAMEDA WHIPSNAKE. (2) ES-6

IN SUMMARY, DUE TO A NUMBER OF SIGNIFICANT POTENTIAL IMPACTS, THE ENVIRONMENTAL ANALYSIS FOR THESE TWO PROJECTS NECESSITATES PREPARATION OF AN EIS, NOT EA, AS MANDATED BY NEPA.

THANK YOU FOR CONSIDERATION OF MY COMMENTS. ES-7

SINCERELY,

Emilie Strauss

EMILIE STRAUSS
1606 HEARST AVE
BERKELEY, CA 94703

LETTER #GW

105 Vicente Rd.
Berkeley, CA 94705
July 26, 2010

To Kim Abbott
NEPA Document Manager
US DOE
One Cyclotron Road
Berkeley, CA 94720

Re: EA for NEPA, General Purpose Lab, 85 and 85A strengthening

Alan Kropp and Associates (AKA) reports for Building 25 or the General Purpose Laboratory, cited in the Final EIR on disc and on the web, were only added to the web after their absence was reported to LBNL. As they were used in the " matrix" of the FEIR to contest points made by several individuals, they would appear to be important. **GW-1**

AKA, May 29, 2009, a preliminary report, made in two weeks "to meet LBNL's objectives," lays out the problems and what additional work will be necessary to help solve them.

1) AKA's preliminary investigation of old boring logs are consistent with the presence of a paleolandslide under B25.

2) Orinda Formation under the Lawrence Road (south and downhill from 25), is potentially part of a palealandslide rather than in-place bedrock.

3) Offsets in the curbs are not sufficient to evaluate historic slides. [Evidently AKA was not given access to the files on historic landslides.]

4) The borings suggest very low factors of safety, although these may be based upon conservative measures.

5) **Additional trenching is needed** (to establish whether the paleolandslide has moved recently.)

GW-2

AKA, April 2, 2010.
Trenches 1 and 2 are mentioned but only T-1 (southwest of 25, 8' deep) appears on the map. There are no photos of the trench nor is it discussed. The "general sketch" at the end of the report is indeed too general. Were there slickensides, indicative of movement?

Historical borings around B25 indicate Moraga volcanics which "break into rubble during drilling." Gravity has moved colluvium downslope. Moraga Formation is highly permeable (although is it called "bedrock," which in common or dictionary definition means hard rock. Neither Moraga Formation nor Orinda Formation fit that definition. **GW-3**

AKA, May 29, 2010 , supplemental report

Boring log #1 (north of 25) has 8' of fill. Clay to 11.5', and silty clay below that. **GW-4**

Boring 2 (south of 25) Moraga volcanics with weak rhyolite, then andesite down to 90' where Orinda claystone and siltstone are found. (Muds and mudstones give rise to manyu problems in civil engineering because they are weak and shrink or swell on being dried or wetted." Mudstones are siltstone, mud-shale, or claystone. "Muds are very reactive to physical disturbances or differential loading, and they slump and flow easily when subjected to stress." (*Oxford Companion to the Earth*, 2000, p. 715) A three-story General Purpose Laboratory would indeed exert differential loaking and stress. **GW-4 cont.**

Boring 3 (south of 2) Orinda Formation
Boring 5 & 6 "southern side of proposed central plant site" (not on map):
Atterberg Limits;
Boring 5, (4-4.5' deep)Plasticity Index 56,;
Boring 6,(6 – 6/5' deep), Plasticity Index 46.
"Onsite soils having a PI of 15 or less are generally considered to have a sufficiently low expansion potential to be used as non-expansive fill." 5 and 6 are marked "Fat Clay" and not to be used for fill. AKA says these must be removed. **GW-5**

In effect after all these reports AKA has not come to a comclusion that the Moraga volcanics are a paleolandslide or in-place "bedrock". AKA did not examine the trench for slickensides, nor did it dig a second trench. Moving or not, should you build on "weak volcanics that break into rubble during drilling"? Will spread footings do the trick when the earthquake strikes? What about the contact with Orinda mudstones? **GW-6** **GW-7** **GW-8** **GW-9** **GW-10**

Both **Buildings 85 and 85A** are shown in the FEIR for CEQA to straddle two paleolandslides, characterized in several earlier consulting reports as potentially liable to move in a major seismic event and at different rates. Slickensides were prevalent throughout the area. In earlier reports 60% of the HWHF buildings (the southwestern parts) overlie the Orinda Formation clays. In the EA, however, AKA's plans show only QLS2 (or QLS4 on the colored map) crossing all but a small part of 85 and no characterization of the leftover area. AKA had declared in an earlier report that 10 feet of Moraga Formation lies under the northeast corner of the buildings, and below that 25 feet of Orinda Formation. What is under this area? **GW-11**

AKA proposes drilling 21 piers around two sides of B85 and 9 piers around two sides of B85A, these to be 5 feet in diameter and 40 to 50 feet deep, TO STOP THE LANDSLIDE, evidently the top one of Moraga Formation (hard but fractured volcanics.) What will stop the building from being torn apart? Has anyone ever used piers to stop a landlside? Into what will those piers be drilled that is less expansionary and stronger than mudstones? (AKA 2006, a propos the Animal Care Facility nearby, suggested a mat under the building so that it might move integrally, a proposal AKA could not make, evidently, for 85, as it would entail rebuilding.) **GW-12**

Missing from the reports are 9 boring logs, AKA 7 – 16. Where are these and their interpretations? They will be needed to determine the quality of the Moraga volcanics, the Orinda mudstones, and whatever lies beneath. **GW-13**

What does lie not far below the surface is water! In the EIR are tables recording water heights, taken from monitoring wells. The EA refers to them on p. 22. North of 85 the water measured from 16 to 12 feet below surface while south of 85 the range was from 40 to 35 feet.. Accounting for the difference in elevations the water table seems to be level there. But east of 85A at the same elevation as the well south of 85, the difference is huge—the level according to AKA ranges between 24 and 0.3 feet. This means that there is a "perched water table" or reservoir and that the other two wells may have penetrated a separate reservoir.

This is just what one expects in the caldera of the volcano upon which the Lab has constructed its buildings. When such a reservoir breaks during a seismic event (the breaks in 1973 may have been caused by a series of small events), the landslides may be devastating as they were in 1973. The unpredictable reservoirs, springs, and aquifers mean that conatminants spread all over. Monitorying wells are seldom left open for long. See the report *Contaminant Plumes of the Lawrence Berkeley National Laboratory…* (2007)http://berkeleycitizen.org/lbnl/cmtw1.html

GW-14

Fire What are the plans in case of a wildlands firestorm? The East Canyon site is heavily wooded, with pines and eucalyptus, grasses and scotch broom, all flammable. The HWHF contains radioactive waste on the first floor and mixed solvents and volatile organic compounds on the second floor of 85. There are a number of storage sheds for liquid and dry combustible compounds. How are these protected from a fire like that of 1991 (2000 degrees, destroying concrete, "fireproof" safes, metals, etc.)?

During the 1991 fire, which reached the south wall of the next, Claremont canyon, Director Shank ordered all personnel to leave. Is this the plan today? How will people, air, water, and earth be protected when the fire reaches the East Canyon buildings or those generating the wastes? We are about due for another wildland fire, which come at 20 year intervals.

GW-15

There is a brief paragraph dealing with fire in the EA. In essence it says "trust us!" It says LBNL has been declared a site with "not a high potential for wildland fires." But FEMA was willing to grant a huge amount of money to ridding the Canyon of trees above the site, a project now on hold. . On EA p. 141, "In 1994, UC LBNL published a Wildland Fire Evacuation/Relocation Plan. The plan, which would apply to the Proposed Action, is based on a wildland fire scenario that would require rapid mobilization of resources, quick decision making and well-coordinated execution by emergency responders during a wildland fire." The footnote sends one to a website that is no longer operating. Have the plans also been abandoned? The 1994 plan was evidently motivated by the lack of a plan in 1991. At a "Community Advisory Group" meeting in June, someone asked about emergency plans. Evidently there were none!

GW-16

GW-17

There is no other building on Lab property which would fill the requirements for the HWHF, so this very dangerous site must remain exposed to fire and landslide with little

GW-18

reinforcing of the building itself. The interim storage of hazardous materials is impossible because they would need more than the 90 days permitted, while the HWHF has a special dispensation, over one year, to sort them out and to find permanent disposal sitse. GW-18 cont.
Which buildings produce all of these radioactive wastes, volatile organic compounds, solvents, etc. that accummulate in 85 and the sheds? How are they protected? How does LBNL rationalize the LRDP in an area so dangerously unstable, so close to the Hayward Fault, and so close to wildlands? GW-19

The best **alternative** for the LRDP is UC's Richmond Field Station, where there is plenty of room for both buildings and parking, construction would be much cheaper on the flat land, and the site is farther from the Hayward Fault. The only negative that LBNL is willing to mention is invalid. The hill site is NOT served by public transit but by Lab shuttle buses, just like Richmond! As bus and BART are to the present site, so BART is to Richmond with a stop one mile away. The RFS is 6 miles or 20 minutes from UC campus. GW-20 GW-21
Evidently the problem lies elsewhere—"scientific adjacencies." This argument has never been explained. The scientists at LBNL, like those everywhere, find their natural colleagues all over the globe! One need only search LBNL personnel's publications! We suspect there is not all that much lab equipment sharing or conversations after work, The reasons for holding so tightly to this dangerous site appear to be that the view of the Bay plus the name "Berkeley" would attract more visiting scientists than "Richmond," although the latter has tremendous views and a sylvan setting! GW-22

We hope that the Department of Energy will be more wary of approving dangerous projects after the miserable performance of the Minerals Management Services. The least the Department can do is to perform an EIS with many more logs of trenches and borings and fewer desperate "solutions" for building over landslides!

Cordially, GW-23

Georgia Wright, Board Member
Save Strawberry Canyon

LETTER #LS

REC'D JUL 2 7 2010

1000 Rispin
Berkeley, California 94705

July 25, 2010

Mr. Kim Abbott, Office of Science
Department of Energy
Lawrence Berkeley National Laboratory
1 Cyclotron Road
Berkeley, California 94720

Re: **Environmental Impact Statement Needed** for Proposed Seismic Life-Safety, Modernization and Replacement of General Purpose Buildings, Phase 2B

Dear Mr. Abbott:

Several years ago I participated in submitting comments re: the Draft Environmental Impact Report for the LBNL Computational Research and Theory Facility building proposed to be built on the ridge above Cyclotron Road. This was before the court established that the CRT merited federal environmental review. I believe it is fortunate for everyone concerned that the CRT facility, planned to intrude upon a natural and precarious landscape, has not been built at that site. In the instance of the "Seismic Life-Safety, Modernization and Replacement of General Purpose Buildings, Phase 2B" it seems obligatory that a full EIS be prepared. LS-1

I have reviewed the EA for the Phase 2B project. I discovered immediately that the title of the project is misleading. Both "seismic" and "life-safety" appear to be misnomers for a project that cannot actually "fix" existing unfavorable conditions for large industrial type buildings on the slopes of Strawberry and Blackberry Canyons. LS-2 In addition to the existing environmental risks, this project has the potential to increase future environmental risks and to cause further degradation of significant natural resources. LS-3

First, it is incredible that there is a Hazardous Waste Handling Facility located in Strawberry Canyon. Because I live in the adjacent Claremont Canyon to the south, I know that Strawberry Canyon is an irresponsible site to place any industrial building, but especially a building that houses contaminated, toxic, and/or radioactive materials. Information regarding the operations and reason for the Hazardous Facility needs to be more complete. What exact materials and quantities are taken there? From where? From which other facility? How are the materials taken there? What is meant by "storage?" How long is each material stored there? What physical barrier is constructed in the facilities that gives the public assurance that the hazardous/radioactive waste "would not LS-4

be released to the environment?" Why is this the *best* site for handling, placement, and/or storage? Would it not be more financially prudent to take or store all waste materials in a non-seismically challenged site? If, in fact, certain waste materials are required to stay on the LBNL site for a required amount of time, then is this not one of the most compelling reasons to *move all of LBNL's research out of the Canyons*? I urge that it is essential to discuss fully in an EIS the whys and wherefores of an appropiate alternative site other than the current LBNL location. **LS-4 cont.**

The EA also ignores, by definition, a respectful discussion of the Hazardous Facility presence within a significant natural park resource. How does the Hazardous Facility affect the aesthetic and cultural value of Strawberry Canyon? Re-establishing high-tech, waste management buildings and the associated diesel truck traffic into a valued landscape corridor seems contrary to NEPA Section 101(b) which makes it the responsibility of the federal government to:

> *assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings... attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences... [and] preserve important historic, cultural, and natural aspects our national heritage...*

How the Hazardous Facility will further impact the irreplaceable physical assets of the Canyon and its social benefits to the adjacent university and urban community must not be overlooked. Any overriding reason to justify seismically strengthening the Hazardous Facility <u>at this site</u>, rather than removing it to an alternative site for the purpose of protecting a beneficial natural environment, merits comprehensive information and discussion. **LS-5**

Due diligence in compliance with NEPA would seem to indicate that the Hazardous Waste Handling Facility merits a stand alone EIS, independent of the other proposed actions in the Phase 2B proposal. **LS-6**

The LBNL objective to establish the General Purpose Laboratory as a modern research and office space within the Blackberry Canyon area also raises many questions that should determine an EIS is in order. The GPL design, its footprint and height, 43,000 sq. ft., with 3 stories and two exhaust stacks, is inappropriate for the hillsides of Berkeley. It seems obvious that LBNL's Long Range Development Plan to develop a 21st Century research "park" within what was once a clean watershed source, defined by oaks, bays and buckeyes, is short-sighted and a risk. No "seismic" bracing or concrete footing can secure such a building, as well as additional buildings, in this unstable location. The **LS-7** **LS-8**

building design itself (might be termed in this location as "green wash") and the planting of a non-native industrial park landscape (after removing 2 coast live oak trees) with surrounding parking spaces belongs elsewhere. Please refer to NEPA Section 101 (b), as quoted above, to reassess the wisdom of building any laboratory and office facility such as the GPL in Blackberry Canyon. **LS-9**

The description of the GPL project and proposed alternatives raises more questions. How would private/corporate participation be defined at such a laboratory? How would the LBNL staff be linked to any private/corporate investment or research? Should there be a disclosure of private investment in regards to conflict of interest (BP comes to mind)? Is the financing of the facility only from federal sources? What federal sources? Is there a time-frame that is mandatory in relationship to the availability of federal financing? **LS-10**

What is meant by offices? If the 3-story GPL is designed to provide 60% office use, then why is an urban setting, such as Richmond accessible to Highway 80, not more suitable?
How will the office and wet-lab research address the Congressional initiative to stimulate economic recovery? Why would not a location such as Richmond be a location that would comprehensively stimulate economic recovery, involving broad community needs, create a new center for research with a civic profile, while also being linked to a University research center? **LS-11**

I am concerned especially that the EA lacks detailed information regarding what will take place in the proposed wet-lab multi-program of the GPL. The EA description of the kinds of research seems to leave nothing out in the form of a general listing, but gives no specifics about potential environmental impacts of any of the kinds of research. The EA is too vague about the kinds of waste. **LS-12**

In particular, it is unclear how extensive the scientific research will be to create and use man-made nanoparticles. The Molecular Foundry, dedicated to state of the art nanosceince was built by LBNL and DOE without the benefit of environmental review. Now it would be irresponsible not to ask about the potential for the cumulative presence of man-made nanoparticles in the atmosphere due to LBNL activities. There is increasing concern about man-made nanoparticles in the atmosphere. This subject deserves serious detailed discussion in an EIS. What is the volume of man-made nanoparticles at LBNL? Has there been any location-site testing of man-made nanoparticles at LBNL surrounding the Molecular Foundry? Could there be a release of nanoparticles through a cooling system? The exhaust stacks? Into the water and waste system? What about potential release into the Strawberry Creek watershed and, thus, into the Bay? What about the wind patterns extending across the Bay to Marin? **LS-13**

I lived through the terror of the Oakland Firestorm of 1991. We had to evacuate our home and for a time we believed that Claremont Canyon had been consumed. It was only a miracle that it was not. A historic fire in 1923 beginning along the ridge of the East Bay Hills consumed all of North Berkeley, stopping just north of Blackberry Canyon. Urban wildland fires are devastating and promise to return to the Oakland-Berkeley Hills. The EA fails to reflect the reality of the dangers. How can the EA minimizes the threat of urban wildland fires? It is a stated danger for all of California. How can there be a serious discussion of the issue when Alameda County map in the EA rationalizes the non-threat of urban wildfires by portraying non-incorporated areas. What about the East Bay Park ridgelands? The Canyons? What about the urban and residential areas adjacent to the wildlands? The potential for urban-wildland fires alone is reason to move all of LBNL elsewhere. **LS-14**

Finally, if a fire occurred, possibly due to a seismic event, how would fire and life-safety be managed at LBNL? The potential for disaster is reason enough to reconsider the LBNL LRDP, in particular the Hazardous Waste Handling Facility and the General Purpose Laboratory. **LS-15**

Sincerely,

Laurie Sarachan

LETTER #CS

From: carole schemmerling [mailto:caroleschem@hotmail.com]
Sent: Tuesday, July 27, 2010 11:00 AM
To: kvabbott@lbl.gov; Jeff Philliber
Subject: EA phase 2

Dear Kim Abbott and Jeff;

Thanks for letting us use email to respond.....it saves me going down the hill in my cranky car.

Cheers.....
Carole Schemmerling

The New Busy think 9 to 5 is a cute idea. Combine multiple calendars with Hotmail. Get busy.

CS-1

STRAWBERRY CREEK WATERSHED COUNCIL

The Strawberry Creek Watershed Council wishes to comment on the EA for the Seismic Safety projects Phase 2B. We approve the plans for the removal of buildings 25/25B, 55 and the trailers at building 71. This plan is welcome, up to a point.....but there are serious issues being overlooked. **CS-1 cont.**

The plans to "strengthen" building 85/85A are so ill-conceived that it is hard to believe that this is a serious proposal.You claim that your upgrades "would prevent movement of the underlying slide in an earthquake" is a perfect example of Wishful Thinking! Therefore we insist that a separate EIS be done for this facility. Buildings 85/85A are on an old landslide, there is No bedrock and it has so much water below, that this project stands alone as one that should be removed all together ASAP. **CS-2** **CS-3** **CS-4**

Your plans for the 25/25B site, are also of great concern. According to the "Bedrock" geological map of LBNL which you sent to us, has No indication of where this Bedrock might be, shows that the 25/25B site is an area of landslide deposits. And that this is an area that is an active ground water remediation site. Where is the logic in paving over a site when you don't know how much contamination is there? How do you prevent detected contamination **CS-5** **CS-6**

from migrating through the ground water? Have you ever accomplished that at LBNL? You certainly have not done so with the tritium plume. CS-6 cont. CS-7

To construct the GPL on the 25/25B site is another very bad idea. All of the issues mentioned above are rational obstructions to the development of this site. There are other sites than LBNL available for new construction. It is totally irrational to construct any new buildings on a hill that is contaminated with huge amounts of toxins, on the Hayward Fault, on the headwaters of 12 tributaries of Strawberry Creek, in the fire zone and believe it or not, the northern end of the Sibley Volcanic Caldera Complex. Maybe LBNL thinks there is no limit to the funds available for this very costly project, but if public funds are going to be used, we
believe it that it is incumbent on the lab to construct on a site that is cost effective! CS-8

The nearly 20 million gallon a year Gorilla missing from the plans is the WATER. Without acknowledging the huge amount of water that is there, the Lab will never understand how irrational their plans are. If their magical thinking allows them to continue to ignore the natural hazards of the site, as well as those they have placed there, then just as has happened in the Gulf, we will all pay dearly. CS-9

Carole Schemmerling
861 Regal Rd.
Berkeley, CA 94708

510.524-4005

CS-9
cont.

S

LETTER #JMP

-----Original Message-----
From: Jennifer Pearson [mailto:jennifer.maryphd@gmail.com]
Sent: Wednesday, July 28, 2010 4:50 PM
To: Abbott, Kim
Cc: jennifer mary
Subject: COMMENTS RE: THE LAWRENCE BERKELEY NATIONAL LABORATORY SEISMIC LIFE-SAFETY, MODERNIZATION AND REPLACEMENT OF GENERAL PURPOSE BUILDINGS, PHASE 2B

July 28, 2010

Mr. Kim Abbott
NEPA Document Manager
Department of Energy, Berkeley Site Office One Cyclotron Road, MS 90-1023 Berkeley, CA 94720

COMMENTS RE: THE LAWRENCE BERKELEY NATIONAL LABORATORY SEISMIC LIFE-SAFETY, MODERNIZATION AND REPLACEMENT OF GENERAL PURPOSE BUILDINGS, PHASE 2B

JMP-1

While the Seismic Life Safety Modernisation and Replacement of General Purpose Buildings Phase 2B lumps together disparate projects, all involve disturbing once again the hilly terrain at LBNL, and a brings to the fore a host of interconnected leftover situations. Thus, this commentary is underlain with concern for our scarce public water asset value, our most precious resource that is stored beneath the LBNL and East Bay Regional Parks--at times referred to as the pure geologic water of the Lennert Aquifer, discovered over 30 years.

I SUSTAINABLE DEVELOPMENT at LBNL-- HYDROGRAPH - WATER ASSETS

The Brundtland Commission Report of 1987 stated we must " meet the needs of the present without compromising the ability of future generations to meet their own needs".

Simply stated, rather than building by building demolition and construction at LBNL, the entire hydrograph of LBNL campus and beyond requires a full study. With respect to embracing the principles of sustainable development aren't we compelled to preserve our scarce public trust water for future generations?

JMP-2

Thus, a full Environmental Analysis is called for; the alternative site of Richmond Field Station may be far more sustainable, more secure and have less impacts on sustainable water assets, not threatening downstream, downhill residents as it fronts on marshlands.

One can argue that this planned construction can hinder progress toward sustainable development. The narrative justifies that safety of human life from seismic threats can be met by developing a General Purpose Lab, retrofitting the Waste Facility and building out 10 more facilities for a complex research campus on the Hill. The GPL building and the concepts of the research projects that it will house may narrowly work towards meeting the needs of the present goal of sustainability--a safer work environment and good research on sustainable energy innovations. However the siting of this building perched on hilly terrain up hill and upstream from where we live and work does not address the needs of the future for the larger community

who share the hydrograph beneath us--in short our future drinking water resources asset will be threatened.

Again, those of us who live and work close-by in the same bioregion as LBNL share the local hydrograph--in the global hydrological cycle that is a significant and inseparable component of the water cycle, of the climate, of the basis of life forms. In short the local water footprint is significant for the needs of the present and for our future. Water that sheds from rainfall permeating the ground along with seeps of upsurges of geologic water abound in the Berkeley Oakland Hills --some flows downhill 900 feet to the SF Bay in open creeks following the basins carved by seismic and water movement; most flows beneath the ground (groundwater in hidden creeks) and permeates into perched water retained below us in the water table, in larger bodies of water as aquifers, which will soon be explored for our drinking water recharge opportunities, These future water sources for human sustainability--for our children and grandchildren deserve fierce consideration. We are facing water scarcity now.

JMP-2 cont.

Although the present Phase 2B Project has stimulated some progress in selected borings for geologic engineering or goeengineering design, it has not met the goal of the Bruntland Commission.

JMP-3

II THE DEPARTMENT OF ENERGY THEMES; and LBNL LEADERSHIP VALUES

On current DOE web-pages, the post Cold-War mission of the Department of Energy for Federal Scientific Laboratories sets forth three themes: the stockpiling of weapons of mass destruction; environmental cleanup; and, technical development and research.

In late 2009, after 20 years at the Lab, Dr. A. Paul Alivisatos took over steering a new course as Director of the Berkeley Lab. The new imagery of the lab describes research across a wide range of scientific disciplines with a strong commitment to sustainable energy innovations and cites:

BERKELEY LAB VALUES are:

Overarching commitment to pioneering science

Highest integrity/impeccable ethics

Uncompromising safety

Diversity in people and thought

Sense of urgency

It is most significant that in 2010 the Director has elevated the Lab's community outreach efforts, hiring staff who listen and inviting community partners to meet with himself and the major decision makers in a friendly Community Advisory Group.

Given the above, we encourage the Director to put out a call in confidence to past employees and long time community members to work up an All Hazards Vulnerability List for the goal of uncompromising safety. Such could enable his management to address the 'dark secrets'

JMP-4

that remain underground from past years of classified research using radionucleides, volatile organic chemicals, biological organisms and much that we do not yet know about that were 'stealthily buried' in the softer soils.

Further reading on DOE pages, states that there are scattered patches of radionucleides or toxic chemicals embedded in the land and buildings on national laboratory sites that can serve as TESTBEDS for pioneering cleanup techniques.

JMP-4 cont.

III LBNL HAS TESTBEDS: The challenge of pioneering environmental waste cleanup technologies for identified underground contaminant plumes:

The LBNL was once listed to be designated as a Superfund Site to receive funding for environmental cleanup under CERCLA (Comprehensive Environmental Response and Liability Act (1980). Unfortunately, LBNL was de-listed administratively/politically with no explanation while Lawrence Livermore Laboratory which had military base legacy contaminants receives robust funding to the present day. Following the first six years, the Federal Government enacted SARA, Superfund Amendments Research Act (1986) to add a focus on innovative research for hazardous waste cleanup.

JMP-5a

We learned recently, that UC Berkeley Engineering Professor Lisa Alvarez-Cohen received a SARA, Superfund Research Program grant. Her team leads in the discovery and application of novel micro-organisms and biochemical pathways for microbial degradation of environmental contaminants to improve bioremediation of superfund contaminants.

Perhaps, there are other researchers working on cleaning water, cleaning soils of hot and cold contaminants who receive SARA funding? If such funded research projects allow experimental work on testbed sites that are not designated Superfund sites, then it begs the obvious question:

JMP-5b

Is anyone at LBNL researching improved cleanup methods for the celebrity, Tritium and other radionucleides, and the synergized toxic chemicals that have been identified in the 'hot zones' of ground, soils, rock layers, creeks, perched water pockets or vaults, and underground waterways,identified in LBNL documents?

Is any effort underway to interest scientists to work pioneering cleanup techniques at any of these plume testbed? Given that Tritium has such a long life, and we hear of traces of tritium found all over the country, it would be consistent with the DOE mission of technical development and research for safe methods of environmental cleanup. These hot zones provide an opportunity! And we learned from previous employees that there are the 'cold zones' of decomposing biological waste.

JMP-6

1V SEISMIC LIFE SAFETY; THE GENERAL PURPOSE LAB AND SAFE WASTE HANDLING BUILDINGS --SAFETY FIRST!

There is so much that we don't yet know of what lies beneath the LBNL, and what has flowed downhill beneath the UCB Campus, and further downhill deep beneath our homes and businesses in Berkeley.

JMP-7a

And we don't know how and where the earth will open up when the Hayward Fault faults.

We don't know what will happen to contaminated plumes; we don't know if the splays that lace the Berkeley hills between the many identified faults will zig zag open, that plentiful geologic water from the Lennert Aquifer beneath the Lab will surge up, or contaminated waste water wil spring up in old traces of springs and seeps in our gardens downhill at our homes.

JMP-7b

While geotechnical engineers can assure us that sample borings and soil studies indicate what they assert IS beneath the LBNL, their studies are shallow nor do they apply to every square foot beneath existing buildings. Thus, an expert engineer in 2010 can design a geoenginered foundation for a new facility where he believes can be safely anchored over earthquake fault splays, underground streams, perched water ponds and layers of rock which sometimes is referred to as 'solid ground'. In earthquake country solid ground is questionable.

Ten years hence, in 2020, another geotechnical engineer may throw out that analysis and design and provide a stricter set of standards of construction, Or, he may recommend no construction whatsoever at that site as he has subsequently learned of a Pandora's Box of warning alerts that cumulatively strike him as an unsustainable site for future generations of humans.

JMP-8

The forces of nature elude forecasters who presume stationarity when using risk analyses.. Climate changes of excessive rainstorms, droughts, killer heatwaves, volcanic ash clouds, earth fault movements, firestorms, impact landslides, sinkholes, underground aquifers depletions or floods, dissolved rock, landslides--all manner of dynamic changes from largely natural forces are risks.

The cumulative risks of more and more disturbances of the steep hills at the LBNL site when more and more construction begins, have yet to be discovered and established for NEPA staff to review. The standards of development set by DOE Facility Safety Office Of Health, Safety, and Security to protect Lab personnel to work in a safe, healthy, and environmentally sound manner will change as future scientists pioneer research.

V ERNEST LAWRENCE CHOSE AN ALTERNATIVE SITE FOR THE SAFETY OF COLLEAGUES AND TEAM

Ernest Lawrence never imagined the Lab he founded would move soil, build, demolish, and rebuild filling out the land he choose as an alternative site to protect the health and safety of his academic colleagues. Ernest Lawrence moved his high energy physics research unit from the UCB Campus to the alternative hill site creating the Radiation Laboratory and in two canyons east of UCB. The land was empty, quite inaccessible for the public; he theorised that the slopes could absorb radioactivity from the accelerator experiments.

VI WOULD LAWRENCE TODAY CONTRIBUTE TO AN ALL HAZARDS VULNERABILITY INDEX COMMUNITY PROCESS?

JMP-9

Lawrence never imagined the range of classified research that took place in the "hot" zones and the problems of "hot" waste which for years were buried in pits in the ground--some forgotten-- and now ly beneath buildings that may soon be demolished or retrofitted. Had he lived until today, he likely would have learned of the high seismic risk and perhaps, even have contributed to an All Hazards Vulnerability Index.

People following the new course of values for the LBNL say it is time now to stop and follow the legacy of Lawrence to not compromise safety. Embrace the Bruntland sustainability: to not comprise the needs of the future generations by present use of resources.

VII A SATELLITE CAMPUS? Let LBNL revered and feared! become LBNL revered!

We request all readers to commit to a smart satellite campus for upcoming facilities development where no humans lives downhill, downstream.

JMP-9 cont.

Compare costs of changing the construction of the General Purpose Lab site to Richmond Field Station. A new GPL at a safe, modern, high accuracy research facility suitable for co-located and co-ordinated research at Richmond Field Station Add a lounge and indoor/outdoor cafe space for teams of individuals with different expertise to share knowledges. Scientists from UCSF who presently research at RSF could join in conversations.Clean Bay air, a beautiful view and ample parking with a a10 minute shuttle ride to the UCB main Campus.

JMP-10

Just imagine Physicist Steven Hawkings coming to visit in his wheelchair and the lack of American Disabilities Act access at the current Lab as opposed to a lovely scenic new laboratory campus on flat Richmond Field Station?

JMP-11

VIII ALTERNATIVE WASTE HANDLING FACILITY AT RFS

Entertain constructing a new state of the art Waste Handling Facility at RFS and then abandoning the current facility. If the building as planned and a satellite campus starting with the GPL is developed at RSF, another waste handling facility will be needed. Templates abound on DOE websites for safe waste facilities; indeed the nearby State Department of Health secure facility or Bayer Labs can provide tours that may assist in realising that the site of the present WHF is far too vulnerable.

JMP-12

IX CURRENT SHODDY PERIMETER SECURITY AT LBNL

The responses on page 54 Section IV.B.7. Intentional Destructive Acts states an UNTRUTH. We can easily see a rusty falling down fence with holes that we could crawl through in many steep slopes or follow the creeks uphill from the roadway by the Strawberry Canyon Recreation Facility or the creek in Blackberry Canyon. These old rusty fences are not secure. The hills above the lab are accessible by car and foot. Homes are within a few hundred feet of the weak fencing. We do not see any walls, lighting, cameras, etc...

JMP-13

"The Proposed Action is not expected to require additional security for the LBNL site The entire LBNL site is fenced, and controlled access is available only at three entry gates. Card Keys would be used for building access." And, "The building would have a guard on the door during normal business hours and card key access."

" If the GPL were to be built at the RFS, the security configuration would be similar..."

This last statement is doubtful. Would DOE permit a skimpy security design for a new asset, a laboratory worth millions of dollars with research projects that are priceless?

JMP-13 cont.

Aside from Lawrence Berkeley and classified Livermore, that lack a perimeter buffer zone to insulate surrounding civilian communities--is there any other Federal Lab that lacks a state of the art secure perimeter?

JMP-14

X WHAT ARE DOE SECURITY STANDARDS?

A 200 feet no private vehicle perimeter?
A blast standoff area?
Perimeter lighting of complex?
An access control center and security plan that can override key controls to all doors and gates?
loading docks outside footprint of main building?

(There is much more available on the internet.)

We continue to request that staff look at asset values and geographic range of threats related to this ICONIC government facility in concert with local law enforcement leadership who know the terrain.

JMP-15

XI FEARED 'COLD' BIOHAZARD LEGACY WASTE ?

An in confidence call to the larger community to partner with the management at LBNL to produce an ALL HAZARDS VULNERABILITY INDEX would allow recognition and future pioneering research on not only the 'hot' waste, but could flesh out the legacy of biological organisms waste that was secretly dumped and buried--the 'cold' biohazard waste of decomposing bodies of experiments with animals.

Years and years ago, when the Lab was still the Rad Lab and highly secretive it was called the "Stealth Lab". We recall the caged hyenas (from above Strawberry Canyon that were screaming when we took our children to swim at the University's pool--i.,e., until their vocal chords were severed); the frightened beagle dogs that barked all night long that we could hear for miles--other animals used in classified research including the radioactive chickens we saw in the poultry facility adjacent to Chicken Creek just up the road from the pool. Much is still there that we don't see or know about. Some organic bio-agents may still be alive. Metaphorically, one can imagine a 15th Century nightmare illustration of evil sinister chimeras lurking below ground awaiting a time to arise and plague the living with 'the sins of our fathers.'. This may not be likely; however it could serve for another testbed research project for SARA funding.

JMP-16

XII HOPE FOR FUTURE GENERATIONS

If we could work together towards an open transparent knowledge process, commit to the best possible clean-up, protect our reserve drinking water bank, and support a beautiful modern secure satellite campus at more stable land of Richmond Field Station perhaps the LAB will no longer be feared, it will be highly revered and attract even more of the best scientists for pioneering research for sustainable practices for all peoples worldwide.

Thank you for your attention to this lengthy essay.

Sincerely, Jennifer Mary Pearson, Ph.D. 1546 Milvia Street, Berkeley, CA 94709

please confirm receipt.

JMP-17

LETTER #ST

Subject: need for full environmental review for GPL
From: Stephanie Thomas <skthomas@flash.net>
Date: Wed, 28 Jul 2010 23:55:54 -0700
To: <kim.abbott@bso.science.doe.gov>
To: <kim.abbott@bso.science.doe.gov>

Mr. Kim Abbott, DOE Office of Science
NEPA Document manager
LBNL
One Cyclotron RD
Berkeley, CA 94720

Dear Mr. Abbott,

I am writing to strongly request that this project, Seismic Life-safety, Modernization and Replacement of general Purpose buildings-Phase 2B undergo a full environmental review. Because of the many hazards and dangers of the area an Environmental Impact Study (EIS), not an Environmental Assessment (EA) is needed so that all of these risks can be discussed as well as how to protect the watershed lands and the cultural heritage of this area. **ST-1**

I have attended lectures and seen films of the area and the problems and dangers of putting buildings in that area. These dangers include the unstable earth below which is made up of mudstone and other material that will move in when the expected major quake occurs on the Hayward Fault. Also The committee to Minimize Toxic wastes has shown that the site is full of contaminants that will be disturbed when graded during construction.. This is a volatile area and too dangerous to disturb near the UC Campus and the neighborhoods nearby as well as the entire area. **ST-2** **ST-3**

In addition Building 85 and 85A have radioactive waste and VOCs. They straddle 2 old landslides, The solution of the piers will not be sufficient. I have learned that there is a new issue of what will happen if fire in that area should come down into these proposed facilities, potentially burning and dispersing radioactive and VOCs into the air and watershed into the bay. **ST-4** **ST-5**

As I am sure you are aware these are serious issues to consider and they require the fullest study and chance for all experts to testify. It would be a serious mistake to allow this to proceed and possibly have this community suffer an inevitable calamity of several sorts. If you had a son or daughter who attends school there or if you or a family member lived near by, i am sure you would want this to have a full assessment. **ST-6**

I have lived in Berkeley over 40 years, have walked the hills in Strawberry Canyon enjoying the views and the wildlife. I have attended walking lectures about this special watershed area and it's importance to the wildlife and the culture of the area. It has quite a history. This is not the place for such buildings- too much risk- too much disruption to what we should preserve. there are alternatives- in Richmond and in Oakland and elsewhere. ST-6 cont. ST-7

This is why this drastic proposal need an EIS.

Thank you

Stephanie Thomas
1824 San Loerenzo Ave
Berkeley, CA 94707

LETTER #CMW

Subject: GPL proposal
From: Charlene Woodcock <charlene@woodynet.net>
Date: Wed, 28 Jul 2010 20:41:26 -0700
To: <kim.abbott@bso.science.doe.gov>
To: <kim.abbott@bso.science.doe.gov>

28 July 2010

Mr. Kim Abbott, DOE Office of Science
NEPA Document Manager
LBNL
One Cyclotron Road
Berkeley, California 94720

Dear Mr. Abbott,

I write to express my strong objection to LBL's building plans for the very sensitive areas in Strawberry and Blackberry Canyons above Berkeley in an area of earthquake faults, fire danger, mudslides, and generally unstable terrain. In addition, the proposed site around Building 25 is proven to be contaminated with toxic wastes, Buildings 85 and 85A have radioactive waste contamination and are also on unstable ground. **CMW-1**

This area is obviously very inappropriate for the existing Hazardous Waste Facility above the botanical garden and the campus. How can a serious plan be put forth to add to the dangers already existing by planning another building in such an unstable area, with so much potential for disaster? **CMW-2**

At the very least, an objective, scientifically sound Environmental Impact Study is essential. Citizens of Berkeley should not have the watershed above our city threatened by these ambitious LBNL building projects without a very thorough examination of the risks and safer alternatives, that would not require extraordinary efforts and costs to ensure safety. **CMW-3**

Sincerely,

Charlene M. Woodcock

LETTER #MLN

From: mleenoonan@comcast.net [mailto:mleenoonan@comcast.net]
Sent: Thursday, July 29, 2010 10:40 AM
To: Abbott, Kim
Subject: LBNL Building Plan

I trust that the Department of Energy will insist that a full federal environmental review be conducted for the projects currently in the planning stages at the Lawrence Berkeley National Laboratory. The risks of soil instability and the potential dispersal of contaminants are significant at the sites, for example, of both the proposed General Purpose Laboratory and the Hazardous Waste Facility. The legacy of the ancient caldera cannot be ignored. **MLN-1**

Even my cleaning lady has spoken up on the hazards. Many years ago she was the university's gardener at the Lawrence Hall of Science. She can remember vividly conversations with a seismologist who had been brought in from Texas as a consultant on various ground water problems which they had been experiencing. "When the Hayward Fault goes," he told her, " this will all be down at Center and Shattuck." LBNL minimizes these perils at its own risk - and at ours as residents of Berkeley. **MLN-2**

Mary Lee Noonan
2599 Buena Vista Way
Berkeley, CA 94708

REC'D JUL 29 2010

LETTER #GG

July 28, 2010

Mr. Kim Abbott
DOE Office of Science
NEPA Document Manager
LBNL
One Cyclotron Road
Berkeley, CA 94720

Re: Inadequate EA Review for Seismic Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2 Project

Dear Mr. Abbott:

Full compliance with the National Environmental Protection Act (NEPA) is necessary for the LBNL Plan to build new research facilities in the hills above the University. The area is an earthquake zone and a landslide zone, and is difficult to access. The "Seismic Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2 Project", includes a major bioresearch building and a toxic waste building. It therefore needs full disclosure and discussion in a Environmental Impact Statement. GG-1

I believe that the Environmental Assessment (EA) is very superficial. It is not persuasive that the natural setting of the Berkeley-Oakland hillsides is worth sacrificing for large glass and steel research and waste buildings. The EA has no serious discussion of the importance of the Strawberry Creek watershed or the connection of the hills to Tilden Park and the East Bay Regional Parks. GG-2

It is significant that the EA ignores discussion of disaster preparedness and safety issues. Also, the burden upon our residential population on a daily basis or in the event of a disaster is ignored. Here are some quotes from City and University officials that can be found in a June, 2005 article on the California Planning & Development Report website: http://www.cp-dr.com/node/415. GG-3

1.) "'It's a built-out environment. Every piece of land has a use of some kind on it,' O'Banion said. For new buildings and facilities, campus planners are eyeing places that are underused, obsolete or **seismically questionable** . . ." (Emphasis added).

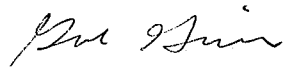
2.) "The third issue is money, specifically fees for municipal services that the city provides. City officials say the city provides $13.5 million worth of services to UC every year, a tab that will increase by $2 million annually under the LRDP. The city's lawsuit argues, 'The university does not commit under the LRDP to pay for the impacts on city services used by the university or to lessen those impacts through effective mitigation.'" GG-4a

3.) "'For example,' added DeVries, 'we provide the entirety of the university's fire protection and ambulance services. We essentially provide a fire department for a community of 50,000 people at no charge.'" (Mr. DeVries was employed at that time in the City of Berkeley Mayor's office). GG-4b

Also, I am attaching two pages from the City of Berkeley General Plan about disaster preparedness and safety issues. They can be found at: http://www.ci.berkeley.ca.us/ContentPrint.aspx?id=496. GG-5

The Department of Energy must take full responsibility for all impacts & liabilities at the LBNL site. I believe that a full EIS is mandatory under NEPA for this project because it will "significantly affect the quality of the human environment" and cause cumulative risk in the event of a disaster.

Sincerely,

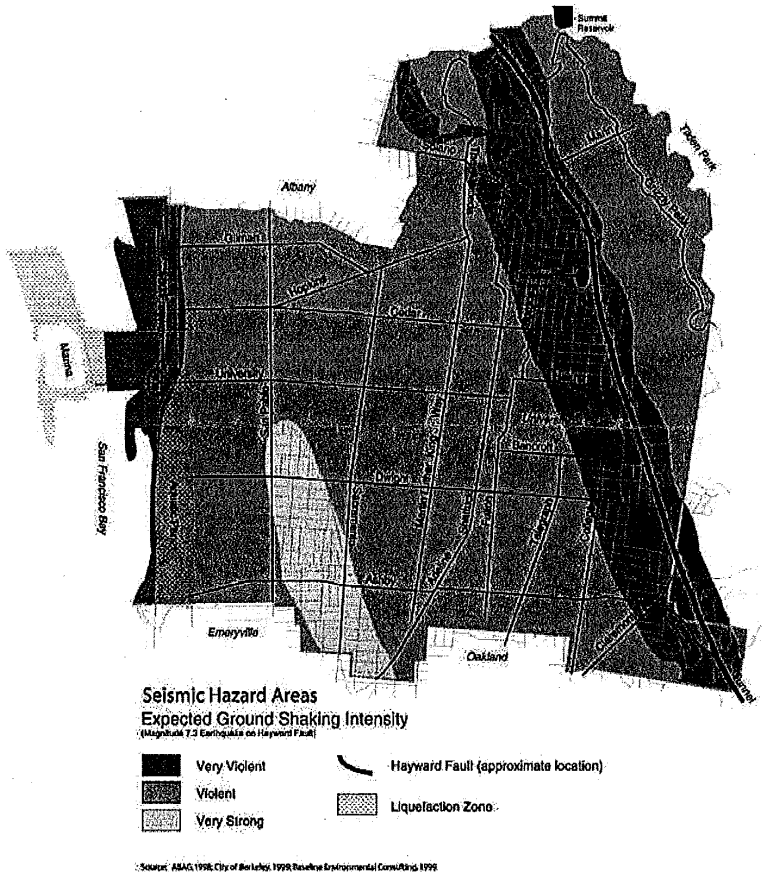


GG-6

Gale E. Garcia
2538 Fulton Street
Berkeley, CA 94704

Attachment

Figure 12. Ground Shaking Intensity



GG-7

These numbers are similar to the 1990 numbers, which yielded 23% for the Southern Hayward, 28% for the Northern Hayward, and 22% for the Rodgers Creek fault. However, many people will be surprised that these are lower estimates. Several changes in the 1999 methodology explain the difference. First, the new report accounted for more variations in fault rupture. For example, the 1990 report estimated probabilities for the rupture of the Rodgers Creek fault, the Northern Hayward and the southern Hayward as individual segments. The 1999 report accounts for the possibility that these individual segments may rupture together and cause larger earthquakes. By allowing for the occurrence of larger earthquakes, the computed probabilities decrease since the larger events are less frequent. Second, the new report includes the effects of the "stress shadow" of the 1906 earthquake. That is, it accounts for interactions between the faults. In the case of the 1906 earthquake, the movement of the San Andreas acted to reduce the stress on the Hayward fault. Third, the new models account for the fact that the Hayward fault "creeps". Through this seismic movement, some of the strain accumulation is released. Finally, new studies have shown that the 1868 earthquake was larger than previously thought, both in terms of the length of the rupture and the amount of slip. A larger rupture results in a larger strain release and contributes to lowering the probability.

The most significant physical characteristics of a major earthquake in Berkeley will be earthquake-induced ground shaking, which can lead to surface fault rupture, ground failure, and fire. Ground shaking is the vibration that radiates from the earthquake fault. Because it can damage or collapse buildings and other structures, it is the most serious and direct hazard produced by an earthquake. The impact of ground shaking on a building or structure is a function of the nature of the underlying soil; the structural characteristics of the building and the quality of workmanship and materials; the location and magnitude of the event; and the duration and character of the ground motion. Figure 12 shows the approximate location and intensity of ground shaking that might be expected in a magnitude 7.3 earthquake on the Hayward fault.

Earthquake-induced ground failure includes liquefaction, settlement, fault rupture, lateral spreading, and landslides. Liquefaction is the loss of soil strength due to shaking on water-saturated granular soils. The potential for liquefaction in Berkeley exists primarily to the west of the railroad tracks in low-lying areas adjacent to San Francisco Bay. Settlement is the vertical consolidation of loose

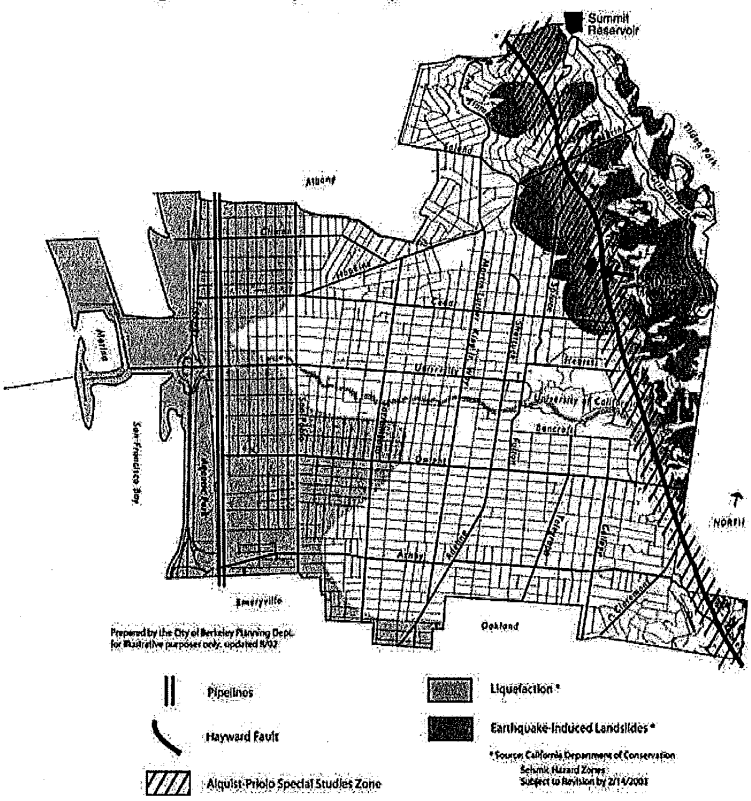
soils and alluvium caused by ground shaking or liquefaction. The ground surface can range from a drop of a few inches to several feet, and may occur many miles from the epicenter. Along the Berkeley waterfront the potential for settlement exists due to underlying weak bay mud fill typical of the area. Lateral spreading is the horizontal movement or spreading of soil toward an open face such as a stream bank or the open sides of fill embankments. In Berkeley, locations most likely to be affected are areas with improperly engineered fill; steep, unstable banks; and areas near the waterfront underlain by soft bay mud soil deposits. In a major earthquake, Berkeley can expect lurch cracking to result in extensive rippling and fracturing of pavement and curbs, and damage to sewer, gas, and water lines. Seismic activity can also trigger landslides, primarily in the hill areas, which can result in significant property damage, injury, and loss of life.

Fire often accompanies earthquake damage. Fire following an earthquake is a particular concern because of the likelihood of numerous simultaneous ignitions, broken mains, and demands on fire personnel. Ruptured or disrupted gas service lines and mains, power lines, water heaters, wood, gas or electric stoves, and other gas or electrical appliances and equipment cause most earthquake-induced fires. As demonstrated in the San Francisco Marina District in 1989 and in the 1995 Kobe earthquake, modern cities are vulnerable to devastation from multiple fires, which, coupled with road blockages and damage to the water delivery system, can greatly exacerbate the initial damage from the seismic forces.

Figure 13 shows the approximate location of areas vulnerable to a combination of hazards caused by a major earthquake.

The combination of earthquake-induced ground shaking, potential lateral spreading, fault rupture and fire is of particular concern in the residential hill areas of Berkeley east of the Hayward Fault line. In these areas, many homes are on steep slopes, and access to many of these areas is difficult for emergency vehicles due to narrow, winding roads, some of which are cul-de-sacs. The eastern edge of the city is heavily wooded, which provides fuel for earthquake-induced fire. These areas are entirely residential and do not have easy access to any City emergency services. If the northern Hayward Fault were to rupture, many of the roads leading from the City's emergency service facilities (police and fire stations) to these residential areas could be made impassible and the areas would then be isolated. There is currently only one fire station east of the Hayward Fault and it is not capable of servicing this whole area without assistance in the event of a major disaster. Other hazards initiated by ground shaking include hazardous material releases and inundation due to reservoir failure. Problems can be exacerbated further and emergency response hindered due to the loss of critical facilities, and disruption of transportation and communication links.

Figure 13. Multiple Earthquake-Related Hazards



GG-7 cont.

LETTER #GB

REC'D JUL 2 9 2010

Kim Abbott, NEPA Document Manager.
Department of Energy, Berkeley Office.
One Cyclotron Rd, MS 90-1023.
Berkeley, CA 94720.

July 14, 2010

Re: DEIR for Seismic Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2 Project.

Dear Kim Abbott,

My comments are directed to the Seismic strenghtening of the Hazardous Waste Handling Facility (HWHF) consisting of buildings 85, 85A, 85B, a yard and prefabricated units. To be be brief, the Seismic Life Safety of the HWHF is likely also brief. In 1989 it was predicted "The Big One" will occur on the Hayward Fault within 30 years; that's just 9 years to go!

The replacement HWHF should never have been built in its present location, situated behind Lawrence Berkeley Lab's Strawberry Canyon gate in Oakland on the East Canyon "Feature", a branch of the Wildcat Fault. In order to build the Non-Nuclear Facility, for the storage and treatment of radioactive and hazardous waste, it was necessary to do at least 4 things: GB-1

1. Ignore the Wildcat and East Canyon Faults and any branch "Features" upon which the Hazardous Waste Handling Facility now sits.

2. Ignore the safety implications of slope stability problems.
The Lab ignored slope stability problems despite:

   a) its own revelation in "Response to Public Comments" IS-7 (LBNL, April 1997) which indicated that a slide 50 feet long by 100 feet wide occurred along the access road to the site of the replacement HWHF in the winter of 1994/95. (Not an ancient slide !)

   b) the knowledge, provided in Public Comment, of a UC Berkeley press release which reported that Centennial Drive, which connects to the access road to the HWHF, was closed for 8 months in 1983/84 due to a huge slide. (Press release enclosed).

3. Failed to do a Supplementary EIR when 2 major changes were made to the original EIR: GB-2

   a) First; building a Non-Nuclear Facility for storage and treatment of radioactive waste and hazardous waste because Department of Energy's (DOE) Western Division "determined that the benefits of constructing a Nuclear Facility do not justify the additional costs," (April 5, 1994 memo to Joe Boda from Alex Dong - enclosed). Surely a Nuclear Facility has more safety features than a Non-Nuclear Facility. Is safety not worth the cost?

   In order to fall below the threshold for a Category 3 Non-Reactor Nuclear Facility, the one the original EIR indicated was to be built, the Tritium Focus Group was actually able to get the DOE to change the threshold from 1000 curies (Ci) to 16,600 Ci (U.S. Dept. of Energy, DOE Standard "Hazard Categorization and Accident Analysis...", DOE STD-1027-92, Dec. 1992, Change Notice no.1, September 1997 - See Attach. I pp A-10, for Isotope H3, and A 12 footnote * - enclosed)

   b) Second: moving the fence-line a considerable distance from the then existing fence-line around the HWHF in order to declare they are not exceeding the allowable radiation dose to the public. This would not be possible without a public hearing and eminent domain proceedings if private property, rather than UC Regents' property were located outside the existing fence-line. (See enclosed: 7/21/99 letter to Watson Gin, DTSC from G. Bernardi CMTW: 2/20/96 memo from G. Weinstein to D.Balgobin, LBNL : 7/14/94 letter to G. Bernardi from T. Powell, LBNL; 3/28/96 memo to H. Mitchell, UC and K. Berkner, LBNL from L. Bean, UC and R. Camper, LBNL) GB-3

I don't find it strange that the safety of the public and employees was not the paramount concern, and that CEQA was violated and radiation thresholds were changed to fulfill the headstrong plans and cost saving motives of the HWHF decision makers as this was done under the tutelage of the University of California, the manager of the Lab. One can see parallels to UC's actions regarding the Memorial Stadium, wherein UC claimed it could dispense with the supporting concrete pier footing tied into the stadium, when the Judge ruled it violated the Alquist-Priolo law. Next, UC saw to it that the Stadium and other State buildings be totally exempted from Alquist-Priolo through the Omnibus Bill (2009). Such amendments are required to be non-controversial! GB-4

LBNL has expressed concern (DEIR Vol. I, 1/29/10 - p. 3-17) that the HWHF (Bldg 85/85A and 85B) is in the area of the official State of California Earthquake Induced Landslide Hazard Zone and that presents a hazard to the HWHF in case a landslide was mobilized in the event of a major earthquake.

A sincere concern would mean compliance with the Alquist-Priolo Act. Do the cost and specifications of the system of concrete pier foundations and tiebacks to stabilize Bldgs. 85/85A comply with Alquist-Priolo? If not, does this mean safety conscious members of the public and potential employees need to avoid both State and Federal government buildings in California?

GB-5

Sincerely,

Gene Bernardi

Gene Bernardi
9 Arden Road
Berkeley, CA 94704

Enclosures: 15 pages

KENNETH R. SCHMITZ
Associate Director -- Grounds Services
Physical Plant Operations

NIVERSITY OF CALIFORNIA
ffice of Physical Resources
00 Carleton Street
rkeley, California 94720

(415) 642-6338
FAX (415) 643-7264

OFFICE OF PUBLIC INFORMATION

101 SPROUL HALL, BERKELEY, CA 9472
(415) 642-3734

5/9/84--McClendon--File #9070

FOR IMMEDIATE RELEASE

Berkeley--Centennial Drive, connecting the "main" University of California-Berkeley campus to hilltop facilities, will reopen tomorrow (Thurs., May 10) after an eight-month closing.

The reopening restores convenient access to U.C.'s Lawrence Hall of Science in plenty of time for the public to take advantage of its summer programs.

The road has been closed from just beyond the U.C. Botanical Garden in Strawberry Canyon since last September 19 to repair damage caused by two years of heavy rains and run-off.

Officials had expected the closure to last only 12 to 15 weeks, but wet weather caused many delays in the work, which included rebuilding a section of the road that had become unsafe.

At the Lawrence Hall of Science, five sessions of summer courses will be offered in computers, biology, chemistry, physics and astronomy for various age levels, ranging from age two through adulthood.

Other activities, such as film series and exhibits, will also be offered.

For information on Lawrence Hall of Science summer activities, call 642-5133.

GB-6

United States Government APR 12 1994 Department of Energy

memorandum

DATE: April 5, 1994

cc: T. Wan

REPLY TO ATTN OF: Oakland Operations Office (WM)

SUBJECT: Classification of the LBL Hazardous Waste Handling Facility

TO: Joe Boda, Director of Western Operations Division, EM-322

We are writing to inform you of the Oakland Operations Office decision to classify the new Hazardous Waste Handling Facility at Lawrence Berkeley Laboratory as a Non-Nuclear Facility. This decision has been concurred upon by LBL and the DOE-LBL Energy Research Site Office.

LBL has completed a review of current inventories and proposed generation rates of radioactive and mixed waste and concluded that this facility will operate below Category 3 Non-Reactor Nuclear Facility thresholds as prescribed in DOE STD-1027-92. In addition, we have reviewed the additional incremental costs involved in constructing and operating a Category 3 Non-Reactor Nuclear Facility and have determined that the benefits of constructing a Nuclear Facility do not justify these additional costs.

We have received assurance from the DOE-LBL Site Office that they will closely monitor the waste generators to keep quantities within acceptable limits. In addition, we will establish waste acceptance criteria for the HWHF and monitor the inventory against these criteria. We are now proceeding with construction of the HWHF as designed under the general criteria of DOE Order 6430.1A, incorporating special features for areas where radioactivity is handled.

Should you have any questions concerning this matter, please contact Dan Nakahara at (510) 637-1640.

Sincerely,

Alex E. Dong, Acting Director
Waste Management Division

GB-6 cont.

Post-it® Fax Note 7671	Date 4/1/97 # of pages ▶
To Nancy Shepard	From J Bartley
Co./Dept.	Co.
Phone #	Phone #
Fax #	Fax #

TS

NOT MEASUREMENT SENSITIVE

DOE-STD-1027-92
December 1992

CHANGE NOTICE NO.1
September 1997

DOE STANDARD

HAZARD CATEGORIZATION AND ACCIDENT ANALYSIS TECHNIQUES FOR COMPLIANCE WITH DOE ORDER 5480.23, NUCLEAR SAFETY ANALYSIS REPORTS

GB-6
cont.

U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

Table A.1 Thresholds for Radionuclides

Isotope	Category 2 [1] Curies	Threshold Grams	Category 3 [2] Curies	Threshold Grams
H-3	3.0E+05	3.0E+01	1.6E+04*	1.6E+00*
C-14	1.4E+06	3.1E+05	4.2E+02	9.4E+01
Na-22	6.3E+03	1.0E+00	2.4E+02	3.8E-02
P-32	4.4E+03	1.5E-04	1.2E+01	4.2E-05
P-33	3.0E+04	1.9E-01	9.4E+01	6.0E-04
P-32, acid**	2.2E+06	7.7E-02	1.2E+01	4.2E-05
P-33, acid**	1.5E+07	9.6E+01	9.4E+01	6.0E-04
S-35	2.5E+04	5.8E-01	7.8E+01	1.8E-03
Cl-36	1.4E+03	4.3E+04	3.4E+02	1.0E+04
K-40	4.7E+03	6.8E+08	1.7E+02	2.4E+07
Ca-45	4.7E+06	2.6E+02	1.1E+03	6.2E-02
Ca-47	4.8E+06	7.8E+00	7.0E+02	1.1E-03
Sc-46	1.4E+06	4.0E+01	3.6E+02	1.1E-02
Ti-44	3.2E+04	1.9E+02	6.2E+01	3.6E-01
V-48	3.0E+06	1.8E+01	6.4E+02	3.8E-03
Cr-51	1.0E+08	1.1E+03	2.2E+04	2.4E-01
Mn-52	4.0E+06	8.8E+00	3.4E+02	7.6E-04
Fe-55	1.1E+07	4.6E+03	5.4E+03	2.2E+00
Fe-59	1.8E+06	3.7E+01	6.0E+02	1.2E+02
Co-60	1.9E+05	1.7E+02	2.8E+02	2.5E-01
Ni-63	4.5E+06	8.0E+04	5.4E+03	9.5E+01
Zn-65	1.6E+06	1.9E+02	2.4E+02	2.9E-02
Ge-68	5.8E+05	8.8E+01	1.0E+03	1.5E-01
Se-75	3.4E+05	2.4E+01	3.2E+02	2.2E-02
Kr-85	2.8E+07	7.2E+04	2.0E+04	5.1E+01
Sr-89	7.7E+05	2.7E+01	3.4E+02	1.2E-02
Sr-90	2.2E+04	1.6E+02	1.6E+01	1.2E-01
Y-91	6.5E+05	2.7E+01	3.6E+02	1.5E-02
Zr-93	8.9E+04	3.6E+07	6.2E+01	2.5E+04
Zr-95	1.5E+06	6.9E+01	7.0E+02	3.3E-02
Nb-94	8.6E+04	4.6E+05	2.0E+02	1.1E+03
Mo-99	7.8E+06	1.6E+01	3.4E+03	7.1E-03
Tc-99	3.8E+06	2.3E+08	1.7E+03	1.0E+05
Ru-106	6.5E+03	1.9E+00	1.0E+02	3.0E-02
Ag-110m	5.3E+05	1.1E+02	2.6E+02	5.5E-02
Cd-109	2.9E+05	1.1E+02	1.8E+02	7.0E-02
Cd-113	1.8E+04	5.3E+16	1.1E+01	3.2E+13
In-114m	3.7E+05	1.6E+01	2.2E+02	9.5E-03
Sn-113	3.2E+06	3.2E+02	1.3E+03	1.3E-01

GB-6 cont.

Isotope	Category 2 Curies	Threshold Grams	Category 3 Curies	Threshold Grams
U-233	2.2E+02***	2.3E+04***	4.2E+00	4.4E+02
U-234	2.2E+02	3.5E+04	4.2E+00	6.7E+02
U-235	2.4E+02***	1.1E+08***	4.2E+00	1.9E+06
U-238	2.4E+02	7.1E+08	4.2E+00	1.3E+07
Np-237	5.8E+01	8.3E+04	4.2E-01	6.0E+02
Np-238	9.1E+05	3.5E+00	1.3E+03	5.0E-03
Pu-238	6.2E+01	3.6E+00	6.2E-01	3.6E-02
Pu-239	5.6E+01***	9.0E+02***	5.2E-01	8.4E+00
Pu-241	2.9E+03	2.8E+01	3.2E+01	3.1E-01
Am-241	5.5E+01	1.6E+01	5.2E-01	1.5E-01
Am-242m	5.6E+01	5.8E+00	5.2E-01	5.3E-02
Am-243	5.5E+01	2.8E+02	5.2E-01	2.6E+00
Cm-242	1.7E+03	5.1E-01	3.2E+01	9.7E-03
Cm-245	5.3E+01	3.1E+02	5.2E-01	3.0E+00
Cf-252	2.2E+02	4.1E-01	3.2E+00	5.9E-03

1 For isotopes not listed below, users may refer to LA-12846-MS, Specific Activities and DOE-STD-1027-92 Hazard Category 2 Thresholds, LANL Fact Sheet or to 10 CFR 30.72, Schedule C and adjust the values consistent with the X/Q value described in Attachment 1 of this Standard. (Note that although LA-12846-MS misstates the Category 2 threshold criterion, its use of the proper X/Q negates any effect of the misstatement. See "Radiological Criteria, p A-3 and Meteorological Conditions, p A-7 for clarification)

Any other beta-gamma emitter - 4.3E+05 Ci
Mixed fission products - 1.0E+03 Ci
Any other alpha emitter - 5.5E+01 Ci

2 For isotopes not listed below, users may refer to LA-12981-MS, Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 List of 757 Radionuclides, LANL Fact Sheet for threshold quantities of any isotopes of interest.

* At the recommendation of the Tritium Focus Group, the Category 3 tritium threshold value has been increased from 1.0E+03 Ci and 1.0E-01 grams to 1.6E+04 Ci and 1.6E+00 grams, consistent with the methodology of EPA used for the other nuclides.

** Provided as an example to indicate that when a substance such as P_{32} is used in a solution (i.e., phosphoric acid) for experimentation, medical treatment, etc., it should no longer be considered as highly volatile/combustible.

*** To be used only if segmentation or nature of process precludes potential for criticality. Otherwise, use the criticality lists for U_{233}, U_{235} and Pu_{239} of 500, 700, and 450 grams, respectively.

GB-6 cont.

Com

7/21/99

Mr. Watson Gin
Acting Deputy Director
Hazardous Waste Managem
Dept. of Toxic Substances C
POB 801
Sacramento, CA 95812-080

Is your RETURN ADDRESS completed on the reverse si

- Complete items 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write *"Return Receipt Requested"* on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

following services (for an extra fee):
1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to: Mr. Watson Gin Act Dep D. Dir Hazardous Waste Mngmnt Dept of Toxic Substances P.O. Box 801 Sacramento, CA 95812-0806

4a. Article Number P 843 026 399

4b. Service Type
☐ Registered ☐ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery

5. Received By: *(Print Name)* S. Kiefer

8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)* X

PS Form 3811, December 1994 102595-98-B-0229 Domestic Return Receipt

Re: EPA ID # CA 4890008986-Lawrence Berkeley National Laboratory (LBNL) Permit Modification Request re: Hazardous Waste Handling Facility (HWHF) Operations

Dear Mr. Gin,

Per our telephone conversation of July 19, 1999 in which you agreed to forward documentation, which I would provide, to the DTSC independent group reviewing the Committee to Minimize Toxic Waste's (CMTW's) appeal of your decision on LBNL's permit modification request, enclosed find the following documents which support CMTW's position that substantial changes have occurred with respect to the circumstances under which the project was undertaken. Under CEQA guidelines such changes require a subsequent or supplemental EIR for the project.

1. Feb 20, 1996 memo to David Balgobin, LBNL, from Gerald Weinstein, M.H. Chew and Associates, indicating that only if the HWHF fence boundary is changed will exceedances (opf regulatory standards for radiation exposure) not occur at the replacement HWHF.

2. July 14, 1999 letter to Gene Bernardi, CMTW, from Terry Powell with attached Joint Memorandum, signed in concurrence April 11, 1996, extending boundary of LBNL such that exceedances of regulatory standards would no longer occur for an offsite member of the public due to the fence line being moved a considerable distance from the former fence line around the replacement HWHF.

3. Sept. 1997 Change Notice #1 of ***DOE Standard,*** *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports,* (US DOE Attachment 1, p A-12) increasing the Category 3 Non-Reactor Nuclear Facility tritium threshold value from 1000 Ci to 16,600 Ci.

The need for a permit modification to increase storage of "mixed" waste and its treatments would not exist if it were not for the tritium "mixed" waste generated by the National Tritium Labeling Facility.

GB-6 cont.

The DOE is not only the enforcer of the regulations governing radionuclides at its facilities, but it conveniently changed a regulation by a magnitude of 16 in order to retroactively legitimize the construction of a non-nuclear HWHF! Furthermore, by virtue of the land (both within and outside of the LBNL) being U.C. Regents' property, the Lab has been able, outside of public knowledge, to merely move its boundaries outward in order to declare that they are not exceeding radiation dose regulations, and to declare the groundwater tritium contamination plume is within LBNL boundaries. If the Lab were surrounded by private property, public notification and ;public hearings regarding these boundary changes would be impossible to avoid.

While the DTSC claims its jurisdiction covers only the hazardous portion of mixed waste, its decision approving the permit modification allows the exposure to radiation of children at the Lawrence Hall of Science, workers (including pregnant women), students and persons visiting Strawberry Canyon for recreation.

We again ask that the DTSC take seriously its mandate to make permit decisions protective of human health and the environment.

The actions of LBNL/DOE, to bring itself into apparent compliance, after the fact, regarding the construction of a non-nuclear HWHF facility definitely merit a subsequent or supplemental EIR as these actions are inextricably related to the permit modification under consideration. **GB-6 cont.**

In Health,

Gene Bernardi

Gene Bernardi, Cochair CMTW
9 Arden Road, Berkeley, CA 94704
510-843-2152

cc: Governor Gray Davis
Director Winston Hickox, CA EPA
Senator Don Perata
Assemblywoman Dion Aroner
US Congresswoman Barbara Lee
US Senator Barbara Boxer
US Senator Dianne Feinstein
Federal Facilities Coordinator Philip Armstrong, US EPA
Mayor Shirley Dean and Berkeley Councilmembers
Mayor Jerry Brown and Oakland Councilmembers

M.H. Chew & Associates, Inc.
Safety Professionals

1424 Concannon Blvd., Livermore, CA 94550-6006
510-443-5077 Fax: 510-373-0624

Memorandum

Date: February 20, 1996

Subject: Basis for Differences Between Criteria Hierarchy In the First and Subsequent Drafts of the Final Safety Analysis Document (FSAD) for the Hazardous Waste Handling Facility (HWHF).

From: Gerald Weinstein, M.H. Chew & Associates, Inc. Gerald Weinstein

To: David Balgobin, Lawrence Berkeley National Laboratory (LBNL).

cc: Carol Kielusiak, LBNL.
Robin Wendt, LBNL.
Charles Guenther, CAI.
Steve Velen, CAI.

GB-6 cont.

Per your request, I am hereby providing the basis for the change to the chemical criteria selection hierarchy used in the first draft of the FSAD for the evaluation of potential health impacts due to hypothetical accidental releases of chemicals at the replacement HWHF. The initial analysis of this facility was based upon a conservative set of screening criteria that were to be used in the absence of published values for the primary chemical accidental release criterion, the Emergency Response Program Guides Level 2 (ERPG-2). For this conservative screening analysis, the order of hierarchical substitution from highest to lowest criterion was as follows: Threshold limit values--short-term exposure levels (TLV–STEL) or TLV–ceiling (TLV–C) values, EPA Levels of Concern (LOCs), and TLV–time weighted averages (TLV–TWA). As discussed below, this original hierarchy was conservative because it did not take into account that TLV–STELs and TLV–Cs are tightly linked to and used in conjunction with TLV–TWAs. As such, the values were derived assuming an already continuous chronic exposure that will not occur for the offsite public. Thus, LOCs, which were developed strictly for accidental release exposures, should be applied, where available, in lieu of the TLV–STELs and TLV–Cs.

The purpose of a screening analysis is to analyze the potential consequences of realistic bounding chemical release scenarios. A conservative set of toxicological criteria or chemical modeling techniques were initially employed in the first stage of analysis. If no exceedances of the bounding concentrations were found using conservative screening toxicological criteria, then no further resources would be expended to re-evaluate the criteria or assumptions used in the analysis. As noted below, the initial screening analysis that was used to evaluate the replacement HWHF in the first draft of the FSAD indicated exceedances. In the reanalysis for the FSAD, given the pending relocation of the HWHF fence boundary, no exceedances occurred due to the physical distance between the hypothetical accidental sources and the location of the nearest hypothetical offsite member of the public.

Subsequent to completion of the first draft of the FSAD, we were independently contracted to evaluate, using similar methodology, the potential offsite exposures due to accidents at the existing HWHF. Our initial analysis indicated there would be exceedances at the existing facility under the assumptions and methodology used in the screening analysis of the

replacement facility. Therefore, following the general approach to screening analyses, the basic assumptions of the analysis for the replacement facility were re-evaluated to determine whether any changes were warranted in order to reach a more realistic conclusion as to the potential risk of public exposure at the existing facility. It should be noted that a re-evaluation of the replacement HWHF was already being conducted independent of the analysis of the existing facility because, as noted above, using initial information on the site boundary, exceedances were indicated at the replacement facility. The re-evaluation of the replacement HWHF had stopped once it was discovered that no exceedances would occur at the replacement facility if the move of the fence boundary (that LBNL facilities engineering was planning for the purposes of land management) were taken into account.

Among the assumptions we scrutinized during the re-evaluation of the existing HWHF was the hierarchy placing TLV–STELs and TLV–Cs above LOCs. The American Conference of Governmental Industrial Hygienists (ACGIH, 1995) defines TLV–STELs and TLV–Cs as follows:

> Threshold Limit Value–Short-Term Exposure Limit (TLV–STEL)—The concentration to which workers can be exposed continuously for a short period of time without suffering from: (1) irritation, (2) chronic or irreversible tissue damage, or (3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially impair work efficiency, and provided that the daily TLV–TWA is not exceeded. It is not a separate independent exposure limit; rather it supplements the time–weighted average (TWA) limit where there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature. STELs are recommended only where toxic effects have been reported from high short-term exposures in either humans or animals.
>
> A STEL is defined as a 15-minute TWA exposure, which could not be exceeded at any time during a workday even if the 8-hour TWA is within the TLV–TWA. Exposures above the TLV–TWA up to the STEL should not be longer than 15 minutes and should not occur more than four times per day.
>
> Threshold Limit Value–Ceiling (TLV–C): the concentration should not be exceeded during any part of the working exposure.

GB-6 cont.

EPA (1987) defines LOCs as follows:

> Levels of concern (LOCs), for the purpose of this document, are defined as the concentrations of an extremely hazardous substance in air above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time.

In reviewing the above criteria, it became clear that TLV–STELs and TLV–Cs are designed to cover work exposures that could occur repeatedly over an entire working lifetime, unlike an accident situation in which the members of the exposed public would not have had any significant prior exposure. The TLV–STELs and TLV–Cs presuppose an already continuous exposure to chemical substances for up to an entire working lifetime. On the other hand, LOCs are developed for the instances in which the public could be exposed to chemical substances for a short time period due to a rare accident and subsequently receive no prolonged additional exposure. In the instance of the current analysis, the concentrations modeled due to accidents represent peak concentrations (i.e., represent maximum short-term concentrations without considering the depletion of the amount of chemicals over time at the source).

The US EPA (1987) has developed guidance for evaluation of such accidental releases. In the guidance document, EPA derived and recommended the primary use of LOCs (see Appendix C and Table C–2 of the document in particular) for chemicals without published ERPG–2 values. Such LOCs were derived by dividing the immediately dangerous to life and health (IDLH) values by a factor of 10 (EPA, 1987). Only in those instances where no ERPG-2s or IDLHs existed for chemicals being analyzed would the TLV–STELs, TLV–Cs, or TLV–TWAs be considered. In light of the fact that such events should be rare and the fact that no such accidents have occurred during the entire lifetime of the existing facility, we determined that LOCs represented the most appropriate criteria among those considered in the absence of ERPG-2s for evaluating the consequences of such a hypothetical release at the existing and the replacement HWHFs. Consequently, following the approach employed by EPA (1987) to assign criteria for accident analysis, the hierarchy was revised so that LOCs took precedence over TLV–STELs and TLV–Cs both for the analysis of the existing facility you asked us to do and the FSAD DOE is requiring for the replacement facility.

GB-6 cont.

References:

ACGIH 1995, American Conference of Governmental Industrial Hygienists, 1995-1996 "Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)," Cincinnati, Ohio.

EPA 1987, U.S. Environmental Protection Agency, Federal Emergency Management Agency, and U.S. Department of Transportation, "Technical Guidance for Hazards Analysis, Emergency Planning for Extremely Hazardous Substances," Washington, DC.

July 14, 1999

Ms. Gene Bernardi, Co-Chair
Committee to Minimize Toxic Waste
9 Arden Road
Berkeley, CA 94704

Dear Ms. Bernardi:

GB-6 cont.

In response to you request for the date on which Lawrence Berkeley National Laboratory's boundary was extended, please see the attached Joint Memorandum issued on March 28, 1996, and signed in concurrence on April 11, 1996, by the University of California at Berkeley and Ernest Orlando Lawrence Berkeley National Laboratory.

Sincerely,

Terry Powell
Community Relations Coordinator

Enclosures

Ernest Orlando Lawrence Berkeley National Laboratory
One Cyclotron Road , Berkeley, California 94720 Tel: 510.486.4387

attachment 2

March 28, 1996

Joint Memorandum

To: Horace Mitchell, Vice Chancellor for Business and Administrative Services
University of California at Berkeley

Klaus Berkner, Deputy Director for Operations
Ernest Orlando Lawrence Berkeley National Laboratory

From: Leroy Bean, Associate Vice Chancellor of Business and Administrative Services
University of California at Berkeley

Robert Camper, Facilities Manager
Ernest Orlando Lawrence Berkeley National Laboratory

Subject: Management of Hill Area Lands

GB-6 cont.

As was stated in the Letter of Cooperation between Chancellor Tien and Director Shank, the University of California, Berkeley (Campus) and the Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) share a common interest in cooperating to manage the risk of wild land fire and to ensure safe and orderly use of Regents property in the east bay hills. To further these objectives, Chancellor Tien and Director Shank have requested that the staff of each organization work closely to support common concerns and interests and have agreed that Berkeley Lab assume management responsibility for particular lands. This memorandum affirms our intent to cooperate and outlines specific implementation guidance relating to the transition of management responsibilities for the specific lands. We ask for your concurrence on this implementation guidance.

A fence and/or other markers, will be installed by Berkeley Lab to clearly delimit boundaries of the management area illustrated (with a crosshatch pattern) on the map attached to the Letter of Cooperation. A licensed surveyor/engineer will survey and document the Regents property line between Cyclotron Road and Campus Drive in 1997. Cost of this survey will be shared equally by the Campus and Berkeley Lab. Following this survey, the Lab and the Campus will work with the President's Office to resolve any disputes with owners of adjacent property regarding ownership rights prior to placement of a fence in the area by Berkeley Lab in 1998/9. To ensure free access from campus to the Big "C", no fence will be installed in the Big "C" draw.

Berkeley Lab will manage the area consistent with the Campus Long Range Development Plan (LRDP). When the Berkeley Lab completes an updated LRDP, this area will be addressed in the preparation of the Berkeley Lab LRDP. After adoption of the revised Berkeley Lab LRDP by the Regents, the Berkeley Lab LRDP shall be the guiding document. Berkeley Lab commits to manage the area such as to ensure that:

Access to natural areas is assured to Campus researchers as needed. Access will be accommodated consistent with Berkeley Lab site access and maintenance policies.

Management of the Chicken Creek riparian area will be accomplished in a manner which recognizes the fragile nature of this environment.

Erosion and sedimentation controls will be guided by best management practices including those described in the Bay Area Association of Governments "Manual of Standards for Erosion and Sediment Control Measures" (May 1995). Techniques which minimize erosion shall be preferred to those which reduce siltation where the former are practical. Use of mulching and vegetative soil stabilization (Chapter 8), soil stabilization fabrics (Chapt. 7 Measure D) and similar measures will be given preference.

Sustainable landscape management treatments will be guided by watershed biodiversity principles and be generally consistent with the East Bay Hills Vegetation Management Consortium's "Fire Hazard Mitigation Program and Fuel Management Plan for the East Bay Hills " (May 1995)

GB-6 cont.

In addition, Berkeley Lab and the Campus will work to achieve the following objectives and activities:

In order to allow for fuel management as well as the visual and functional integration of lands into Berkeley Lab, Campus will relocate materials from the Poultry Husbandry/Chicken Creek area to be managed by Berkeley Lab prior to September 1996. Berkeley Lab may demolish the wooden shed located immediately below Building 31.

Access to Campus-maintained hydraugers and fire trails is assured to Campus facilities staff. Maintenance of utilities and roads will be unchanged with the exception of those portions of fire roads which will be located within Berkeley Lab, which will now be maintained by Berkeley Lab. It is acknowledged that Berkeley Lab and its vegetation management contractors may use the Upper Jordan Fire trail to access the area above Building 74 and to remove debris and plant material from this portion of the site.

Campus staff and contractors shall continue to have access to lands adjacent to Centennial Drive and all other Campus-managed roads outside of Berkeley Lab in order to repair drainage, roadbed, soils or bedrock conditions which make the roadway less safe or usable.

Should historic contaminated soil or ground water be identified in the management area, remediation will remain the responsibility of its source.

Berkeley Lab will continue to explore options which may allow it to bring two small contiguous parcels of Campus-managed Regents property, at the western base of Blackberry Canyon and immediately north of lower Cyclotron Road, under its management. During this time, Campus will develop an access system in these areas.

Berkeley Lab and the Campus will update the Campus Hill Area Fire Prevention Committee annually on the progress in wildland fuel management made under this joint memorandum.

We look forward to working with you to implement the Letter of Cooperation. In the event a dispute or disagreement should arise, it is our intent that it be amicably resolved by the staff with our guidance. We will, of course, inform you if any dispute or disagreement should one arise.

We appreciate the opportunity to work together in order to reduce the risk of wild land fire and to ensure safe and orderly use of Regent property in the east bay hills.

Respectfully submitted,

Leroy Bean
Assoc. Vice Chancellor of Business
and Administrative Services
UC Berkeley

3/28/96
Date

J. Robert Camper
Facilities Manager
Berkleley Lab

3-28-96
Date

Signed in Concurrence:

Horace Mitchell
Vice Chancellor for Business
and Administrative Services
UC Berkeley

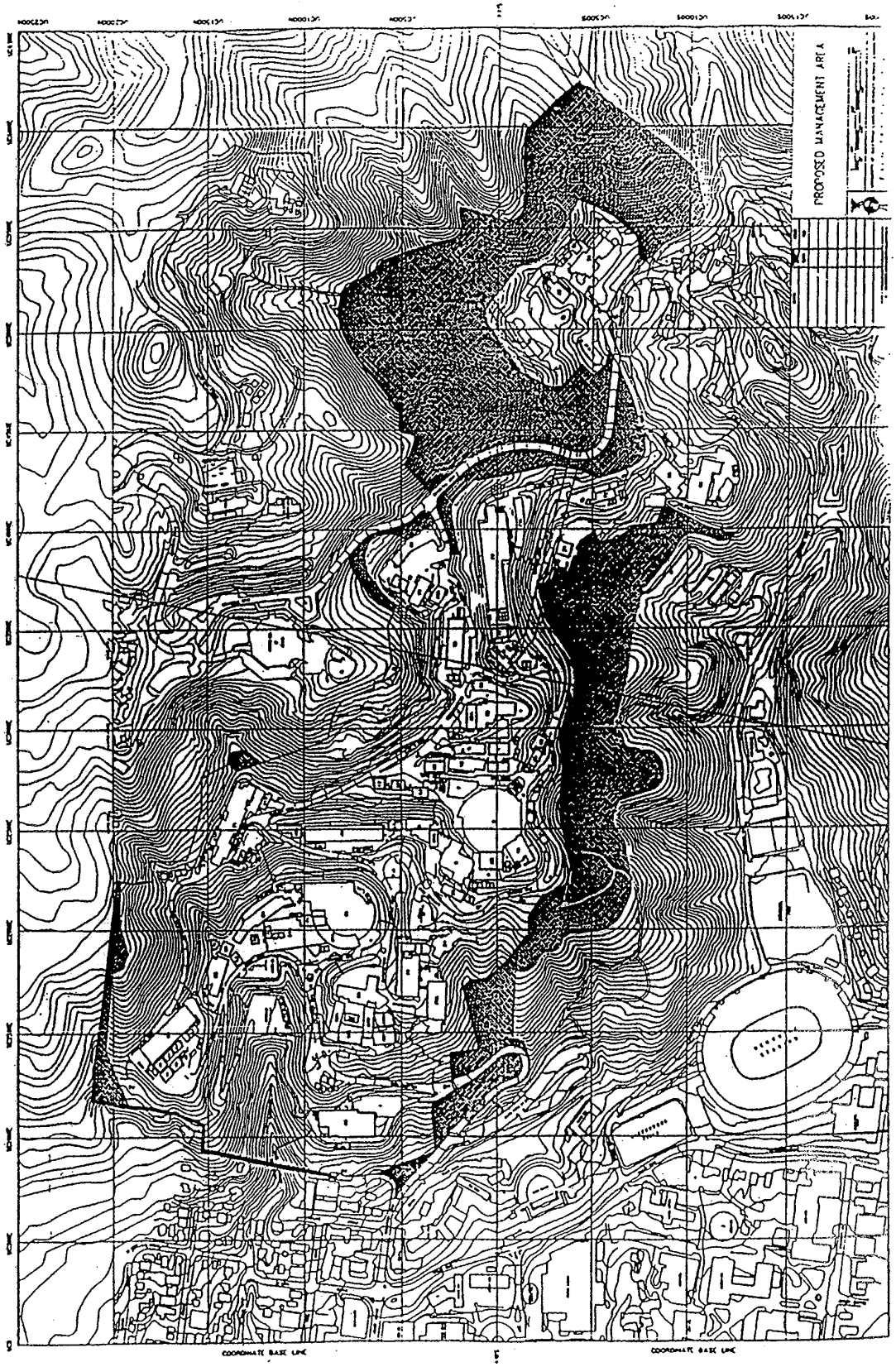
4/2/96
Date

K Berkner
Klaus Berkner
Deputy Director for Operations
Berkeley Lab

4-11-96
Date

cc: Chancellor Tien
Director Shank
Senior Vice President Kennedy
Site Office Manager Nolan
Director Dobbins

GB-6 cont.


PROPOSED MANAGEMENT AREA
COORDINATE BASE LINE
COORDINATE BASE LINE

GB-6 cont.

REC'D JUL 2 9 2010

LETTER #BR

COMMENTS ON LAWRENCE BERKELEY NATIONAL LABORATORY SEISMIC LIFE-SAFETY MODERNIZATION AND REPLACEMENT OF GENERAL PURPOSE BUILDINGS PHASE 2 B.

PRESENTED TO
KIM ABBOTT
NEPA DOCUMENT MANAGER
UNITED STATES DEPARTMENT OF ENERGY
BERKELEY SITE OFFICE
ONE CYCLOTRON ROAD
M/S 90-R1023
BERKELEY CA 94720

BR-1

SUBMITTED BY
BARBARA ROBBEN
1964 EL DORADO
BERKELEY CA 94707
510-524-2383

COMMENTS ON LBNL SEISMIC LIFE-SAFETY, MODERNIZATION AND REPLACEMENT OF GPL BUILDING, PHASE 2B.

FIRST I WANT TO THANK YOU FOR MAILING ME A COPY OF THE DRAFT ENVIRONMENTAL ASSESSMENT DOCUMENT. IT IS ESSENTIAL TO HAVE THE DOCUMENT IN HAND, IN ORDER TO BE ABLE TO READ IT AND TO COMMENT ON IT. WHEN THE FINAL ENVIRONMENTAL ASSESSMENT IS PUBLISHED, I WILL NEED TO HAVE A COPY OF THAT, AS WELL. THANK YOU IN ADVANCE FOR SENDING IT.

APOLOGIES IF I HAVE INADVERTENTLY MIS-NAMED ANY OF THE AGENCIES INVOLVED. I KNOW THAT THE UNIVERSITY OF CALIFORNIA, THE LAWRENCE BERKELEY NATIONAL LABORATORY, THE DEPARTMENT OF ENERGY AND PERHAPS OTHERS INTERACT IN THEIR FUNCTIONS AND RESPONSI-BILITIES THERE ON THE HILL.

I HAVE INCLUDED COMMENTS THAT I MADE FOR THE DRAFT ENVIRONMENTAL IMPACT REPORT, GENERAL PURPOSE BUILDINGS, PHASE 2 PROJECT, SUBMITTED ON MARCH 15, 2010.

BR-1 cont.

GROUND WATER.

IN THE FINAL EIR OF THIS PROJECT, DATED JUNE 21, 2010, I HAD MADE SOME COMMENTS ON THE TOXIC CONTAMINATION OF THE GROUNDWATER BY LBNL, NOTING THAT THE U.C. SITE ORIGINALLY WAS SELECTED BECAUSE OF ITS ABUNDANT FRESH WATER SPRINGS SUITABLE FOR DRINKING WATER. (5-280)

YOUR RESPONSE TO MY COMMENT (BR-26) IS:
"AS FOR GROUNDWATER CONTAMINATION, UC LBNL IS CLEANING UP THE GROUNDWATER UNDER THE REGULATORY AUTHORITY OF CALIFORNIA DEPT. OF TOXIC SUBSTANCES CONTROL. THE LONG TERM GOAL IS TO RESTORE ALL GROUNDWATER AT THE SITE TO DRINKING WATER STANDARDS, IF PRACTICABLE, EVEN THOUGH THE GROUNDWATER IS NOT USED AS A SOURCE OF DRINKING WATER".

BR-2

THERE ARE SEVERAL THINGS WRONG HERE.
THERE IS THE ADMISSION THAT TOXIC CONTAMINATION HAS TAKEN PLACE, AND THAT THE SITE IS UNDER THE SUPERVISION OF THE CALIFORNIA DEPT. OF TOXIC SUBSTANCES. THIS SUGGESTS THAT DAMAGE HAS BEEN DONE AT THE SITE IN THE PAST. LOGIC SUGGESTS THAT THE SITE BE CLEANED UP. THIS SHOULD BE ACCOMPLISHED BEFORE ANY THOUGHTS OF FUTURE BUILDING AT THE SITE. STEP #1 SHOULD ALWAYS BE TO REMEDY ONE'S MISTAKES BEFORE CONSIDERING ANY OTHER DESIRED OUTCOMES. "IF PRACTICABLE" IS SUCH A HEDGE. ONCE THE LAB GETS ITS DESIRED BUILDINGS, WHAT INCENTIVE DOES IT HAVE TO REMEMBER ITS PROMISE TO "RESTORE GROUND WATER AT THE SITE TO DRINKING WATER STANDARDS"?

AND THEN THE SITE WOULD BE COVERED WITH THE BUILDING(S). LET'S EXAMINE YOUR SISTER LAB AT LAWRENCE LIVERMORE NATIONAL LABORATORY. MY UNDERSTANDING OF THIS SITE IS THAT IT IS A "SUPER-FUND" SITE. REMEDIAL WORK DONE AT THIS SITE IS NOT DONE "IF PRACTICABLE". IT IS A NATIONAL PRIORITY TO CLEAN UP THIS SITE. HUNDREDS OF WELLS AND OVER A THOUSAND BORE-HOLES HAVE BEEN DRILLED TO MONITOR THE CONTAMINATION. NOW THAT IT'S KNOWN WHERE THE CONTAMINATES ARE THE PROBLEMS ARE TO CLEAN UP, CAPTURE THE WATER, PREVENT MIGRATION. 37 TREATMENT FACILITIES ARE ON SITE. THERE ARE CONSTANT NEW PROBLEMS AND UNEXPECTED COSTS. THERE IS REGULATORY OVERSIGHT AT ALL TIMES. **BR-2 cont.**

MY QUESTION IS: WAS LBNL EVER CONSIDERED FOR A "SUPERFUND" SITE DESIGNATION? WHEN WAS THIS AND WHAT WAS THE OUTCOME? COMMUNITY MEMBERS COULD BE RIGHTLY NERVOUS ABOUT THE TOXIC LEGACY OF THE LAB EVEN IF IT WAS NOT A DESIGNATED SITE. IS LBNL A 'SECOND-TIER TOXIC SITE', AND WHAT WENT INTO THE DECISION? **BR-3**

IN ANY CASE, IT IS AWKWARD TO IMAGINE THE BASEMENT OF A NEW GENERAL PURPOSE LAB BEING DRILLED FOR BORE-HOLES AND WELLS TO MONITOR THE CONTAMINATION. THE COMMON SENSE CONCLUSION IS INESCAPABLE: CLEAN UP THE TOXICS AT THE LAB BEFORE ANY CONSIDERATION OF FUTURE BUILDING. THIS SHOULD NOT BE A "LONG-TERM GOAL". IT SHOULD BE AN <u>IMMEDIATE</u> GOAL. THE LONG TERM GOAL SHOULD BE TO KEEP IT FREE OF TOXICS EVER AFTER. **BR-4**

IF THE LAB IS UNDER THE REGULATORY AUTHORITY OF THE CALIFORNIA DEPT. OF TOXIC SUBSTANCES, HOW DOES THIS CONFORM WITH REGULATORY AGENCIES AT NATIONAL LEVEL? BR-5

THE PUBLIC WAS INVITED TO COMMENT ON LBNL'S DRAFT EIR, AND WE RECEIVED THE OUTCOME OF THAT IN A DOCUMENT DATED JUNE 21, 2010, THE FINAL EIR, A STATE OF CALIFORNIA DOCUMENT: CEQA: CALIFORNIA ENVIRONMENTAL QUALITY ACT.

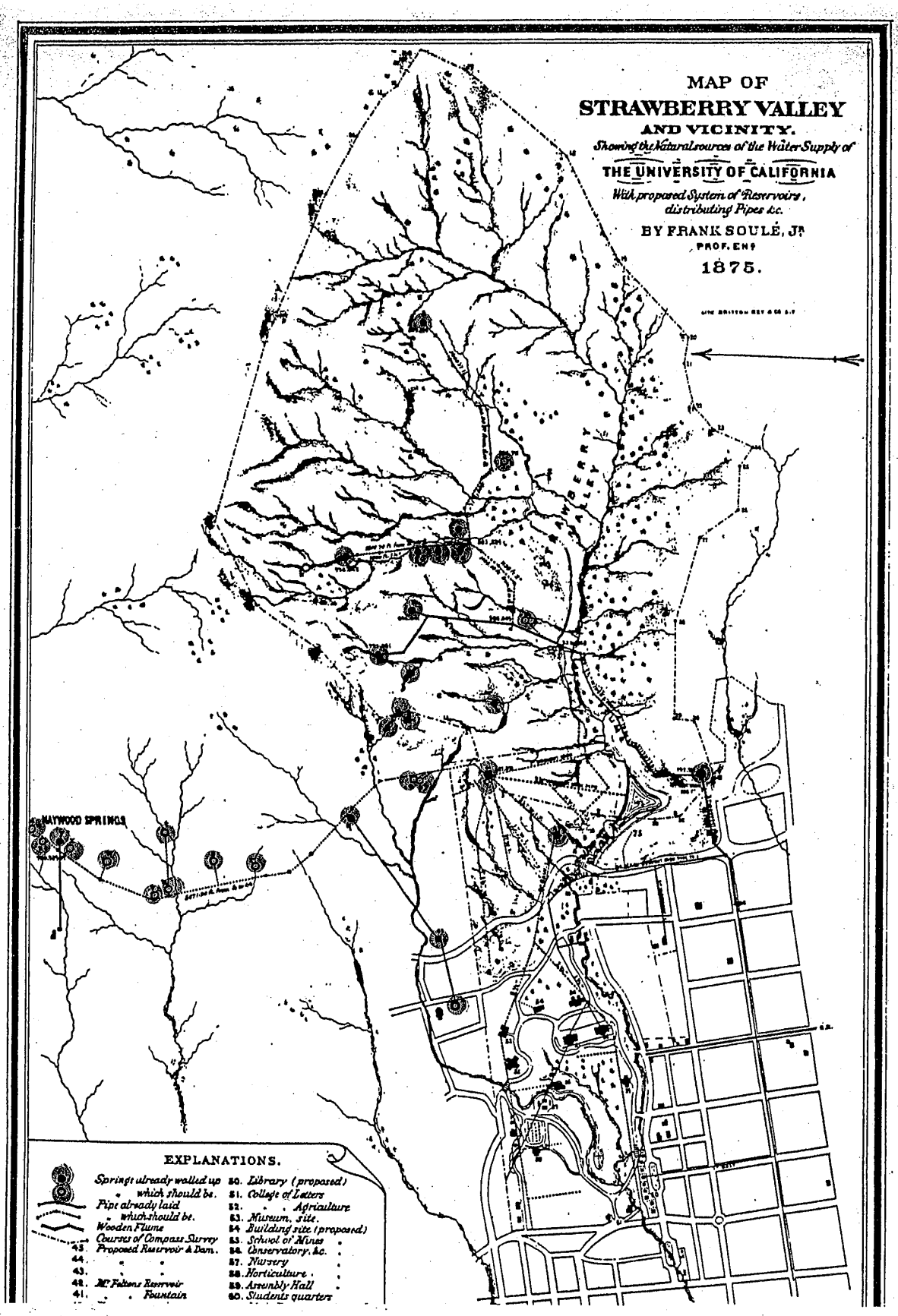
ONE WEEK LATER, HOWEVER, ON JUNE 28, 2010, A SECOND OPPORTUNITY APPEARED FOR CITIZEN COMMENT: A DRAFT ENVIRONMENTAL ASSESSMENT FROM THE DEPT. OF ENERGY, A NATIONAL DOCUMENT: NEPA: NATIONAL ENVIRONMENTAL POLICY ACT. BR-6

WILL THE TOXIC SUBSTANCES REGULATION BECOME MORE STRICT AT THE NATIONAL LEVEL? WHAT AGENCY WILL BE SUPERVISING THE FUTURE CLEAN-UP? BR-7

AND FINALLY I WOULD LIKE TO COMMENT ON LBNL'S RESPONSE, " EVEN THOUGH THE GROUNDWATER IS NOT USED AS A SOURCE OF DRINKING WATER". GROUNDWATER BY ITS NATURE IS A SHARED RESOURCE. LBNL MAY POSSIBLY CHOOSE NOT TO DRINK THE GROUNDWATER FROM A WELL ON ITS PROPERTY, BUT THE NEIGHBORS OF THE LAB MAY DRILL A WELL INTO THAT SAME AQUIFER WITH THE EXPECTATION OF BEING ABLE TO DRINK IT. THE UNDERGROUND RESERVOIR OF WATER DOES NOT STOP AT THE LBNL FENCE-LINE. THE SAME APPLIES TO STRAWBERRY CREEK. IT IS A SHARED RESOURCE WITH THOSE DOWN- BR-8

STREAM. STRAWBERRY CREEK FLOWS THROUGH THE CITY OF BERKELEY. PEOPLE - AND ANIMALS - SHOULD BE FREE TO USE THE CREEK WITHOUT THREAT OF CONTAMINATION IN THE WATER. WHEN THE WATER REACHES THE BAY, AND SUBSEQUENTLY THE OCEAN, IT MUST BE FREE OF LBNL CONTAMINATION.

BR-8 cont.


MAP OF
STRAWBERRY VALLEY
AND VICINITY.
Showing the Natural sources of the Water Supply of
THE UNIVERSITY OF CALIFORNIA
With proposed System of Reservoirs, distributing Pipes &c.
BY FRANK SOULÉ, Jr
PROF. ENG
1875.
HAYWOOD SPRINGS
EXPLANATIONS.
Springs already walled up
" which should be.
Pipe already laid
" which should be.
Wooden Flume
Courses of Compass Survey
45. Proposed Reservoir & Dam.
44. " "
43. " "
42. Mt Fletons Reservoir
41. " " Fountain
50. Library (proposed)
51. College of Letters
52. " " Agriculture
53. Museum. site.
54. Building site (proposed)
55. School of Mines "
56. Conservatory. &c. "
57. Nursery "
58. Horticulture " "
59. Assembly Hall "
60. Students quarters

BR-9

INCLUDED IS A MAP OF STRAWBERRY VALLEY, 1875, "SHOWING THE NATURAL SOURCES OF THE WATER SUPPLY OF THE UNIVERSITY OF CALIFORNIA" PREPARED BY FRANK SOULÉ, JR., PROF. ENG.

THIS MAP HAS BEEN PHOTOCOPIED, PROBABLY MANY TIMES, SO THAT IT IS SOMEWHAT DIFFICULT TO PIN-POINT EACH OF THE SPRINGS SHOWN ON THE MAP, SO I HAVE MARKED AS MANY AS I COULD FIND IN RED. NO DOUBT THE ORIGINAL MAY BE FOUND IN U.C. ARCHIVES. UNFORTUNATELY THE U.C. BERKELEY "WATER RESOURCES CENTER ARCHIVES" SEEMS TO BE IN THE PROCESS OF BEING DISPERSED TO VARIOUS LOCATIONS STATEWIDE, TO ITS DETRIMENT.

MY POINT IS THAT IT HAS BEEN KNOWN FOR A LONG TIME THAT THERE EXISTS PLENTIFUL AMOUNTS OF FRESH WATER IN THE AQUIFERS, SPRINGS AND CREEKS OF STRAWBERRY CANYON, AND IT SHOULD COME AS NO SURPRISE THAT BUILDINGS PLACED THERE WOULD HAVE HYDROLOGIC ISSUES.

UNDERGROUND WATER WILL BE AFFECTING THE STABILITY OF BUILDINGS; ADD COSTS TO CONSTRUCTION; CONTRIBUTE TO LANDSLIDES, SOIL CREEP, EROSION; AND THRU FISSURES IN THE BEDROCK, ALLOW TOXIC SUBSTANCES KNOWN TO BE PRESENT AT LBNL, AND IN THE SOIL, TO ENTER INTO THE AQUIFER AND THE SURFACE DRAINAGE SYSTEM AS WELL.

BR-9 cont.

PLEASE INCLUDE EITHER MY COPY OF SOULÉS MAP IN YOUR ENVIRONMENTAL ASSESSMENT REPORT, OR A MORE SUPERIOR VERSION FROM YOUR ARCHIVES. I AM ALSO INCLUDING TWO RECENT NEWSPAPER ARTICLES ABOUT THE WATER ARCHIVES AND THE UNIVERSITY'S ATTEMPTS TO CONSERVE WATER BY INSTALLING AERATORS AND SHOWER TIMERS ON CAMPUS. THESE ARTICLES POINT UP THE FACT THAT THERE ARE GAPS IN THE WAY THAT THE UNIVERSITY OF CALIFORNIA IS MANAGING ITS WATER RESOURCES AND ITS USAGE. YOU MAY ELIMINATE THESE TWO NEWSPAPER ARTICLES FROM YOUR E.A., SINCE THEY PERTAIN TO THE CAMPUS. YET, AS IS STATED IN THE D.O.E. DOCUMENT: "LBNL IS OPERATED BY THE UNIVERSITY OF CALIFORNIA..." AND, "DRINKING WATER IS SUPPLIED TO LBNL AND THE CITIES OF BERKELEY AND RICHMOND BY THE EAST BAY MUNICIPAL UTILITY DISTRICT (EBMUD)." THE SURVIVAL OF HUMANS ON THIS PLANET MAY HINGE ON WHETHER WE ARE ABLE TO UNDERSTAND EARTH'S NATURAL SYSTEMS AND NOT ABUSE THEM. ALL OF EARTH'S SYSTEMS - PLANTS ANIMALS, HUMANS, WEATHER, OCEANS, MARINE LIFE - WE ALL RELY ON WATER. WE MUST BE GOOD STEWARDS OF WATER IF WE ARE TO SURVIVE. **BR-10**

I WOULD LIKE TO SEE A MORE THOROUGH DISCUSSION OF THE HYDRAUGERS AND STORM WATER MENTIONED IN IV.C.3. PLEASE INCLUDE FACTS ABOUT THE LANDSLIDES THAT TRIGGERED THE NEED FOR THE HYDRAUGERS. DID THE HYDRAUGERS SOLVE THE IMMINENT LANDSLIDE PROBLEM? **BR-11**

I WOULD ALSO LIKE YOU TO INCLUDE INFORMATION ON THE WELL OR WELLS THAT WERE SUBSEQUENTLY DRILLED. WHAT IS THE FLOW FROM DRILLED WELL(S)? WHAT USE IS MADE OF THAT WATER? PLEASE INCLUDE RESULTS OF WATER QUALITY TESTS. **BR-12**

IT IS IMPORTANT THAT A MAP OF THE HYDROLOGY OF THE CANYON BE INCLUDED. IT SHOULD INCLUDE THE LOCATION OF HYDRANTS, WELLS, STORAGE TANKS, PIPES, CULVERTS, STORM DRAINS, SANITARY SEWERS, INLETS ETC.: ALL OF THE INFRASTRUCTURE THAT HAS BEEN INSTALLED SINCE THE TIME OF SOULÉ, IN FACT.

THIS IS PARTICULARLY IMPORTANT IN THE LIGHT OF THE FACT THAT WATER RUNS DOWNHILL. AT THE BASE OF LBNL LIES THE HAYWARD FAULT... AND OF COURSE, MOST OF THE CITY OF BERKELEY. ANY OF LBNL'S PIPES, CULVERTS, STORM DRAINS, AND SANITARY SEWERS THAT CROSS THE FAULT WILL LIKELY BE SEVERED AND RENDERED INOPERATIVE BY A MAJOR RUPTURE OF THE FAULT. **BR-13**

WHAT ARE LBNL'S EMERGENCY PLANS IN THIS REGARD? PLEASE BE SPECIFIC.

THE USE, HAZARDS, AND DEMOLITION OF TRAILERS.

III. B. 3

WHAT WAS THE JUSTIFICATION OF BRINGING TRAILERS TO THE LAB?

WAS THERE A PLAN TO UTILIZE TRAILERS ON THE HILL OR WAS IT MORE OF AN EXPEDIENT MEASURE TO HOUSE A PARTICULAR EXPERIMENT, OR TO ACCOMMODATE A PRESTIGEOUS PROFESSOR, OR BECAUSE FUNDING SUDDENLY BECAME AVAILABLE.

MY POINT HERE IS THAT IF THE TRAILERS APPEARED SUDDENLY AND RANDOMLY, AND IF THEIR ARRIVAL WAS NOT WELL THOUGHT OUT, THEN WHEN LBNL IS THINKING OF DEMOLISHING THEM AND REPLACING THEM WITH LARGE, MODERN AND EXPENSIVE BUILDINGS, IT MIGHT BE AT LEAST WISE TO EXAMINE THE ORIGIN OF THE INITIAL TRAILERS. IF THE REASONS FOR BRINGING IN THE TRAILERS WAS SOMEHOW FLAWED, THE IDEA OF REPLACING THE TRAILERS WITH PERMANENT BUILDINGS WOULD BE LIKE BUILDING ON A FLAWED FOUNDATION.

HAVE YOU A HISTORICAL SUMMARY OF THE DATES AND USES OF THE VARIOUS TRAILERS? LIKELY THERE WERE NO PERMITS INVOLVED BUT LBNL COULD AT LEAST DISCUSS THIS IN THE ENVIRONMENTAL ASSESSMENT.

BR-14

REGARDING THE USE OF TRAILERS AT LBNL:
IN SOME RESPECTS TRAILERS MIGHT BE THE IDEAL 'BUILDING' ON THE HILL. THEY ARE LOW-LYING, A SINGLE STORY, WITH ESCAPE EXITS NEAR AT HAND. IF THE TRAILER SHOULD HAPPEN TO SLIDE DOWN HILL IN A LANDSLIDE, THE WHOLE TRAILER WOULD PROBABLY SLIDE AS A UNIT.

ARE YOU ABLE TO FIND DOCUMENTATION OF THIS TYPE OF THINKING IN YOUR ARCHIVES? THE REASON FOR TRAILERS? **BR-14 cont.**

A LARGE, GLASSY, MODERN BUILDING SUCH AS THE PROPOSED GENERAL PURPOSE LAB SEEMS SO OUT-OF-CHARACTER WITH THE ENVIRONMENT OF THE CANYON.

THIS IS NOT TO SAY THAT EXPERIMENTS OF THE 2000's MUST BE HOUSED IN TRAILERS BUT ONLY THAT IT WOULD BE WISE TO CONSIDER ALTERNATIVES TO THE TRADITIONAL GENERIC LARGE GLASSY BUILDING: IF LBNL PREFERS THIS TYPE OF CONSTRUCTION, THEN IT WOULD BE PRUDENT TO LOOK AT OTHER BUILDING SITES. (YOUR ALTERNATIVES III.C.2 and 3.) **BR-15**

SINCE THE INCEPTION OF THE LAB ON THE HILL IN THE 1940s, HAD ONLY A FEW SMALL EXPERIMENTS BEEN DONE IN A FEW SMALL TRAILER-LIKE FACILITIES, THERE WOULD LIKELY NOT BE THE COMMUNITY OBJECTIONS THAT ARE THE RESULT OF LBNL'S ENORMOUS EVER-INCREASING ACTIVITIES AND BUILDING PROJECTS IN A HIGHLY UN-SUITABLE LOCATION. IT IS THE LOCATION, THE SCALE, AND IN SOME CASES THE NATURE OF THE EXPERIMENTS BEING DONE, THAT WORRIES THE CITIZENS AND NEIGHBORS. **BR-16**

IV.B.6 SOILS

THIS SECTION SHOULD BE REMOVED FROM IV.B, "ISSUES DETERMINED NOT TO WARRANT FURTHER CONSIDERATION", AND MOVED TO IV.C, "ISSUES DETERMINED TO WARRANT FURTHER CONSIDERATION", WHERE THERE IS AN OPPORTUNITY TO CONSIDER EROSION, RUN-OFF, SLOPE, LANDSLIDES, etc. WITH CLAY SOIL THERE WILL BE SHRINKAGE AND SWELLING. THE "ATTACHMENT TO BEDROCK" THAT YOU MENTION SOUNDS SUBSTANTIAL, BUT THAT BEDROCK IS ACTUALLY WEAK. BR-17

IV.B.7 INTENTIONAL DESTRUCTIVE ACTS

THIS SECTION SHOULD SIMILARLY BE MOVED TO IV.C TO ALLOW FOR FURTHER CONSIDERATION.
SINCE LBNL ACTIVITIES SEEM TO REQUIRE CONSTANT SURVEILLANCE AND GUARDED PERIMETERS THESE ACTIVITIES ALSO EXPOSE RESIDENTS OUTSIDE OF THE FENCE TO DANGER SHOULD SOMETHING UNTOWARD HAPPEN. YOUR DOCUMENT CLAIMS THAT PHASE 2B PROJECTS "WOULD NOT RESULT IN A CHANGE TO THE RISK OF INTENTIONAL DESTRUCTIVE ACTS". BUT BY SUBSTITUTING A LARGE MODERN BUILDING FOR TRAILERS COMMITS LBNL FAR INTO THE FUTURE... AND TERRORISM SEEMS TO BE ON THE RISE. BR-18

V.C.3. WATER RESOURCES. Comments also applicable to other section.

LBNL SEEMS TO PUT GREAT EMPHASIS IN ITS ENVIRONMENTAL ASSESSMENT DOCUMENT ON THE SUPPOSITION THAT THE NEW G.P.L. PROJECT WILL NOT FURTHER DAMAGE THE ENVIRONMENT: "PREVIOUSLY DEVELOPED LAND... NO CHANGES IN RUN-OFF OR GROUNDWATER INFILTRATION... WOULD NOT CONTRIBUTE TO LOSS... NO INCREASES....". A LARGE PART OF WHAT THE COMMUNITY IS OBJECTING TO IS THE DAMAGE THAT HAS ALREADY BEEN DONE! TO SAY THAT ANY NEW PROJECT WON'T MAKE IT WORSE IS TO MISS THE POINT ENTIRELY. THE ACTUALITY IS THAT BUILDING A LARGE STATE-OF-THE ART STRUCTURE AS A 'REPLACEMENT' FOR SOME SMALL FALLING-APART STRUCTURES ESCALATES THE PROBLEMS, AND COMMITS EVERY ONE INVOLVED TO A CERTAIN COURSE OF ACTION FOR A LONG, LONG TIME. **BR-19**

"MINIMAL IMPACT... ONLY 8% ADDED IMPERVIOUS SURFACE .... REMOVAL OF 9.5 ACRES OF HABITAT... REMOVAL OF 5 ACRES... LOSS OF 3.14 ACRES..."

THESE ARE CUMULATIVE IMPACTS. PAGE 158 LISTS ADDITIONAL PROJECTS, HUGE PROJECTS, QUITE NEARBY. ALL OF THE MANY PROJECTS THAT HAVE BEEN ADDED TO THE HILL SINCE 1940 TO THE PRESENT ARE ACCEPTED AS "BASELINE". AS IN "OH, ALL THOSE OTHER BUILDINGS AND PROJECTS, WELL, WE WON'T MAKE IT ANY WORSE, SO IT'S OK." **BR-20**

V. C. and Alternatives.

THIS REPORT STATES THAT TRITIUM, RADIO-ACTIVE MATERIALS, V.O.C.s etc. HAVE BEEN RELEASED IN THE AREA IN THE PAST, AND YET ASKS US TO BELIEVE THAT THERE IS NOTHING TO WORRY ABOUT AT PRESENT. IT BASICALLY ASKS CONCERNED CITIZENS TO TRUST THE AGENCIES THAT CAUSED THE CONTAMINATION TO BE THE AGENCIES THAT WILL DETERMINE OUR SAFETY NOW. THIS IS INADEQUATE. THE ALTERNATIVE CHOSEN MUST THUS BE A "NO PROJECT" ALTERNATIVE, OR ELSE, A FULL ENVIRONMENTAL IMPACT STUDY: E.I.S. BR-21

AS TO THE "REDUCED PROJECT" ALTERNATIVES, IT HAS BEEN STATED IN THE E.A. THAT THOSE ALTERNATIVES DO NOT MEET MODERN RESEARCH PROGRAM NEEDS.

THE POINT IS EXACTLY THAT.

HAPHAZARD BUILDING WAS ALLOWED ON THE HILLSIDE FOR OVER 60 YEARS, AND NOW, BECAUSE IT WAS DONE, LBNL BELIEVES THAT WE AS A NATION, AS A STATE, OR AS A UNIVERSITY, MUST REBUILD THE MESS TO A HIGHER STANDARD. I WOULD ARGUE FOR THE OPPOSITE CONCLUSION: THE LAB AS IT IS, HAS BEEN BUILT IN HELTER-SKELTER FASHION AS OPPORTUNITIES PRESENTED THEMSELVES, AND THAT IF IT DOES NOT MEET MODERN NEEDS, IT SHOULD BE GRADUALLY PHASED OUT, AND REMOVED FROM ITS BASICALLY UNSUITABLE HILLSIDE LOCATION. BR-22

AT THE VERY LEAST, A FULL ENVIRONMENTAL IMPACT STUDY IS CALLED FOR.

Universities to obtain UC Berkeley water archive

Officials say move of documents to UC Riverside, Cal State San Bernardino will help cut costs

SUPPLEMENTARY MATERIAL

By Mike Taugher
mtaugher@bayareanewsgroup.com

The West's premier archive of historical materials about water development is being moved from UC Berkeley to two universities in Southern California.

The Water Resources Center Archives, a unique collection of technical reports, speeches, photographs and other historical materials, has been housed at the Berkeley campus for more than a half-century.

However, budget worries and concerns that the Agriculture and Natural Resources Division of the UC president's office lacked the expertise to maintain the archive led university officials to seek proposals from other schools interested in housing the collection.

Late last week, UC Senior Vice President Dan Dooley announced

See **ARCHIVES,** *Page 7*

BR-23

Archives

From page 1

that the archive would be moved to libraries at UC Riverside and Cal State San Bernardino.

In making the announcement, UC officials said that UC Riverside has a record of expanding digital access to materials about agriculture and the environment.

The materials, including 200,000 technical reports and thousands of photographs, maps, newsletters speeches and other documents, are scheduled to be moved beginning this fall.

"We have a strong interest in preserving and digitizing the collection for the future ... to ensure the widest research access to all of the archive's contents," UC Riverside librarian Ruth Jackson said.

The school plans to charge for Internet access to the materials, which now are available for free.

"I think it's sad that we're going to be leaving Berkeley after 51 years, but I look forward to the water archive continuing to serve UC and the California water community from the Riverside campus," said Linda Vida, librarian and archive director for more than 17 years. She is one of four employees at the archive.

The collection is open Monday through Friday from 10 a.m. to 5 p.m., but Vida said it was unknown whether it would remain open on the Berkeley campus after July.

Contact Mike Taugher at 925-943-8257.

Obstacles Remain in Campus Efforts to Conserve Water

by **Samantha Strimling**
Contributing Writer

Amid global concern that water will one day become a scarce and precious resource, UC Berkeley's Office of Sustainability is attempting to overcome technical complexities and financial strains in order to implement programs projected to save up to 53 million gallons of water and $4 million.

ONLINE PODCAST
Go online for further discussion of water conservation projects.

In response to consecutive years of drought, Joanna Zhang, a water associate for the Chancellor's Advisory Committee on Sustainability, published a report in March detailing the campus's current water conservation plans and goals. The report used and expanded upon data from UC Berkeley alumna Jubilee Daniels' 2005 master's thesis, which has inspired some campus water conservation initiatives.

One large-scale project is the replacement of faucet aerators to reduce the rate of water flow — an inexpensive way to reduce water use because aerators are donated by East Bay Municipal Utilities District (EBMUD), leaving only the cost of labor, said Lisa McNeilly, director of the Office of Sustainability.

During 2008 and 2009, student group Building Sustainability at Cal discovered that more than 300 aerators could be replaced to save water, said Claire Evans, the group's lead program coordinator, in an e-mail. They worked with Physical Plant-Campus Services to install the new aerators, which reduce water flow from about two gallons per minute to 0.5 gallons per minute.

The chancellor's advisory committee has since uncovered about 700 more aerators to be replaced, McNeilly said, amounting to water savings of approximately 6.5 million gallons annually. The campus will begin installing these aerators in the coming months.

According to McNeilly, progress is already observable in the campus irrigation system, which currently makes up 8 percent of water use.

"Ninety percent of irrigation systems are now connected to a weather system that regulates how much water is released," she said. "This is an area where we have definitely seen success."

Such successes have inspired the Office of Sustainability to do more to conserve water. They are considering launching pilot programs in the future, such as installing shower timers with red lights to encourage students to reduce the length of their showers.

"Sometimes you need to do something, see the success, and that gives you the momentum to do something else," McNeilly said.

However, other projects inspired by the 2005 thesis are riddled with complications, making them expensive to implement. The challenge of maintenance has inhibited the installation of more waterless urinals beyond the ones installed in 2008 in the Martin Luther King Jr. Student Union.

"There is a different kind of cleaner and filter, and we must train the (maintenance) staff," said Christine Shaff, communications director for the campus Department of Facilities Services. "All of our pipes are installed to have a certain volume of liquid go through them, (which is) done by installing them at a certain angle. If there is more liquid, we put the pipes at an angle not as steep. If we don't replace all the pipes, there will not be as much water, so urine will just sit in the pipes and corrode them."

Such complications mean toilet and urinal renovations are only done during whole-bathroom renovations.

According to McNeilly, similar technical complexities involved in renovating single-pass cooling systems in laboratories as well as the variations among laboratories have prohibited substantial reduction of water use in laboratories, which constitute about 19 percent of campus water use.

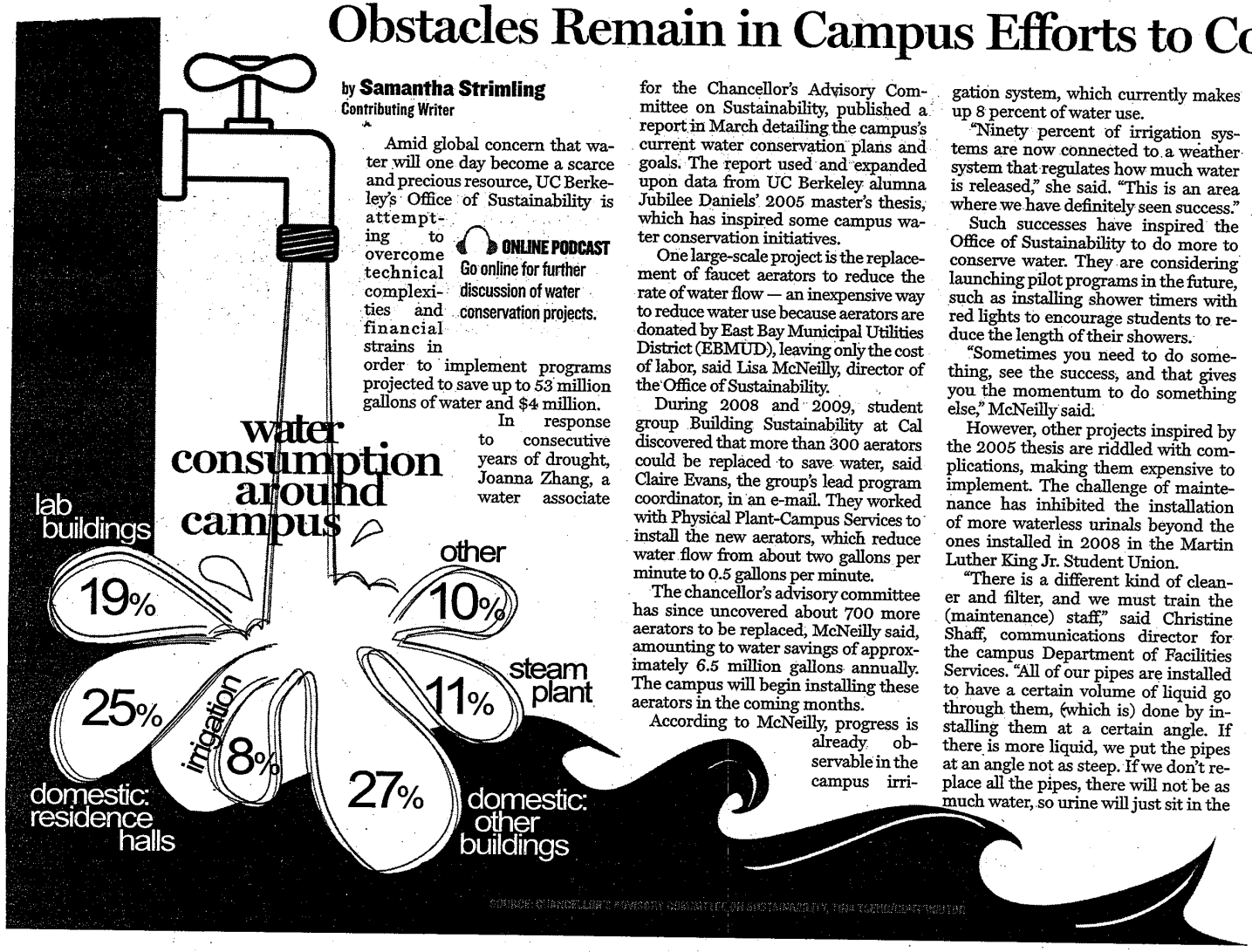
Making campus water data available has also been complicated by technical issues. In addition to the four meters EBMUD uses for billing, Physical Plant-Campus Services monitors meters on almost every building on campus. Over 23 meters are "state of the art," McNeilly said, showing the water used in 15-minute increments. However, the software used to read the data is "not very user-friendly," and there are no definite plans to install better software.

According to McNeilly, another inhibitory cost is that involved in buying water-efficient parts for domestic water use systems, especially because EBMUD does not always give rebates for necessary parts.

"There was a gym that wanted to buy a low-flow showerhead," McNeilly said. "EBMUD only offered a residential one meant to (be used) two to three times a day, so the gym had to buy (the showerheads) at full cost."

Despite the complications and costs of water conservation, Daniels said continuing efforts are necessary.

"It is important to not just teach about sustainability but to show through how we operate the school that sustainability can be put into practice," she said.



Contact Samantha Strimling at sstrimling@dailycal.org.

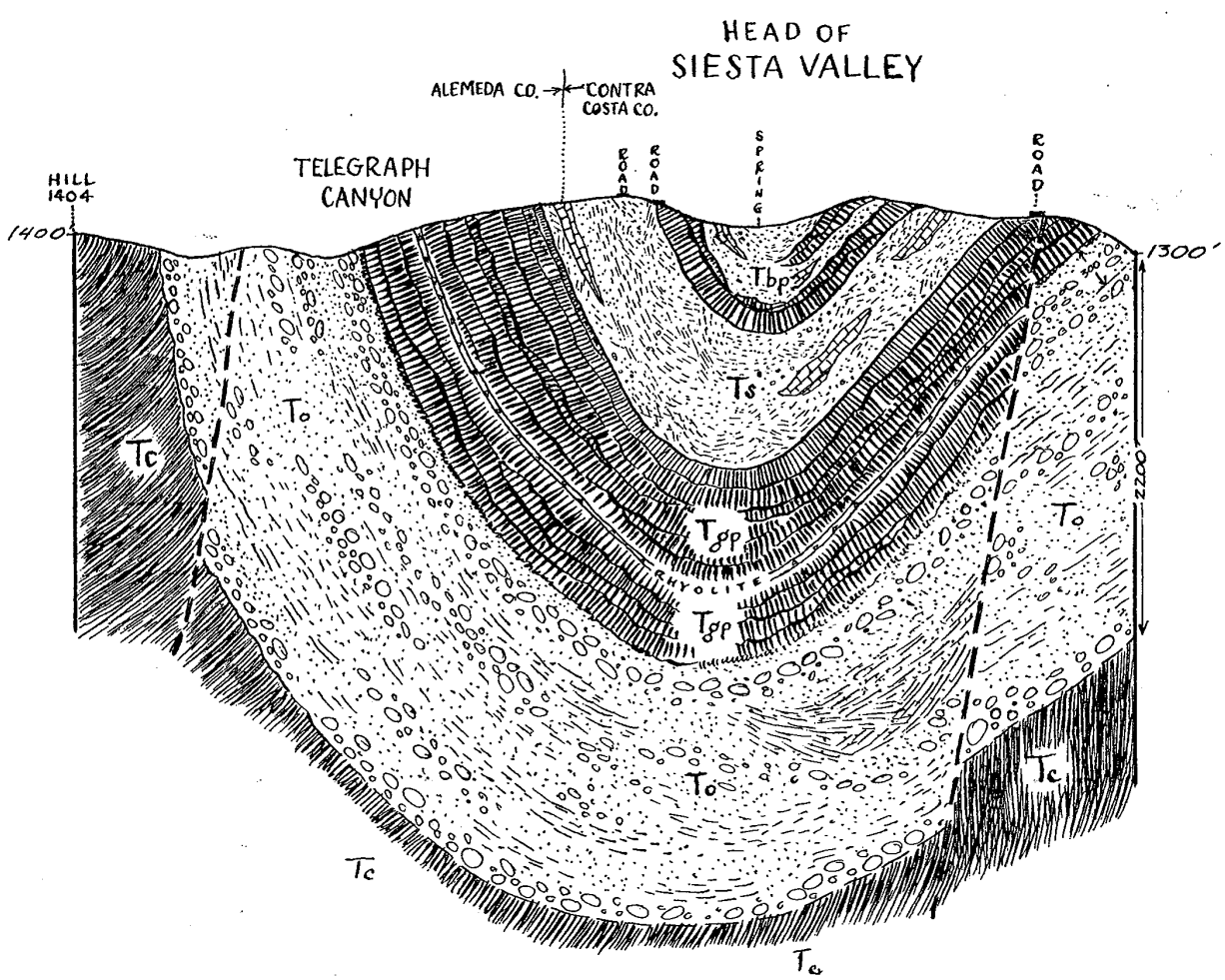
Monday, July 26, 2010

A COMMENT ON THE ERRATA OF JUNE 29, 2010 FINAL ENVIRONMENTAL IMPACT REPORT:

I HAD REQUESTED A GEOLOGIC CROSS-SECTION FOR THE AREA IN QUESTION. IT WAS ADDED AS A NOTICE OF ERRATA.

I MUCH PREFER MY OWN DRAWINGS (ENCLOSED) MADE WHEN A STUDENT AT U.C. BERKELEY IN GEOLOGY AND SOIL SCIENCE. I BELIEVE THE INFORMATION IS PRESENTED IN A MORE HELPFUL AND VISUAL WAY. PERHAPS YOU COULD DO SOMETHING SIMILAR TO HELP READERS UNDERSTAND THE UNDERLYING ROCK FORMATIONS OF THE AREA. TO MANY PEOPLE, "BEDROCK" MEANS "SOLID". THAT IS NOT THE CASE IN MUCH OF THE MATERIAL THAT UNDERLIES THE LAB BUILDINGS.

BR-25



CROSS-SECTION (A-A')

1 inch = 1000 feet

Tbp	Bald Peak fm.
Ts	Siesta fm.
Tgp	Grizzly Peak fm.
To	Orinda fm.
Tc	Claremont fm.

BR-25 cont.

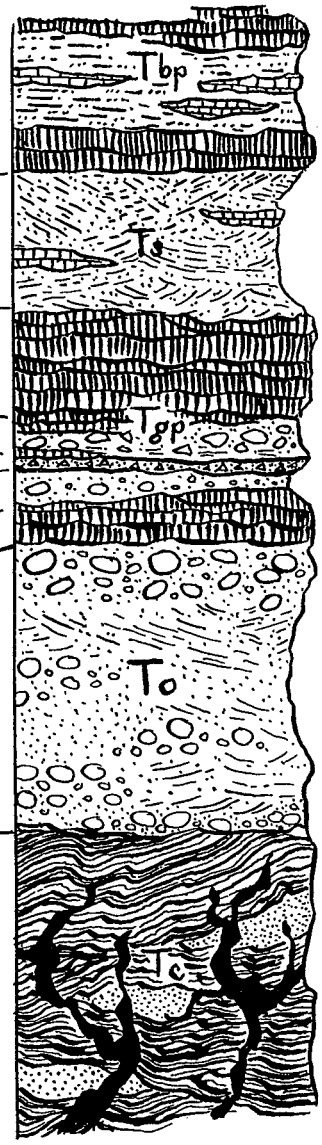
Bald Peak fm.
olivine basalt, limestone
clay, sandstone, cgs.

Siesta fm.
clay, mudstone, sandstone

Grizzly Peak fm.
- upper flow - basalt "e"
- sediment "d"
- rhyolite tuff "c"
- sediment "b"
- lower flow - basalt "a"

Orinda fm.
conglomerates, sandstones
mudstones, siltstones.

Claremont fm.
interbedded chert-shale
sandstone lenses, diabase
dikes



Stratigraphic Column
Berkeley Hills

1 inch = 1000 feet

BR-25
cont.

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT, GENERAL PURPOSE BUILDINGS, PHASE 2 PROJECT, FOR UNIVERSITY OF CALIFORNIA, LAWRENCE BERKELEY NATIONAL LABORATORY, BERKELEY, CALIFORNIA.

SUBMITTED TO
JEFF PHILLIBER
UC-LBNL ENVIRONMENTAL PLANNER
ONE CYCLOTRON ROAD MS 76-234A
BERKELEY CA 94720

BR-26

BY
BARBARA ROBBEN
1964 EL DORADO
BERKELEY CA 94707
510-524-2383

15 MARCH 2010

COMMENTS ON D.E.I.R., SEISMIC LIFE SAFETY, MODERNIZATION, AND REPLACEMENT OF GENERAL PURPOSE BUILDINGS, PHASE 2.

THANK YOU FOR SENDING ME A COPY OF THE REPORT. IT IS A LARGE THICK DOCUMENT, BUT NICELY DONE. IT WOULD BE AN IMPOSSIBILITY TO COMMENT ON THE DOCUMENT WITHOUT HAVING IT IN HAND, SO I DO THANK YOU FOR THAT. IN THE FUTURE I THINK THAT IT IS IMPERATIVE THAT YOU ORDER COPIES ENOUGH FOR ALL INTERESTED AND AFFECTED CITIZENS. ALSO, I PERSONALLY RECEIVED A LETTER INFORMING ME OF BOTH THE DOCUMENT AND THE PUBLIC COMMENT SESSION, AND THAT WAS HELPFUL. I DO WONDER HOW MANY OF THESE LETTERS WERE SENT OUT, AND WHETHER THIS INFORMATION WAS AVAILABLE WIDELY, OR ONLY TO A FEW OF US WHO HAD PREVIOUSLY COMMENTED ON OTHER LBNL PROJECTS.

ALSO: IF THIS DOCUMENT IS ONLY A CEQA DOCUMENT, HOW WILL CITIZENS BE ABLE TO COMMENT ON THE NEPA DOCUMENT? PLEASE FORWARD TO ME THE NEPA DOCUMENT AS IT BECOMES AVAILABLE. p. 1-2

I ALSO REQUEST A COPY OF THE FINAL EIR FOR THIS PROJECT. p. 1-4

BR-26 cont.

PERHAPS WHAT IS CALLED FOR IN THE WAY OF DRAFT E.I.R. COMMENTS ARE SPECIFIC QUESTIONS SUCH AS:

> THE MAP ON p. 3-4 SHOWS THE BUILDINGS OF THE LBNL BUT IT FAILS TO SHOW ANY PART OF BERKELEY THAT CITIZENS MAY BE FAMILIAR WITH, BECAUSE ALL OF THE AREA SHOWN IS OFF-LIMITS TO US. IS BLACKBERRY GATE THE ONE AT THE TOP OF HEARST AVENUE? COULD HEARST AVENUE AND CENTENNIAL DRIVE PLEASE BE LABELLED? "OLD TOWN" IS MENTIONED IN THE TEXT, BUT IT IS NOT LABELLED ON THE MAP.

INSTEAD, AGAIN AND AGAIN AS I READ YOUR DRAFT E.I.R., I AM COMPELLED TO SAY ONLY THAT: BR-26 cont.

> NO FURTHER CONSTRUCTION SHOULD TAKE PLACE UPON THE HILL.

THE REGENTS ARE SCHEDULED TO CONSIDER THE FINAL E.I.R. AND THEY WILL HAVE THE DOCUMENT IN HAND FOR 10 DAYS PRIOR TO THEIR DECISION. THIS IS HARD FOR ME TO UNDERSTAND. WILL THE FINAL E.I.R. BE AVAILABLE TO ME BY THAT TIME? WILL OUR PUBLIC COMMENTS BE INCLUDED IN THE FINAL E.I.R. OR WILL THEY JUST BE SUMMARIZED AS THEY WERE ON p. 2-2.C, "AREAS OF CONTROVERSY"?

THIS PRESENT DRAFT E.I.R. IS AN INTERESTING DOCUMENT, AN IMPROVEMENT OVER SEVERAL PREVIOUS LBNL E.I.R.s. THE PHOTOGRAPHS AND MAPS ARE CLEAR, AND THE WRITING IS WELL DONE. THAT LEADS TO THE QUESTION OF THE TOTAL COST OF PREPARING THE DOCUMENT.

IT HAS BEEN SAID TO ME THAT COPIES OF THE REPORT ARE TOO COSTLY FOR DISTRIBUTION TO THE PUBLIC. BUT THAT IS THE PURPOSE OF IT!
SURELY THE COST TO PREPARE THE DOCUMENT FAR OUT-WEIGHS THE COST OF THE COPIES. THE LAB NEEDS TO PROVIDE COPIES IN RESPONSE TO HONEST REQUESTS.
IT IS MUCH TOO LARGE AND COMPREHENSIVE A DOCUMENT TO BE ABLE TO BE REVIEWED IN A LIMITED LIBRARY SETTING. LOOK AT THE EXPENSE OF PROVIDING COPIES THIS WAY: THE AVERAGE WORKER PREPARING THE DOCUMENT EARNS X DOLLARS PER HOUR.
WE WHO ARE REVIEWING THE DOCUMENT AND WRITING COMMENTS ARE SIMILARLY PUTTING IN AN EQUAL EFFORT. YOU DO NOT PAY US. BUT YOU SHOULD AT LEAST CONTRIBUTE ENOUGH DOLLARS TO OUR EFFORTS SO THAT WE CAN BE PROVIDED WITH THE DOCUMENT NECESSARY FOR OUR WORK ON IT.

BR-26 cont.

COMMENTS

"THE PROJECT AIMS TO PROVIDE SEISMICALLY SAFE FACILITIES ... REPLACING THE DEMOLISHED SPACE .... BUILT TO HIGHER SEISMIC SAFETY STANDARDS" p1-1. A.

The problem here is that the site chosen is basically NOT seismically safe. It is wishful thinking to believe that a structure, however new and wanted, will ever be actually 'seismically safe' when the Hayward fault ruptures. Your employees there will be given a false sense of security, but because of the location of the project, will actually still be in danger. The other problem is that, in order to strive for seismic safety in a basically un-safe location, larger amounts of money will be required - and that is our money, our taxes that are being spent to engineer this building; more money than if the buildings were located in a safer area.

BR-26 cont.

"CONSTRUCTION OF THE EFFICIENT NEW BUILDING WILL ALLOW LBNL TO VACATE 36,000 g.s.f. OF OFF-SITE LEASED SPACE". p.1-5.

The problem is that instead of moving lab activities away from this unstable and unsuitable area, plans are being made to move yet more people and activities in. This should not be done, in my opinion. If an un-safe building needs to be demolished, then do so in a safe way, but do not build additional buildings, whether you consider them to be "replacement" buildings or not.

CUMULATIVE IMPACTS p.2-9. F.

the combination of projects listed for the LBNL site along with those listed for the U.C. Campus is staggering in both number and size.
As a citizen of Berkeley with some hope of being able to continue living here, it is clear after reading these lists of projects that either quality of life will be seriously compromised, or that in a matter of time these two agencies will continue to encroach on previously privately-owned property like a huge tsunami until there is nothing else left: just a gigantic monolithic U.C./LBNL Complex from one end of the city to the other, and no one left to pay the sewage and infrastructure bills.
To say that "an additional number of vehicles may possibly create need for a traffic signal" is to completely miss the impacts of this enormous building frenzy. I'm thinking that nowadays U.C. might better stand for the "University of Construction" or the "University of Cranes".
Everywhere one goes, one is likely to find a construction fence along with a sign "No Pedestrian Access". this is a great inconvenience to pedestrians, who then have to cross two additional streets to continue on their way. These barricades seems to be erected in a quite off-hand manner. Had the barrier been across a vehicle route, I'm sure arrangements would be made to accomodate the vehicles: not so with pedestrians. the most egregious example of this is on Hearst Avenue, where a barrier to pedestrian access has been in place for years. It also blocks

BR-26 cont.

one lane of street traffic, and my observation has been that the blocked off area is used only to accomodate the personal vehicles of construction workers, in other words, a parking lot. Yet it is Hearst Avenue which is always designated as the route of choice for demolition and construction materials for LBNL.

I would like to see this matter of the blocked-off lanes and side walk on Hearst Avenue specifically addressed in your E.I.R.

BR-26 cont.

4.5 GEOLOGY AND SOILS.
POTENTIAL PROJECT IMPACTS 4.5-16
I HAVE TO DISAGREE WITH YOUR DECISION TO LABEL THESE PROJECTS AS "LESS THAN SIGNIFICCANT" AS REGARDING THE RISKS INVOLVED.
SECTION 4.5-15 DISCUSSES THE SOIL TYPES (unstable), THE SLOPE OF THE LAND (30, 50, 75% slopes), AND THE EROSION (by which I suppose you mean 'landslide') POTENTIAL (highly susceptible).
FROM READING THE SOILS ANALYSIS SECTION I WOULD THINK THAT THE IMPACT OF BUILDINGS ON THIS SITE WOULD POSE 'EXTREMELY HIGH SIGNIFICANCE' RISKS.
I KNOW THIS ALSO FROM MY OWN KNOWLEDGE OF THE AREA SURROUNDING THE LBNL FENCE-LINE.
IT ALMOST SEEMS LIKE LBNL HAS NOT READ ITS OWN REPORT AT ALL. PERHAPS THERE IS A HOPE THAT NO ONE NOTICES THAT SOME CRUCIAL ITEMS HAVE BEEN DEEMED TO BE "UNIMPORTANT". THE MANNER IN WHICH SECTION 4.5-16 SO CASUALLY DISMISSES VERY IMPORTANT MATTERS, CASTS DOUBT ON THE VERITY OF THE ENTIRE DRAFT E.I.R.

BR-26 cont.

THIS OPENS UP SEVERAL POSSIBILITIES FOR THE INQUIRING CITIZEN TO PONDER:

1. IF THE LAB RECEIVES A MAJOR PART OF ITS FUNDING FROM THE TAX-PAYERS IN ONE FORM OR ANOTHER, LBNL'S CAVALIER ASSESSMENT OF THE RISKS MAY STEM FROM THE BELIEF THAT, SHOULD ANYTHING HAPPEN TO THE LAB FROM SOIL-CREEP, LANDSLIDES, EARTHQUAKES AND SO ON, THAT THE TAX-PAYERS WOULD PAY FOR A RE-BUILD, OR THAT THE TAX-PAYING CITIZENS ASSUME THE RISK FOR THE LBNL MANAGEMENT.

2. THE RESPONSIBLE ADMINISTRATORS NEED TO LOOK AT THE FACT THAT ANY NEW BUILDINGS, AND ANY OLDER BUILDINGS ALREADY ON THE SITE, MIGHT BE DESTROYED AND THAT IT COULD MEAN THE END OF LBNL.
BECAUSE INDIVIDUAL ADMINISTRATORS WOULD APPARENTLY NOT BEAR THE RISKS OF THEIR UNFORTUNATE DECISIONS TO BUILD ON UNSUITABLE LOCATIONS, THEY ARE EXPOSING TAX-PAYERS AND THE NEIGHBORING COMMUNITY TO THE RISKS, INCLUDING THE ENVIRONMENTAL HAZARDS LBNL WOULD LEAVE BEHIND, SHOULD THE FACILITY COLLAPSE OR SLIDE AWAY DOWN HILL. THE ADMINISTRATORS WHO MADE THE BAD DECISIONS COULD WALK AWAY FREE AND MOVE ON TO JOBS ELSEWHERE.

BR-26 cont.

SEC 4.5-16. D. 4.5-9.

THERE ARE KNOWN FAULTS IN OUR AREA. WE CAN CERTAINLY ALL EXPECT SOME FUTURE SHAKING FROM MORE THAN ONE OF THEM, BUT TO CONTINUE TO PLACE MAJOR BUILDING PROJECTS SO NEAR TO THE HAYWARD FAULT IS COMPLETELY IRRESPONSIBLE. THE LIKELY-HOOD OF EXTREME SHAKING, LIQUIFACTION, LAND-SLIDING AND RUPTURE IS SO GREAT THAT THE WELL-INFORMED PRUDENT PERSON WOULD DESIGNATE THE WHOLE OF STEEP STRAWBERRY CANYON AS A NATURE PRESERVE. THIS WOULD ALSO BENEFIT THE TENS OF THOUSANDS OF STUDENTS AND FACULTY OF THE U.C. B. CAMPUS.

IT SEEMS THAT SELF-INTEREST, ALONG WITH LACK OF PLANNING, HAS ALLOWED INDIVIDUALS OR GROUPS TO PARCEL OFF SELECTED SITES IN STRAWBERRY CANYON ... BECAUSE IT IS "CLOSE TO THE UNIVERSITY CAMPUS AND FOLKS LIKE TO GO BACK AND FORTH EASILY".
THIS ARGUMENT DOES NOT HOLD SWAY WITH THE PUBLIC AT ALL.

BR-26 cont.

SEC. 4.5-8 ADDRESSES THE ISSUES OF ALTERNATIVE PRACTICES VERY WELL:

1. "AVOID CONSTRUCTION ON KNOWN FAULTS OR LANDSLIDES"...
2. "DISCOURAGE DEVELOPMENT ON SLOPES..."
3. "UTILIZE LANDS SUBJECT TO SEVERE SEISMIC AND GEOLOGIC HAZARDS FOR LOW INTENSITY PARK AND RECREATIONAL ACTIVITIES OR OPEN SPACE".
4. "NOT LOCATE PUBLIC FACILITIES FOR HUMAN OCCUPANCY IN FAULT ZONE AREAS ..."

3-17.6 "OFFICIAL STATE OF CALIFORNIA EARTH-QUAKE INDUCED LANDSLIDE HAZARD ZONE:"

"A SYSTEM OF BELOW-GRADE PIER FOUNDATIONS AND TIE-BACKS, AND ADDITIONAL BRACING AND GIRDERS, METAL CASINGS AND CONCRETE..."
IS THE ENGINEERING SOLUTION TO THE PROBLEM, BUT IT OVERLOOKS THE COMMON-SENSE SOLUTION, WHICH IS NOT TO BUILD THERE.

'MODERN NEW BUILDINGS' AND 'SEISMIC STRENGTHENING' AND 'VISTA CORRIDORS' AND 'FOOD SERVICES' JUST MAKE THE SITUATION WORSE. NO MORE BUILDING SHOULD BE DONE ON THE HILL.
BUILDINGS, AS THEY BECOME OBSOLETE OR HAZARDOUS SHOULD BE REMOVED OR ENCASED IN PLACE, WORKING TOWARD THE GOAL OF EVENTUALLY RESTORING THE HILLSIDE TO ITS NATURAL STATE. A NEW TYPE OF THINKING WILL BE REQUIRED.

BR-26 cont.

THERE IS AN HONESTY IN THIS E.I.R. THAT WAS NOT PRESENT IN SOME PREVIOUS LBNL DOCUMENTS:
SEC. 4.1-5 STATES: "LBNL IS LOCATED ON A STEEP HILLSIDE..."
"THE BUILT ENVIRONMENT IS A RESULT OF 'AS-NEEDED' CONSTRUCTION ... PATHWAYS ENCROACH ON SERVICE AREAS ... BOX-LIKE GREY METALLIC STRUCTURES..."
THESE DESCRIPTIONS SHOULD GIVE LBNL ITSELF PAUSE.

1. THE FIRST BUILDING WAS BUILT TO ACCOMODATE SECRET WW II PROJECT...
2. ADDITIONAL PROJECTS IN EVER-INCREASING AMOUNTS...
3. BUILDINGS ERECTED IN HAPHAZARD FASHION...

4. THE REAL REASON BUILDINGS ARE ADDED IS THAT IT IS CLOSE TO CAMPUS.
5. THE LAND IS OWNED BY U.C.
6. SCIENCE CAN ATTRACT FUNDS
7. A COMBINATION OF PROFESSORS AND THEIR EXPERIMENTS; GRADUATE STUDENTS LOOKING FOR EXPERIENCE WITH PAY AND LEADING TO ADVANCED DEGREES

BUT THE WHOLE THING IS BASED ON A HOUSE OF CARDS – THE LOCATION IS NOT SUITABLE!

BR-26 cont.

FIG. 3-5, AN AERIAL VIEW OF BUILDING 25 COMPLEX, THOUGH A LOVELY PHOTO GRAPH, IS SCARY IN THE EXTREME WHEN IT IS THEN POSSIBLE FOR AN ORDINARY CITIZEN TO VIEW THE CITY THAT HAS BEEN CONSTRUCTED UP THERE IN THAT CANYON. FROM WW II ONWARD, CONSTRUCTION APPARENTLY HAS JUST NEVER STOPPED. IT IS THE EVER-INCREASING NUMBER AND SIZE OF THE BUILDINGS THAT CONCERNS ME, ALONG WITH THE CONTAMINATION OF THE ENVIRONMENT AND THE POTENTIALLY HAZARDOUS NATURE OF THE EXPERIMENTS BEING CARRIED ON THERE. THE TOXIC LEGACY OF ALL THIS ACTIVITY HAS LEFT ITS MARK ON NOT ONLY THE SOIL OF THE LBNL, BUT ON THE GROUND-WATER AND THE SURFACE WATER WHICH IS SHARED BY ALL.

BR-26 cont.

STRAWBERRY CREEK DRAINS THE CANYON BUT THEN FLOWS THRU THE CITY OF BERKELEY AND INTO THE BAY. U.C. STUDENTS DOING PROJECTS IN THE CREEK ARE INSTRUCTED TO WEAR PROTECTIVE EQUIPMENT BEFORE TOUCHING THE WATER OF THE CREEK. AND YET THE U.C. SITE WAS ORIGINALLY SELECTED BECAUSE OF THE ABUNDANT FRESH-WATER SPRINGS SUITABLE FOR DRINKING WATER! WHAT HAS HAPPENED UP THERE?

4.0-2 3. "THE PROPOSED PROJECT WOULD RESULT IN RE-LOCATION OF APPROXIMATELY 100 U.C. L.B.N.L. PERSONNEL FROM A SITE ON POTTER STREET TO THE L.B.N.L. MAIN CAMPUS".

I believe that people should be re-located in the other direction: OFF the L.B.N.L. Hill Site.

4.0-4 TO 4.0-10. PROJECTS ON THE LBNL SITE.

THESE PAGES LIST THE 15 MAJOR PROJECTS PROPOSED OR UNDERWAY. EACH OF THESE PROJECTS INDIVIDUALLY IS HUGE, AND THE CUMULATIVE IMPACT OF THEM ALL IS FAR IN EXCESS OF THE AREA'S CUMULATIVE ABILITY TO BEAR THEM. THE CUMULATIVE IMPACTS ARE

TOO GREAT FOR THE CITY TO BEAR;
TOO GREAT FOR THE CITIZENS AND NEIGHBORS TO BEAR;
TOO GREAT FOR THE TAX-PAYERS ABILITY TO FUND;
TOO GREAT FOR THE AREA AND TYPE OF SITE;
and TOO GREAT FOR THE INFRASTRUCTURE,
TRAFFIC, NOISE, DUST, UTILITIES, SAFETY,
SUNLIGHT, VIEWS, SCENIC VISTAS, LAND-
FILLS AND ALL ELSE LISTED IN YOUR D.E.I.R.

THE CUMULATIVE IMPACTS ARE IMMENSE. THEY ARE NOT 'LESS THAN SIGNIFICANT' IN ANY WAY.

BR-26 cont.

THE PHASE II GENERAL PURPOSE LABORATORY PROJECT SEEMS NOT TO CARRY AS MANY NEGATIVE ASPECTS AS SOME OF THE OTHER PREVIOUSLY PROPOSED LBNL PROJECTS. HOWEVER IT REPRESENTS YET ANOTHER CONSTRUCTION PROJECT AND BUILDING CLUSTER ON THE HILLSIDE. IN SECTION AFTER SECTION THE REPORT STATES "OH, WE'LL PLANT TREES," OR "WE'LL COVER THE DEBRIS TRUCKS" OR "WE WILL RE-LOCATE ANY WHIPSNAKES WE FIND", AND THAT CAN LEAD THE CASUAL READER TO BELIEVE THAT ALL IS WELL ON THE HILL. BUT IT IS FAR FROM AN ACCEPTABLE OUTCOME FOR THE AREA AND THE CITIZENRY AS A WHOLE. THE HILLSIDE ALREADY IS MUCH TOO CONGESTED FOR SAFETY, BEING A LARGE, QUITE POSSIBLY TOXIC EXPERIMENTAL COMPLEX SITUATED ON A DANGEROUS, STEEP, UNSTABLE HILLSIDE LOCATION. RELOCATING A WHIPSNAKE OR WETTING DOWN CONSTRUCTION DUST SOUNDS LOVELY, BUT IT OBSCURES THE LARGER OVERALL PROBLEM.

BR-26 cont.

ADDENDUM TO MY COMMENTS. 10am 15 MARCH 2010

I HAVE JUST CALLED MR. MARK CHEKAL-BAIN, THE COMMUNITY RELATIONS DIRECTOR AT LBNL, TO INQUIRE ABOUT THE BEST METHOD TO SUBMIT MY COMMENTS, TODAY BEING THE DUE DATE... ONLY TO BE INFORMED THAT MR. CHEKAL-BAIN IS NO LONGER EMPLOYED AT THE LAB, HIS LAST DAY BEING FRIDAY.

YET IT WAS HE WHOSE CARD IS ATTACHED TO MY COPY OF THE DRAFT E.I.R., AND HE, ALONG WITH MR. JEFF PHILLIBER, WHO PRESIDED OVER THE PUBLIC COMMENT PERIOD ON FEB. 25. AS FAR AS I KNOW, NO ONE HAS HAD ANY FORE-WARNING ABOUT THIS CHANGE IN PERSONNEL.

BR-26 cont.

I HAVE HAD SEVERAL QUESTIONS ANSWERED BY MR. CHEKAL-BAIN IN THE PAST, AND I WONDER IF THE ANSWERS I GOT FROM MR. CHEKAL-BAIN WILL STILL BE VALID. SO OFTEN IN THE PAST, WHEN DEALING WITH INSTITUTIONS, ONE EMPLOYEE WILL GIVE ONE ANSWER, WHILE A SUBSEQUENT PERSON WILL DENY KNOWLEDGE OF THAT AND INSTEAD WILL COME UP WITH SOMETHING QUITE DIFFERENT. I HOPE THAT WILL NOT BE THE CASE AT LBNL.

THIS ABRUPT CHANGE IN COMMUNITY RELATIONS DIRECTORSHIP JUST RE-ENFORCES MY OPINION THAT INSTITUTIONAL EMPLOYEES COME AND GO, AND THAT THEIR OWN PRIORITIES MAY TAKE PRECEDENCE OVER THE LONG-TERM WELL-BEING OF THE COMMUNITY AS A WHOLE.

LETTER #SSC

SAVE STRAWBERRY CANYON
P.O. BOX 1234
BERKELEY, CALIFORNIA 94701

WWW.SAVESTRAWBERRYCANYON.ORG

REC'D JUL 2 9 2010

July 27, 2010

Kim Abbott, NEPA Document Manager
Office of Science
Department of Energy
One Cyclotron Road
Berkeley, California 94720

Re: Inadequate Environmental Assessment (EA) for Seismic Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2 Project (Phase 2 Project)

Dear Mr. Abbott:

Having reviewed the EA for the Lawrence Berkeley National Laboratory (LBNL) Phase 2 Project, Save Strawberry Canyon (SSC) urges the Office of Science to determine that an Environmental Impact Statement (EIS) is required in order to be in compliance with the National Environmental Policy Act (NEPA). SSC, a non-profit organization with some 400 members, believes that the Canyon lands are a significant environmental resource of unique geological character, deserving of protection and preservation. SSC-1

As LBNL continues to proceed in its efforts to implement its 2006 Long Range Development Plan (Plan), intending to build major research facilities on the Canyon hillsides, defined by unstable soils and a complex watershed, our concerns continue. Without a Site-wide EIS, the EA for the Phase 2 Project fails to adequately describe the affected environment, to assess the existing and potential environmental impacts and risks, and to consider a range of alternative choices that could fulfill the project building(s) purposes.

Undertaking further federal action to implement the proposed Phase 2 Project, including the General Purpose Laboratory (Building 25) in Blackberry Canyon and the Hazardous Waste Handling Facility (Building 85 and 85A) in Strawberry Canyon, should not proceed without detailed analysis of the geological conditions of each site. In a glaring omission, the EA ignores the fact that the hill campus is encompassed by the western edge of a collapse caldera, formed after a volcanic eruption some 10 million years ago. The caldera presents geological dangers that deserve comprehensive assessment. SSC-2

It is troubling, furthermore, that the EA relies solely upon the LBNL California Environmental Quality Act (CEQA) Environmental Impact Report (EIR) and the SSC-3

Phase 2 Project EIR for background information and analysis regarding the geology of the area. (Please see attachments #1, Letter, March 15, 2010, #2, Letter, July 9, 2010) le this reliance has led incorrectly to a conclusion that no significant impacts are likely. It is critical to note that the EA conclusions neither stand on their own merit, nor are they substantiated by the incomplete information in the Phase 2 Project EIR. Based on the lack of geotechnical analysis in the EA alone, the EA is an insufficient agency action. **SSC-3 cont.**

SSC refers to the Phase 2 Project EIR materials and in particular the Alan Kropp and Associates (AKA) reports:

- The AKA reports for Building 25 or the General Purpose Laboratory, cited in the Final EIR on disc and on the web, were only added to the web after their absence was reported to LBNL. As they were used in the " matrix" of the FEIR to contest points made by several individuals, they would appear to be important. **SSC-4**

- AKA, May 29, 2009, a preliminary report, made in two weeks "to meet LBNL's objectives," lays out the problems and what additional work will be necessary to help solve them.

  1) AKA's preliminary investigation of old boring logs are consistent with the presence of a paleolandslide under B25.

  2) Orinda Formation under the Lawrence Road (south and downhill from 25) is potentially part of a paleolandslide rather than in-place bedrock.

  3) Offsets in the curbs are not sufficient to evaluate historic slides. [Evidently AKA was not given access to the files on historic landslides.]

  4) The borings suggest very low factors of safety, although these may be based upon conservative measures.

  5) **Additional trenching is needed** (to establish whether the paleolandslide has moved recently.)

- AKA, April 2, 2010.

  Trenches 1 and 2 are mentioned but only T-1 (southwest of 25, 8' deep) appears on the map. There are no photos of the trench nor is it discussed. The "general sketch" at the end of the report is indeed too general. Were there slickensides, indicative of movement? **SSC-5**

Historical borings around B25 indicate Moraga volcanics that "break into rubble during drilling." Gravity has moved colluvium downslope. Moraga Formation is highly permeable (although is it called "bedrock," which in common or dictionary definition means hard rock. Neither Moraga Formation nor Orinda Formation fit that definition. **SSC-6**

- AKA, May 29, 2010, supplemental report

Boring log #1 (north of 25) has 8' of fill. Clay to 11.5', and silty clay below.

Boring #2 (south of 25) Moraga volcanics with weak rhyolite, then andesite down to 90' where Orinda claystone and siltstone are found. (Muds and mudstones give rise to many problems in civil engineering because they are weak and shrink or swell on being dried or wetted." Mudstones are siltstone, mud-shale, or claystone. "Muds are very reactive to physical disturbances or differential loading, and they slump and flow easily when subjected to stress." (*Oxford Companion to the Earth*, 2000, p. 715) A three-story General Purpose Laboratory would indeed exert differential loading and stress. **SSC-7**

Boring #3 (south of 2) Orinda Formation

Boring #5 & 6 "southern side of proposed central plant site" (not on map):

Atterberg Limits;

Boring #5, (4–4.5' deep) Plasticity Index 56;

Boring #6, (6 – 6/5' deep), Plasticity Index 46.

"Onsite soils having a PI of 15 or less are generally considered to have a sufficiently low expansion potential to be used as non-expansive fill." 5 and 6 are marked "Fat Clay" and not to be used for fill. AKA says these must be removed. **SSC-8**

In effect after all these reports AKA has not come to a conclusion that the Moraga volcanics are a paleolandslide or in-place "bedrock." AKA did not examine the trench for slickensides, nor did it dig a second trench. Moving or not, it is critical to ask whether building on "weak volcanics that break into rubble during drilling" is responsible. And, to ask whether spread footings will do the trick when the earthquake strikes. Or, what will be the affect of contact with Orinda mudstones. **SSC-9**

Both Buildings 85 and 85A are shown in the EIR to straddle two paleolandslides, characterized in several earlier consulting reports as potentially liable to move in a major seismic event and at different rates. Slickensides were prevalent throughout the area. In earlier reports 60% of the HWHF buildings (the southwestern parts) overlie the Orinda Formation clays. In the EA, however, AKA's plans show only QLS2 (Moraga landslide) crossing all but a small part of 85 and no characterization of the leftover area (please see attachment #3: Figures 1 and 2). AKA had declared in an earlier report that 10 feet of Moraga Formation lies under the northeast corner of the buildings, and below that 25 feet of Orinda Formation. It is significant that what is under the area is unknown. **SSC-10**

AKA proposes drilling 21 piers around two sides of B85 and 9 piers around two sides of B85A, these to be 5 feet in diameter and 40 to 50 feet deep, TO STOP THE LANDSLIDE, evidently the top one of Moraga Formation (hard but fractured volcanics). What will stop the building from being torn apart? Has anyone ever used **SSC-11**

piers to stop a landslide? Into what will those piers be drilled that is less expansionary and stronger than mudstones? (AKA 2006, a propos the nearby Animal Care Facility, suggested a mat under the building so that it might move integrally, a proposal AKA could not make, evidently, for 85, as it would entail rebuilding.) **SSC-11 cont.**

Missing from the reports are 9 boring logs, AKA 7 – 16. Where are these and their interpretations? They will be needed to determine the quality of the Moraga volcanics, the Orinda mudstones, and whatever lies beneath. **SSC-12**

What does lie not far below the surface is water! In the EIR there are tables recording water heights, taken from monitoring wells. The EA refers to them on p. 22. North of 85 the water measured from 16 to 12 feet below surface while south of 85 the range was from 40 to 35 feet. Accounting for the difference in elevations the water table seems to be level at that point. But east of 85A at the same elevation as the well south of 85, the difference is huge—the level according to AKA ranges between 24 and 0.3 feet. This means that there is a "perched water table" or reservoir and that the other two wells may have penetrated a separate reservoir.

This variance is just what one expects in the caldera of the volcano upon which LBNL has constructed its buildings. When such a reservoir breaks during a seismic event (the breaks in 1973 may have been caused by a series of small events), the landslides could be devastating as they were in 1973. The unpredictable reservoirs, springs, and aquifers mean that contaminants may have spread all over. Monitoring wells are seldom left open for long. See the report *Contaminant Plumes of the Lawrence Berkeley National Laboratory*... (2007) http://berkeleycitizen.org/lbnl/cmtw1.html. **SSC-13**

The EA notably has only a brief paragraph dealing with fire and concludes that there is no significant finding of an existing or potential hazardous fire impact. Again, in essence it says "trust us!" relying on the Plan EIR that has declared the site to be "not a high potential for wildland fires." This is an obvious oversight as LBNL is located in an area that already has a history of being threatened by the one of the most damaging California urban/wildland fires on record. The Oakland Firestorm of 1991, in fact, reached the south wall of the adjacent Claremont Canyon. At that time LBNL Director Charles Shank ordered all personnel to leave the LBNL site. **SSC-14**

In particular, The Hazardous Waste Handling Facility site in Strawberry Canyon is in a heavily wooded location, with pines and eucalyptus, grasses and scotch broom, all flammable. Building 85 contains radioactive waste on the first floor and mixed solvents and volatile organic compounds on the second floor. There are a number of storage sheds for liquid and dry combustible compounds. How are these highly flammable and environmentally detrimental structures to be protected from a fire like that of the 1991 Firestorm (2000 degrees, destroying concrete, "fireproof" safes, metals, etc.)? **SSC-15**

This is another oversight that has led incorrectly to a conclusion that no significant impacts are likely. It is, in fact, not congruent that a sizable Federal Emergency Management Agency grant has been proposed to rid the Canyons of trees because of potential urban/wildland fires and is currently under NEPA review. Please note p. 141 of the EA, "In 1994, UC LBNL published a Wildland Fire Evacuation/Relocation Plan. The plan, which would apply to the Proposed Action, is based on a wildland fire scenario that would require rapid mobilization of resources, quick decision making and well-coordinated execution by emergency responders during a wildland fire." The footnote sends one to a website that is no longer operating. Have the plans been abandoned? The 1994 plan was evidently motivated by the lack of a plan in 1991. At a "Community Advisory Group" meeting in June, someone asked about emergency plans. Evidently there were none! **SSC-16**

In closing, for the above reasons and others not enumerated, SSC urges the Office of Science to determine that an EIS is required for the Phase 2 Project in order to be in compliance with NEPA.

Thank you for your attention given to these important matters.

Cordially,

Georgia Wright/le)

Georgia Wright, for
Save Strawberry Canyon **SSC-17**

Attachments:

#1. Letter from Garniss Curtis, Georgia Wright, and John R, Shively to Jeff Philliber, LBNL, March 15, 2010, with attachments

#2. Letter from SSC to Russell Gould, Chairman Board of Regents, July 9, 2010, with attachments

#3. Figure 1: From Alan Kropp & Assoc; Inc 2006A Geotechnical Investigation Report: Animal Care Facility, and Figure 2: From Phase 2 Project EA, p. 20

SSC-18

Attachment #1

March 15, 2010

Jeff Philliber, UC-LBNL Environmental Planner
Lawrence Berkeley National Laboratory (LBNL)
One Cyclotron Road, MS 76-234A
Berkeley, CA 94720

cc: Kim Abbott, Environmental Program Manager
Office of Science
Berkeley Site Office
1 Cyclotron Road MS 90-1023

re: Draft Environmental Impact Report for Seismic Life Safety, Modernization, and replacement of General Purpose Buidlings, Phase 2 Project, SCH# 2008122030

Dear Mr. Philliber and Ms. Abbott:

This is written in response to the invitation for public written commentary regarding the subject project, as required by the California Environmental Quality Act (CEQA) for a draft Environmental Impact Report (DEIR) and for all requirements of the National Environmental Protection Act (NEPA).

SSC-18 cont.

We hereby advise you of the hazards of the construction on the LBNL (Lab) site, as presently proposed in the subject DEIR. We also wish to emphasize the dangers to people, structures and vulnerable research facilites that may in any way contain hazardous materials, should this project be executed at the proposed LBNL site.

Regarding the geology of the site the observations cited in the DEIR concerning the adequacy for construction are seriously deficient. Lacking are geological studies for the General Purpose Laboratory (GPL) deep enough to provide any understanding of the geology below approximately three meters. Furthermore the severe destruction to the Lab infrastructure is predictable due to the mercurial geology and steepness of the Lab site.

Of primary concern should be the fact that an earthquake is now predicted to be imminent on the Hayward Fault trace. That trace runs completely through the lower west side of the Lab site. When the event occurs, it is predicted to destabilize the entire Lab site. CEQA establishes significant relevant criteria for impacts. It asks if the impact of the proposed project related to geology and soils would be considered significant. Certainly it would expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

a) rupture of a known earthquake fault
b) strong seismic shaking
c) seismic-related ground failure, including liquefaction
d) landslides

The attachments will describe the underlying geology of the LBNL site which should convince you that:

1. No new buildings of any kind should be construsted on the present LBNL site.

2. A plan to relocate all the existing facilities to a safer location, preferably well west of the known Hayward Fault trace should be instituted

3. The available UC Richmond Field Station site should be seriously considered.

Very truly yours,

Garniss Curtis, PhD, Professor Emeritus, Earth and Planetary Sciences, UCB
10 St. James Court
Orinda, CA 94563

Georgia Wright, PhD,
105 Vicente Road
Berkeley, CA 94705

John R. Shively, P.E.,
2 Van Cleave Way
Oakland, CA 94619

Attachments::
Transcript of Video with John Shively and Garniss Curtis
Map of LBNL and Caldera
Section of Caldera
Garniss Curtis
4 reports from B. J.Lennert (1979-1987)
Questions from the Appendices

SSC-18 cont.

Transcript of Video "The Fault: Quakes, Slides, & the Lawrence Berkeley Lab"

I'm Ignacio Chapela, Professor of Environmental Sciences at UCBerkeley. I'm on the board of Save Strawberry Canyon and we've made a video for the university community, the neighbors of Strawberry and Blackberry canyons, and the citizens of the Bay Area. This concerns the danger from the buildings already on the hillside and from those planned for it.

I am standing on the lower fire trail, south of Centennial Drive. Behind me the black box you see is the new Molecular Foundry, 96,000 square feet.
UC and the National Lab want to construct 980,000 new square feet of buildings while demolishing 320,000, thus adding 660,000 square feet to the lab campus. They want 500 new parking places and 860 new employees.

All of this is planned for Blackberry Canyon, directly above Hearst Avenue and its houses and dorms, and in Strawberry Canyon, north and south of Centennial Drive, above the stadium, Greek Theater and dorms.
This is extremely unstable land, and close to the Hayward Fault. This video will explain our concerns.

I'm John Shively.In the early 70's I was the Principal Engineer at UC Berkeley Office of Architects and Engineers.

SSC-18 cont.

In August of 1974, during a major drought, I received a call from Lawrence Berkeley Lab advising that the steep hillsides were sliding in two separate areas near the Lawrence Hall of Science, due to underground water. I called consulting civil engineer, Ben Lennert, and we drove up to observe the slides.

The most active slide was on the steep hillside below Lawrence Hall of Science and above the Lab Hilac accelerator building. It had broken a lab building, broken an internal lab road, and cut the underground utilities . This slide was growing rapidly and threatened the Lawrence Hall of Science.

The other slide was located on the steep hillside above the Lab corporation yard and just below the steep portion of Centennial Drive. It was slower moving but had severed the underground utilities that served the Hall of Science and threatened to take out Centennial Drive above the corporation yard.

Ben's first idea was to drill hydraugers, which are horizontal wells, into the corporation yard hillside, hoping to tap the aquifer and let gravity drain the water. He drilled several hydraugers but failed to hit the aquifer. I then surmised that that much water had to be coming from the much larger watershed located higher up in the expansive Grizzly Peak area of Tilden Park. I proposed drilling a conventional vertical well just at the south end of the Space Science Lab. We drilled the well and hit the aquifer at about 150 feet down.

Video 2

When we commenced pumping, both slides stopped. We directed the water south into Strawberry Creek. Some of it was intercepted for very welcome use in the drought-parched UC Botanical Gardens.

I'm Garniss Curtis, emeritus professor in the department of Earth and Planetary Sciences at the University of California, Berkeley. Ina Letter I wrote to the regents, I emphasized that there should be no buildings in Strawberry Canyon near the Stadium nor Blackberry Canyon and these are the reasons why.

In working with Ben Lennert 25 or 30 years ago investigating landslides and also places that new buildings could be made, I found geologic reasons that threaten these areas. The geologic setting is this. Here is the active Hayward Fault. Here is the Wildcat Canyon Fault and between them once 10 million years ago was a volcano. That volcano erupted violently and made a big cavity in which this whole area collapsed to form a great void.

The outlines of the western margin of that void is here from the botanical garden going northwards several miles and includes all of these buildings resting on material that collapsed into the void we call a caldera.

In working with John Shively and Ben Lennert concerning the slides on Centennial and this location which threatened these buildings to the west , we found we were in volcanic rock fragments, volcanic rock, in clay matrix which was sliding as water moved it.

In this caldera filled with debris from the old cone, it left great cavities between large blocks of andecite which collected water and that water was gradually seeping out and causing these landslides, and unless they pumped that water out some way, we'd continue to have slides in this caldera material.

SSC-18 cont.

A horizontal hole drilled did not relieve the water, but when a vertical hole was put down, it bumped into one of these cavities filled with water and over the next 10 years 16 or 14 million gallons of water were pumped out. That's a huge amount of water to pump out of one place, but that was a function of the collapsed material making many cavities that were not filled with ash and left vacancies for water.

The Hayward Fault, after passing close to Bowles Hall, goes right through the stadium where it has offset the two sides of the stadium since its construction in 1923. The interior pillars damaged some 30 years ago have only recently been reinforced with concrete and reinforcing steel.

Behind Hearst Mining Bldg and a few feet to the east if the Lawson Adit, , that is a tunnel going eastward to the Hayward Fault. In the tunnel are several exposures of the offset of Strawberry Creek as determined from the contained rounded cobbles of Strawberry Canyon origins. This indicates a displacement of more than 2000 feet north along the Hayward Fault. East of the Hayward Fault are cretaceous sedimentary rocks older than 65 million years. These are dipping westward at 20 to 30 degrees.

(Above Stern Hall)What we're looking at here is sandstone, bedded sandstone, and you can see the parting dipping off toward the Bay and two parting zones dipping off toward the Bay on the outcrop of the sandstone and disappears up hill there and disappears under the soil.

(drawing) This caldera is like a great big tub of mud with no rigidity to it at all and much heavier than water, pressing against these cretaceous beds dipping westward.

The US Geological Survey has made extensive study of the Hayward Fault and found that the return time on earthquakes going back to the time of Christ is about 130 years. The last major quake was in 1868, 140 years ago. In short it's overdue. The survey by USGS says that there's a 65% chance of a major quake, 6.5 to 7 magnitude, occurring in the next 35 years. If an earthquake occurs when these beds have been soaked with winter rain, the chances of a major landslide are great along the slippage planes of sandstone dipping westward towards campus. Buildings in the lower parts of both Strawberry and B Canyons would be buried if not destroyed. These buildings will move Keep in mind the Loma Prieta quake of 1989 of magnitude 6.9 which from a distance of over 60 miles destroyed a section of the Bay Bridge, a section of the overhead freeway in Oakland. killing 63 people, and many houses on filled ground in the Marina of northern San Francisco some 70 miles from the quake!

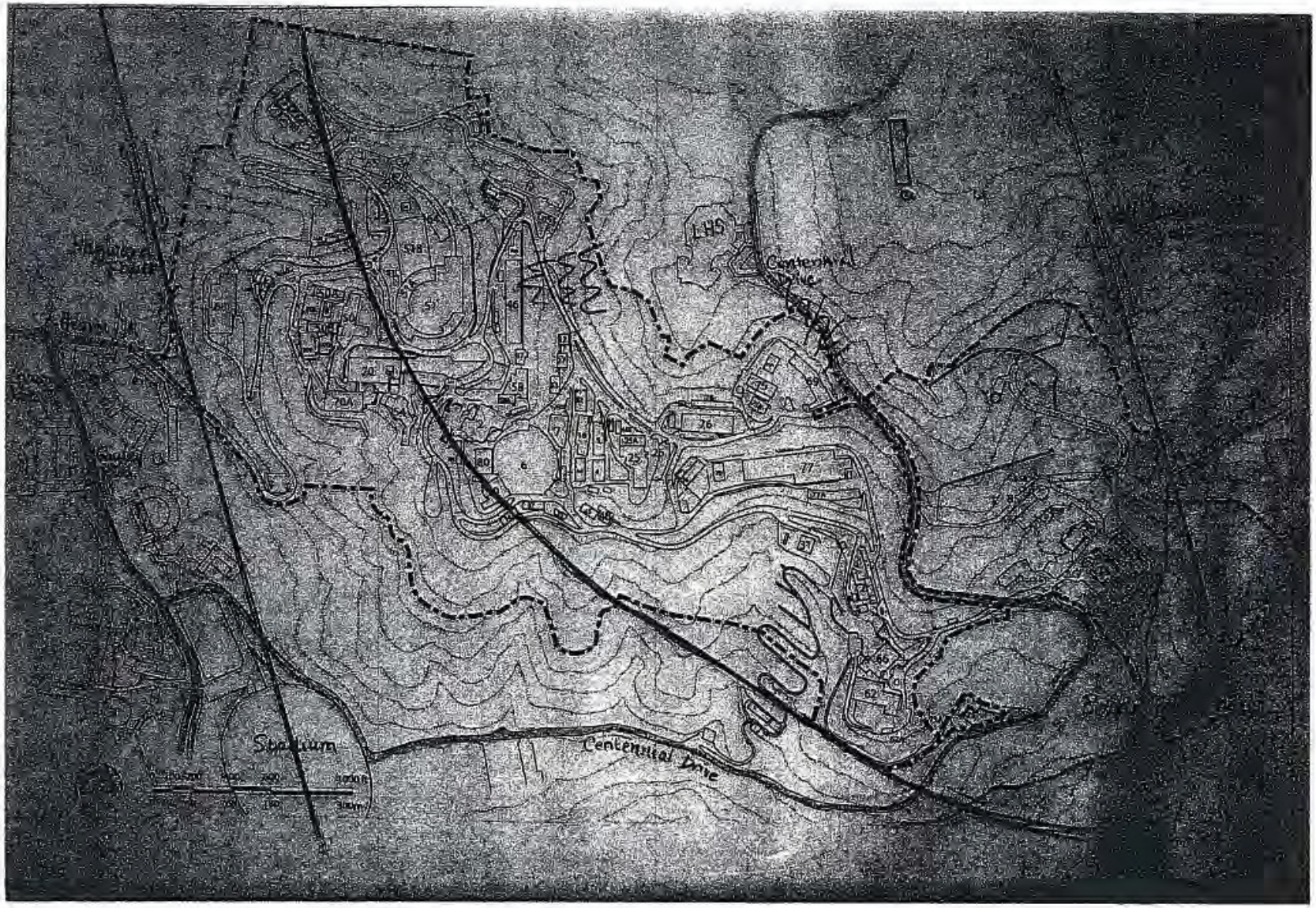
No major buildings should be built on the hills or canyons above the campus.

(Ignacio)There are alternatives to constructing more buildings above campus. These alternatives are cheaper and certainly much safer and many are owned by the university.

I hope that the Regents and administrators of the university will consider the dangers to students, faculty and neighbors of building on these fragile hill sites so close to the Hayward Fault.

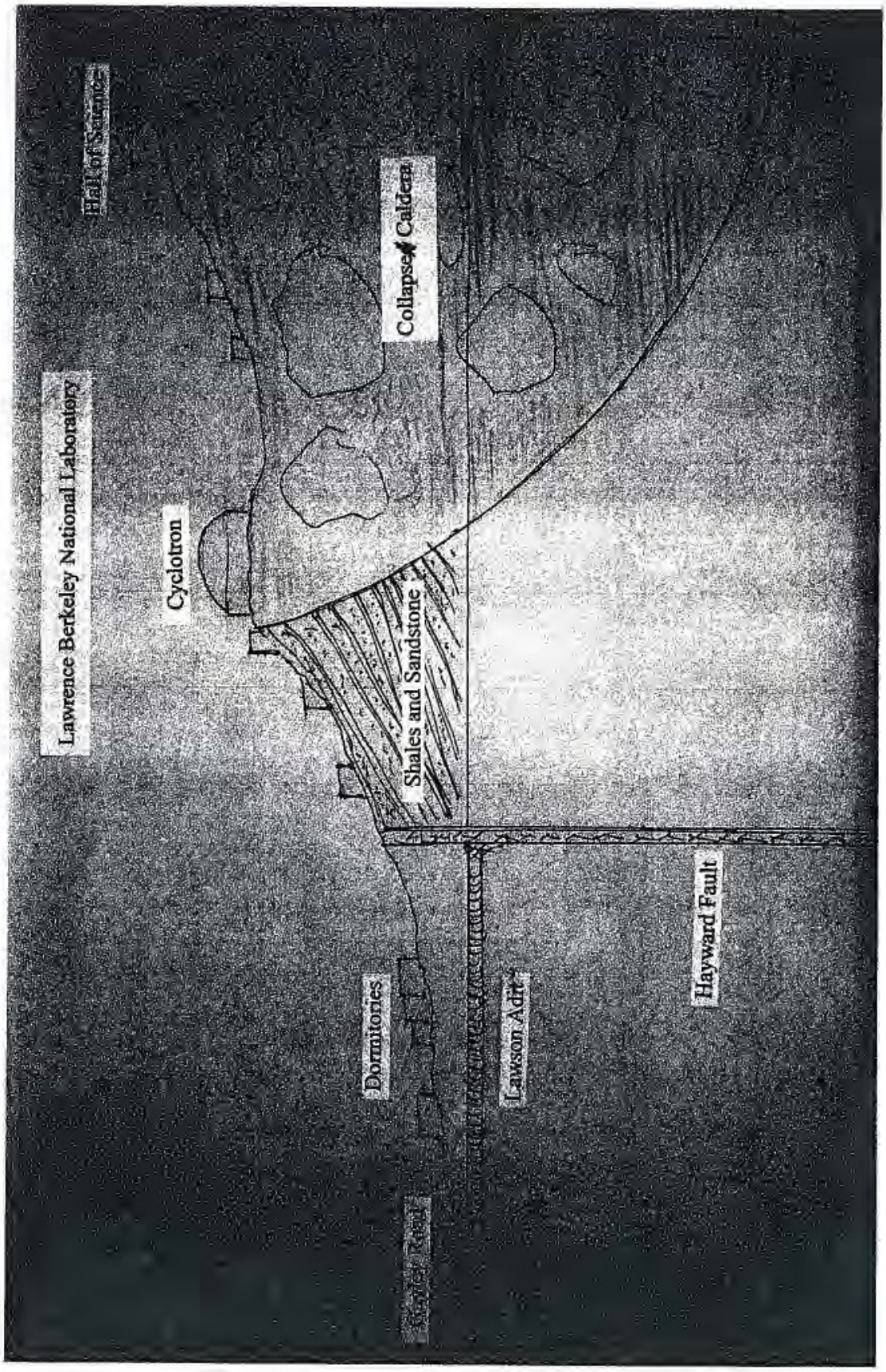
This video is being distributed in order to alert those at risk as well as those with the responsibility for the safety of the campus and its neighbors.

SSC-18 cont.



LBNL with extent of caldera

SSC-18
cont.


Lawrence Berkeley National Laboratory
Cyclotron
Collapse Caldera
Shales and Sandstone
Dormitories
Lawson Adit
Hayward Fault

SSC-18 cont.

The soil profiles obtained by Lettis from shallow trenches around Building 25 revealed expansive soils that soak up water during wet seasons and would be subject to sliding during a major earthquake. (Lettis, Appendix Plates 2 & 3 attached here) The trenches also revealed isolated blocks of andesite (volcanic stone) 10 and more feet in length and 4 feet in diameter.

Elsewhere in the Berkeley area are large pieces of andesite 10 feet in width and 30 feet in thickness. These are all randomly oriented. All of these are in a matrix of clay-rich sedments, sometimes horizontally bedded, often, though, in contorted beds, and some piled on top of each other. For example, in a small quarry a few hundred feet north of LaLoma Avenue, these blocks show deformation from the differential pressure they were under from deep burial. The Orinda Formation is named for outcrops near Orinda, beautifully exposed on the east side of Caldecott Tunnel. The consultants' reports label almost any sandy and pebbly beds as Orinda Formation. There is no Orinda Formation in the caldera. The formation is older than the volcano.

Lettis and Associates separate some units and identify formations which, on Grizzly Peak Boulevard may easily be identified as the Orinda and Moraga Formations. Lettis and Associates, however, identify any sandy beds exposed at the surface or in bore holes as Moraga Formation. This sandy material is missing, however, in the Moraga Formation found along the road to Redwood Canyon. The Moraga thrust fault at the base of the Moraga andesite flows is well exposed there.

SSC-18 cont.

None of the reports done for this EIR contain a reputable geologic map of the LBNL area. More investigation of areas outside the Lab site might have alerted the consultants that the LBNL area is geologically different from any other area in the Berkeley Hills. It is bounded on the east by the Wildcat Fault and on the west by an arcuate contact between Upper Cretaceous Great Valley Sequence, well bedded shales and thin sandstone beds, all of which dip westward at about thirty degrees. (See Transcript and its figures) The boundary has been named the "Chicken Creek Fault"; it is probably not a fault as it approximately makes an arc starting at the Wildcat Fault immediately south of the Botanical Gardens and swinging around to meet the Wildcat Fault crossing Shasta Road not far uphill from the Brzilian Room. We identify this contact as the margin of a caldera which collapsed after a large eruption evacuated the magma chamber under the volcano. In fact we think we have identified a large welded ash flow that poured out of this magma champber to the west of the Hayward Fault. It has the same age (10 million years) and mineral composition as a rhyolite tuff exposed in the center of Moraga volcanics along Grizzly Peak Boulevard and at the southern end of the Moraga Formation at the type locality.

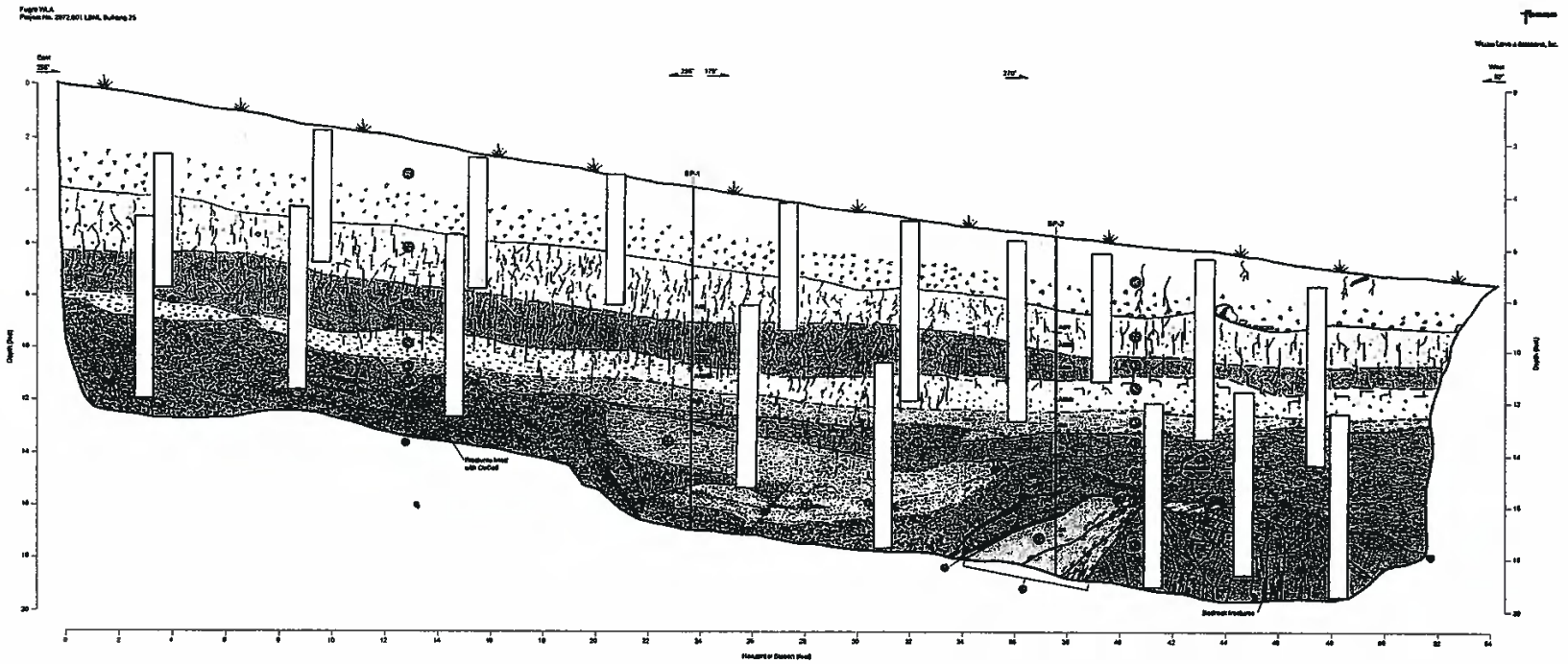
The collapsed volcanic rocks that fell and slid into the caldera were subsequently buried by sediments and volcanic ash. Many voids between the piles of blocks and andesite collected ground water, recently tapped by wells drilled by Lennert and Shively. Lennert

told me that over a period of ten years, 14 to 16 million gallons of water were pumped out. (See Lennert Letter of 1987).

The US Geological Survey predicts a major earthquake of magnitude 6.7 or greater will occur on the northern section of the Hayward Fault with a 62% probability before 2032. The great earthquake of 1868 broke along the southern part and extended almost to the campus of UC. The Hayward Fault runs along the west margin of LBNL so that there will be severe ground-shaking in this area. Consider the damage caused to the Bay Bridge and Cyprus Ramp from the Loma Prieto quake in 1989, whose epicenter was 50 miles away. Should the northern Hayward Fault undergo a comparably large failure with an epicenter, say, 7 miles from LBNL, the force would be 50 times that which struck the Bridge and Ramp in 1989.

The sediments collected in the caldera are not suitable material upon which to build. A major eaarthquake during a wet period could lead to landslides in caldera soft sedimentary rocks and the collapse of the west wall of the caldera with its stratified creetaceous shales dipping westwared toward dormitories and houses. Measurements show that the Hayward Fault is creeping right laterally about 0.5 cm per year while the east side of the fault is rising 0.5 cm per year, becoming more unstable. Sooner of later this cretacous wall will slide, taking with it most of LBNL. The imminent earthquake of the Northern Hayward Fault might trigger it.

SSC-18 cont.



Symbols

Soil pattern

Pedogenic fracture

Contact, solid where known, dashed where approximate, dotted where inferred

Fault, dashed where approximate, dotted where inferred

Shear zone

Soil profile (see Appendix A)

Unit Descriptions

Layer 1b: SILT (ML); Very dark gray (10YR 3/1) dry; soft; 85% silt, 10% very fine sand, 5% clay; high dry strength; high toughness; no dilatancy; low plasticity; blocky massive structure, abundant cracks (1" to 0.5" diameter) and mottles, common large roots (1-4" diameter), based contact planar to slightly undulatory over 2-3".

Layer 1c: Sand with silt and gravel (SW); Light yellowish brown (2.5Y 6/4) dry; dense; 65-85% coarse gravels; 20% very fine sand, 20% silt, 5-10% gravel; low dry strength; slow to no dilatancy; low toughness; non-plastic; gravel is angular (1" to 3") clasts, gravel clasts are ventifacted and are partial coated for mottles, one glass shard found, based contact is planar and sharp (FILL).

CLAY, silty with sand (CL); Very dark gray (10YR 3/1) dry to slightly damp; stiff; 70-85% clay, 20% silt, 4-10% fine sand, some coarse sand; medium dry strength; slow dilatancy; medium to high toughness; medium to high plasticity; regular blocky to weak columnar pedogenic structure, caving below LBHI 5-6; mottles existing vertical subsurface pedogenic surfaces, moderate to weak clay films coating some coarse sand clasts, common fine pores, common roots and rootlets; weak to no reaction to HCl; massive, angular coarse sand consists primarily of Mesozoic Franciscan fragments; slightly wavy diffuse based contact over ~6" (COLLUVIUM) A-prime/B pedogenic soil horizon).

CLAY, silty (CL); from coarse sand; Very dark gray (10YR 3/1); slightly damp; medium silt; 70-89% clay; 30-20% silty; trace to 5% coarse sand; low to medium dry strength; no dilatancy; low toughness; medium to high plasticity; angular magnetite massive pedogenic structure; moderate to weak clay films on pedogenic faces and coating clasts in sand clasts, weak carbonate (CaCO3) film coating clasts, clasts are mostly ventifactured, reddish (5Y) brown and ventifactured with HCl, common roots and rootlets, fine fine pores; heavy stress are angular and consist of Mesozoic Franciscan, coarse sand clasts seem to be associated with areas with higher abundance of roots, living root mat, diffuse based contact over ~6", very (COLLUVIUM) and stained diffuse contact with A/B2 soil horizon).

CLAY, silty with sand (CL-ML); Dark reddish brown (5YR 3/3) dry to slightly damp; medium stiff; 65% clay, 25% silt, 10% fine to coarse sand; based in 70% coarse, 5% fine-grained, subrounded to subangular sand of Mesozoic Franciscan (Rhyolite and Andesite) and clasts of stained altered bedrock deposited at postfaulted/post storage lens (alluvium clasts); medium dry strength; no dilatancy; medium toughness; medium plasticity; irregular angular to very weak blocky pedogenic structure; weak clay films coating clasts; CaCO3 coating clasts, abundant small ~ 1-2 mm diameter carbonate nodules throughout; based contact is gradational over ~6 inches, (BEDROCK, stained member of the altered altered bedrock deposited at postfaulted/post Storage lens, A/B2 with minor Bt soil complex).

CLAY, silty (CL-ML); Dark reddish brown (5YR 3/3) dry; medium stiff; 65-80% clay, 20-40% silt, <10% sand; medium dry strength; no to slow dilatancy; medium toughness; medium plasticity; irregular angular pedogenic structure; clay films on pedogenic surfaces, abundant CaCO3 nodules 1-2.5 cm diameter along the base of the unit, some subrounded carbonate cobbles, moderate to weak clay films coating some coarse sand clasts, common fine pores, common roots and rootlets; weak to no reaction to HCl; massive, angular coarse sand consists primarily of Mesozoic Franciscan fragments; slightly wavy diffuse based contact over ~6" (COLLUVIUM) A-prime/B pedogenic soil horizon).

CLAY, silty, with gravel (ML); Dark reddish brown (5YR 3/3) dry; medium stiff; 30-40% clay, ~65% coarse sand, ~20% fine gravel, 10-30% silt; weakly interbedded clasts of white Unit 4B and 4E, poorly defined coarse-grained stained, granular nature of deposit, interbeds within Units 4B and 4E have CaCO3 precipitations; (BEDROCK, interbedded weakly-grained bedrock of alluvium member of the altered altered bedrock deposited at postfaulted/post Storage lens, Bt soil complex).

CLAY, silty (CL-ML); Reddish brown (5YR 4/3) dry to damp; medium stiff; 45-65% clay, 40-55% silt, <10% sand; medium dry strength; no to slow dilatancy; medium toughness; medium plasticity; weak irregular angular pedogenic structure; clay films on pedogenic surfaces and clasts, few 0.5 cm wide CaCO3 nodules, abundant mottled CaCO3 flecks; few angular coarse sand clasts, reduces dilatancies strongly with HCl, mottle has weak to no reaction to HCl; based stained is diffuse over ~6 inches and planar (BEDROCK, alluvium member of the altered altered bedrock deposited at postfaulted/post Storage lens, Bt soil complex, pedogenic subset of Unit 4B).

SILT with sand (ML); Reddish brown (5YR 4/3) dry to slightly damp; soft; ~65% silt, ~40% sand, trace clay; no dry strength; slow dilatancy; low toughness; low plasticity; very weak angular blocky pedogenic structure, weak clay films on pedogenic surfaces and clasts; stained is the to coarse grained, subangular; CaCO3 filaments coating/infilling some pedogenic fractures, filaments have strong reaction to HCl, matrix has weak to no reaction to HCl; Unit 5E has no matrix and bedrock fabric, Unit 5E has blocky cobbles fabric, cobbles is well consolidated and unweathered to angular/angular #1 fine subbrown clasts (BEDROCK, alluvium member of the altered altered bedrock deposited at postfaulted/post Storage lens, Bt soil complex).

SAND, silty, clayey (SC-SM); Dark reddish gray (5YR 4/2); damp soft to medium soft; ~40% very fine sand, ~30% silt, ~15% clay; blind grained; contains with consolidated gravel interbeds; and overall, slight to strong reaction to HCl; based contact is gradational over 1" (BEDROCK, fine-grained facies of sandstones member of the altered altered bedrock deposited at postfaulted/post Storage lens; Bt complex).

GRAVEL with silt and sand (GW-GM); Reddish brown (2.5YR 4/4) dry; loose; ~55% gravel, ~30% sand, ~15% silt; conglomerate with subrounded Oceanic and Mesozoic gravels; poorly sorted; highly fractured; many CaCO3 nodules and filaments (stained) up to 2" long; bedding; pedogenic pedogenic structure, upper 2 feet of conglomerate is highly weathered, clasts of Orinda Formation are weathering in place; conglomerate is well consolidated in places and weakly weathered where more than 2 feet of the conglomerate profile is exposed (BEDROCK, conglomerate member of the altered altered bedrock deposited at postfaulted/post Storage lens, Bt complex).

BRECCIATED ANDESITE; angular and brecciated andesite with overbanking calcium carbonate seams and coatings/blocks. Fault zone exposed.

ANDESITE; gray approximate minerals rock, angular blocks of weathered andesite.

Notes

- Fault orientation, 35°, 27°NW
- Fault orientation, 321°, 8°NE
- Fault plane, opposite footing wall, 350°, 30°W
- Fault orientation, 314°, 20°N. Locally between Stations 59 and 61 the fault plane is wavy and undulates with 3-4 inches relief. A 1-2 inch thick layer of CaCO3 coats the fault plane, the CaCO3 is moderately hard, and plate down on footwall wall, no displacement of overlying horizons.
- Fault orientation, 302°, 35°NE. A 1-2 inch thick layer of CaCO3 coats the fault plane, the CaCO3 is moderately hard, and plate down on footwall wall, no displacement of overlying horizons.
- Bedding orientation, 355°, 35°N
- Fault orientation, 350°, 30°NE
- Bedding orientation, 354°, 13°E
- East-dipping shear planes deform sand in fault contact with alluvium
- East-dipping shear not present on footwall wall. East-dipping shear is discontinuous near the base of the trench where it is truncated by a west-dipping shear. West-dipping shear is the dominant feature.
- Fault orientation, 320°, 55°SW. Across trench strike and dip measured from the base of the sand-bedding ground.
- Soil bedding orientation, 324°, 16°SW (plot A/B2)
- Clay gauge ~1.5" thick at bottom of trench (this is angle stand of clay, 51 inch thick, where it crosses Station 56.
- Primary fault zone highly sheared, completely shared footwall, very wavy, no remaining sheared bands.
- Shear zone sheared footwall was spiked by thin seams of clay gauge CaCO3 and chunks, fractures are edged and stained weathered Fe patches.
- CaCO3-free footwall predominately footwall-derived through gravel to sub-rounded, that variously mineralized CaCO3-lined fractures over Station 73.

FAILSOLANDSLIDE INVESTIGATION
LOG OF TRENCH 7-1

PLATE 2

Appendix C-2,A Lettis Plate 2

Curtis - 3

SSC-18
cont.

SSC-18 cont.

LENNERT AND ASSOCIATES
SOILS ENGINEERS
3309 BROWNS VALLEY ROAD, NAPA, CALIFORNIA
707 · 252-9273 94558

Job Number 789
27 August 1979

Mr. Gaetano P. Russo
Department of Facilities Management
University of California
2000 Carlton Street
Berkeley, CA 94720

Re: Hill Area Dewatering Program

Dear Mr. Russo:

This letter presents a brief status report on the program to date, and confirms verbal directive received from the University in regard to the on-going drilling program.

The present status of Horizontal Drain No. 789-A is outlined briefly as follows:

SSC-18 cont.

The hole was taken to a horizontal depth of 2,102 feet. A profile of the drain, with key information shown thereon, is presented on an informal drawing entitled "Horizontal Drain No. 789-A," dated 19 August 1979, attached.

A fault was encountered at 1,056 feet, as predicted; a maximum-seepage flow of 37 gpm was obtained from the fault. A basalt dike was encountered at about 1,085 feet, not predicted; a maximum seepage flow of 105 gpm was obtained at this point. The Moraga syncline structure was encountered as predicted; a maximum-seepage flow of 450 gpm was obtained upon first penetrating the massive flow rock stratum as encountered in Test Well No. 789-1. The University Fault was encountered at about 2,000 feet, as predicted; a maximum-flow rate of something in the range of 1,000 gpm was obtained at this point. The rock beyond the University fault was a clastic sediment, in comparison to the basaltic and rhyolitic flow rocks and tuffs encountered in the Moraga syncline; however, the sediment contained volcanic clasts and thus probably lies in the lower Moraga tuffaceous sediments rather than in the Orinda formation as predicted.

Sustained, essentially clear, water flow rates have varied from about 15 to 150 gpm. The 15 gpm minimum rate has continued for months, probably coming from the fault and dike at about 1,050 to 1,100 feet. The 150 gpm rate was observed after 24 hours with the hole at about 1,780 feet, where it first entered the massive

Moraga flow rock stratum. The larger sustained flow rates, encountered at and beyond 1,780 feet, appear to have reduced due to plugging of the drill hole as much or more than due to rapid drainage of local "water pockets." Until the hole is cased full-length with perforated pipe, no valid estimate can be made of the probable long-term flow rate; but with present information it appears that the final sustained flow rate will be substantial if the hole is succussfully cased to at least 2,000 feet.

Open voids have been encountered at a number of locations, apparently associated with faults; these voids strongly support our initial concept of open faults resulting from tension in the blocks between the Hayward and Wildcat faults. Some of these structures were heavily water-bearing, as at 1,785 feet. At other locations, the voids are apparently presently drained; all drill water and cuttings for about 250 feet of hole were "absorbed" by such a structure at one time during the drilling.

The 6-inch diameter casing was advanced with no insurmountable problems, using the under-reamer bit and drill-jack technique. On 28 June a slide at about 190 feet began to "bind" the casing; as the "bind" progressively worsened the casing could not be advanced beyond 1,200 feet. The casing was later pulled back to 1,100 feet, to relieve the "bind" and permit drilling through the casing; it is now "locked solid" at 1,100 feet. The casing was perforated in place in the 900 to 1,080 and 600 to 625 foot intervals.

SSC-18 cont.

After completing the hole to 2,102 feet on 11 August, 4-inch perforated casing was installed beginning on 13 August. The casing advanced "dead loose" and without problems until a depth of 1,636 feet was achieved on 16 August. At this point "solid rock" was encountered. Probing three times with the 4-inch casing and four times with the 3 7/8-inch bit failed to recover the old hole. The hold had been open for several weeks at this point, and traversed four times with the drilling tools with no trouble. During the period 13 August through 15 August a total of five earthquakes occurred, ranging in Richter Magnitude from 2.0 to 3.3, with epicenters in the nearby Orinda area. There appears to be no reasonable doubt that the hole was offset due to movement of a fault, or large block of rock, during the period 12 through 15 August. As a result the hole must be re-drilled beyond the 1,636-foot depth if work on the drain is to be continued.

Since there is no "under-reamer" bit available for 4-inch casing, the hole cannot be advanced further with this casing in place; it was thus removed during 22 to 24 August. A test was performed to determine if 5-inch casing would pass the "bind" in the 6-inch casing at 190 feet; the test showed some "binding," but it is believed probable that the 5-inch casing can be run through the 6-inch casing. An alternate procedure is to re-drill the hole to 2,100 feet at 5 7/8-inch diameter, and again attempt to install 4-inch casing.

In conclusion, the hole has been taken 100 feet beyond original target length, and the predicted geologic structure and seepage water conditions were encountered. Our original geologic and engineering concepts, as expressed in our report dated 17 December 1978, have been proven beyond any reasonable doubt.

The tremendous problems which we have encountered in installing the drain have arisen solely from difficulties in drilling and installing casing, and from instability of the rock structure in which the drain is being installed. The drilling and casing problems have been solved by devising a new technique, consisting essentially of drilling an oversize hole with an expanding bit, and jacking the casing into the hole directly behind the bit. In addition, the torque of the drilling equipment was more than doubled to provide sufficient power to overcome friction on the drill rods. The problems of ground instability, such as the slide at 190 feet and the fault offset at 1,636 feet, are beyond control, and pose a very serious hazard of total failure which cannot be assessed.

The water level in Test Well No. 789-1 has been periodically observed, to assess the effects of the horizontal drain on the ground water in the synclinal structure south of the University fault. The average flow rate in the well Shively No. 1 has been observed to monitor the deep ground water conditions in the geologic block north of the University fault. The results are shown graphically on an informal drawing entitled "Deep Well Data," dated 6 August 1979, attached. Referring to the drawing, the following major aspects of the data are commented upon briefly:

SSC-18 cont.

The initial, steeply dropping portion of the curve for the test well represents the drainage of drilling fluid. The intercept with the flat portion of the curve is at the "spillover" elevation of the synclinal major basalt flow rock stratum in the ridge. The flatter portion of the curve appears to be the normal "drainage curve" for the syncline for this season and time of year. The rate of fall stabilized at 0.9 inches per day from 14 June to 28 July, and the water surface then began to rise slightly. On 1 August the water surface began to decline again, at a stable rate of about 1.4 inches per day.

The major basalt flow rock body was first penetrated by the horizontal drain on 28 July, with an initial flow rate of 450 gpm, dropping to 150 gpm after one day and 87 gpm after two days. On 31 July the hole was found to be "plugged," and has not been "clear" since; the flow rate was 70 gpm prior to beginning drilling. The indicated medium-term flow rate without plugging is about 60 gpm; deducting 15 gpm for the structure at 1,100 feet, a flow rate from the basalt stratum of about 45 gpm is indicated.

The well Shively No. 1 shows a gradually increasing flow rate from about 11 1/2 gpm on 1 March, with a steeper rise beginning about

1 May and a very steep rise beginning about 1 August. This flow rate curve is much different from that observed last year; see our report dated 17 December 1978 for the curve for last year. During the past two weeks the curve has "taken off," with a flow rate of 27.4 gpm on 27 August; this is unprecedented, startling, and indicates a massive rise in the ground water level during this period. The recent very rapid rise in flow rate could be related to the unusual seismic activity in this area, mentioned previously.

The curve for the test well indicates that either the horizontal drain produced no appreciable effect on the well, or that the water supply is so large that the effect is very small; while there can be no definite decision made with present data, we believe the second choice to be more probable. Only if the horizontal drain can be cased to 2,000 feet, and the results observed for several weeks or months, will we know for sure whether or not the drain is dewatering the structure tapped by the well.

The curve for Shively No. 1 indicates a massive rise in ground water level; since the well taps a major, widespread acquifer structure, it is reasonable to assume that this rise is occurring generally in the block north of the University fault, if not in the entire hill area. The horizontal drain should have no perceptible effect on the well, since it did not encounter a major acquifer north of the fault, as far as we could determine during drilling. It is reasonable to assume that the rise in ground water north of the University fault, as indicated by the well, will possibly produce a major slide in this area in the near future. The purpose of the contemplated second major horizontal drain is to dewater this structure and prevent such a slide problem.

At this time we believe that the best way to proceed further with Horizontal Drain No. 789-A is to employ 5-inch diameter casing and an under-reamer bit, redrilling and casing the hole as necessary. A guess of the additional cost of this procedure is around $30,000, with no guarantee at all of the accuracy of this figure. The greatest hazard of failure of this procedure appears to lie in the 5-inch casing "binding" in the 6-inch casing at 190 feet, or the 5-inch casing being "locked" by another fault movement.

An alternate procedure is to re-drill the hole to 2,100 feet at 5 7/8-inch diameter, and again attempt to install 4-inch casing. This method is deemed somewhat less likely of success, due to our inability to drill an over-size hole for the casing if the original hole is "lost." Further, a fault movement which "locked" the casing would end all further effective operation. The additional cost of this procedure is guessed at $15,000, with no assurance at all of the accuracy of this figure.

SSC-18 cont.

If the 5-inch casing is employed, and reaches some reasonably deep penetration, it may be feasible to run 4-inch casing through the 5-inch casing and thus complete the drain. Since we already have the 4-inch casing, the extra cost of this procedure would be nominal.

It is hereby confirmed that this office has been directed by the University to employ the procedure using the 5-inch casing. We have thus, on this date, placed orders for the 5-inch under-reamer bit and 5-inch casing on behalf of the University. The drilling crew is now on "home leave," and is to return on 5 September; if all material and equipment is then on site, work will resume on this date. The procedure using the 4-inch casing will be employed as a last resort, if for some reason the 5-inch casing cannot be advanced to the 2,000-foot depth.

It is necessary that a decision be made this week regarding the second major horizontal drain. If this is not done, any later decision to install this drain will entail a delay in starting of at least two months. A rough budget and schedule, with no guarantee of accuracy, will be prepared for the second horizontal drain if you decide to proceed therewith immediately after completion or final failure of the first drain.

The severe problems, and great time and cost over-runs, experienced to date in this project lie solely in the difficulties of pioneering new drilling and casing procedures, and in the instability of the rock structures in which we are operating; while we have dealt with these problems, very effectively we believe, they are not within our control. We thus give no guarantees of cost, time, or success, as we did not at the start of this work. The writer has continued with this project, at great personal and financial cost, solely because there is no apparent alternative for slope stabilization in the upper Campus area, and the potential for a large slide appears so ominous that we dare not stop short of success or proven ultimate failure. Should you feel that the University has a more effective alternate to solution of the hill area stability problems, this office will be most happy to pass the baton to another runner.

Beginning in July, accounting and cost control was assumed by the University. Thus, while we continue to check and approve invoices for payment, we have ceased computing financial status statements.

Respectfully submitted,

B. J. Lennert

jel
Attachments

cc: Mr. Forrest E. Tregea
Mr. Richard M. Koch

SSC-18 cont.

LENNERT AND ASSOCIATES
SOILS ENGINEERS
3309 BROWNS VALLEY ROAD, NAPA, CALIFORNIA
707 · 252-9273 94558

Job Number 789-A
28 May 1980

Mr. Gaetano P. Russo
Department of Facilities Management
University of California
2000 Carlton Street
Berkeley, CA 94720

Re: Slide at Centennial Drive Overpass
Progress Report

Dear Mr. Russo:

On 13 May 1980 the diversion pipe to carry water from Shively No. 1 to the storm drain inlet at the overpass on Centennial Drive was essentially completed, and the well flow was admitted to the pipe. The system commences with a 2-inch diameter Schedule 40 PVC line from the pre-existing 2-inch diameter line in the Fire Trail to Test Well No. 789-1, laid in a trench. A riser was installed at the test well to permit flow from this well to be put into the system if it is developed; a gate valve was installed just beyond the riser to permit pumping water from the test well to the fire system storage tank at Shively No. 1. From about 50 feet west of the test well the line consists of 2-inch diameter Wesflex Gold Label 80 psi polyethylene pipe, laid on the ground surface to the storm drain inlet; the surface line is anchored to #4 rebar stakes and trees with galvanized iron wire. Risers to admit air were installed in the polyethylene line at about 200-foot intervals, to reduce flow velocities and prevent undesirable hydraulic phenomena. The line is functioning well, and as expected, with no indications of undesirable hydraulic effects. The flow enters Mather Grove at the outlet of the culvert, about 100 feet below the overpass. Engineering design and field layout was provided by this office, and materials were purchased by this office for the University; installation was performed by University forces. Still to be accomplished is burying the pipe in the fire trail at the power-line tower, installation of a valve box over the gate valve at the test well, and some staking out and tieing at various points along the line; this is to be accomplished by University forces as soon as time permits.

With completion of the above work, any contribution of flow from Shively No. 1 to worsening ground water conditions in the Hill Area has been totally eliminated. The Campus is thus now no longer potentially contributing to development of dangerous ground water conditions in the Campus or LBL areas by reason of disposal of the flow from the well.

SSC-18 cont.

On 28 May 1980 a plan, brief specifications and bid form, for regrading and repaving the slide area in Centennial Drive just below the overpass, were hand-delivered to the University. The work consists of removing the existing surfacing in the slide area and regrading and compacting the existing aggregate base subgrade, placing new aggregate base to new line-and-grade, and repaving the area; the guard rail is to be removed and re-installed on the south side of the road, and a new asphalt concrete curb is to be placed on this side. A new compound vertical curve, with 0.5 foot "hump," is being constructed in the slide area, similar to past major regrading, to reduce the frequency of major regrading as the past slow creep-slide movement continues. If acceptable bids are received next week, it is hoped that the work can be completed in no more than two weeks; this will permit re-opening the road around 16 June 1980.

The past, and recent, slide movements have grossly distorted the embankment below the overpass structure; maximum lateral deflection is in the range of 3 feet. In addition, small slope movements have reduced the roadway area width by up to several feet. With these conditions, the downhill lane can be restored to near-previous geometry, and considering the overall road design and condition, is deemed marginally tolerable; the uphill lane is much too narrow, and must be widened by installation of a retaining wall. This wall will be designed, and then bid, as soon as completion of the area regrading permits the required geometry to be accurately defined; in the interim, barricades must be placed along the shoulder of the uphill lane and the traffic speed limit reduced in this lane. By performing the regrading prior to constructing the retaining wall, we will be able to reopen the road to traffic some 6 weeks earlier than would be the case if the retaining wall were built first.

SSC-18 cont.

On Plate I, attached, we have plotted the vertical slide deflection at the center of the overpass abuttment wall versus date; rainfall data supplied by LBL is also shown. Referring to the plate, it is seen that the accelerated slide movement commenced in February, some 10 days after the beginning of a period of heavy and continuous rainfall. The water from Shively No. 1 was being ejected into the canyon above the overpass at this time, and had been since last year. It is seen that the slide movement temporarily ceased some 12 days after the rainfall ended; it then resumed some 6 days after another day of heavy rain. Slide movement then ceased again some 9 days after the flow from Shively No. 1 was removed from the canyon, and has not resumed to this date. As described in previous correspondence, water in the canyon has been entering the ground at the New Fault, some 200 yeards northwesterly of the overpass; we believe that this water has been the key cause of the recent accelerated slide movements. We also believe that the water from Shively No. 1 entering the fault contributed to this causation, and was a substantial cause of the movement continuing until 15 May. At this time it appears that with installation of the pipe to divert the

flow from Shively No. 1 stability conditions for the slide body have been restored to those pertaining in past years; we would thus infer that the past slow creep, at a vertical rate of about 3 inches per year at the overpass abuttment wall, will continue as before, slower in the summer and more rapid during the rainy season. However, it must be recognized that we have experienced three wet winters in a row; many signs indicate that the stress-field between the Hayward and Wildcat faults is periodically changing the deep aquifer conditions, and ground water conditions are now very severe by recent historical standards; there is thus the obvious possibility of an increase in slide creep-rate, or a major slide movement, at any time.

In consideration of the above information, you are advised that in performing the subject remedial work you are taking a calculated risk; if more rapid slide creep movement resumes, or if a major slide occurs, you will lose the value of the new work. Excepting for removing the flow from Shively No. 1 from the canyon, we have not taken any measures to improve stability conditions for the slide body; thus the previous slide conditions, perhaps worsened by the past three wet winters and recent tectonic phenomena, still pertain. The goal of the present work is simply to restore the road to usable geometry; mitigation of the slide conditions is far beyond the present budgetary limits.

SSC-18 cont.

In past years the overpass structure has been progressively tilted to the east by creep-movement of a fairly large slide body occupying the canyon northerly of the structure; the distortion became so severe two years ago that structural failure appeared imminent, and this office installed steel reinforcing members to prevent sudden collapse. During drilling Horizontal Drain No. 789-A last year, the New Fault was encountered at 1,050 feet, and produced a large flow of water; this flow has continued, now at the rate of about 7 gpm, coming mainly from the New Fault. Referring to our hill area Geologic Map (revised 11/26/79), it is seen that this fault must supply (or drain) most of the deep ground water which activates the slide body. Shortly after the fault was tapped by Horizontal Drain No. 789-A last year, movement of the overpass structure ceased, and has not resumed during this past rainy season; contrary to the experience of past years, there has been absolutely no movement of the structure since last fall. We thus tentatively conclude that the drainage provided by No. 789-A has stabilized the slide body, and the structure is now comparatively safe, with the past serious threat of structural collapse eliminated. Barring a major change in deep aquifer conditions resulting from the stress field between the Hayward and Wildcat faults, it is our opinion that the overpass structure is no longer in hazard.

As described in our letter dated 13 April 1980, the present slide is a local embankment failure of the fill placed to form the roadway below the overpass. It has been creeping since it was first constructed, necessitating major regrading twice in about the past

10 years. We have no reason to believe that stability conditions are any more favorable now than they were in past years, and they may be considerably worse. It is noted that flow from Hydrauger No. 2 abruptly ceased when the slide moved overtly in February; this is strongly suggestive that the drain may have failed, thus causing the slide, or that the slide may have sheared off the drain. We intend to rod-out the drain, to check it, as part of the present program, if funds permit. A major attempt to stabilize the slide would involve, at the least, drilling several 1,000±-foot horizontal drains into the slide area, in an attempt to provide deep and area-wide dewatering of the area around the fill embankment; this would entail expenditure of at least $100,000. A modest attempt to improve stability conditions would be implementation of our previous recommendation of placing a culvert in the canyon above the overpass and across the New Fault, to keep runoff from rain water from entering the fault; this measure would be appropriate under the present program if funds are available. An assuredly successful stabilization program, involving removing the fill embankment and underlying weak soils, and replacement with a stable embankment section, would involve a major incursion into Mather Grove and an expenditure of at least $500,000.

We have been attempting to clean Test Well No. 789-1, by blowing with air and use of commercial detergent, with little success to date. The space between the drilled hole and casing appears to be solidly packed with silt and clay, and rock fragments, originating from the tuffaceous rocks overlying the andesite rock aquifer at the 300- to 390-foot depth. We shall continue this attempt for another week, using both detergent and foam. If we succeed in cleaning the well, we will test-pump it to see if it taps a sufficiently extensive aquifer system to warrant permanent pumping. We cannot evaluate the potential yield of the well unless and until it can be cleaned. If we do not succeed in cleaning the well, we will abandon the attempt to pump it, but will retain the well as a piezometer to monitor the water level in the syncline. In the meantime the water level in the well continues to rebound to the 240-foot level between periods of blowing, a somewhat disturbing level but not apparently excessively dangerous. If the water level resumes the past pattern of rising at 3 or 4 inches per day, and reaches the 200-foot level, more drastic measures may be warranted.

SSC-18 cont.

In the past two years deep ground water levels, as evidenced by the flow rate from Shively No. 1, have peaked about the first part of June, in mid-July and again in September-October, with each peak successively higher; we do not yet know if Horizontal Drain No. 789-A, or the Test Well No. 789-1, will also show this pattern. At this time there is substantial reason to believe that this pattern will be repeated, with even higher levels possibly occurring due to the past three wet winters and on-going stress conditions between

the Hayward and Wildcat faults. If this situation does repeat this year, there will be a condition of increased hazard of a major slide occurring at any of several locations during these periods of more severe ground water conditions. With accumulation of more data this year, we will be in a better position to evaluate this situation. Thus the present program of observations of ground water flow rates and embankment deflections, now being handled by University personnel, should be continued.

SSC-18 cont.

Respectfully submitted,

B. J. Lennert
R.C.E. No. 9232

jel

Attachment

cc: Mr. Richard M. Koch
Mr. Forest C. Timberman

LENNERT AND ASSOCIATES
SOILS ENGINEERS
3309 BROWNS VALLEY ROAD, NAPA, CALIFORNIA
707 · 252-9273 94558

Job Number 789-A
10 September 1980

Mr. Gaetano P. Russo
Department of Facilities Management
University of California
2000 Carlton Street
Berkeley, CA 94720

Re: Hill Area Stabilization Program

Dear Mr. Russo:

This letter presents a brief final status report for the dewatering and slide repair measures recently implemented by this office. Reference is made to letters from this office dated 26 June, 28 May, and 30 April 1980.

Recent measurements by University personnel have shown that the slide at the overpass on Centennial Drive is still moving, at a rate much higher than has been experienced in the past at this time of year. Ground water conditions in that area appear to be unusually severe, probably due to the past three wet winters and/or to stress conditions associated with the Hayward and Wildcat faults. Recent "rodding" of the old horizontal drains at the overpass (Hydraugers Nos. 1 and 2) has revealed that Hydrauger No. 2 is ruptured at 138 feet; this is on the projected surface of recent slide movement. Flow from this drain ceased abruptly when the slide showed a large movement last February. The water previously outletted by the drain is thus now "backing up" behind the slide, worsening stability conditions. It thus appears probable that the slide will move again sufficiently to necessitate closing Centennial Drive, either during the deep ground-water high in September-October or during the next winter rainy season. The only apparent remedial measures with a reasonable chance of success are long hydrauger drains drilled from Chicken Canyon or major regrading of the fill embankment, as described in previous reports; any such measures would entail the expenditure of a large sum of money. Replacing Hydrauger No. 2 might be helpful, but we feel that overall this would be inadequate to bring stability conditions back to the previous marginal level if we experience another wet winter.

SSC-18 cont.

The proposed retaining walls at the overpass slide have not been constructed. It is our understanding that you wish to hold this work in abeyance until the stability of the embankment is determined by further observations of the creep or slide movements.

The proposed culvert across the fault northerly of the overpass structure has not been installed. This culvert would prevent rain runoff from entering the fault, and would thus improve stability conditions at the overpass during the rainy season; the cost of this installation would be minor. We recommend that this culvert be installed prior to the forthcoming winter rains, if you wish to attempt to preserve the fill embankment at the overpass.

The attempts to develop Test Well No. 789-1 for pumping were unsuccessful. It appears doubtful that this well will yield sufficient flow to warrant pumping. If you wish to attempt dewatering with a well in this area, a new well located much closer to the University fault appears to offer the most probability of success. Due to the difficulty in assuring intercepting a major aquifer with a vertical well, we do not feel that the chances of success with this procedure warrant the cost, excepting only in a critical situation.

SSC-18 cont.

Horizontal Drain No. 789-A has apparently dewatered the slide body above the overpass sufficiently such that since the flow from the fault at 1,050 feet was developed the overpass structure has ceased to be deflected by the slide. It thus appears that, barring a change in the fault-permeability conditions, the overpass structure is no longer in hazard due to this slide movement.

It is our opinion that Centennial Drive in the area of the LBL Corporation Yard remains in hazard of slide movement due to high ground water levels and continuing changes in area fault-permeability conditions. The same is true of the Lawrence Hall of Science fill embankment, which is over-steep at about 1.35 to 1 slope, and lies in a very large Pleistocene slide body; this fill embankment is also considered to be potentially unstable during a major earthquake. Past measurements by University personnel indicate continuing slow creep of both embankments, ceasing in the dry season and increasing during winter seasons with heavy rainfall.

Job Number 789-A
10 September 1980

Since you have no present expectation of drilling any more major horizontal drains, we are returning the under-reamer bits, which were developed for Horizontal Drain No. 789-A, to the supplier. These bits have been held, with the supplier's permission, pending further drilling.

It is our understanding that the program of dewatering and slide repair has now been terminated. The activities of this office in connection with this program are thus ended with issuance of this letter. Should you wish to retain the samples obtained in the past drilling programs, please so notify this office and we will deliver them to you.

SSC-18 cont.

Respectfully submitted,

B. J. Lennert

jel

cc: Mr. Richard M. Koch

BEN J. LENNERT
CIVIL ENGINEER • SOILS ENGINEER
(RETIRED)
CONSULTATION ONLY

30 June 1987

Mr. Gene B. Cross

'87 -5

Assistant Vice Chancellor
Department of Facilities Management
2000 Carlton Street
Berkeley, CA 94720

Dear Mr. Cross:

On 26 June 1987 Mr. John DeLucchi of DeLucchi Well and Pump Co. called me on the telephone and described apparent conditions at the dewatering well southerly of the Space Sciences Building, which I installed in 1975, which indicated that there may be a potential for failure and loss of the well; he called me because he knew that I had installed the well and he did not know that I had retired. This letter is being written because I have been advised by Counsel that if an engineer has knowledge of a hazardous condition and fails to inform someone at hazard, even though he has no connection with them, he may be liable under the legal doctrine of "failure to inform". This letter is addressed to you because I have been told that you are head of the appropriate department and I do not know of any other suitable person; by this letter I hereby inform you, and the Campus, in accordance with the presumed "obligation" described above.

SSC-18 cont.

The information which I recieved from the driller, and which I remember from the past, is presented very briefly on the following two pages; I give no assurance as to the correctness or completeness of this information; the evaluations and judgements are given to fulfill my presumed "duty", and the same reservations apply.

It is the judgement of the undersigned that failure to continue pumping this well will result in appreciably increased hazard of embankment failure involving Centennial Drive and nearby downslope buildings; in the event of a major earthquake failure of this hill-slope area is virtually certain, with resulting life-hazard to those present in the area.

A reply to this letter is neither expected nor desired.

Very truly yours,

B. J. Lennert
R. C. E. No. 9232

Copy to: Dave Wenner
Gene Metz
Dick Koch

3309 BROWNS VALLEY ROAD • NAPA, CALIFORNIA 94558 • (707) 252-9273

BEN J. LENNERT
CIVIL ENGINEER • SOILS ENGINEER

HISTORY AND CONDITIONS

The well was completed in April 1975. See our report for Job Number 734 dated 25 April 1975. The drilled depth was 475 feet; the casing length was 397 feet; the pump was set to 390 feet. The pump was a 10 hp Gordon hung on 3 inch pipe. The initial water level was at a depth of 172 feet from TOC.

The well was pumped continuously, and the ground water surface reached the bottom electrode level after a period of months. The well then held the groundwater surface between the electrodes. As far as we know the well has been pumped continuously since excepting for breakdowns and pump replacement.

The well was installed to lower the groundwater in the ridge area above the Lawrence Hall of Science and the LBL corporation yard, in response to previous and potential slide movements as well as "creep" in Centennial Drive and the Lawrence Hall of Science fill area. See our report for Job Number 789 dated 26 November 1979. As best I can recall the well lowered the groundwater surface from a depth of about 175 feet to 350 feet, and then produced between 10 and 20 acre feet per year.

SSC-18 cont.

DRILLERS REPORT

The Writers understanding of the gist of the Drillers report is as follows:

A new pump was installed something less than one year ago. Everything was the same as when the pump was replaced around three years previously.

This month, when a new pump was installed, the casing appeared to be "grossly distorted" such that the string "hung up" at one point until it then passed and "bumpiness" was felt over a considerable depth. Much scale from the casing was found in and on the pump and pipe, indicative of probable stress in the casing; fine rock fragments (sand sizes) were also recovered. All this is new since last year.

The Driller is concerned that the above may indicate impending failure of the casing and loss of the well.

The Driller believes that drilling and casing a new well may be difficult and slow.

The Writer does not gaurantee any of the above; you should deal directly with the Driller.

BEN J. LENNERT
CIVIL ENGINEER • SOILS ENGINEER

EVALUATION AND WARNING

If the casing has deformed during the past year, since the casing is in bedrock the bedrock is presumeably deforming. The only apparent probable causes for this are tectonic deformation between the Hayward and Wildcat faults, greatly accellerated due to an impending major earthquake, and/or an extremely large developing landslide.

If the well is no longer pumped the groundwater surface will presumeably rise some 175 feet; this could pose a major threat to hillside stability and to existing buildings thereon, as well as to Centennial Drive; in the event of a major earthquake the result could be an order of magnitude increase in hazard to life and property.

In the Writers judgement drilling and casing a new well could take weeks. The new well must be some distance from the existing well to limit interaction during drilling; if located too far from the existing well and/or incorrectly, the new well could "miss" the higher permeability "target" and not suitably replace the old well.

The situation appears to be serious. At the least the existing well should be subjected to inspection by television camera and a "gyroscopic rabbit" to evaluate the condition of the well; if a potential for failure of the well is indicated a new well should be drilled and cased as soon as possible and/or other equal or more effective measures taken.

Apparently the well pumping rate and groundwater surface level have not been checked since the Writer resigned from this work in 1979. These should be checked in correllation with the above, and any indicated changes made in pump size, etc.

It is not certain at this time that the well is in danger, but the evidence does warrant the investigation described above; since installing a new well will be quite costly, it is not reasonable to do so unless the need is established. If the monitoring program maintained by the writer prior to 1979 had been continued, you would probably now know what has caused (or is causing) the observed phenomena; it appears that reinstating that program at this time is strongly indicated by the recently obtained data, as well as by the current concensus that a major earthquake is immanent in the Campus area.

SSC-18 cont.

Questions from the Appendices

Where are the specific reports, in January in draft form, mentioned in 4.5 p. 18?

Where is Alan Kropp 2009, mentioned in the Wm Lettis report on Bldg 25 but not included?

Alan Kropp 2007 (Bldg 85) advised tiebacks and drilled piers to strengthen Building 85. These would simply increase the number already there, drilled into claystone and siltstone, not bedrock. The consultants warn, moreover, of landslides in this area, especially seismically-induced. They found slumps and instability within mixed landslide deposits. See especially the charts on page 26 (2006A) where the stability is analyzed and fails under certain conditions.

The hazards to be mitigated.

4.5-19 "The proposed project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving **landslides**." Rather than suggest mitigation measures, the report promises more specific investigations. The trenches were too shallow to show anything save the presence of large volcanic rocks in a clay matrix, the sign of the caldera.

4.5-p. 24 Expansive soil. 2006 EIR determined soil was not expansive save in southern part of LBNL site, which includes Bldg. 85/85/A. Alan Kropp 2006A (for Bldg 86, between 83 and 85 and for 85) shows Atterberg Limits far exceeding those of non-expansive material.

Atterberg Limits were not cited for Bldg. 25 area. What are they?

Without consideration of the caldera and the past evidence of its instability, (the landslides of 1974 and the later problems of dewatering the hill during small seismic events: Lennert September 1980), these consulting reports and the mitigation suggestions are dangerously inadequte.

SSC-18 cont.

Attachment #2

SAVE STRAWBERRY CANYON

P.O. BOX 1234
BERKELEY, CALIFORNIA 94701

Save Strawberry Canyon is a citizens' group that seeks to preserve and protect the watershed lands and cultural landscape of Strawberry Canyon. Save Strawberry Canyon was formed out of the urgent need to take action in response to the threat of intrusive, inappropriate development on the Canyon lands.

Strawberry Canyon, opposite the Golden Gate, is a unique link to the East Bay Regional Park District lands and, by its streams and views, to San Francisco Bay. The Canyon itself with its streamside vegetation, oak-bay woodlands, grasslands, and surrounding slopes, is a rich repository of wildlife directly adjacent to the dense urban populations of the UC Berkeley Campus and the cities of Berkeley and Oakland.

Save Strawberry Canyon seeks to inform the public about the impacts of proposed developments, to encourage location of such developments to more suitable sites, and to promote better public access to the beautiful Canyon with its wildlife and scenic resources. Mission Statement

July 9, 2010

Russell Gould, Chairman
Board of Regents
University of California
% Office of the Secretary and Chief of Staff
111 Franklin Street, 12th Floor
Oakland, California 94607
Anne.Shaw@ucop.edu
FAX: (510) 987-9224

Leslie Tang Schilling, Chair
Committee on Grounds and Buildings
Board of Regents
University of California
%Office of the Secretary and Chief of Staff
111 Franklin Street, 12th Floor
Oakland, California 94607

Re: GB4 Certification of Environmental Impact Report (EIR) and Approval of Design of the Seismic Life Safety Modernization and Replacement of General Purpose Laboratory Building, Phase 2 (Seismic Phase 2) Project, Lawrence Berkeley National Laboratory (LBNL)

SSC-18 cont.

Dear Mr. Gould, Ms. Schilling, and Members of the Board of Regents:

Save Strawberry Canyon (SSC) urges the Board of Regents not to certify the Environmental Impact Report (EIR) for LBNL's proposed Seismic Phase 2 Project. The EIR fails to consider fully the impacts to the natural environment, the risks to the health and safety of the community, and the use of resources without degradation and unintended consequences.

SSC, a non-profit corporation representing some 300 members, remains concerned that LBNL's Long Range Development Plan (LRDP) to build an alternative and sustainable energy research campus on the hillsides above the University of California Campus may have significant detrimental effects upon the environment. While it is laudable that the Seismic Phase 2 Project proposes to replace unused and unsafe buildings, both the LRDP and the Seismic Phase 2 Project overlook the obvious fact that there are other safer, underutilized industrial locations upon which to develop, such as the Richmond Field Station. The once-in-a-lifetime monies committed to the Seismic Phase 2 Project, whether from the American Recovery and Investment Act (ARA), that is public investment, from diminishing University resources, and/or from the financial support of private corporations, all, merit wise-use expenditure to create the most productive opportunity for research.

We are concerned by the EIR's continuing lack of acknowledgement and consideration of the cumulative impacts. Past LBNL projects as well as the ongoing and projected future University projects within the hill area are of serious consequence. The effects include soil, water and air

contamination, traffic congestion, damage to aesthetic and natural values, and strain on scarce fire and disaster services.

In particular, the Regents must know of the growing concern over the question of the stability of the hillsides and the insufficient information for review. Accordingly, SSC makes the following comments:

1) The FEIR is missing the AKA 2009 and 2010 geotechnical reports. These were promised in the DEIR and in the Lab's responses to comments on the DEIR appended to the FEIR (pp. 5-259 and 5-265 among others). These were not provided during the CEQA reiew process. Such geotechnical reports are essential for assessing the Project.

2) The missing Figures 1 & 2 in the FEIR, provided in the "Notice of Errata" when asked for, are not new but include a map showing the two landslides beneath the Hazardous Waste Handling Facility (Buildings 85 and 85A) and a section of the hill under the General Purpose Laboratory (Building 25) in the Old Town area showing unstable Moraga volcanics over Orinda formation.

3) Responses in the DEIR "Master Responses" to the video "The Fault: Quakes, Slides, & the Lawrence Berkeley Lab," letters, and comments, indicate either a willful misunderstanding or misreading of a sketch section of the caldera. Geotechnical reports submitted with the LRDP and with EIRs for individual Lab buildings reveal all of the features that geologists associate with such a caldera: lobate deposits of andesite and blocks of basalt, both volcanic rocks; inclusions of other volcanics; mudstones and bedded water-tables, reservoirs of water at different levels rather than consistent aquifers, that filled up the magma chamber. [1]

4) Welded tuff (ash) defines the edge of the caldera that has been identified with precision before it became overgrown or built upon. The part of the caldera east of the Wildcat Fault lies to the south in Sibley Volcanic Park, separated from the LBNL caldera by 4 miles in 10 million years. (See the Hayward fault two-foot offset of the two halves of Memorial Stadiums over a mere 90 years.)

SSC-18 cont.

---

[1] Dunn and Goodman, Oct, 1984. "Hill Area Dewatering and Stabilization Studies"

"This synclinal structure is locally complicated by faulting and the presence of remnants of the volcanic vents through which the Moraga rocks were extruded. Rocks of the campus hill area represent part of a vent complex that has been truncated and displaced along the Wildcat fault and lack the well-developed synclinal structure of the rocks east of the Wildcat fault. The remainder of the vent complex is located several miles to the southeast in Robert Sibley Volcanic Regional Preserve (formerly Round Top Regional Park). The upper campus hill area represents a portion of this complex, juxtaposed between Hayward, Wildcat and Strawberry Canyon faults, with complex internal structure resulting from the superposition of uplift and folding on the volcanic vents and associated volcanic and sedimentary rocks."

5) How will LBNL stabilize the Hazardous Waste Handling Facility (85 and 85A), so dangerous that it cannot be moved or disturbed during retrofitting? By drilling piers "under the overhang" (that is, outside the building) to "stop the landslide"! Some of the twenty-one "40' to 50'piers" are evidently intended to reach beyond the perched water tables that range from 11' to 40' below surface. But what do the engineers expect to find under all this mudflow and water? Imagine trying to anchor Jello with toothpicks on a tilted plate. (These mitigating measures are described in the Environmental Assessment for DOE, June 28, 2010.)

6) Buildings 85 and 85A are located in the East Canyon, at the other end of the site from the fire station. Flammable brush surrounds the site. No plan to safeguard these buildings and their dangerous contents has been reviewed. Is the plan simply to evacuate the site at the smell of smoke? Do any fire crews aside from the one at the Lab know which buildings need to be safeguarded, wetted down, or quickly emptied of their contents? The area is subject to wildfires.

7) The costs of dewatering the hill and repairing slopes, roads, and buildings (20 slides in 12 years—1964–1976, now up to slide no. 40, according to the map published in the EA) indicate that the site is the most expensive and dangerous place to build. Orinda Formation as described in all the borings is composed of claystone and siltstone, which are different forms of mudstone. "Mudstones give rise to many problems in civil engineering because they are weak and shrink or swell on being dried or wetted. Muds are very reactive to physical disturbances of differential loadings, and they slump or flow easily when subjected to stress." (*The Oxford Companion to the Earth*, 2000, p. 715.) Buildings, as stated in at least one geo-tech report, destabilize these mudstones, so misleadingly labeled "bedrock."

8) The caldera, loaded with buildings, presses against the cretaceous shale and sandstone above the dormitories, private residences and campus properties below. A dip-and-strike measurement taken by Emeritus Professor Garniss Curtis on June 6, 2010 above Bowles Hall indicated a westward dip of around 40 degrees. This is in the hill area topped by some of the newer Lab buildings, a hill which has slid in the recent past and has had to be reinforced with a web of concrete. *Buildings on the LBNL site endanger not only Lab personnel but also those below in the event of the expected earthquake.*

9) Planners are undecided about the placement of the GPL. As the composition of LBNL grounds varies every few feet , a new set of reports will be necessary if the building is differently sited.

SSC-18 cont.

SSC appreciates the recommendation to the Regents that action not be taken to give final approval of the General Purpose Laboratory (GPL) site at Building 25, pending completion of the National Environmental Policy Act (NEPA) review. SSC expects that the inadequacies of the EIR will be answered in an Environmental Impact Statement (EIS) with a presentation of serious alternative site analysis.

It is too soon to certify the EIR or to proceed with any aspect of the Seismic Phase 2 Project given the many unresolved concerns, including the question of harmful impacts of contaminated water flow during demolition and construction. SSC has recently sought the engagement of the State and Regional Water Quality Control Boards to pose the possibility that LBNL may have acted prematurely by requesting demolition and construction permits. (Please see enclosed letter, SSC to San Francisco Regional Water Quality Control Board, July 2, 2010)

SSC-18 cont.

SSC believes that the Regents will benefit if they pause to request further environmental review for the proposed Seismic Phase 2 Project. In the fall of 2008 the Regents decertified LBNL's proposed Helios Energy Research Facility (Helios) due to discussions initiated by the public regarding the stability of LBNL's proposed hillside site in Strawberry Canyon. (Please see the three enclosed letters.)

Thank you for your serious attention given to these matters.

Sincerely,

Georgia Wright

Georgia Wright, for
Save Strawberry Canyon

Encl:
1. Letter, SSC to San Francisco Bay Regional Water Quality Control Board, July 2, 2010
2. Letter, Garniss Curtis to Anne Shaw (Regents), May 11, 2008
3. Transcribed from original, letter, A. Paul Alivisatos to Professor Emeritus Curtis, May 5, 2020
4. Letter, Garniss Curtis to Director Alivisatos, June 12, 2010, including 2 figures

Cc:
Mark G. Yudof, President, University of California
Paul Alivisatos, Director, LBNL

Attachment #1

SAVE STRAWBERRY CANYON

P.O. BOX 1234
BERKELEY, CALIFORNIA 94701

Save Strawberry Canyon is a citizens' group that seeks to preserve and protect the watershed lands and cultural landscape of Strawberry Canyon. Save Strawberry Canyon was formed out of the urgent need to take action in response to the threat of intrusive, inappropriate development on the Canyon lands.

Strawberry Canyon, opposite the Golden Gate, is a unique link to the East Bay Regional Park District lands and, by its streams and views, to San Francisco Bay. The Canyon itself with its streamside vegetation, oak-bay woodlands, grasslands, and surrounding slopes, is a rich repository of wildlife directly adjacent to the dense urban populations of the UC Berkeley Campus and the cities of Berkeley and Oakland.

Save Strawberry Canyon seeks to inform the public about the impacts of proposed developments, to encourage location of such developments to more suitable sites, and to promote better public access to the beautiful Canyon with its wildlife and scenic resources. Mission Statement

July 2, 2010

Bruce Wolfe, Executive Officer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, California 94612

Re: Request for Risk Assessment vis-à-vis Section X State Water Board Order No. 2009-0009-DWQ for Lawrence Berkeley National Laboratory (LBNL) Seismic Phase II Project, Construction General Permit (CGP) issued May 13, 2010

Dear Dr. Wolfe:

Per a letter received from Dorothy Rice, Executive Director, State Water Resources Control Board, dated June 8, 2010, Save Strawberry Canyon understands that in accordance with Section X State Water Board Order No. 2009-0009-DWQ, a recent CGP granted to LBNL for the Seismic Phase II Project may be rescinded if the San Francisco Bay Water Board deems it appropriate to evaluate issuance of an individual storm water construction/demolition permit. It is our request that the San Francisco Bay Water Board initiate such an assessment for the Seismic Phase II Project. We request, too, that your agency review Notices of Intent (NOI) for all LBNL projects going forward.

SSC-18 cont.

Matters of water quality, contamination, quantity, and release would seem to be of particular consequence at LBNL. It has only recently been recognized that the 200-acre site adjacent to the Hayward Fault is encircled by a collapsed caldera within which there may be a deeply embedded residue of accumulated radioactive waste, volatile organic compounds and chemical solvents. In fact, it should be noted by your agency that in 1998 the Environmental Protection Agency determined that LBNL was eligible for listing on the National Superfund Priorities List, due to detection of tritium in the air, soil, groundwater, and surface water. In 2001 LBNL was administratively removed from the eligibility list without comment.

At this time, in light of the unique geological nature of the LBNL site and in

light of LBNL's long-term association with the research of the Cold War years, we urge the San Francisco Bay Water Board to exercise the authority given it by Section X State Water Board Order No. 2009-0009-DWQ. It must be presumed that the entire LBNL site may pose a significant risk to the water quality of local, state, and national resources.

Thank you for your attention given to this request.

Sincerely,

Lesley Emmington Jones.

Lesley Emmington Jones, for
Save Strawberry Canyon

SSC-18 cont.

Cc:
Dorothy Rice, Executive Director, State Water Resources Control Board
Bruce Fujimoto, State Water Resources Control Board
Shin-Roei Lee, San Francisco Bay Water Board
Cherry Seward, San Francisco Bay Water Board
John Muller, Chair, San Francisco Bay Water Board
Carole Schemmerling, Strawberry Creek Watershed Council
Barbara Boxer, U.S. Senator
Diane Feinstein, U.S. Senator
Barbara Lee, Congresswoman, U.S. Congress
Keith Carson, Alameda County Supervisor
Kim Abbott, Department of Energy/LBNL
Gary S. Hartman, DOE ORO NEPA
Paul Alivisatos, Director, LBNL
Mark G. Yudof, President, University of California
Phil Stevens, Urban Creeks Council

Attachment #2

On Sun, May 11, 2008 at 2:10 PM, Garniss Curtis <gcurtis@berkeley.edu> wrote:
To: anne.shaw@ucop.edu
From: Garniss Curtis <gcurtis@berkeley.edu>
Subject: regarding certification of final environmental impact reports for the proposed computational research and theory facility and the helios energy resource facility and project approvals.
Cc:
Bcc:
Attachments:

As the request for my geologic opinion on the advisabilty of constructing large buildings in the lower part of Strawberry Canyon and in the next canyon to the north known as Blackberry Canyon came to me on May 4th, I have to be brief and rely on my memory. I shall first say as strongly as I can "absolutely do not construct any buildings in those two canyons", then I shall go into the reason based on the work I did as consultant to Mr. Ben Lennart 25 to 35 years ago who was contracted by the University to investigate a number of sites for possible constructions or for stopping landslides that were threatening buildings.

First, the geologic setting of the two areas: The active Hayward Fault goes across the mouths of both canyons. Further east, the Wildcat Canyon fault parallels the Hayward Fault behind the Botanical Gardens and northward joins the Hayward near the town of San Pablo. Southward the Wildcat Canyon fault can be easily traced to Sibley Park and beyond. A few small epicenters lie along this fault near its junction with the Hayward, but it does not seem to be active elsewhere to the south. However, in the past the the area between the two streams and the two faults. which includes the whole of the Lawrence Laboratory complex lay four miles to the south next to Sibley Park. The volcanic rocks in both areas have potassium-argon dates of approximately 10 million years, and the rhyolite found in both of them is the same rhyolite. The volcanic rocks underlying most of the Lawrence Lab complex fill an old crater, a collapse caldera. The old volcano that once rose above these rocks collapsed after the expulsion of a very large amount of rhyolite ash, now largely removed by erosion. The volcanic rocks broke up as the collapse occurred and many show crushing and deformation and are mixed with large amounts of ash and volcanic fragmental debris. This material should never have been built on as it is so clay-rich and unconsoidated. The western rim of this caldera is easily traced trom its arcuate shape which is cut off by the Wildcat Canyon Fault just south of the Botanical Gardens near the upper part of Strawberry Creek. It swings around very close to the old Cyclotron and continues north to join the Wildcat Canyon Fault in Wildcat Canyon not far from the Merry-go-Round in Tilden Park. The boundary rocks to the west are sandstones and shales thought to be of Cretaceous age, that is, they are older than 65 million years. Exposures of these sandstones and shales are good below Bldg 50 down to Bowles Hall, and they dip westward at angles of 20 to 25 degrees, about which more later. The Hayward Fault passes very close to the rear of Bowles Hall after going through the Stadium where it has caused major deformation of the support pillars and offset of the two sides of the stadium since its construction in 1927.

SSC-18 cont.

Behind Hearst Mining Bldg and a few feet to the east, is the Lawson Adit which is a tunnel going eastward. Begun in the 1920' or earlier, it was completed in 1938 when it reached the Hayward Fault. Professor George Louderback told me (Personal comm.)

that it was not ordinary fault gouge that he found in the Hayward Fault zone but a pecular mixture of serpentine and metamorphic rocks that also appear on the surface and underlie Stern Hall and part of Foothill Student Housing. Founders Rock near the corner of Hearst and Gayley Road is in this melange. Also in the tunnel are several exposures of the offset of Strawberry Creek as determined from the contained rounded cobbles of Strawberry Canyon origin . Thus this indicates a displacemeent of more than 600 feet north along the Hayward Fault.

Still further north along the Hayward all the way to San Pablo huge amounts of the melange similar to that in the Lawson Adit have been squeezed out of the Hayward Fault and are gradually sliding down the slope below the fault Much of this melange has reached the bottom of the hill back of El Cerrito. Along the Arlington many houses built on this melange are sliding and have caused a great number of legal problems. Within the fault itself no movement can be detected in these deposits, some of which are more than 100 feet thick. Thus we believe that movement and expulsion of this melange takes place during major earthquakes on the Hayward Fault.

A great deal of research has been done recently on the Hayward Fault by the USGS at Menlo Park which was reported in a talk on the last Thursday of this past April. They have established a return time of major quakes of 6.5-7 magnitude on the Hayward Fault of 130 years. The last major quake along the northern part of the Hayward Fault was 140 years ago, so we are over-due. They estimate that there is approximately a 65 percent chance a major quake will occur in the next 30 years.

Lennart was able to get survey notes from East Bay Municipal Utility District for the San Pablo Dam water tunnel to El Cerrito which crosses the Hayward Fault and shows that the right lateral horizontal movement of approximately one centimeter per year is matched by uplift of the east side of the fault of approximatelly one centimenter per year also. So, with the evidence of the horizontal displacement of the old Strawberry Creek of 600 feet horizontally along Galey Road, the Cretaceous sedimentary rocks east of the Hayward Fault there have also risen 600 feet . Building 50(?) sits on these Cretaceous strata which, as mentioned dip westward 20-25 degrees. If an earthquake occurs when these beds are soaked with winter rains the chance of a major landslide are great along the slippage planes of shale dipping westward. Minor slides have already occurred in these beds behind Bowles Hall. Indeed, the Foothill Student Housing was planned to be built there until I called attention to the landslide. A major landslide would probably destroy all the buildings on both sides of Galey Road from the Stadium to the buildings on both sides of Hearst Avenue and would probably reach Dow Library, destroying everthing in its path to that point and possibly beyond. Buildings in the lower parts of both Strawberry and Blackberry Canyons would be buried if not destroyed.

SSC-18 cont.

Major landslides of the type I have described here are not rare along the Hayward Fault as was shown to us during our study of the Hayward fault at the base of the hill behind the Clark Kerr Campus. We discovered that most of that campus was underlain by a large landslide that had originated in Claremont Canyon, and was gradually moved northward along the Hayward Fault. Trenches and drill holes showed this landslide to be up to 30 feet thick. It extends westward to and possibly beyond Piedmont Ave. Further south is a huge landslide that underlies most of the campus of Mills College and extends westward another quarter mile Still further south are more large slides that have originated in canyons and steep slopes east of the Hayward Fault. As the hills rise and become unstable, earthquakes cause them to break loose and slide. Very few large

slides have occurred on the eastern slopes of the Berkeley Hills, hence fhe relationship to earthquakes of major land slides close to the Hayward Fault along the western slopes of the Berkeley Hills. Normal erosion rounds off unstable areas on the eastern slope of the Berkeley Hills before they break loose and slide.

Most of the buildings of the Lawrence Lab. are on the unstable ground filliing the old caldera. particularly the Bevatron and associated buildings. As the Cretaceous beds immediately west of these buildings have been eroded away there is nothing to keep these soft caldera-filled beds from sliding. The buildings on them will certainly move a few feet in a major earthquake if not hundreds of feet. Keep in mind the Loma Prieta quake of l989 of magnitude 6.9 which from a distance of over 60 miles destroyed a section of the Bay Bridge, a section of the overhead freeway in Oakland killing 63 people, and many houses on filled ground in the Marina of northen San Francisco some 70 miles from the quake!

No! Major buildings of any kind should not be constructed in either of these canyons bordering this huge block of unstable rock.

--

Profesor Emeritus Gamiss H. Curtis
Dept. Earth and Planetary Science
Univ. Calif, Berkeley, CA

--

Gamiss H. Curtis
Berkeley Geochronology Center
E-Mail: gcurtis@uclink.berkeley.edu

SSC-18 cont.

Attachment #3

May 5, 2010 (transcribed from original)

Dear Professor Emeritus Curtis:

Thank you for your letter dated April 11, 2010, advising us of the USGS predictions related to the Hayward fault. We appreciate your expressed concerns, and, as we discussed at our meeting with you on March 31, 2010, the Lab has devoted considerable effort to study the local geology in relation to human safety and construction. The risks posed by future seismic events are significant for all residents and organizations in the East Bay, and we should work together to prepare for such an event.

It is also important to assess risks on the basis of evidence. In our meeting, you acknowledged that your caldera hypothesis does not match the full range of evidence that is now available. I hope that you have given more thought to the matter and have reconsidered in light of the new data presented to you. In the interest of presenting the full case to the public, I invite you to attend our next Community Advisory Group meeting on July 8, present your current thinking and hear more of the research presented by our geologists. This will afford interested members of the public an opportunity to hear a full spectrum of views on the matter.

SSC-18 cont.

As you know, the Berkeley Lab has been a fixture of the East Bay for over 80 years with an auspicious history. As the current Director I am acutely aware of the need for responsible stewardship on behalf of the neighborhood residents, the larger East Bay community, and the nation.

Thank you again, for taking the time to meet with me and others at Berkeley Lab. I look forward to continuing our dialogue and hope that you will join us on July 8.

Sincerely, A. Paul Alivisatos
Director

Attachment #4

10 St. James Court
Orinda, CA 94563
June12, 2010

Paul Alivisatos, Director
Lawrence Berkeley National Laboratory
One Cyclotron Road
Berkeley, CA 94720

Re: Your letter of May 5, 2010

Dear Director Alivisatos:

I have not changed my mind about the validity of LBNL's location on a collapse-caldera. The evidence I presented to all of you at our meeting showing an arcuate line extending from the Wildcat Fault south of the Botanical Gardens around the cyclotron and following closely Shasta Rd to its intersection with Grizzly Peak Blvd and beyond to its intersection again with the Wildcat Fault 150 yards north of Shasta Rd has been called the Chicken Creek Fault and Cyclotron Fault in reports done for LBNL. Neither of the two reports show the continuation of this fault to intersections with the Wildcat Fault, which should have been done.

To clarify my evidence for a collapse-caldera, I have made a tracing of the caldera and the Wildcat Fault and have shown the age of 10 to 12 million years for all the exposed rocks in the caldera in pink. Outside of its margin the Cretaceous rocks belonging to the Great Valley Sequence of 65 to 138 million years have been colored green. Once, of course, the 10 to 12 million year old rocks of mid-Miocene age covered all the Cretaceous rocks surrounding the caldera but have been eroded away. The caldera rocks dropped down far enough in the caldera so were not completely eroded away.

SSC-18 cont.

Not discussed in any report but exposed in the ridge west of the Wildcat Fault and inside the caldera are flat-lying layered welded tuff beds 50 feet and more in thickness composed of rhyo-dacite. These once were much thicker and covered a wide area. It was the expulsion of this welded tuff that caused the collapse of the caldera. The source conduit is oval-shaped and shown in red and now covered with houses so it is difficult to see, but its mineral and chemical composition are identical with the welded tuff.

The source of the Moraga volcanics and the caldera was in Sibley Park. Tectonic deformation has turned these beds up to the vertical, allowing erosion to remove most of the Moraga volcanic source and all of the other half of the caldera.

Sincerely,

Garniss H. Curtis

Garniss Curtis, Professor Emeritus UCB, Earth and Planetary Sciences

Attachment #5
Point 1

SSC-18 cont.

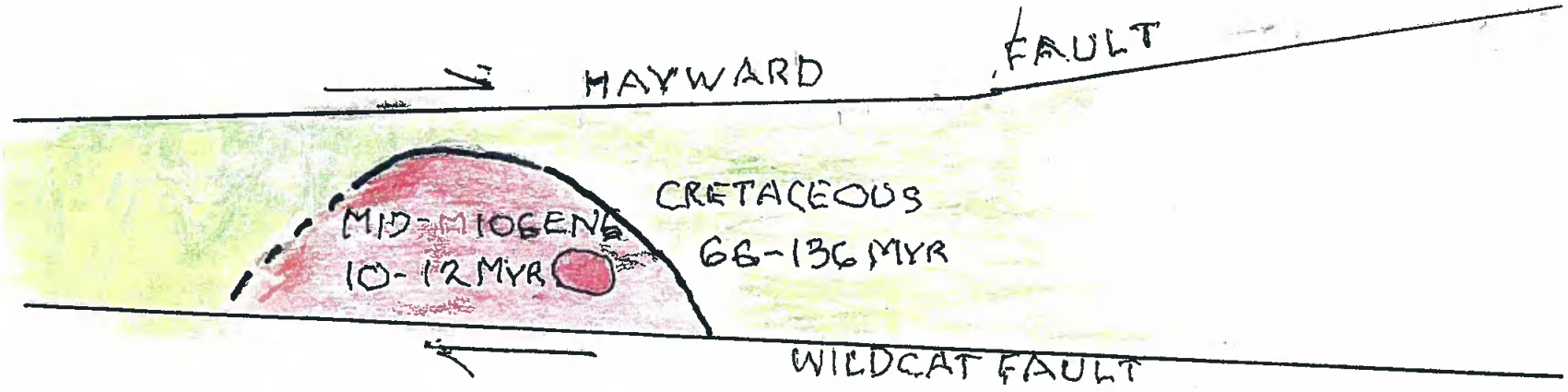


Figure 2

SSC-18
cont.

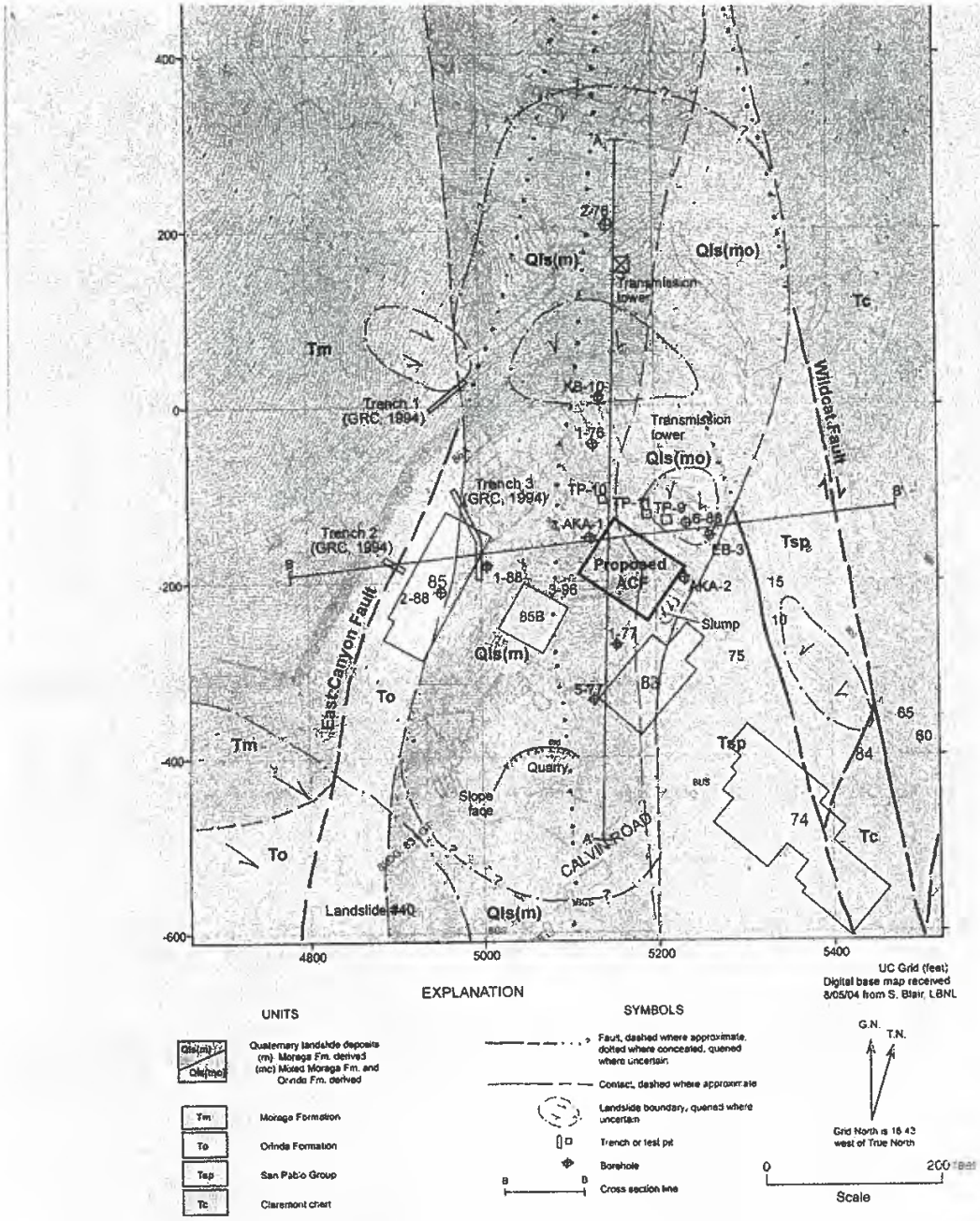


Figure 6. Geologic map of the East Canyon area of the LBNL campus, including the proposed ACF. Base topography from S. Blair, LBNL, 2004. Map shows bedrock units and bedrock-involved landslide deposits, bedrock faults, and outlines of landslide bodies. Quaternary unconsolidated deposits and artificial fill are omitted for clarity, but are shown on cross sections A-A' and B-B'. Borehole, trench, and test pit sources used to construct cross sections are listed with the cross sections. Mapping based on field reconnaissance, borehole compilation and reinterpretation (including Gilpin, 1994), RFI Final Report (2000), as part of this study. Unpublished data from P. Jordan (pers. communication, 2004).

LBNL ANIMAL CARE FACILITY

Preliminary Geologic Map

WLA William Lettis & Associates, Inc.

Attachment #3

From Alan Kropp & Assoc; Inc 2006A
Geotechnical Investigation Report: Animal Care Facility

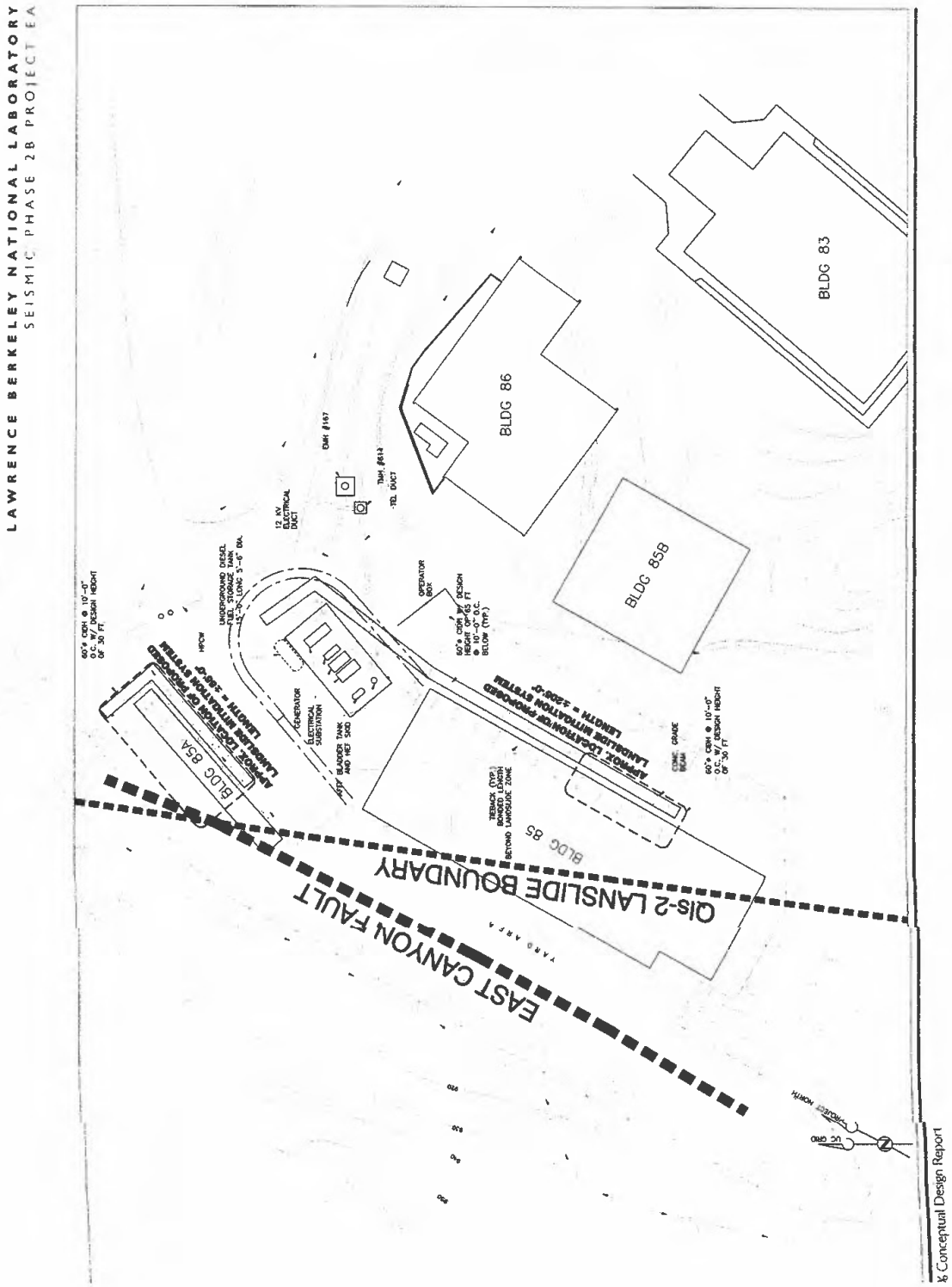
428-00050

Fig. 1

SSC-18 cont.

Attachment #3

From Environmental Assessment, p. 20 2010 Fig. 2



& Conceptual Design Report

SSC-18 cont.

REC'D JUL 2 9 2010

Committee to Minimize Toxic Waste

LETTER #CMTW

DOE/SLSII/DEA
COMMENTS#1of5

Kim Abbott, NEPA Document Manager
Department of Energy, Berkeley Site Office
One Cyclotron Road, MS 90-1023
Berkeley, CA 94720

July 26, 2010

Re: Comments on the Draft Environmental Assessment (DEA) for a project titled: The Lawrence Berkeley National Laboratory (LBNL) Seismic Life-Safety, Modernization and Replacement of General Purpose Buildings, Phase 2B. CMTW-1

Dear Mr. Abbott,

Landslides at LBNL have created havoc at the site since the inception of the University of California Radiation Laboratory (UC Rad Lab) in the 1940s. Attachment 1. "Chronology of the Campus Hill Area Development and Slope Instability Through 1984" is especially noteworthy, since it shows how major slides started occurring immediately after and as a result of construction on the hill.

The Department of Energy (DOE) has not fulfilled its obligation under the National Environmental Policy Act (NEPA) to adequately describe, analyze and consider the natural and man-made hazards at each of the sites of the proposed Seismic Life-Safety Phase 2B project (the Project). Indeed, the 43,000 square foot General Purpose Laboratory (GPL) building is proposed to be constructed in the Old Town/Strawberry Canyon Landslide Area on top of the most contaminated soils and groundwater contamination plumes extending under the entire B25/GPL site. In the East Canyon, B85 Complex, the lab's Hazardous Waste Handling, Storage and Treatment Facility is undermined by the East Canyon Slide and the yet unknown, undetermined impacts/influences and transport paths of the millions of gallons of perched groundwater along the Wildcat Fault! And in the Blackberry Canyon B55 and B71 sites are impacted by the Blackberry Canyon slide, radioactive and chemical contamination in soil and groundwater and the influences of springs, earthquake faults and the North Fork of Strawberry Creek. CMTW-2

In an article "Geologist reveals nature's plan in Berkeley hill walk" (Hills Publication/Berkeley Voice February 24, 1994) retired geologist Hal Wollenberg states: "One plant engineer said this is the last place to build a national laboratory," about the unstable ground (Attachment 2.) And yet, the projects continue with deficient analysis fueled by the seemingly unending taxpayer funded ARRA monies! (Attachment 3 A & B) CMTW-3

ATTACHMENT 1.

Chronology of the Campus Hill Area Development and Slope Instability Through 1984

Early 1900's	Development of the campus hill area begins
1949	Numerous slides occur as a result of Bevatron (Building 51) construction (1st recorded stability problems)
1950's	LBL significantly increases construction, massive cuts and fills undertaken to create flat pads for roads and buildings
1962	Small slope failures occur in the slopes behind Building 46, at site of Building 77, and reactivation of old slide uphill and east of Building 17
1962	Hydraugers installed to stabilize cut slope at northeast corner of Building 77 site
1963	Additional hydraugers installed behind slope north of Building 77 to stabilize old slide area
1963	Centennial Drive constructed
1967 - 1969	Slope instability continues at cut and fill behind Building 77, slope repairs and installation of hydraugers
1967	Slide on natural slope between Building 76 and 79
1969	Wet winter, much larger and more damaging slides occur including major failure of slope between LBL Corporation Yard and Centennial Drive which is repaired with buttress fill and subdrainage
1968-69	Serious slide occurs at the Centennial Drive overpass eastern abutment, road partially closed, hydraugers installed
1970	Slide occurred adjacent to Building 71 southeast parking lot, hydraugers installed
* 1973 →	Building 46 bisected by a very large slide, major repairs required including dewatering; slide continues to move in wet seasons
1975	Slide at compacted fill south of Building 77
1978	Slide at compacted fill south of Building 72
1975 →	Major hill area dewatering program undertaken, Shively Well No. 1 drilled (still continuously pumped)
1978	Centennial Drive overpass deforms further, steel bracing added
1979	Large scale dewatering of the hill attempted, second well drilled, two long nearly horizontal hydrauger drains installed into hill from Poultry Husbandry site
1980's	Numerous small slumps and mudflows occurred throughout hill area
1982	Earth movement at Centennial Drive overpass causes road closure, temporary repairs
1983	More movement at Centennial Drive overpass, road closed, major buttress fill repair required
1984	Centennial Drive reopened

Source: Complied from information contained in the Hill Area Dewatering and Stabilization Studies (Converse Consultants, 1984).

CMTW-4

In addition to the information above, by 1987 LBNL had mapped some 30 landslides within the lab's Strawberry and Blackberry Canyons, and by 2008 the number of slides was up to 40, including LBNL's East Canyon landslide area.

Regarding Building 46 slide (see above), notes from a site visit by Robert Dunn and Professor Richard Goodman (October 18, 1976) state: Building 46 was "first founded on what was thought to be solid basalt-actually was LARGE BLOCKS." See also attached figure of the collapsed caldera (after Garniss Curtis, Professor Emeritus) at LBNL.

CMTW-5

ATTACHMENT 2.

Geologist reveals nature's plan in Berkeley hill walk

Hills Publication Feb. 24, 1994

By Julie Freestone

Nearly 100 employees turned out at Lawrence Berkeley Laboratory at lunch time recently to hear a retired geologist provide an explanation of the history of land formations in the hills above Berkeley.

Speaking with a megaphone and leading the group up steep hills to see firsthand what earthquakes and volcanos did to the terrain, Hal Wollenberg communicated his enthusiasm during the more than one-hour al fresco lecture.

Describing rocks which are over 70 million years old, Wollenberg said, "We have a juxtaposition of terrains, some might call it geological chaos." He showed the group "younger" Orinda rocks and much older ones, but pointed out 50 million years was missing in between.

Although the Orinda rocks may sound like ancient history, Wollenberg described how the rocks, which have relatively low permeability affect current conditions. When ground water moves through the hills, the Orinda rocks block the flow and exacerbate landslides.

"One plant engineer said this is the last place to build a national laboratory," he said with a laugh about the unstable ground.

Wollenberg said the Orinda formation was probably deposited seven to eight million years ago, made up of stream deposits, sandstone and landslide deposits which formed the hills.

Later. volcanic rock capped the ridges and valleys.

Leading the group to a hillside behind building 46, Wollenberg traced the history of a tunnel dug into the hillside, explaining it had once been used to provide Berkeley with a water system, but more recently was the site of drilling to better identify the rock formations in the hill.

He pointed to a spot where a 1973 landslide "sundered" building 46 and threatened other buildings. Emergency procedures were started to put in drains to reduce the level of water in the hills and prevent future slides.

"After the rain, 300,000 cubic years of materials were removed, composted and returned to the slope," Wollenberg said, pointing out it is now thickly vegetated with Scotch broom.

Besides being fueled by the accumulation of water, Wollenberg said landslides also occur where volcanoes have deposited material which undergoes a sort of baking action, creating a softer clay layer. "It becomes a slide plane," he explained.

During the walk, employees who didn't know each other compared notes on recent layoffs and on the work their units were doing, but all seemed fascinated with the geological lecture.

"Working here is like being in school," said Peter Fraser, a quality engineer at LBL. "You drive down the road and see things but don't usually have anyone to ask. Here, there are experts everywhere. Why not use them?"

Standing at the highest point of the lab, the group did just that, peppering Wollenberg and several other geologists on the walk with questions about different colored rocks.

Wollenberg pointed the Orinda formation, which he said is especially beautiful near the Caldecott tunnel. Above that is the Moraga rocks, which he described as "highly fractured, a typical mud flow, more common and much more dangerous" than the hard, intact lava flow.

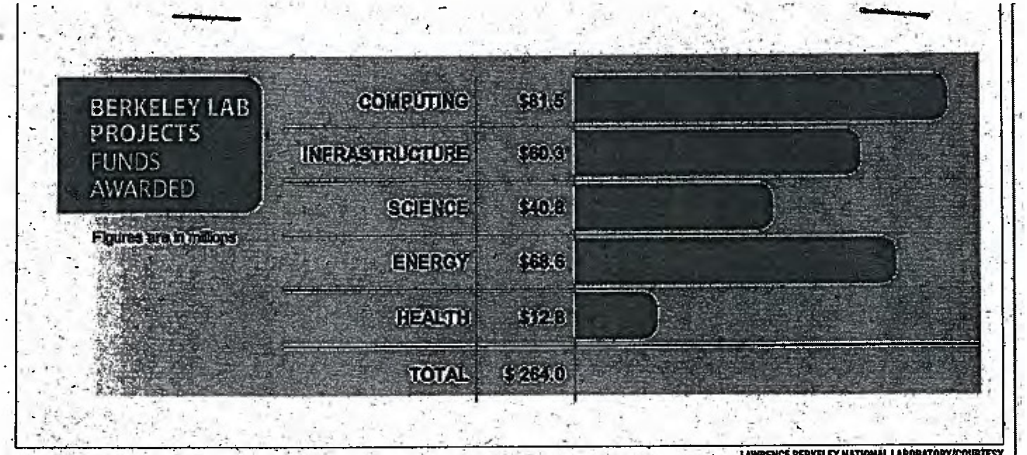
Explaining mud flows, he said, "They travel the farthest and wipe out whole cities."

Wollenberg and geologist Pat Williams promised to lead another walk in the spring to describe more recent features such as faulting and explain the role they play in the current life of LBL.

CMTW-6

3/84

THE DAILY CALIFORNIAN
Berkeley, California
Tuesday, February 2, 2010
www.dailycal.org
Established 1871. Independent Student Press Since 1971.



LAWRENCE BERKELEY NATIONAL LABORATORY/COURTESY

Berkeley Lab Reaps Benefits of Stimulus

by Cristian Macavei
Contributing Writer

While double-digit unemployment continues to plague many areas of the country, federal stimulus grants are funding research at Lawrence Berkeley National Laboratory that may lead to long-term economic growth.

About $264 million has been allocated to the lab since March 2009 through the American Recovery and Reinvestment Act for research in computing, energy, health and other sciences.

ONLINE PODCAST
Cristian Macavei talks about the stimulus grants to Berkeley lab.

"Last year, we made the largest investment in basic research funding in history, an investment that could lead to the world's cheapest solar cells or treatment that kills cancer cells but leaves healthy ones untouched," said President Obama in his State of the Union address last week.

The lab is pursuing a variety of projects in areas such as energy, biofuels and computing that will provide scientific benefits in the future, according to Julie Chao, a lab spokesperson.

"The $11.3 million for the Advanced Light Source, one of the world's brightest sources of ultraviolet and soft X-ray beams, alone will facilitate scientific discoveries in everything from disease research to alternative fuels," she said in an e-mail.

Another stimulus grant, a $12.8 million grant from the National Institutes of Health, will help fund research into radioactive decontamination, cancer and other health conditions, according to a lab statement.

The institutes awarded $4.2 million of the grant to the lab's two-year radioactive decontamination project. The funding will allow researchers to further develop two molecules that may better treat nuclear contamination.

About $81.5 million for computing research and development and $60.3 million for infrastructure spending has been awarded to the lab since March 2009, according to a lab statement.

Chao said in an e-mail that the first portion of the stimulus money was allocated to the lab for infrastructure projects, while additional funding for science and research came in later months. Many projects are still under development.

"Many of them are still hiring, purchasing equipment, setting up experiments and so forth," she said. "A good number of these are multi-year projects."

At least 192 jobs have been created or retained as of Dec. 31, 2009 due to the influx of stimulus funding, according to Chao.

"All kinds of jobs have been created and retained thanks to the Recovery Act funding, from construction workers and electricians to research assistants, project managers, engineers and, of course, scientists," she said in the e-mail. "Plus, through the procurement of goods and services, many jobs have been created or retained at vendors and subcontractors, both locally and nationally."

The lab itself has seen its budget—most of which comes from the U.S. Department of Energy—increase by about $58 million since the 2008 fiscal year to about $648 million in the 2009 fiscal year, according to a November 2009 lab statement. $11 million of the increase came from stimulus funding.

The lab's budget is estimated at $774 million for the 2010 fiscal year, with about $122 million from stimulus funding, according to the statement.

Chao said federal agencies are allocated

>> STIMULUS: PAGE 2

STIMULUS: Research Spending May Boost Economy

FROM FRONT

money by Congress, which they then route for specific use to laboratories such as Berkeley lab.

Mike Janes, a spokesperson for New Mexico-based Sandia National Laboratory, said in an e-mail that the Sandia lab has received $45.3 million of stimulus funding from the act as of Jan. 22 this year. $21.9 million has been assigned for capital funding and $23.4 million has been assigned for operating funding.

Sandia is using the stimulus funds to develop low-carbon energy solutions and to address key energy security challenges, such as reducing U.S. oil dependence, Janes said.

John Ellwood, a UC Berkeley professor in the Goldman School of Public Policy, said it is important to consider which funding would most effectively stimulate the economy.

"The interesting thing is we are awash in research money while we are starved at the state," he said.

Stimulus funding for research would not necessarily temper stubborn unemployment rates, Ellwood said.

"Someone could argue that the cost per job created will be very high with stuff at the labs because you'll have to buy lots of expensive equipment and lots of expensive labor," he said.

But stimulus spending for research will allow the American economy to grow in the long run, he said. Additionally, the funding will provide needed resources for university-related projects.

"As a resident of California and as a faculty member of Berkeley, this stuff is great," Ellwood said. "The money is coming from all American taxpayers, and it's going to California and to the University of California, which we in a narrow selfish world love."

Cristian Macavei covers research and ideas. Contact him at cmacavei@dailycal.org.

ATTACHMENT 3A

4/84

CMTW-6 cont.

CMTW-6 cont.

ATTACHMENT 7D

Established 1871. Independent Student Press Since 1971.

THE DAILY CALIFORNIAN

Berkeley, California | Monday, March 30, 2009 | www.dailycal.org

5.184

RESEARCH & IDEAS

Lawrence Berkeley Lab Gains Federal Funds

by **Christine Chen**
Contributing Writer

Lawrence Berkeley National Laboratory will receive $115 million as part of President Barack Obama's American Recovery and Reinvestment Act, as announced by Secretary of Energy and former director of the lab Steven Chu last week.

The funding comes from a portion of the $787 billion act Obama signed in February aimed to move research forward at major science institutions, while creating new jobs at the same time.

"Most of these projects (being funded by the act) have to do with infrastructure upgrades, and a number of those have been approved, but we have not received any of the money yet," said Jeff Miller, a spokesperson for the lab.

Among the projects that will be funded is the construction of a lab and office building for the Advanced Light Source synchrotron, a soft X-ray light source used by scientists to learn more about atomic structure.

About $14.3 million will go toward constructing a building next to the synchrotron as well as toward the ongoing project of demolishing the Bevatron, an older particle accelerator, to make room for new science buildings.

Another $1.5 million will go toward maintenance for the synchrotron, which is an open facility used by two thousand scientists and industries per year, said Roger Falcone, director of the synchrotron and a UC Berkeley professor of physics. The lab will need to hire about three dozen extra construction workers, he said.

"This will accelerate the completion of the project and fulfill the other half of the requirement of stimulus funding, which is to create jobs, so it provides additional work for the construction field," Falcone said. "It will accelerate the process, which will make the research happen sooner."

Another proposed project at the lab is the Berkeley Lab Laser Accelerator, which scientists anticipate will receive $19 million. The money could

>> LAB: PAGE 2

$115 Million

Money the lab will receive from the economic stimulus bill

VICTORIA CHOW/STAFF

Projects the money will fund include:

- Construction for the Advanced Light Source synchrotron
- Demolition of the Bevatron
- Completion of the Berkeley Lab Laser Accelerator

SOURCE/LAWRENCE BERKELEY NATIONAL LABORATORY

LAB: Funding May Help Create New Jobs

FROM FRONT

potentially fund 50 to 60 new employees to do technical work on the laser system.

Because the high-energy laser system produces a large electric field, it can be built at a smaller scale than normal-sized accelerators while producing the same amount of energy, said Wim Leemans, director of the project. He said while the project received high ratings among scientists, there wasn't enough funding available to build it until recently.

"We were afraid we would lose our leadership in this area, and now we're back in the position so we can maintain the lead," Leemans said. "They told us that we would have gotten money about two years from now, but they would have to spread the project out more years than we wanted. Now, with the (act), we can do it on a much faster timescale, so it allows us be competitive with the rest of the world."

Again, DOE has failed to follow NEPA regulations regarding communicating with the public the most important information pertaining to the LBNL site, including, but not limited to the critical significance of the CURTIS CALDERA, inside which LBNL buildings are located, including all the components of this Project, on the unconsolidated melange of volcanic fragmental debris left behind when the caldera collapsed. (Attachment 4 A & B)

In fact LBNL is located in the northwestern crater (Curtis Caldera) of the Sibley Volcanic Cluster, connected to the Sibley Volcanic Regional Preserve of the East Bay Regional Park District.

Information provided by the Sibley Volcanic Preserve states the following: " 10 million years ago volcanic eruptions began near what is now Round Top Volcano in Sibley Park. The magma may have risen through a fractured zone now known as "Wildcat Fault". Two volcanic centers developed here: a larger volcano rose to the west; a smaller cone (Round Top Volcano) formed on the eastern flank of the larger. The two eruptive centers were separated by the Wildcat Fault, a branch of the large Hayward Fault System.

9 million seven hundred thousand years ago a violent eruption blew the lid off the larger volcano. Rhyolite ash spread over 3 counties. Ash deposits have been traced many miles to the east and south - and can be found today 40 miles north at Sears Point. Following this great eruption, the volcano collapsed to form a crater or "caldera" 2 miles long and a mile wide. The Lawrence Berkeley Laboratory is now located on the deeply eroded remains of this volcanic caldera."

The Sibley Volcanic Preserve's informational brochure further states: "How many volcanos? Round Top is the obvious one. There are smaller ones outside the Preserve to the north and southeast. Another, of rhyodacitic composition (rather like the ash from Mount St. Helens), underlies the Lawrence Berkeley Laboratory and Little Grizzly Peak in Tilden Regional Park. About 9.8 million years ago it was erupting beside Round Top. Subsequently it was shifted about 3.5 miles northwest by movement along Wildcat Fault. That makes a total of 4 volcanos." (Attachment 5, 2 pages).

CMTW-7

The proposed Project does not assure, as required by NEPA, "safe, healthful surroundings", due to the UNMITIGABLE nature of the site itself. Elevated Life-Safety Risks will continue at the lab as long as LBNL operates at the current site on the unconsolidated soils of the collapsed caldera. The DEA projects a false sense of security/ safety as it ignores the fact that seismic upgrading of buildings does not remedy the instability of the site. Indeed, CONDITIONS OF THE LAND ARE THE DOMINANT HAZARD FEATURES, NOT BUILDINGS ALONE!

CMTW-8

ATTACHMENT 4A

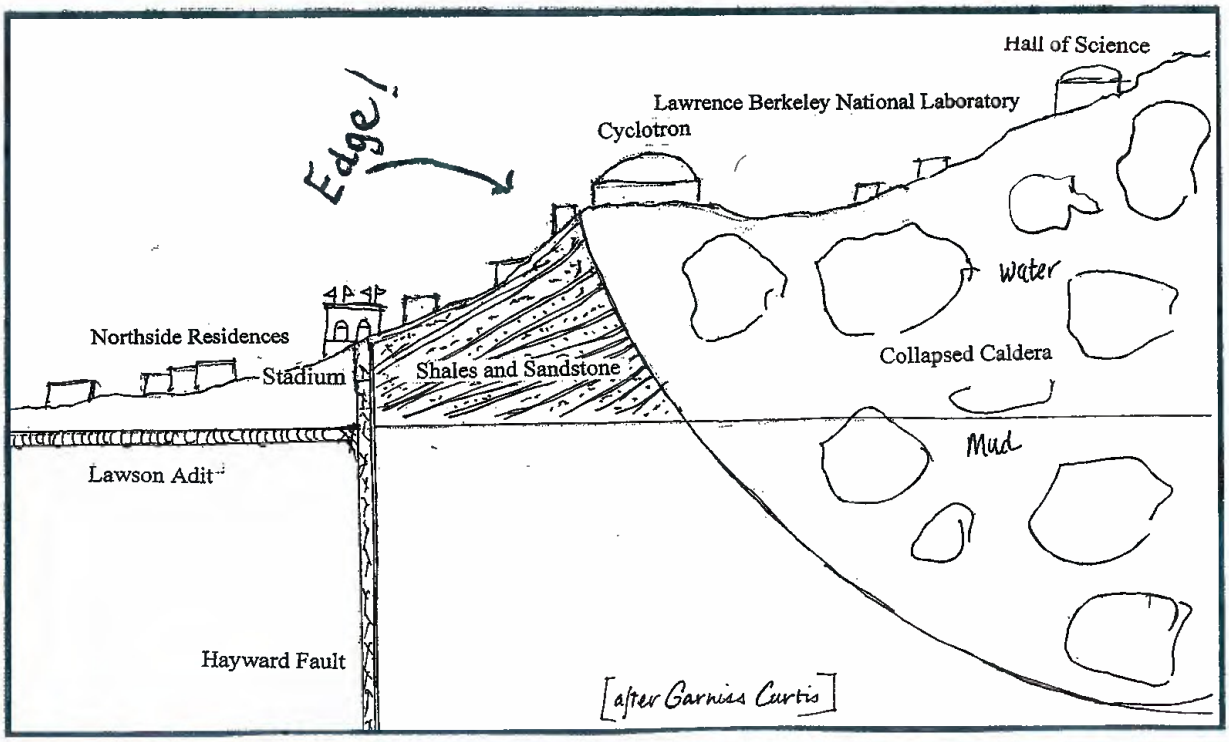


Figure above shows an unknown mixture of mud, perched water and boulders, for which LBNL has yet to do a comprehensive hydrogeological study of its composition. Also missing is the mapping of LBNL's hydrostratigraphic units (HSUs), which would show the hydraulic connection between various permeable layers of the HSUs sedimentary sequences.

7/8

CMTW-9

ATTACHMENT 4B.
(3 PAGES)

Statement of Garniss H. Curtis, Professor Emeritus
Department of Earth and Planetary Science, U.C. Berkeley

On Sun, May 11, 2008 at 2:10 PM, Garniss Curtis <gcurtis@berkeley.edu> wrote:

To: anne.shaw@ucop.edu
From: Garniss Curtis <gcurtis@berkeley.edu>
Subject: regarding certification of final environmental impact reports for the proposed computational research and theory facility and the Helios energy resource facility and project approvals. [*Please note that several typographical errors and misspellings have been corrected in the following text.*]

As the request for my geologic opinion on the advisability of constructing large buildings in the lower part of Strawberry Canyon and in the next canyon to the north known as Blackberry Canyon came to me on May 4th, I have to be brief and rely on my memory. I shall first say as strongly as I can "absolutely do not construct any buildings in those two canyons", then I shall go into the reason based on the work I did as consultant to Mr. Ben Lennart 25 to 35 years ago, who was contracted by the University to investigate a number of sites for possible constructions or for stopping landslides that were threatening buildings.

CMTW-9 cont.

First, the geologic setting of the two areas: The active Hayward Fault goes across the mouths of both canyons. Further east, the Wildcat Canyon fault parallels the Hayward Fault behind the Botanical Gardens and northward joins the Hayward near the town of San Pablo. Southward the Wildcat Canyon fault can be easily traced to Sibley Park and beyond. A few small epicenters lie along this fault near its junction with the Hayward, but it does not seem to be active elsewhere to the south. However, in the past, the area between the two streams and the two faults (which includes the whole of the Lawrence Laboratory complex) lay four miles to the south next to Sibley Park. The volcanic rocks in both areas have potassium-argon dates of approximately 10 million years, and the rhyolite found in both of them is the same rhyolite. The volcanic rocks underlying most of the Lawrence Lab complex fill an old crater, a collapse caldera. The old volcano that once rose above these rocks collapsed after the expulsion of a very large amount of rhyolite ash, now largely removed by erosion. The volcanic rocks broke up as the collapse occurred and many show crushing and deformation and are mixed with large amounts of ash and volcanic fragmental debris. This material should never have been built on as it is so clay-rich and unconsolidated. The western rim of this caldera is easily traced from its arcuate shape which is cut off by the Wildcat Canyon Fault just south of the Botanical Gardens near the upper part of Strawberry Creek. It swings around very close to the old Cyclotron and continues north to join the Wildcat Canyon Fault in Wildcat Canyon not far from the Merry-go-Round in Tilden Park. The boundary rocks to the west are sandstones and shales thought to be of Cretaceous age, that is, they are older than 65 million years. Exposures of these

sandstones and shales are good below Building 50 down to Bowles Hall, and they dip westward at angles of 20 to 25 degrees, about which more later. The Hayward Fault passes very close to the rear of Bowles Hall after going through the Stadium where it has caused major deformation of the support pillars and offset of the two sides of the stadium since its construction in 1927.

Behind Hearst Mining Bldg and a few feet to the east, is the Lawson Adit which is a tunnel going eastward. Begun in the 1920' or earlier, it was completed in 1938 when it reached the Hayward Fault. Professor George Louderback told me (Personal comm.) that it was not ordinary fault gouge that he found in the Hayward Fault zone but a peculiar mixture of serpentine and metamorphic rocks that also appear on the surface and underlie Stern Hall and part of Foothill Student Housing. Founders Rock near the corner of Hearst and Gayley Road is in this melange. Also in the tunnel are several exposures of the offset of Strawberry Creek as determined from the contained rounded cobbles of Strawberry Canyon origin . Thus this indicates a displacemeent of more than 600 feet north along the Hayward Fault.

Still further north along the Hayward all the way to San Pablo huge amounts of the melange similar to that in the Lawson Adit have been squeezed out of the Hayward Fault and are gradually sliding down the slope below the fault. Much of this melange has reached the bottom of the hill back of El Cerrito. Along the Arlington many houses built on this melange are sliding and have caused a great number of legal problems. Within the fault itself no movement can be detected in these deposits, some of which are more than 100 feet thick. Thus we believe that movement and expulsion of this melange takes place during major earthquakes on the Hayward Fault.

CMTW-9 cont.

A great deal of research has been done recently on the Hayward Fault by the USGS at Menlo Park which was reported in a talk on the last Thursday of this past April. They have established a return time of major quakes of 6.5-7 magnitude on the Hayward Fault of 130 years. The last major quake along the northern part of the Hayward Fault was 140 years ago, so we are over-due. They estimate that there is approximately a 65 percent chance a major quake will occur in the next 30 years.

Lennart was able to get survey notes from East Bay Municipal Utility District for the San Pablo Dam water tunnel to El Cerrito which crosses the Hayward Fault and shows that the right lateral horizontal movement of approximately one centimeter per year is matched by uplift of the east side of the fault of approximately one centimeter per year also. So, with the evidence of the horizontal displacement of the old Strawberry Creek of 600 feet horizontally along Galey Road, the Cretaceous sedimentary rocks east of the Hayward Fault there have also risen 600 feet. Building 50(?) sits on these Cretaceous strata which, as mentioned, dip westward 20-25 degrees. If an earthquake occurs when these beds are soaked with winter rains the chance of a major landslide

are great along the slippage planes of shale dipping westward. Minor slides have already occurred in these beds behind Bowles Hall. Indeed, the Foothill Student Housing was planned to be built there until I called attention to the landslide. A major landslide would probably destroy all the buildings on both sides of Galey Road from the Stadium to the buildings on both sides of Hearst Avenue and would probably reach Dow Library, destroying everything in its path to that point and possibly beyond. Buildings in the lower parts of both Strawberry and Blackberry Canyons would be buried if not destroyed.

Major landslides of the type I have described here are not rare along the Hayward Fault as was shown to us during our study of the Hayward fault at the base of the hill behind the Clark Kerr Campus. We discovered that most of that campus was underlain by a large landslide that had originated in Claremont Canyon, and was gradually moved northward along the Hayward Fault. Trenches and drill holes showed this landslide to be up to 30 feet thick. It extends westward to and possibly beyond Piedmont Ave. Further south is a huge landslide that underlies most of the campus of Mills College and extends westward another quarter mile Still further south are more large slides that have originated in canyons and steep slopes east of the Hayward Fault. As the hills rise and become unstable, earthquakes cause them to break loose and slide. Very few large slides have occurred on the eastern slopes of the Berkeley Hills, hence the relationship to earthquakes of major landslides close to the Hayward Fault along the western slopes of the Berkeley Hills. Normal erosion rounds off unstable areas on the eastern slope of the Berkeley Hills before they break loose and slide. CMTW-9 cont.

Most of the buildings of the Lawrence Lab. are on the unstable ground filling the old caldera, particularly the Bevatron and associated buildings. As the Cretaceous beds immediately west of these buildings have been eroded away there is nothing to keep these soft caldera-filled beds from sliding.. The buildings on them will certainly move a few feet in a major earthquake if not hundreds of feet. Keep in mind the Loma Prieta quake of l989 of magnitude 6.9 which from a distance of over 60 miles destroyed a section of the Bay Bridge, a section of the overhead freeway in Oakland killing 63 people, and many houses on filled ground in the Marina of northern San Francisco some 70 miles from the quake!

No major buildings of any kind should be constructed in either of these canyons bordering this huge block of unstable rock.

Profesor Emeritus Garniss H. Curtis
Dept. Earth and Planetary Science
University of California, Berkeley, CA

Garniss H. Curtis
Berkeley Geochronology Center
E-Mail: gcurtis@uclink.berkeley.edu

10/84

Attachment 1 (continued)

Sibley Volcanic Regional Preserve

Continued from reverse

is disrupted, giving the appearance of drag-folding resulting from relative uplift of the lava occurring during the past 10 million years. Alternatively, the disruption of the mudstones may have occurred earlier, at the time of volcanic activity. This site was close to, or was in, the wall of the volcano, and would have been subject to all kinds of slumping, sliding, and plowing. To see Post 5, proceed northwest along the main road, then take the first right, then left to the quarry pit.

5 Massive basalt was removed from this major quarry pit. The north wall shows a set of thick lava flows tilted on edge, nearly vertical. The well-defined layers near the top of the face are jointing-units resulting from shrinkage caused by cooling. They are analogous to the basalt pillars of Devil's Postpile in the southern Sierra.

6 This is a sequence of basaltic tuffs (ash) lying on top of a dark lava (far left), all tilted steeply to the east. The base of the tuffs was baked red, probably because the lava below was still hot and steaming when the ash landed. At the top of the sequence there is another lava flow (far right, to the right of the post) that baked the underlying tuffs red.

7 Before you is a basalt flow, massive at left, rubbley to the right. The lower parts of lava flows, coming into contact with cold land surfaces, harden early and are then often jumbled by turbulence and drag. The angle of the cut here makes the structure of the flow difficult to visualize, and the picture is further complicated by a shear zone (fault) cutting from lower left to upper right in the massive basalt, giving a false impression of bedding. The rubbley part of the flow is filled with vesicles caused by gas pockets, which were later filled with chalcedony, opal, calcite, zeolites, and sometimes green celadonite. To your far right you can see another view of the sequence at stop 6. Note the thin parallel bands in the soft tuff. These suggest the ash fell into water because bedding in ash that falls on dry land is usually disrupted by tree roots.

8 This huge, reddish-brown block of lava fell from the cliffs to the upper right. The lava cooled and hardened while it was still moving, resulting in dramatic fragmentation, what geologists call "autobrecciation" (self-broken).

9 Here you see hard lava to the right and left, and soft, easily eroded tuff between, all tilted eastward almost to vertical. The lava to the left baked the top of the tuffs brick red. This lava has been mostly quarried away, but looks as if it was probably 100-150 feet thick. These flows were not fluid, but contained enough silica to be more viscous. They probably moved at a slow walk, with glowing blocks of lava tumbling down a steep front and setting vegetation on fire.

10 The brick-red knobs in the foreground, and rugged outcrops of the same color on the skyline, are made of cinder that flew from Round Top and landed while still hot, so the pieces welded together.

11 The major valley to the north across Highway 24 is Siesta Valley. It coincides with the axis of the Siesta Syncline, a great fold that has lifted up thousands of feet of rocks on both sides. You are standing on the southwest limb of the fold, which includes all the rocks in Sibley.

HOW MANY VOLCANOES? Round Top is the obvious one. There are smaller ones outside the Preserve to the north and southeast. Another, of rhyodacitic composition (rather like the ash from Mount St. Helens), underlies the Lawrence Berkeley Laboratory and Little Grizzly Peak in Tilden Regional Park. About 9.8 million years ago it was erupting beside Round Top. Subsequently it was shifted about three and one-half miles northwest by movement along Wildcat Fault. That makes a total of four volcanoes.

THIS PRESERVE is named to honor Robert Sibley, a founder and director of the East Bay Regional Park District, and president of the Board of Directors from 1948 until his death in 1958. The original 227-acre Preserve was dedicated with Tilden Regional Park and Temescal Regional Recreation Area in October 1936, two years after the Park District's formation. A quarry site north of Round Top was added in 1977, and another quarry site farther to the northwest was added in 1991. Together, these acquisitions brought the Preserve close to its current 660 acres. With the addition of these quarry sites, the Park District inherited a cross-sectional look at relics of the volcanic activity that occurred in the Berkeley Hills.

At the southern park boundary is 235-acre Huckleberry Botanic Regional Preserve. The Skyline National Recreation Trail, which connects Richmond-El Sobrante to Castro Valley, traverses both of these parks.

POLICE, FIRE, MEDICAL EMERGENCY **9-1-1**
EBRPD HEADQUARTERS **1-888-EBPARKS**
PARK OFFICE **1-888-EBPARKS,**
..... **option 3, ext. 4554**
TDD ..... **(510) 633-0460**

To Reach Sibley Volcanic Regional Preserve: From Highway 24 just east of the Caldecott Tunnel, take the Fish Ranch Road exit and go north, uphill, for .8 miles to Grizzly Peak Blvd. Turn left and go 2.4 miles to Skyline Boulevard. Turn left on Skyline and proceed to the park entrance, on the left. PUBLIC TRANSIT: The closest bus line, AC Transit #305, runs Tuesdays and Thursdays, from mid-morning to mid-afternoon. From Lake Merritt BART, 19th Street BART, or Rockridge BART, take AC Transit bus 59 or 59A to the Montclair Transit Center. Transfer to AC Transit #305 and exit at Colton Boulevard and Ridgewood Drive. Walk the short distance from Colton to Skyline Boulevard, turn left and proceed a mostly level, 0.9-mile walk that passes the Huckleberry Preserve staging area. AC Transit: dial 511 (TDD/TTY: 1-800-448-9790) to confirm transit information.

If you would like this information in an alternative format, please contact the EBRPD Public Affairs Department at (510) 544-2200, fax (510) 635-3178, TDD (510) 633-0460, or info@ebparks.org.

East Bay Regional Park District
2950 Peralta Oaks Court,
PO Box 5381
Oakland, CA 94605-0381
1-888-EBPARKS www.ebparks.org

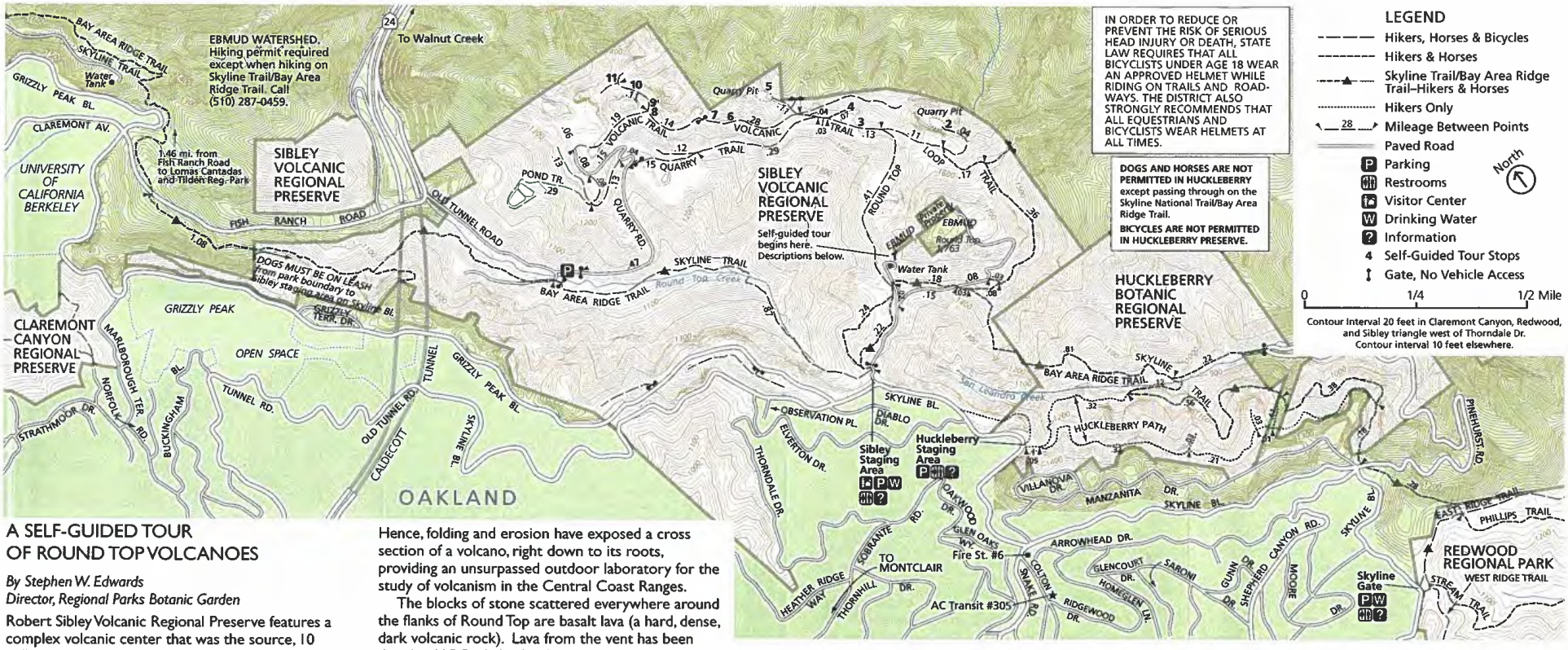
Rev. 4/10

Sibley Volcanic
Regional Preserve

East Bay
Regional Park District

11/04

CMTW-9
cont.



A SELF-GUIDED TOUR OF ROUND TOP VOLCANOES

By Stephen W. Edwards
Director, Regional Parks Botanic Garden

Robert Sibley Volcanic Regional Preserve features a complex volcanic center that was the source, 10 million years ago, of most of the lavas that underlie the ridges from Inspiration Point in Tilden Regional Park to Moraga. Round Top, one of the highest peaks in the Berkeley Hills, consists of lavas, breccias (unsorted mixtures of fine and coarse volcanic debris) and tuffs (lithified volcanic ash – ash that has become stone) that once filled a volcano.

Though Round Top was once the infilling of a great crater, it stands out today because it was originally surrounded by "incompetent" (easily eroded) sedimentary rocks of the Orinda Formation, which have eroded away. During the past 10 million years the Berkeley Hills were uplifted on a gigantic scale because of strains on the Hayward and Moraga fault systems. This uplift folded the rock formations, and the Round Top vent complex was tilted on its side. Hence, folding and erosion have exposed a cross section of a volcano, right down to its roots, providing an unsurpassed outdoor laboratory for the study of volcanism in the Central Coast Ranges.

The blocks of stone scattered everywhere around the flanks of Round Top are basalt lava (a hard, dense, dark volcanic rock). Lava from the vent has been dated at UC Berkeley by the potassium-argon radioisotopic dating method. The oldest is 10.2 million years old.

A great diversity of volcanic phenomena is preserved for study at Sibley. Basaltic dikes (feeders of the vents), tuff-breccias (ash containing a jumble of blocks and chunks of lava), lava flows, red-baked cinder piles, air-fall tuffs, and the major vent itself can all be seen first-hand in the course of an easy hike. Numbered posts, which correspond to the numbered descriptions below, have been placed at some of the most interesting outcrops.

1 To visit this site, walk up the paved road to the EBMUD water tank. A dark basalt dike, an important feeder of lava to the crater, cuts through a sequence of tuff-breccias (grayish brown) and pebbly mudstones (light gray), all inside and near the bottom of the crater. The mudstones indicate ponding of water; the tuff-breccias are the remains of landslides and blockfalls into the pit from the surrounding walls.

2 This pit was made by quarry operations in which huge amounts of massive basalt lava were removed. The result is a tremendous boon to geology, for the pit exposes the interior of the Round Top volcano. You are standing on bedded tuff-breccias, which filled much of the crater, settling at times into a small lake. Studies of exposures north and south suggest the crater was a little wider than the present quarry pit. The steep wall across the pit consists of lava that capped the crater after it was filled. Eventually the Round Top vent buried itself in basalt flows. From this point, note the view of Mt. Diablo, which, though it contains some submarine volcanic rocks, never was a volcano.

12.

3 This roadcut exposes Orinda Formation river gravels, sands, and mudstones. The red (when moist) streaks and layers in these river beds were caused by oxidation of iron in the sediments. Such varicolored "redbeds" are explored worldwide for the fossils of plants and animals they contain. Elsewhere in the Preserve, bands of more intense red are found at the tops and bottoms of lava flows. In such cases iron was oxidized and reddened by baking and steam action; these bands are called "bake zones." A related process occurs when a brushfire reddens rocks and soil. To see Post 4, walk about 100 feet past Post 3, then bear to the right.

4 Before you is a wall with basalt on the left and Orinda mudstones on the right. The bedding in the mudstones

Continued on reverse

CMTW-9 cont.

ATTACHMENT 5.(A)

Sibley Volcanic Regional Preserve

Continued from reverse

is disrupted, giving the appearance of drag-folding resulting from relative uplift of the lava occurring during the past 10 million years. Alternatively, the disruption of the mudstones may have occurred earlier, at the time of volcanic activity. This site was close to, or was in, the wall of the volcano, and would have been subject to all kinds of slumping, sliding, and plowing. To see Post 5, proceed northwest along the main road, then take the first right, then left to the quarry pit.

5 Massive basalt was removed from this major quarry pit. The north wall shows a set of thick lava flows tilted on edge, nearly vertical. The well-defined layers near the top of the face are jointing-units resulting from shrinkage caused by cooling. They are analogous to the basalt pillars of Devil's Postpile in the southern Sierra.

6 This is a sequence of basaltic tuffs (ash) lying on top of a dark lava (far left), all tilted steeply to the east. The base of the tuffs was baked red, probably because the lava below was still hot and steaming when the ash landed. At the top of the sequence there is another lava flow (far right, to the right of the post) that baked the underlying tuffs red.

7 Before you is a basalt flow, massive at left, rubbley to the right. The lower parts of lava flows, coming into contact with cold land surfaces, harden early and are then often jumbled by turbulence and drag. The angle of the cut here makes the structure of the flow difficult to visualize, and the picture is further complicated by a shear zone (fault) cutting from lower left to upper right in the massive basalt, giving a false impression of bedding. The rubbley part of the flow is filled with vesicles caused by gas pockets, which were later filled with chalcedony, opal, calcite, zeolites, and sometimes green celadonite. To your far right, you can see another view of the sequence at stop 6. Note the thin parallel bands in the soft tuff. These suggest the ash fell into water because bedding in ash that falls on dry land is usually disrupted by tree roots.

8 This huge, reddish-brown block of lava fell from the cliffs to the upper right. The lava cooled and hardened while it was still moving, resulting in dramatic fragmentation, what geologists call "autobrecciation" (self-broken).

9 Here you see hard lava to the right and left, and soft, easily eroded tuff between, all tilted eastward almost to vertical. The lava to the left baked the top of the tuffs brick red. This lava has been mostly quarried away, but looks as if it was probably 100-150 feet thick. These flows were not fluid, but contained enough silica to be more viscous. They probably moved at a slow walk, with glowing blocks of lava tumbling down a steep front and setting vegetation on fire.

10 The brick-red knobs in the foreground, and rugged outcrops of the same color on the skyline, are made of cinder that flew from Round Top and landed while still hot, so the pieces welded together.

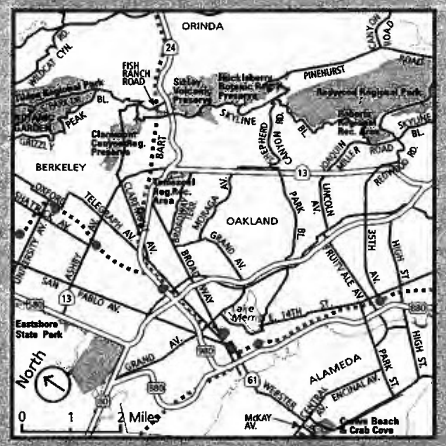
11 The major valley to the north across Highway 24 is Siesta Valley. It coincides with the axis of the Siesta Syncline, a great fold that has lifted up thousands of feet of rocks on both sides. You are standing on the southwest limb of the fold, which includes all the rocks in Sibley.

HOW MANY VOLCANOES? Round Top is the obvious one. There are smaller ones outside the Preserve to the north and southeast. Another, of rhyodacitic composition (rather like the ash from Mount St. Helens), underlies the Lawrence Berkeley Laboratory and Little Grizzly Peak in Tilden Regional Park. About 9.8 million years ago it was erupting beside Round Top. Subsequently it was shifted about three and one-half miles northwest by movement along Wildcat Fault. That makes a total of four volcanoes.

THIS PRESERVE is named to honor Robert Sibley, a Park District founder, director, and president of the East Bay Regional Park District from 1948 until his death in 1958. The original 227-acre Preserve was dedicated with Tilden Regional Park and Temescal Regional Recreation Area in October 1936, two years after the Park District's formation. A quarry site north of Round Top was added in 1977, and another quarry site farther to the northwest was added in 1991. Together, these acquisitions brought the Preserve close to its current 660 acres. With the addition of these quarry sites, the Park District inherited a cross-sectional look at relics of the volcanic activity that occurred in the Berkeley Hills. This brochure includes a self-guiding geological tour of the park.

At the southern park boundary is 235-acre Huckleberry Botanic Regional Preserve. The Skyline National Recreation Trail, which connects Richmond-El Sobrante to Castro Valley, traverses both of these parks.

POLICE, FIRE, MEDICAL EMERGENCY	9-1-1
EBRPD HEADQUARTERS	1-888-EBPARKS
PARK OFFICE	1-888-EBPARKS, option 3, ext. 4554
TDD	(510) 633-0460



To Reach Sibley Volcanic Regional Preserve: From Highway 24 just east of the Caldecott Tunnel, take the Fish Ranch Road exit and go north, uphill, for 1.8 miles to Grizzly Peak Blvd. Turn left and go 2.4 miles to Skyline Boulevard. Turn left on Skyline and proceed to the park entrance, on the left. PUBLIC TRANSIT: The closest bus line, AC Transit #305, runs Tuesdays and Thursdays, from mid-morning to mid-afternoon. From Lake Merritt BART, 19th Street BART, or Rockridge BART, take AC Transit bus 59 or 59A to the Montclair Transit Center. Transfer to AC Transit #305 and exit at Colton Boulevard and Ridgewood Drive. Walk the short distance from Colton to Skyline Boulevard, turn left and proceed a mostly level, 0.9-mile walk that passes the Huckleberry Preserve staging area. AC Transit: dial 511 (TDD/TTY: 1-800-448-9790) to confirm transit information.

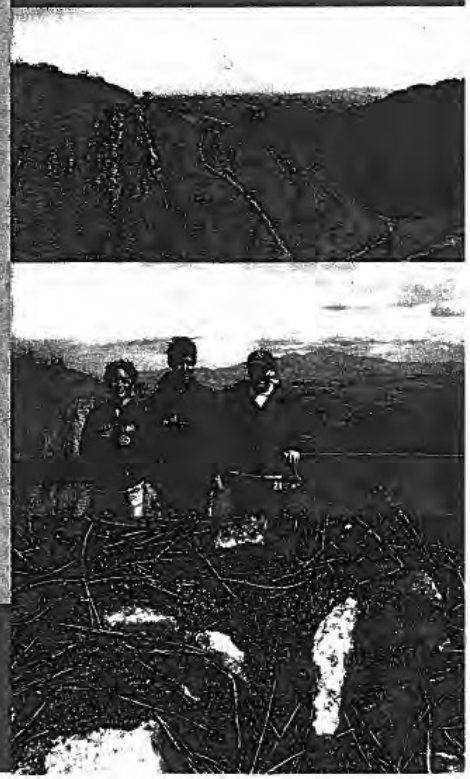
If you would like this information in an alternative format, please contact the EBRPD Public Affairs Department at (510) 544-2200, fax (510) 635-3478, TDD (510) 633-0460, or info@ebparks.org.

East Bay Regional Park District
2950 Peralta Oaks Court
P.O. Box 5381
Oakland, CA 94605-0381
1-888-EBPARKS www.ebparks.org

Rev. 8/09

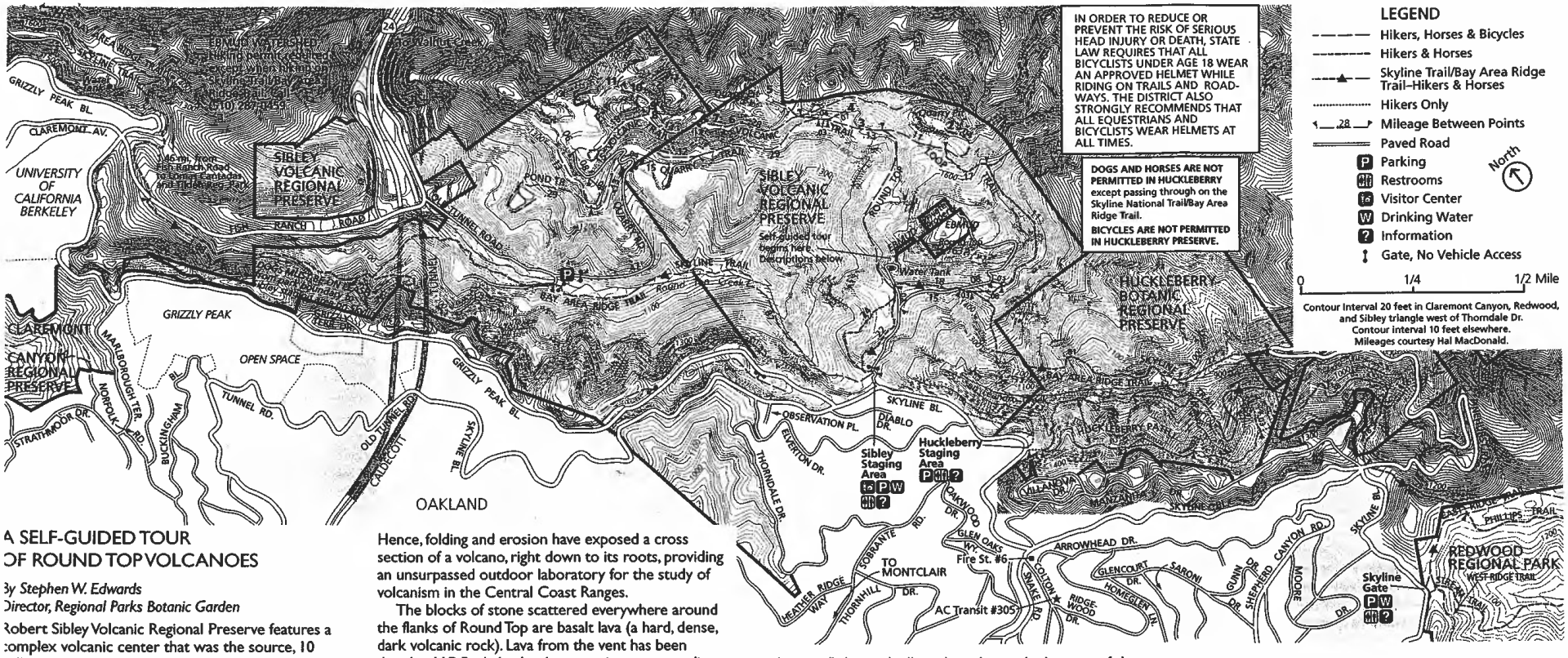
Sibley Volcanic Regional Preserve

East Bay Regional Park District



11/84

CMTW-9 cont.



A SELF-GUIDED TOUR OF ROUND TOP VOLCANOES

By Stephen W. Edwards
Director, Regional Parks Botanic Garden

Robert Sibley Volcanic Regional Preserve features a complex volcanic center that was the source, 10 million years ago, of most of the lavas that underlie the ridges from Inspiration Point in Tilden Regional Park to Moraga. Round Top, one of the highest peaks in the Berkeley Hills, consists of lavas, breccias (unsorted mixtures of fine and coarse volcanic debris) and tuffs (lithified volcanic ash–ash that has become stone) that once filled a volcano.

Though Round Top was once the infilling of a great crater, it stands out today because it was originally surrounded by "incompetent" (easily eroded) sedimentary rocks of the Orinda Formation, which have eroded away. During the past 10 million years the Berkeley Hills were uplifted on a gigantic scale because of strains on the Hayward and Moraga fault systems. This uplift folded the rock formations, and the Round Top vent complex was tilted on its side. Hence, folding and erosion have exposed a cross section of a volcano, right down to its roots, providing an unsurpassed outdoor laboratory for the study of volcanism in the Central Coast Ranges.

The blocks of stone scattered everywhere around the flanks of Round Top are basalt lava (a hard, dense, dark volcanic rock). Lava from the vent has been dated at UC Berkeley, by the potassium-argon radioisotopic dating method. The oldest is 10.2 million years old.

A great diversity of volcanic phenomena is preserved for study at Sibley. Basaltic dikes (feeders of the vents), tuff-breccias (ash containing a jumble of blocks and chunks of lava), lava flows, red-baked cinder piles, air-fall tuffs, and the major vent itself can all be seen first-hand in the course of an easy hike. Numbered posts, which correspond to the numbered descriptions below, have been placed at some of the most interesting outcrops.

1 To visit this site, walk up the paved road to the EBMUD water tank. A dark basalt dike, an important feeder of lava to the crater, cuts through a sequence of tuff-breccias (grayish brown) and pebbly mudstones (light gray), all inside and near the bottom of the crater. The mudstones indicate ponding of water; the tuff-breccias are the remains of landslides and blockfalls into the pit from the surrounding walls.

2 This pit was made by quarry operations in which huge amounts of massive basalt lava were removed. The result is a tremendous boon to geology, for the pit exposes the interior of the Round Top volcano. You are standing on bedded tuff-breccias, which filled much of the crater, settling at times into a small lake. Studies of exposures north and south suggest the crater was a little wider than the present quarry pit. The steep wall across the pit consists of lava that capped the crater after it was filled. Eventually the Round Top vent buried itself in basalt flows. From this point, note the view of Mt. Diablo, which, though it contains some submarine volcanic rocks, never was a volcano.

3 This roadcut exposes Orinda Formation river gravels, sands, and mudstones. The red (when moist) streaks and layers in these river beds were caused by oxidation of iron in the sediments. Such varicolored "redbeds" are explored worldwide for the fossils of plants and animals they contain. Elsewhere in the Preserve, bands of more intense red are found at the tops and bottoms of lava flows. In such cases iron was oxidized and reddened by baking and steam action; these bands are called "bake zones." A related process occurs when a brushfire reddens rocks and soil. To see Post 4, walk about 100 feet past Post 3, then bear to the right.

4 Before you is a wall with basalt on the left and Orinda mudstones on the right. The bedding in the mudstones

12/84

Continued on reverse

CMTW-9 cont.

The Curtis Caldera at LBNL is like a giant bowl, basin, syncline holding millions of gallons of water, perched groundwater, at various elevations causing instability in the hillside soils, landslides. Groundwater moves along the many earthquake faults at the lab site, comes up to the surface from springs, associated with the faults, continually causing havoc. (Attachment 6.)

Of special interest is the presence and movement of groundwater along the Wildcat Fault in the East Canyon at LBNL's Hazardous Waste Handling Facility site, B 85 complex. We understand that a project/study, titled NUMO, funded by the Japanese Nuclear Waste interests, is presently investigating the movement of water along the Wildcat Fault.

The DEA is extremely deficient in addressing concerns related to soils and groundwater. Indeed, the DEA completely excluded the analysis of soils (IV.B.6./p.49/53), and the importance of groundwater, its impacts on soils and movement along faults (IV.C.3./p.79) We therefore request that a full-scale EIS (Environmental Impact Statement) be prepared to address these and other concerns. We also ask that the findings of the NUMO Study, including the analysis of ⟶ the two 500 feet deep soil borings, taken at the HWHF site be included in the EIS.

As Attachment 7. we are enclosing the HYDROGEOLOGIC INVESTIGATION section (#5) of the Converse Consultants, Inc. 1984 HILL AREA DEWATERING AND STABILIZATION STUDIES, illustrating the continuing nature of slope stability problems at LBNL.

CMTW-10

Another glaring omission of the DEA was the total exclusion of analysis of Hazards from Wildfires under Cumulative Effects (V.B./p.160). LBNL is located in a High Risk Wildland Fire Zone/Critical Fire Area (California Fire Hazard Severity Zone).
In 1991, when some 4000 structures burnt in the Berkeley-Oakland Hills Firestorm, just 3/4 miles from LBNL, one canyon away, the entire lab was evacuated. The lab director gave orders to the 2 remaining firefighters at the lab's firestation to evacuate, all LBNL firetrucks had already been sent to Oakland, and thus the Nuclear-Industrial Complex, in the middle of a residential neighborhood, during a historic firestorm was left alone, unprotected.

What indeed are LBNL's plans to fight a radioactive fire? What plans are in place to protect the surrounding residential neighborhoods from radioactive fallout? Are there any coordinated efforts to evacuate surrounding residents, some only some 100 meters from LBNL's fenceline? The more laboratory buildings in the canyon, the more chemical and radioactive materials and waste will result, all of this needs detailed analysis in a full-scale EIS!

CMTW-11

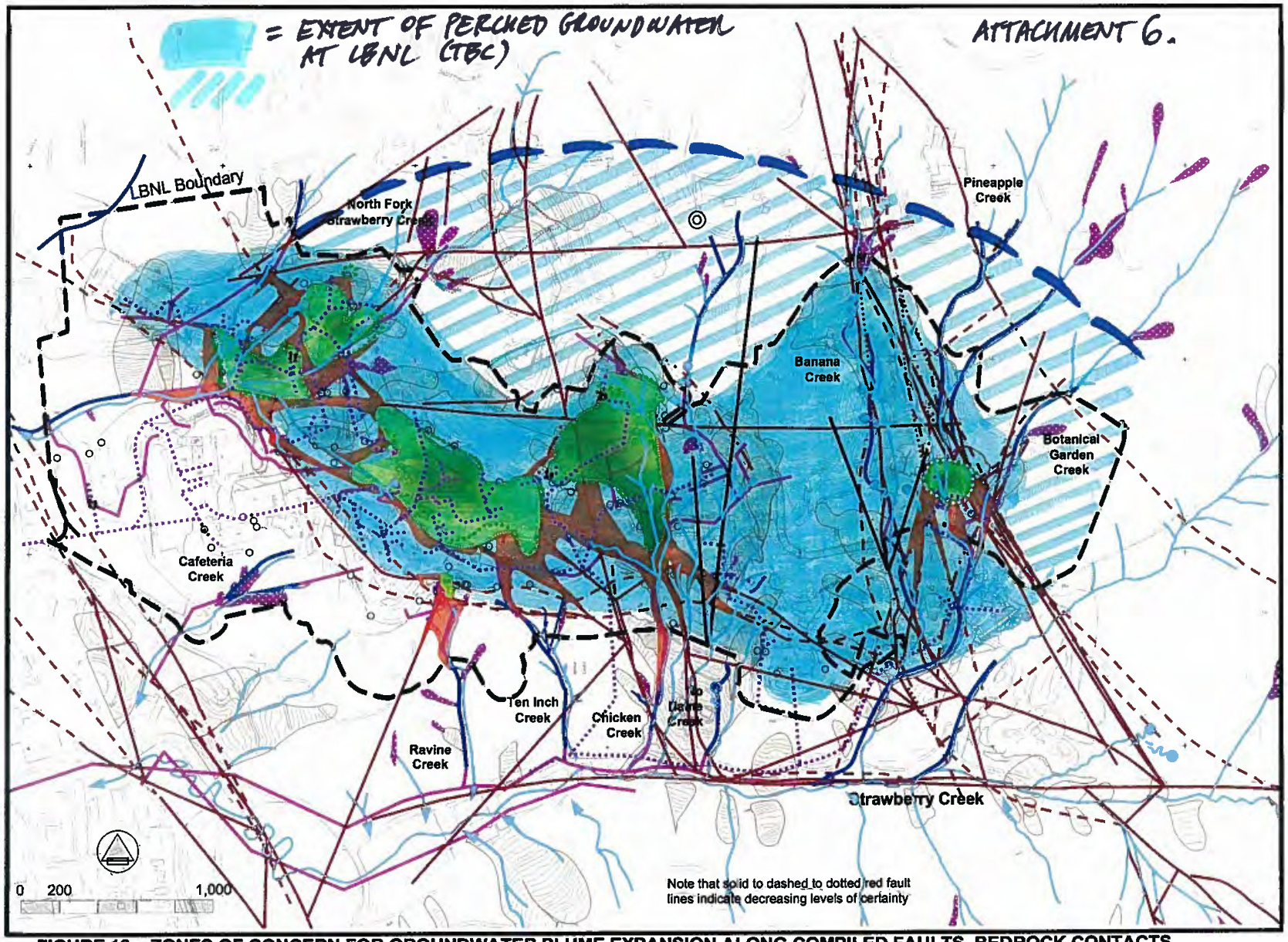


FIGURE 18a. ZONES OF CONCERN FOR GROUNDWATER PLUME EXPANSION ALONG COMPILED FAULTS, BEDROCK CONTACTS, LANDSLIDES, HISTORIC AND MODERN CREEKS. SEE NEXT PAGE FOR MAP LEGEND.

ATTACHMENT 7.
(25 PAGES)

HILL AREA DEWATERING AND STABILIZATION STUDIES

October 1984

CMTW-12 cont.

Prepared for:

University of California
Department of Facilities Management
2000 Carleton Street
Berkeley, California 94720

P. 15/84

5. HYDROGEOLOGIC INVESTIGATION

5.1 PURPOSE

Continuing slope stability problems in the Lawrence Berkeley Laboratory (LBL) - Centennial Drive hill area have been thought in the past to be related to large amounts of ground water and high groundwater levels. Various measures have been attempted in the past to remove ground water from the hill area slopes in order to improve the gross stability of the slopes, with varying degrees of success. Such work, including the installation of wells and horizontal drains (hydraugers) has been less expensive than other potential mitigations but apparently has not been successful for all conditions in preventing further landsliding, creeping deformation and other slope instability.

The present investigation was undertaken for the following reasons:

(1) to clarify the role of ground water in affecting slope stability of the area,

(2) to identify specific areas where high groundwater levels may present a slope stability problem,

(3) to formulate opinions as to the effectiveness (past, present, and future) of dewatering, or groundwater removal in the upper hill area in improving the stability of the area, and

(4) to develop preliminary recommendations for a type and extent of a dewatering program should such a program be determined to be effective and economical.

CMTW-12 cont.

5.2 SCOPE

The following items were included in the scope of investigation:

(1) collect and review previously existing data on both University and LBL wells and hydraugers in the study area;

(2) collect rainfall data for the hill area;

16/84

(3) install a network of piezometers at selected locations to provide additional information on groundwater conditions throughout the hill area;

(4) monitor the groundwater net by taking water level measurements in the newly installed piezometers and in selected LBL well and inclinometer holes for a period of approximately one year;

(5) reduce, tabulate, and plot all rainfall, piezometric, well and drain data for the hill area in the vicinity of Centennial Drive (i.e., excluding all portions of LBL to the southwest and west of LHS);

(6) develop contour maps showing seasonal variations of the primary groundwater surface and depth to ground water for the study area, and identify areas where high groundwater levels may present a slope stability problem;

(7) analyze all data in order to develop conclusions regarding the relationship between groundwater depth and slope stability in the area and the effectiveness of past and future dewatering attempts in the hill area; and

(8) provide preliminary recommendations for a dewatering program if judged to be warranted.

CMTW-12 cont.

5.3 PREVIOUS WORK

Past geotechnical work performed in the LBL-Centennial Drive hill area is described in general in Section 1.5. Small-scale dewatering had been performed in the past for LBL for localized areas of slope instability or failure under consultants such as Harding-Lawson (HLA) and Dames and Moore (D&M). An attempt was made by the University to institute a hill area dewatering program in the 1970's. Lennert and Associates was retained by the University in April, 1973 as consulting civil engineers for the program.

The first attempt at dewatering the hill area was the installation in the spring of 1975 of Shively Well No. 1 (see Section 5.4.2) by Lennert. The second, and last attempt by Lennert involved the installation in the summer of 1979 of two hydraugers (789-A and 789-B; see Section 5.4.3) from the Poultry Husbandry area northward toward the Animal Behavior Research Station (Hydrauger 789-A) and Building 77 (Hydrauger 789-B). Together with the hydraugers, a second dewatering well (789-1) was drilled at the top of the hill overlooking Centennial Drive and the Corporation Yard to the southwest.

17/84

This well, however, became clogged and could not be effectively pumped. The well was subsequently abandoned but has intermittently been used as an observation well (see Section 5.4.3).

Dewatering measures instituted by Lennert were based on the belief that the main reservoir of deep ground water in the hill area is the volcanic flow (i.e., fractured) rocks of the Moraga Formation situated within a synclinal structure underlying the ridge extending from LBL Building 62 northward to Little Grizzly Peak. These flow rocks were thought to be bottomed in the syncline by less permeable Orinda Formation bedrock (although some permeable sandstone and conglomerate beds within the Orinda exist, they are interbedded with impermeable shales and siltstones). Lennert asserted that ground water was also controlled in the hill area by faults such as the University fault (Section 4.4.1.2.4) and the New fault (Section 4.4.1.2.5) which acted as groundwater barriers or as conduits for water flow through cracks and voids along these faults. Lennert also asserted that surface water entered these "tension faults," entering directly and quickly into the groundwater regime.

Lennert's dewatering program was designed to intercept water in the tension faults and to lower the regional groundwater table by removing water from the reservoir of permeable Moraga flow rocks within the syncline. An evaluation of the effectiveness of Lennert's program is discussed in Section 5.4.4.

CMTW-12 cont.

5.4 CURRENTLY AVAILABLE DATA AND DATA SOURCES

Currently available hydrogeologic data consisted of flow and piezometric measurements of various wells, hydraugers, and subsurface drains by consultants or by LBL or University personnel. The general locations of the wells, hydraugers, and drains with information utilized in this investigation are shown on Plate 4. Measurements have been and are currently being recorded by University personnel for flows in Shively Well No. 1 (Section 5.4.2), hydraugers in the Botanical Garden and Poultry Husbandry areas (Section 5.4.3), and the subdrain for the LHS creek fill (Section 5.4.4).

Measurements on wells and slope inclinometers on LBL property have been and are currently being recorded by LBL maintenance personnel. The records include flow and water level measurements in the Building 46 and 51 (Bevatron) area, Corporation Yard area, Building 77 (Mechanical shops) area, and Building 71 (HILAC) area. Of the many wells and inclinometer holes on LBL property, only those located in areas

18/84

judged to be critical in the past were measured by LBL personnel. Readings were continued only if sufficient variations in water levels were noted. Readings were taken more frequently during rainy months as opposed to dry months. Because of personnel changes, most of the LBL records could not be found and only records covering the periods from January, 1979 to November, 1981, and August, 1983 to the present were available.

5.4.1. Rainfall Data

Rainfall records for the period July 1, 1964 through January 31, 1984 were obtained from the LBL Environmental Health and Safety Group. The rainfall gauge is located a Building 75 in the LBL Corporation Yard. Daily rainfall figures for the five-year period 1979-83 are tabulated on Drawings C-1 through C-10 and are shown in bar graph form on Drawings C-11 through C-15. Total annual rainfall figures for the rainfall years 1964-65 through 1982-83 are summarized in Table 5-1.

CMTW-12 cont.

TABLE 5-1

TOTAL ANNUAL RAINFALL BY RAINFALL YEAR*

LAWRENCE BERKELEY LABORATORY, BLDG. 75

Rainfall Year	Rainfall (inches)	Rainfall Year	Rainfall (inches)
1964-65	25.16	1974-75	24.00
1965-66	18.73	1975-76	10.79
1966-67	32.92	1976-77	12.79
1967-68	17.22	1977-78	37.22
1968-69	34.21	1978-79	22.53
1969-70	27.09	1979-80	30.95
1970-71	23.94	1980-81	16.90
1971-72	13.93	1981-82	48.91
1972-73	36.78	1982-83	43.52
1973-74	35.92		

*July 1 - June 30

19184

5.4.2 Shively Well No. 1

Shively Well No. 1 was installed by Ben Lennert in the spring of 1975 adjacent to the dirt road near the south end of the Space Sciences Laboratory parking lot (see Plate 4). The well was intended to help lower the groundwater level in the rock structure underlying the ridge and to improve stability conditions in the LHS and Corporation Yard areas. The well was drilled to a depth on the order of 400 feet. A boring log for this well could not be found.

A 10-hp pump was installed in the well at a depth of approximately 380 feet, with an automatic switching probe to activate the pump whenever the water level rose to 30 feet above the pump (depth of 350 feet). A pneumatic gauge for direct reading of water depth in the well is located in a box next to the well. The first 10-hp pump was activated in April, 1975 and operated more or less continuously (with occasional breakdowns) until the pump burned out and was replaced in March, 1982 by a 3-hp pump. The 3-hp pump operated on a continual basis from March, 1982 to December, 1983, when the pump was replaced again with a 10-hp pump which was installed on December 7, 1983. The pump was replaced because the groundwater level was found to be approximately 160 feet above the pump elevation in the well (i.e., at a depth of 220 feet). This fact indicated that either the pump had failed, or that the pump did not have sufficient capacity to draw down the water table to the level of the pump.

CMTW-12 cont.

Pumped water from the Shively well is stored in an adjacent water tank. Overflow from the tank was originally discharged into the drainage basin leading to the Centennial Drive overpass area. Because of concern for excess groundwater recharge, a diversion pipe was constructed in May, 1980 to connect the storage tank to a storm drain inlet near the Cell Culture Laboratory parking lot in the overpass area. This pipeline broke around December, 1982 and was replaced by a temporary line running from the well to a catch basin in the LHS east parking lot. The original diversion pipe was repaired and reconnected to the storage tank in December, 1983.

Pump flow readings (in gpm) in the Shively well were taken by Lennert between the time of installation to the end of 1979. His detailed records, if any, were not found, but his past correspondence with the University indicated that the well was pumping about 31 gpm in late 1975, and between 8 and 15 gpm between April, 1978 and July, 1979.

Pump flow readings for Shively No. 1 have been recorded by University personnel on an intermittent basis since October, 1979. These records were tabulated and are presented on Drawings C-16 through C-23. The results are also plotted for

20/84

calendar years 1979 through 1983 on Drawings C-32 through C-36. The records indicate that flow between October, 1979 and February, 1980 ranged from 20 to 27 gpm, after which flows dropped to 15 to 16 gpm through 1980. Flows ranged from 11 to 15 gpm from January, 1981 through mid-February, 1982 when the 10-hp pump failed. After replacement with the 3-hp pump, flows were measured at 22 to 28 gpm until December, 1982, when readings were discontinued because the temporary overflow pipe was connected to the measurement point at the storage tank. Flow readings were resumed when the 10-hp pump was reinstalled in December, 1983.

Water levels in the well were not taken in the past. The water level was recorded on December 1, 1983 to be at a depth of 220 feet when the 3-hp pump was removed. On December 7, 1983, the depth to water was measured at 200 feet prior to installation of the 10-hp pump. As of February 7, 1984, the depth to water in the well was measured at 334 feet.

5.4.3 Lennert Hydraugers

As part of University contract work, numerous hydraugers were installed in the hill area by Lennert and Associates. These included hydraugers installed in the Corporation Yard slope in 1968, Hydraugers Nos. 1 and 2 and two others in the overpass/Botanical Garden area installed in 1969, and Hydraugers Nos. 789-A and 789-B installed in the Poultry Husbandry area in 1979. The hydraugers installed by Lennert in the Corporation Yard were apparently connected to a manifold within the buttress fill constructed in 1975 (Section 6.2.-4.1), and can no longer be individually measured.

CMTW-12 cont.

Hydrauger Nos. 1 and 2, as shown in Plate 4, were installed to lower groundwater levels in the overpass area because of the noted instability in the overpass abutments. Hydrauger Nos. 1 and 2 were 4.5-inch and 2.5-inch diameter drains, respectively, drilled into the area north of the overpass. Both drains exited in Mather Grove south of the overpass and west of Mather Creek. In addition, a 27-foot deep subdrain was installed on the north side of Cyclotron Road terminating at a vertical well connected to Hydrauger No. 1. Two other hydraugers were installed on the north side of Cyclotron Road north of the guard shack, but are sealed and cannot be measured.

A hydrauger was also supposedly installed through the cistern in the old quarry at the northeast end of the Cell Culture Lab parking lot. According to LBL personnel, this hydrauger may have been the upstream end of the original Hydrauger No. 2 which was reportedly sheared off in the 1970's and then connected to the storm drain system. A

21/84

replacement Hydrauger No. 2 was then drilled. This account of such a replacement could not be confirmed from written correspondence or maps.

Flow records were supposedly kept by Lennert for Hydrauger Nos. 1 and 2 through 1979. Measurements of these two hydraugers have been recorded by University personnel since October, 1979. The latter records are tabulated in Drawings C-24 through C-31 and are plotted in Drawings C-37 through C-40. Readings were not taken between May and August, 1980, when the ends of the hydraugers rusted off. The ends were subsequently re-exposed and readings taken until April, 1982 when measurements could no longer be taken. Flow has since been observed in Hydrauger No. 1, but flow apparently ceased in Hydrauger No. 2 in 1982 probably because of the slide movement in the east overpass abutment. Hydrauger No. 2 was removed south of the overpass during excavation for the east abutment compacted fill repair in late 1983.

Hydrauger Nos. 789-A and 789-B were drilled in 1979 to lengths of approximately 2,100 and 910 feet, respectively, as shown in Plate 4. Hydrauger No. 789-A was drilled with the intent of dewatering the Moraga flow rocks located in the syncline as postulated by Lennert. The holes were encased with 6-inch diameter casing for the first 1,100 feet, and with 5-inch or 4-inch diameter casing at greater horizontal depths. Three alignments were actually drilled into the hill starting at the same entry point in the Poultry Husbandry area. According to Lennert, aquifers were encountered between 1,057 and 1,092 feet and at approximately 1,780 feet (horizontal distance). Maximum initial water flows from these aquifers were on the order of 100 and 1,000 gpm, respectively, dropping off substantially with time to flows at the pipe outlet presently on the order of 4 to 12 gpm. Hydrauger No. 789-A was intended to intersect Test Well 789-1, but it cannot be determined how close to the well the hydrauger is actually located.

CMTW-12 cont.

Hydrauger No. 789-B was intended to intercept any seepage resulting from leakage from Hydrauger No. 789-A, and was drilled to the northeast corner of Building 77. This hydrauger was cased to 100 feet with 6-inch diameter steel pipe, and the rest of the way with 1.5-inch diameter slotted plastic pipe. The initial flow from this hydrauger was on the order of 30 gpm, decreasing to about 1 gpm after one month.

Flow measurements of Hydrauger Nos. 789-A and 789-B have been recorded by University personnel since October, 1979 and February, 1980, respectively. These flows are tabulated on Drawings C-24 through C-31 and are plotted on Drawings C-41 through C-45.

22/84

5.4.4 LHS Creek Fill Subdrain

Measurements of flow from the subdrain outlet of the LHS creek fill subdrain (Section 6.1.4) have been recorded by University personnel since October, 1979. The measurements are tabulated on Drawings C-16 through C-23 and are plotted on Drawings C-46 through C-50. The outlet for the 8-inch diameter subdrain pipe is located in Blackberry Canyon below the toe of the creek fill.

5.4.5 Test Well No. 789-1

Test Well No. 789-1 was drilled in 1979 to a depth of 667 feet on the knoll southeast of Shively Well No. 1, as shown on Plate 4. The well was intended to complement the Shively Well in dewatering the Moraga volcanic flow rocks in the postulated underlying syncline. The well could not be developed, however, and currently functions only as an observation well. A limited number of water level readings have been recorded in the past and during the present investigation. These readings are tabulated on Drawing B-23.

5.4.6 LBL Wells and Slope Inclinometers

Numerous wells (pumping or observation-type) and slope inclinometer casings have been installed throughout LBL property by LBL or its consultants. These installations are concentrated at locations experiencing previous slope stability problems such as in the Bevatron area (Buildings 46 and 51), the Corporation Yard, the Building 77 area, and the HILAC building (Building 71). Water level readings were obtained for a number of these holes in which LBL personnel have taken past readings. A certain number of these holes were selected for use in helping to develop groundwater contour maps for the hill area (Section 5.7.1). For these holes, past variations in groundwater depth were noted, certain 1983 readings were utilized, and additional readings taken during the course of the present investigation by Converse personnel. The selected holes are listed in Table 5-2.

CMTW-12 cont.

5.4.7 LBL Hydraugers

Slope stabilization work on LBL property has also included the installation of hydraugers in previously identified unstable areas such as east of Buildings 46 and 51, on the slope to the southeast of Building 71, and in the Corporation Yard and Building 77 areas. Measurements by LBL maintenance personnel have been tabulated and plotted in this report for hydraugers measured at Buildings 71 and 77.

23/84

TABLE 5-2

SUMMARY OF EXISTING LBL WELLS AND CASINGS UTILIZED FOR GROUNDWATER MEASUREMENTS

LBL Hole Designation	Hole Type	General Location
HLA-1.064	SI	Corporation Yard Guard Shack
HLA-2.064	SI	NE Corner, Building 76
HLA-1.098	SI	Centennial Drive
HLA-2.098	SI	Corporation Yard Fill Slope
HLA-3.098	SI	Centennial Drive
HLA-7.102	OW	SW Corner, Building 53
HLA-8.107	SI	NW Corner, Building 46
HLA-1.108	SI	On Road E of Building 76
HLA-2.108	SI	SW Corner, Building 77
HLA-7.130	SI	Lower Corporation Yard Slope
HLA-10.130	OW	Corporation Yard
HLA-15.130	OW	Corporation Yard
HLA-18.130	SI	N Side of Building 77
HLA-19.130	OW	Loading Dock, NE Corner, Bldg 77

KEY

OW = observation well
SI = slope inclinometer casing

CMTW-12 cont.

The Building 71 hydraugers were installed to the south of Building 71 on the east side of the "Y" road intersection.

24/84

These hydraugers were installed in 1970 and were drilled eastward into the LHS hill, underlying an old landslide which occurred in 1970 and was repaired in 1974. The hydraugers are connected to a manifold and are measured at a location below the building.

The Building 77 hydraugers measured by LBL personnel are one of numerous sets of hydraugers drilled in the cut and fill slope behind Building 77 below the Corporation Yard. Flows are measured from a manifold daylighting from the slope connected to four hydraugers installed by HLA which extend beneath the Corporation Yard. In addition to these and other hydraugers installed in the slope by HLA, 15 hydraugers were installed in 1962-63 in the same slope by Dames and Moore.

Measurements for the hydraugers are tabulated on Drawings C-16 through C-31 and are plotted on Drawings C-46 through C-50 (Building 71) or on Drawings C-42, C-43 and C-45 (Building 77). Measurements for the Building 71 hydraugers were obtained for the periods October, 1979 through November, 1981 and August, 1983 through December, 1983 as recorded either by LBL or University personnel. Measurements for the Building 77 hydraugers were obtained from March, 1980 through February, 1981, and from August, 1983 through December, 1983.

CMTW-12 cont.

5.5 NEW DATA SOURCES

In order to obtain a reasonably accurate network of groundwater level measurement points, new piezometers and inclinometer holes were installed by Converse throughout the hill area. These installations were used in combination with surviving piezometers, wells, and inclinometers installed during previous work for the University or LBL.

A total of 17 Converse piezometers, labelled P-1 through P-17 were monitored during the study period (through February, 1984). Installation details for the piezometers are described in Section 3.1.3. A total of eight slope inclinometers, labelled SI-1 through SI-8, were also monitored for water levels during the study period. The locations of the piezometers and inclinometers and other general information are shown on Plate 1.

Water level measurements were taken during the period from December, 1982 to February, 1984, though not all installations were measured over the entire period. Piezometers P-1 through P-12 and slope inclinometers SI-1 through SI-8 were installed during or before December, 1982, while piezometers P-13 through P-17 were installed at a later date.

25/84

Water level readings taken from the piezometers and inclinometers are tabulated on Drawings B-12 through B-26. These readings are also plotted on Drawings B-27 through B-34.

5.6 GROUNDWATER GEOLOGY

Adverse groundwater conditions have been evident at the Berkeley hillside throughout its gradual change from undeveloped rangeland to an office and research complex for the University. In the 1880's and early 1900's, the abundant springs on the hill supplied water to some of the residents of eastern Berkeley. At one time a spring on the hill fed a storage tank located near the south end of the LHS. This tank was connected to residential areas below by a buried pipe that can be seen today where it has been exposed in a landslide scarp below the LHS. During excavations for the LBL Bevatron an adit into the hillside was exposed. The adit served as a collection gallery for spring water that was piped to Hilgard Avenue for domestic use, and flowed at a steady 18 to 20 gpm once reopened by a bulldozer.

Periodically springs appear at other locations on the hill where they never occurred before. Water levels in an observation well above the LBL Corporation Yard have risen 30 feet in a 48-hour period at a time when no rain had fallen for weeks. A similar well located less than 100 feet away showed no change in level during this time.

CMTW-12 cont.

Relatively continous monitoring of hill area groundwater levels has been conducted by University and LBL staff and by various outside consultants as described in Section 5.4. Ben Lennert has stated in past reports that deep groundwater levels in the hill tend to vary during a typical year, with highest levels generally occurring in September with lesser peaks in May-June and July. This contention was not well supported, however, by the presently available and newly generated data reviewed for this investigation. In 1983, many hydraugers and wells appeared to reach maximum flow levels and water elevations around April, declining after April and starting to rise again in November or December (see Section 5.7.2.1). Most wells also show some differences in time of response to precipitation, and some do not appear to respond to any conventional stimuli, including rainfall, drought, drainage installation or local pumping.

5.6.1 Structure and Controls

Groundwater levels and flow patterns within the Berkeley hillside are controlled by the combined effects of the deformed, interbedded rocks and fractures superimposed on the

26/84

rocks. Contact relations and discontinuity patterns are important for understanding the groundwater flow regime.

5.6.1.1 Permeability

The permeability of a rock (its ability to permit fluids or gases to reside within or move through the rock mass) is generally thought of as being composed of two component permeabilities: primary and secondary permeabilities. Primary permeability is dependent upon interconnected voids within the rock mass. This permeability can range from extremely high in clean, coarse sandstones or gravel conglomerates, having many large, connected voids that transmit fluids easily and rapidly, to nearly zero in hard crystalline rocks and shales having low void ratios and restricted flow paths. Secondary permeability is that derived from discontinuities within the rock, including all sizes of cracks, features, fault zones or bedding planes. Similarly, secondary permeability can range from extremely high in rocks containing open fractures to negligible in isotropic, unfractured plutonic rocks.

In the rocks of the Berkeley Hills near the campus, secondary permeability in the form of rock fractures is by far the most important. Though large contrasts in primary permeability undoubtedly exist between the different rock types on the hillside, the primary permeabilities are all too low to play an important role in local groundwater flow. Locally, the Orinda Formation may contain a few small lenses of pervious sandstone and conglomerate, but these are not believed to be extensive.

CMTW-12 cont.

Secondary permeability in the form of fractures within the rock mass is therefore thought to control groundwater flow in the upper campus hill area. All of the rocks within the hill area appear to have been fractured to some degree, with the resultant permeability depending partly on the lithologic characteristics of the host rock. Generally, softer, clay-rich formations such as the Cretaceous shales and Orinda shales do not develop high permeabilities when fractured, since the softer rock tends to "heal" fractures unless they are mechanically opened. Extremely high secondary permeability is typically developed by fracturing of hard volcanic rocks of the Moraga Formation, which includes tuff-agglomerate, breccias and flow rocks. Flow rocks often develop a network of open cracks oriented perpendicular to cooling surfaces after extrusion. Later tectonic and vent-collapse related fractures are then superimposed on the original breaks, leaving an extensively fractured rock that provides a conduit for rapid flow of large quantities of water. The 100+ gpm instantaneous flows noted during the

27/84

drilling of Hydrauger 789-A were associated with highly fractured volcanic flow rock. Drillholes made at many locations of the upper hill area have revealed the Moraga volcanics to be pervasively fractured at depth, in many cases to the extent that drilling became impossible owing to rapid loss of drilling fluids from the borehole. Infrequent surface exposures of slightly weathered bedrock on the hill show closely spaced joints and irregular fractures in a chaotic assemblage. Fracture margins locally show some weathering or alteration of the rock mass to clay, but most remain clean and hard. Consistent patterns of strong fracturing are not discernible due to the poor exposures and highly weathered state of most outcrops.

5.6.1.2 Contacts

Both depositional and faulted geologic contacts have significance for the movement of ground water, in that often a contact represents a surface across which large variations in the physical characteristics, including primary and secondary permeabilities, may occur. Fault contacts may have special importance because they can form a groundwater boundary or conduit in otherwise isotropic rocks. The Orinda Formation overlies the Cretaceous shales at the site along an old fault zone composed of highly fractured, weathered gouge and clayey material, probably an effective barrier to groundwater flow. The two formations, however, are predominantly composed of weathered, soft shales and mudstones with low primary permeability, so little flow occurs through these rocks anyway. In terms of permeability contrasts, the contact between the older sedimentary Orinda and younger, volcanic Moraga Formations is more important. These rocks are interfingered and interbedded, forming an irregular contact zone locally altered to rock fragments, in a clayey matrix.

CMTW-12 cont.

Ground water may move relatively freely through the fractured Moraga rocks, but is impeded from flowing easily into and through the Orinda by the relatively impermeable contact zone and the less pervious nature of the Orinda rocks. This restriction results in an accumulation of water at and above the contact zone, and flow along the contact when gradients are sufficient. Often, such flow exits the hillside in the form of springs or seeps. A comparison of observed springs and seeps on the hill in recent years with mapped geology shows a strong correlation between spring locations and the Orinda-Moraga contact zone. Since this contact is irregular, owing to the partly interbedded nature of the formations, springs do not occur at a single level on the hill.

Consideration of available data indicates that of the three fault zones in the area supported by geologic evidence

28/84

(i.e., the Wildcat, Hayward, and Strawberry Canyon faults), the Wildcat fault zone bears the most important role in the hydrogeology of the hill. Both the Hayward and Strawberry Canyon zones occupy topographically low positions, placing them well below the elevations of hill area trouble spots. The Wildcat fault, however, may locally create a groundwater barrier, and is also important because it juxtaposes the hill area rocks with the probable source area for the prodigious quantities of ground water that have plagued the hill area.

The inferred source area of ground water is a major northwest striking syncline east of the Wildcat fault, formed in Claremont, Orinda and Moraga rocks. The synclinal structure, one of a series of major folds in the Berkeley hills, extends from southeast of Round Top Regional Park/Sibley Volcanic Preserve to north of the campus hill area. The syncline is relatively flatlying, with portions dipping northwest or southwest in detail. It is probable that the syncline is interconnected with the campus hill area via fractures within the volcanic rocks, providing relatively free flow between the syncline and the hill area.

It is not presently known how the fault gouge within the Wildcat zone affects flow. Since the Wildcat has been mapped previously as a collection of en-echelon faults not necessarily continuously connected, it may be possible that it does not represent an effective barrier to flow across its trace.

CMTW-12 cont.

5.7 EVALUATION AND CONCLUSIONS

5.7.1 Groundwater Contour and Depth Maps

In order to more accurately develop a picture of groundwater conditions in the hill area and help identify locations where slope stability may be influenced by ground water, maps showing the seasonal variation of groundwater elevation and depth were prepared. The maps were based on water level measurements taken in various wells, piezometers, and slope inclinometer casings throughout the study area representing the following four periods:

(1) Spring, 1983 (mid-April)

(2) Summer, 1983 (early-August)

(3) Fall, 1983 (early-November)

(4) Winter, 1984 (early-January)

29/84

The time of readings selected (e.g., mid-April) for mapping were chosen to best exemplify the conditions to be expected over the particular season. Unavoidably these maps do show some anomalies that are peculiar to the particular study period and may not be representative of other years (See Section 5.7.2 for discussion). Readings for early January, 1984 were used to represent typical winter conditions rather than mid-season readings, since a period of relative drought occurred after January, 1984 as compared to normal rainfall years.

The measurement points used to construct each map are shown on the groundwater contour map for each season. The maps are intended to represent the approximate location where the main body of ground water would be expected to be encountered. The maps do not take into account nor identify the presence of perched water tables. Perched ground water was noted at some locations measured by the double-installation piezometers such as at P-4, P-5, and P-9. At these locations, the measured water level judged to represent the location of the main groundwater body was selected for use.

Since close spacing of measurement points was required to obtain reasonable accuracy, only the portion of the hill area centered on Centennial Drive was selected for mapping. The mapped area is oriented roughly southeast-northwest and includes the overpass and Botanical Garden areas, Building 77 and Corporation Yard areas, and the LHS and Space Sciences Laboratory areas. Because of a lack of closely-spaced data points, the Bevatron, Cyclotron, HILAC, Poultry Husbandry and southern Botanical Garden areas were not mapped.

CMTW-12 cont.

Maps showing both groundwater contours and depth to ground water were generated using computer program GPCP, developed originally by California Computer Products, Inc. (CALCOMP). The degree of accuracy of these maps is primarily dependent on the spacing of the input measurement points and a selected spacing of the computer program grid. As expected, the degree of accuracy of any extrapolated points on the map (i.e., any locations that are not between two or more measurement points) is much lower than for interpolated points.

A total of eight maps were produced and are included in Plates 5 and 6 (groundwater contour maps) and Plates 7 and 8 (depth to ground water maps). The maps represent a simplification of actual groundwater conditions because of limitations on the number of available data points and on the method of analysis. For instance, the program cannot model local fluctuations in groundwater levels due to geologic factors such as seepage barriers, faults, or formational contacts. The generated groundwater contours, however, do

appear to be quite reasonable compared to the topographic ground surface and the groundwater level input data. The only reasonably suspected fault-related groundwater barrier in the study area; i.e., the Wildcat fault, is, for the most part, not included in the mapped area.

It should be noted in particular that the "depth to ground water" maps are most likely accurate only near points of water level measurement. The depth values generated by the computer program were obtained with respect to a generally "smoothed" topographic surface rather than the actual topographic surface. This was done because depth to ground water may vary radically within a small area due to the presence of local cuts, fills, creek bed depressions, and mounds. Such local anomalies were too small in scale to be modeled by the computer program given the 300 to 500-foot spacing of the measurement points. The main value of the depth maps is therefore limited to distinguishing areas underlain by a "shallow" groundwater table versus areas underlain by "moderate" to "deep" groundwater tables as referred to in the following section. Extreme care must therefore be exercised in using these maps for any other purpose other than their use in this study.

5.7.2 Discussion and Evaluation

5.7.2.1 Interpretation of Groundwater Maps

CMTW-12 cont.

The depth contour maps indicate that, as can be expected, the primary groundwater table as measured by the piezometers and other measurement points is relatively deep under the ridge on the northeast flank of Centennial Drive and relatively shallow on the lower portions of the ridge within the Strawberry Creek drainage areas. Uphill of the LBL Grizzly Gate entrance road, the depth to ground water was found to exceed 50 feet below Centennial Drive, becoming deeper to the northeast. Downhill of the LBL Grizzly Gate entrance road, the depth to ground water below Centennial Drive was found to generally decrease to the order of 20 feet or less in the overpass and Botanical Garden areas.

Groundwater depths of 20 feet or less throughout the year were identified at the north end of the Corporation Yard, near the eastern end of Building 77, and in the Strawberry Creek drainage area containing the Botanical Garden, overpass structure, Mather Grove, Cell Culture Laboratory (Building 83) and Biomedical Laboratory (Building 74). Groundwater depths of less than 10 feet were measured throughout the year in Piezometer P-7 at the greenhouse in the Mather Grove area. A groundwater depth of less than 20 feet was registered in the vicinity of the Crafts Building

31/84

(Building 76) and between Buildings 72 and 77 on the winter and spring contour maps.

Input data and maps generated by this study indicate that there is little seasonal variation in groundwater levels in the study area. Variations on the order of 10 feet or less throughout the study period were noted in the majority of the measurement points. Though closely spaced readings were not taken, the available data still suggests that the groundwater table does not fluctuate more than on the order of one or two feet in direct response to periods of heavy rainfall. Most peak groundwater levels were found to occur in March or April. Some of these observed peaks for selected localities are summarized in Table 5-3.

TABLE 5-3

PERIODS OF PEAK GROUNDWATER LEVELS AT VARIOUS LOCALITIES IN 1983

Locality	Month(s) of Peak Ground Water
Overpass Structure	March - April
Mather Grove	March
Corporation Yard	March
Crafts Building (Bldg. 76)	March - April
Centennial Drive (E of Bldg. 77)	March - April
LHS NW Parking Lot	December - January *

* Peak not pronounced

CMTW-12 cont.

Readings taken in early 1984 indicated peak levels in many piezometers in January, with lower levels in February. Since minimal rainfall occurred between January and May of 1984 as compared to other years, it could be inferred that peak groundwater levels in many hill area locations probably

32/84

occur at the end or within a month after the end of the last heavy rainfall of the season.

The groundwater maps show a large variation in water levels in the vicinity of the Space Sciences Laboratory and Shively Well No. 1 over the four seasons monitored. The variation appeared to be due to the operational characteristics of the Shively Well pump rather than a function of time of year. Apparently, during 1983 the pump was experiencing a slow failure, or groundwater flows exceeded the capacity of the pump (see Section 5.4.2). The maps show a progressive rise in groundwater level in the well from the spring through fall of 1983. Though water level measurements were not actually taken in the well until December, 1983, measurements in nearby piezometers indicated that the water level in the Shively Well was rising. Water level elevations at the Shively Well were estimated in the maps in order to show this trend. Measurements taken in December, 1983 prior to reinstallation of the 10-hp pump suggest that the natural depth to ground water at the well site is probably on the order of 200 feet.

As of April, 1984, the 10-hp pump should have been maintaining a water depth in the well of 350 to 380 feet. Assuming that the capacity of the new pump is adequate to maintain the intended water level in the well, water surface elevation, groundwater levels in the vicinity of the well should be fairly constant year-round. Measurements from adjacent piezometers indicate that the radius of influence of the well (i.e., distance from the well to zero drawdown) is on the order of 600 to 700 feet around the well.

CMTW-12 cont.

5.7.2.2 Ground Water and Slope Stability

The stability of a slope is governed primarily by the following factors:

1) engineering properties of the materials underlying the slope;

2) water pressures within the slope induced by the presence of ground water;

3) bedrock structure (includes orientation of discontinuities, faults, or other zones of weakness);

4) geometry (e.g., steepness) of the slope; and

5) external loads or forces on the slope.

33/84

Given the presence of ground water, there can be a significant reduction the overall stability of a slope through: 1) the addition of weight to a potential sliding mass and 2) the reduction of maximum shear strength available to resist a failure along a potential sliding surface. Slope failures may be of the wedge, block, spreading, flow, or rotational type. It is important to note that although high water pressures induced by ground water are usually the initiating cause of a slide, other adverse factors such as those listed above must also be present in order for slope failure to occur.

The measured groundwater levels in the hill area indicate that the groundwater table would most likely contribute to slope failures in the Strawberry Creek drainage basin area containing the overpass structure, Botanical Garden, Mather Grove, and Biomedical Laboratory. In addition to high groundwater levels, the area is flanked by steep slopes and underlain by thick colluvial deposits and residual soils that have been subjected in the past to both flow and deep-seated slides. Additional surcharge loads on the slopes, such as the overpass abutment fills, have contributed to local instability. The source of ground water in the area is judged to be from a combination of the following:

- volcanic Moraga flow rocks underlying the ridge to the north;
- surface infiltration through the extensive colluvium deposits extending upstream in the creek basin;
- Claremont cherts, shales, and sandstones to the east and southeast; and
- possible water flow along the Wildcat fault.

CMTW-12 cont.

Other areas identified where the groundwater table may affect slope stability include the rear slope of the Corporation Yard area, the slopes to the north and east of the Mechanical Shops (Building 77), and the area near the intersection of Cyclotron road and the Building 77 access road (at the north end of Building 72). The Corporation Yard and Building 77 slopes have been the sites of extensive dewatering installations including wells and hydraugers, and the stability of these areas appears to have been improved based on recent performance. The Corporation Yard slope is analyzed in detail in Section 6.2.4.

The slope behind Building 77 consists of a fill slope above the upper retaining wall on the north side of Building

77 and a cut slope on the east side of the building. Seepage zones and old slide planes were exposed in the cut slope when it was originally excavated in 1962, and hydraugers were installed by Dames and Moore to relieve the seepage pressures. Slides continued to occur in the cut slope during the 1960's, and in 1969, a compacted fill slope with subdrainage was installed at the northeast corner of the building behind the loading dock. Measurements from slope inclinometers installed through the Corporation Yard fill indicate that the fill slope behind Building 77 is still creeping southwestward.

The slope downhill of Cyclotron Road to the south of Building 77 has also experienced stability problems in the past. The steep slope below the intersection of Cyclotron Road and the Building 77 access road has been identified as an old slide area. Two adjacent portions of the slope have already been repaired by buttress fills. Near-surface ground water in this area may conceivably cause future sliding in this area.

Other sites of deep-seated sliding on LBL property not included in the study area were discussed in the available literature reviewed. Most notable of these are the following:

- slide on slope behind Building 64
- slide through Building 46 east of Bevatron
- slide on hill slope southwest of LHS building

CMTW-12 cont.

Abundant groundwater seepage was noted in each of these slides. The large slide which distorted Building 46 and threatened the Bevatron during the winter of 1972-73 was stabilized by removing the upper half of the slide and by installing dewatering wells and hydraugers throughout the area.

The majority of the slide plane of the Building 46 slide was said to be located in the baked, altered clays at the Orinda-Moraga formational contact. In this case, a large proportion of the slide mass was composed of Moraga volcanics overlying the contact which was found to be adversely dipping out of the exposed slope. Sliding along the contact, identified as an old landslide slip plane, was re-initiated by high groundwater pressures. HLA concluded that these high pressures were caused by seepage along faults passing through the slide area. A similar geologic condition (i.e., adversely dipping contact) was encountered in the mass of Moraga volcanics underlying the slope between Buildings 64 and 71,

although an HLA investigation later concluded that no sliding along the formational contact at this location has taken place to date.

Slides in the study area not directly related to the groundwater table are primarily of the shallow, flow type (sloughs, slumps, or flows) caused by saturation of surficial soils on the slope. Water within the slope may be the result of rainfall, surface runoff or infiltration, locally perched water tables or water transmitted by springs or faults. Perched water tables are common in the hill area due to the complex folding and faulting of the underlying bedrock and the presence of permeable beds (e.g., sandstone, conglomerate) within impermeable layers (e.g., shale, siltstone). The presence of perched water may tend to be seasonal. Many perched water tables in the hill area may possibly be fed by the groundwater table via fault or shear zones, permeable layers, or formational contacts. Another type of perched water table that may develop during a period of heavy rainfall would form above the soil-bedrock contact below the slope due to the relative impermeability of the bedrock. Water pressures would therefore build up as the slope became saturated, causing a flow slide along the soil-rock contact.

Shallow flow slides or slumps have been observed in the LBL and Centennial Drive areas, primarily in areas underlain by Orinda sediments, but also on occasion in the highly weathered soils overlying Moraga volcanics. Such slides have been observed in some fill slopes, as well as in cut slopes where old slide materials or slide-susceptible soils were exposed. Highly plastic clays exposed in many locations in the hill area are susceptible to failure since they tend to lose strength when saturated. These clay soils are also susceptible to the formation of shrinkage cracks which would allow surface infiltration of water. Shallow slides have been observed in the past in areas including below Centennial Drive at road Station 10+50 and other location prior to construction of the road; in the ravine area near Building 62, the slope below Cyclotron Road south of Building 77, and areas in the Blackberry Creek drainage area that were repaired during construction of LHS. It is very difficult to quantitatively predict the probability of failure for these shallow slides, but the following locations within the study area are judged to possess a greater than average probability for future shallow sliding:

CMTW-12 cont.

(1) Mather Grove and west Botanical Garden area south and west of Centennial Drive,

(2) colluvial slopes overlying the Cell Culture Laboratory parking lot,

36/84

(3) slope between Centennial Drive and Building 77 access road,

(4) slope between Centennial Drive and Building 69, and

(5) slope west and downhill of Building 62.

5.7.2.3 Evaluation of Past Dewatering

Past dewatering efforts in the hill area performed for the University consisted basically of the following:

- Shively Well No. 1
- Hydrauger Nos. 789-A and 789-B
- hydraugers in overpass/Botanical Garden area

Shively Well No. 1 was installed in 1975 with the intent of dewatering the Moraga flow rocks in the postulated syncline underlying the ridge and to improve stability conditions in the Corporation Yard, LHS, and overpass areas. As discussed in Section 4.3.2.1, a review of all geologic work has indicated that the volcanic flow rocks underlying the ridge are most likely part of a volcanic vent complex that does not exhibit a synclinal structure such as seen east of the Wildcat fault.

CMTW-12 cont.

Water level data was not available to compare groundwater conditions before and after installation of the Shively well; however, hydrauger flows in the Corporation Yard were contended by Lennert to have decreased substantially after installation of the well. This contention is consistent with observations in 1983 that the radius of influence (radius to zero groundwater drawdown) of the well is on the order of 600 to 700 feet. There is insufficient evidence to show that the Shively well has lowered groundwater levels under the creek fill/LHS northwest parking lot, which is located at the periphery of the well's influence. There is also no evidence to indicate that the Shively well has improved groundwater conditions in the overpass area. However, since the well has appeared to improve stability conditions in and below the Corporation Yard slope and in the benched areas between the LHS and Space Sciences Laboratory, we recommend continued pumping of this well. Failure of this well would likely result in a slow rise of the groundwater level in the Corporation Yard area which could eventually result in decreased stability of the Centennial Drive road fill.

Hydrauger No. 789-A was installed in 1979 to assist in dewatering the syncline, while Hydrauger No. 789-B was drilled primarily to intercept leakage that might occur from the perforated casing of Hydrauger No. 789-A. Analysis of flow records and the groundwater history of the hill area over the past five years indicates that these hydraugers have not been noticeably effective in improving the overall stability of the hill area. Current flows in Hydrauger No. 789-A (on the order of 3 to 12 gpm) are judged to be too small to noticeably influence groundwater levels in the hillside.

Hydraugers installed in the overpass/Botanical Garden area appear to have contributed to increasing the near-surface slope stability of the area while in an operative condition, but did not eliminate stability problems in the area. Analysis of the limited flow data indicated that the hydrauger flows were very responsive to rainfall when in an unclogged, intact condition, indicating that hydraugers should be successful in helping to drain shallow perched water tables, seeps along faults and other impervious water barriers, and near-surface water flow, particularly from pervious colluvial soils. The number of hydraugers installed however, is judged to have been too small to prevent the numerous slope stability problems that have occurred in this area. Hydraugers were not placed in sufficient quantity and in the optimum locations to have possibly prevented the failure below the east abutment overpass fill.

CMTW-12 cont.

5.7.3 Conclusions and Recommendations

Slope stability problems in the Centennial Drive/LBL area appear to be affected by the groundwater table which may contribute primarily to deep-seated slope failures anytime during or shortly after the rainy season, and by shallow ground water which may cause flow slides, slumps, or sloughs that occur usually during or shortly after periods of prolonged rainfall. Our current investigation has determined probable areas where a high groundwater table may contribute to landslides. Likely areas susceptible to such failures were discussed in Section 5.7.2.

The occurrence of shallow flow slides is highly dependent on underlying soil materials, slope geometry and presence of subsurface water. Flow slides may be evaluated in terms of general risk of future failure potential. Areas judged to be particularly susceptible to shallow slope failures in the study area were also discussed in Section 5.7.2.

We conclude that past dewatering efforts in the hill area have been effective in improving slope stability on a local, site-specific basis, a exemplified by the installation

of hydraugers and wells in the LBL Bevatron and Building 77 areas. Past dewatering efforts with the intent of improving the slope stability over a wide area; i.e., area-wide dewatering are judged to have been of limited benefit. Installation of area-wide dewatering measures such as Shively Well No. 1 and Hydraugers 789-A and 789-B have not appeared to have noticeably improved the overall stability of the hill area. Shively Well No. 1 has appeared to have locally improved the stability of Centennial Drive in the vicinity of the LBL Corporation Yard, however.

Based on current groundwater levels and detailed analyses of the hill area, we also conclude that further areal, deep watering of the ridge traversed by Centennial Drive is not likely to substantially improve the stability of the hill area. Slope failures on University property in the upper campus hill area (i.e., in the vicinity of LHS, Centennial Drive and the Botanical Garden) have been and will probably continue to be mainly of the shallow, flow type activated by slope saturation during or shortly after periods of heavy rainfall. Dewatering of the deep groundwater bodies in the ridge using deep wells or long hydraugers is not expected to noticeably reduce the occurrence of the shallow flow slides. The failure of the Centennial Drive overpass east abutment fill appeared to have been influenced by the rising of the groundwater table, but this failure occurred primarily because of the added load imposed on the slope by the saturated abutment fill and the loss of strength of residual soil at the contact between the colluvium and the weathered bedrock.

CMTW-12 cont.

We recommend any that future dewatering efforts be concentrated in local areas where instability problems have been shown to exist, and in areas where groundwater levels are found to be close to the surface in areas where other factors conducive to slope instability are present. Pumping of the Shively well should be continued since it appears to benefit the stability of Centennial Drive and the Corporation Yard slope below the road. Detailed recommendations for dewatering where applicable for the specific sites analyzed in this investigation are presented in Chapter 6.

39/84

We also ask that the EIS include the entire transcript from LBNL's July 8, 2010 Community Advisory Group (CAG) meeting. The agenda included presentations and discussions related to LBNL geology and geotechnical status of the Berkeley Lab site, as well as comments from concerned members of the public. (Attachment 8) Many conflicting statements were made by LBNL geotechnical experts. CMTW-13

Also, after reviewing some of LBNL's geotechnical reports associated with the DEA projects, it appears that extreme time pressure was put on contractors. For instance Alan Kropp & Associates (AKA) Memorandum of May 29, 2009 regarding B25 Slide Investigation, states: " The preliminary study was conducted over a two week-period in order to meet LBNL schedule objectives. For this reason, the scope of our investigation and analyses were limited to what could be reasonably completed within the targeted timeframe." The study contained data sheets for 3 test borings, first numbered as WLA-B 1 to3 (William Lettis & Associates), then changed to AKA 1 to 3, with a notation that AKA-3 was AKA-4 (?), there were references to 25 photos, which were not included in our copy, and a page titled Soil Boring Locations Near Bldg's 25&48, without any map showing the boring locations. CMTW-14

An other report by Furgo William Lettis & Associated, dated December 10, 2009 regarding LBNL B25-Core Review for the GPL Geotechnical Study makes the following statements:"...samples appeared to be missing...samples were not readily found by FWLA in the core library. According to LBNL staff, logs for soil borings SB25-95-1 through SB25A-95-1 are not available...evaluating physical properties (e.g. stiffness and plasticity) is difficult to impossible because the samples are on the order of 10 to 15 years old and thus, the original moisture content in unknown...some key samples were not located in the core library (borings W25-95-26) and thus we are unable to evaluate the quality of these boring logs...etc." CMTW-15

Furthermore, Appendices attached to AKA's April 2, 2010 Report regarding geotechnical investigations GPL at B25 Site, included Logs of Borings by AKA/WLA, Logs of Borings from Previous Geotechnical Reports by Others and Logs of Previous Environmental Borings by LBNL but excluded all reports and conclusions. We therefore ask that all these reports be included in their entirety as Appendices to the EIS! We also ask that a Report by Laurel M. Collins titled "Geology of the East Canyon and the Proposed Hazardous Waste Handling Facility, LBNL" be included as an Appendix to the EIS. (A Draft of April 1993 is enclosed as Attachment 9) CMTW-16 CMTW-17

Also statements such as:" The recommendations presented herein are not intended to stabilize the site or mitigate the potential for landslide type movement", by AKA (April 8,2010, Geotechical Investigation, B71 BELLA) reflect the limitations of geotechnical experts regarding the uncertainties associated with sites, such as LBNL. CMTW-18

ATTACHMENT 8.

LAWRENCE BERKELEY NATIONAL LABORATORY (LBNL)

Community Advisory Group (CAG)

Thursday, July 8, 2010
7:00 – 9:30 pm
North Berkeley Senior Center, 1901 Hearst Avenue, Berkeley, CA 94709

Meeting objectives:

- Understand and discuss the geology and geotechnical status of the Berkeley Lab site.
- Identify potential concepts and strategies for improving geotechnical safety at the Lab and reducing related community impacts.

A G E N D A

7:00 pm	1.	Welcome
	2.	Update on Currently Proposed and Possible Future Projects
	3.	Overview of Geology and Geotechnical Status of the Berkeley Lab
	4.	Concepts and Strategies for Improving Geotechnical Safety
	5.	Public Comments
9:30 pm		*-- Close --*

CMTW-19

www.lbnl-cag.org

41/84

ATTACHMENT 9

DRAFT

Geology of the East Canyon and the Proposed Hazardous Waste Handling Facility, Lawrence Berkeley Laboratory

Laurel M. Collins
Senior Research Associate
Earth Science Division
Lawrence Berkeley Laboratory
Berkeley California

April 1993

CMTW-19 cont.

42/84

Table of Contents

List of Abbreviations iii

Introduction 1

Scope of Work 1

Background 2

SUMMARY DESCRIPTION OF GEOLOGIC UNITS 2

KNOWN FAULTS OF THE EAST CANYON 3

Other Geologic Investigations 3

RECENT STUDIES 1992-1993 3

PAST STUDIES 1900-1991 4

East Canyon Geologic Field Mapping 6

FINDINGS 6

UNRESOLVED QUESTIONS 9

Conclusions 9

Recommendations 10

Appendix I, Memo on Geological Investigation, East Canyon A1-1

Appendix II, Memo on Geotechnical Synopsis A2-2

Appendix III, Summary of Previous Geological Investigations A3-3

Appendix IV, Figures A4-4

Appendix V, References A5-5

CMTW-19 cont.

43/84

List of Abbreviations

DM - Dames and Moore

ECF - East Canyon Fault (Borg)

GRC - Geo/Resource Consultants

HF - Holland Fault

HLA - Harding Lawson Associates

HWHF - Hazardous Waste Handling Facility

KF - Korbay Fault

Ku - Upper Cretaceous

LF/B - Lawson Fault/Borg

LF/DM - Lawson Fault/Dames and Moore

LF/K - Lawson Fault/Korbay

LF/L - Lawson Fault/Lawson

LBL - Lawrence Berkeley Laboratory

NF - New Fault (Lennnert)

Tc - Tertiary Claremont Formation

Tm - Tertiary Moraga Formation

Tm-e - Tertiary early Eocene to Miocene

To - Tertiary Orinda Formation

UCB - University of California, Berkeley

WF - Wildcat Fault

CMTW-19 cont.

Introduction

The Hazardous Waste Handling Storage Facility (HWHF) for the Lawrence Berkeley Laboratory (LBL) is proposed for the lower portion of East Canyon (Fig. 1) within Strawberry Creek watershed. For the purposes of this report, the East Canyon area is bounded by the Wildcat Fault (WF) to the east, the East Canyon Fault (ECF) to the west, Centennial Drive along the UCB Botanical Garden to the south, and Grizzly Peak to the north. The proposed HWHF (Building 85) is located about 150 feet west of Building 83, Cell and Molecular Biology Laboratory.

The need for geologic investigation of the proposed HWHF site was identified in a September 1992 Memorandum (Appendix I). The rationale for this study is twofold: 1) to investigate the presence and possible activity of faults, and 2) to evaluate the potential effect of faults upon ground water hydrology.

The complex geology of East Canyon, including the effects of volcanism, interfingering of formations, folding, faulting, erosion, as well as the lack of bedrock outcrops in the central portion of the canyon, likely account for most of the disagreement among experts about its geology. Despite the various geologic maps that have accumulated, their reliability is uncertain because the maps do not depict the field evidence that constrains the location and contact of different bedrock units.

Since September 1992, bedrock outcrop mapping has been conducted by the author. New geophysical and geotechnical investigations have been collaboratively performed by Geo/Resource Consultants (GRC) and Pat Williams (Staff Scientist/Geologist, LBL). These investigations have produced greater definition of the geologic characteristics of the site. This report will discuss the results and implications of the previous studies and the new bedrock outcrop mapping. The geologic outcrop map is shown on Plate I, a cross section is shown on Plate II, and other pertinent maps are included as Figures in Appendix IV.

CMTW-19 cont.

Scope of Work

The aim of this study was to resolve confusion about location of geologic units and associated faults. To this end, a bedrock outcrop map was made on which field evidence was differentiated from assumed or inferred bedrock relations.

Reconnaissance along stream courses, gullies, remote hillsides, and construction sites was conducted to map outcrops within the East Canyon area. Because there are few outcrops within East Canyon, some reconnaissance mapping was conducted along the upper areas of Strawberry and Claremont Canyons. Some field mapping was conducted in a mutual effort with Professor David Jones, UCB Department of Geology and Geophysics. His contribution is gratefully acknowledged.

Historical and recent stereo air photography was used to identify lineations that could represent faults or bedrock contacts and to help identify the distribution of different formations through geomorphic and vegetation

analysis. Black and white stereo photos from 1939, 1946, 1947, 1974, 1983 and 1990, as well as color stereo photos from 1973, 1978 and 1992 were examined.

Numerous geotechnical reports covering the greater vicinity of East Canyon were examined. Boring logs for buildings 74, 83, 66 and 62 were reviewed to help resolve conflicting interpretations. This report focuses only upon the geology of the East Canyon relative to the HWHF.

Samples and thin sections from several outcrops were made to determine if some of the bedrock units in the East Canyon study area could be found in other portions of Strawberry Canyon. Steve Flexser (Earth Science Division, LBL) performed petrographic analyses, and the samples are available for future reference.

Background

SUMMARY DESCRIPTION OF GEOLOGIC UNITS

A brief description of the bedrock units is given below. These units have been well described in numerous published documents and geotechnical reports on file at LBL. Throughout East Canyon, however, the distribution of these units has not been well resolved.

The oldest rocks present in the study area occupy the lower portions of Strawberry Canyon. On the accompanying map (Plate I), these upper Cretaceous (Ku) rocks comprise marine sandstones and shales. Generally, they are believed to be faulted against the younger formations. The second-oldest unit comprises rocks of early Eocene to Miocene age (Tm-e). They include Sobrante Formation marine shales and various interbedded marine sandstones, cherts, and occasional volcanic outcrops. The nature of contacts among units within the Tm-e, and the distribution of Tm-e throughout East Canyon is not well understood. The mid-Miocene marine Claremont Formation (Tc) that consists of interbedded cherts and shales is considered to be in fault contact with the Tm-e sediments (Jones and Curtis, 1992). The Claremont is highly folded and faulted, with numerous sandstone, tuffaceous, and diabase dikes cutting and/or interstratified with the chert beds. The late Miocene-early Pliocene Orinda Formation (To) is stratigraphically above the Claremont, but is considered to be in fault contact with the Claremont. The Orinda consists primarily of non-Marine pebble conglomerates, sandstones and siltstones. It is prone to landsliding, typically earthflows, due to the presence of montmorillinite clay that has expansive properties. The geomorphic expression of the Orinda Formation is that of gentle slopes, as compared to the steep slopes of adjacent formations. The Orinda sediments interfinger with Pliocene Moraga (Tm) volcanic rocks comprising a series of intercalated basalts, andesites, and tuffaceous agglomerates. Volcanic feeders and vents (Ng, et al, 1989; Borg, 1991; Holland and Wollenberg, 1992; Garniss Curtis, personal communication, 1993) are inferred to occur within Strawberry Canyon, and thus some of the complexity of folding and faulting may be related to processes occurring contemporaneously with deposition of Moraga volcanics. These volcanic rocks cap the highest peaks in the watershed, and extend into and occupy a good portion of the study area. Deposits of alluvium, colluvium, and landslide debris cover much of the bedrock units throughout East Canyon.

CMTW-19 cont.

KNOWN FAULTS OF THE EAST CANYON

Although much information about the geology of the Berkeley Hills is available, there is disagreement among existing reports about the local pattern of faulting within East Canyon. Two faults, the Wildcat (WF) and the East Canyon (ECF), have been verified to exist within the Canyon. The ECF, as originally proposed by Borg (1991), was recently confirmed during trench studies at the HWHF and interpreted as inactive (pending Geo/Resource Report, 1993). Borg's geologic map (1991) showed that the ECF defined the western edge of East Canyon and that its trace was very near the proposed HWHF.

The Wildcat Fault, which defines the eastern edge of East Canyon, juxtaposes the older Claremont Formation with the younger Orinda Formation in this area. Its existence has been proposed by many investigators, although the local context and configuration of the WF throughout the Berkeley Hills has never been well understood or adequately described. About 1,000 feet northwest of LBL Building 74, a trace of the WF was trenched by Korbay and Lewis (1980). This is the only known subsurface investigation of the WF. Korbay and Lewis reported that they considered the WF to be inactive in the East Canyon. They also reported that it was considered to be active north of El Cerrito (Korbay and Lewis, 1980, cite Bishop, 1973) where evidence of fault creep from offset curbs, pavement cracks, deflected streams and breaks in slope ~~have been observed~~. A detailed review of previous investigations, involving the various interpretations of the WF and other postulated faults, is included in Appendix III and summarized in the section pertaining to past studies.

CMTW-19 cont.

Bishop ~~[illegible]~~ reported? (otherwise cite source or omit)

Near the HWHF, the WF and the ECF are approximately 4,000 feet from the active trace of the Hayward Fault, which passes near the mouth of Strawberry Canyon. The maximum magnitude earthquake anticipated on the Hayward Fault is 7.5 (Steinbrugge, et al, 1987). The WF is nearly parallel to the Hayward Fault and there has been some speculation that a structural connection exists between the active Hayward and Pinole faults and that some such structure may pass through the Wildcat Fault (Williams, personal communication).

Other Geologic Investigations

RECENT STUDIES, 1992-1993

During December 1992 Geo/Resource Consultants (GRC) performed seismic refraction and magnetometer surveys of the HWHF site in preparation for exploratory trenching (Tryhorn and LeFebvre, 1992). At this time two inferred faults, the ECF (Borg, 1991) and the Korbay Fault (KF) (Korbay, 1985) were to be investigated. The KF was inferred to be east of the ECF (Fig. 2a). Some graphical results of GRC's magnetometer survey are shown on a contour map of the magnetometer data (Fig. 2b). On the basis of the magnetimetry, GRC suggested that the ECF might exist north of the HWHF footprint and connect to the inferred KF south of the footprint (Fig. 2a). An additional, and perhaps tenuous interpretation is suggested by this author: the magnetometer data indicate that the ECF could be offset by a SW-NE trending fault that cuts a

sp? magnetometry

topographic saddle near the margin of a volcanic outcrop that is just west of Building 83 (Fig. 3). Volcanic outcrop is out of place so saddle is probably not indicative.

Three trenches were excavated in January 1993, and were investigated collaboratively by GRC and LBL staff (Fig. 4). Trenches 1A and 1B were near the power line access road, north of the HWHF site. The unstable walls in trenches 1A and 1B prohibited entry or close examination of the strata but, observed from a distance above the trench walls, a wide zone of sheared rock was noted in the western half of trench 1A. In trench 1B volcanic bedrock was seen at the western end; this bedrock stepped downward toward the east and abruptly became highly fractured at the east end of the trench. Trench 2, very close to the footprint of the HWHF site, exposed a very well defined NW-striking, E-dipping shear zone in Moraga Formation volcanic rock. Horizontal slickensides in the projected area of the ECF were observed. On the western edge of this shear zone, bedrock stepped about 2 feet downward toward the east. The shear zone yielded an initial flow of about 50 to 60 gpm when the trench was first opened, that later diminished to a steady 5 gpm. (Although speculative, it ~~may be~~ possible that ground water flow along the trace of the ECF is exacerbating slope stability to the south, near the fill for the Centennial Drive overpass.) This shear zone corroborated the evidence for the presence of the ECF. The ECF was interpreted by Williams and GRC to be inactive because the shear zone could not be detected to extend into the overlying colluvium. Trench 3, extending into the footprint of the HWHF, exposed low angle shears near the middle of the trench that appeared to be related to a rotational toe of a landslide. A small amount of water flow was generated from this trench. No evidence of the KF was discovered. A detailed report is anticipated from GRC in May 1993.

CMTW-19 cont.

An historical map by Soulé (1875) showed natural sources of water supply in Strawberry Canyon (Fig. 5). It indicated the presence of a spring near the location of trench 2 (spring "f" on Soulé map). It is possible that natural spring flow was intercepted for water development at this site. Borg (1991) suggested that other springs mapped by Soulé demarcated the trace of the ECF.

Past movement associated with the ECF may have had both vertical and horizontal components, as indicated by the bedrock steps in trenches 1B and 2 and by horizontal slickensides in trench 2. These bedrock steps may be connected along the trace of the ECF. Trench notes taken by Williams indicate the following shear directions (Fig. 4): south wall in trench 2, about 30 feet from the west end, N6W and N20W dipping easterly; north wall trench 2, about 35 feet from west end, N0W and N38W dipping easterly. The projection of some of the bearings conforms with GRC's magnetometer survey (Tryhorn and LaFebvre, 1992) that suggests that the ECF may jog eastward toward the inferred KF. These fracture pattern data may be important for future characterization of ground water flow patterns. The trench investigation also confirmed that the underlying bedrock ~~was~~ Moraga volcanics and that the overlying colluvium ~~was~~ as much as 15 feet deep, thickest toward the northern end of trench 3.

PAST STUDIES, 1900 TO 1991

Previous investigations are reviewed in detail in Appendix III and are summarized here. Because Borg's geologic mapping indicated that the ECF was a splay of the WF that merged together in the northern end of East Canyon, it

was important to assess the WF as part of this investigation. Appendix III serves as the basis for my conclusions concerning the unresolved geology of the East Canyon.

Numerous geotechnical reports have been produced for the HWHF and nearby buildings. Several inconsistencies occur in the earlier geologic maps and interpretations of faulting for the area are inconsistent. This can be demonstrated by plotting various fault interpretations from different investigators on a single map (Fig. 6). To some degree the differences in interpretation of the WF reflect the likelihood that it is a broad shear zone (perhaps greater than 600 feet wide in the vicinity of the HWHF) with numerous splays. Differences also may result from the interpretations of the fault from land form features by different geologists, and from the production of maps at many different scales. Inconsistencies in fault locations were demonstrated by Steve Blair (LBL) in his 1992 Memo concerning Synopsis of Current Geotechnical Data on the WF and the East Canyon Area (Appendix II).

The location and activity status of the WF has been addressed in the literature and in several consultant reports to LBL. Some of the older maps by Lawson and Palache (1900) indicate that the WF is a single trace that has been offset by a cross fault. A geology Ph.D. thesis by Untermann (1934) describes the WF as a zone of disturbance one fourth of a mile wide. Contemporary maps still show a number of interpretations that include a single fault trace that may or may not be offset, two traces that splay near Building 74, or a wide shear zone with multiple traces throughout the northeastern edge of East Canyon. However, only one report from Korbay and Lewis (1980) presents actual data on the fault from the afore mentioned trench, 1,000 feet north of Building 74. They conclude that the WF is an inactive vertical fault with the east side displaced upward relative to the west side. Their report also cites the belief of Garniss Curtis (Emeritus Professor of Geology and Geophysics, UCB) that the WF exhibits right lateral displacement as well. David Jones (personal communication) believes that within the East Canyon the WF may be a thrust fault, with older rocks to the east overriding the Orinda sediments to the west. CMTW-19 cont.

12

The LBL and UCB consultant reports reviewed for this study cite the Korbay and Lewis (1980) study as the basis of their conclusion that the WF is inactive. Other reports, such as King (1984), refer to a disagreement that occurred between trench investigators (Korbay and Curtis) about the inactive classification of the WF. Curtis, as well as Ben Lennert, who was also present at the trench, both believed that the sharp vertical face of the bedrock step was a young feature that had to represent recent and thus "active" faulting (personal communication); Korbay and subsequently Burton Marliave (a co-investigator) did not agree (see Appendix III section on Harding Lawson Associates for a more detailed discussion of the trench investigation). In my opinion, which is based upon review of the Korbay and Lewis report (1980), there is insufficient ~~and confounding~~ evidence in the trench log ~~that makes it impossible~~ to establish whether that trace of the WF has been active during the Holocene . Despite all the investigations to date, the WF has been poorly defined regarding location and number of splays within its larger zone of shearing. Borg (1991) considers the WF to be "possibly active" and based upon the occurrence of similar volcanic units, that it has had approximately 6 km of offset (for comparison the Hayward Fault has had tens of kilometers offset). There has been some agreement that the characteristic mode of movement of the WF is right lateral strike slip and that relative motion is downward to the

west, either normal or thrust, in the vicinity of East Canyon. In my opinion, only substantial subsurface investigations incorporating trenching could definitively characterize the WF zone.

The ECF had not been investigated or inferred prior to Borg's 1991 study. He suggested that movement on it might be more recent than that on the WF. This assumption was based upon a jog of the WF that Borg interpreted at the northern end of East Canyon (Fig. 7a and 7b). Borg thought that the WF may have been offset by right lateral movement of the ECF. This interpretation is different from that shown on Plate I. The intersection of the WF and the ECF is appears complex and thus subject to different interpretations. The question of whether one fault has been more recently active than the other might only be definitively resolved with future subsurface investigation near the faults' intersection. If these faults delineate a graben, they may have both been active at similar times. On the other hand, one fault, perhaps the WF, could have had a greater degree of right lateral movement (creep or discrete displacements) and could have been active without requiring movement from the other fault. The recent 1993 trench investigation established that the ECF did not appear to be recently active, as discussed in the previous section.

Rock types and their distribution in the East Canyon have also been poorly characterized. Past interpretations of the East Canyon have invoked large-scale landsliding in combination with colluvial deposition, or numerous parallel faults in a broad WF shear zone, to explain the lack of stratigraphic continuity among various bedrock formations. There is poor agreement between different geologic maps in the location of bedrock contacts. And further, the nature of the contacts between the Moraga and Orinda on the west side of the WF, and between the Claremont and Sobrante on the east side of the WF, is uncertain. According to Jones and Curtis (1992) the contact between the Sobrante and Claremont Formations is faulted throughout the extent of these two units. It is possible that this contact has been mistaken for the WF in some cases. Jones (personal communication) also considers that the contact between the Orinda and Moraga, just west of the WF on the northern fire trail below the UCB Animal Behavior Station, appears faulted. Additionally, the dip of adjacent sedimentary beds and volcanic flows are unconformable. The geologic maps by previous investigators have not indicated fault contacts between these formations.

CMTW-19 cont.

East Canyon Geologic Field Mapping

FINDINGS

The Geologic Map of East Canyon is shown on Plate I and the cross section of A-A' is shown on Plate II. The map highlights outcrops that were verified in the field. Outcrops are depicted as heavily shaded areas outlined in black, and are labeled according to their associated formation. Deposits of colluvium, with the exception of some float material, and alluvium are not depicted on this map; it is intended to only show bedrock relationships if the overburden of colluvium and alluvium were removed. Float, depicted by an "x" symbol, was occasionally mapped in some areas to try to determine the extent of particular formations. Some borehole information from previous studies is indicated as circles with crosses. Outcrops exposed in WF trench A (Korbay and Lewis, 1980) and GRC (pending report, 1993) trenches 1-3 are shown. Since there are →

Something missing

colluvium/alluvium. Previous bore hole data by GRC indicates that volcanic agglomerate and andesite occur in the HWHF footprint. The agglomerate appears to overlie the andesite.

Second, the question concerning the existence of the East Canyon Fault, as previously mapped by Borg, has been verified in GRC trench 2 just north of the HWHF footprint. Field evidence of the projected northern extent of the ECF includes slight variations in soil type, and changes in topography noted in the field and to some extent depicted on the contour map.

With regard to the lithologic units present in the East Canyon, conclusions and questions raised from the geologic mapping are presented below. The discussion is ordered geographically from central, south, east, north, and west East Canyon. An historical photo of the East Canyon (Lawson and Palache, 1900) has been included because it exhibits the geomorphic expression of the bedrock units that cannot be observed today due to the vegetative cover of the hills (Fig. 7).

In the central portion of East Canyon, the Moraga is in contact with the Orinda Formation. Surface mapping and subsurface exploration have not revealed whether the contact is depositional or faulted. Either alternative is possible, as inferred on Plate I. The triangular-shaped canyon, that is bounded by faults, suggests the presence of a graben rather than large-scale landsliding for the mechanism responsible for its formation.

There is still some question about the orientation of the ECF south of the HWHF. It trends generally north-south, but it appears either to curve or splay southeastward (Plate I). This is a slightly different interpretation than Borg's (Fig 8a and 8b) and is based upon several lines of evidence. These include the GRC magnetometer data, the measured direction of shear planes in GRC trench 2, and a linear channel that is apparent in the field but not well depicted on the base map for Plate I (Fig. 6, an historical contour map, depicts this linear channel much better than Plate I). The splay of the ECF may be intersected by a possible cross fault interpreted from the GRC magnetometer survey (1992), and by a small fault that was inferred from slickensides observed in volcanic rocks at the small quarry east of the security gate.

CMTW-19 cont.

The southern segment of East Canyon, the area within the hairpin curve of Centennial Drive, is the most poorly understood. Borg indicates that Moraga volcanics are offset by the ECF. Very few exposures occur in this area that has been planted as a redwood grove. Because of the tree cover, the contour map does not show the details of topography or the gullies. As a result, the geologic interpretation for this area is highly speculative. Outcrops of both Orinda and Moraga Formation were observed in a gully. Landsliding has been documented near the Centennial Drive overpass and may be related to ground water movement along the ECF. Hummocky topography within the redwood grove indicates historical landsliding that is likely more extensive than depicted by LBL Plant Engineering (1981) for Landslide # 40. The presence of the Orinda Formation in this area is highly probable, as indicated by the earthflow type of landsliding, which is particularly characteristic of the Orinda Formation rather than the Moraga.

If the Moraga occupies a faulted wedge, just southeast of the security gate, then a fault may extend along the Moraga - Orinda contact into central East

Canyon. This would be similar in projection to Dibblee's (1980) interpretation of the WF (Fig. 9). Alternatively the fault may veer eastward and extend into Korbay's projected cross fault LF/K (Fig. 10). Without further geologic characterization the pattern of outcrops and faulting in this area cannot be resolved.

In the eastern portion of East Canyon, the Tm-e sandstone outcrops near Building 74. A sample was taken from the bedrock exposure located in an excavation for a new substation. A thin section of the sample has been examined by both Jones and Flexser. They independently confirm that this sandstone is not from the Orinda Formation. Jones believes that it is probably Miocene, older than and not part of the Claremont Formation. Bore hole data from Dames and Moore (DM) (1962) and from Korbay and Lewis (1980) suggest that Orinda units occur to both the east and west of the Tm-e outcrop. This is supported by float from the Orinda Formation that was mapped in the field. The extent of the Tm-e unit southward is very speculative.

The presence of the Tm-e is possibly explained by its being faulted and displaced against the Orinda Formation within a broad WF shear zone (Plate I). Brown-colored shales that were intercepted at 25 and 9 feet by Dames and Moore (DM) (1962) in borings 9 and 13 (Fig. 11), respectively, were interpreted by DM as part of the Claremont Formation. Alternatively, the shales could be associated with the Tm-e units rather than the Claremont Formation, as numerous shale and outcrops are representative of the Tm-e along the upper, southern fire trail bordering the ridge between Strawberry and Claremont Canyon (about one half mile south of the HWHF, between the Claremont Formation and the Upper Cretaceous units). This hypothesis is represented on Plate I.

CMTW-19 cont.

In the eastern segment of East Canyon the Claremont Formation occurs east of the WF zone. The Claremont has numerous faults and folds, many of which are not portrayed on this map due to their lack of relevance to the questions concerning the HWHF. The numerous faults in the Claremont have commonly been thought to be associated with the intense folding that happened prior to the deposition of the Orinda Formation. This does not mean, however, that all the faults in the Claremont should be considered Pliocene or Miocene in age. More recent offsets could have occurred along splay faults associated with the WF shear zone. The predominant dip of the chert is steep, varying slightly to either side of vertical. A sandstone dike intrudes the basal portion of the near-vertical chert beds. This sandstone unit has been observed as outcrops, and it causes geomorphic breaks in slope. This geomorphic expression is apparent in stereo aerial photography, and on high resolution contour maps. Both the eastern and western boundaries of the Claremont Formation appear to be defined by a thick shale bed, devoid of chert. One plausible working hypothesis for the occurrence of the Claremont Formation in the East Canyon area is that it occupies an anticline whose axial plane dips steeply toward the west, and with its east limb overturned. Extensive limb shearing is suggested by the numerous northwest-southeast trending faults cutting the Claremont Chert (Cross Section Plate II).

To the north side of East Canyon, which is beyond the extent of Plate I, the Claremont Formation pinches out between the eastern and western sections of the Orinda. The head of the canyon is defined by a saddle of Orinda sediments between peaks of Moraga volcanics near Grizzly Peak Blvd. The WF continues

northwestward, but the down dropping associated with its westward side does not seem readily apparent much beyond a quarter mile to the NW of the canyon head.

The local structural setting of the Moraga volcanics on the west side of East Canyon is not well resolved. Along Centennial Drive, just north of the base map used for this project, Borg (1991) and Dibblee (1980) show that the Moraga rocks strike northwesterly and dip eastward about 25 to 35 degrees, respectively. Along the power line/fire trail that starts at Centennial Drive and then heads eastward into the East Canyon, the dip of the Moraga Formation appears to vary. From the beginning of the trail at Centennial Drive to the nose of a small ridge (near a power pole) the volcanic beds dip westward. Continuing eastward along the fire trail, numerous fractures and calcite filled veins occur where the beds dip eastward and then westward again. The deformed configuration of these beds could be representative of other faults in this area. Plate I shows an inferred fault paralleling the ECF. Field evidence is scant but also includes a small escarpment along the northeast side of the valley.

Because of the critical character of the HWHF, the effects of faults on ground water flow are particularly important to establish in the East Canyon. In some cases, faults are permeable flow paths. This for example is likely within the Moraga volcanics. In other cases, such as within the Orinda shale or where fault gouge occurs, impermeable barriers may form. Hydrology of fault zones can thus influence landsliding. In this respect, it is relevant to note that two landslides in the East Canyon that have required past mitigation occur along the projected traces of the ECF and the WF. A 1981 revised map from LBL Plant Engineering (Fig. 12) showing landslides 41 and 40 is of interest because landslide #40 may be affected by ground water flow associated with the ECF. Evidence of substantial flow was revealed during the excavation of trench 2. Landslide #41 is also situated between two inferred traces of the WF at Building 74. Additionally, during a landslide investigation for the UCB Botanical Garden and the Jordan Trail (Fig. 13), Provenzano (1991) suggested that excessive pore pressures from seepage flow along his interpreted projection of the WF were affecting slope stability. It appears that a portion of an historical landslide has been reactivated. The springs mapped by Soulé (1875), that occur along the trace of the ECF, are also likely examples of water seepage controlled by faulting (Borg, 1991).

CMTW-19 cont.

UNRESOLVED QUESTIONS FOR THE GREATER EAST CANYON AREA:

1. What is the nature of the Wildcat Fault? For example, is it a wide shear zone with numerous traces or a single trace; is it a shallow thrust or a high-angle strike-slip fault; are any or all of the possible traces and splays of the WF active?

2. What is the nature of the contact between the Moraga and Orinda Formations throughout central East Canyon? This is particularly important for characterizing ground water flow in the area.

3. What are the distribution and significance of sedimentary rocks (Tm-e?) west of the WF that are not considered Orinda or Claremont Formation?

Conclusions

No active faults have been found to exist beneath the HWHF building footprint. Concerning overall geology of the East Canyon, and based upon my original field work and past studies, I conclude that there is insufficient evidence to confidently explain the relationships among the various geologic units between ECF and the WF or to determine the activity status of all the faults that potentially exist in the area.

The Geologic Map (Plate I) suggests that the East Canyon occupies a broad shear zone of the WF, and that the ECF may be a major splay within that zone. Both these faults show elements of right-lateral and vertical displacement. The canyon may have formed as a result of shearing and/or down dropping between the ECF and the WF. It should therefore, be considered a graben.

this is confusing - do you mean motion on the HF in response to a HF EQ? - any way - the motion causes the earthquake doesn't result from it.

The Geologic Map shows inferred fault splays beneath Buildings 74 and 83. If an earthquake occurred on the WF, vertical or horizontal motion would ~~not~~ likely be ~~as great as motion in response to~~ a moderate to large quake nearby on the Hayward Fault. Yet even if the WF ~~is inactive~~, the potential for displacement to occur on it or other subsidiary faults of the Hayward must not be disregarded if the Hayward generated a large quake.

This surface mapping effort has not found new evidence to indicate that the WF is active, nor can potential activity in the broader shear zone near Buildings 74 and 83 be ruled out. To date, the only subsurface investigation of the WF involved trenching of a single splay that was more than 1,000 feet north of Building 74. The fault splays that are inferred to occur beneath Buildings 74 and 83 can only be confirmed by examination of the presently concealed subsurface. Exposures of the fault traces may be revealed during excavation of the planned access road to the HWHF.

CMTW-19 cont.

Recommendations

1. Because faults and hydrologic flow patterns are important to the settings of Buildings 74 and 83, geologists should investigate the planned excavation for the access road to the HWHF. If bedrock is encountered, the evidence to prove or disprove the presence of a fault and its status of activity may be at hand. If only colluvium is encountered along the road cut, then subsurface investigations may be prudent to resolve these questions. The Geologic Map of East Canyon (Plate I) should be updated by information revealed during grading excavations.

2. A map showing "raw" geological observations at LBL should be produced. This map should show outcrop information as well as borehole lithologies, such as those compiled by Holland and Wollenberg (1992) for the on-going LBL Site Characterization Project. The previous geological maps prepared by consultants to LBL are in conflict with boring and outcrop information in a number of locations (Holland, personal communication). A single updated geological map should be compiled to aid in foundation design, ground water control, and slope stability.

3. Recommendation 2 should be a component of an integrated, comprehensive, and computerized data base for the geology of LBL. An efficient computer-

based system would allow simplified and on-going amendments of the map as more is learned from future investigations. The map could be implemented as a layer in Facilities new AutoCAD system. This implementation would make the latest geological understanding of the LBL site available on-line, particularly to the Facilities civil/structural group.

4. A repository for all boring samples, outcrop samples and thin sections should be established to aid in the identification of local stratigraphy. This resource should be made available to consultants who perform geotechnical studies for LBL and available to LBL staff involved in site characterization studies. This repository could contain many samples suitable for future geotechnical and engineering soils tests. This ~~could possibly~~ would likely save costs to future investigations.

5. When future geotechnical investigations are performed, consultants should utilize computer-based maps discussed in recommendation 3 as a base. This would assure more accurate and consistent results from project to project. The results of their investigations should be subsequently entered into the computer system. At a minimum, contracted geotechnical consultants should make use of the "raw" updated geological map discussed in recommendation 2.

6. Contracted geotechnical consultants should be required to submit maps that delineate between physically verified/observed and inferred/interpreted geological information (ie., outcrop maps). Additionally, consultants should be required to yield unused boring samples for inclusion in the sample repository discussed in recommendation 3.

7. Local consultants and researchers that have performed past studies on LBL property should be contracted or at least contacted to submit outcrop information compiled from their previous studies.

CMTW-19 cont.

Appendix I - Memorandum on Geological Investigation, East Canyon

CMTW-19
cont.

LAWRENCE BERKELEY LABORATORY
Bldg.: 50C Room: Ext.: 5344

September 24, 1992

MEMORANDUM

To: Steve Blair, Kam Tung

From: Harold Wollenberg, Pat Williams

Subject: Geological investigation, East Canyon area

Introduction

The need for accurate representation of local geology in the vicinity of Lawrence Berkeley Laboratory has been long standing. Numerous maps with varying interpretations have been produced since Andrew C. Lawson's work at the turn of the century. Recent preliminary geologic mapping of the Berkeley Hills, by Scott G. Borg (1991), summarized by Wollenberg et al. (1992), reveals an interpretation of local geology that includes an inferred East Canyon Fault trending approximately N-S and crossing the eastern part of the lab, just west of the biomedical research facilities. Previous geologic maps have delineated the Hayward and the Wildcat faults as significant and seismically active in the general vicinity, although the status of the Wildcat fault has been of recent debate. The status, as well as possible seismic and hydrologic implications of the inferred East Canyon fault are yet unknown. However, Borg suggests that the age of this fault is probably younger than the earliest activity on the Wildcat fault. To properly characterize the geologic setting of the LBL's East Canyon area, which will include the Waste Handling and Storage Facility planned for construction in 1993, we propose detailed investigations to determine 1) if the fault exists, 2) if so, its accurate location, and 3) the possible seismic and hydrologic ramifications of the fault to the existing and planned facilities.

CMTW-19 cont.

Background

The eastern part of LBL is located on steep-sided slopes in Strawberry Canyon that have been subject to repetitive geologic processes that include seismic and landslide activity. Consequent to the urbanization of these hillsides, these processes now constitute

57/84

hazards to the human population and to the infrastructure of LBL. As part of the Site Restoration Program at LBL, preliminary geologic studies to assess the hydrogeologic conditions of bedrock were initiated in 1992 by the Earth Sciences Division.

A geologic map and report was produced by Borg (1991). Borg's map combined field reconnaissance, historical air photo interpretation and some original site mapping. The existence of the East Canyon Fault is inferred from 1) airphoto lineations, 2) apparent offsets in the stratigraphy, 3) an alignment of springs known to exist in 1875, and 4) right lateral movement that may be creating a northward jog in the Wildcat fault. The northern terminus of the East Canyon fault has not been established, but its northern intersection with the Wildcat fault warrants further investigation to clarify possible interrelation.

Exposures of the Moraga Volcanics adjacent to, and west of the East Canyon fault are extremely altered and oxidized, suggesting past ground water movement. Borg suggests that the absence of altered volcanics east of the inferred trace of the fault indicates that the fault could be a groundwater barrier. Exposures of the mineralized zone are located on a powerline trail northwest of the proposed waste handling storage facility. New exposures may be revealed during grading and excavation operations for the access road. **CMTW-19 cont.**

The wedge of property bounded by the Wildcat and East Canyon faults and the roadway to the Cell and Molecular Biology facilities has the geomorphic characteristics of a large landslide deposit. Geologic investigations in the early 1980s by Harding, Lawson & Assoc. depicts this segment of land as a landslide, yet mapping by Borg (1991) shows that bedrock contacts can be followed on some portions of this feature. Lineations from the Wildcat fault and the inferred East Canyon fault are observable on stereo air photos. This indicates that if this feature is a landslide, it has been cut by younger faulting. The nature of this landform should be established in order to determine the potential for either storm or seismic-induced failure.

1992 Progress

During September 1992 some field reconnaissance of the East Canyon area has been performed by Earth Sciences Division staff. Laurel Collins, Senior Research Associate, has been collaborating in a mutual field mapping effort with Dr. David Jones, Dept. of Geology and Geophysics, University of California at Berkeley. Their field mapping in the general vicinity of the East Canyon area yields additional information that was not indicated on the Borg map. Collins and Jones' mapping effort includes reconnaissance of bedrock exposures in streambeds, banks, and gullies, and detailed lineation mapping and geomorphic airphoto interpretation from low altitude, 1971, color stereo airphotos. Interpretation of vegetation assemblages associated with the different bedrock types, geomorphic characteristics, and assessment of previous mapping efforts are used to extrapolate bedrock contacts for inaccessible sites. Previous mapping to the south and in upper portions of the watershed by Jones has established additional field verification of bedrock exposures over a broader area than that covered by Borg.

CMTW-19 cont.

Recommendations for FY1993

A detailed geologic map of the East Canyon area is necessary to better define the seismic and hydrologic characteristics of the Waste Handling and Storage Facility's site. Of primary hydrologic concern are the questions: are the faults in this area permeable pathways for the movement of fluids into the Strawberry Creek drainage, or are they impermeable barriers to fluid movement? What effects will future movements on the faults have on the hydrologic integrity of the facility? In addition to the direct benefits to LBL, investigation of the inferred East Canyon fault and its seismic significance will benefit the greater community of the Berkeley Hills.

To complete and produce a final geologic map we recommend the following:

1. Conduct additional field mapping along stream courses, trail cuts, and at excavation sites for new construction projects. Additional bedrock outcrops may become exposed as LBL and UCB perform vegetation clearing and prescribed burning treatments for their fuel reduction programs. A schedule of such activities will be

furnished to L. Collins, who is also a member of the Hill Area Fire Prevention Committee. Though most field mapping should be concentrated near the East Canyon site in an effort to detail the local geologic characteristics, a minor amount of mapping in adjacent watersheds will be necessary to define the boundary and extent of the East Canyon fault.

2. Review historical photo archives, make copies of selected frames and annotate when pertinent. Stereo airphotos, taken during 1939 and 1946, will be utilized to interpret geomorphic conditions prior to major construction activities in the canyon. Additional photography from different years will also be reviewed.

3. Review and summarize existing geotechnical documents concerning landslide and fault hazard studies.

4. Observe and document flow conditions, during fall drought and later wet season, at springs discovered in the field or depicted in the 1875 map that are located along the proposed trace of the East Canyon fault.

CMTW-19 cont.

5. As drilling information becomes available within the LBL property, supplement maps with subsurface information.

6. As bedrock exposures are revealed during road grading operations at the East Canyon construction site, concurrently advise LBL with respect to appropriate level of required study in the interim between grading and start of building construction.

7. In cooperation with the LBL site restoration project, complete a definitive report and map on bedrock, fault and landslide locations for the East Canyon area.

Suggested FY 1993 Budget:

0.1 FTE, Pat Williams: $8K*

0.4 FTE, Laurel Collins: $25K*

60/84

Expenses, report preparation: $3K

*does not include overheads

References:

Borg, S.G., 1991. Geology of Lawrence Berkeley Laboratory; internal rept. Earth Sciences Div., 3 Oct. 1991.

Wollenberg, H.A., Borg, S.G., Holland, P.J., Williams, P.L., and Evelland, M., 1992. Geological studies relating to the site restoration program at the Lawrence Berkeley Laboratory. Proc. Waste Management Conf. San Juan, PR, April 9-11, 1992. LBL-32172.

CMTW-19 cont.

Appendix II -Memorandum on Geotechnical Synopsis

CMTW-19 cont.

SYNOPSIS OF CURRENT GEOTECHNICAL DATA ON THE WILDCAT FAULT AND LBL EAST CANYON AREA

The following is a brief summary of geotechnical reports and studies between 1974 and the present concerning the Wildcat Fault and LBL East Canyon Area. All documents are available for review in their entirety through LBL Plant Engineering.

• **Active Faults are defined by the State Geologist as those exhibiting evidence of surface displacement during the last 11,000 years (Holocene Age).**

• **Potentially active faults are defined as those that have been active in the last 3 million years.**

List of Reports:

1) ***Geologic Investigation, Building 74 Addition,*** HLA, July 25, 1974, LBL Geotechnical File #238

2) ***Review of Building 74 Addition Geologic Investigation,*** letter from Burton Marliave dated Oct. 15, 1974. LBL Geotechnical File #239

3) ***Preliminary Geologic Investigation, Proposed Biodynamic Laboratory Building,*** HLA, dated July 31, 1975, LBL Geotechnical File #29

4) ***Wildcat Fault Study, Biomedical Laboratory II Project,*** HLA, February 19,1980, LBL Geotechnical File #35

5) ***Review of Wildcat Fault Study by Harding Lawson Assoc.,*** letter from Burton Marliave dated Feb. 27, 1980. LBL Geotechnical File #35

6) ***Preliminary Geotechnical Evaluation, Proposed East Canyon Corporation Yard*** , HLA, January 18, 1985. LBL Geotechnical File # 190

7) ***Geotechnical Investigation, Replacement Hazardous Waste Handling Facility,*** Geo/Resource Consultants, Inc., October 17, 1989. LBL Geotechnical File #

8) ***Geology of Lawrence Berkeley Laboratory,*** Scott G. Borg, Geologist, October 3, 1991.

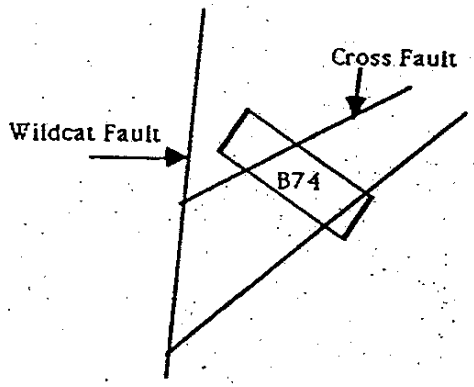
9) *Geologic Studies Relating to the Site Restoration Program at the Lawrence Berkeley Laboratory,* H.Wollenberg, S.Borg, P.Holland, B.Smith, P.Williams, M.Eveland, for Proceedings, 1992 Waste Management Conference, San Juan, Puerto Rico, April 9-11, 1992

CMTW-19 cont.

Report Synopsis

Geologic Investigation, Building 74 Addition, HLA, July 25, 1974, LBL Geotechnical File #238

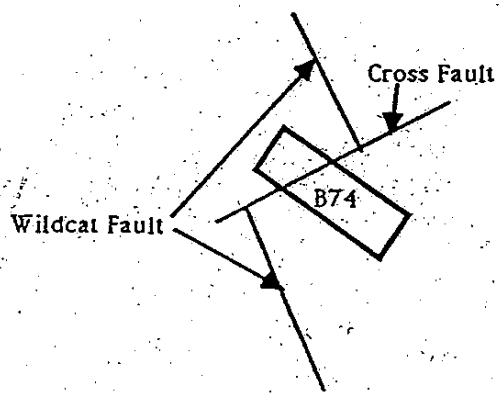
Discusses Alquist-Priolo Act, Wildcat Fault and cross fault "all considered seismically inactive." "The Wildcat Fault and the unnamed adjacent faults do not displace alluvial sediments of Holocene Age or bedrock younger than the Moraga volcanics" (8 million years).



CMTW-19 cont.

Review of Building 74 Addition Geologic Investigation, letter from Burton Marliave dated Oct. 15, 1974. LBL Geotechnical File #239

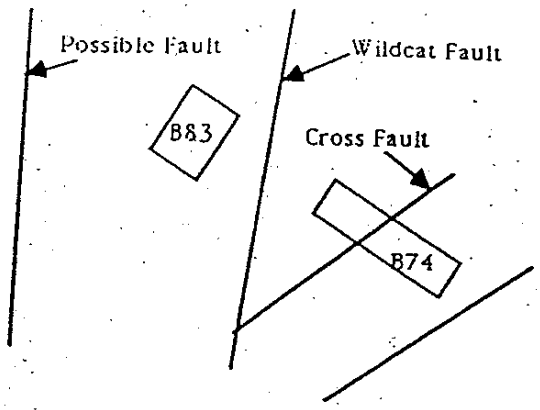
Disagrees with location of Wildcat Fault from above HLA report. Does agree that "no potential hazard exists from the faults in the immediate area". Recommends design earthquake is 7.5 magnitude on the Hayward Fault. Suggests the fault configuration shown at right.



64/84

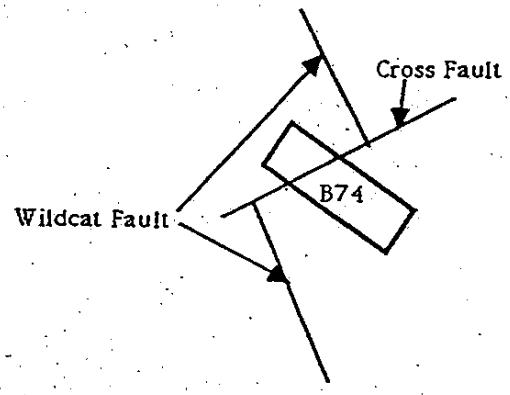
Preliminary Geologic Investigation, Proposed Biodynamic Laboratory Building, HLA, dated July 31, 1975, LBL Geotechnical File #29

Plate 1 shows "possible faults" just east of Bldg 83 site and in overpass ravine both running north and south. Report recognizes Wildcat Fault in the area but states that "neither the Wildcat Fault in this area nor any other fault in the site vicinity is known to be active." as discussed in the Bldg 74 report dated July 25, 1974. Simplified version of Plate 1 is shown at right.



Wildcat Fault Study, Biomedical Laboratory II Project, HLA, February 19,1980, LBL Geotechnical File #35

Trenches excavated across Wildcat Fault north of Bldg 83 and just south of Bldg 74.. Trenches were examined by Korbay, Curtis, Lennert, and Marliave. Report again concludes that neither the Wildcat Fault or the cross fault are active or potentially active. Fault layouts shown at right.



Review of Wildcat Fault Study by Harding Lawson Assoc., letter from Burton Marliave dated Feb. 27, 1980. LBL Geotechnical File #35

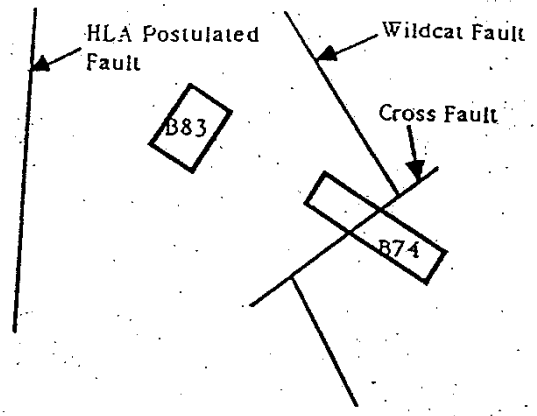
Letter concurs with HLA report of 2/19/80 that there is no evidence of recent fault activity on the Wildcat Fault in the vicinity of LBL property 1

CMTW-19 cont.

65/84.

Preliminary Geotechnical Evaluation, Proposed East Canyon Corporation Yard, HLA, January 18, 1985. LBL Geotechnical File # 190

Reiterates that the Wildcat Fault is not seismically active. Report mentions that a branch of the Wildcat fault may underlie the site. "This postulated fault is based on our interpretation of the site geology including information gained in previous investigations and conditions exposed during landslide repair work adjacent to the overpass along Centennial Drive." Fault layouts shown at right.



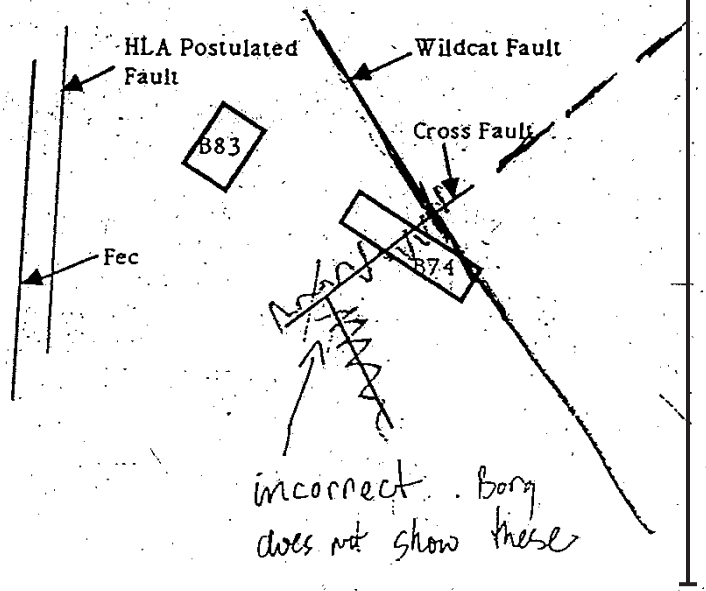
Geotechnical Investigation, Replacement Hazardous Waste Handling Facility, Geo/Resource Consultants, Inc., October 17, 1989.

Refers to Wildcat Fault Study by HLA of 2/27/80 to conclude that fault is inactive.

CMTW-19 cont.

Geology of Lawrence Berkeley Laboratory, Scott G. Borg, Geologist, October 3, 1991.

States that there is substantial (though circumstantial) evidence for the existence of a N-S East Canyon fault designated Fec. Also states that "this fault is inferred to be younger than the earliest activity on the Wildcat Fault and it is possible that this fault has been recently active." Recommends additional mapping and initial trenching in 3 locations. If fault evidence is discovered, then follow up with deep (100-200') drilling.



66/84

Geologic Studies Relating to the Site Restoration Program at the Lawrence Berkeley Laboratory, H. Wollenberg, S.Borg, P.Holland, B.Smith, P.Williams, M.Eveland, for Proceedings, 1992 Waste Management Conference, San Juan, Puerto Rico, April 9-11, 1992

Paper refers to **Borg, 1991** and reiterates that there is substantial evidence for the existence of the East Canyon fault (F_{EC}) based on 1) air photos, 2) apparent stratigraphic offsets, and 3) spring alignment in 1875. Paper mentions other possible faults at LBL and concludes that "once these faults are verified, their roles as pathways or barriers for movement of groundwater can be determined." Location of F_{EC} is the same as shown in Borg's paper above.

CMTW-19 cont.

67/84

CMTW-19
cont.

1. Borg

The geology of Strawberry Canyon was recently mapped by Scott Borg (LBL Geologist) as part of the Site Characterization project to evaluate hydrogeologic conditions of the LBL property. In his report on the Geology of the Lawrence Berkeley Laboratory, Borg (1991) depicted the ECF as a right-lateral, N-S trending fault in the eastern portion of East Canyon (Fig. 8a and 8b). The ECF provided Borg an explanation for the jog in the otherwise fairly linear trace of the WF that separates older Miocene-early Eocene sediments and Claremont Formation from younger, mostly Pliocene Orinda and Moraga Formations. He did not determine whether the ECF terminates at the intersection of the WF but he did consider movement on the ECF to be more recent than movement on the WF.

Borg showed two other faults that splay northwestward from the WF shear zone. These faults define the central northern area of East Canyon. Borg infers that they may separate and define wedges of Siesta and Orinda sediments. There may have been a color error in his map such that it is more likely that he was depicting the Sobrante Formation rather than the Siesta. His map shows that the Building 85 footprint would be on Moraga volcanics.

At the southern portion of East Canyon, west of the WF, and within the hairpin curve of Centennial Drive, Borg shows an E-W depositional contact between Moraga and Orinda bedrock. This interpretation is different from any previous maps for the area.

To the east of the WF Borg shows a queried NE-SW trending fault that displaces Claremont and Orinda sediments. This fault is herein referred to as Lawson Fault/Borg (LF/B) because it was first depicted in 1900 by Lawson and Palache in their publication about the geology of the Berkeley Hills. Lawson indicated that the fault, herein referred to as Lawson Fault/Lawson (LF/L), crossed and offset the WF and continued southwestward toward Strawberry Creek (Fig. 14). On the other hand, Borg believes that the LF/B does not crosscut the WF. Thus, Borg considers movement to be more recent on the WF, while Lawson considered movement on the LF/L to be more recent.

CMTW-19 cont.

2. Geo/Resource Consultants (GRC)

During 1989, GRC performed a Geotechnical Investigation for the proposed HWHF (Ng, et al, 1989). Their mapping showed a trace of the WF separating Claremont and Orinda bedrock along eastern East Canyon (Fig. 15). The LF/L was not within their study area. The Orinda is shown to contact the Moraga to the east of the HWHF. Building 83 is shown to straddle the contact and this interpretation was probably based upon an earlier geotechnical evaluation by Korbay (1985). GRC reports the WF and LF/L as inactive. This was based upon GRC's review of the HLA report (Korbay and Lewis, 1980). The proposed HWHF footprint is shown to be on Moraga bedrock as borne out by GRC's borings and test pits.

3. Dames and Moore (DM)

Dames and Moore (1962) showed cross faulting in a roughly E-W projection through Building 74 (Fig. 11). The cross fault lined up between boring #10,

which reportedly intersected Orinda Formation at the surface, and borings #9 and 13, which intersected brown silicious shale at 25 feet and 14 feet depth, respectively. This shale was interpreted by DM to represent the Claremont Formation. An alternative interpretation could be that the silicious shale is part of the Tm-e bedrock that contains interbedded shales and sandstones. DM indicates that boring #10 is to the north of the cross fault, which herein is designated Lawson Fault/Dames and Moore (LF/DM). Their study does not confirm the existence of the cross fault through any other analysis.

4. Harding-Lawson Associates (HLA)

Reports by HLA have included a variety of interpretations of the geology and faulting within East Canyon. Their most recent reports are referenced herein. In their Preliminary Geotechnical Evaluation of the Proposed East Canyon Corporation Yard Development (Korbay, 1985) the HWHF footprint would occur on Moraga bedrock (Fig. 10). The WF is delineated as a single trace to the east of East Canyon, and to the south the WF is offset by an E-W trending cross fault intersecting Building 74. This cross fault is in the general vicinity of LF/L but it has a slightly different location and projection than LF/B or LF/DM. It is thus referred to as Lawson Fault/Korbay (LF/K), after the HLA Project Engineering Geologist. LF/K intersects Centennial Drive just south of the security gate at Cyclotron Road and projects westward. The map in Figure 9 also shows the inferred KF paralleling a linear drainage channel to the west of the WF.

The earlier HLA report (Korbay and Lewis, 1980) showed a slightly different geologic interpretation than that shown in 1985. In particular, the KF is not indicated (Fig. 16). The 1980 HLA report discusses that Lennert (1976) expressed concern for potential activity on either the WF or the cross fault (LF/L or LF/K?). Accordingly, HLA performed a trench analysis in 1980 and concluded that the WF and the LF/K were both inactive. This determination was based upon HLA's analysis of two trench studies: trench A on the WF in northern East Canyon; and trench B on the cross fault LF/K just west of Building 74 (Fig. 16 and Plate I).

CMTW-19 cont.

In 1980 Korbay, Lennert and Curtis were all present at the trench A site for the WF, which was located approximately 1000 feet north of the HWHF (HLA's Log of trench B is shown in Fig. 17). Their disagreement regarding activity of the WF has been noted (King, 1984; personal communication from Curtis and Lennert, 1993). Furthermore, since Borg's map and Plate I show several faulted strands near the trench location, and HLA's WF trench never intersects chert from the Claremont Formation (which might define the eastern edge of the WF), it is impossible to say with certainty that Korbay actually viewed "the" WF in the HLA trench. HLA's trench shows that a contact between the Orinda and a light yellow brown clayey sandstone demarcates the WF. This sandstone may be sandstone that is associated with the Sobrante or Tm-e unit, that is frequently found near the base of the Claremont. Curtis has remarked (personal communication) that he has observed a light gray, poorly cemented sandstone near the base of the Claremont Formation at the east side Building 74. He interprets it as distinct from the Orinda and Moraga, which could imply that there may be yet another sandstone unit that is unresolved along the WF shear zone near Building 74.

The WF has been postulated to be a wide shear zone which implies that it may not have a single trace, as depicted on so many of the maps. Korbay concluded that since there was no displacement of colluvium, the WF was not active. However, a discrepancy exists in the HLA log of trench A. The detail of the WF shear shows that there is a vertical bedrock step on the eastern edge of the fault trace, but it is not shown in the larger diagram of the entire trench wall, nor is an explanation given in the text for the stepped feature. Notes on the detailed drawing indicate that "no gouge on sandstone surface" was observed by Korbay on the face of the bedrock step. It is conceivable that if gouge had formed it could have been removed by erosion subsequent to the displacement. Alternatively, landsliding following the displacement could have overlain the fault displacement and would not require evidence of shears in the colluvium. Curtis (personal communication, 1993) considers that the opportunity for gouge or slickensides to form is very unlikely when near-surface colluvium is faulted against bedrock. The sharpness of the bedrock face led him to believe that the WF had been recently active. Given that the bedrock step is shown in Korbay's detailed drawing, where more care was taken to draw features exposed at the fault trace, the step clearly seems to exist. It is the discrepancy, about the interpretation of the bedrock step and whether shears, fault gouge, or slickensides are even required when colluvium is faulted against bedrock that makes resolution of whether the WF has been active during the last 11,000 years very difficult. This latter problem plus the lack of continuous bedrock outcrop along the base of the trench, lack of detailed characterization of the overlying soil and colluvium above the fault trace, and the failure of the trench to intersect chert from the Claremont Formation, in my opinion, leaves the only known trench analysis on the WF unresolved.

CMTW-19 cont.

A second trench B was excavated by HLA to determine if LF/K was active since it was interpreted to offset the WF (Fig. 16). HLA states that the location of the cross fault was previously determined from an exposure behind building 74 and interpretation of test borings from other investigations. Information about the exposure is not given nor has it been found in previous reports reviewed for this study. No trenching has ever been done on the LF/K to verify its location on the East side of the WF. The projection of LF/K actually plots to the north of the DM's boring #10 (Fig. 10), which was DM's basis for the location of the cross fault to the south of the boring, and thus Korbay's cross fault trench was to the north of DM's projection of LF/DM. If HLA's trench was only 65 feet long, as indicated on their trench log (and not 73 feet as shown by Korbay and Lewis, 1980) then it is unlikely that the HLA trench intersected the cross fault projected by DM. The HLA trench log B (Fig. 18) indicates that bedrock was not intersected and that only an altered zone in a sandy clay colluvium was encountered to demarcate the possible location of the LF/K. Korbay concluded that since the upper three feet of soil did not show displacement, the LF/K was not active. On the basis of this scant information, I do not believe the location of a cross fault, whether it is LF/L, LF/B, LF/DM, or LF/K has been verified. Additionally, if there is a cross fault, it cannot be ascertained from existing reports whether it offsets the WF or vice versa.

In a subsequent report by HLA (Korbay, 1982) a different interpretation of the WF and the cross fault is shown (Fig. 19). Two cross faults were inferred and displacement of the Claremont cert is indicated by the cross faults.

The nature of the contact between the Moraga and Orinda Formations in central East Canyon is not explained by Korbay in his 1985 report because the contact is shown to be overlain by Quaternary Colluvium (described as landslide debris and colluvium) (Fig. 10). However, the older 1980 Geologic Map shows a depositional contact existing between Orinda and Moraga bedrock in northern East Canyon, north of the fire trail near the UCB Animal Behavior Station (Fig. 19). This differs with Jones' interpretation that these two units are faulted against each other in this area.

5. Converse Consultants (CC)

In a report by Converse Consultants (King, 1984), the mapping of the WF and the LF/K (Fig. 20) is similar to that by Korbay in 1985 (Fig. 10). CC discuss that the WF has a sense of displacement similar to the Hayward Fault Zone, right lateral slip with a similar east-side-up vertical component. The CC report quotes Curtis that 3.5 miles of right lateral displacement from the Sibley Volcanic vent to the East Canyon Area has occurred over the last eight million years. CC concludes that the activity of WF remains a question but based upon Korbay and Lewis' (1980) study of the WF, they judge that it is most likely not active within the study area. However, they did not perform a critical review of Korbay and Lewis' trench investigation.

The central East Canyon is mapped by CC as Quaternary Colluvium overlying Orinda and Moraga bedrock. The nature of their contact is shown to be depositional at the northern extent of the East Canyon. Southwestern East Canyon is shown as a Quaternary landslide that has destabilized portions of Centennial Drive and Cyclotron Road west of the security gate.

CMTW-19 cont.

The 1984 CC report depicts faults identified by HLA and Lennert (Fig. 21). HLA's interpretations are discussed in the text above. Lennert's mapping is from Lennert and Associates Hill Area Dewatering Study, Revised Geologic Map (1979). Lennert depicts an E-W trending fault, referred to as New Fault (NF) by the CC report. Voids encountered during drilling and the disappearance of surface runoff into cracks in a ravine were the basis for his postulated NF. Based upon lack of surface expression and lack of offset geologic units, CC did not support the existence of NF.

Lennert also depicted the E-W trending University Fault to cross the Upper portion of East Canyon and that it and NF are both truncated by the WF. A smaller fault trending northwestward into the Animal Behavior Research Station is indicated to the north of University fault. The CC report did not support the existence of the University Fault. The smaller fault was not addressed in CC's analysis.

6. Holland & Wollenberg

In their Initial Appraisal of the Geologic Controls of Ground Water Occurrence and Movement in the "Grizzly" Area of the LBL, Holland and Wollenberg (1992), suggest an E-W trending fault, herein referred to as the Holland Fault (HF), just north of Lennert's postulated NF (Fig. 22). This fault is suggested in one of two hypotheses to explain the geology near Building 77 as interpreted from numerous boring logs. The HF is discussed as part of a hypothesized setting that includes a volcanic center. The eastward projection of the HF

would intersect the ECF at about 1,000 feet elevation. Holland and Wollenberg hypothesize that this fault would have an apparent south-side down offset.

This is consistent with the geomorphology of central East Canyon. A slightly northerly projection of the HF may be used to possibly explain two geomorphic features that can be seen on Figure 6. The saddle behind the knob just north of the end of the trace of the HF could be down dropped to the south. Two drainage channels, at points A and B, are also beheaded near the 1,000 feet elevation in central East Canyon.

7. Provenzano

A report on Slide Repair Investigation for the UCB Botanical Gardens by Provenzano (1991) indicated that the cause of a landslide in the Botanical Gardens was due to excessive subsurface seepage flow, partly related to the crossing of the WF. Provenzano sites unpublished data that was provided to him by Ben Lennert and includes a geologic map with Lennert's interpretation of the location of the WF (Fig. 13). This map indicates that the WF is not displaced by any cross faults and that the WF projects through Building 74 in a different southeasterly trend than previously indicated on Lennert's map cited by CC.

CMTW-19 cont.

8. Dibblee

The published Geologic Map of the Briones Valley Quadrangle (Dibblee, 1980) shows a different interpretation of the WF from those of other investigators. Dibblee indicates that it veers west of Building 74, and appears to meet up with the KF in the area within the hairpin curve of Centennial Drive (Fig. 9). The distribution of bedrock is also shown to be quite different than that of other investigators, particularly that the Orinda Formation is not shown to occur west of the WF or between the Moraga and Claremont Formations.

Appendix IV - Figures

CMTW-19
cont.

In 1998 the US Environmental Protection Agency declared LBNL eligible for listing on the National Priorities List (NPL) for Superfund clean-up.

The legacy contamination at LBNL is significant and a couple of pump and treat operations do not adequately deal with the contamination issues. LBNL has never mapped the site's hydrostratigraphic units (HSUs) to better understand the hydraulic connection between various permeable layers of the HSU's sedimentary sequences to facilitate a more accurate construction of groundwater flow and contaminant fate-and-transport model. We ask that DOE fund a rigorous mapping of all the HSUs associated with the Project sites and that this mapping be included in the EIS. Section IV.C.2 was superficial and did not adequately address the serious contamination present at LBNL. As a reference to groundwater cleanup we include a presentation by Lawrence Livermore National Laboratory's Site Restoration Program Leader, available at UC Water Resources Center Archives' website. (Attachment 10.) **CMTW-20**

After 70 years in Strawberry Canyon, it is time for LBNL to move offsite to better facilitate the vision of its current director Alivisatos (Attachment 11, p.2) to reorganize the lab's physical layout and <u>create a second campus</u>. The lab's antiquated concept of co-locating research (buildings) should be changed to embrace a modern "Global Network University" concept with "Portals" (campuses) not just in different cities but countries, which is the cutting edge trend among universities (NYU) and other institutions of higher learning. **CMTW-21**

To exercise the principle of co-locating research in every day lab life is impossible, based on the DEA's description (IV.B.7./p.54) of lab practices to prevent Intentional Destructive Acts. "The entire LBNL site is fenced, and controlled access is available only at three entry gates. <u>Card keys would be used for building access</u>... The building would have a guard on the door during normal business hours and <u>card key access</u>. " Indeed, no one from the outside, even from labs next door can casually walk in and "exchange ideas", as is continually purported by LBNL officials. In fact access to any building/lab/office is strictly controlled and available only on a "need to know" basis. **CMTW-22**

For the reasons stated above, we ask that LBNL very seriously consider expanding the co-location concept to the entire Bay Area, i.e. consider alternative locations for the second campus in Richmond (Richmond Field Station), Vallejo (Mare Island), Oakland (former Navy Base), Alameda (former Naval Station) and in Fremont (former NUMMI plant/See attachment 12.) to avoid continuing logistical, environmental, geotechnical constraints and legal challenges, currently crippling LBNL and its future! **CMTW-23**

ATTACHMENT 10.

Lawrence Livermore National Laboratory

History of a Ground Water Cleanup Project: LLNL's Livermore Site

May 4, 2010

Pete McKereghan

Site 200 Restoration Program Leader

Lawrence Livermore National Laboratory, P. O. Box 808, Livermore, CA 94551

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344

CMTW-24

Presentation Outline

- Site Background
- Site Hydrogeology
- Remediation Approach
- Effectiveness of Selected Remedy
- Regulatory Process
- Accomplishments
- Summary

(Technology Ventures Corp in partnership with US DOE . Nports on tech transfer)

INNOVATION: America's Journal of Technology Commercialization

ATTACHMENT 11 (4 PAGES)

Vol 8 #2

Raising the Energy Level at the Berkeley Lab

April/May 2010
Paul Alivisatos

By Ken Castle

He has an endearing laugh, an amiable personality and a sense of informality that puts people at ease. But behind the affable demeanor is a man with a mission. Paul Alivisatos, the new director of the Lawrence Berkeley National Laboratory, isn't wasting time or energy in his assault on global warming. He's determined to establish the lab as an energy research hub and to accelerate the transfer of technology in ways that can have significant impact. To accomplish this, he's asking his 4,000 employees to overhaul the lab's culture, priorities and collaborative processes. And could they please do this yesterday?

With a Ph.D. in chemistry, Alivisatos is soft-spoken but resolute. "Our lab needs to be much more strategic and much better coordinated in its approach to research on climate and the carbon cycle," he says. "The scale of innovation that is required to address these global problems is enormous and there is an urgent need for us to step up with more focus and more resources." In his view, it's time to get scientists out of their silos, encourage them to work as a team on common objectives and convert their research into deliverable applications.

CMTW-24 cont.

Alivisatos, 50, was named in November to the position that was formerly occupied by Steven Chu, who was appointed secretary of the Department of Energy last year. Alivisatos was acting director until the University of California's Board of Regents made the appointment permanent. Managed by the University since 1931, Berkeley Lab—which was the first in the national laboratory system—performs research in nanoscience and advanced materials, life sciences, computing, energy and earth sciences, physics and cosmology.

It might be argued that Alivisatos, who was raised in Chicago but spent part of his childhood in Greece, has big shoes to fill, and quite a legacy to inherit. But, as deputy director during Chu's tenure at the lab, he's been well-groomed for management, which is often outside the comfort zone of academics. "He's an incredible scientist with incredible judgment on a variety of issues," Chu says of his former colleague. "He's level-headed and calm, and he has an ability to inspire people. Also, he has the leadership to take projects from material science to real-world applications."

Indeed, the multi-tasking Alivisatos, who still conducts his own nanoparticle research and still regularly meets with a group of grad students at the university, knows something about what it takes to create a business. He was a scientific founder of Nanosys Inc. and Quantum Dot Corporation and is a board member of Solexant, Inc. Nanosys, which was launched in 2003, produces materials that give LCD displays better

color and brightness and extend the capacity of lithium ion batteries. Quantum Dot, a nanotech startup acquired by Invitrogen in 2005, develops tiny semiconductor crystals that fluoresce brightly with small amounts of light, thus providing detailed imaging tools for medical researchers studying the behavior of cells and organs. Solexant, founded in 2006, manufactures third generation thin film photovoltaic technologies that significantly increase the efficiency of solar cells and thus reduce the cost of solar modules. All of these technologies spun off from projects that Alivisatos spearheaded at the lab.

Being involved with startups, he says, has been a sometimes humbling and frequently enlightening experience. "When you take things from the lab to the marketplace, there are so many considerations and so many ways to work that issue," he says. The commercial success of a new company, he adds, has more to do with the talent of the leadership, especially the CEO, than with the technology. Without strong marketing, sales and production efficiencies, groundbreaking discoveries can have difficulty finding a life outside of the laboratory—a reality that often confounds scientists, says Alivisatos.

A key challenge for the Berkeley Lab, as well as for the nine other DOE labs across the country, is coming up with a system of collaborating with industry. Last year, the Government Accountability Office issued a report on shortcomings in the labs' technology transfer programs. It said that the facilities lacked parameters such as consolidated goals, performance measurements, incentives, funding and flexibility.

While the Berkeley lab has a track record of giving birth to startups and licensing its science, Alivisatos acknowledges that sometimes the catalyst is little more than "throwing it over the fence"—a comment punctuated by his trademark laugh. "But the consensus is that this is not the preferred model," he says, "and that we need to think about better structures." One organization that is trying to tackle the bottlenecks, he adds, is the Joint BioEnergy Institute, a San Francisco Bay Area partnership that consists of the Berkeley Lab and five other nearby labs and institutions, among them Lawrence Livermore and Sandia national laboratories. Their mission is to stimulate development of the next generation of biofuels—liquid fuels derived from the solar energy stored in plant biomass.

CMTW-24 cont.

"When we talk to our friends in industry, both the large established companies and the startup entrepreneurs, we often find that each one has a different idea on how to interact with us," he says. "We have to be flexible, and hopefully the DOE will be flexible. It's very possible that a nimble industry innovator will be able to do things that our lab would never be able to do, and yet our lab has the basic science that is a good resource. We might need to do research cooperatively in different ways. It might be that we would have a consortium, if it is a competitive situation, or particular partners that want a closer relationship. There are a lot of challenges, but we have to be excited about the opportunities."

Certainly, Alivisatos is turning up the wattage at Berkeley Lab, which is situated on a hill above the UC campus but also maintains satellite facilities in west Berkeley and neighboring Oakland. Among his five key objectives is a major reorganization of the physical layout. He'd like to consolidate the outliers into a second campus and revitalize the main campus by replacing old, seismically challenged buildings with new ones. Potential sites for the second complex are being identified and a recommendation is in the wings. While the need exists to add more staff and work space (and, not incidentally, more grants), Alivisatos is reaching out to the surrounding neighborhoods with assurances that the main campus will not extend beyond its existing footprint, thus addressing the concerns of environmentalists and residents.

As part of a new community relations initiative to dispel the lab's walled garden impression, Alivisatos regularly meets with members of the Berkeley City Council, inviting them to come up and visit. And he's formed an advisory group to engage friends and critics alike, providing updates and inviting feedback on

existing and proposed projects. Given the "green" sensibilities of Berkeley and the local economic stimulus from the lab, that sort of relationship would seem natural. However, the reality is that it hasn't been warm and fuzzy in years past. "We haven't done a good job of telling our story," says James Krupnick, chief of operations and a lab veteran of 33 years. "But Paul has a knack for explaining things in layman's language."

Another goal is to improve efficiency at the lab. Alivisatos wants to initiate peer and scientific reviews of all 14 divisions, which function with their own directors and set their budgets independently. He wants to see if the operations staff can tighten up on administrative costs and if scientists can network more frequently with other teams. These reviews, suggests Krupnick, are aimed at eliminating duplication, as well as reorienting the staff to focus on key technological objectives. The vision is that if the fundamental and applied science groups can work cooperatively at much higher levels than they have in the past, real progress can be made on the innovations that are needed to affect climate change.

Alivisatos has identified two key science initiatives that hold the most promise for commercial applications: Carbon Cycle 2.0 and Next Generation Light Source. The second of these is an extension of his own pioneering research in nanocrystals, and reflects his involvement in creating startups. He believes there are more opportunities to develop low-powered light sources, using quantum dots and quantum rods for a variety of electronics and medical devices, and thus reduce demand from the grid.

But his overriding priority is an ambitious, all-hands-on-deck effort to eliminate carbon emissions. "Our lab is supposed to solve big problems," he told his staff in a February call-to-action briefing. The goal of this initiative, he said, "is to make sure that the lab itself has the biggest impact that it is capable of having. We have lots of people who are making wonderful discoveries in fundamental science but who could contribute more to the issues of carbon cycle research than they are today."

CMTW-24 cont.

The lab scientists are being tasked to create more precise climate modeling and to move the needle on biofuels, solar photovoltaics, battery efficiency and carbon capture. Also, said Alivisatos, they should expedite their research into the relatively new field of artificial photosynthesis, which holds long-term promise. Berkeley Lab has been working on something called the Helios project, in which the goal is to create photovoltaic cells in the form of a semiconductor membrane of nanocrystals that would mimic natural photosynthesis, the process by which green plants convert sunlight into electrochemical energy. The end product would be the storage of solar energy in the form of renewable liquid transportation fuel. Alivisatos has calculated that 58 million acres of non-arable land covered with photovoltaic nanocrystals would be enough to replace all of the gasoline consumption in the United States. In this effort, the lab is investigating three prototype systems: generating biofuels from biomass and algae, and using solar energy to directly convert water and carbon dioxide to fuels.

While some teams are developing new technologies, others, he says, need to concentrate on short-term solutions. Specifically, the lab should address how to make more efficient use of fossil fuel, since reliance isn't going away anytime soon, and to temporarily store carbon dioxide—in processes referred to as capture and sequestration—without releasing it into the atmosphere.

Clearly, life will change for the scientists at Berkeley Lab as they rally around a new, more critical mandate. But there is little doubt that Alivisatos is held in high esteem by his colleagues and knows how to manage change. "It's amazing to see how Paul handles both his academic research and his administrative duties," says Peidong Yang, himself a world-renowned Berkeley chemist with expertise in nanoscience and solar-based nanotechnology. Years ago, Yang worked with Alivisatos to build a molecular foundry at the lab and, more recently, is helping him develop a solar innovation hub as an outgrowth of the Helios project. "Paul

has always had vision and a deep grasp of the science behind the problems," says Yang. "He communicate exceptionally well with scientists from various disciplines, with chemists, physicists and engineers. He has this ability to pull people together."

With his multiple talents, Alivisatos seems to be the right man in the right place. And he embraces a profound chance to make history. "This is an amazing period for the lab," he says, one in which he anticipates expansion, improved integration and transparency, and more financial support from the federal government. "Since the nation has decided to rely on science to lay a foundation for the future, as well as help dig ourselves out of recession, our job with the labs is to make sure there is good return on investment."
Paul Alivisatos realizes that his is a high-stakes assignment. Time is running out, and every nanosecond counts.

Ken Castle is a freelance writer who reports from California for Innovation.

CMTW-24 cont.

ATTACHMENT 12.

Lawrence Fremont National Laboratory

A New National Center with Consortium Partners for Green Clean Technologies/Research/Development/Manufacturing.

Five million square feet of laboratory/office/research and manufacturing space **already built and immediately available** at the NUMMI Fremont site, previously occupied by a joint venture between General Motors and Toyota, which ended on April 1, 2010.

The site is in the **geographic center of the Bay Area**, served by an excellent transportation infrastructure, a trained workforce and research and development communities nearby as well as supportive elected officials!

The new **Lawrence Fremont National Laboratory (LFNL)** will be just
35 miles from Berkeley (UC/LBNL)
30 miles from Oakland (22 miles from the Oakland International Airport)
41 miles from San Francisco/UCSF (32 miles from SFO)
18 miles from Livermore (LLNL/SANDIA),
12 miles from Hayward (Cal State EB)
16 miles from San Jose (Airport) and Silicon Valley
18 miles to Menlo Park/Palo Alto/Stanford/SLAC

The LFNL, future anchor/center and hub of the Green Corridor going north, south, east and west, is centrally located to all of the East Bay, South Bay, Peninsula and San Francisco!

This is the **Opportunity of the Century for the Department of Energy**, Lawrence Laboratories, UC and the Consortium of Private Industries they are now or will be partnering with in the future; British Petroleum (BP), Energy Biosciences Institute (EBI), Joint BioEnergy Institute (JBEI/Jay Keasling), Amyris Biotechnologies, Nanosys Inc., Quantum Dot Corporation/Invitrogen, Solexant Inc. (Last 3 associated with Paul Alivisatos), etc.

It is specifically an Opportunity of a Lifetime for the Lawrence Berkeley National Laboratory, to offload facilities from the unstable Strawberry Creek watershed site, with its unconsolidated soils, water and mud of a collapsed caldera, riddled with landslides and earthquake faults, stifled by logistical, environmental, geotechnical constraints and legal challenges, currently crippling LBNL and its future.

CMTW-24 cont.

Since this Project is so huge, expensive and controversial, we are submitting all of our 3 previous comment letters* to the CEQA process to be considered (and responded to) as comments to the NEPA DEA process. Especially we ask you to review our report titled: "Contaminant Plumes of the Lawrence Berkeley National Laboratory and their Interrelation to Faults, Landslides, and Streams in Strawberry Canyon, Berkeley and Oakland, California", specifically sections dealing with Contaminant Sites, both regarding chemical and hazardous contamination and radioactive contamination, Drainage Network Mapping, Geologic "Bedrock" (Formation) Mapping, Fault Mapping, Landslide Mapping, Plume Monitoring Sites and Zones of Concern for Potential Plume Migration, as well as Future Development and Site Conditions and in conclusion our General Recommendations warrant careful consideration in the full-scale EIS, as they all deal with concerns related to Project sites, i.e. B85 complex, B25 complex (GPL) and B 71/55 sites of the DEA. (Attachment 13). CMTW-25

Inadequacies of the DEA are blatant, uncertainties associated with these sites enormous, "Detailed information concerning significant environmental impacts" (required by NEPA were glaringly missing, thus denying decision makers the ability to adequately assess all potential and existing environmental risks associated with the Project. THUS A FULL-SCALE EIS IS REQUIRED, especially since significant amounts of public, taxpayer funds under ARRA are proposed to be committed to this ill conceived Project with extreme risks inherent at the site. CMTW-26

Sincerely,

Pamela Sihvola
Co-chair, CMTW
P.O. Box 9646
Berkeley, California 94709

* Our comments on the DEA are organized in 5 sections titled:
DOE/SLSII/DEA
COMMENTS#1of5 through #5of5

ATTACHMENT 13(A)

CONTAMINANT PLUMES OF THE LAWRENCE BERKELEY NATIONAL LABORATORY AND THEIR INTERRELATION TO FAULTS, LANDSLIDES, AND STREAMS IN STRAWBERRY CANYON, BERKELEY AND OAKLAND, CALIFORNIA

Strawberry Creek Watershed ca. 1965

Laurel Collins, Geomorphologist
Watershed Sciences
1128 Fresno Ave
Berkeley, California 94707
collins@lmi.net

for

Pamela Sihvola, Project Manager
Committee to Minimize Toxic Waste
P.O. Box 9646
Berkeley, California 94709

CMTW-27

83/84

ATTACHMENT 13 (B)

TABLE OF CONTENTS

INTRODUCTION 1

OBJECTIVES 3

REPORT ORGANIZATION 4

GENERAL SITE DESCRIPTION 5

CONTAMINANT SITES 5

- CHEMICAL AND HAZARDOUS CONTAMINATION 5
- RADIOACTIVE CONTAMINATION 10

METHODS 12

RESULTS AND DISCUSSION OF DATA COMPILATION 13

- DRAINAGE NETWORK MAPPING 13
- GEOLOGIC BEDROCK MAPPING 18
- FAULT MAPPING 24
- LANDSLIDE MAPPING 35
- PLUME MONITORING SITES 41
- ZONES OF CONCERN FOR POTENTIAL PLUME MIGRATION 44
- FUTURE DEVELOPMENT AND SITE CONDITIONS 46

CONCLUSIONS AND GENERAL RECOMMENDATIONS 50

ACKNOWLEDGMENTS 50

REFERENCES 51

CMTW-27 cont.

84/84

Committee to Minimize Toxic Waste

DOE/SLSII/DEA
COMMENTS#2of5

Board of Regents, University of California
Russell Gould, Chairman

URGENT

c/o Anne Shaw, Secretary
Office of the President
1111 Franklin Street, 12th. fl.
Oakland, California 94607

July 8, 2010

Via fax # (510) 987-9224

Subject: Comments on Action item GB 4, before the Regents' Committee on Grounds and Buildings (July 13, 2010): Certification of Environmental Impact Report (EIR) and Approval of Design of the Seismic Life Safety Modernization and Replacement of General Purpose Laboratory (GPL) Building, Phase 2 (Seismic Phase 2) Project, Lawrence Berkeley National Laboratory (LBNL)

Honorable Chair Russell Gould and Members of the UC Board of Regents,

We urge you not to certify the above referenced EIR for the Project proposed for the Lawrence Berkeley National Laboratory (LBNL) site, located in the Strawberry Creek Watershed in Berkeley and Oakland, California, for the following reasons:

CMTW-27 cont.

1. The entire EIR for LBNL's Seismic Life Safety Project is wrong-headed by stating that the "Project" would remedy LBNL space which poses Seismic Life Safety risks, because it willfully ignores the fundamental meaning of the fact, that the entire LBNL site is on the State of California's delineated official seismic hazard zone for earthquake induced landslides (CGS 2003 a/b).

The following is a citation by LBNL's Geotechnical consultant Alan Kropp & Assoc. in reference to another ARRA funded project at LBNL also associated with the Building 71 site: "The recommendations presented herein are not intended to stabilize the site or mitigate the potential for landslide type movements." (April 8, 2010 Geotechnical Investigation, Building 71 BELLA). Building 71 site is on top of a major landslide, included in the CGS Seismic Hazard Zone Report map, showing a landslide extending from the hills - upslope of B 71-beneath most of the B 71 complex and into the valley below.

These same concerns apply to the sites of the other components of the Project EIR currently before you. Of special concern are the landslides undermining Building 85 complex, LBNL's Hazardous Waste Handling, Storage and Treatment Facility and the Building 25 complex, the proposed site for the General Purpose Laboratory (GPL).

THE DAILY CALIFORNIAN
Established 1871. Independent Student Press Since 1971.
Berkeley, California
Monday, July 12, 2010
www.dailycal.org

CMTW-27 cont.

UC Board of Regents Set To Hear Lab's Seismic Plan

by **Zoe Filippenko**
Contributing Writer

The Lawrence Berkeley National Laboratory will propose a seismic modernization plan to the UC Board of Regents at their Tuesday meeting to begin updating the hazardous buildings within the facility, but concerns have been raised by community members over the environmental impacts of the construction.

The proposal suggests retrofitting one building, constructing a new general lab and demolishing two buildings and six trailers. It is part of the lab's long-term development plan pioneered in 2006. According to the plan, only 51 percent of the lab's buildings were assessed as suitable for use and 24 percent of the structures needed seismic upgrades.

Additionally, the report states that 62 percent of all lab buildings are more than 40 years old, pushing them past the age where it becomes more cost-effective to construct a new building.

"The takeaway message for us is that safety is of primary importance," said Jeff Miller, head of public affairs at the lab.

However, the nonprofit organization Save Strawberry Canyon has been continuously voicing concerns about the lab's building endeavors.

According to the organization's president, Lesley Emmington, the lab is built on the remains of a dead volcano that is composed of soft soils and large amounts of water.

The composition of the land is relatively unknown, but it has proven to be susceptible to serious erosion and landslides, Emmington said. Not only is building on top of this soft soil dangerous, but the natural resources and beauty of the watershed will be

>> LAB: PAGE 2

The Daily Californian **NEWS**

LAB: Proposal Estimates Plan to Finish by 2014

FROM FRONT

threatened, she added.

"How are they going to stabilize the building if there is nothing but soft, shaky soil underneath?" she said. "Lawrence Berkeley Lab places things in this area, but if the structures are moved 20 feet, there is nothing solid from part to part."

But Jerry O'Hearn, the retrofit project's director, said there are "no significant, unavoidable environmental impacts in the Environmental Impact Report." He added that the new building will out-perform set energy standards by 50 percent.

Buildings are chosen for repair and retrofit through a rating system on a scale of very poor to good. Those deemed most hazardous become the highest priority to retrofit, according to Miller.

Projected timelines under the new proposal estimate that the various projects would begin in 2011 and be completed by 2014. The lab, which employs approximately 4,000 people, would have to relocate employees in one of the buildings scheduled for demolition. The other building has been vacant for years due to its hazardous structure.

The lab already received funding for the proposed construction, allocated by the U.S. Department of Energy as part of a stimulus package for all of the 10 labs under the authority of the department's Office of Science.

Contact Zoe Filippenko at zfilippenko@dailycal.org.

1a. 2/11

2.

In addition to the landslide risks of the proposed GPL site, the area, known as LBNL's Old Town, contains some of the most serious and extensive legacy contamination at the lab, especially VOCs, Volatile Organic Compounds, potentially causing a threat to any personnel from construction workers to LBNL employees present at the site at any time!

CMTW's concerns regarding radioactive and hazardous waste contamination at LBNL were largely ignored, specifically as they were expressed in our report: "Contaminant Plumes of the Lawrence Berkeley National Laboratory and their Interrelation to Faults, Landslides, and Streams in Strawberry Canyon, Berkeley and Oakland, California" submitted as part of our comment letter to LBNL.

Enclosed is a brief chronology of some of the 40+ landslides already mapped at LBNL (Attachment 1.) as well as a figure showing the collapsed caldera of the site with unknown mixture of mud, perched water and boulders, for which LBNL has yet to do a comprehensive hydrogeological study of its composition. (Attachment 2.) Also missing is the mapping of LBNL's hydrostratigraphic units (HSUs), which would show the hydraulic connection between various permeable layers of the HSUs sedimentary sequences, thus facilitating a more accurate construction of ground water flow and contaminant fate-and-transport models.

CMTW-27 cont.

3. Two critical figures, referred to on page 5-227 of the Final EIR, were missing . They were hastily sent out with a Notice of Errata on June 30, 2010. The title of Figure 1. is "Bedrock geologic map of LBNL", and yet it only refers to various formations present at LBNL, such as Moraga Formation, Orinda Formation etc. There is no bedrock at LBNL, the use of the word bedrock is misleading, it is a misnomer, and LBNL should carefully describe what they mean specifically when using this word! (Attachment 3.)
Furthermore, the Draft EIR contained a figure titled:" Wildcat Fault Study" by William Lettis & Assoc. Inc. (Figure 4.5-2, on page 4.5-13). This figure was replaced by another, modified figure, on page 3-9 of the Final EIR, without any reference to the author/source of the modifications, date or reason for the modifications. There should have been a proper explanation attached to this new figure, as to what was changed and why, since it is related to that critical East Canyon landslide, undermining LBNL's Hazardous Waste Handling Facility!
Indeed, the entire EIR provides no information or discussion regarding any investigations performed to determine the depth, width and length of each of the 3 landslides impacting the projects at B 71, B 25 complex and B 85 complex sites. No discussion or analysis or proposals as to how to actually remedy the landslides themselves, by removing the hazardous soils etc. No serious discussion was provided for the consideration of alternate sites either.

In conclusion, we again urge you not to certify the EIR before you.

Elevated Life Safety Risks will continue as long as LBNL operates at the current site on the unconsolidated soils of a collapsed caldera. The EIR projects a false sense of safety, as it ignores the fact that what ever is done structurally to the buildings, does not remedy the instability of the site. The conditions of the land are the dominant hazard features, not the buildings alone! The EIR offers only superficial mitigations, as if a landslide could be stopped by a row of toothpicks, as is the case with the lab's Hazardous Waste Handling Facility (HWHF) proposal.

No new structures should be erected at LBNL's known landslide areas, and it is imperative that the HWHF be relocated outside the seismic and wild land fire hazard zone to a more stable ground, away from residential populations. The same applies to the GPL building.

Taxpayer funds are scarce, whether it is state/UC funding or federal ARRA/DOE funding, good money should not be thrown after bad places.

We therefore propose the consideration of the old NUMMI plant in Fremont as the new Lawrence Fremont National Laboratory, to be LBNL's II Campus. Five million square feet of laboratory/office/ research and manufacturing space already built is immediately available. Tesla Motors will occupy only some 5% of the facility. (Attachment 4.)

And lastly, LBNL is a nuclear industrial complex, with radioactive and hazardous releases in Berkeley's Strawberry Canyon since the 1940s. It would be imperative for UC/LBNL to clean up the canyon lands and waters and restore them to their pre-industrial state, and start a new campus somewhere else with better regulations, technologies to prevent future releases into the atmosphere. There is NO SAFE DOSE OF IONIZING RADIATION was the June 2005 finding of the National Academy of Sciences Panel: BEIR VII, Committee on Biological Effects of Ionizing Radiation. (Attachment 5.)

Save Strawberry Canyon from future development, restore it to its natural state.

Sincerely,

Pamela Sihvola, Co-chair
CMTW
P. O. Box 9646
Berkeley, CA 94709

cc: Leslie Schilling, Chair, UC Regents Committee on Grounds and Buildings

ADDENDUM Geology of the East Canyon and the proposed Hazardous Waste Handling Facility, Lawrence Berkeley National Laboratory, a Study (April 1993) to be hand-delivered at the BG Committee meeting on July 13, 2010.

CMTW-27 cont.

Chronology of the Campus Hill Area Development and Slope Instability Through 1984

Early 1900's	Development of the campus hill area begins
1949	Numerous slides occur as a result of Bevatron (Building 51) construction (1st recorded stability problems)
1950's	LBL significantly increases construction, massive cuts and fills undertaken to create flat pads for roads and buildings
1962	Small slope failures occur in the slopes behind Building 46, at site of Building 77, and reactivation of old slide uphill and east of Building 17
1962	Hydraugers installed to stabilize cut slope at northeast corner of Building 77 site
1963	Additional hydraugers installed behind slope north of Building 77 to stabilize old slide area
1963	Centennial Drive constructed
1967 - 1969	Slope instability continues at cut and fill behind Building 77, slope repairs and installation of hydraugers
1967	Slide on natural slope between Building 76 and 79
1969	Wet winter, much larger and more damaging slides occur including major failure of slope between LBL Corporation Yard and Centennial Drive which is repaired with buttress fill and subdrainage
1968-69	Serious slide occurs at the Centennial Drive overpass eastern abutment, road partially closed, hydraugers installed
1970	Slide occurred adjacent to Building 71 southeast parking lot, hydraugers installed
* 1973 →	Building 46 bisected by a very large slide, major repairs required including dewatering; slide continues to move in wet seasons
1975	Slide at compacted fill south of Building 77
1978	Slide at compacted fill south of Building 72
1975 →	Major hill area dewatering program undertaken, Shively Well No. 1 drilled (still continuously pumped)
1978	Centennial Drive overpass deforms further, steel bracing added
1979	Large scale dewatering of the hill attempted, second well drilled, two long nearly horizontal hydrauger drains installed into hill from Poultry Husbandry site
1980's	Numerous small slumps and mudflows occurred throughout hill area
1982	Earth movement at Centennial Drive overpass causes road closure, temporary repairs
1983	More movement at Centennial Drive overpass, road closed, major buttress fill repair required
1984	Centennial Drive reopened

Source: Complied from information contained in the Hill Area Dewatering and Stabilization Studies (Converse Consultants, 1984).

CMTW-27 cont.

In addition to the information above, by 1987 LBNL had mapped some 30 landslides within the lab's Strawberry and Blackberry Canyons, and by 2008 the number of slides was up to 40, including LBNL's East Canyon landslide area.

Regarding Building 46 slide (see above), notes from a site visit by Robert Dunn and Professor Richard Goodman (October 18, 1976) state: Building 46 was "first founded on what was thought to be solid basalt-actually was LARGE BLOCKS." See also attached figure of the collapsed caldera (after Garniss Curtis, Professor Emeritus) at LBNL.

Attachment 2.

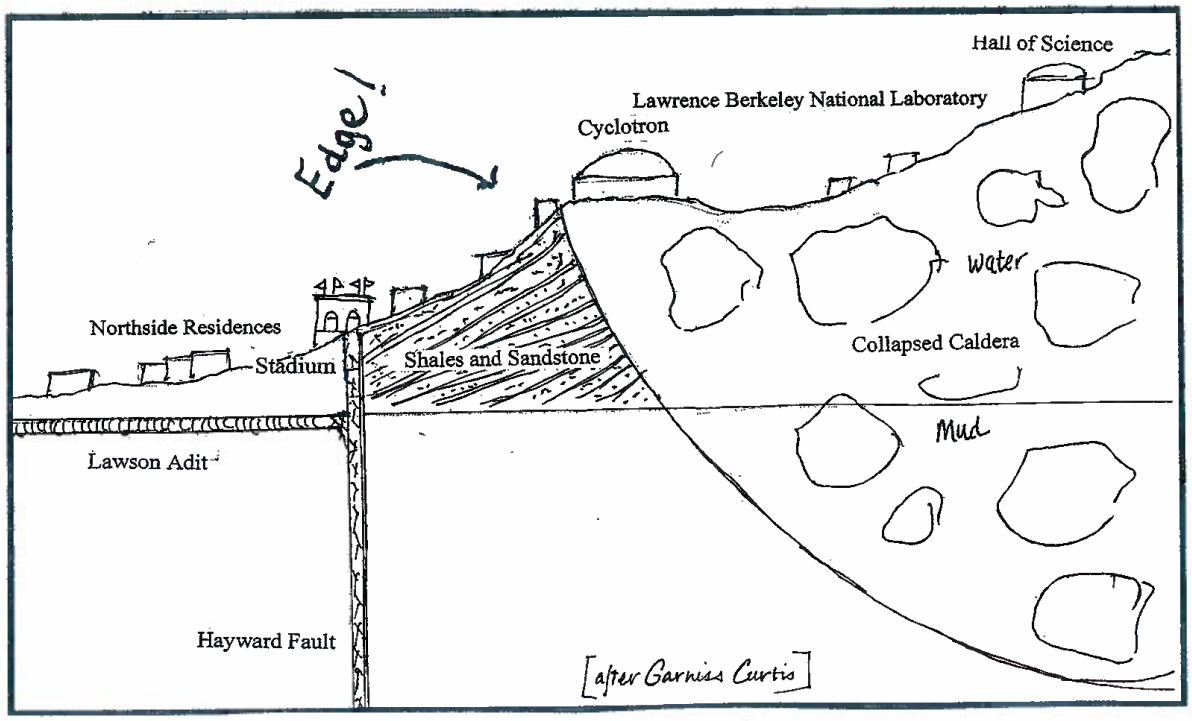


Figure above shows an unknown mixture of mud, perched water and boulders, for which LBNL has yet to do a comprehensive hydrogeological study of its composition. Also missing is the mapping of LBNL's hydrostratigraphic units (HSUs), which would show the hydraulic connection between various permeable layers of the HSUs sedimentary sequences.

6/11

CMTW-27 cont.

Lawrence Berkeley
National Laboratory

June 29, 2010

NOTICE OF ERRATA
FINAL ENVIRONMENTAL IMPACT REPORT

Project Title:	Seismic Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2 Project, SCH# 2008122030
Lead Agency:	University of California
Location:	Lawrence Berkeley National Laboratory One Cyclotron Road, Berkeley, California 94720
County:	Alameda County
Contact Person:	Jeff Philliber, Environmental Planner Lawrence Berkeley National Laboratory One Cyclotron Road, MS 76-234A Berkeley, CA 94720

Final Environmental Impact Report:
The above-referenced Final Environmental Report (EIR) has been submitted to The UC Regents for review and consideration, and it has also been made available on June 23, 2010 for viewing by the public. The Final EIR will be considered for certification by the UC Regents at the July 13-15 UC Regents' meeting to be held at UC San Francisco Mission Bay. Over 400 Notices of Availability of the Final EIR have been sent out to agencies and the public, along with paper copies and CDs to those who commented on the Draft EIR or who otherwise requested them. A copy of the Final EIR is available for viewing in the Berkeley Public Library at 2090 Kittredge Street, Berkeley, California. The Final EIR is also available on the following website: http://www.lbl.gov/Community/SeismicPhase2B/index.html.

CMTW-27 cont.

Errata:
Two figures referenced as being in the Final EIR inadvertently were not included in the initial production of that document. They are included in this errata notice, which is hereby incorporated into the Final EIR. The two figures are referenced in that document as follows:

> **Final EIR page 5-227, paragraph 1:** "Figure 1 shows the most recent and comprehensive bedrock geology map of the entire LBNL main hill site, which was prepared by Parsons Engineering Science, Inc. (PES) and the UC LBNL."
>
> **Final EIR page 5-227, paragraph 2:** "Figure 2 shows a geologic section through the LBNL main hill site from PES and UC LBNL (2000), again based on data from many years of borings, outcrops, road cuts and construction excavations."

Both Figure 1 and Figure 2 are attached and included in this errata notice.

If you have any question, please contact Jeff Philliber at the above address or via email at planning@lbl.gov.

Signature _____ Date: 6-29-10
Jeff Philliber, Environmental Planner
Lawrence Berkeley National Laboratory

cc: LBNL CEQA Agency and selected Public Mailing List

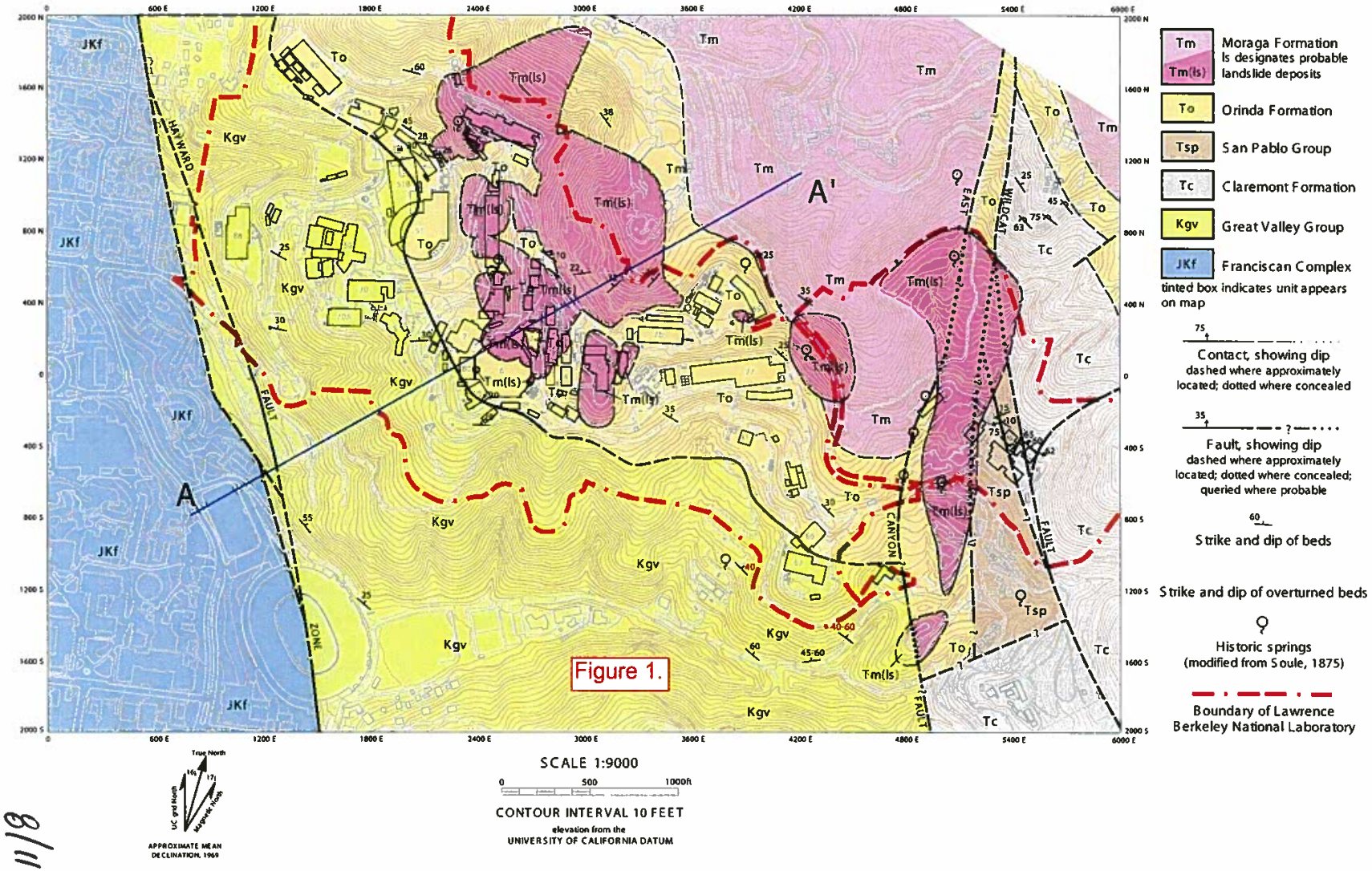


Figure 1. Bedrock geologic map of LBNL. (modified from Figure 4.2-1 of PES and LBNL 2000)

8/11

ATTACHMENT 3A

CMTW-27 cont.

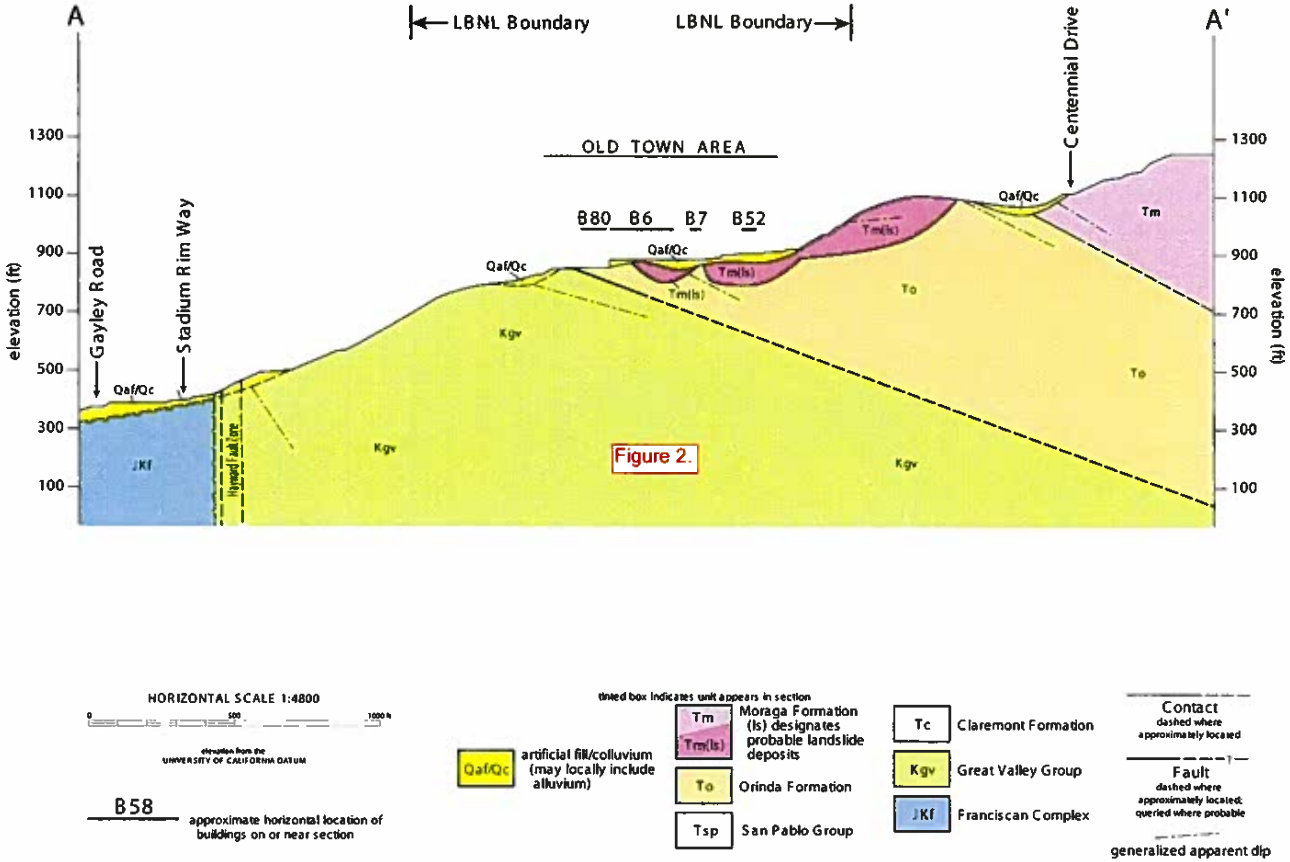


Figure 2. Cross section A-A' (location shown on Figure 1). Near dip section through the Tertiary strata. Depth to the base of the lowest volcanic mass relative to the top of the Orinda Formation shown. (Figuire 4.2-3 of PES and LBNL 2000.)

9/11

ATTACHMENT 3B

CMTW-27 cont.

Lawrence Fremont National Laboratory

A New National Center with Consortium Partners for Green Clean Technologies/Research/Development/Manufacturing.

Five million square feet of laboratory/office/research and manufacturing space **already built and immediately available** at the NUMMI Fremont site, previously occupied by a joint venture between General Motors and Toyota, which ended on April 1, 2010.

The site is in the **geographic center of the Bay Area**, served by an excellent transportation infrastructure, a trained workforce and research and development communities nearby as well as supportive elected officials!

The new **Lawrence Fremont National Laboratory (LFNL)** will be just
35 miles from Berkeley (UC/LBNL)
30 miles from Oakland (22 miles from the Oakland International Airport)
41 miles from San Francisco/UCSF (32 miles from SFO)
18 miles from Livermore (LLNL/SANDIA),
12 miles from Hayward (Cal State EB)
16 miles from San Jose (Airport) and Silicon Valley
18 miles to Menlo Park/Palo Alto/Stanford/SLAC

The LFNL, future anchor/center and hub of the Green Corridor going north, south, east and west, is centrally located to all of the East Bay, South Bay, Peninsula and San Francisco!

This is the **Opportunity of the Century for the Department of Energy**, Lawrence Laboratories, UC and the Consortium of Private Industries they are now or will be partnering with in the future; British Petroleum (BP), Energy Biosciences Institute (EBI), Joint BioEnergy Institute (JBEI/Jay Keasling), Amyris Biotechnologies, Nanosys Inc., Quantum Dot Corporation/Invitrogen, Solexant Inc. (Last 3 associated with Paul Alivisatos), etc.

It is specifically an Opportunity of a Lifetime for the Lawrence Berkeley National Laboratory, to offload facilities from the unstable Strawberry Creek watershed site, with its unconsolidated soils, water and mud of a collapsed caldera, riddled with landslides and earthquake faults, stifled by logistical, environmental, geotechnical constraints and legal challenges, currently crippling LBNL and its future.

CMTW-27 cont.

10/11

NO SAFE DOSE OF IONIZING RADIATION

June 2005 finding of the
National Academy of Sciences Panel: BEIR VII,
Committee on Biological Effects of Ionizing Radiation

Even lower radiation poses risk, panel says

No exposure level found below which dosage is harmless

By H. Josef Hebert
Associated Press

WASHINGTON — The preponderance of scientific evidence shows that even very low doses of radiation pose a risk of cancer or other health problems and there is no threshold below which exposure can be viewed as harmless, a panel of prominent scientists concluded Wednesday.

The finding by the National Academy of Sciences panel is viewed as critical because it addresses radiation amounts commonly used in medical treatment and is likely also to influence radiation levels the government will allow at abandoned nuclear sites.

The nuclear industry, as well as some independent scientists, have argued that there is a threshold of very low-level radiation at which exposure is not harmful, or possibly even beneficial. They said current risk modeling may exaggerate the health impact.

The panel, after five years of study, rejected that claim.

"The scientific research base shows that there is no threshold of exposure below which low levels of ionized radiation can be demonstrated to be harmless or beneficial," said Richard F. Monson, the panel chairman and a professor of epidemiology at Harvard's School of Public Health.

The committee gave support to the "linear, no threshold" model that is currently the generally acceptable approach to radiation risk assessment. This approach assumes that the health risks from radiation exposure decline as the dose levels decline, but that each unit of radiation — no matter how small — still is assumed to cause cancer.

"It is unlikely that there is a threshold below which cancers are not induced," said the report, although it added that at low doses "the number of radiation-induced cancers will be small." And it said cancers from such low-dose exposures may take many years to develop.

The panel, formally known as the Committee on Biological Effects of Ionizing Radiation, or BEIR, generally supported previous cancer risk estimates — the last one by an earlier BEIR group in 1990.

Contrary to assertions that risks from exposure to low-level radiation may have been overstated, the panel said "the availability of new and more extensive data have strengthened confidence in these (earlier) estimates."

The committee examined doses of radiation of up to 100 millisievert, a measurement of radiation energy deposited in a living tissue. A single chest X-ray accounts for 0.1 millisievert, average background radiation 3 millisievert a year and a whole body CT scan delivers 10 millisievert.

The committee estimated that 1 out of 100 people would probably develop solid cancer or leukemia from an exposure of 100 millisievert of radiation over a lifetime with half of those cases being fatal.

The report noted that exposure from a whole body CT scan is much higher than the usual X-ray, and it raised concerns about the frequency in which such medical diagnostics should be used.

THE SPOKESMAN-REVIEW 415-7421-1111 44-CENTS PLUS TAX

11/11

CMTW-27 cont.

LBNL/SLS II/DEIR COMMENTS/INTRO

Committee to Minimize Toxic Waste

DOE/SLSII/DEA COMMENTS#3of5

March 14, 2010

Jeff Philliber, UC-LBNL Environmental Planner
Lawrence Berkeley National Laboratory
One Cyclotron Road, MS 76-234A
Berkeley, California 94720

Subject: Comments on the Draft Environmental Impact Report (DEIR) for Seismic Life Safety, Modernization, and Replacement of General Purpose Buildings, Phase 2 Project at the Lawrence Berkeley National Laboratory (LBNL)

Dear Mr. Philliber,

The above referenced Project consists of the demolition of Buildings 25, 25B and 55, six modular trailers associated with Building 71, the construction of an approximately 43,000 gross square foot General Purpose Laboratory (GPL), and the seismic strengthening of the Building 85 complex – LBNL's Hazardous Waste Handling, Treatment and Storage Facility, all located in the Strawberry Creek Watershed's Strawberry and Blackberry Canyons.

CMTW-27 cont.

Our comments are provided in two (2) parts. Since all the project components (areas associated with B85 complex, B25 and B71) are located site- wide at LBNL, in areas of great concern to the community, i.e. on top of earthquake faults, active landslides, radioactive and chemical contamination plumes (both soil and groundwater), creeks and networks of creeks etc., **Part 1** of our comment letter is titled: **Contaminant Plumes of the Lawrence Berkeley National Laboratory and their Interrelation to Faults, Landslides, and Streams in Strawberry Canyon, Berkeley and Oakland, California**, and cover our concerns in the following areas evaluated in the DEIR: Biological Resources, Geology and Soils, Hazards and Hazardous Materials, Hydrology and Water Quality, Land Use and Planning, Transportation and Traffic, Utilities and Service Systems – and we ask that you respond to our concerns in a comprehensive and serious manner.

Part 2 of our comment letter on DEIR consists of all the comments we provided on the Notice of Preparation (NOP) of the above referenced document, as these comments and concerns were largely ignored in the preparation of DEIR .The only changes that occurred between the NOP and the NOA (Notice of Availability) of the DEIR related to the demolition of several buildings and structures in the Old Town area, i.e. Buildings 4, 5, 14, 16, and 17, possibly some of the most contaminated buildings at LBNL, and Building 74F in the East Canyon, which were all removed from the EIR process, escaped all public and agency comment as they were secretly included into the Old Town

Demolition project, for which a Categorical Exclusion under NEPA was filed in December 2009, without any notice to the public. Please, explain why? We also ask that a full blown EIS under NEPA be prepared for the Old Town Demolition project.

Every single structure evaluated in the DEIR is located in a landslide area, as officially defined by the State of California, as being in an Earthquake Induced Landslide Hazard Zone, i.e. landslides will be mobilized in the event of a major earthquake – expected to happen any day now on the active Hayward Fault! (See attachment 1). Furthermore all the components of this Project are located in areas of LBNL where legacy chemical and radioactive contamination is present in the soil and groundwater, due to operations during the last 70 years, which the DEIR failed to describe in the kind of detail that the site and its history warrants! The DEIR is deficient, inadequate, misleading and in sections erroneous. For instance a claim is made that the new proposed location of the GPL is not located in Strawberry Canyon, when indeed Figure 4.8-1 of the DEIR shows the Strawberry Creek Watershed divisions into Blackberry Canyon and Strawberry Canyon, indicating clearly that the entire Building 25 site, the proposed location of the GPL, is in Strawberry Canyon, in the middle of the Building 25 slide and Building 25A Lobe of the Old Town Groundwater Solvent (VOC) Plume! (See attachment 2, A and B)

In conclusion, LBNL, UC and the Department of Energy (DOE) continue to willfully ignore and exclude the most significant, fundamental facts related to the Lab site, i.e. the unconsolidated nature of the volcanic rocks, mud and water that fill an old crater, a collapsed caldera, on which LBNL facilities were built starting in 1940! What is the use of drilling 35-50 foot deep holes for piers into this unconsolidated mélange of volcanic fragmental debris, without ever reaching bedrock, to attempt to tieback the Lab's Hazardous and Radioactive Waste Treatment and Storage Facility (B85 complex), further wasting taxpayer funds! The landslide on which the Hazardous Waste Handling Facility (HWHF) was built is over 2200 feet (7+ football fields) long, between the East Canyon Fault (with its numerous springs already identified by UC in 1875) and the Wildcat Fault.(See attachment 3, A and B).

CMTW-27 cont.

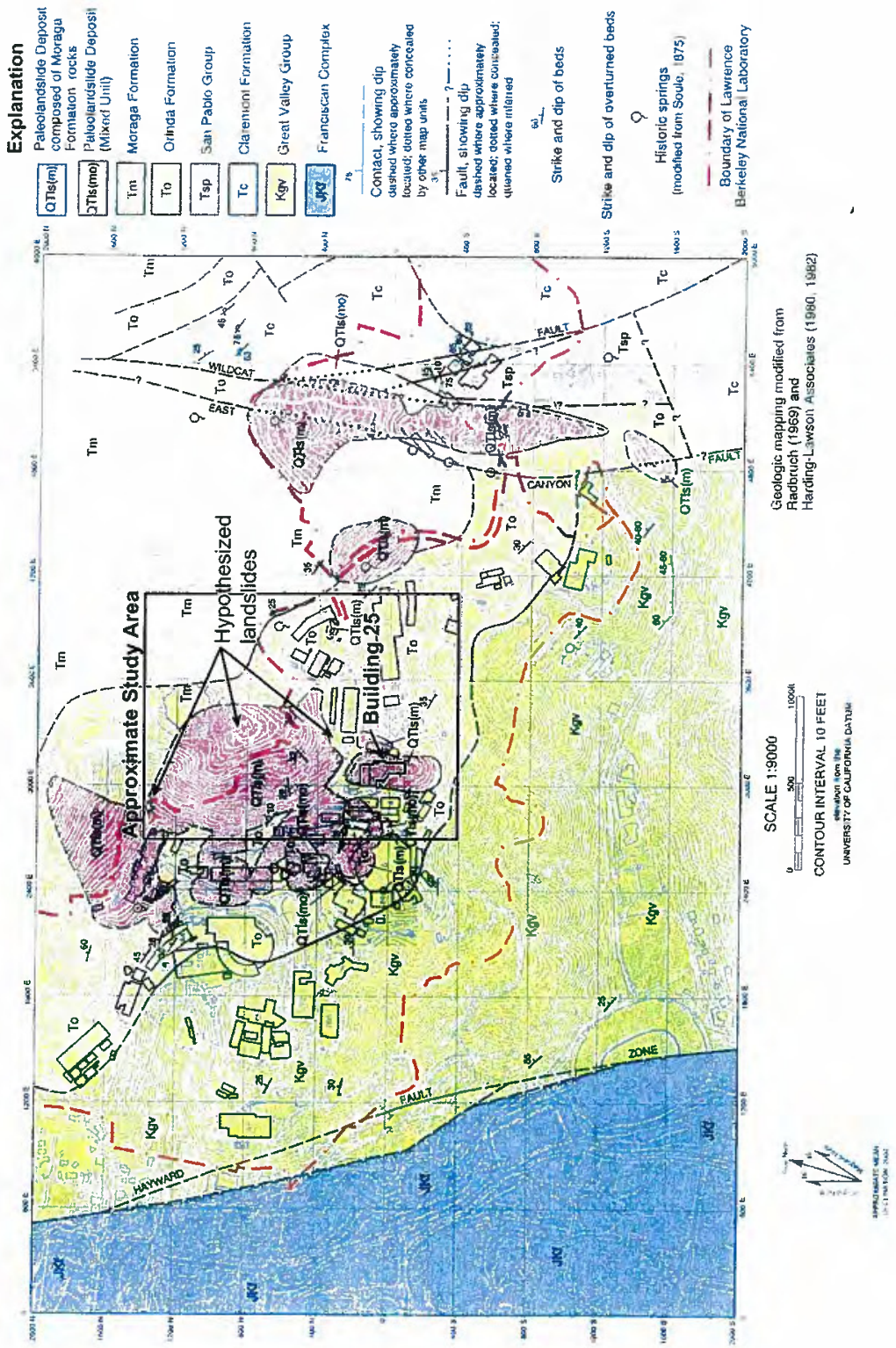
The same danger is present at the B71 and B25 sites, as both are on top of active landslides (See attachment 1). We therefore ask that LBNL/DOE/UC immediately issue a site-wide **MORATORIUM** to any new construction and immediately assemble an international, world-class, independent group of geotechnical experts to perform all-encompassing, site-wide geological investigations and excavations regarding faulting, geology and landslides in the Strawberry and Blackberry Canyons, and that these experts be paid by some of the $ 264 million of ARRA (American Recovery and Reinvestment Act) funds, already received by LBNL! (See attachment 4, A and B)

We also ask that at the same time, during the moratorium, a comprehensive Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) be prepared for this Project!

ATTACHMENT 1.

Fugro WLA
Project No. 2072.001 LBNL Building 25

FUGRO



LBNL GEOLOGIC MAP FROM THE RFI (PARSONS, 2000) REPORT

CMTW-27 cont.

FIGURE 3

Graphics, Active Projects, 2072.001, Modified 08.31.09

JANUARY 28-FEBRUARY 3, 2010

THE BERKELEY DAILY PLANET

Volume 11, Issue 43 DAILY ONLINE, WEEKLY IN PRINT $2 Donation Requested

The Volcano Beneath

By GEORGIA WRIGHT

Most people do not know that the Lawrence Berkeley National Laboratory is almost entirely sited on a caldeara, a collapsed volcano. Below this caldera there is the Hayward Fault, which cuts through Memorial Stadium and across the bottom of the hills. The Hayward Fault is due for a magnitude 6.5 to 7.0 earthquake anytime within the next 30 years. Still, LBNL plans to build up to a million square feet of research facilities on its steep and unstable hills above the city and UC campus.

The Save Strawberry Canyon organization has successfully challenged the lab's building plans in court on both the state and federal level, but remains concerned that three new construction projects are now planned for the Blackberry Canyon area, within the caldera, including the BELLA laser accelerator. In addition, the controversial Computational Research and Theory facility (CRT) is planned to be built below the edge of the caldera, marked by the Cyclotron.

A new YouTube video explains the caldera phenomena. It makes a strong case for preventing any new construction on the LBNL sites within both the Blackberry and Strawberry canyons. Such buildings would be unstable and could further endanger the lives and structures below them.

Years ago, Professor Emeritus of Geology Garniss Curtis and civil engineer Ben Lennert did field testing throughout the East Bay. They located the perimeter of the old volcano, whose constituent rocks, mud, and water press downhill on the strata of sandstone and shale that have been pushed up to a 30-degree angle by the Hayward Fault, moving up one centimeter a year. The plates along the Hayward Fault have moved north on the east and south on the west at the same rate. The stadium, constructed in 1923, is evidence of

Continued on Page Twenty-Six

PARTISAN POSITION

The Volcano Beneath

Continued from Page One

this offset, the crack on the south only partially disguised today by a huge image of a football player, but visible above it. The whole length of the stadium sits astride the fault.

When the predicted earthquake occurs, buildings and hills will most certainly slide, and the material squeezed up by the plates will cause even more damage. Researchers have said that Indian Rock and Founders' Rock were thrown up in a past event. Professor Curtis and Dr. Ignacio Chapela, associate professor of environmental science, explain in the video that the university's building plans, both at LBNL and at the stadium, create an unnecessary risk for the campus and the citizens of Berkeley.

For LBNL there are viable alternative sites. The university does own 50 acres of underutilized space at the Richmond Field Station with beautiful bay views, only 10 minutes farther from campus than the hill site.

(It is ironic that the university recently engineered a state bill, with the help of the city of Berkeley, to exempt the stadium from the Alquist-Priolo Earthquake Safety Zoning Act.)

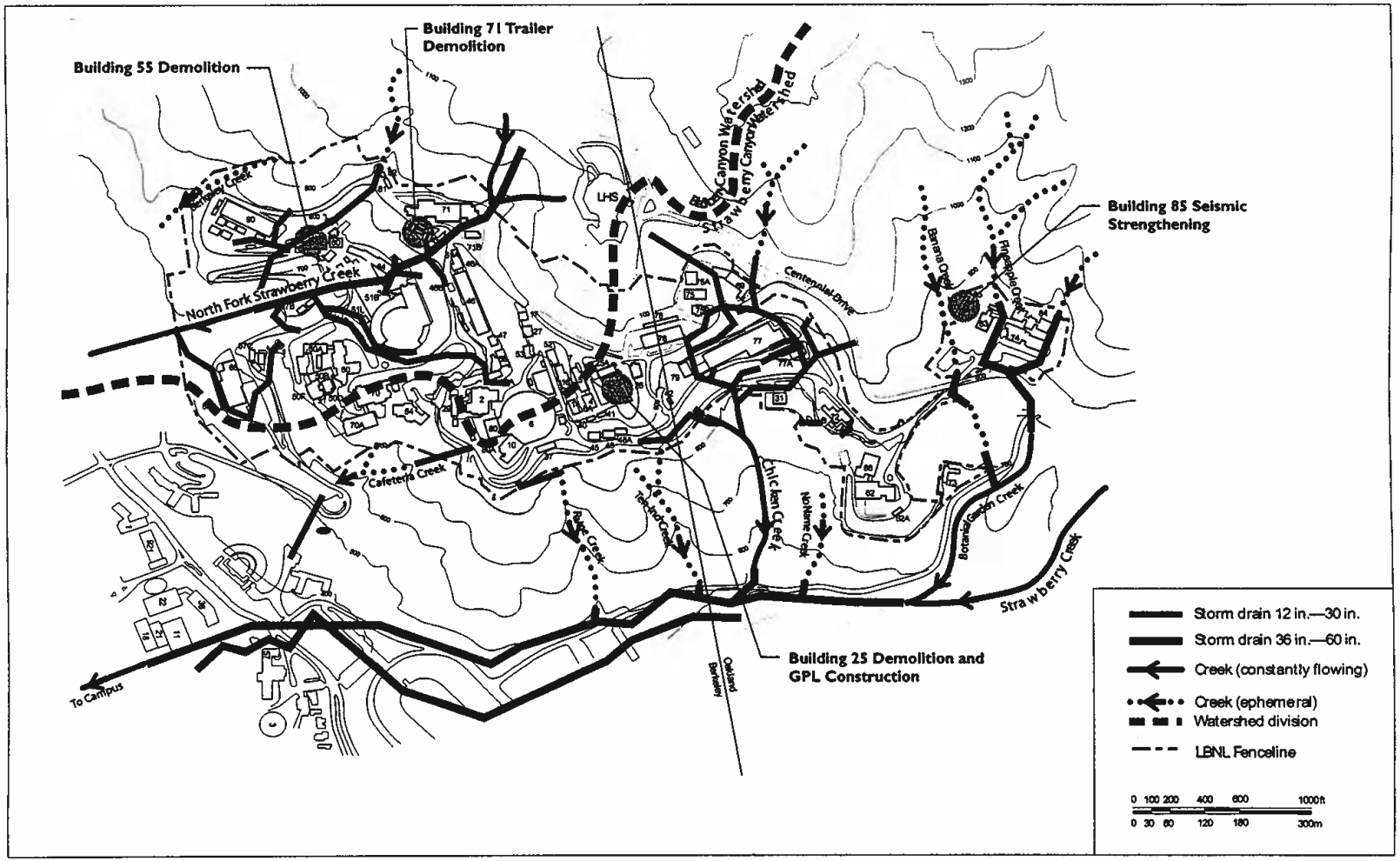
The regents are in charge of lives as well as buildings and research. The video, entitled *The Fault, Quakes, Slides, and the Lawrence Berkeley Lab,* contributes new information that should give everyone as well as the regents serious pause.

The YouTube video featuring Professors Curtis and Chapela can be found at www.youtube.com/watch?v=8FOmck-AHpes. More information is on the Save Strawberry Canyon website, www.savestrawberrycanyon.org.

4/83

ATTACHMENT 1A

CMTW-27 cont.



Source: LBNL Environment, Health, and safety Division, 2009, Stormwater Pollution Prevention Plan, June, Page 2-5.

FIGURE 4.8-1

STORM WATER POLLUTION PREVENTION PLAN

5/83

ATTACHMENT 2A

CMTW-27 cont.

ATTACHMENT 2B

§5.6 E. Stormwater

Berkeley Lab lies within the Strawberry Creek watershed, which covers an area of about 354 hectares (874 acres). There are two main creeks in the watershed, Strawberry Creek and the North Fork of Strawberry Creek, plus several small tributaries that generally do not flow all year long. This watershed includes other University of California property, public streets in both Oakland and Berkeley, and private property. Near Berkeley Lab, the Strawberry Creek watershed is further subdivided into the Blackberry Canyon and Strawberry Canyon watersheds (see Figure 5-4).

Surface runoff from Berkeley Lab is substantial because of the site's hillside location, the amount of paved or covered surface, and the moderate annual rainfall. In the 1960s, Berkeley Lab began installation of its storm drain system, which is designed to handle runoff intensities expected in a 25-year maximum-intensity storm. All stormwater runoff from the site drains through this system to Strawberry Creek or its north fork, which join below the Laboratory on the UC Berkeley campus.

Under the State of California's NPDES program, Berkeley Lab must follow the General Permit for Stormwater Discharges Associated with Industrial Activities.[6] Permit

CMTW-27 cont.

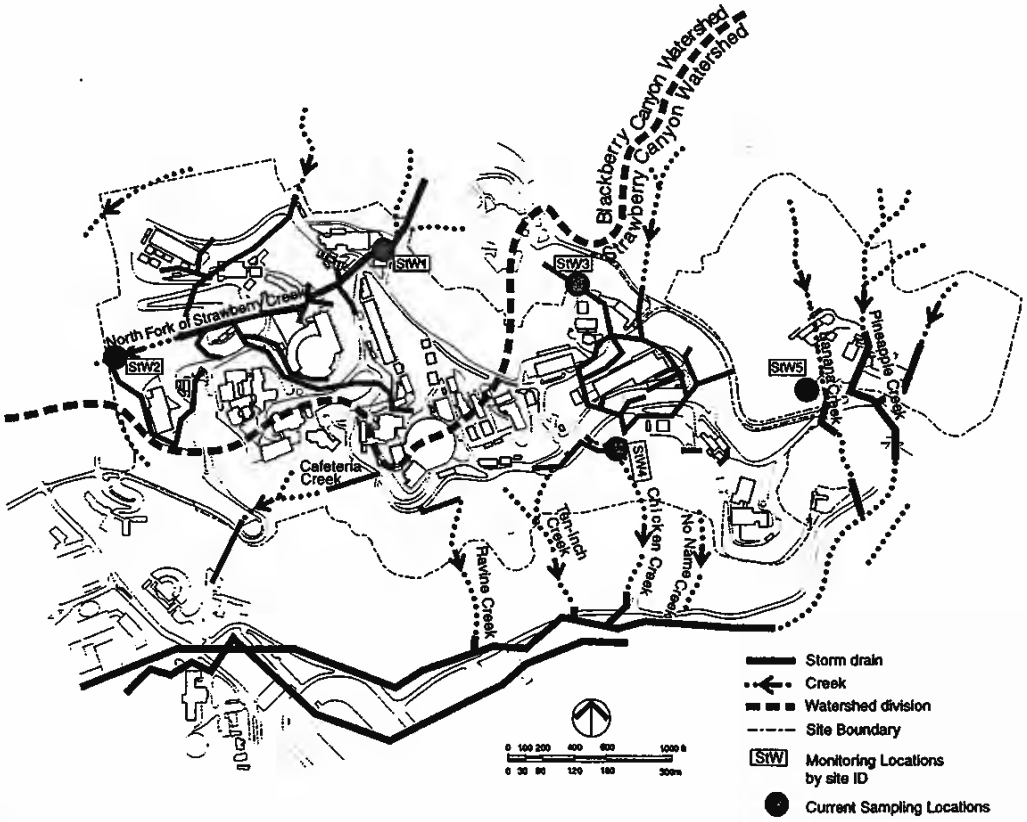


Figure 5-4 Stormwater Sampling Locations

6/83

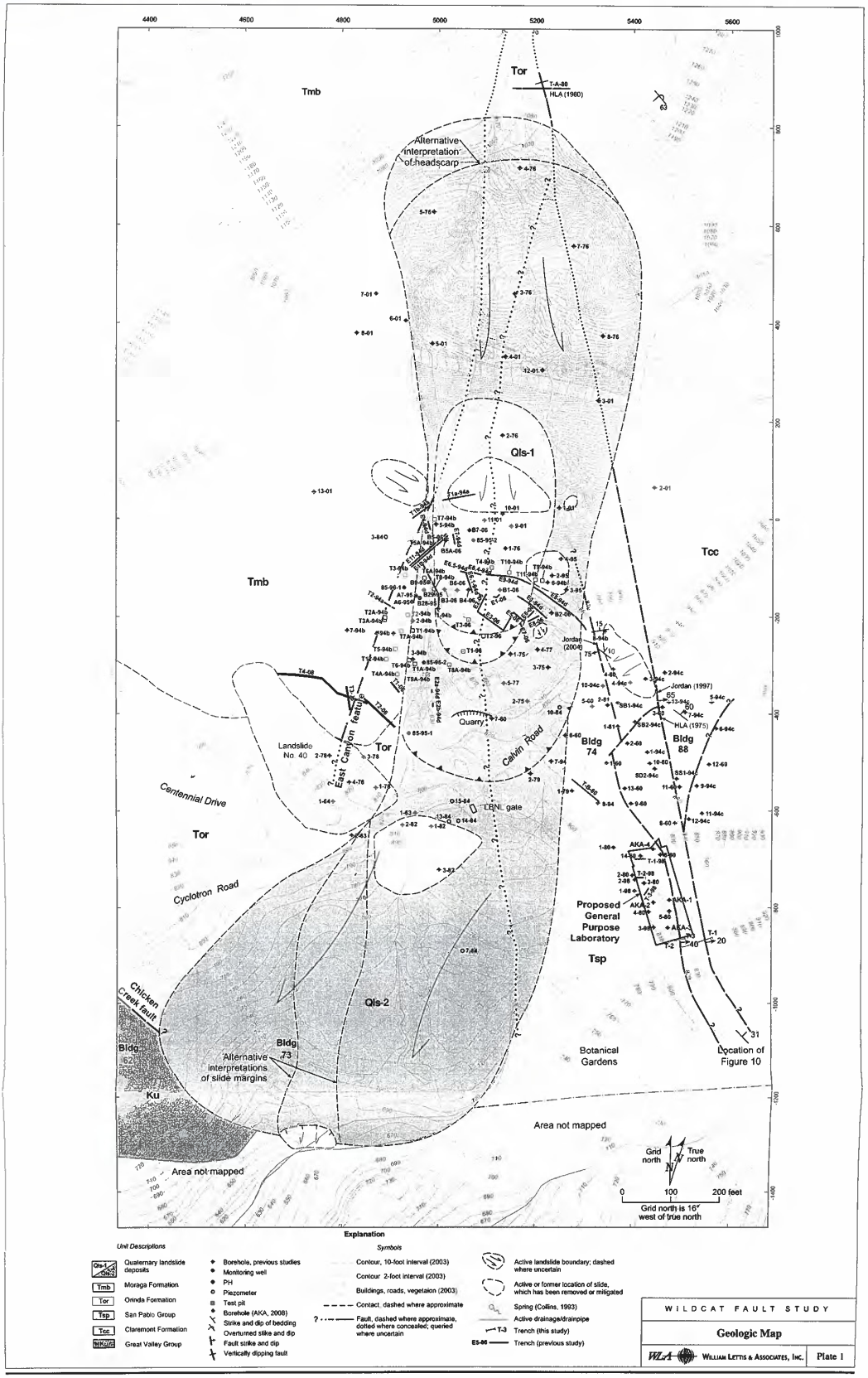


FIGURE 4.5-2
GEOLOGIC MAP OF THE EAST CANYON AREA

CMTW-27 cont.

7/83

ATTACHMENT 3A

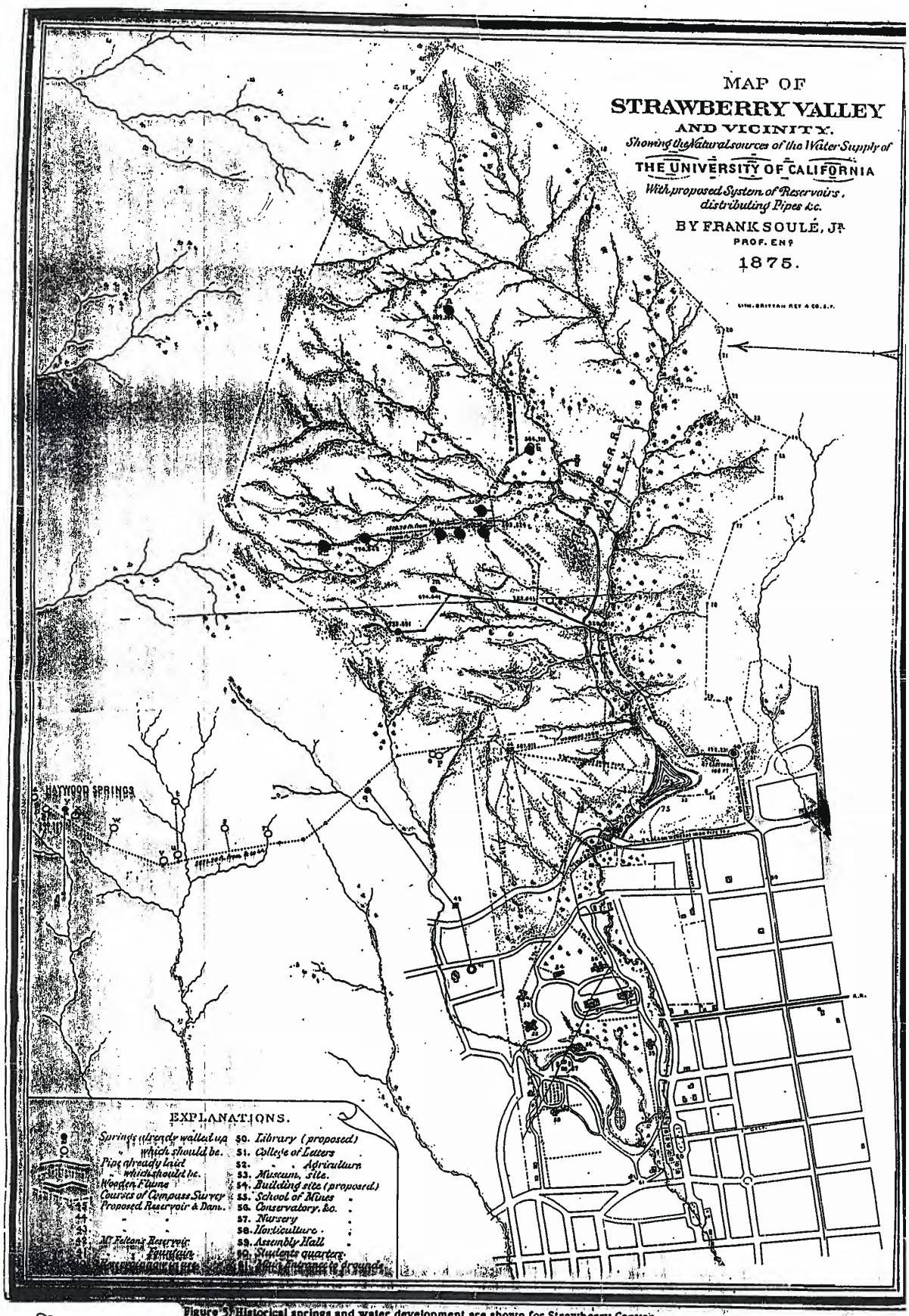


Figure 2. Historical springs and water development are shown for Strawberry Canyon Watershed as mapped by Soulé (1875). Springs d, f, g and h, which are highlighted in yellow, plot very closely to the trace of the ECF according to Borg (1991).

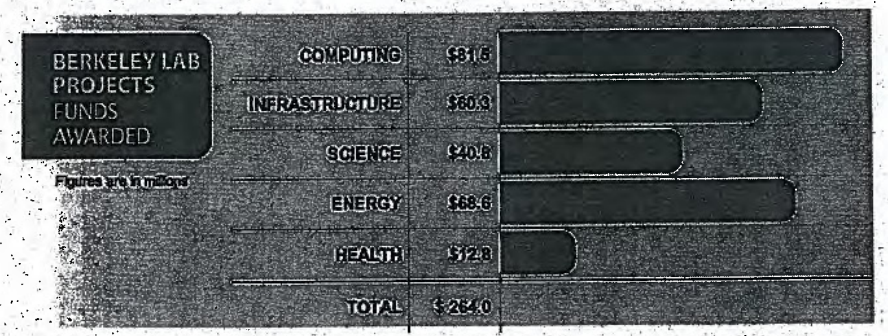
ATTACHMENT 3B

CMTW-27 cont.

8/83

THE DAILY CALIFORNIAN
Established 1871. Independent Student Press Since 1971.
Berkeley, California Tuesday, February 2, 2010 www.dailycal.org

ATTACHMENT 4A



LAWRENCE BERKELEY NATIONAL LABORATORY/COURTESY

Berkeley Lab Reaps Benefits of Stimulus

by Cristian Macavei
Contributing Writer

While double-digit unemployment continues to plague many areas of the country, federal stimulus grants are funding research at Lawrence Berkeley National Laboratory that may lead to long-term economic growth.

About $264 million has been allocated to the lab since March 2009 through the American Recovery and Reinvestment Act for research in computing, energy, health and other sciences.

ONLINE PODCAST
Cristian Macavei talks about the stimulus grants to Berkeley lab.

"Last year, we made the largest investment in basic research funding in history, an investment that could lead to the world's cheapest solar cells or treatment that kills cancer cells but leaves healthy ones untouched," said President Obama in his State of the Union address last week.

The lab is pursuing a variety of projects in areas such as energy, biofuels and computing that will provide scientific benefits in the future, according to Julie Chao, a lab spokesperson.

"The $11.3 million for the Advanced Light Source, one of the world's brightest sources of ultraviolet and soft X-ray beams, alone will facilitate scientific discoveries in everything from disease research to alternative fuels," she said in an e-mail.

Another stimulus grant, a $12.8 million grant from the National Institutes of Health, will help fund research into radioactive decontamination, cancer and other health conditions, according to a lab statement.

The institutes awarded $4.2 million of the grant to the lab's two-year radioactive decontamination project. The funding will allow researchers to further develop two molecules that may better treat nuclear contamination.

About $81.5 million for computing research and development and $60.3 million for infrastructure spending has been awarded to the lab since March 2009, according to a lab statement.

Chao said in an e-mail that the first portion of the stimulus money was allocated to the lab for infrastructure projects, while additional funding for science and research came in later months. Many projects are still under development.

"Many of them are still hiring, purchasing equipment, setting up experiments and so forth," she said. "A good number of these are multi-year projects."

At least 192 jobs have been created or retained as of Dec. 31, 2009 due to the influx of stimulus funding, according to Chao.

"All kinds of jobs have been created and retained thanks to the Recovery Act funding, from construction workers and electricians to research assistants, project managers, engineers and, of course, scientists," she said in the e-mail. "Plus, through the procurement of goods and services, many jobs have been created or retained at vendors and subcontractors, both locally and nationally."

The lab itself has seen its budget—most of which comes from the U.S. Department of Energy—increase by about $58 million since the 2008 fiscal year to about $648 million in the 2009 fiscal year, according to a November 2009 lab statement. $11 million of the increase came from stimulus funding.

The lab's budget is estimated at $774 million for the 2010 fiscal year, with about $122 million from stimulus funding, according to the statement.

Chao said federal agencies are allocated

>> STIMULUS: PAGE 2

STIMULUS: Research Spending May Boost Economy

FROM FRONT

money by Congress, which they then route for specific use to laboratories such as Berkeley lab.

Mike Janes, a spokesperson for New Mexico-based Sandia National Laboratory, said in an e-mail that the Sandia lab has received $45.3 million of stimulus funding from the act as of Jan. 22 this year. $21.9 million has been assigned for capital funding and $23.4 million has been assigned for operating funding.

Sandia is using the stimulus funds to develop low-carbon energy solutions and to address key energy security challenges, such as reducing U.S. oil dependence, Janes said.

John Ellwood, a UC Berkeley professor in the Goldman School of Public Policy, said it is important to consider which funding would most effectively stimulate the economy.

"The interesting thing is we are awash in research money while we are starved at the state," he said.

Stimulus funding for research would not necessarily temper stubborn unemployment rates, Ellwood said.

"Someone could argue that the cost per job created will be very high with stuff at the labs because you'll have to buy lots of expensive equipment and lots of expensive labor," he said.

But stimulus spending for research will allow the American economy to grow in the long run, he said. Additionally, the funding will provide needed resources for university-related projects.

"As a resident of California and as a faculty member of Berkeley, this stuff is great," Ellwood said. "The money is coming from all American taxpayers, and it's going to California and to the University of California, which we in a narrow selfish world love."

Cristian Macavei covers research and ideas. Contact him at cmacavei@dailycal.org.

9/83

CMTW-27 cont.

Established 1871. Independent Student Press Since 1971.

THE DAILY CALIFORNIAN

Berkeley, California | Monday, March 30, 2009 | www.dailycal.org

RESEARCH & IDEAS

Lawrence Berkeley Lab Gains Federal Funds

by **Christine Chen**
Contributing Writer

Lawrence Berkeley National Laboratory will receive $115 million as part of President Barack Obama's American Recovery and Reinvestment Act, as announced by Secretary of Energy and former director of the lab Steven Chu last week.

The funding comes from a portion of the $787 billion act Obama signed in February aimed to move research forward at major science institutions, while creating new jobs at the same time.

"Most of these projects (being funded by the act) have to do with infrastructure upgrades, and a number of those have been approved, but we have not received any of the money yet," said Jeff Miller, a spokesperson for the lab.

Among the projects that will be funded is the construction of a lab and office building for the Advanced Light Source synchrotron, a soft X-ray light source used by scientists to learn more about atomic structure.

About $14.3 million will go toward constructing a building next to the synchrotron as well as toward the ongoing project of demolishing the Bevatron, an older particle accelerator, to make room for new science buildings.

Another $1.5 million will go toward maintenance for the synchrotron, which is an open facility used by two thousand scientists and industries per year, said Roger Falcone, director of the synchrotron and a UC Berkeley professor of physics. The lab will need to hire about three dozen extra construction workers, he said.

"This will accelerate the completion of the project and fulfill the other half of the requirement of stimulus funding, which is to create jobs, so it provides additional work for the construction field," Falcone said. "It will accelerate the process, which will make the research happen sooner."

Another proposed project at the lab is the Berkeley Lab Laser Accelerator, which scientists anticipate will receive $19 million. The money could

>> LAB: PAGE 2

$115 Million

Money the lab will receive from the economic stimulus bill

VICTORIA CHOW/STAFF

Projects the money will fund include:

- Construction for the Advanced Light Source synchrotron
- Demolition of the Bevatron
- Completion of the Berkeley Lab Laser Accelerator

SOURCE/LAWRENCE BERKELEY NATIONAL LABORATORY

LAB: Funding May Help Create New Jobs

FROM FRONT

potentially fund 50 to 60 new employees to do technical work on the laser system.

Because the high-energy laser system produces a large electric field, it can be built at a smaller scale than normal-sized accelerators while producing the same amount of energy, said Wim Leemans, director of the project. He said while the project received high ratings among scientists, there wasn't enough funding available to build it until recently.

"We were afraid we would lose our leadership in this area, and now we're back in the position so we can maintain the lead," Leemans said. "They told us that we would have gotten money about two years from now, but they would have to spread the project out more years than we wanted. Now, with the (act), we can do it on a much faster timescale, so it allows us be competitive with the rest of the world."

10/83

ATTACHMENT 4B

CMTW-27 cont.

Since 1940, land use and planning at LBNL has been sporadic, haphazard, initially due to the secret nature of the Manhattan Project and later, during the cold war, the culture of secrecy continued under the Atomic Energy Commission and Department of Energy. If indeed UC considers this site to be a viable Hill Campus – now is the time to finally determine that fact, and if the unconsolidated soils of the collapsed caldera are deemed **unsuitable** for future development, it is critical that no more taxpayer funds be wasted into this landsliding, fault fractured sinkhole, but instead in the future of a new LBNL campus in Richmond or Oakland!

Sincerely,

Pamela Sihvola
CMTW
P.O. Box 9646
Berkeley, CA 94709

CMTW-27 cont.

PS. What is the total estimated cost of the Project?
Please list projected costs per each Project component.

How much of the Project is funded by LBNL's $ 264 million ARRA funds?
Please list ARRA funded portions, in dollar ($) amounts per each Project component.

11/83

DOE/SLSII/DEA
COMMENTS#4of5

LBNL/SLS II/DEIR
COMMENTS/PART 1

CONTAMINANT PLUMES OF THE LAWRENCE BERKELEY NATIONAL LABORATORY AND THEIR INTERRELATION TO FAULTS, LANDSLIDES, AND STREAMS IN STRAWBERRY CANYON, BERKELEY AND OAKLAND, CALIFORNIA

Laurel Collins, Geomorphologist
Watershed Sciences
1128 Fresno Ave
Berkeley, California 94707
collins@lmi.net

for

Pamela Sihvola, Project Manager
Committee to Minimize Toxic Waste
P.O. Box 9646
Berkeley, California 94709

INTRODUCTION

The Lawrence Berkeley National Laboratory (LBNL), initially called the UC Radiation Laboratory, was originally located on the University of California Berkeley (UCB) central campus in Alameda County during 1932. By 1940, it was relocated to its present site in the steep hills of Strawberry Canyon east of the Hayward Fault and the central UCB campus (Figure 1). The first major facility, the 184-inch synchrocyclotron was built with funds from both private and university sources, and was used in the Manhattan Project in the development of the world's first nuclear bomb. Beginning in 1948 the U.S. Atomic Energy Commission and then its successor agency, the Department of Energy (DOE) funded the lab while it continued to expand its facilities in Strawberry Canyon.

CMTW-27 cont.

Numerous geotechnical investigations have been conducted during the past six decades as LBNL expanded while also experiencing problems with slope stability. The many geotechnical and environmental reports generated by LBNL, as well as research from local academic, state, and federal entities, indicate that minimal agreement has existed among scientists on the location of bedrock contacts or location and status of earthquake faults and landslides in the Canyon.

This is important because LBNL has been required to monitor radioactive accidents and chemical releases that have contaminated the groundwater and tributary streams of Strawberry Creek, which flow westward from the jurisdictional boundaries of Oakland to Berkeley and the UCB Campus. There has been concern by the public that mitigation to protect public health might be compromised by the lack of comprehensive (and agreed upon) information on the potential transport pathways of contaminants along bedrock contacts, faults, and landslides. Without such information, the array of sampling wells

33

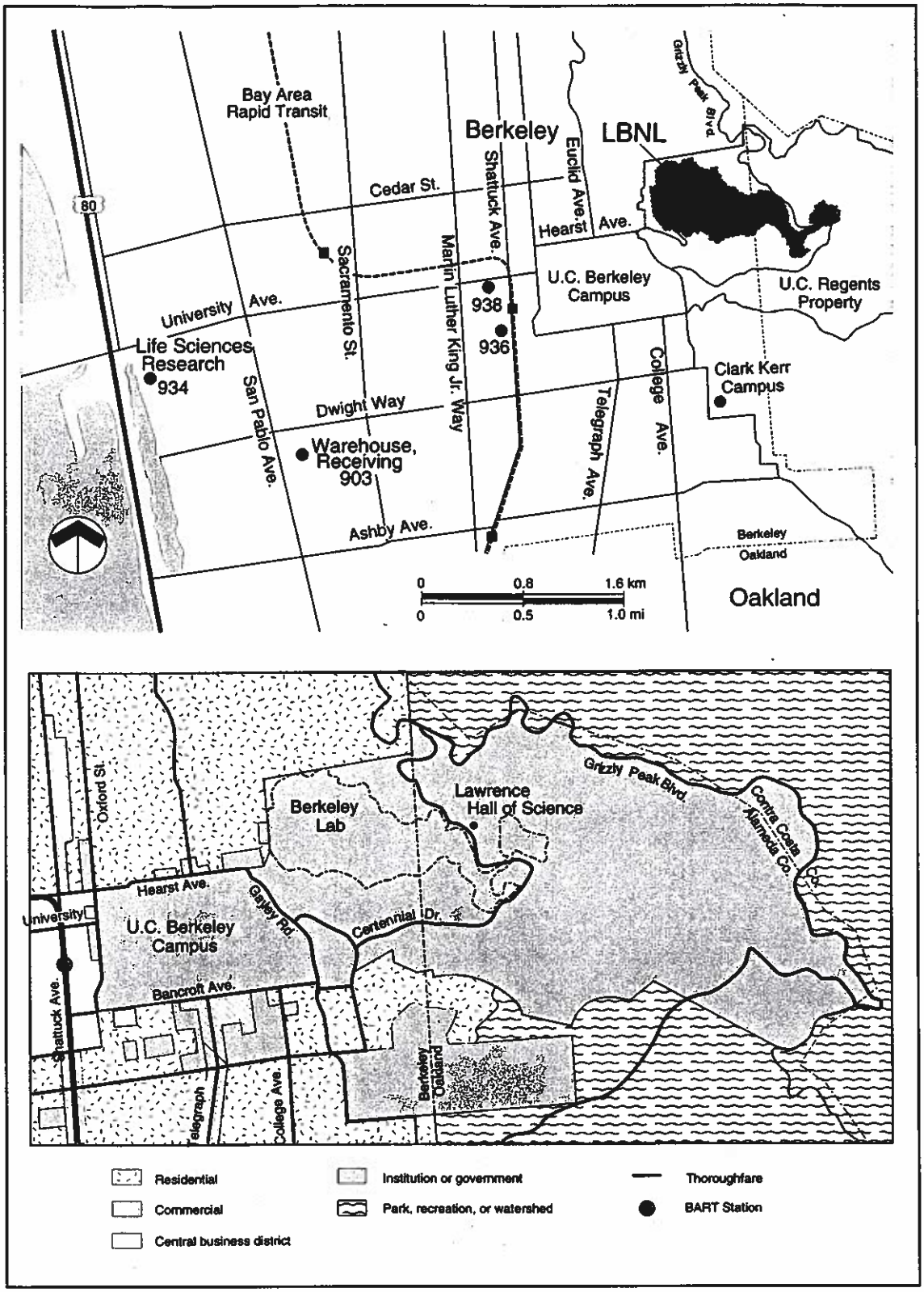


FIGURE 1. VICINITY AND ADJACENT LAND USE. Source: LBNL RCRA Facility Investigation Report, (also known as LBNL, 2000).

CMTW-27 cont.

designed to monitor contaminant migration have not been strategically placed to define the limits of contamination or potential plume migration. During 1991, the Department of Energy's (DOE) Tiger Team found 678 violations of DOE regulations that cover management practices at LBNL. A key finding was that air, soil, and water in Berkeley and Oakland are contaminated with tritium and other radioactive substances and toxic chemicals.

Our project and this report "Contaminant Plumes of the Lawrence Berkeley National Laboratory and their Interrelation to Faults, Landslides, and Streams in Strawberry Canyon, Berkeley and Oakland, California" was supported by a grant from the Citizens' Monitoring and Technical Assessment Fund (MTA Fund) to the Committee to Minimize Toxic Waste (CMTW). The report addresses the need to compile and develop publicly accessible maps of Strawberry Canyon, which show the geologic and geomorphic characteristics that might influence ground and surface water movement near known LBNL contaminant sites. The intent of this map compilation project is to show where there is or is not agreement among the various technical reports and scientific interpretations of Strawberry Canyon. This report can be found on the following web site: http://www.cmtwberkeley.org

OBJECTIVES

The specific objectives of the project were:

1) Help define or show where there is potential confusion or disagreement about the location of geological units and associated faults by showing interpretations by various science organizations.
2) Help define the historical channel and landslide network.
3) Locate verifiable bedrock outcrops as the basis for geologic interpretation;
4) Identify sites of slope instability, especially those associated with groundwater, and landslides;
5) Synthesize surface geotechnical information with contaminant plume information for the greater Strawberry Canyon area on a common base map.
6) Post results of technical report on CMTW's web site.

CMTW-27 cont.

This project provides necessary information to better evaluate the status of existing geological knowledge for Strawberry Canyon and the potential for contaminant migration pathways at existing plumes sites. By achieving a common base of understanding, a more effective monitoring and mitigation plan can be developed for the contamination sites. Benefits will also be provided for future geotechnical investigations during expansion of facilities at either LBNL or UCB. We have started by compiling available information on a series of overlays that show:

a) Current stream and storm drain network, and all sewer lines and hydraugers, delineation of the Lennert Aquifer;

b) Interpretation of historic drainage network and springs as indicated on the Map of Strawberry Valley and Vicinity Showing the Natural Sources of the Water Supply of the University of California, by Frank Soulé, Jr. 1875;
c) Geology;
d) Faults, seismicity, and Alquist Priolo Earthquake Fault Zone;
e) Landslides;
f) Areas of contamination evaluated in the Resource Conservation and Recovery Act (RCRA) process;
g) Additional toxic sites located outside the LBNL fence line, but on UC land, such as the old waste pit at the former Chicken Creek animal husbandry site as well as groves of trees and vegetation, south of the Lawrence Hall of Science, contaminated with tritium (radioactive hydrogen) in soil;
h) Topography with building sites, and roads.

REPORT ORGANIZATION

This report is specifically designed to demonstrate what is known about the key components of Strawberry Canyon that can influence surface and subsurface water transport, particularly near infrastructure and known contaminant plumes at LBNL. We have taken the key elements of surface drainage, geology, faults, and landslides and divided them into distinct subsections for this report.

We first provide a General Site Description and then provide information about the Contaminant Sites. This is followed by a brief discussion of Methods used in this report to produce original maps and compile existing information. Within the Results section, each subsection on Surface Drainage, Geology, Fault mapping, and Landslides provides background information and a few smaller scale maps showing recent interpretations. Larger maps are provided to show compilations of recent information.

CMTW-27 cont.

These compilations are used to determine whether there is agreement by different researchers about the location of faults, bedrock contacts, or landslides. Each compilation map shows the contaminant plumes in the context of the different physical elements to determine if those elements could have potential influences on contaminant transport. The Plume Monitoring Sites are then shown to indicate the array and position of sampling and monitoring wells. This latter information is presented in much detail in several online documents produced by LBNL (2000, 2003, 2004 and 2007) that can be downloaded from their web site (www.lbl.gov/ehs/index2.shtml).

Within the Results subsection, a map on Zones of Concern is provided that indicates potential groundwater migration sites near each plume that might not be adequately sampled or understood given the present status of knowledge of factors that can influence groundwater transport. A map showing Future Development and Site Conditions and the compilation of potential factors that could influence plume migration is shown as the final map within the Results section. Conclusions and General Recommendations are provided at the end of the report.

GENERAL SITE DESCRIPTION

LBNL is located in a very seismically active area, next to the Hayward Fault on the steep west facing slopes of the Berkeley Hills within the 874-acre Strawberry Canyon. Figure 2 shows the location of the Alquist Priolo Earthquake Fault Zone and the footprint of buildings and roads in Strawberry Canyon. It also shows the location of several known contaminant plumes that are monitored by LBNL. The nature of these plumes is discussed further in the section on Contaminant Sites. The building sites and their associated numbers are shown in Figure 3a, while Figure 3b provides a legend to the building numbers.

Topographic relief in the canyon ranges from 400 feet to 1800 feet, whereas elevations within the LBNL boundary range from about 500 feet to 1000 feet. The Mediterranean climate of the Coast Ranges produces a mean annual rainfall of about 28 inches. Within the LBNL site, two major east-west trending creeks, Strawberry and North Fork of Strawberry, have perennial flow that drains respectively through Strawberry and Blackberry Canyons toward the City of Berkeley and the San Francisco Estuary.

CONTAMINANT SITES

Chemical and Hazardous Contamination

LBNL operations fall under a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit. The Permit requires that LBNL investigate and address historic releases of hazardous waste and hazardous constituents within their property as part of the RCRA Corrective Action Program. LBNL's Environmental Restoration Program is responsible for carrying out these activities.

CMTW-27 cont.

Waste products at the LBNL have included solvents, gasoline, diesel fuel, waste oils, polychlorinated biphenyls (PCBs), Freon, metals, acids, etchants, and lead and chromate based paints. According to the LBNL RCRA Facility Investigation (RFI) Report (2000), the primary contaminants detected in soil and groundwater at LBNL have been volatile organic compounds (VOCs) including tetrachloroethene (also known as tetrachloroethylene or perchloroethene [PCE]), trichloroethene (also known as trichloroethylene [TCE]), carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), cis-1, 2-dichloroethene (cis-1, 2-DCE), 1,1,1- trichloroethane (1,1,1-TCA), and 1,1-dichloroethane (1,1-DCA). Some of these are common solvents and degreasers that have been used at LBNL for equipment cleaning. Smaller concentrations of other VOCs (e.g., benzene, toluene, ethylbenzene, and xylenes [BTEX]; chloroform; and vinyl chloride) have also been detected.

The LBNL RFI (2000) reported that contamination of soil and groundwater by petroleum hydrocarbons was associated with former underground storage tank sites and that PCB contamination has been primarily associated with spilled transformer oils and waste oil tanks. Freon- 113, a coolant for experimental apparatus, has been detected in groundwater south of Building 71.

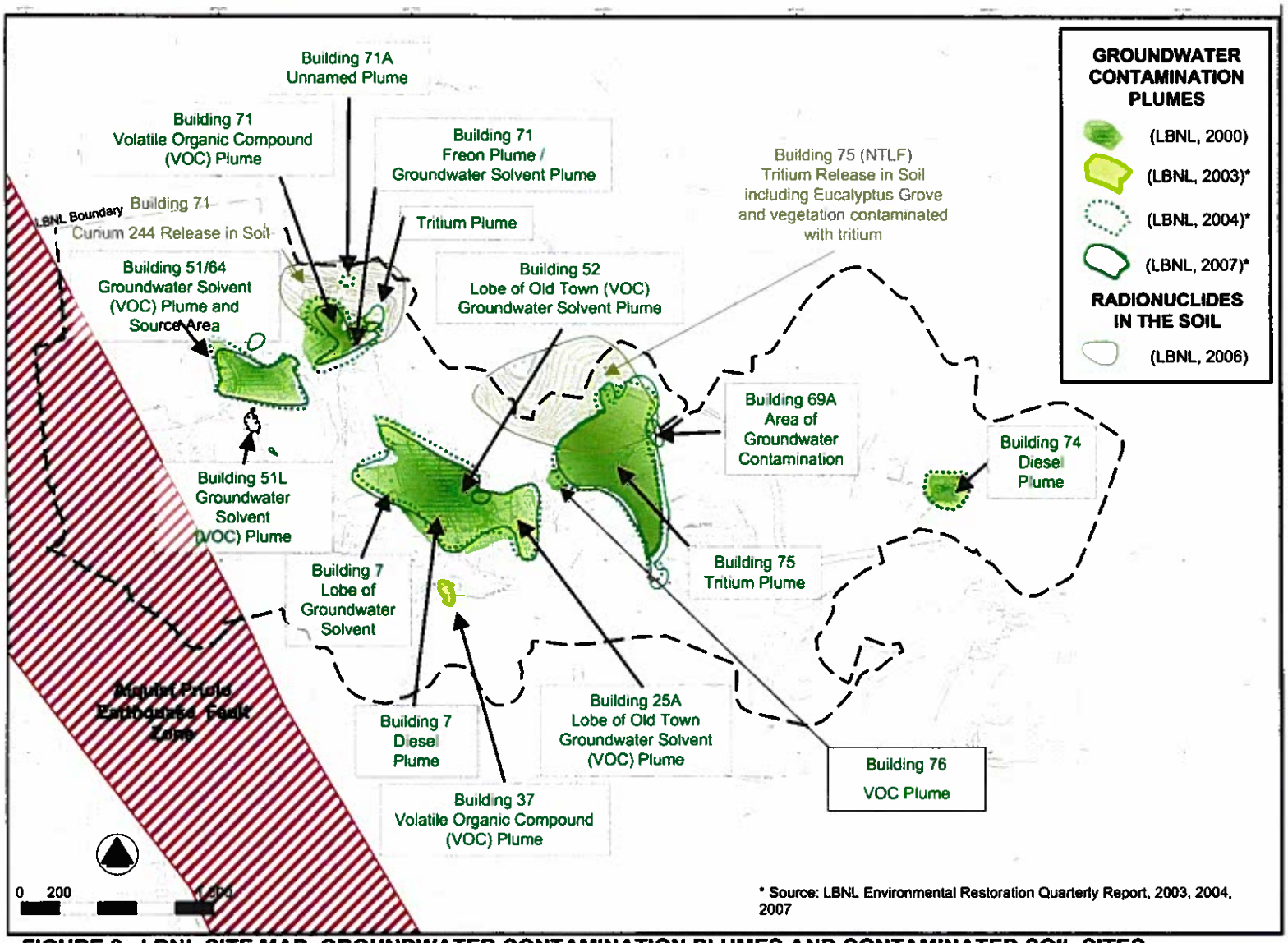


FIGURE 2. LBNL SITE MAP, GROUNDWATER CONTAMINATION PLUMES AND CONTAMINATED SOIL SITES.

CMTW-27 cont.

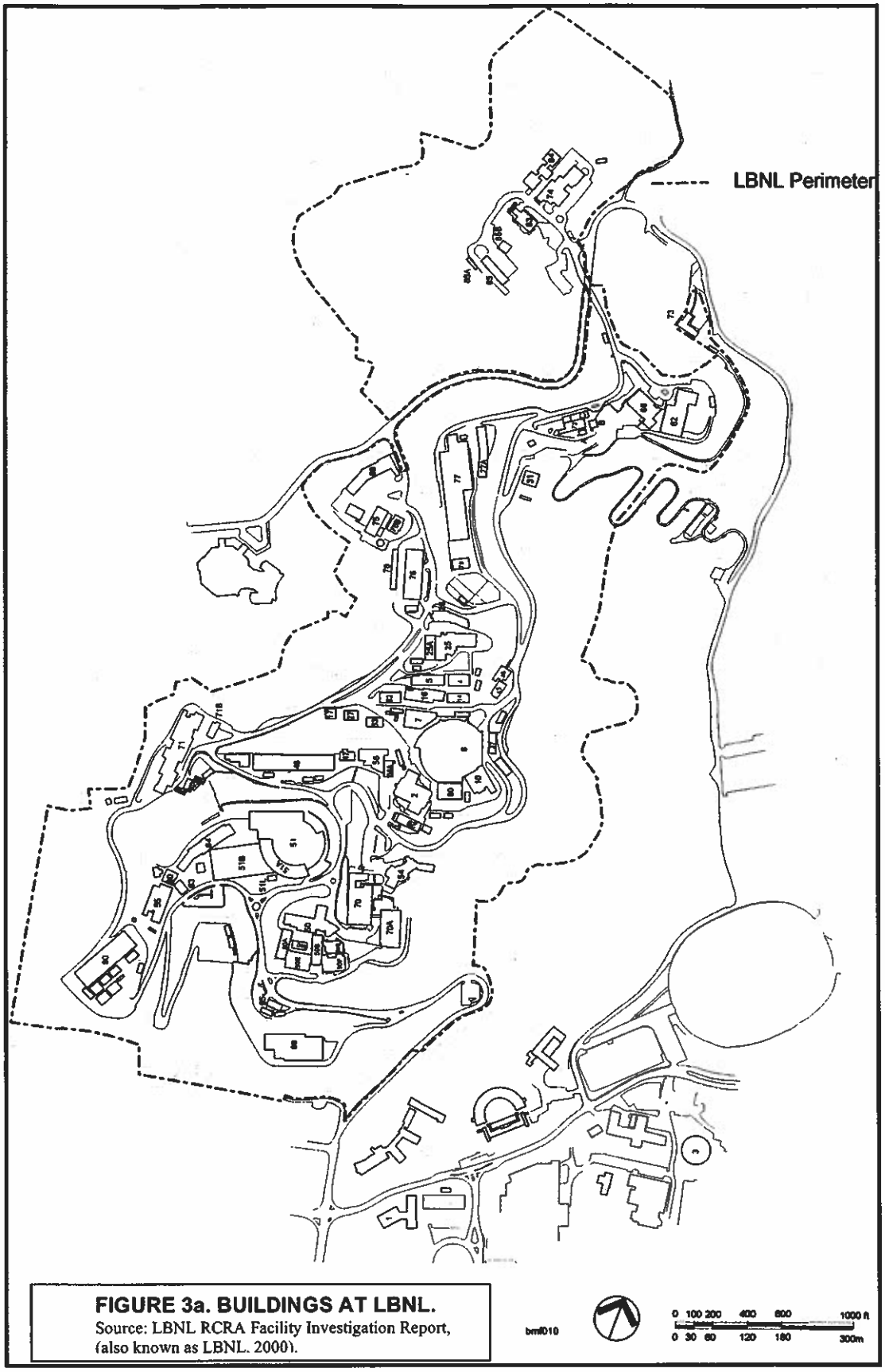


FIGURE 3a. BUILDINGS AT LBNL.
Source: LBNL RCRA Facility Investigation Report, (also known as LBNL. 2000).

CMTW-27 cont.

2	Advanced Materials Laboratory (AML)	55	Life Sciences
2a	Materials Storage	55A	Life Sciences
4	ALS Support Facility	55B	Emergency Generator
4A	Safety Equipment Storage	55C	Life Sciences
5	Accelerator and Fusion Research	56	Biomedical Isotope Facility
5A	Mechanical Storage	58	Heavy Ion Fusion
5B	Electrical Storage	58A	Accelerator Research & Development
6	Advanced Light Source (ALS)	58B	Lubricant and Solvent Storage
7	ALS Support Facility	60	High Bay Laboratory
7A	Radio Shop	61	Standby Propane Plant
7C	Office	62	Materials & Chemical Sciences
10	ALS Support Facility	62A	Environmental Energy Technologies, Materials Sciences
10A	Utility Storage	62B	Utility Storage
13A-C	Environmental Monitoring	63	Environmental Energy Technologies
13E,F	Sewer Monitoring Station	64	B-factory, Life Sciences
13G	Waste Monitoring Station	64B	Riggers
13H	Radiation Monitoring Station	65	Site Access Office
14	Earth Sciences Laboratory	66	Surface Science Catalysis Lab, Materials Sciences, Center for Advanced Materials
16	Accelerator and Fusion Research Laboratory	67B,C	Environmental Energy Technologies
17	EH&S	67D	Mobile Infiltration Test Unit
25	Engineering Shop	67E	Environmental Energy Technologies Field Lab
25A	Engineering Shop	68	Upper Pump House
25B	Waste Treatment Facility	69	Archives and Records, Shipping
26	Health Services, EH&S	70	Nuclear Science, Environmental Energy Technologies
27	ALS Support Facility	70A	Chemical Sciences, Earth Sciences, Engineering, Life Sciences, Nuclear Science
29	Engineering, Life Sciences	70B	Utility
29A,B	Engineering	70E	Storage
29C	Environmental Energy Technologies	70G	Liquid Nitrogen Storage
31	Chicken Creek Maintenance Bldg., Earth Sciences	71	Center for Beam Physics, Ion Beam Technology
31A	Earth Sciences	71A	Ion Beam Technology, Low Beta Lab
34	ALS Chiller Building	71B	Center for Beam Physics
36	Grizzly Substation	71C,D,F,H,J,P	B-factory
37	Utilities Service	71K	Accelerator and Fusion Research, B-factory, Chemical Sciences
40	Engineering Electronics Lab	72	National Center for Electron Microscopy (NCEM)
41	Engineering Communications Lab	72A	High Voltage Electron Microscope (HVEM)
42A	Emergency Generator House	72B	Atomic Resolution Microscope (ARM)
43	Compressor Bldg.	72C	ARM Support Laboratory
44	Indoor Air Pollution Studies	73	Atmospheric Aerosol Research
44B	Environmental Energy Technologies	74	Life Sciences Laboratory
45	Fire Apparatus	74C	Emergency Generator
46	Accelerator and Fusion Research, Engineering, Environmental Energy Technologies, Photography Services, Printing	75	Radioisotope Service & National Tritium Labeling Facility (NTLF)
46A	Engineering Div. Office	75A,B,C	Environment, Health & safety
46B	Engineering	76	Facilities Shops, Motor Pool/Garage
46C, D	Accelerator and Fusion research	77	Engineering Shops
47	Accelerator and Fusion research	77A	Ultra High Vacuum Assembly Facility (UHV)
48	Fire Station	77C	Welding Storage
50	Accelerator & Fusion Research, Physics, Library	77D	Drum Liquid Storage
50A	Director's Office, Nuclear Science, physics	77H	Auxiliary Plating
50B	Physics, Computing Sciences	77J-N	Chemical Storage
50C	Computing Sciences, NERSC	78	Craft Stores
50D	Center for Computational Sciences and Engineering	79	Metal Stores
50E	Computing Sciences, Offices	80	ALS Support Facility
50F	Computing Services	80A	ALS Support Facility
51	Technical and Electronics Information	81	Liquid Gas Storage
51A	Bevatron	82	Lower Pump House
51B	External Particle Beam (EPB) Hall	83	Life Sciences Laboratory
51F, G	Nuclear Science	84	Human Genome Laboratory
51L	Computer Training Center	85	Hazardous Waste Handling Facility
51N, Q	Earth Sciences	88	88-Inch Cyclotron, Nuclear Science
52	Cable Winding Facility	88B	Compressor Shelter and Storage
52A	Utility Storage	88C	Flammable Gas/Liquid Storage
52B	ALS Support	88D	Emergency Generator
53	Environmental energy technologies	90	Copy Center, DOE Site Office, Earth Sciences, Environmental Energy Technologies
53A	Gardner's Storage	90B,F,G,H,J,K	Facilities
53B	Accelerator and Fusion Research	90C, P	Earth Sciences
54	Cafeteria	90R	Utility Storage

FIGURE 3b. KEY TO LBNL BUILDINGS SHOWN IN FIGURE 3a. Source: LBNL, 2000

CMTW-27 cont.

The Human Health Risk Assessment (LBNL, 2003) identified chlorinated volatile organic compounds in soil and groundwater and PCBs in soil as chemicals of concern (COC) at LBNL. Prior to submission of the Corrective Measures Study (CMS) Report, Berkeley Lab completed Interim Corrective Measures (ICMs) that reduced residual PCB concentrations at the two units where PCB levels were a concern to less than the required media clean-up standard. LBNL (2007) discusses that after submittal of the Corrective Measures Implementation Work plan, elevated concentrations of PCBs were detected in shallow groundwater samples collected near the Building 51 Motor Generator Room Filter Sump, indicating PCBs were a potential COC in the soil at this location.

Groundwater is not used for drinking or other domestic water supply at LBNL. Water is supplied to LBNL and Berkeley residents by the East Bay Municipal Utility District (LBNL, 2007). In addition there are many private backyard wells in the city. Unless otherwise designated by the State's Water Quality Control Board, all groundwater is considered suitable, or potentially suitable, for municipal or domestic water supply. Exceptions to this policy are specified in State Water Resources Control Board Resolution 88-63.

Resolution 88-63 defines all groundwater as a potential source of drinking water, with limited exceptions for areas with total dissolved solids exceeding 3,000 milligrams per liter (mg/L), low yield (<200 gallons per day [gpd]), or naturally high levels of toxic chemicals that cannot reasonably be treated for domestic use. Under the Water Board's Water Quality Control Plan, groundwaters with a beneficial use of municipal and domestic supply have cleanup levels set no higher than Maximum Contaminant Levels (MCL's) or secondary MCLs for drinking water.

CMTW-27 cont.

The following descriptions from the 2007 Draft LBNL Long Range Development Plan (LRDP) report exemplify some of the conditions and circumstances at the contaminant sites. Note that Old Town is in the general vicinity of Buildings 25 and 52, near the central land holdings of LBNL. All plumes can be seen in Figure 2. Further details can be found within the referenced reports.

> The Old Town Groundwater Solvent Plume is a broad, multi-lobed plume of VOC contaminated groundwater, which underlies much of the Old Town area. The distribution of chemicals in the plume indicates that it consists of three coalescing lobes that were originally discrete plumes derived from distinct sources. The Building 7 lobe, which contains the highest VOC concentrations of the three lobes, extends northwestward from the northwest corner of Building 7 to the parking area downhill from Building 58. Leaks and/or overflows of VOCs (primarily PCE) from the Former Building 7 Sump, an abandoned sump that was located north of Building 7, were the primary source of the Building 7 lobe. These chemicals were initially released as free product to the soil around the sump and then migrated as dense non-aqueous-phase liquid (DNAPL) into the saturated zone, forming a source zone for further migration of contaminants. Continuing dissolution of contaminants from the soil and westward to northwestward flow of the groundwater from the sump area has resulted in the development of the Building 7 lobe of the Old Town Groundwater Solvent Plume.

Contaminated soil and groundwater were present beneath the area where Building 51L was located. The principal contaminants were VOCs that were used as cleaning solvents, or were derived from degradation of cleaning solvents. In addition, a small area of VOC-contaminated soil was present beneath the abandoned Building 51A stormdrain catch basin next to the Building 51A B-door. Contaminated soil in the bottom of the catch basin was removed in 2002. However, groundwater samples from temporary groundwater sampling point SB51A-01-8B installed through the catch basin have contained elevated VOC concentrations, suggesting the presence of additional contaminated soil beneath the catch basin.

A network of subdrains and relief wells located around the perimeter of Building 51 collects subsurface water from the adjacent hillside. Water collected by this network discharges to the Motor Generator Room Filter Sump, which is part of the Building 51 internal floor-drain system. After submittal of the Corrective Measures Implementation (CMI) Work plan, elevated concentrations of PCBs were detected in shallow groundwater samples collected near the sump, indicating that PCBs were a potential COC in the soil at this location.

The Building 51/64 Groundwater Solvent Plume extends south and west from the southeast corner of Building 64 beneath the former location of Building 51B. The corrective measures required for the Building 51/64 Groundwater Solvent Plume consist of operation of an in situ soil-flushing system in the up gradient portion of the plume, implementation of Monitored Natural Attenuation in the down gradient portion of the plume, and collection and treatment of water from the Building 51 subdrain system.

CMTW-27 cont.

The location of the Building 69A Area of Groundwater Contamination is shown in Figure 2. The most likely source of the contamination was leakage from a pipeline in the Building 69A Hazardous Materials Storage and Delivery Area that drains to the Building 69A Storage Area Sump. A dislocation was observed in one of the sump drainpipes and repaired in 1987.

Radioactive Contamination

Since November 1991, the State of California Department of Toxic Substances Control (DTSC) and LBNL have identified 174 "units" of hazardous contamination in the Strawberry Creek Watershed. At least 8 of these 174 "units" were identified as having radioactive contamination. At the same time the California Department of Health Services (DHS) also participated as an additional quality assurance check and provided independent laboratory results to complement LBNL's environmental monitoring programs.

In September of 1995, the California Department of Health Services (DHS) Environmental Management Branch released the Agreement in Principle (AIP) Annual Report, which identified LBNL's National Tritium Labeling Facility (NTLF), Building 75 as a major concern for radioactive contamination in the environment. The AIP report states:

> This facility (NTLF) handles kilocurie quantities of tritium (^3H) to label a variety of molecules that are subsequently employed in chemical, pharmaceutical, and biomedical research. It is conceded that releases from the tritium-stack as well as fugitive releases from Building 75 are the primary source of tritium at LBNL. Air-fall, rainout, and possibly transport in fog impacts soil, groundwater, and surface water. There is an area of tritium contaminated groundwater in the vicinity of Building 75. The Quarterly Progress Report, First Quarter FY 1992, (May 1993) reports sampling ten hydraugers, one, immediately down-slope from NTLF, reportedly contained 32,000 pCi/L of tritium.

The AIP Program collected and analyzed surface water samples, which demonstrated that tritium is detectable in surface water around LBL. The AIP further states:

> One recent investigation, by Leticia Menchaca (LBNL), analyzing for tritium in transpired vapor from plants on LBNL suggest that there may be significant amounts of tritium in the upper, non-saturated, soil strata. It appears that there may be sufficient evidence to suggest that there may be more tritium in the environment than previously suspected. There are apparently no validated explanations for the appearance of tritium in streams not obviously associated with NTLF. (See Table 1)

During the above referenced investigation, tritium concentration in rainwater was detected as high as 239,000 pCi/L and 197,946 pCi/L in transpired water vapor from trees near the University of California's Lawrence Hall of Science.

Table 1. Comparison of Tritium Levels from Split LBNL Surface Water Samples
Collection Date: June 15, 1995 (Table LBNL-6c, AIP Report, 1995)

Location	AIP Results	AIP Duplicate	LBNL Results
	(pCi/L)	Results (pCi/L)	(pCi/L)
Blackberry Creek	3335 ± 255		
Claremont Creek	< 328		
Wildcat Creek	1147 ± 218	944 ± 214	
Lower Strawberry Creek	5902 ± 294		
Upper Strawberry Creek	< 328	< 328	

CMTW-27 cont.

In addition, the AIP report expressed concern over the release of Curium-244 from Building 71, the Heavy Ion Linear Accelerator (HILAC). It states:

> An area of soil near Building 71 is historically (circa 1959) reported to have been contaminated with Curium-244 when a Curium target being used in an experiment was vaporized. Some of this contamination, reportedly, was transported by the buildings ventilation system and deposited outside. This is documented in two interviews in the RCRA Facility Assessment at LBL Sep. 30, 1992: this document reports that "Cleanup of curium contaminated concrete inside the building is documented but there is no record of sampling outside Bld. 71."

The AIP program's other concerns for radioactive contamination in the LBNL environs included former radioactive waste storage and staging areas, former radioactive decontamination areas and abandoned above ground radioactive waste holding tanks.

In 1998, the US Environmental Protection Agency (EPA) performed a Superfund reassessment of LBNL concluding that "Based upon a preliminary Hazard Ranking System score, the US EPA has determined that LBNL is eligible for the National Superfund Priorities List" for cleanup, due to tritium in air, soil, groundwater, and surface water.

In September of 2001, LBNL announced that the NTLF would cease operations by 12/31/01.

In June 2005 National Academy of Sciences panel, formally known as the Committee on Biological Effects of Ionizing Radiation, or BEIR, concluded that there is no exposure level found below which dosage of radiation is harmless. The preponderance of scientific evidence shows that even very low doses of radiation pose a risk of cancer or other health problems. The National Academy of Sciences panel is viewed as critical because it addresses radiation amounts commonly used in medical treatment and is likely to also influence the radiation levels that the government will allow at abandoned and other nuclear sites.

METHODS

Our approach to developing a basic understanding of the contaminant plumes of the Lawrence Berkeley National Laboratory and their interrelation to faults, landslides, and streams in Strawberry Canyon was to develop a series of overlays that would show the conditions and various interpretations by previous investigations. The base map data sources were from the City of Berkeley and LBNL Facilities Division, the map projection: California State Plane, Zone III, (map scale 1:3000). Map layers for plumes, geology, faults, and landslides were scanned and then digitized as individual slides.

CMTW-27 cont.

For the historic channel and landslide network mapping, a base map scale of 1-inch equals 200 feet was used to draw channels and landslides as they were interpreted from stereo aerial photographs and historic maps. The historic map of the drainage network was from Soulé (1875). The topographic projections of Soulé's 1875 base map were not compatible to present day cartographic or survey standards. The stream network, however, in most cases, seems to have a good representation of the number of tributaries and the relationship of one confluence to another. Because Soulé's map could not be digitized directly as an overlay, it was necessary to interpret his intent with regard to channel and spring mapping. This was accomplished by referring to predevelopment topographic maps shown in LBNL (2000) and by viewing stereo pairs of historical air photos, some of which predated development of the 1940's.

Different years of aerial photography were used to map landslides, landslide scars, and colluvial deposits. Three black and white photos were used for the earliest period that represented circa 1935. There were a few sections of stereo overlap in these photos, whereas all the newer photos had complete stereo coverage. The full stereo photo analysis included photos from 1939, 1946, 1947, and 1990. A distinction was made,

when possible, to establish between deep-seated and shallow slides. Shallow slides were expected to be less than 30 feet deep, whereas deep-seated slides exceeded 30 feet. Source areas for shallow slides, called colluvial hollows, were also mapped. These source areas often contain scars of former landslides and in some cases have had recent sliding, but certainty was low from aerial interpretation. When there was a high certainty of activity occurring within the last century, the slides were delineated accordingly. Activity status of earthflows was not determined. However, at the very least, these slides should be expected to have higher than normal creep rates than the surrounding soils and they will probably continue to have renewed activity within their boundaries.

RESULTS AND DISCUSSION OF DATA COMPILATION

Drainage Network Mapping

Within the Lab site, two major east-west trending creeks, Strawberry and North Fork of Strawberry, have perennial flow that drains respectively through Strawberry and Blackberry Canyons toward the City of Berkeley and the San Francisco Estuary. North Fork of Strawberry Creek flows through the boundaries of LBNL. Mainstream Strawberry Creek is not within LBNL boundaries, yet seven of its north-south trending tributaries that flow southward, do drain from the LBNL. These tributaries, cited in the LBNL RFI, 2000 include Cafeteria Creek, Ravine Creek, Ten-inch Creek, Chicken Creek, No-name Creek, Banana, and Pineapple Creeks as shown in Figure 4. The latter two flow into Botanical Garden Creek, which is not within the LBNL boundary, but flows into the central reach of mainstream Strawberry Creek.

CMTW-27 cont.

The pathways of natural surface water runoff have been altered by years of land use activities in the Canyon, which have caused the natural topography to become highly altered by cut and fill activities, roads, impervious surfaces from buildings and parking lots, and by stormdrain and other infrastructure construction. Natural and land use-related landslides have also changed the flow pathways of both surface and groundwater. Numerous faults, deep-seated landslide failure planes, bedrock contacts, fractures, and joints compound the natural influences on groundwater. They can all strongly influence the direction and rate of subsurface flow.

However, the location of bedrock contacts and faults can be challenging to detect, especially in an unstable landscape where landsliding can mask the geomorphic signatures of faults and bedrock contacts. Overlaying surficial deposits from alluvial fans and colluvium can also obscure these features. Groundwater flow has also been artificially altered by spring development, wells, hydraugers, utility trenches, sewers, subsurface drains, and pumps installed to mitigate contamination, as well as to intercept hill water that historically has caused landslides at LBNL.

Campus Principal Engineer John Shively conceived of the idea of a vertical well to intercept hill-water that was causing landslides both inside and adjacent to LBNL in 1974. He retained Civil Engineer B. J. Lennert to install what is now known as the Shively well, located next to the UC Silver Space Sciences building. It should be noted

that the major hill landslide of August 1974 (during a dry season) broke a lab building at LBNL, took out a portion of a laboratory road, and was threatening UC Berkeley's Lawrence Hall of Science.

At the same time another landslide was developing above the Lab's corporation yard, threatening the University's Centennial Drive. Lennert's attempts to stop the slides by dewatering the hill area with horizontal hydraugers weren't working. The Shively well apparently stopped both slides.

In 1984 Converse Consultants, Inc. conducted investigations in the eastern portion of the Strawberry Canyon. Their findings were published in a report titled "Hill Area Dewatering and Stabilization Studies" which defined the location of the Lennert Aquifer in the following:

> Dewatering measures instituted by Lennert were based on the belief that the main reservoir of deep ground water in the hill area is the volcanic flow (i.e., fractured) rocks of the Moraga Formation situated within a synclinal structure underlying the ridge extending from LBL Building 62 northward to Little Grizzly Peak. These flow rocks were thought to be bottomed in the syncline by less permeable Orinda Formation bedrock (although some permeable sandstone and conglomerate beds within the Orinda exist, they are interbedded with impermeable shales and siltstones). Lennert asserted that ground water was also controlled in the hill area by faults such as the University Fault and the New Fault, which acted as groundwater barriers or as conduits for water flow through cracks and voids along these faults. Lennert also asserted that surface water entered these "tension faults", entering directly and quickly into the groundwater regime.

CMTW-27 cont.

The location of the Shively well that drains the Lennert aquifer, hydraugers as well as sewers, and stormdrains at LBNL are also shown in Figure 4.

Little remains of the natural drainage network within LBNL boundaries, yet its natural pattern can been interpreted from historical photos and information from Soulé (1875), as shown in Figure 5. The drainage network does not depict differences in perennial versus intermittent or ephemeral flow; it simply indicates where well-defined channels are expected. The springs, however, do represent sites of presumed perennial wetness. Soulé indicated that several springs were developed for water diversion prior to his 1875 map. In Figure 5, the arrows represent where channels might have become non-distinct as they spread across their alluvial fans at the base of steep hillsides. Alluvial fans store bedload and often convert surface flow to subsurface flow over coarse-bedded, highly permeable alluvium.

Near the central and northern LBNL property, two areas show a particularly high density of channels per unit area. These correspond to two east-west trending valleys. The eastern valley is referred to as East Canyon and the central one is Chicken Ranch Canyon. The high density of channels in these valleys appears to be associated with large landslides

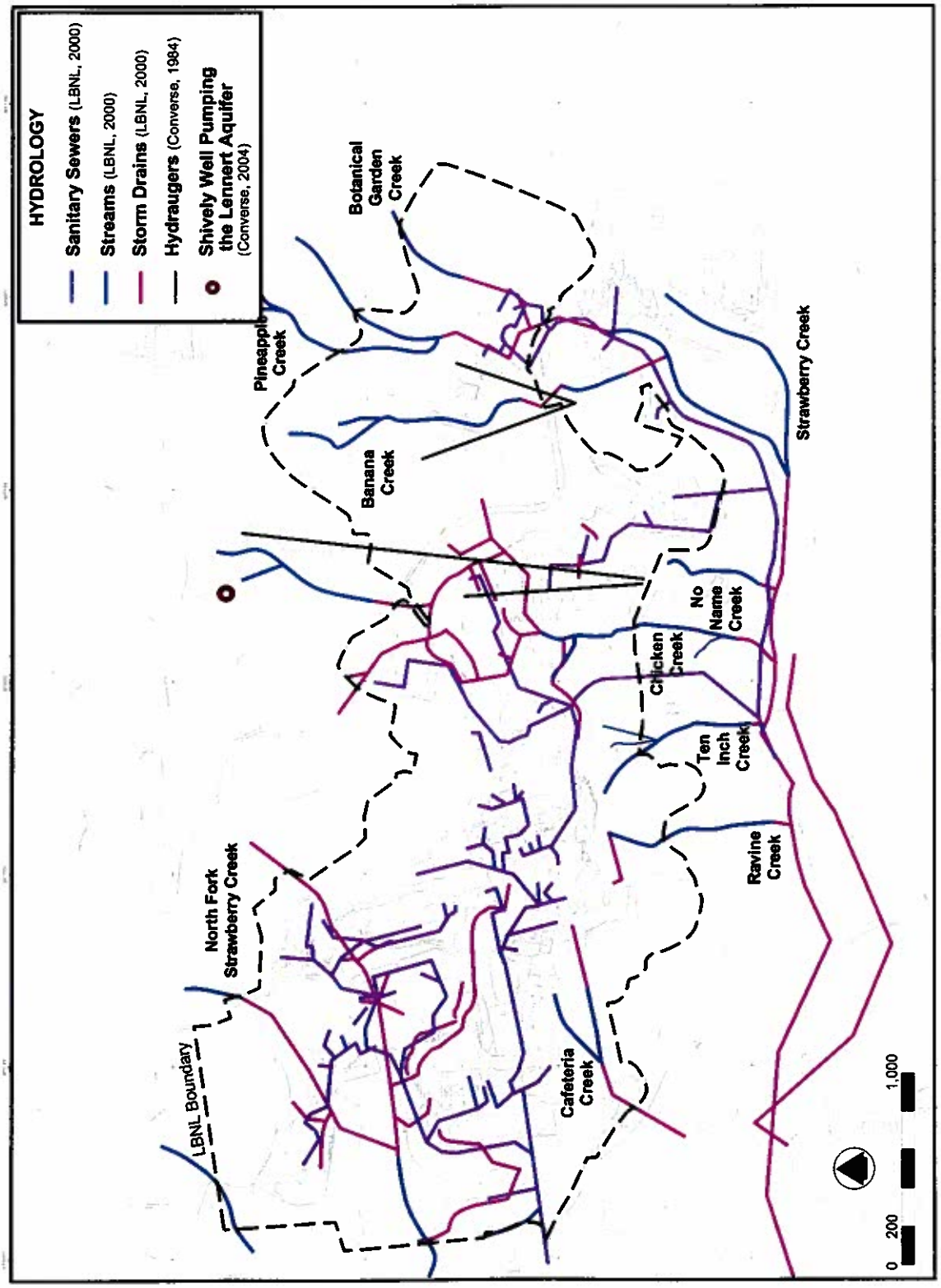


FIGURE 4. MODERN DRAINAGE NETWORK AT LBNL IN STRAWBERRY CANYON

CMTW-27 cont.

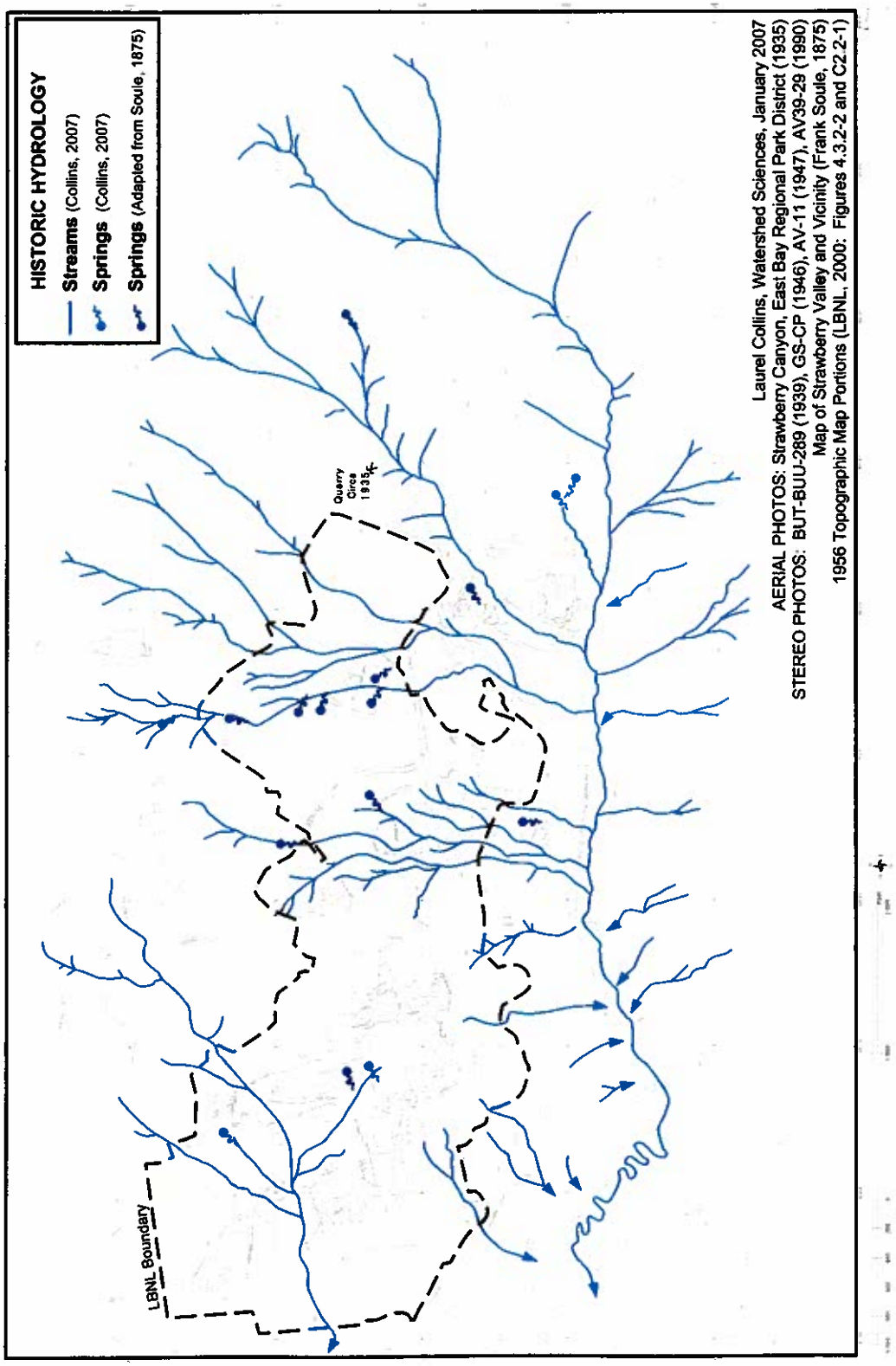


FIGURE 5. INTERPRETATION OF HISTORIC CHANNEL NETWORK AT LBNL IN STRAWBERRY CREEK WATERSHED

CMTW-27 cont.

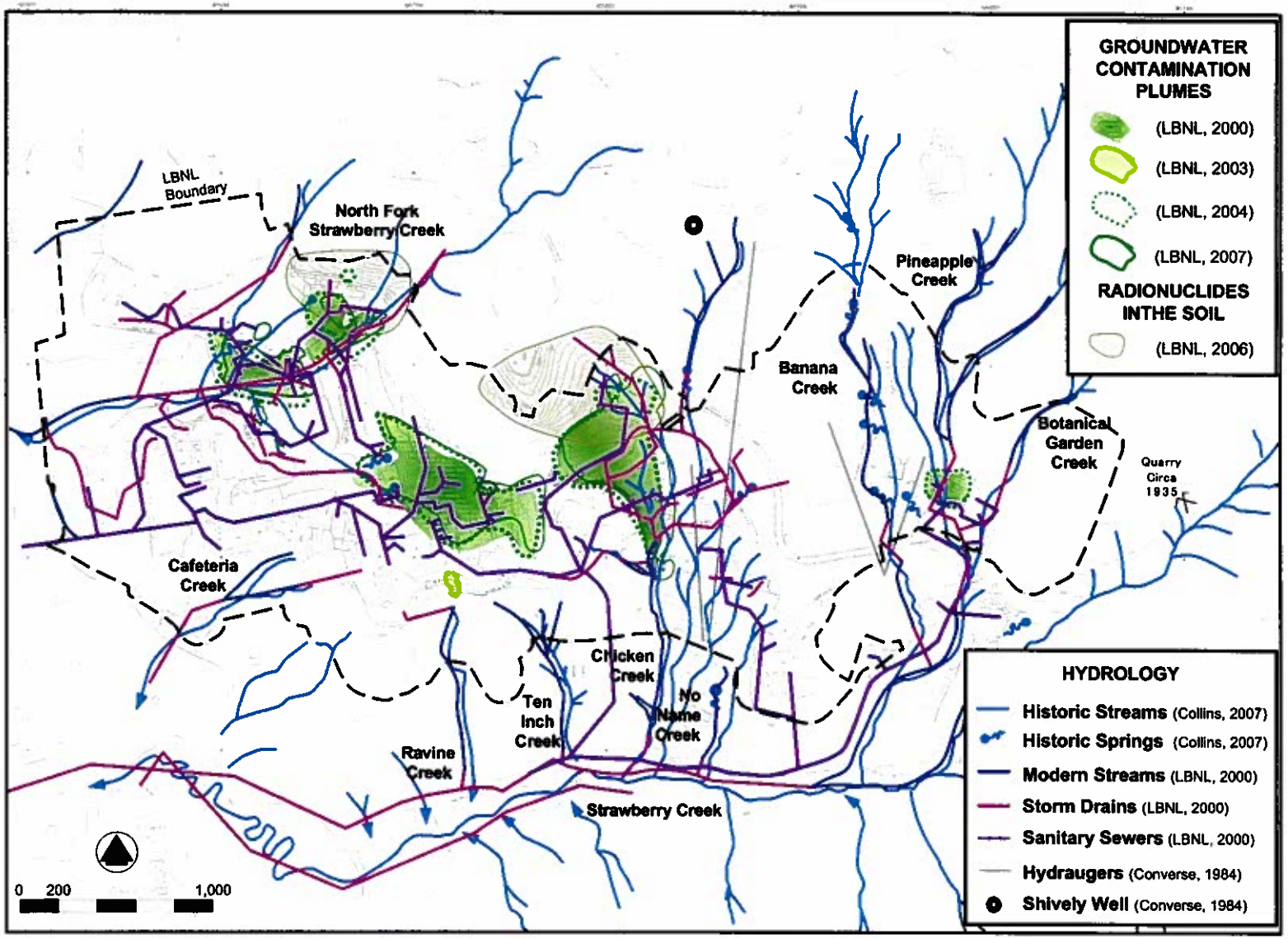


FIGURE 6. GROUNDWATER CONTAMINATION PLUMES IN RELATION TO THE MODERN AND HISTORIC DRAINAGE NETWORKS AT LBNL

CMTW-27 cont.

that occupy the valley floors (Figure 7a). It is likely that highly erosive soils exist in the valley because they have been mechanically disturbed by both landsliding and faulting. In addition, the clay-rich nature of the soils and landslide deposits in these valleys often leads to slow percolation rates, especially along failure planes of earthflows, which can create perched water tables. These factors contribute to increased runoff per unit area, which leads to increased drainage density.

The historic drainage network helps with interpretation of topographic features such as the landslides in East and Chicken Creek Canyons, but it is also useful for showing movement along fault lines such as the Hayward Fault. At the bottom left corner of Figure 5, over 1200 feet of right lateral channel offset has occurred on Strawberry Creek along the area that is now the UCB stadium. Historic channel mapping is also important for predicting potential migration pathways of contaminant plumes along alluvial soils that might have been buried by large deposits of artificial fill, such as in Blackberry Canyon.

A compilation of the current and historic drainage network relative to the 2000, 2003, 2004, and 2007 LBNL contaminant plume locations is shown in Figure 6. Areas shown in grey indicate the location of radionuclides (tritium and curium 244) in soil (LBNL 2006). All the plumes, except Building 37 VOC plume, are shown to intersect historic drainage channels. Storm drains intersect all contaminant plumes except Building 37. The hydraugers do not appear to intersect plume boundaries, although the Building 74 Diesel Plume is very close to the northernmost hydrauger. The contaminant plumes have a general pattern of downhill convergence into both the historic channel and modern storm drain network.

CMTW-27 cont.

Geologic Bedrock Mapping

The complex geology of Strawberry Canyon involves periods of volcanism, sedimentary deposition within fresh water and marine environments, tectonic uplift, folding, and significant shearing along fault zones that have offset different-aged terrains. LBNL (2000) describes the underlying geologic structure at the lab to be a northeast dipping faulted homocline. Generally, the oldest rocks occupy the lower portions of Strawberry Canyon, while youngest rocks are found toward the east along the ridge.

The middle of the Canyon is more complex with older bedrock formations faulted and offset against younger ones along the Space Science's fault, University fault, New fault, Strawberry Canyon fault, Lawrence Hall of Science fault complex and various un-named faults, as well as the Wildcat and East Canyon Faults. Bedrock of Jurassic to Cretaceous-aged Franciscan Assemblage is mostly to the west of the Hayward Fault, beyond Strawberry Canyon. In this area, these rocks are typically marine sandstones that are faulted against younger bedrock of the Great Valley Sequence along the Hayward Fault at the base of the canyon.

The Cretaceous-aged Great Valley Sequence also has a marine origin. It ranges from mudstone and shale to sandstone with occasional conglomerate. The Great Valley Sequence is in fault contact with the Late to Middle Miocene-aged Claremont and the Late Miocene-aged Orinda Formations in different parts of the Canyon. The Claremont Formation is primarily siliceous chert inter-bedded with shale that formed in a deep marine environment.

Locally the chert is commonly highly fractured, folded, and faulted. It tends to form erosion resistant outcrops along some ridges.

Conversely, the Orinda is primarily mudstones, sandstones, and minor conglomerates that formed in a non-marine environment. The predominantly clay-rich Orinda shale unit tends to be associated with topographic valleys and is particularly prone to deep-seated landslides. Orinda is stratigraphically overlain and occasionally inter-fingered with the Late Miocene Moraga Formation, which is volcanic in origin and locally tends to be highly fractured, jointed, brecciated, and commonly vesicular (LBNL, 2000). In some places, it has been faulted and offset against the Orinda, especially to the west of the Wildcat Fault.

Although both Orinda and Moraga Formations are highly fractured, the Moraga has hard volcanic flow rocks of andesite and basalt while the Orinda tends to have low strength and hardness. The Moraga Formation is overlain and in contact with the Late Miocene non-marine sedimentary deposits of the Siesta Formation along the northeastern ridgeline. Beyond the ridge, the volcanic rocks of the Late Miocene Bald Peak Formation overlay the Siesta Formation along the axis of a structural syncline (Graymer, 2000).

Figures 7a, 7b, and 7c show interpretations of the geology in Strawberry Canyon that are different. Although the maps also have slightly different spatial extents, they overlap through most of the LBNL property. All maps identify the Orinda, Moraga, and Claremont Formations, yet the location of the bedrock boundaries do not agree. There are also some slight naming differences for the Great Valley Group rocks identified by LBNL and Graymer versus the Panoche Formation identified by Borg. The Panoche Formation simply represents a part of the Great Valley Group and is therefore not a significant difference in interpretation. Dunn (1976) reported that with regard to slope stability, the worst building sites in Strawberry Canyon were along the Orinda, and the Orinda/Moraga contact zones. The principal formations shown to be intersecting the contaminant plume sites are the Orinda and Moraga Formations, Figures 8a and 8b.

CMTW-27 cont.

Figure 8a shows a compilation of the Moraga bedrock contacts as individually mapped by LBNL, Graymer, Collins, and Borg in the respective Figures 7a, 7b, 7c, and 7d. Figure 8b shows a compilation of bedrock contacts of the Orinda Formation. Note that the Building 51L and 61/64 plumes intersect rocks of the Great Valley Sequence. The location of bedrock contacts near the plume sites is particularly important because ground water can travel laterally along the contact zone rather than just move topographically downhill. This is particularly relevant when sharp reductions in permeability occur in the downhill bedrock. Soil permeability and transmissivity are much greater in the Moraga Formation because it has lower clay content than the Orinda.

When groundwater traveling from the Moraga Formation intercepts the Orinda Formation, positive pore pressures can build, forcing water to move along alternative pathways such as along a bedrock contact, through fractures, or toward the surface where it can cause landslides and/or springs. Interpretation of the size of each contaminant plume and its migration is constrained by the array and number of sampling wells. If water laterally.

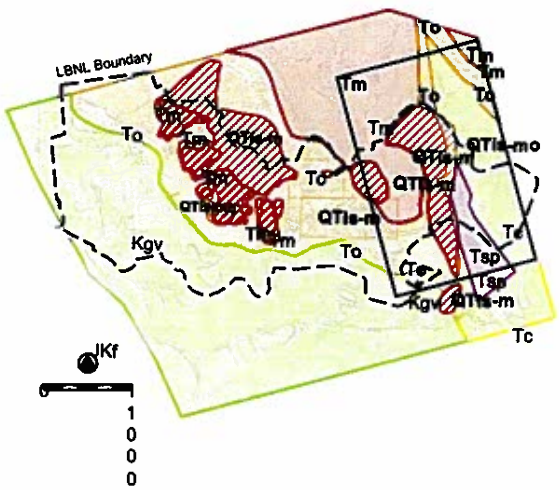


Figure 7a. LBNL (2000)

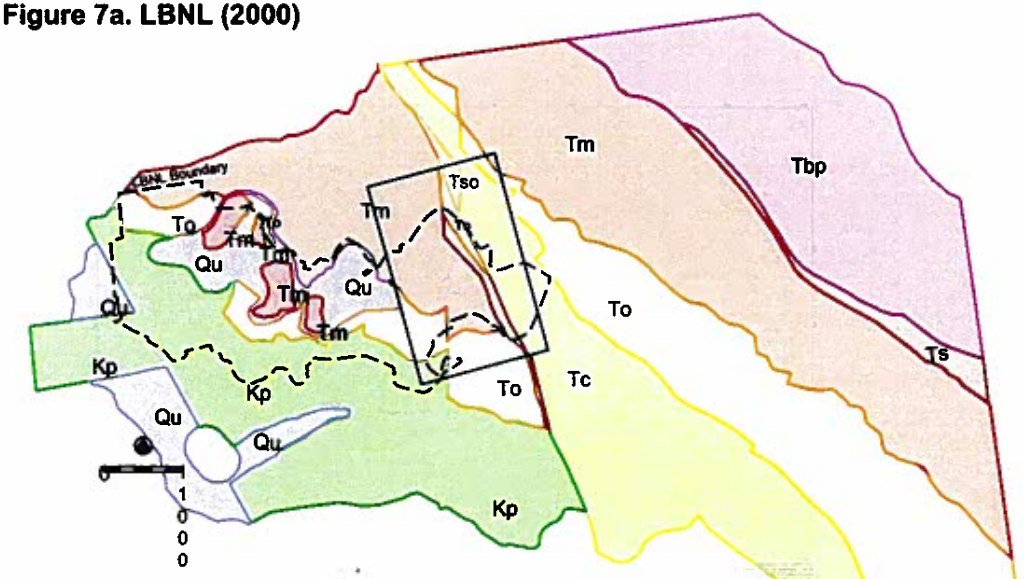


Figure 7b. Borg (1991)

Bedrock Geology of LBNL
LBNL (2000)

LBNL (2000) Modified from Radbruch (1969) & Harding Lawson Assoc (1980, 1982)

- Landslide - Moraga Formation (QTls-m)
- Paleolandslide - Mixed (QTls-mo)
- Moraga Formation (Tm)
- Orinda Formation (To)
- Claremont Formation (Tc)
- Great Valley Group (Kgv)
- San Pablo Group (Tsp)
- Franciscan Complex (JKf)

Geology of Strawberry Canyon
Borg (1991)

- Moraga Formation (Tm)
- Orinda Formation (To)
- Claremont Formation (Tc)
- Sobrante Formation (Tso)
- Panoche Formation (Kp)
- Bald Peak Basalt (Tbp)
- Surficial Deposits (Qu)
- Siesta Formation (Ts)

CMTW-27 cont.

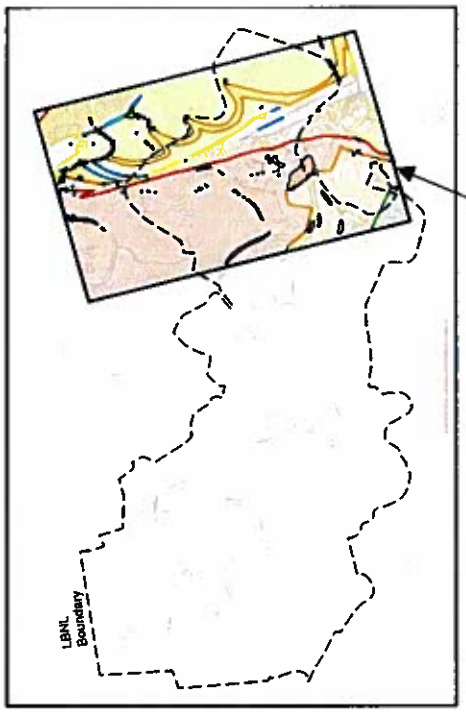


Figure 7c. Collins (1993)

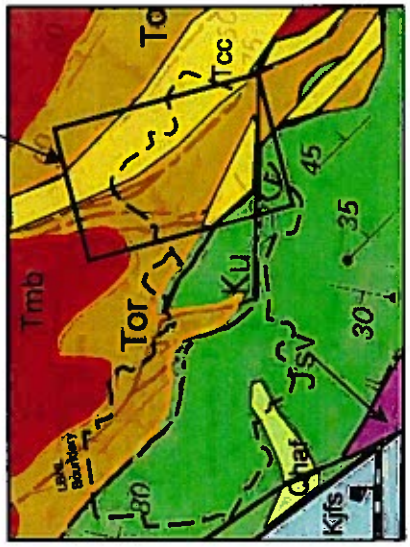


Figure 7d. USGS, Graymer (2000)

Geology of the East Canyon and the Proposed Hazardous Waste Handling Facility (Collins 1993)

- Moraga Formation (Tm)
- Orinda Formation (To)
- Claremont Formation - Chert Outcrop (Tc)
- Claremont Formation - Sandstone Outcrop (Tc-ss)
- Claremont Formation - Shale outcrop (Tc - sh)
- Miocene and Upper Eocene Sediments (Tm-e)
- Upper Cretaceous Sediments (Ku)
- Landslides (LBNL Plant Eng, 1981)

Geology in the LBNL Area USGS, Graymer (2000)

- Moraga Formation (Tm)
- Orinda Formation (To)
- Claremont Chert (Tcc)
- Holocene Alluvial Fan (Qhaf)
- Upper Cretaceous Sediments (Ku)
- Jurassic Keratophyre (Jsv)
- Franciscan Complex Sandstone (Kjfs)

CMTW-27 cont.

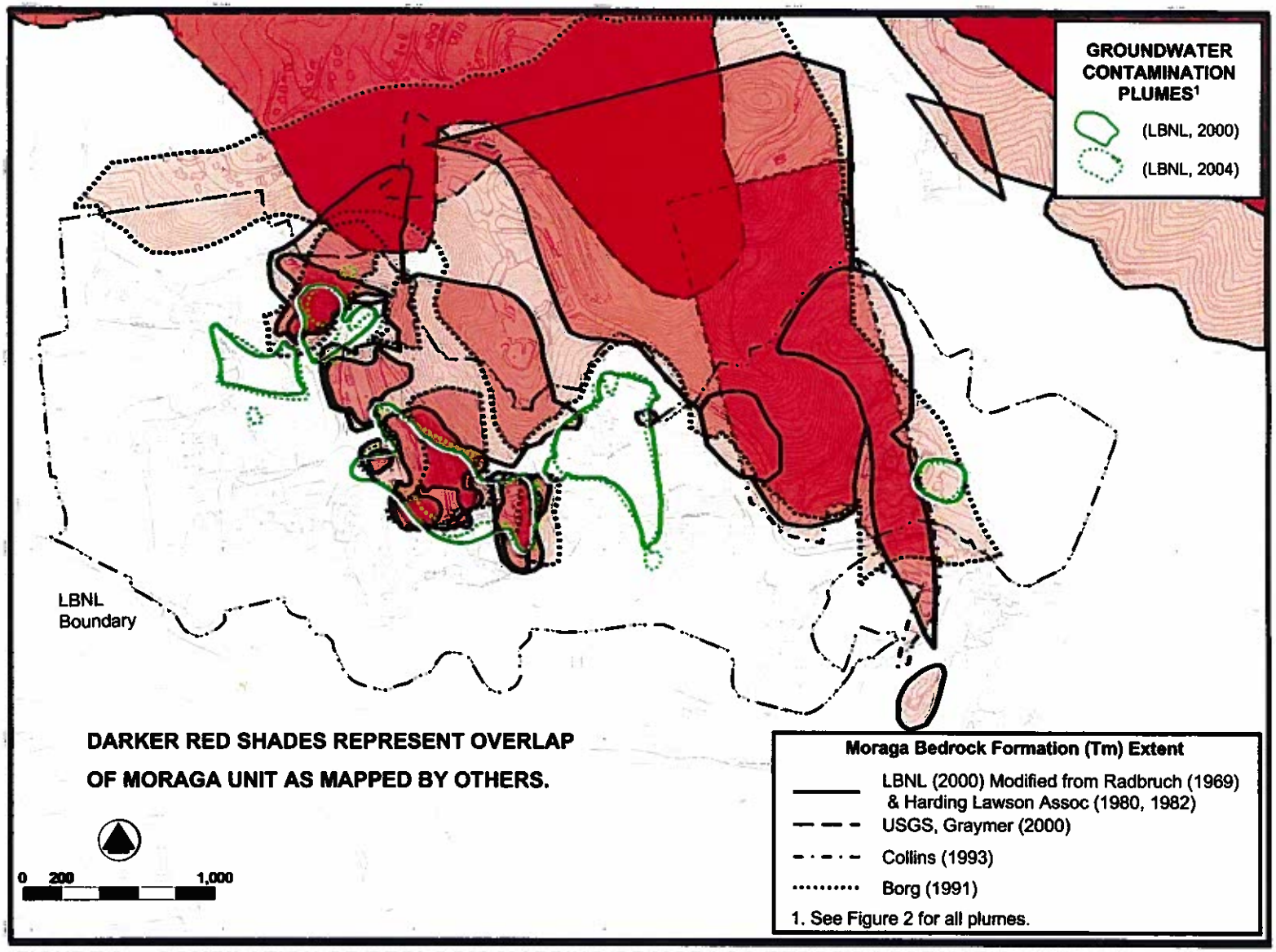


FIGURE 8a. COMPILATION OF GEOLOGIC MAPPING OF MORAGA BEDROCK FORMATION AT LBNL.

CMTW-27 cont.

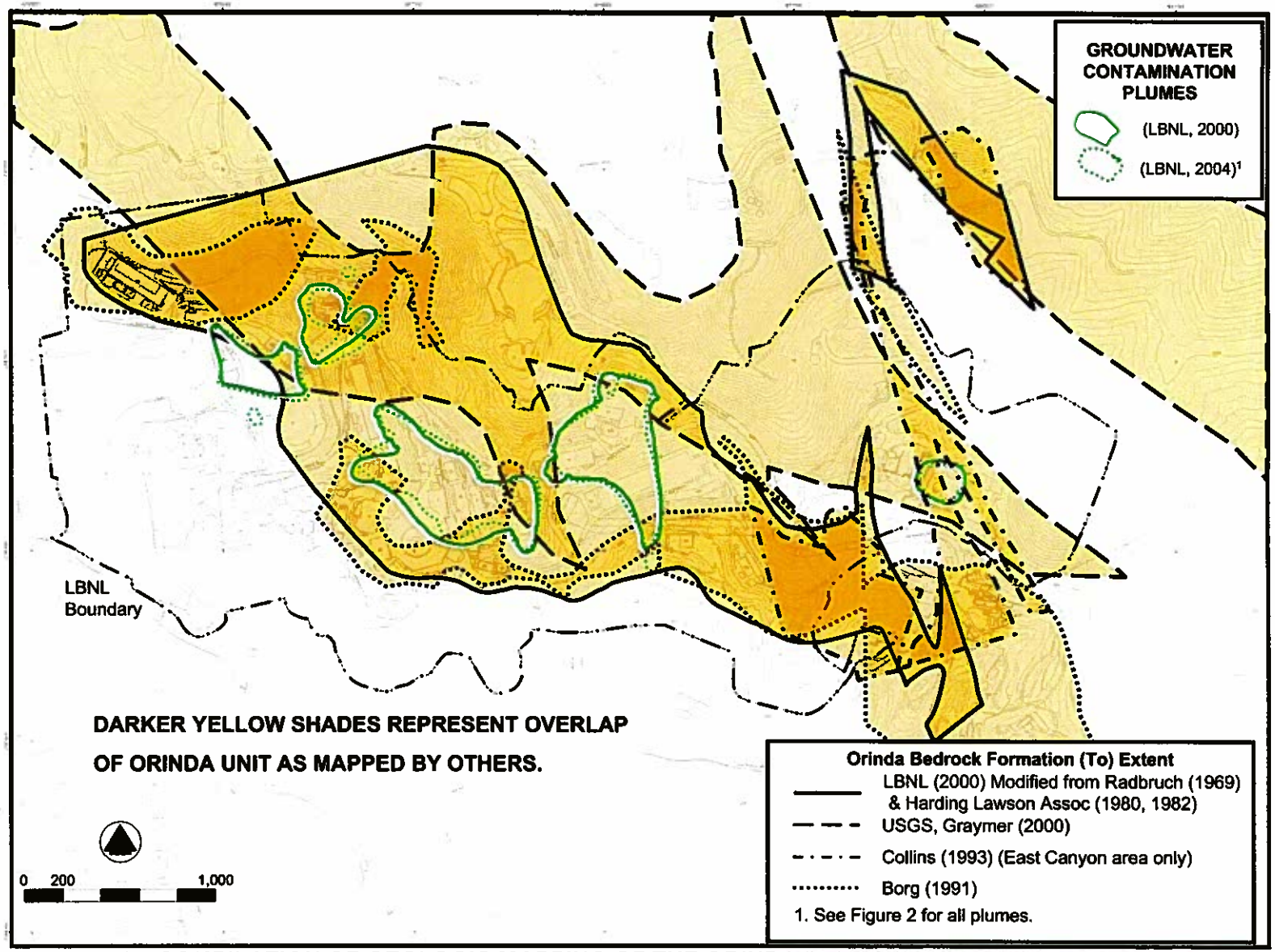


FIGURE 8b. COMPILATION OF GEOLOGIC MAPPING OF THE ORINDA BEDROCK FORMATION AT LBNL

CMTW-27 cont.

migrates along a bedrock contact and if monitoring wells are not placed in a sufficient array to detect these potential flow pathways, the extent and migration of a plume could be easily misinterpreted. Figure 8a and 8b show substantial differences in the interpretation of the location of the bedrock contacts at nearly every plume site.

During the past 60 years, UCB and LBNL have produced innumerable investigations and geotechnical reports for existing and proposed building sites in Strawberry Canyon. Yet, agreementon the position of faults, landslides, and bedrock contacts has not been consistent among these reports. The lack of continuity among the various reports has been noted by previous researchers who have called for a more comprehensive effort to produce a verifiable picture of landslides and geology (Dunn 1976; Collins, 1993; Collins and Jones, 1994).

For example, in 1976 J. Dunn stated that with regard to instability of hillsides near Buildings 46 and 77, most activity involved failure of material in the Orinda Formation or sliding of the Moraga Volcanics on the Orinda. Although borings had been completed, samples recovered, and tested, he reported that the results and conclusions had not been tied together in a workable package. An earlier report by Collins (1993), recommended that "raw" geological observations such as bedrock outcrops should be shown on future geological investigations and that such maps should be an essential component of an integrated, comprehensive, and computerized database for the LBNL site.

With LBNL producing a GIS-based three-dimensional view of their local geologic interpretations, much has been accomplished since 1993. Yet, a verifiable map showing locations of bedrock outcrops and exposures in excavations remains elusive. Hence, it still remains unclear what information has or has not been used as a foundation for LBNL's geologic map, and why their interpretations differ from reports by their previous consultants

CMTW-27 cont.

Fault Mapping

The Hayward Fault is part of the larger San Andreas Fault system. It is seismically active and falls within the Alquist Priolo Earthquake Fault Zone, Figure 2. Numerous secondary splay faults are also associated with the Hayward Fault, such as the Wildcat and East Canyon Faults that trend northwestward through East Canyon, Figure 9a. As shown in Figures 9b and 9c, these named faults, as well as the Space Science's Fault, University Fault, New Fault, Strawberry Canyon Fault, Lawrence Hall of Science Fault Complex and numerous un-named faults have been mapped by other researchers. Whether or not a fault has been named or identified within the Alquist Priolo Earthquake Zone does not mean that it is not imperative to show it on geologic maps, especially to relate its position to known contamination sites, especially when the information already exists in published reports.

With respect to plume migration, to identify whether a fault is active is not as important as identifying its potential influence on groundwater transport. Without sufficient understanding of fault locations, planning where to place monitoring wells for defining

and constraining plume boundaries cannot be well founded. Fault mapping is also clearly important for identifying potential hazards to buildings and infrastructure, particularly because splay faults and other faults in close proximity to the Hayward Fault have potential to rupture during large magnitude quakes, especially those emanating nearby.

Figure 10 shows the plume locations and a compilation map of the faults shown by various researchers in Figures 9a, 9b, and 9c. As noted in Figure 10, we call the fault that runs along the Bevatron (Building 51a) and the Advanced Light Source (Building 6) the Cyclotron Fault. The compilation indicates that fault mapping by LBNL does not correspond well with faults mapped by USGS (2007), Converse Consultants (1984), Harding Lawson (1979), or Lennert Associates (1978). Although there is some general agreement about the Hayward, Cyclotron, and Wildcat Faults, there is poor agreement on the existence and location of many of the other faults mapped by others within the LBNL property boundary.

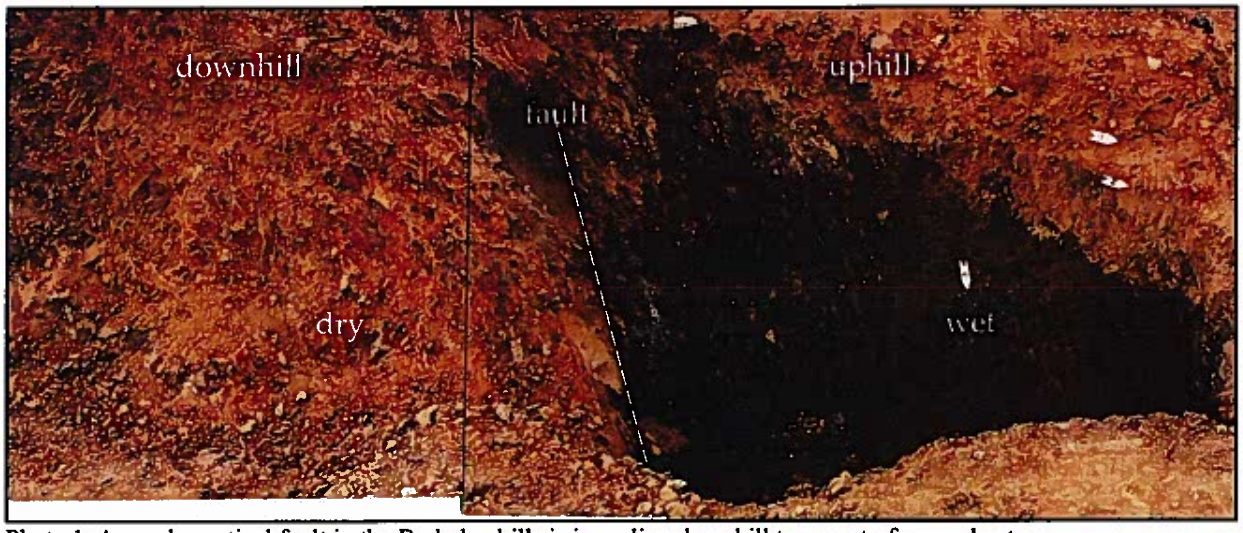


Photo 1. A nearly vertical fault in the Berkeley hills is impeding downhill transport of groundwater, causing it to flow laterally along the fault trace. Water is collecting in a pool at the base of the wet side of the excavation.

During grading operations for the construction of the new LBNL Hazardous Waste Handling Facility and throughout many new excavations in the Berkeley hills, conducted during the 1993 Oakland Hills post-fire reconstruction, Collins and Jones (1994) stated that they made numerous observations of faults exerting strong control on groundwater movement and swale development. Photo 1 shows an example of one of the sites they observed in the Berkeley Hills where groundwater flow moved laterally along a fault plane that impeded downslope groundwater transport. They also observed that the location of crown scarps of several recently active earthflows in the Berkeley Hills corresponded to the location of fault traces. They suggested that fault traces in many areas of the Berkeley Hills are masked by younger deposits of sediment from landslides and streams.

It is important to consider that when excavations expose faults or when utility trenches intersect faults that also intersect contaminated groundwater, the excavations or trenches

CMTW-27 cont.

can become additional avenues for contaminant plume migration. Also important to consider is that zones of varying permeabilities in clay-rich fault gouge can provide traps and pathways for moving water, and in some cases, the traps can build enough pressure to initiate landslides and potentially convert the subsurface flow to surface flow.

Potential problems associated with the lack of definitive geologic mapping in Strawberry Canyon are increased by the proximity of the active Hayward Fault and related seismicity. According to Steinbrugge, et al, (1987) the maximum magnitude earthquake anticipated is 7.5, which has the potential of causing right-lateral horizontal offsets that could average 5 feet along the Hayward Fault. Hoexter (1992) reported that there was potential for secondary or splay faults in the East Bay to have triggered slip from quakes generated along the primary Hayward Fault. Wildcat Fault appears to be a likely splay from the Hayward Fault. Hoexter's survey of historical earthquakes indicated that triggered slip on splays have movement that is usually less than 20% of the primary offset. This suggests that 1.5 feet of horizontal offset on a splay fault from the Hayward Fault could be anticipated if the maximum magnitude quake occurred. Hoexter also reported that vertical displacements could accompany horizontal slip, although a much smaller percentage of total movement would be expected. Such projections of horizontal and vertical offsets along secondary faults should be sufficient to warrant more detailed mapping of fault patterns within Strawberry Canyon.

We believe that sufficient information is not available from the literature to confidently determine the activity status of the numerous faults that exist along the Wildcat Fault shear zone, which may be as much as 600 feet wide and includes the East Canyon Fault (Collins, 1993). Published USGS maps in this report are not of adequate detail or scale to delineate all the bedrock complexity of Strawberry Canyon, yet more detail is shown by USGS than that which LBNL represented on their Bedrock Geology Map, provided in their investigative RFI report (LBNL, 2000). This is perplexing because much geologic complexity has been demonstrated in previous reports and investigations conducted by LBNL's own geotechnical consultants. For example, Figure 11 shows a compilation map detail of faults mapped by various consultants and researchers for just the East Canyon (Collins, 1993). Figure 11 demonstrates general agreement that the Wildcat Fault exists, but poor agreement on its location or number of traces within its shear zone. This site is important because it is the location of the diesel fuel plume near Building 74, and is the proposed location for new buildings in the East Canyon described in the recent LBNL LRDP Report (2007).

CMTW-27 cont.

During the grading operations for the LBNL Hazardous Waste Handling Facility (Building 85), numerous northwest and east-west trending faults were exposed near the Wildcat Fault shear zone northwest of LBNL Building 74. So many faults were intersected that it brought into question whether the previous 1980 Harding Lawson report by Korbay and Lewis, called the Wildcat Fault Investigation (performed for Building 74), was actually sufficient to evaluate the Wildcat shear zone. The trench was located more than 1000 feet north of Building 74 and inconsistencies within the trench logs confounded interpretation of vertical displacements at the fault trace (Collins, 1993). Further concern arises about the activity status of Wildcat Fault because according to King (1984) and verbal communication from Curtis (1993), a disagreement occurred at

the trench site between investigators Steve Korbay of Harding Lawson Associates and Dr. Garniss Curtis of UCB Department of Earth and Planetary Science. Curtis believed there was sufficient evidence in the trench site to designate the Wildcat Fault active, while Korbay did not.

LBNL does not show the Wildcat Fault as active (LBNL, 2000) and we are not presently aware of any additional trench investigations that have been conducted on the Wildcat Fault since 1980. Additional lines of evidence concerning fault activity in Strawberry Canyon, however, can be gleaned from maps showing the epicenters of local seismicity. In Figure 12a, we compiled the fault mapping by others from Figures 9a, 9b, and 9c and overlaid the epicenters of seismic events that have occurred in the Strawberry Canyon during the last 40 years. Over 57 earthquakes with Richter Magnitude between 1.8 and 3.0 have occurred in Strawberry Canyon. Such a high incidence of microseismicity within the mapped traces of Wildcat Fault and between the Wildcat and the Cyclotron Faults provides compelling evidence that additional faults other than just the Hayward should be considered as active in Strawberry Canyon. Indeed, recently during March 2007 two small earthquakes, magnitude 2.0 and 1.4, shook the Canyon along an un-named fault and the Hayward Fault, respectively (http://quake.wr.usgs.gov/recenteqs/).

During the 1991 excavation for Building 84 in the East Canyon, Collins, Jones, and Curtis observed bedrock contacts and numerous fault exposures in the excavated bedrock at the building site. Of particular significance was the discovery of an entire geologic bedrock unit, the Briones Formation, which had never before been mapped in Strawberry Canyon. The Briones outcrop, which was full of marine shell fragments, was interpreted as a tectonic block that has been dragged along the Wildcat Fault during the last 10 million years. Its displacement might exceed 9 miles, which is twice the amount previously considered possible along this fault (personal communication Dr. D. Jones, UCB Department of Earth and Planetary Science).

CMTW-27 cont.

Pat Williams (former LBNL staff Scientist Earth Sciences Division) speculated that a structural connection might exist between the active Hayward and Pinole Faults, and that the linkage might be associated with the Wildcat Fault (personal communication, 1992). Bishop (1973) documented evidence of active creep along the Wildcat Fault north of El Cerrito. During a 1971 survey of the East Bay Municipal Utility District water tunnel (between San Pablo Reservoir and the Kensington Filtration plant), vertical and right lateral displacements were documented near the Wildcat Fault shear zone. Taylor (1992) reports that the pattern of fault creep observed in the Montclair area (south of Berkeley) and elsewhere along the Hayward fault indicates that the broad fault zone might contain more than one Holocene active fault trace.

During the winter of 1992, another subsurface trench investigation was conducted on the East Canyon Fault. It was performed by Geo Resource Consultants and LBNL staff for LBNL. Evidence of both vertical and horizontal offset was discovered. This dual type of motion is probably typical for faults in the Canyon. Jones and Brabb (1992) suggest that significant displacement has occurred across the Berkeley Hills from combined strike-slip and thrust movements. Jones (1992) reports that most of the major strike-slip faults in the

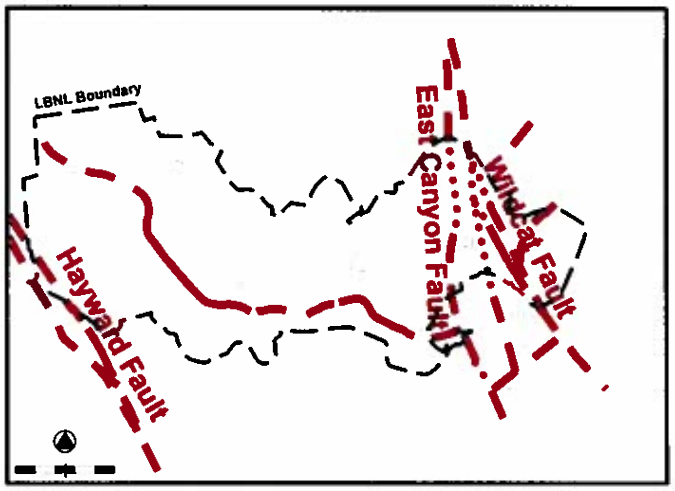


FIGURE 9a. LBNL (2000) Based on:
Harding-Lawson (1980, 1982), Radbruch (1969)

FIGURE 9. SELECTED EXAMPLES OF FAULT MAPPING STUDIES AT LBNL IN STRAWBERRY CANYON

FAULTS

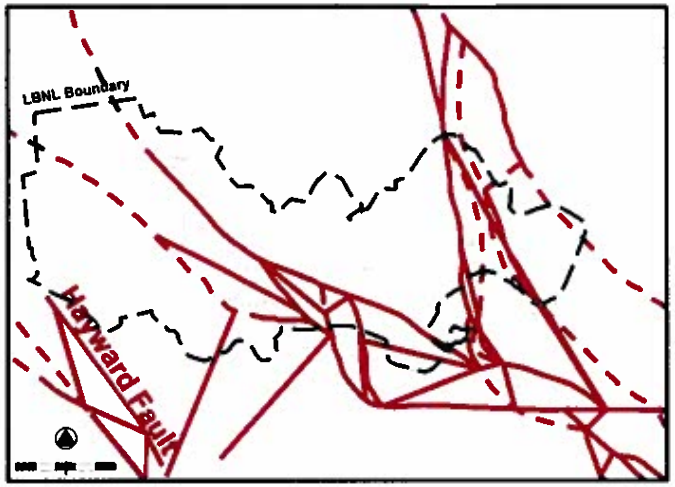


FIGURE 9b. USGS on Google Earth (2007)

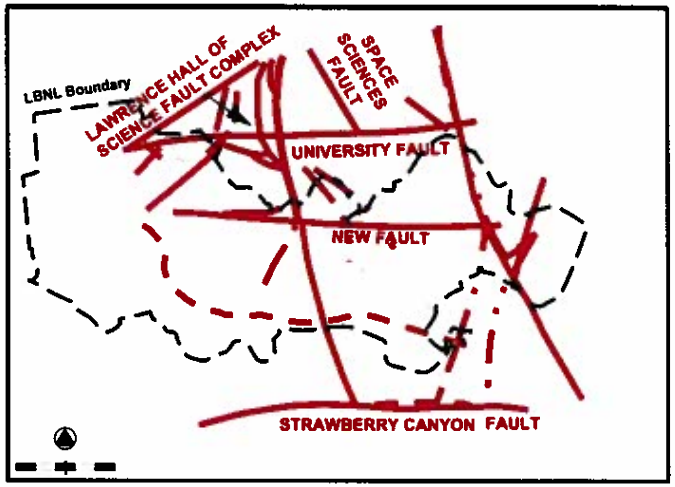


FIGURE 9c. Converse Consultants (1984) Based on:
Harding-Lawson (1979), Lennert & Associates (1978)
(Mapping does not include western portion of LBNL.)

CMTW-27
cont.

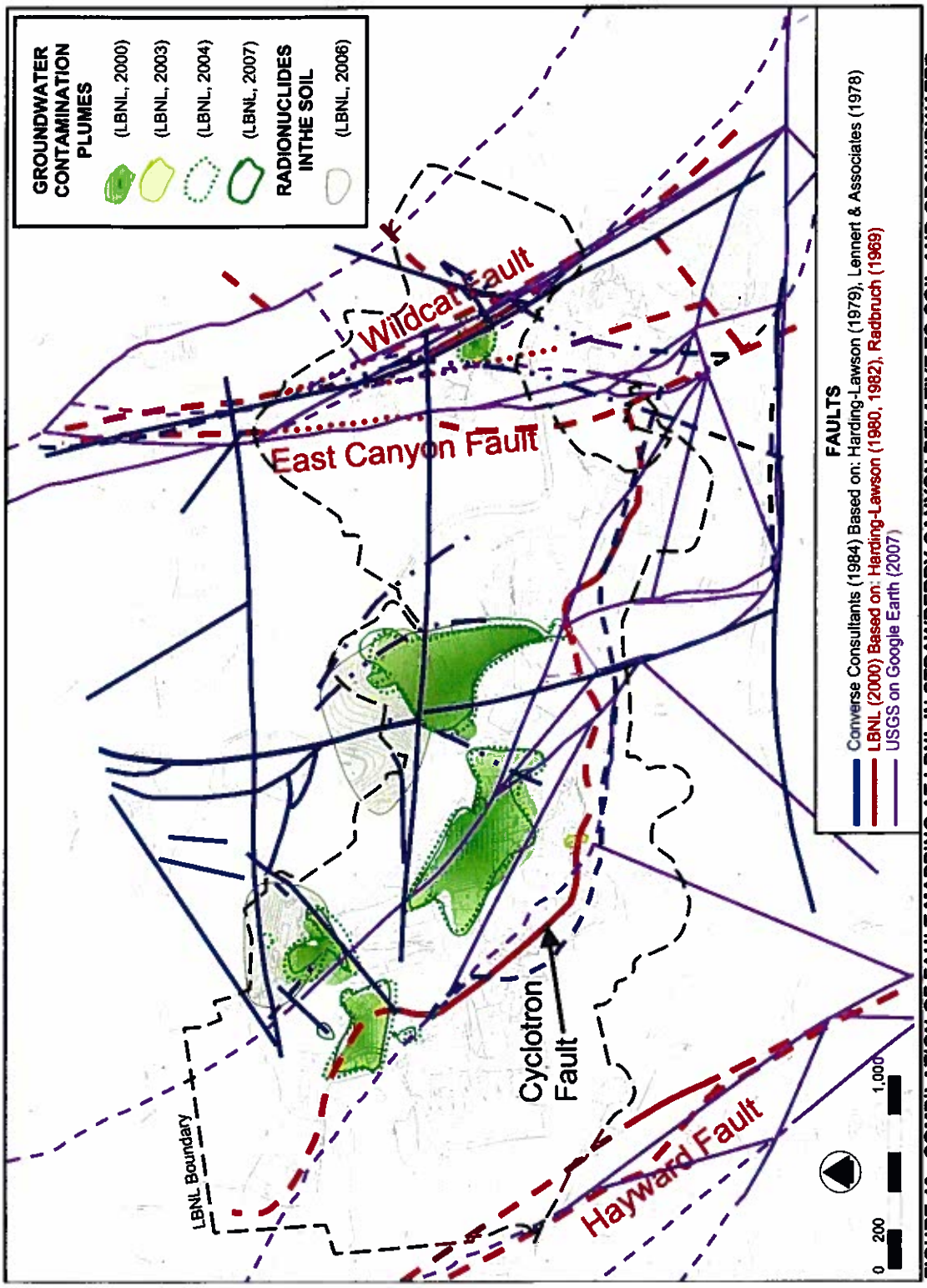


FIGURE 10. COMPILATION OF FAULT MAPPING AT LBNL IN STRAWBERRY CANYON RELATIVE TO SOIL AND GROUNDWATER CONTAMINANT PLUMES.

CMTW-27 cont.

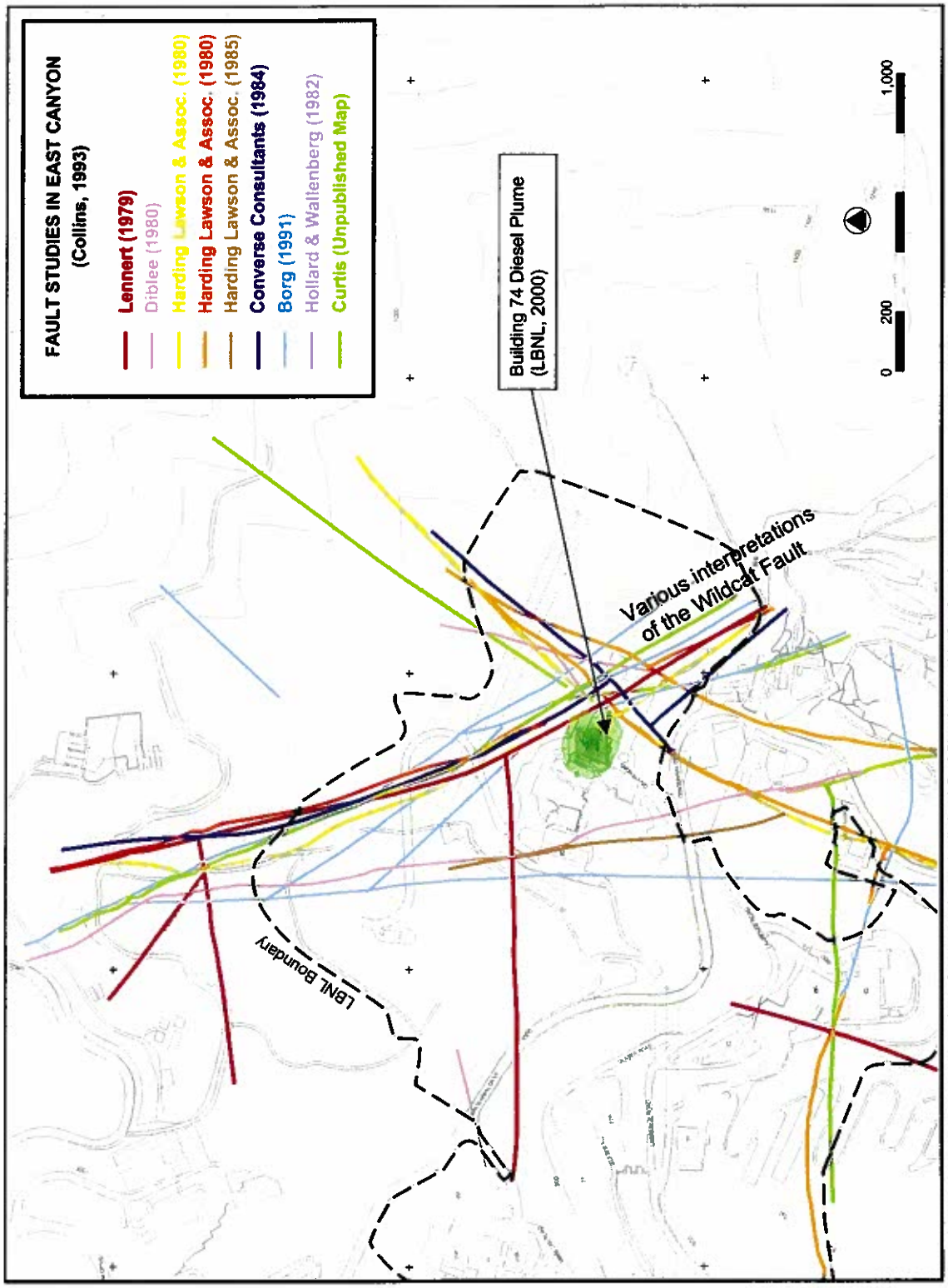


FIGURE 11. COMPILATION OF FAULT MAPPING AT LBNL IN EAST CANYON

CMTW-27
cont.

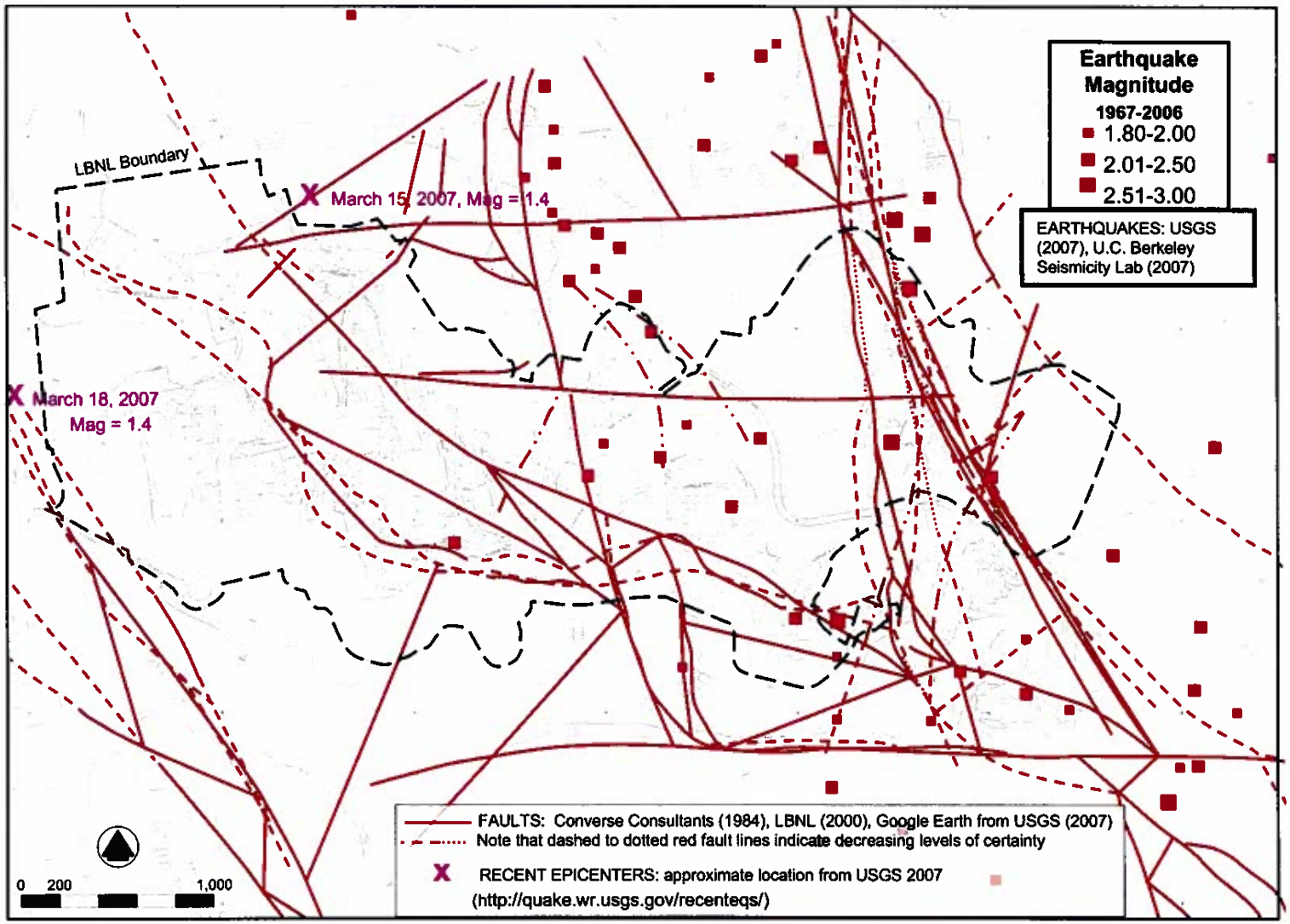


FIGURE 12a. EARTHQUAKE EPICENTERS AND FAULT COMPILATION AT LBNL IN STRAWBERRY CANYON 1967 - 2007

CMTW-27
cont.

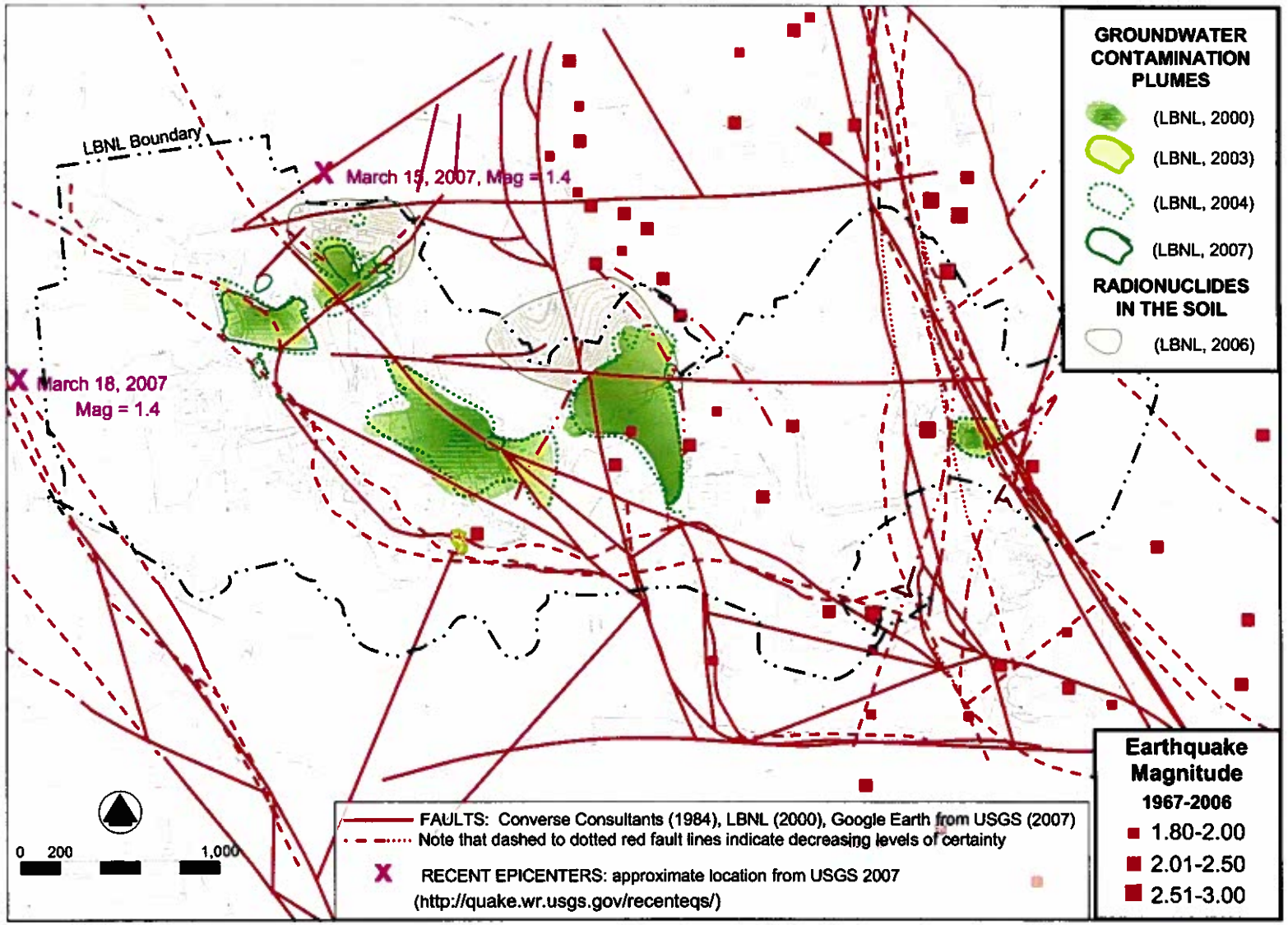


FIGURE 12b. GROUNDWATER CONTAMINATION PLUMES AND RADIOACTIVE CONTAMINATION IN SOIL RELATIVE TO FAULTS AND EARTHQUAKE EPICENTERS AT LBNL IN STRAWBERRY CANYON

CMTW-27
cont.

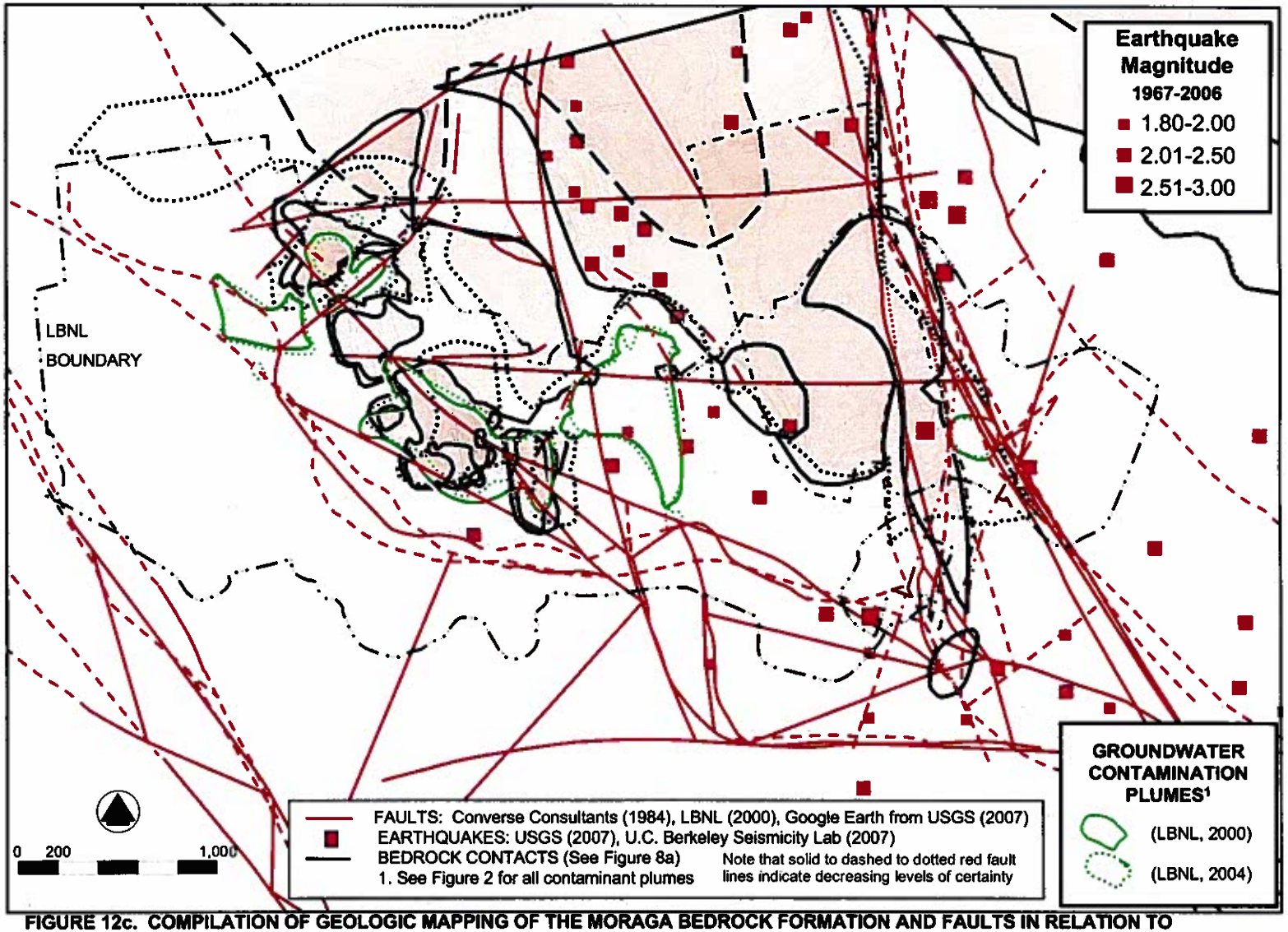


FIGURE 12c. COMPILATION OF GEOLOGIC MAPPING OF THE MORAGA BEDROCK FORMATION AND FAULTS IN RELATION TO CONTAMINANT PLUMES AT LBNL IN STRAWBERRY CANYON

CMTW-27 cont.

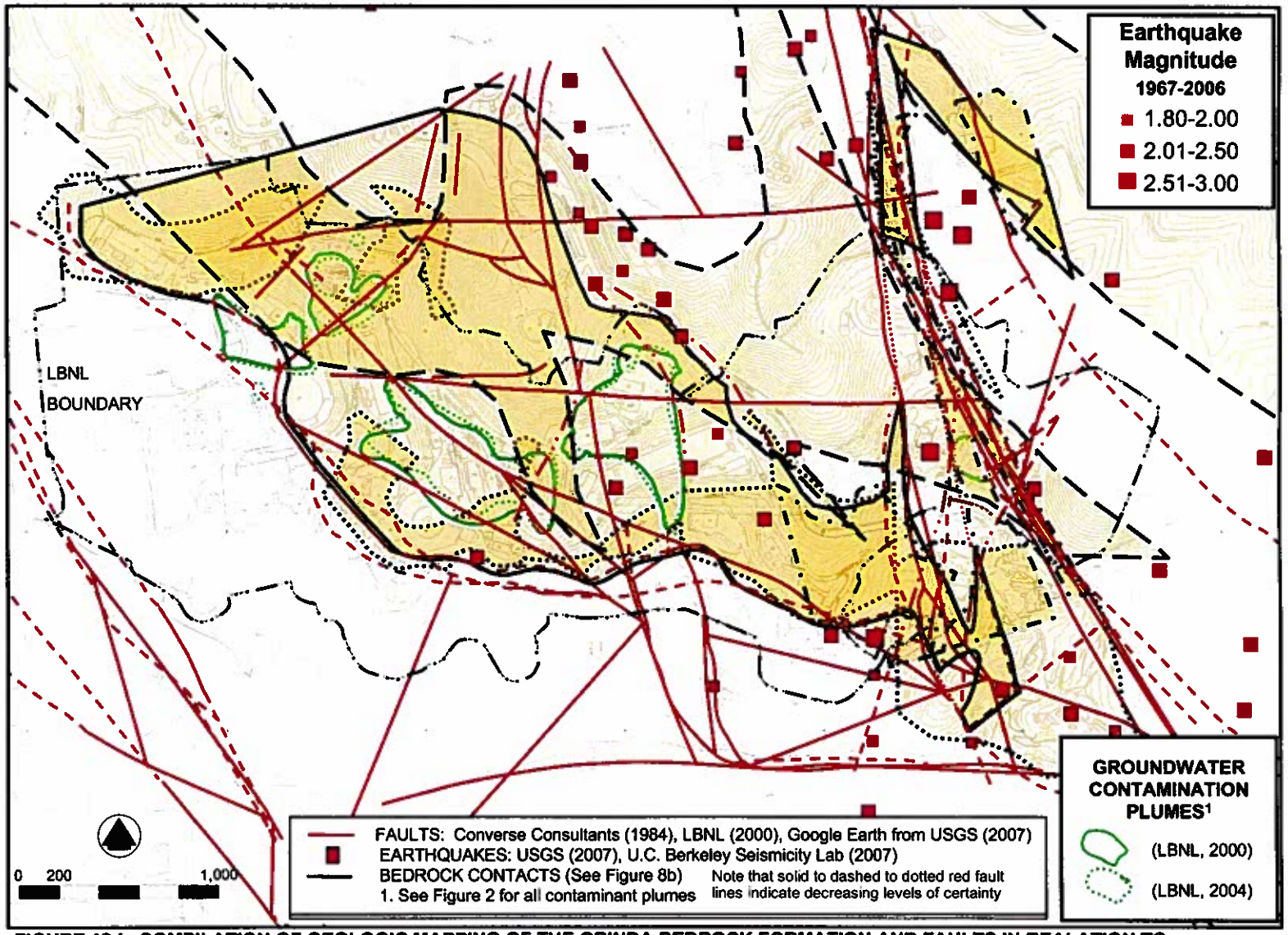


FIGURE 12d. COMPILATION OF GEOLOGIC MAPPING OF THE ORINDA BEDROCK FORMATION AND FAULTS IN REALATION TO CONTAMINANT PLUMES AT LBNL IN STRAWBERRY CANYON

CMTW-27 cont.

Coast Ranges have attendant parallel thrust faults rooted within primary strike slip faults. In particular, Jones' geometric model of kinematics and stress transfer through the crust indicates that many thrust faults are still active within the Bay Area. The implication of these findings is that more consideration should be given to assessing risks posed byvertical displacements of faults, as well as horizontal offsets. Faults with a principal component of vertical motion have been mapped by LBNL (2000) and others (USGS, 2007; Converse Consultants, 1984; Harding Lawson, 1979; and Lennert Associates, 1978), but little is known about their potential for thrust or down-dropping movements.

In Figure 12b, the location of the various faults shown previously in Figure 12a is shown relative to contaminant plume sites. As can be seen, every plume intersects at least one fault that has been mapped by either LBNL, its consultants, or by USGS (Figures 9a, 9b, 9c). When fault locations and the different bedrock contacts are shown in combination with the contaminant plume locations, as in Figures 12c and 12d, a complex picture emerges, showing that numerous influences could be affecting groundwater transport and contaminant plume migration. In the latter two figures, it can be seen that faults and bedrock contacts do not necessarily coincide. If the complexity of geologic conditions at the contaminant plume sites is oversimplified, the extent and potential contaminant dispersement could be underestimated because monitoring wells were not placed at key positions along fault lines.

Landslide Mapping

CMTW-27 cont.

Deep-seated and shallow landslides occur throughout the Berkeley Hills including Strawberry Canyon. Both artificial and natural mechanisms have contributed to increased rates of landslide activity in many areas. Land use activities in the hills can decrease slope stability by the action of grading large cuts or filling deep canyons to create flat areas for roads and buildings. Such grading operations interrupt surface and subsurface flow, and create impervious surfaces that increase runoff. The cuts remove lateral hillside support and convert groundwater flow to surface flow. The fills can increase the loading of a hillside and can increase or decrease groundwater saturation depending upon whether they are capped by an impervious surface and whether they are properly drained.

Triggers for initiating landslide movement can be artificial or natural. The natural triggering mechanisms can include intense or prolonged rainfall, greater than normal seasonal rainfall, earthquakes, or changes in mass balance from other landslides. Artificial triggers can include concentrated runoff from roads and other impervious surfaces, increased saturation from drain blockages, removal of root strength by deforestation, removal of lateral slope support, and increased loading of pre-existing slides by added weight of artificial fill.

Several landslide maps of Strawberry Canyon have been produced by different researchers, as shown in Figures 13a through 13f. All maps show that numerous landslides have been mapped within the LBNL boundary, yet not all researchers agree on location, size, or types of landslides. Nor do all maps necessarily depict the same comparable landslide category. For example, some maps show colluvial deposits and

some show colluvial hollows as source areas for shallow slides and/or landslide scars, for example Figure 13b versus Figure 13c.

Additionally, some maps group colluvium with fill, such as Figures 13a and 13b. Nonetheless, we expect that the brown polygons on map Figures 13a through 13e and the brown and purple ones in map Figure 13f all represent shallow to deep-seated landslide failures. Using historical and recent aerial photographs, the landslide features in Figure 13f were specifically mapped for this project and the slides therefore, are mapped relative to the historical topography and channel network as per Figure 5.

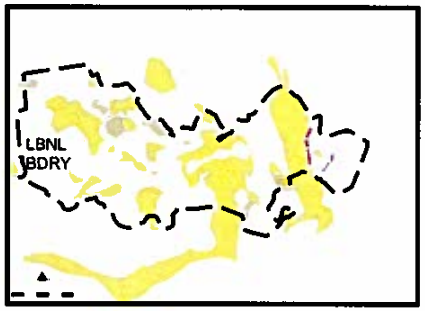
Figure 14 shows a compilation of the contaminant plumes with all the landslides and surficial mapping shown in Figure 13a-13f. The compilation shows general agreement about the existence of large landslides in Chicken Creek basin and East Canyon but the boundaries of individual landslides have poor overlap. Because Figure 14 becomes overwhelmed by landslide features that cover more than 50% of the LBNL property, it is too difficult to read the numerous overlapping polygons. We have therefore reduced the number of map overlays in Figure 15 to just three interpretations, Nielsen, LBNL, and Collins (Figures 13a, 13b, and 13f.) We also eliminated the fill and colluvium shown in Figure 14, along mainstream Strawberry Creek that was mapped by Nielson and LBNL near of the UCB Memorial stadium in the southwest corner of the map.

Figures 14 and 15 indicate that all the contaminant plumes either lie fully within or intersect the boundaries of landslides. This means that in addition to the complexities already demonstrated by bedrock contacts and faults intersecting the plume boundaries, there is also high probability that landslide failure planes could further influence groundwater movement. Moreover, the developing picture of complexity signifies that groundwater can transfer along any number of pathways (bedrock contacts, faults and landslide failure planes) and in any order of combination. In addition, future interpretation of contaminant plume migration could be complicated by continued earthflow creep movement or significant surges in slide activity.

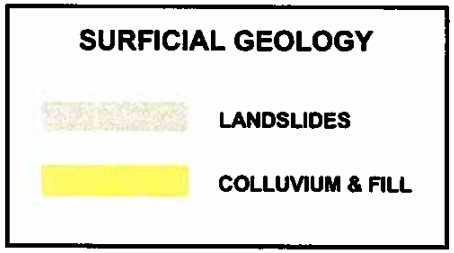
CMTW-27 cont.

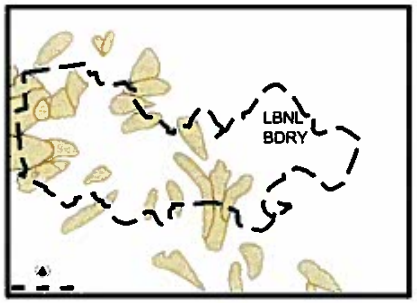
The deep-seated slides in Strawberry Canyon, shown in Figure 13e and 15, in most cases tend to be slumps, earthflow, or complex earthflows that can involve movement of large intact blocks of bedrock and extend from ridge top to valley bottom. The complex slides can be characterized by multiple failure planes and zones of stability and instability that change after the mass balance is altered by renewed activity or by man-made changes during grading operations. In many cases, there is rotational movement near the crown scarp and the entire mass can slowly creep or move in sudden surges. These kinds of slides are often associated with clay-rich earth or bedrock. Perched water tables at the rotated head of the deposit can be common. Similarly, springs can typically be found where the failure plane near the toe of the slide verges toward the ground surface and converts its subsurface flow to overland flow. If contaminant plumes intersect landslides and travel along landslide failure planes, surface waters within seep gullies on the landslide or at the toe of the slide could also be at risk of contamination.

13a. Tor Nielsen, 1975 (USGS)



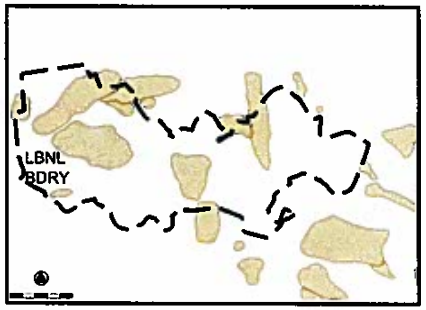
13b. LBNL, 2000





13c. Unpublished, Received from Kropp Assoc. (no author or date).

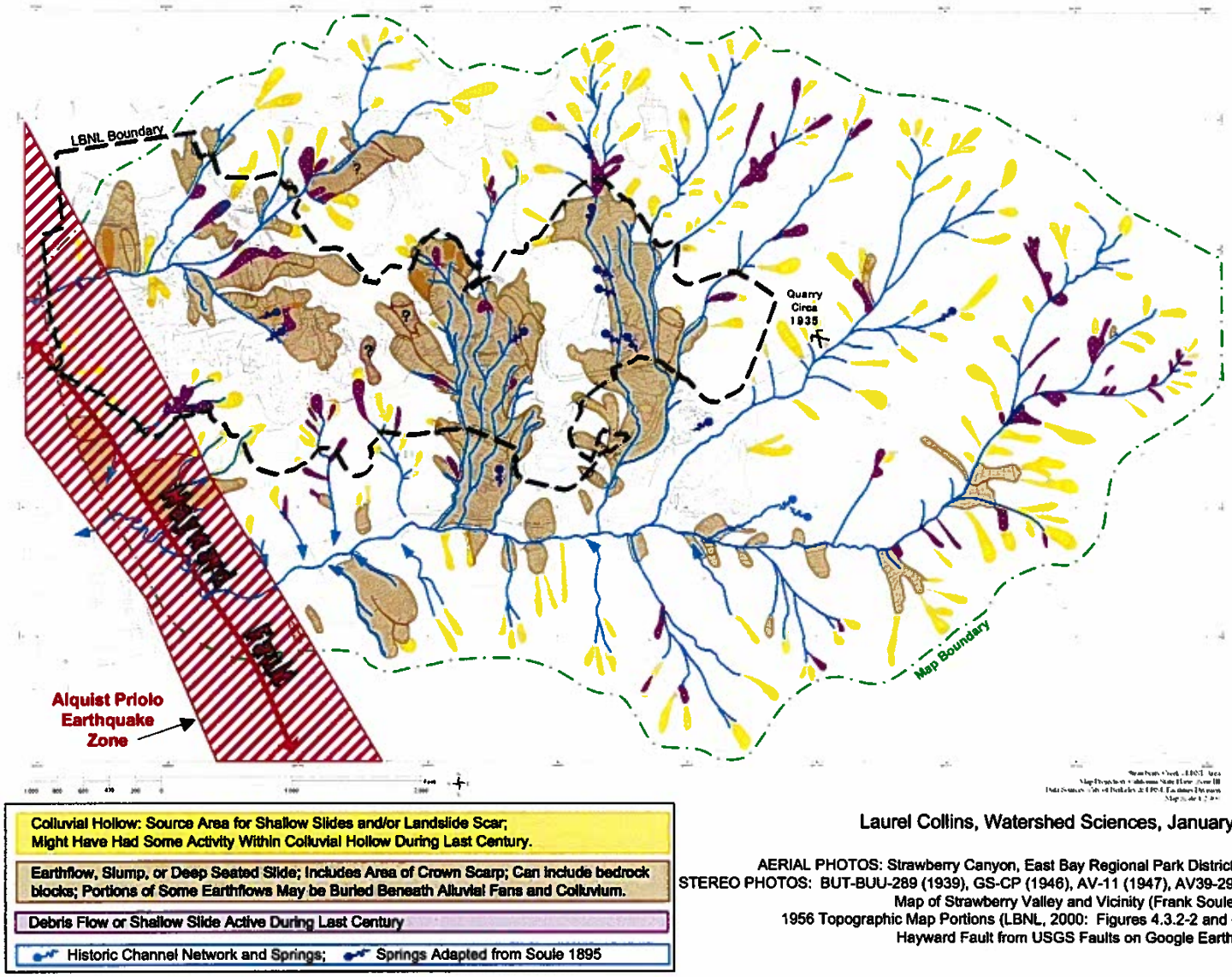
13d. Unpublished, Received from Kropp Assoc. (no author or date).



13e. California Geological Survey, 2003

FIGURES 13a-13e. MAPS OF LANDSLIDE STUDIES AND SURFICIAL DEPOSITS GEOLOGY

CMTW-27 cont.



Laurel Collins, Watershed Sciences, January 2007

AERIAL PHOTOS: Strawberry Canyon, East Bay Regional Park District (1935)
STEREO PHOTOS: BUT-BUU-289 (1939), GS-CP (1946), AV-11 (1947), AV39-29 (1990)
Map of Strawberry Valley and Vicinity (Frank Soule, 1895)
1956 Topographic Map Portions (LBNL, 2000: Figures 4.3.2-2 and C2.2-1)
Hayward Fault from USGS Faults on Google Earth (2007)

FIGURE 13f. INTERPRETATION OF HISTORIC CHANNEL AND LANDSLIDE NETWORK AT LBNL IN STRAWBERRY CANYON

CMTW-27
cont.

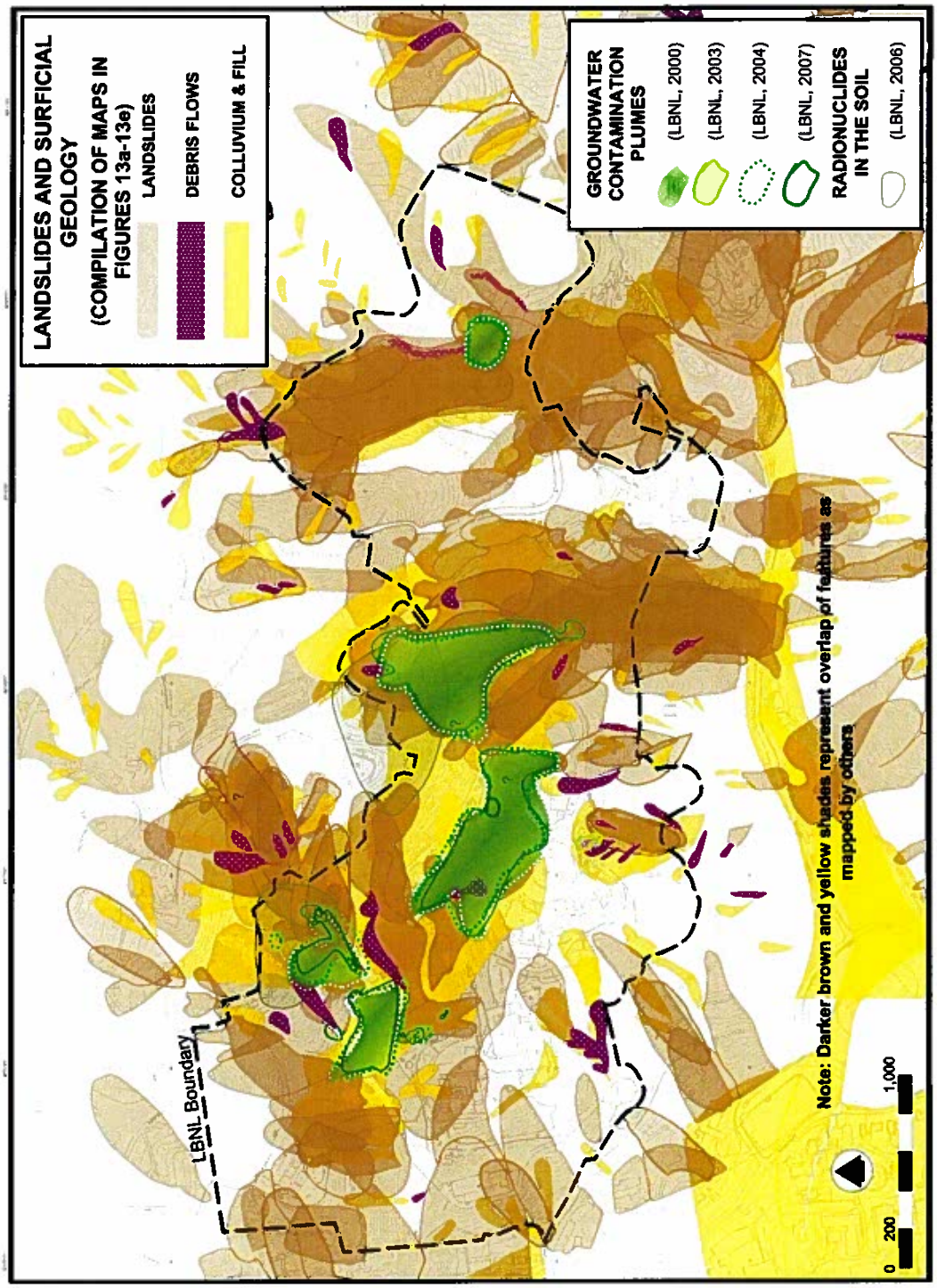


FIGURE 14. COMPILATION OF LANDSLIDE AND SURFICIAL GEOLOGY MAPS 13a-13f IN STRAWBERRY CANYON

CMTW-27 cont.

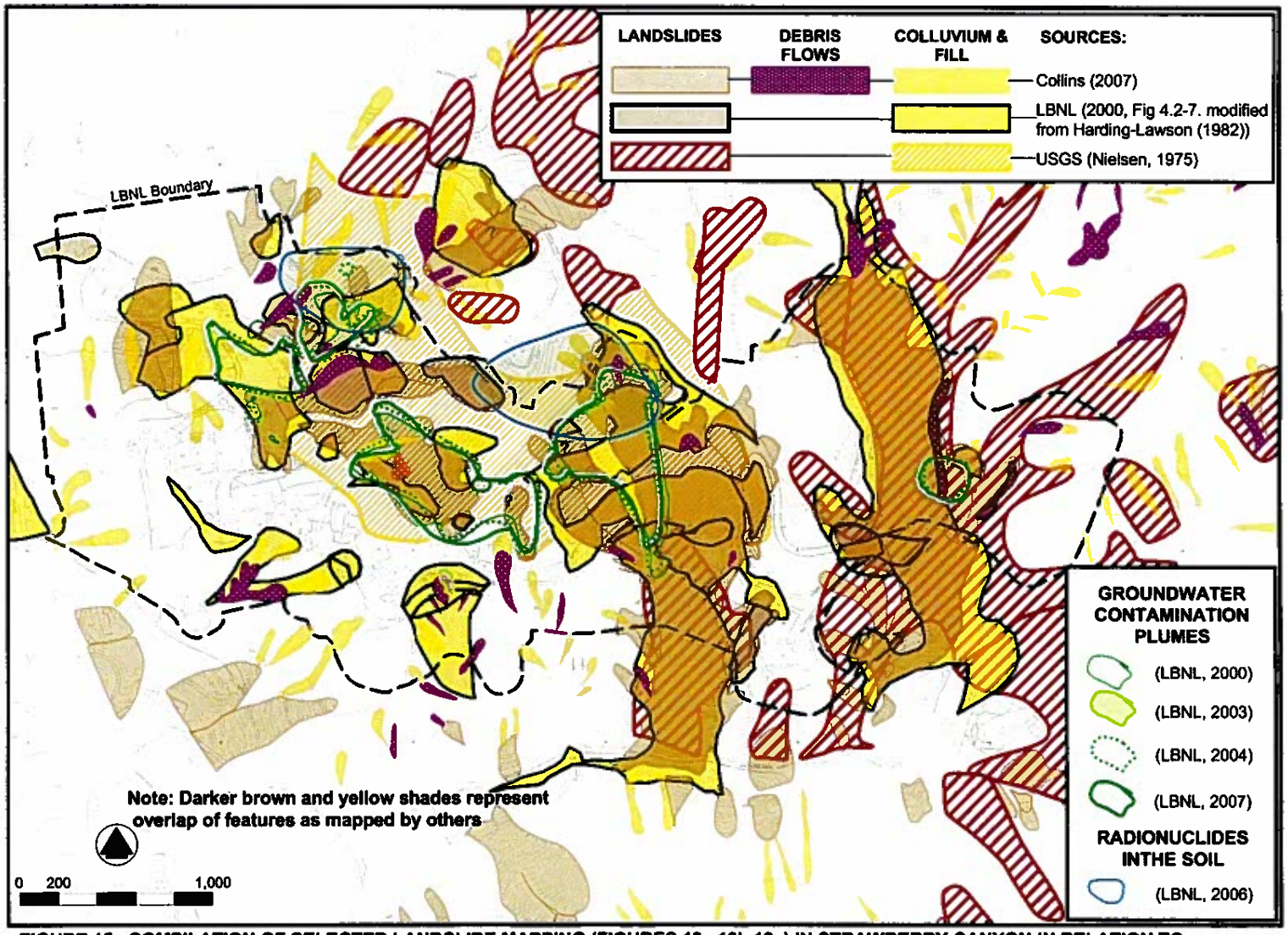


FIGURE 15. COMPILATION OF SELECTED LANDSLIDE MAPPING (FIGURES 13a,13b,13e) IN STRAWBERRY CANYON IN RELATION TO GROUNDWATER CONTAMINATION PLUMES

CMTW-27 cont.

Shallow landslides in Strawberry Canyon, shown in Figures 13e and 15, tend to be soil slips, debris slides, and debris flows, which typically occur on steep slopes and move typically at high rates of speed. They tend to be translational in movement and are often associated with soils or bedrock that is porous and not necessarily clay-rich. They often occur within colluvium-filled hollows. The debris flows can form alluvial fans at the base of their run-out pathways.

The head of East Canyon appears to have numerous alluvial fan deposits that might be overlaying a deep-seated earthflow within the Orinda Formation. The earthflow might be overlaying or obscuring fault traces. Alternatively, the earthflow might have been sheered by fault displacement. Interpretation of earthflow shear planes versus fault planes at the Wildcat Fault trench were an additional subject of contention between Garniss Curtis (UC Berkeley) and Steve Korbay (Harding Lawson Associates) during the investigation that was discussed earlier in this report. In 1993, Jones and Collins also had concerns about interpretations of earthflow failure planes versus faults in the Chicken Creek basin area when they observed road cut exposures together with UCB staff and geotechnical consultants.

Plume Monitoring Sites

A series of monitoring and water quality sampling wells were constructed at the plume sites during 1990s when contamination monitoring was first required by State of California Department of Toxic Substances Control as a condition of LBNL's Hazardous Waste Facility Operating Permit (issued in 1993). The criteria for establishing well locations came from historic data review for activities in each building at LBNL that could have potentially led, during normal operations, to dumping, spills and accidents prior to the existence of any environmental regulations and oversight. Figure 16 shows the location of all the wells, some of which LBNL has already closed, i.e. "properly destroyed" or is in the process of closing.

CMTW-27 cont.

Additionally, Figure 16 shows the location of the wells relative to the contaminant plume boundaries mapped by LBNL. Although numerous wells are located within the plume boundaries delineated by LBNL, the perimeters are not constrained by active sampling wells, especially along the potential migration pathways of faults, drainage courses, utility and sewer trenches, (and other engineered backfill) and landslides, as demonstrated in Figure 17a (map legend is Figure 17b). Bedrock contacts between Moraga and Orinda Formations (Figure 8a and 8b) are important, but were too complex to include in Figure 17a.

In order to adequately assess whether the monitoring wells are defining the actual contaminant plume boundaries, agreement on location of faults, bedrock contacts, and landslide boundaries is needed which is based upon well-founded information of what is actually known and what is hypothesized. Once improved mapping is accomplished at a higher resolution and accuracy than in the maps presented in this report, a strategy can then be developed to determine future locations of key sampling and monitoring sites. Until this is accomplished, there is reason for credible concern about contaminant plume boundaries and the groundwater monitoring program conducted to date by the LBNL.

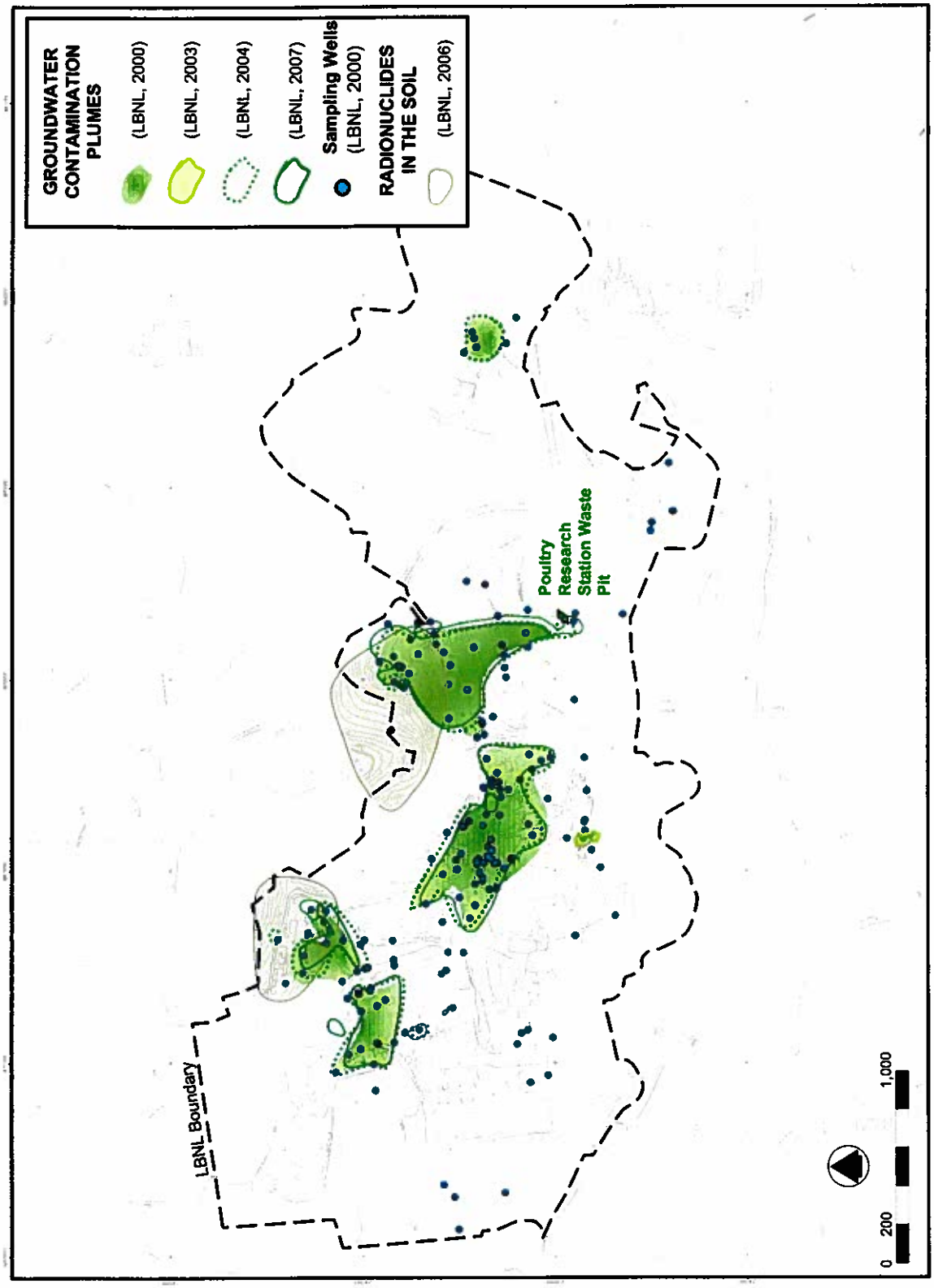


FIGURE 16. GROUNDWATER CONTAMINATION PLUMES AND SAMPLING WELLS

CMTW-27 cont.

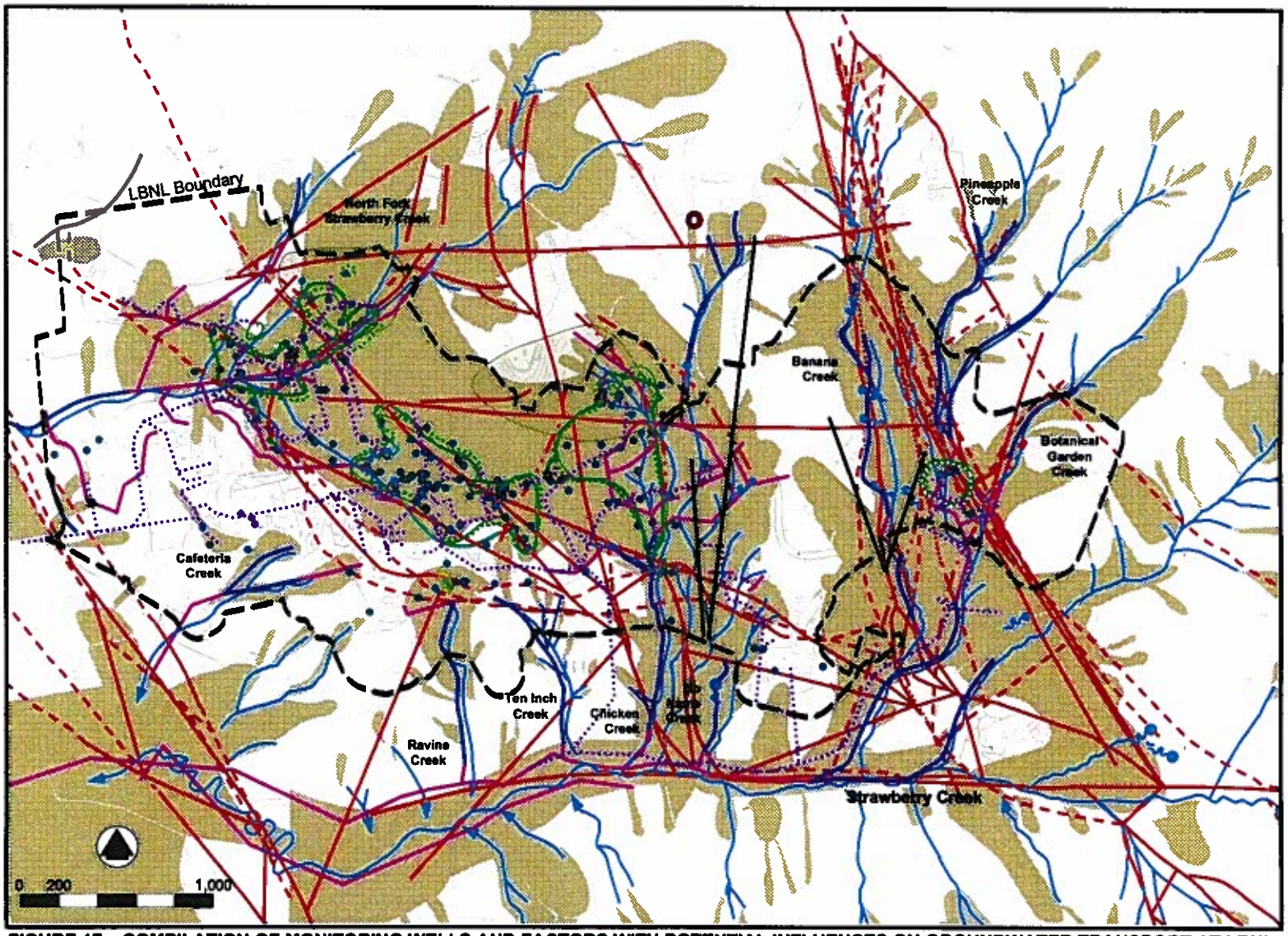


FIGURE 17a. COMPILATION OF MONITORING WELLS AND FACTORS WITH POTENTIAL INFLUENCES ON GROUNDWATER TRANSPORT AT LBNL. FOR BEDROCK CONTACTS VIEW FIGURES 8a AND 8b. SEE NEXT PAGE FOR MAP LEGEND.

CMTW-27 cont.

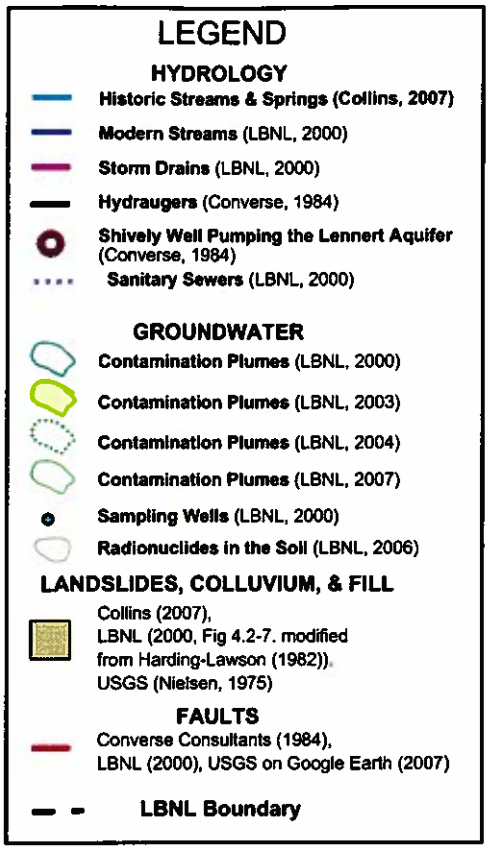


FIGURE 17b. LEGEND FOR FIGURE 17a COMPILATION OF FACTORS WITH POTENTIAL INFLUENCES ON GROUNDWATER TRANSPORT AT LBNL.

CMTW-27 cont.

Zones of Concern for Potential Plume Migration

Given the status of what is currently known, Zones of Concern for potential migration of contaminant plumes are delineated in Figure 18a (legend shown in Figure 18b). These are areas where contaminant migration might yet be undetected because of either insufficient placement of sampling wells or insufficient understanding and/or consideration of where bedrock contacts, faults, landslides, utility trenches, and current or historic drainages exist. These zones were based upon the compilations of many other researchers mapping of geology, and infrastructure. The compilation maps shown previously were used to define Zones of Concern because we do not have knowledge of which individual geology or landslide map is most accurate. Hence, the Zones of Concern should be considered suggestive of possible areas requiring further investigation.

The zones provide a graphic example of why either a better array of monitoring wells are needed and why a verifiable picture of the physical landscape is essential in Strawberry Canyon. Furthermore, potential surface water contamination is possible along drainages that intersect faults, landsides, and bedrock contacts that intersect contaminant plumes. An additional component of contaminant plume analysis not addressed in our project is the depth of contamination and subsurface geologic conditions. These require three

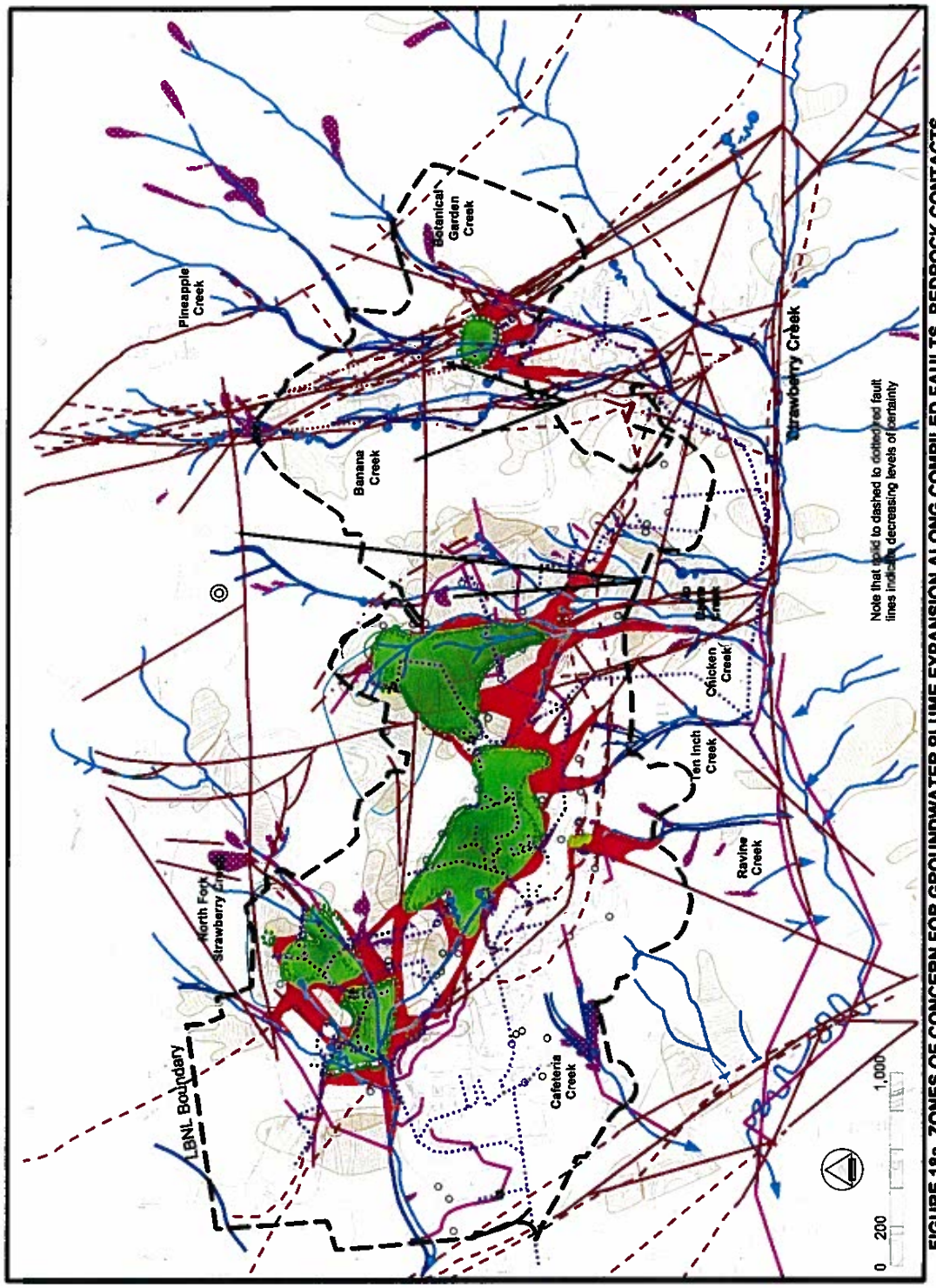


FIGURE 18a. ZONES OF CONCERN FOR GROUNDWATER PLUME EXPANSION ALONG COMPILED FAULTS, BEDROCK CONTACTS, LANDSLIDES, HISTORIC AND MODERN CREEKS. SEE NEXT PAGE FOR MAP LEGEND.

CMTW-27 cont.

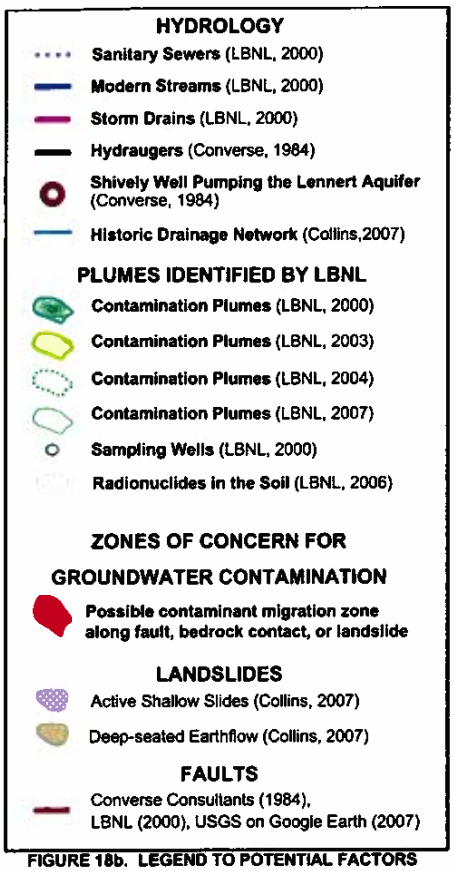


FIGURE 18b. LEGEND TO POTENTIAL FACTORS INFLUENCING CONTAMINATED GROUNDWATER PLUME EXPANSION

CMTW-27 cont.

dimensional analyses, which LBNL has shown on their GIS-based maps (LBNL 2000) that use as their foundation the geologic picture of Figure 7a and fault map of Figure 9a.

Future Development and Site Conditions

The LBNL presently occupies 202 acres, however by 2025 LBNL anticipates a net increase of occupied space of about 660,000 square feet, an increase of 1000 people, and up to 500 additional parking spaces (LBNL, 2007a). Figure 19 shows the tentative footprint of proposed future buildings in their Long Range Development Plan, which is available at www.lbl.gov/LRDP/. The map shows about 30 new buildings dispersed throughout their property boundary. Much of the new construction is planned for areas previously avoided because of stability or fault issues. For example, the majority of the new construction will be located in the Chicken Creek basin and the East Canyon where deep-seated landslides have been mapped.

Figure 20a (map legend shown in Figure 20b) shows landslide hazard risks (as mapped by LBNL) and deep-seated landslides (as mapped on the historic drainage network in Figure 13f by Collins). Interestingly, the deep-seated slides are not considered areas of high to medium risk even though large-scale landslide movement could be triggered by

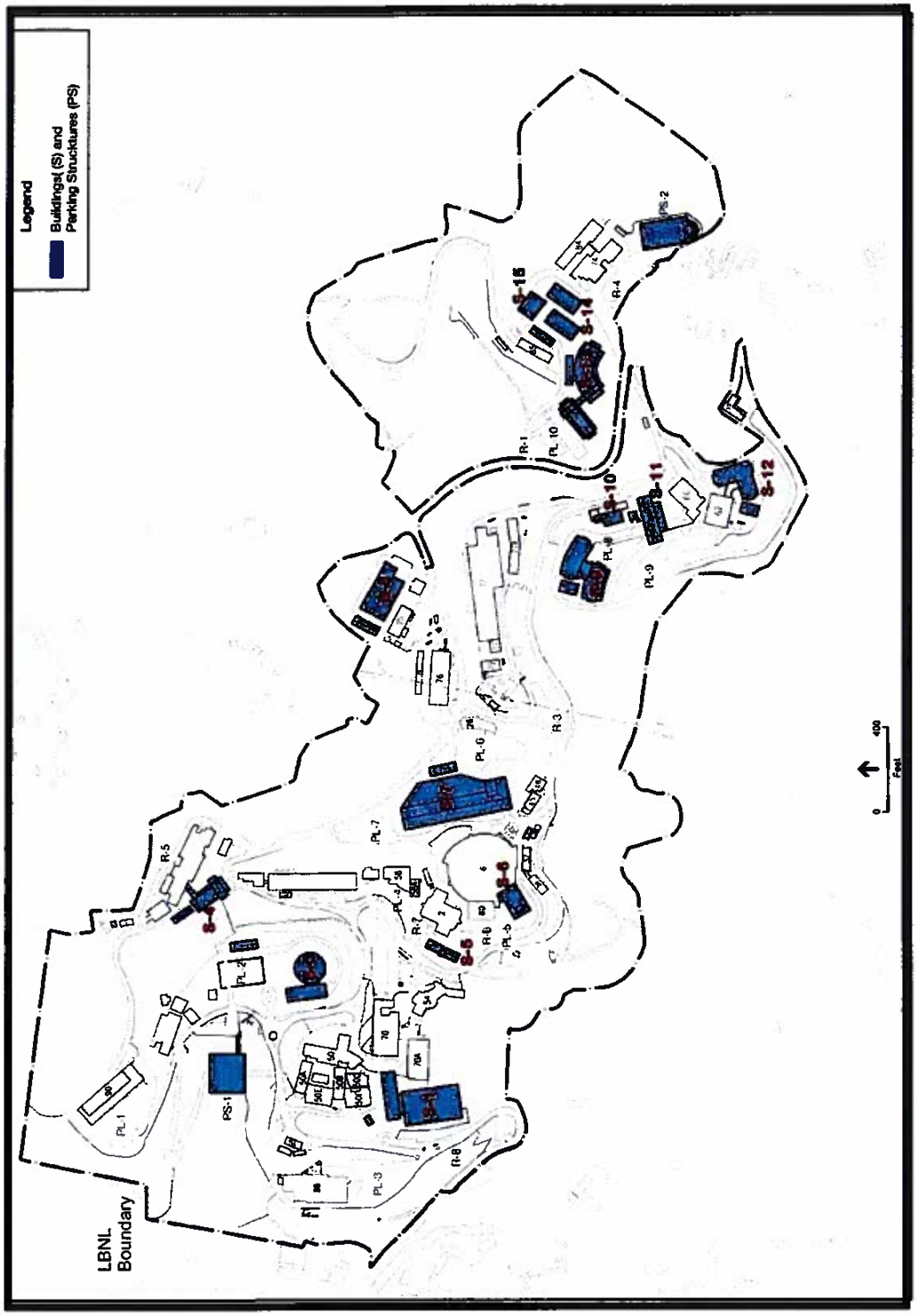


Figure 19. FUTURE BUILDING SITES AT LBNL ACCORDING TO LONG RANGE DEVELOPMENT PLAN (LBNL, 2007a).

CMTW-27 cont.

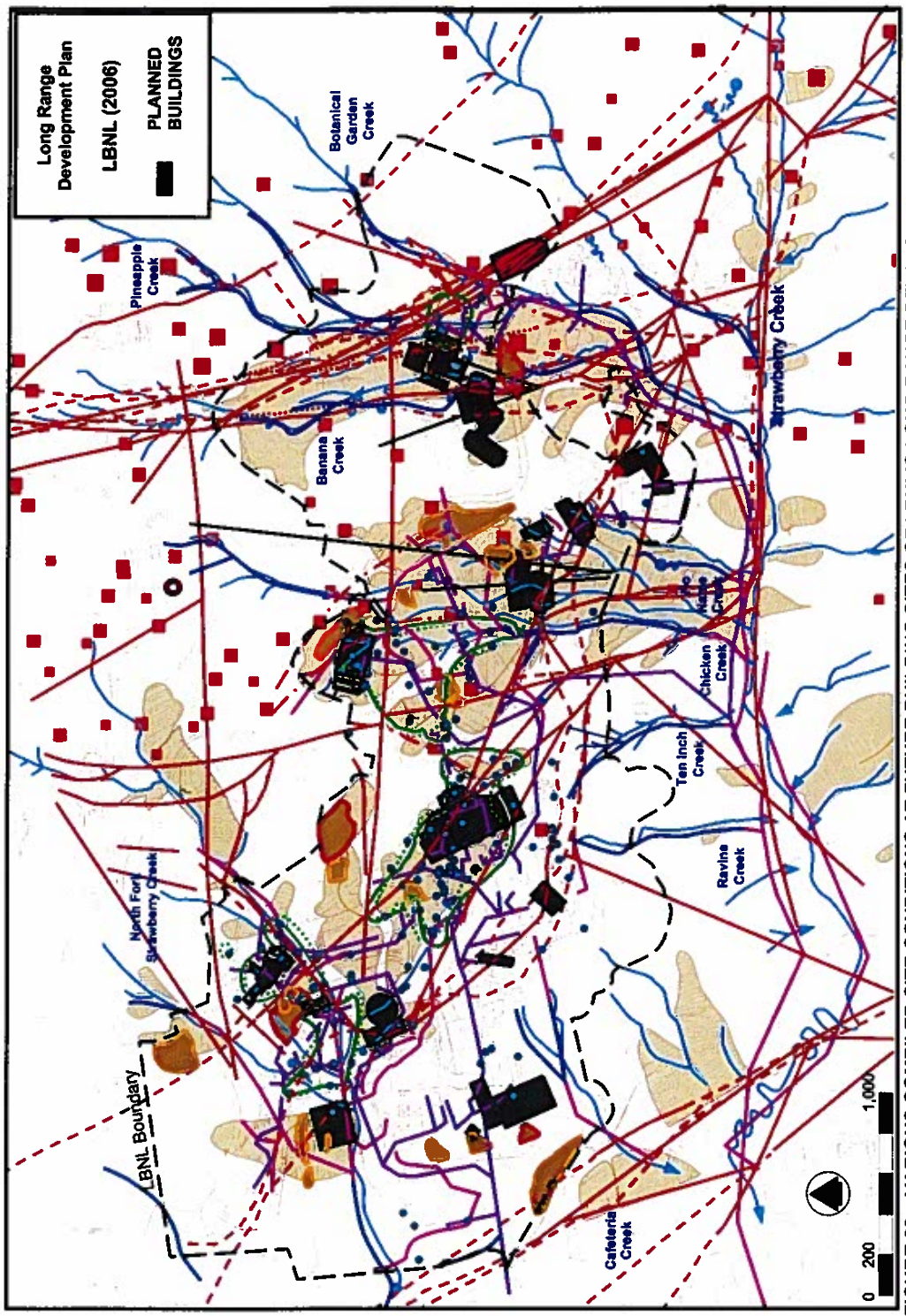


FIGURE 20a. VARIOUS COMPILED SITE CONDITIONS AT FUTURE BUILDING SITES OF LBNL'S LONG RANGE DEVELOPMENT PLAN. SEE NEXT PAGE FOR MAP LEGEND. NOTE THAT SOLID TO DASHED TO DOTTED RED FAULT LINES INDICATE DECREASING LEVELS OF CERTAINTY.

CMTW-27 cont.

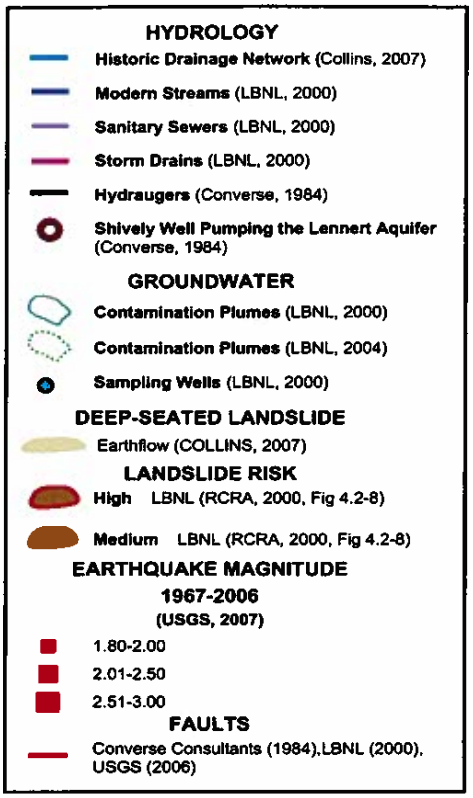


FIGURE 20b. KEY TO MAP 20a SITE CONDITIONS AND FUTURE BUILDING LOCATIONS

CMTW-27 cont.

large magnitude earthquakes on the Hayward Fault and many of the slides overlay or intersect faults. Many buildings are shown to straddle faults that occur on the deep-seated landslides. Various other compiled site conditions in Figure 20a are also shown at the proposed LBNL building sites including the known contaminant plume locations. Some of the new building sites would require grading within the plume locations, which could alter existing groundwater transport pathways, as well as require special handling of contaminated soils.

As planning proceeds, Environmental Impact Analyses will require geologic and environmental information. These required legal documents demonstrate additional future needs for integrated and comprehensive mapping efforts of geologic and environmental conditions in Strawberry Canyon. As more excavations and investigations are conducted, the opportunities will increase to make verifiable geologic maps showing actual bedrock, landslide, and fault exposures.

CONCLUSIONS AND GENERAL RECOMMENDATIONS

At the very least, it is important to identify where there is valid disagreement on geologic conditions, particularly at contaminant plume sites, to determine if these sites pose a threat to human health and safety. Specific investigations or well placed monitoring wells could be designed to resolve some of these issues. Without an improved understanding and portrayal of the geology in Strawberry Canyon, it is difficult to accept that the monitoring sites were specifically designed to detect potential movement of groundwater along intersecting faults, landslide failure planes, bedrock contacts, utility trenches, storm drains, and historic drainages.

If the complexity of geologic conditions at the contamination sites has been and continues to be oversimplified, and because monitoring wells were not placed at key locations along faults, utility trenches, old creek beds/seeps and other parameters that influence groundwater movement, the extent and dispersement of contaminants may have been, and will continue to be underestimated in the future. As development continues in the Strawberry Creek Watershed, and probabilities increase for more uncontrolled releases and contaminant spills, the need will also increase to have an improved and comprehensive base of understanding. Protection of human health and water quality should be a priority, requiring more than a conservative approach when trying to investigate the extent of toxic contamination in an urban environment.

- An outside scientific technical review group should be formed to oversee LBNL's plume monitoring strategy and evaluate interpretations of plume migration. CMTW-27 cont.
- The types of factors that influence groundwater flow that have been compiled on the maps in this report should be developed on a three dimensional GIS base map.
- Information from previous consulting reports should be compiled to show the locations of verifiable bedrock outcrops, landslide deposits, landslide failure planes, and fault trace locations.
- Confidence levels should be assigned to various features such as faults, bedrock contacts, landslides, and boundaries of plume contamination.
- Future geologic investigations and excavation work in Strawberry Canyon should be required to show verifiable geologic exposures on the same base map and assign confidence levels to future interpretations.
- Further investigation of the nature of faulting, geology, and landslides in Strawberry Canyon should be conducted.

ACKNOWLEDGMENTS

We thank the Citizens' Monitoring and Technical Assessment Fund for supporting this project and the Urban Creeks Council for administering the grant. Gretchen Hayes is thanked for constructing many map overlays. Eric Edlund assisted with topographic base map production. Gene Bernardi, Roger Byrne, Claudia Carr, Jim Cunningham, Mark McDonald, and L. A. Wood are thanked for draft review, and Landis Bennett for posting the report on the web. Cover photograph courtesy of berkeleycitizen.org.

REFERENCES

Bishop, C.C., R. D. Knox, R. H. Chapman, D. A. Rogers, and G. B. Chase, 1973. Geological and Geophysical Investigations for Tri-Cities Seismic Safety and Environmental Resources Study: California Division of Mines and Geology, Preliminary Report 19, Report and Plates, 1973.

Borg, S. G., 1991. Geology of the Lawrence Berkeley Lab, LBNL, Internal Report Earth Science Division, 3 October 1991.

California Department of Health Services, 1995. AIP (Agreement in Principle) Annual Report.

California Geological Survey, 2003. Seismic Hazard Zone Report for the Oakland East 7.5-Minute Quadrangle, and Briones 7.5-Minute Quadrangle, Alameda, and Contra Costa Counties, by California, Department of Conservation.

Collins, L. M., 1993. Draft: Geology of the east Canyon and the Proposed Hazardous Waste Handling Facility, LBNL, Report and Plates, April 1993.

Collins and Jones, 1994. Research Proposal to UC Berkeley for Geological Investigation of Strawberry Canyon.

Converse Consultants, Inc., 1984. Hill Area Dewatering and Stabilization Studies

Curtis, G., 1993. Unpublished map of the Berkeley Hills, no date.

Diblee, T. W., Jr., 1980. Preliminary Geologic Map of the Briones Valley, US Geological Survey, Open File Report 80-539, Scale 1:24,000, 1980.

Dunn, R. J., 1976. Landslides and Engineering Geology at the Lawrence Berkeley Laboratory, for CE 299, Professor R.E. Goodman, Winter 1976, Spring 1976, Fall 1976, and December 1976. Report on file at Alan Kropp Assoc., Berkeley CA.

Hoexter, D. F., 1992. Potential for triggered Slip on Secondary Faults in the East Bay: Implications for the Planning Process, in Proceedings of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area: Special Publication 113, Department of Conservation Division of Mines and Geology, Dp. 153-158, 1992.

Holland, P. J., and H. A. Wollenberg, 1992. Initial Appraisal of the Geologic Controls of Ground Water Occurrence and Movement in the "Grizzly" Area of the Lawrence Berkeley Laboratory, LBNL, LBID - 1852, February 1992.

Jones, D. L., 1992. Tectonics of a Transpressive Plate Boundary: A New Paradigm for the Central California Coast Ranges, in Proceedings of the Second Conference on

CMTW-27 cont.

Earthquake Hazards in the Eastern San Francisco Bay Area: Special Publication 113, Department of Conservation Division of Mines and Geology, p 28, 1992.

Jones, D. L., and E. Brabb, 1992. Tectonic Significance of the Neogene Berkeley Hills Fold and Thrust Belt, in Proceedings of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area: Special Publication 113, Department of Conservation Division of Mines and Geology, p 117, 1992.

King, K. B., 1984. Hill Area Dewatering and Stabilization Studies, Prepared for UCB, Dept. of Facilities Management: Converse Consultants, Job #82-41601, Report and Plates, October 1984.

Korbay, S. R., and L. E. Lewis, 1980. Wildcat Fault Study, Biomedical Laboratory Project, LBNL: Harding-Lawson Associates, Job#2000,145.01, Report and Plates, February 1980.

Korbay, S. R., 1982. Geology of Lawrence Berkeley Laboratory: Harding-Lawson Associates, Job #2000135.01, Report, and Plates, September 1982.

Korbay, S.R., 1985. Preliminary Geotechnical Evaluation Proposed East Canyon Corporation Yard Development, LBNL: Harding-Lawson Associates, Job #2000,170.01, Report and Plates, January 1985.

Kropp, A,. and Associates, no date. Two hand drawn landslide maps of Strawberry Canyon with no identified author.

Lawson, A. C., and C. Palache, 1900. The Berkeley Hills, A detail of Coast Range Geology, University of California Bulletin of Department of Geology, Vol. 2, #12, p. 349-350, Report and Plates, A. C. Lawson Editor, 1900.

LBNL, 2000. RCRA Facility Investigation (RFI) Report, 2000.

LBNL 2003, and 2004. LBNL Environmental Restoration Program (ERP) Quarterly Progress Reports.

LBNL, 2006. fig 1.4-8.ai

LBNL, 2007a. Notice of Availability LBNL, 2006 Long Range Development Plan and Draft Environmental Impact Report, January 22, 2007.

LBNL, 2007b. LBNL Long Range Development Plan, Draft Environmental Impact Report, January 22, 2007.

LBNL, 2007. Draft RCRA Corrective Measures Implementation Report for the Lawrence Berkeley National CA-EPA ID No: CA4890008986 Environmental Restoration, January 2007.

CMTW-27 cont.

Lennert, B. J., Hill, 1979. Area Dewatering Program, Lawrence Berkeley Laboratory: Lennert and Associates, Job #789, Report and Plates, November 1979.

Provenzano, J. M., 1991. Report of Slide Repair Investigation, Adjacent to University of California Berkeley Botanical Gardens and across the Jordan Fire Trail, Berkeley, California: Job #2008-1-91, Report and Plates, October 1991.

Shively, J., PE, 1999. Letter to LBNL Director Shank.

Soulé, F., Jr., 1875. Map of Strawberry Valley and Vicinity.

Steinbrugge, K. V., J. H. Bennett, H. J. Lagorio, J. F. Davis, G. Borchardt and T. R. Toppozada, 1987. Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area, by California Department of Conservation, Division of Mines and Geology, Special Publication 78, Report and Plates, 245 p., 1987.

Taylor, C. L., 1992. New Evidence of Fault Creep on a Second Trace of the Hayward Fault, Montclair Village Area of Oakland, California, in Proceedings of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area: Special Publication 113, Department of Conservation Division of Mines and Geology, p. 159-163, 1992.

USGS, 1975, Nielsen, T. US Geological Survey Open File Map 75-277-42, Oakland West, and Briones 7.5' quadrangles.

USGS, 2000 Graymer. Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California, Miscellaneous Field Studies, MF-2342 Version 1.

USGS on Google Earth, 2007. Geologic Map of Alameda County, from USGS Scientific Investigations Map 2918.

USGS, 2007. USGS web site for recent earthquakes: http://quake.wr.usgs.gov/recenteqs/

Williams, P., 1992. Online map of the Hayward Fault at UC Berkley:http://seismo.berkeley.edu/hayward/ucb_campus.html

CMTW-27 cont.

LBNL/SLS II/DEIR
COMMENTS/PART 2

Committee to Minimize Toxic Waste

DOE/SLSII/DEA
COMMENTS#5of5

Jeff Philliber
Environmental Planning Group
Lawrence Berkeley National Laboratory
One Cyclotron Road, MS 76-234 A
Berkeley, CA 94720

January 26, 2009

Comments on the Notice of Preparation (NOP)/Environmental Impact Report (EIR) under CEQA and Environmental Assessment (EA) under NEPA for Seismic Life Safety Phase 2B Project at the Lawrence Berkeley National Laboratory

Dear Mr. Philliber,

Again - another proposed project, this time with at least 17 (seventeen) individual components, in the treacherous Strawberry Canyon Caldera, the location of the Lawrence Berkeley National Laboratory (LBNL).

It will be impossible to adequately analyze the environmental impacts of these 17 individual projects in one EIR/EA as proposed.

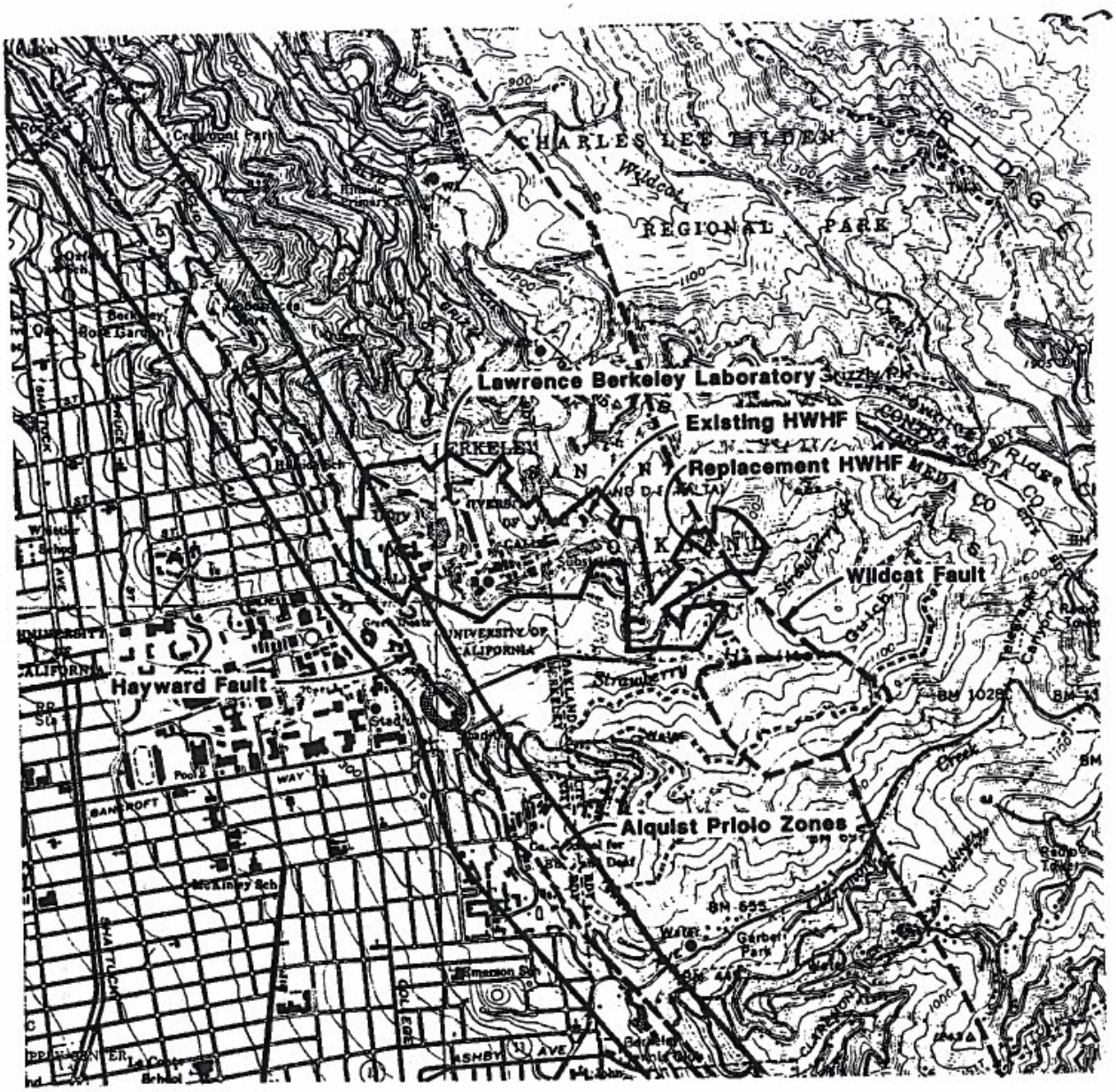
At minimum we ask that the project be severed to its 5 major geographical components, as described in Figure 3 of the NOP's project information section, and that 5 separate, individual EIR/EA/EIS reports be prepared, for the reasons stated below.

The entire LBNL campus is situated in the HAYWARD EARTHQUAKE FAULT IMPACT ZONE (HEQFIZ), as seen in the 1992 USGS map (page 2), sandwiched between the Hayward Fault and the Wildcat Fault.

The inadvisability of any development/any new development in the Strawberry Canyon Caldera is very soberly described by UC Berkeley's Garniss H. Curtis, Professor Emeritus, Department of Earth and Planetary Science in his May 11, 2008 comment letter (pages 3-5). We ask that all these concerns be addressed in the EIR/EA/EIS reports' Geology and Soils section. It appears that, since the collapsed caldera is filled with unstable landslide materials, a major earthquake along the Hayward Fault will have Potentially Significant Impacts, that cannot be mitigated by anything other than not building in the canyon, i.e. a complete moratorium on new construction at LBNL and a gradual off-loading of facilities from the Hill to safer areas. We ask that this scenario be included in the scope of the EIR/EIS.

CMTW-27 cont.

5/83



SOURCE: Base Map U.S.G.S.
California Division of Mines and Geology 1992

NORTH

0 1000 2000

SCALE IN FEET

FIGURE II-20
MAP SHOWING ALQUIST PRIOLO ZONES AND WILDCAT FAULT

Lawrence Berkeley Laboratory

SFO33214.AO 7.13.92E

2/19

CMTW-27 cont.

Statement of Garniss H. Curtis, Professor Emeritus
Department of Earth and Planetary Science, U.C. Berkeley

On Sun, May 11, 2008 at 2:10 PM, Garniss Curtis <gcurtis@berkeley.edu> wrote:

To: anne.shaw@ucop.edu
From: Garniss Curtis <gcurtis@berkeley.edu>
Subject: regarding certification of final environmental impact reports for the proposed computational research and theory facility and the Helios energy resource facility and project approvals. [*Please note that several typographical errors and misspellings have been corrected in the following text.*]

As the request for my geologic opinion on the advisability of constructing large buildings in the lower part of Strawberry Canyon and in the next canyon to the north known as Blackberry Canyon came to me on May 4th, I have to be brief and rely on my memory. I shall first say as strongly as I can "absolutely do not construct any buildings in those two canyons", then I shall go into the reason based on the work I did as consultant to Mr. Ben Lennart 25 to 35 years ago, who was contracted by the University to investigate a number of sites for possible constructions or for stopping landslides that were threatening buildings.

First, the geologic setting of the two areas: The active Hayward Fault goes across the mouths of both canyons. Further east, the Wildcat Canyon fault parallels the Hayward Fault behind the Botanical Gardens and northward joins the Hayward near the town of San Pablo. Southward the Wildcat Canyon fault can be easily traced to Sibley Park and beyond. A few small epicenters lie along this fault near its junction with the Hayward, but it does not seem to be active elsewhere to the south. However, in the past, the area between the two streams and the two faults (which includes the whole of the Lawrence Laboratory complex) lay four miles to the south next to Sibley Park. The volcanic rocks in both areas have potassium-argon dates of approximately 10 million years, and the rhyolite found in both of them is the same rhyolite. The volcanic rocks underlying most of the Lawrence Lab complex fill an old crater, a collapse caldera. The old volcano that once rose above these rocks collapsed after the expulsion of a very large amount of rhyolite ash, now largely removed by erosion. The volcanic rocks broke up as the collapse occurred and many show crushing and deformation and are mixed with large amounts of ash and volcanic fragmental debris. This material should never have been built on as it is so clay-rich and unconsolidated. The western rim of this caldera is easily traced from its arcuate shape which is cut off by the Wildcat Canyon Fault just south of the Botanical Gardens near the upper part of Strawberry Creek. It swings around very close to the old Cyclotron and continues north to join the Wildcat Canyon Fault in Wildcat Canyon not far from the Merry-go-Round in Tilden Park. The boundary rocks to the west are sandstones and shales thought to be of Cretaceous age, that is, they are older than 65 million years. Exposures of these

CMTW-27 cont.

sandstones and shales are good below Building 50 down to Bowles Hall, and they dip westward at angles of 20 to 25 degrees, about which more later. The Hayward Fault passes very close to the rear of Bowles Hall after going through the Stadium where it has caused major deformation of the support pillars and offset of the two sides of the stadium since its construction in 1927.

Behind Hearst Mining Bldg and a few feet to the east, is the Lawson Adit which is a tunnel going eastward. Begun in the 1920' or earlier, it was completed in 1938 when it reached the Hayward Fault. Professor George Louderback told me (Personal comm.) that it was not ordinary fault gouge that he found in the Hayward Fault zone but a peculiar mixture of serpentine and metamorphic rocks that also appear on the surface and underlie Stern Hall and part of Foothill Student Housing. Founders Rock near the corner of Hearst and Gayley Road is in this melange. Also in the tunnel are several exposures of the offset of Strawberry Creek as determined from the contained rounded cobbles of Strawberry Canyon origin . Thus this indicates a displacemeent of more than 600 feet north along the Hayward Fault.

Still further north along the Hayward all the way to San Pablo huge amounts of the melange similar to that in the Lawson Adit have been squeezed out of the Hayward Fault and are gradually sliding down the slope below the fault. Much of this melange has reached the bottom of the hill back of El Cerrito. Along the Arlington many houses built on this melange are sliding and have caused a great number of legal problems. Within the fault itself no movement can be detected in these deposits, some of which are more than 100 feet thick. Thus we believe that movement and expulsion of this melange takes place during major earthquakes on the Hayward Fault.

CMTW-27 cont.

A great deal of research has been done recently on the Hayward Fault by the USGS at Menlo Park which was reported in a talk on the last Thursday of this past April. They have established a return time of major quakes of 6.5-7 magnitude on the Hayward Fault of 130 years. The last major quake along the northern part of the Hayward Fault was 140 years ago, so we are over-due. They estimate that there is approximately a 65 percent chance a major quake will occur in the next 30 years.

Lennart was able to get survey notes from East Bay Municipal Utility District for the San Pablo Dam water tunnel to El Cerrito which crosses the Hayward Fault and shows that the right lateral horizontal movement of approximately one centimeter per year is matched by uplift of the east side of the fault of approximately one centimeter per year also. So, with the evidence of the horizontal displacement of the old Strawberry Creek of 600 feet horizontally along Galey Road, the Cretaceous sedimentary rocks east of the Hayward Fault there have also risen 600 feet. Building 50(?) sits on these Cretaceous strata which, as mentioned, dip westward 20-25 degrees. If an earthquake occurs when these beds are soaked with winter rains the chance of a major landslide

are great along the slippage planes of shale dipping westward. Minor slides have already occurred in these beds behind Bowles Hall. Indeed, the Foothill Student Housing was planned to be built there until I called attention to the landslide. A major landslide would probably destroy all the buildings on both sides of Galey Road from the Stadium to the buildings on both sides of Hearst Avenue and would probably reach Dow Library, destroying everything in its path to that point and possibly beyond. Buildings in the lower parts of both Strawberry and Blackberry Canyons would be buried if not destroyed.

Major landslides of the type I have described here are not rare along the Hayward Fault as was shown to us during our study of the Hayward fault at the base of the hill behind the Clark Kerr Campus. We discovered that most of that campus was underlain by a large landslide that had originated in Claremont Canyon, and was gradually moved northward along the Hayward Fault. Trenches and drill holes showed this landslide to be up to 30 feet thick. It extends westward to and possibly beyond Piedmont Ave. Further south is a huge landslide that underlies most of the campus of Mills College and extends westward another quarter mile Still further south are more large slides that have originated in canyons and steep slopes east of the Hayward Fault. As the hills rise and become unstable, earthquakes cause them to break loose and slide. Very few large slides have occurred on the eastern slopes of the Berkeley Hills, hence the relationship to earthquakes of major landslides close to the Hayward Fault along the western slopes of the Berkeley Hills. Normal erosion rounds off unstable areas on the eastern slope of the Berkeley Hills before they break loose and slide.

CMTW-27 cont.

Most of the buildings of the Lawrence Lab. are on the unstable ground filling the old caldera, particularly the Bevatron and associated buildings. As the Cretaceous beds immediately west of these buildings have been eroded away there is nothing to keep these soft caldera-filled beds from sliding. The buildings on them will certainly move a few feet in a major earthquake if not hundreds of feet. Keep in mind the Loma Prieta quake of 1989 of magnitude 6.9 which from a distance of over 60 miles destroyed a section of the Bay Bridge, a section of the overhead freeway in Oakland killing 63 people, and many houses on filled ground in the Marina of northern San Francisco some 70 miles from the quake!

No major buildings of any kind should be constructed in either of these canyons bordering this huge block of unstable rock.

Profesor Emeritus Garniss H. Curtis
Dept. Earth and Planetary Science
University of California, Berkeley, CA

Garniss H. Curtis
Berkeley Geochronology Center
E-Mail: gcurtis@uclink.berkeley.edu

LBNL is a nuclear-industrial complex and many of the 14 structures proposed for demolition have been potentially used for work involving radioactive and hazardous materials and are potentially located on contaminated soil and on top of known radioactive and hazardous waste contamination plumes.

The NOP document referred to these 14 structures as trailers, labs and shops without any specifics as to their past use.

LBNL's Site Environmental Reports provide the following names and descriptions:

Buildings

25 Mechanical Technology/Engineering Shop
25B Waste Treatment Facility
55 Research Medicine/Radiation Biophysics

(74 Research Medicine/Radiation Biophysics, Cell&Molecular Biology Laboratory)
74F Housing for animals used for research at facility above

4 Magnetic Fusion Energy (MFE)/ALS Support Facility
5 Magnetic Fusion Energy (MFE)/Accelerator and Fusion Research
14 Accelerator&Fusion Research&Earth Sciences
16 Magnetic Fusion Energy Laboratory/Accelerator and Fusion Research Laboratory
17 EH&S/Applied Sciences Lab

(71 Heavy Ion Linear Accelerator (HILAC/Center for Beam Physics, Ion Beam Technology)
71 C, D, F, H, J, P B-Factory associated with facility above

LBNL operates facilities which contain Radioactive Material Areas (RMAs) that are subject to radioactive air emissions regulations of NESHAPs (National Emission Standard for Hazardous Airborne Pollutants) and have the pontial to emit radionuclides into the atmosphere. Building 55 has at least 9 such sources.

We ask that the Hazards and Hazardous Materials sections of the EIR/EIS address/describe in detail the history of the uses of all the 14 buildings proposed for demolition and list all the equipment and radioactive/hazardous materials used at these structures and the various kinds of wastes generated there during their lifetime.

This will help to better assess the degree of contamination associated with each of the structures, lab equipment, waste water/sewer lines, sumps etc. Especially, as you know, almost 3 pounds of mercury was recently found in a Building 71Q storm drain sump, (pages 7-8) estimated to have been there from 10 to 40 years.

CMTW-27 cont.

impact
Special categories Cat OE – operational emergencies Cat R - recurring

25. Description of Occurrence

On September 29th, while cleaning out a catch basin using a vacuum extractor, Facilities Labor Shop employees observed metallic mercury in the sediment at the bottom of the catch basin. Work was stopped and EH&S was contacted. The asphalt area around the catch basin was assessed for mercury and decontaminated, as subsequently was the vacuum truck. The extracted sediment was removed from the vacuum truck and stored in a 55-gallon drum; the drum was placed in a WAA. Waste materials from the cleaning were properly discarded. The catch basin itself was temporarily closed and sealed with polyethylene sheeting pending future clean up response planning and investigation.

On October 12th, Labor Shop personnel, under the supervision of site IH personnel, removed the rest of the contaminated sediment from the catch basin and placed it in a lined 30-gallon drum. The drum was placed in a WAA, and samples of the sediment inside this drum and the drum noted above (from the original effort to clean the catch basin) were collected on October 14th. Also that day a video camera was inserted into a 4-inch cast iron pipe leading to the catch basin and a 10-inch corrugated metal pipe leading out of it. This effluent pipe was corroded, and the camera could not be inserted very far into it. No mercury was observed in either of these two pipes. Additionally, six sediment samples were collected from a concrete structure at the outfall of the storm drain line to the North Fork of Strawberry Creek. Sampling results from the analytical laboratory were received Oct 21, 2005. They indicate that it is unlikely that any mercury had been released into the creek: two samples were non-detect at a detection limit of 0.13 and 0.16 mg/kg, respectively, and the maximum of the 4 other samples was 0.34 mg/kg, within the 0.5 mg/kg background concentration of mercury for Berkeley Lab soil and bedrock.

The two samples taken from the drums which contained catch basin sediment showed the following results for mercury: 7,900 mg/kg in the 30-gallon drum, and 2,400 mg/kg in the 55-gallon drum. Based on the actual weight of the sediment in the drums, the amount of mercury found in the catch basin was calculated to be 2.9 pounds. This exceeds the federal reportable quantity for mercury of 1 lb. Accordingly, on October 24th, LBNL notified the Office of Emergency Services, The City of Berkeley, the Regional Water Quality Control Board, and the Department of Toxic Substances Control (which had previously been informally notified).

CMTW-27 cont.

28. Operating Conditions of System/Building/Equipment: The pipe from the floor drain in the basement of building 71 which had led to this catch basin had been cut and capped in 1995 as part of the effort to eliminate illicit connections as required by the California industrial storm water permit held by Berkeley Lab. Mercury had been found in the floor drain and pipe at that time (see SAN-LBL-EHS-1995-0001). The effluent pipe is corroded and blocked, presumably crushed. The catch basin only drains the relatively small surface area around it. According to Laborers' records, this catch basin had been cleaned on 10/26/04, but only to a depth of 68 inches . The bottom of the catch basin has now been determined to be 79 inches. It is presumed that this mercury has been in the sediment of this catch basin for from 10 to 40 years.

CAUSAL INFORMATION

32. Description of Cause:

ISM DEFICIENCIES

35. ISM Deficiencies or Weaknesses (check all that are applicable):

Scope of Work LTA* Analyzed Hazards LTA Developed/Implemented Controls LTA
Performed Work Within Controls LTA Feedback and Improvement LTA X ISM not applicable

* LTA = Less Than Adequate

LBNL ORPS SHORT FORM WORKSHEET

Notes and instructions:

1. The ORPS Short Form is used for Significance Category 4 occurrences. Excluding corrective actions required to mitigate the problem, completion of the Short Form constitutes the sole requirement for reporting Category 4 occurrences.
2. Some fields in the DOE ORPS database are not applicable to LBNL operations, thus field numbers in this form are not sequential.
3. Electronic version of this form is available at the LBNL ORPS web site, . Other ORPS references and resources are available at the website or contact the Office of Assessment and Assurance (OAA) at 4046 / 7457 for additional assistance.

FACILITY / PERSONNEL INFORMATION

2. Name of Division / Department: Environment, Health, and Safety
3. Facility Function Code (check only one):

Explosive (03)	Tritium Activities (09)	Fusion Activities (10)
Environmental Restoration (11)	Solar Activities (14)	Accelerators (16)
Laboratory – Analytical (17A)	Laboratory – R & D (17B)	Balance-of-Plant – Offices (99A)
Balance-of-Plant – Machine shops (99B)	Balance-of-Plant – Site/outside utilities (99C)	Balance-of-Plant – Safeguard / security (99D)
Balance-of-Plant – Storage (99E)	Balance-of-Plant – Laundries (99F)	XBalance-of-Plant – Infrastructure (99G)

5. Name of Division Director/ Division ORPS Designee: Regina Lackner
6. DD / Designee Phone No.: (510) 486-7413 **7. Job Title of ORPS Designee:** Regulatory Compliance Eng.
11. Program / Project: Unknown (historic release)
12. DOE Secretarial Office (i.e., sponsoring DOE program; Office of Science [SC] is LBNL's default choice):

BV	EE	EH	EI	EM	FE
ME	NA	NE	NP	RE	X SC (default choice)
SE	SO	SW	UE	WA	

13. System/Building/Equipment involved in occurrence: Storm drain catch basin.
17. Plant Area (building & room location of occurrence): East of building 71Q.

CMTW-27 cont.

DATE AND TIME INFORMATION

18. Discovery (when event or condition was first identified) **Date:** 9/29/05 **Time:** ~ 10 am.
19. Categorization (when reportability and significance determined) **Date:** 10/24/05 **Time:** ~ 9 am.
26. DOE Notification **Date:** 10/11/05 **Time:** ~ 2 pm
27. Other Notification (person and organization contacted): **Date:** 10/12/05 **Time:** 10 am

	10/24/05	12 pm
Dr. Waqar Ahmad, Department of Toxic Substances Control		
George Leyva, Regional Water Quality Control Board		
Dacia, Office of Emergency Services	10/24/05	12 pm
Nabil Al-Hadithy, City of Berkeley	10/24/05	1 pm

OCCURRENCE DESCRIPTION

20. Subject / Title of Occurrence: Mercury in Storm Drain Catch Basin
22. Significance Category (each reportable occurrence has a Significance Category. See .)
Cat 1 – significant X Cat 2 – moderate impact Cat - 3 minor impact Cat 4 – some impact

To further illuminate our concerns we are enclosing a copy of CMTW's March 2007 Report titled:

Contaminant Plumes of the Lawrence Berkeley National Laboratory and their Interrelation to Faults, Landslides, and Streams in Strawberry Canyon, Berkeley and Oakland, California (as a CD).

We specifically ask you to review sections on CONTAMINANT SITES (Chemical and Hazardous Contamination and Radioactive Contamination), DRAINAGE NETWORK MAPPING, FAULT MAPPING, LANDSLIDE MAPPING, ZONES OF CONCERN FOR POTENTIAL PLUME MIGRATION and FUTURE DEVELOPMENT AND SITE CONDITIONS.

Figure 2. in our Report (page 10) shows a significant VOC (Volatile Organic Compound)groundwater plume associated with B 71 and its "trailer" area, surrounded by a radioactive tritium soil plume.

In the "Old Town" area buildings 4, 5, 14, 16 and 17 are all located on top of the huge Old Town VOC groundwater solvent plume.

In the East Canyon the B 74 Diesel plume is migrating into the area of the proposed General Purpose Lab.

Figure 18 a. shows the Zones of Concern at LBNL for Groundwater Plume Expansion along Faults, Bedrock contacts, Landslides, Historic and Modern Creeks. Please note and address in the EIR/EIS that all 5 areas of the proposed " Seismic Life Safety Phase 2B Project" are impacted by migrating groundwater contaminant plumes, earthquake faults and landslides. (page 11.)

CMTW-27 cont.

Figures 10 and 14 show the mapping of Wildcat Fault and the East Canyon Fault as well as the huge landslide area associated with these faults. It is quite incredible to observe that indeed LBNL/DOE (Department of Energy) knew of the presence of these earthquake faults and landslide areas, and yet proceeded with the construction of the Lab's Hazardous and Radioactive Waste Handling, Storage and Treatment Facility in this treacherous area in 1996, and now must attempt with seismic upgrades of the building (B 85), and the stabilization of the landslide beneath it. (pages 12-13)

Figure 20 a. (page 14) shows various site conditions at future sites of LBNL's Long Range Development Plan.

Please read carefully Garniss H. Curtis' comments: " Most of the buildings of the Lawrence Lab. are on unstable ground filling the old caldera... The buildings on them will certainly move a few feet in a major earthquake if not hundreds of feet."

We ask you to include a very serious analysis of the B 85 situation and instead of a Band-Aid, a plan for relocating these dangerous operations to a more stable and accessible area.

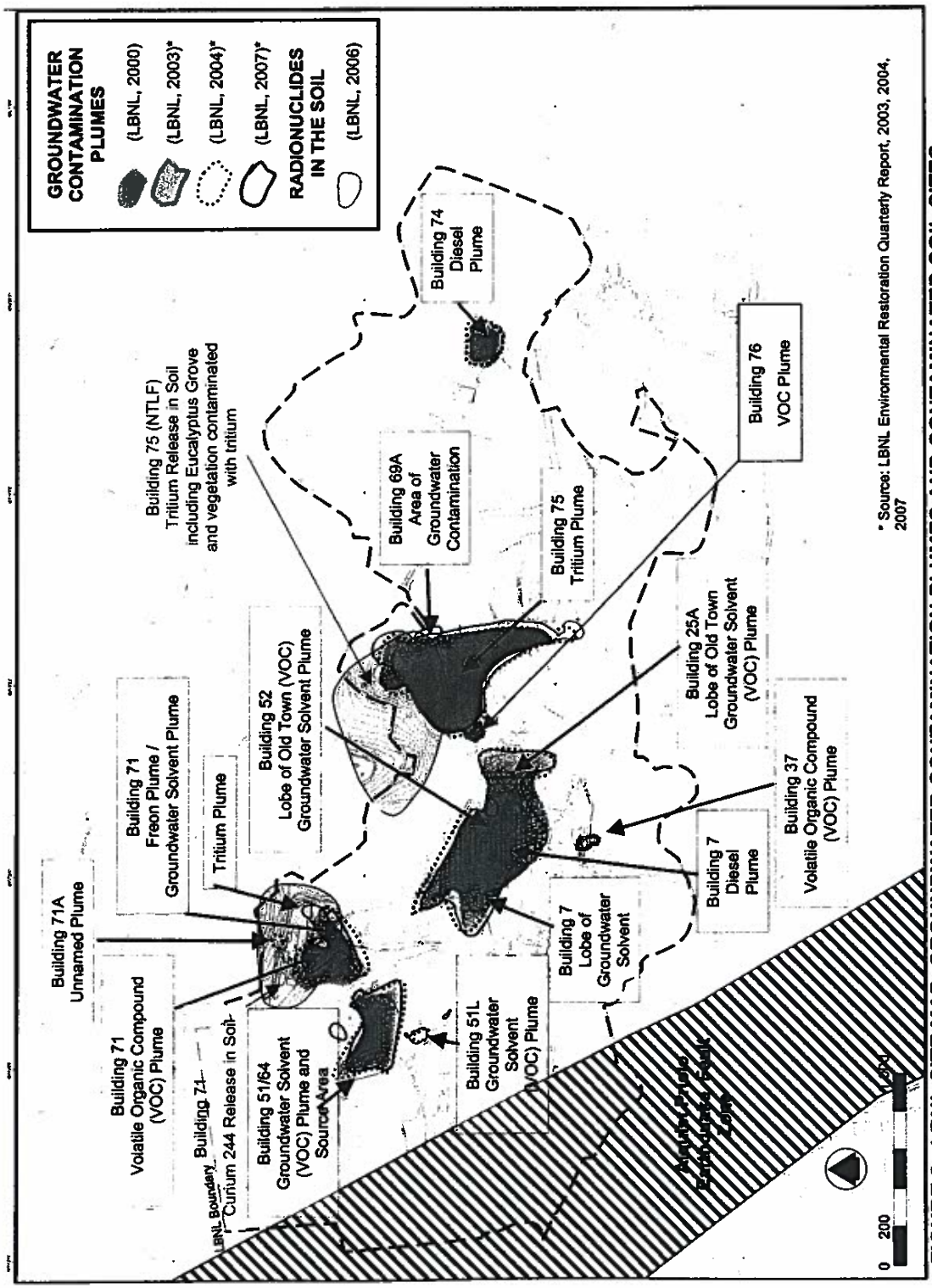


FIGURE 2. LBNL SITE MAP, GROUNDWATER CONTAMINATION PLUMES AND CONTAMINATED SOIL SITES.

CMTW-27 cont.

10/19

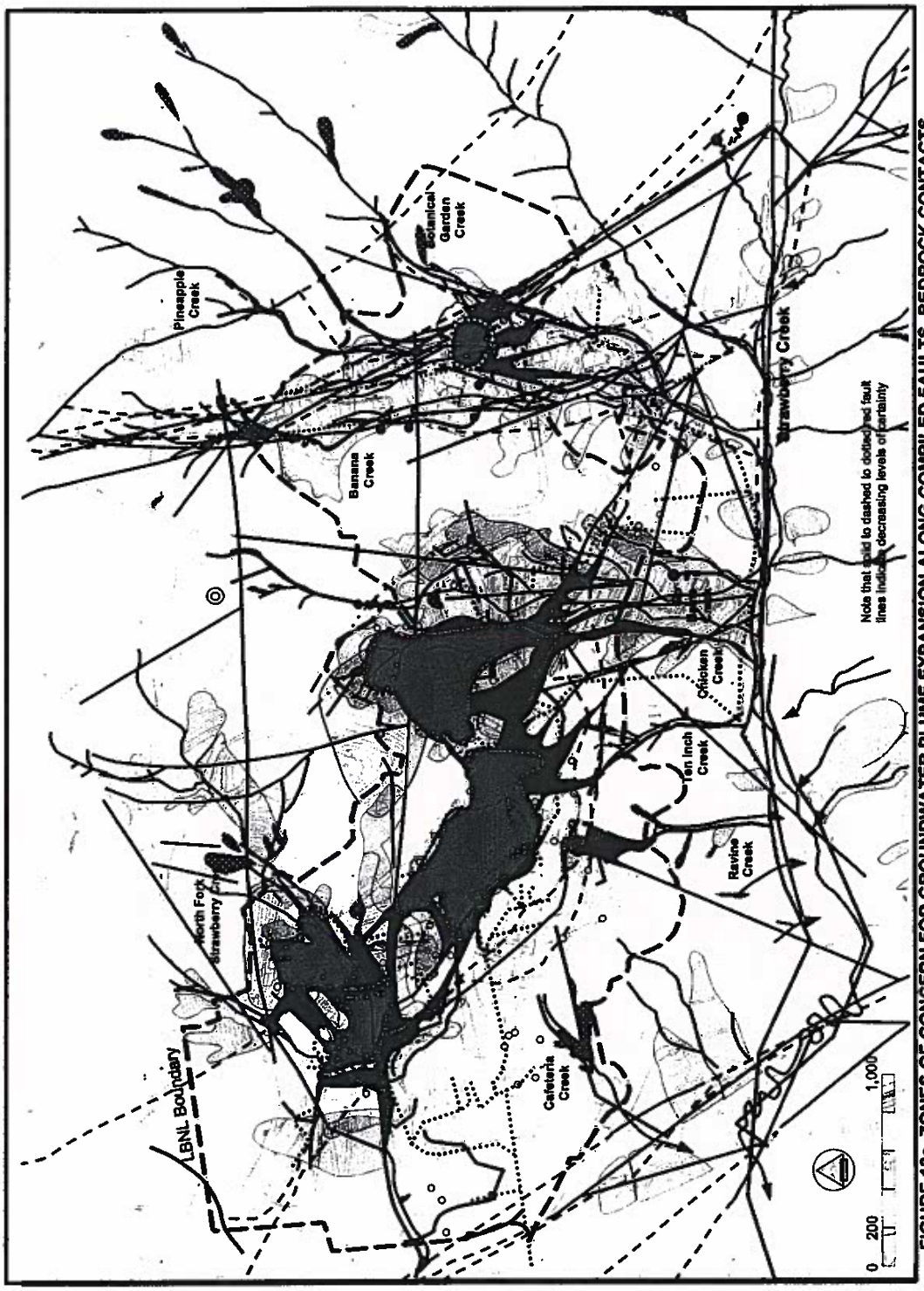


FIGURE 18a. ZONES OF CONCERN FOR GROUNDWATER PLUME EXPANSION ALONG COMPILED FAULTS, BEDROCK CONTACTS, LANDSLIDES, HISTORIC AND MODERN CREEKS. SEE NEXT PAGE FOR MAP LEGEND.

CMTW-27 cont.

11/19

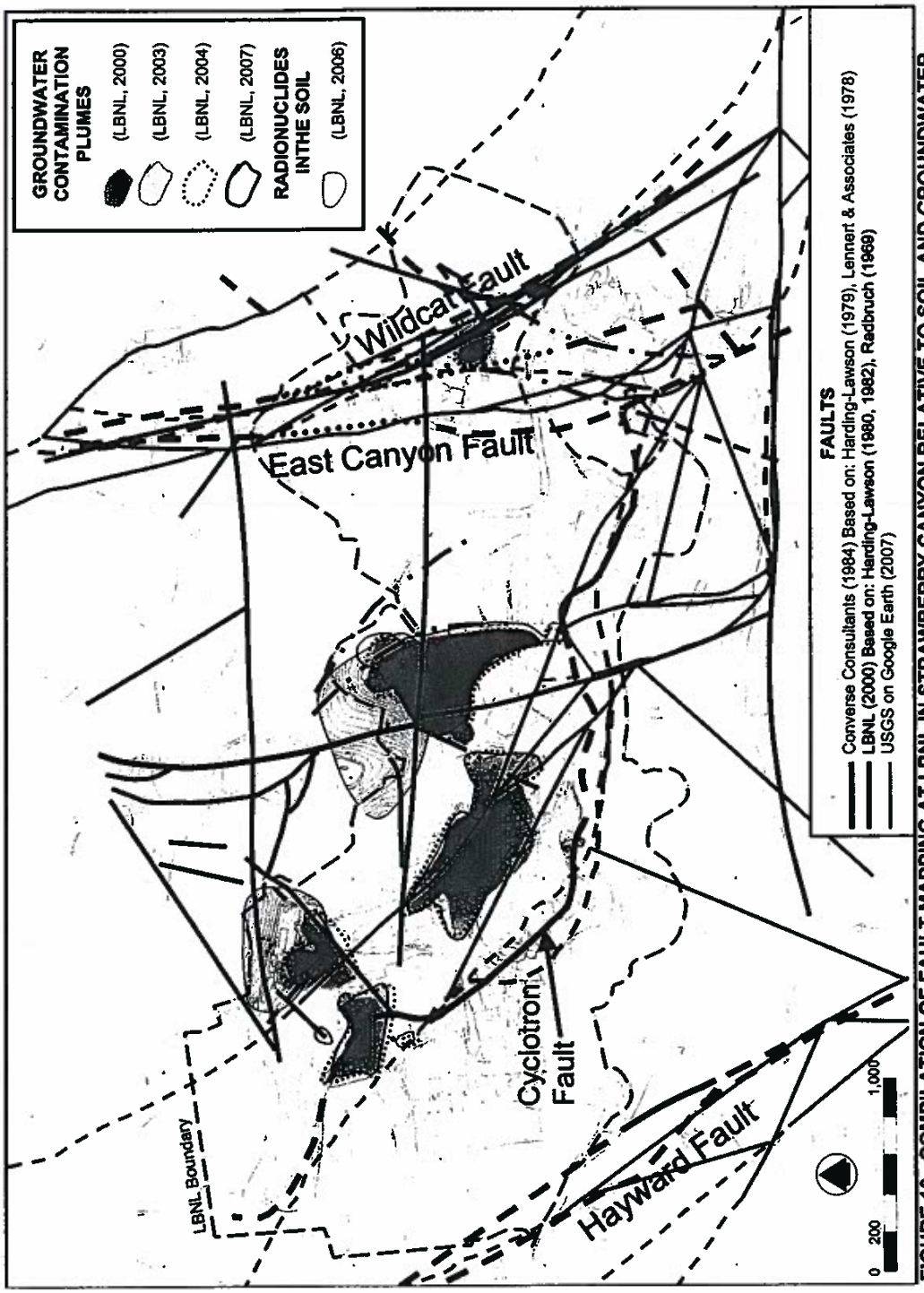


FIGURE 10. COMPILATION OF FAULT MAPPING AT LBNL IN STRAWBERRY CANYON RELATIVE TO SOIL AND GROUNDWATER CONTAMINANT PLUMES.

CMTW-27 cont.

12/19

FIGURE 14. COMPILATION OF LANDSLIDE AND SURFICIAL GEOLOGY MAPS 13a-13f IN STRAWBERRY CANYON

CMTW-27 cont.

13/19

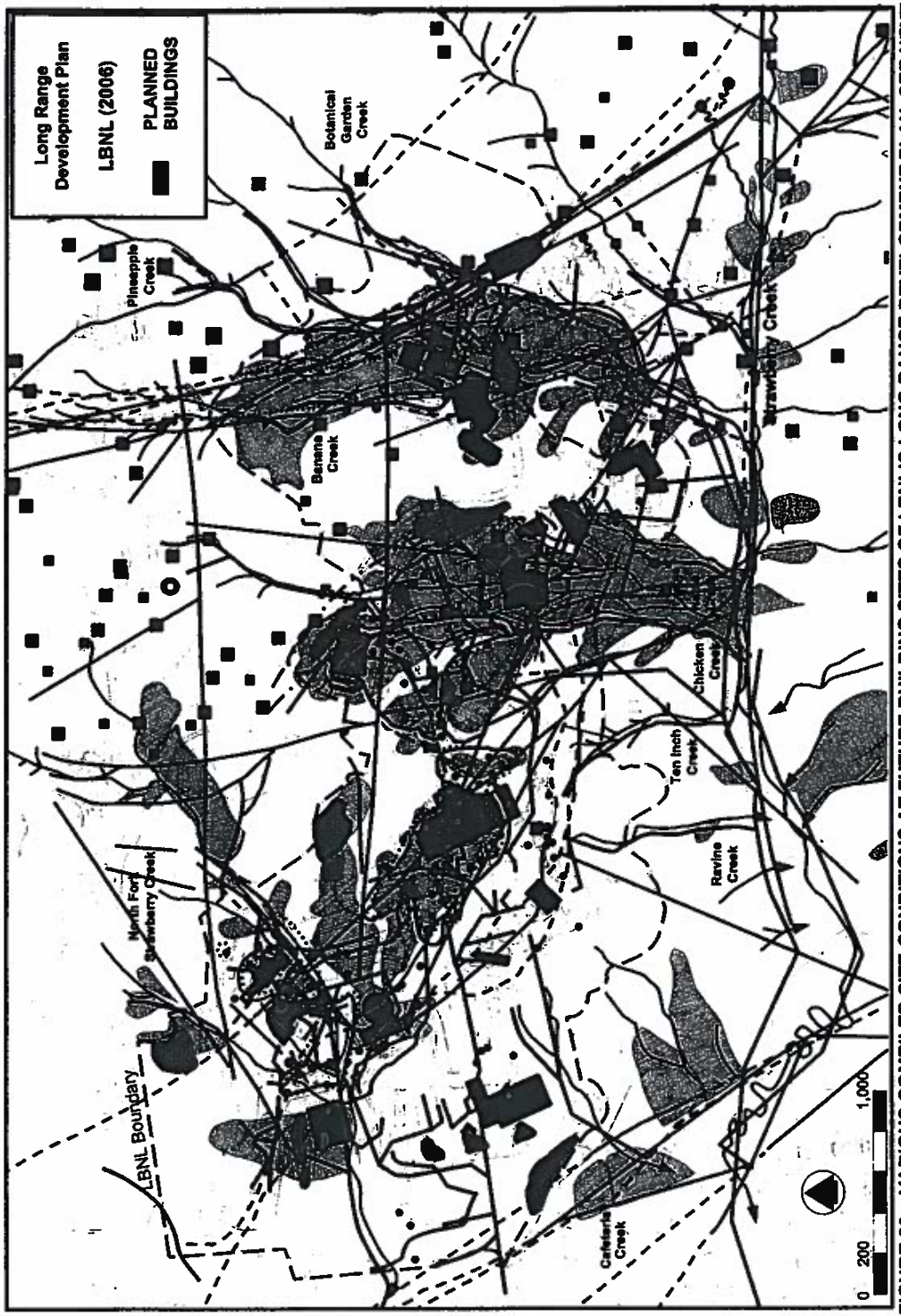


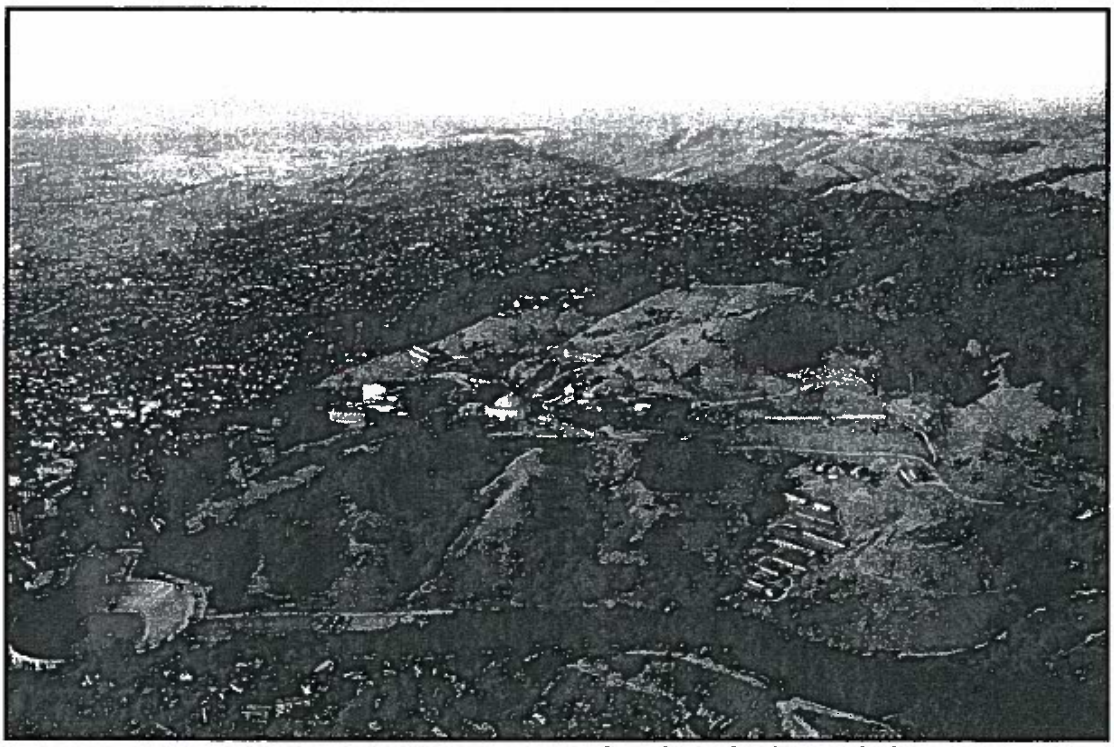
FIGURE 20a. VARIOUS COMPILED SITE CONDITIONS AT FUTURE BUILDING SITES OF LBNL'S LONG RANGE DEVELOPMENT PLAN. SEE NEXT PAGE FOR MAP LEGEND. NOTE THAT SOLID TO DASHED RED FAULT LINES INDICATE DECREASING LEVELS OF CERTAINTY.

CMTW-27 cont.

14/19

CONTAMINANT PLUMES OF THE LAWRENCE BERKELEY NATIONAL LABORATORY AND THEIR INTERRELATION TO FAULTS, LANDSLIDES, AND STREAMS IN STRAWBERRY CANYON, BERKELEY AND OAKLAND, CALIFORNIA

March 2007



Strawberry Creek Watershed ca. 1965

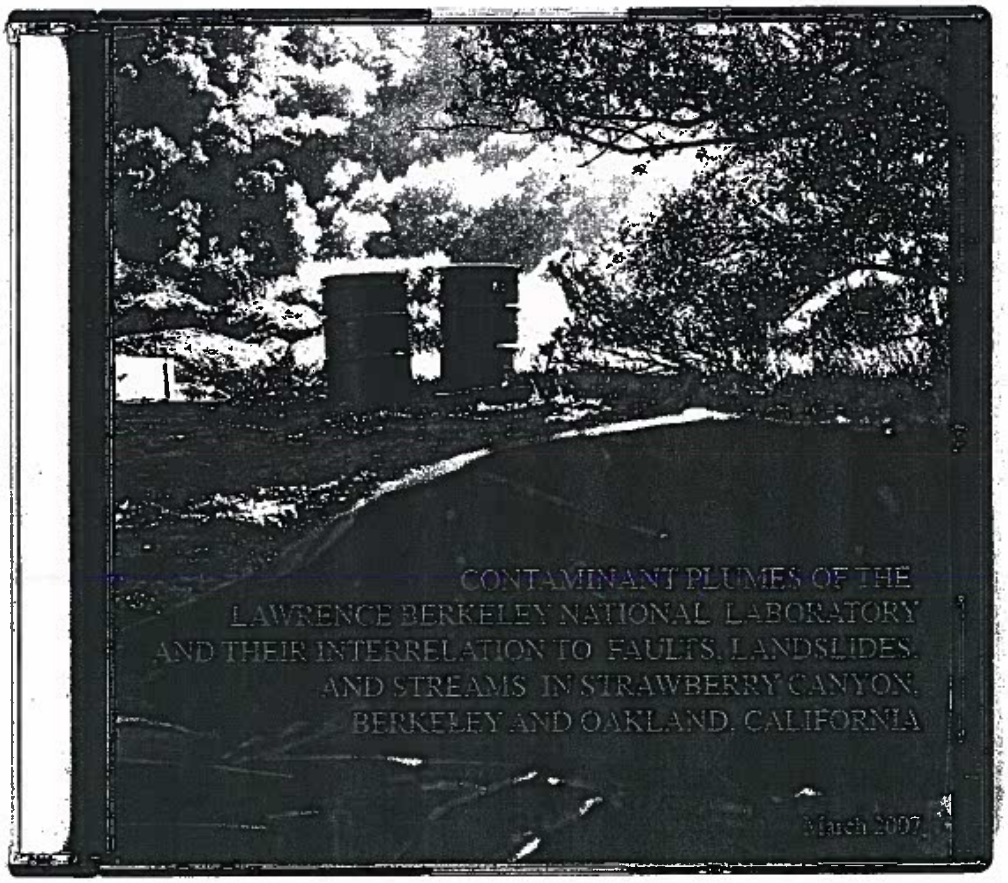
Laurel Collins, Geomorphologist
Watershed Sciences
1128 Fresno Ave
Berkeley, California 94707
collins@lmi.net

for

Pamela Sihvola, Project Manager
Committee to Minimize Toxic Waste
P.O. Box 9646
Berkeley, California 94709

CMTW-27 cont.

15/19


CONTAMINANT PLUMES OF THE
LAWRENCE BERKELEY NATIONAL LABORATORY
AND THEIR INTERRELATION TO FAULTS, LANDSLIDES,
AND STREAMS IN STRAWBERRY CANYON,
BERKELEY AND OAKLAND, CALIFORNIA
March 2007

CMTW-27 cont.

KENNETH R. SCHMITZ
Associate Director — Grounds Services
Physical Plant Operations

UNIVERSITY OF CALIFORNIA
Office of Physical Resources
2000 Carleton Street
Berkeley, California 94720

(415) 642-6338
FAX (415) 643-7264

OFFICE OF PUBLIC INFORMATION

101 SPROUL HALL, BERKELEY, CA 94720
(415) 642-3734

5/9/84--McClendon--File #9070

FOR IMMEDIATE RELEASE

Berkeley--Centennial Drive, connecting the "main" University of California-Berkeley campus to hilltop facilities, will reopen tomorrow (Thurs., May 10) after an eight-month closing.

The reopening restores convenient access to U.C.'s Lawrence Hall of Science in plenty of time for the public to take advantage of its summer programs.

The road has been closed from just beyond the U.C. Botanical Garden in Strawberry Canyon since last September 19 to repair damage caused by two years of heavy rains and run-off.

Officials had expected the closure to last only 12 to 15 weeks, but wet weather caused many delays in the work, which included rebuilding a section of the road that had become unsafe.

At the Lawrence Hall of Science, five sessions of summer courses will be offered in computers, biology, chemistry, physics and astronomy for various age levels, ranging from age two through adulthood.

Other activities, such as film series and exhibits, will also be offered.

For information on Lawrence Hall of Science summer activities, call 642-5133.

-agl-

17/19

CMTW-27 cont.

JOHN R. SHIVELY

CONSULTING ENGINEER

P.O. Box 7136
Berkeley, California 94707
(510) 531-1355

May 28, 1999

Dr. Charles Shank, Director
Lawrence Berkeley National Laboratory
1 Cyclotron Road, Mail Stop 50A-4119
Berkeley, California 94720

Re: City of Berkeley Fire Fighting System

Dear Dr. Shank:

Enclosed is a copy of my comments on the City of Berkeley's Draft Environmental Impact Report (DEIR) for the City's proposed Saltwater Fire Fighting System (SFFS). I propose an entirely different fire-fighting alternative, one that would be valuable to LBNL, referred to as the Hillwater Fire Fighting System. It would use a nearby existing source of hillwater rather than saltwater pumped from the Bay.

HFFS is of consequence to LBNL because it would enhance the fire fighting capability of the Lab's own fire protection. It would provide for reservoir impounded hillwater as a backup water source, should the normal water source fail during a major earthquake or a 1991 type conflagration. The HFFS alternative would utilize water from an existing hill area dewatering well located just south of the Space Sciences Laboratory. The water would be held in one or more large reservoirs.

I conceived of the idea of that vertical well, to intercept the hill-water that was causing the slides both inside and adjacent to LBNL, back in 1974.. I retained Civil Engineer B. J. Lennert to install this well. I was the Campus Principal Engineer in the campus Office of Architects and Engineers at that time. During August of 1974 a major hill slide had occurred inside LBNL. It broke a Lab building, took out a portion of a Lab road, and was threatening Lawrence Hall of Science. At the same time another slide was developing above the Lab's corporation yard, threatening the University's Centennial Drive. Lennert's attempts to stop the slides by dewatering the hill area with horizontal hydraugers weren't working.

CMTW-27 cont.

The well apparently stopped both slides. Presumably the campus continues to pump the well to prevent future slides. Later in the 70's, after I had left the A & E Office, the campus fire marshal had a large reservoir tank installed near the well, kept full by the well, to provide the primary source of water for fighting fires in the relatively inaccessible areas of upper Strawberry Canyon. Unfortunately, sometime in the late 80's, the campus removed that reservoir, to make way for the construction of a new laboratory building. Since then the water produced by the well has been dumped straight into Strawberry Creek.

The HFFS alternative would not only enhance the Lab's own fire protection capability, it could have reliability and cost savings advantages for the City, compared to the saltwater proposal. LBNL's support is requested to encourage the City to conduct a feasibility study of the hillwater alternative. Please contact me if you wish more information about the hillwater alternative or the history of hill area slides.

Sincerely yours,

John R. Shively

John R. Shively, P.E.

Enclosure:

The same seismic and landslide hazards that afflict the B 85 site are present at the proposed 43,000 sq.ft. Bio Lab (General Purpose Laboratory) location, just some 200 yards downhill to the SE, on top of the Wildcat Canyon Fault.

The massive East Canyon Slide (see Figure 14.) extends all the way down to the bottom of Strawberry Canyon and continually undermines the stability of Centennial Drive, the only public (and emergency access) road through the Canyon.

We ask that you abandon this new construction project at the proposed East Canyon site and instead very seriously consider the UC owned Richmond Field Station, as an alternative location.

Indeed, the RFS, a prime Bay View property, must be considered as the future site for all LBNL Bio Science (Life Science) facilities, as well as for the Helios/EBI and CRT projects, in order to avoid the potential catastrophic failures predicted for the Strawberry Canyon Caldera during the next major earthquake - and to save publicly funded facilities, equipment and some 5000 human lives!

Sincerely,

Pamela Sihvola/CMTW
P.O. Box 9646
Berkeley, CA 94709

CMTW-27 cont.

PS. Landslides in the Strawberry Canyon are triggered by heavy rains and underground water sources (during the dry season).

The attached UC Press release of May 9,1984 describes the closure of Centennial Drive for a period of eight months, due to heavy rains and run-off in one of the main landslide areas. (page 17)

Former UC Engineer John R. Shively describes a dry season landslide of August 1974, due to impounded hillwater of the Lennert Aquifer, as previous dewatering attempts by hydraugers had failed. (page 18)

The EIR/EIS reports must include rainfall data for at least the past 40 years for the highest LBNL locations/elevations as well as current data regarding the Lennert Aquifer and its impacts at LBNL.