

Attachment 21 –  
Attachment 12 of Pamela Sihvola and LA Wood Letter June 7, 2005

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Subject: Preliminary Geological Report Pertaining To The Bedrock  
Conditions In The Vicinity Of The Bevatron At The Univer-  
sity Of California At Berkeley

Attention Mr. H. L. Jensen

Dear Sir:

Following your instructions I have made an examination of the geological conditions of a portion of the Wilson Tract in the vicinity of the Bevatron site and am submitting herewith a preliminary report for such consideration as it might be useful in the present course of construction. Considerable excavation is to be made in this area in preparation of subgrades for the various structures, and since much of the present surface area is covered by thick residual material which is mixed with the rather soft pervious underlying bedrock formation, it is difficult to determine the character of much of this proposed foundation material. After the deep excavations have been made in this area a better understanding of the foundation material will be had and at that time treatment of the drainage problems can best be determined. In the light of the present surface conditions a few general recommendations are here presented but in the absence of a knowledge of the proposed foundation footings for the various structures these suggestions are only of a tentative nature and should be altered to conform to the footing plans and to the geologic conditions disclosed by the various excavations.

A sketch map is here presented that shows the general area under consideration. On this map the original 25 foot contours are shown and also the outlines for the various base grades at the Bevatron and Warehouse sites. The contact between the areal distribution of the Cretaceous shales and sandstones with the Orinda clays and gravels is noted, as well as a few measurements of the dips and strikes of these formations. The location of the main culverts that run down Blackberry Creek is indicated as well as four suggested intercepting drains for the purpose of drawing off the ground water from the area. Two east and west cross-sections show the general relation the original ground surface and the proposed cuts and fills.

The area under consideration which occupies the eastern portion of the Wilson Tract drains westerly along Blackberry Creek. Two main branches, one running southwesterly, and the other running northwesterly from the direction of the Cyclotron, join the main stem of Blackberry Creek about 300 feet northerly from the Research laboratory.

The contact between the older Cretaceous shales and sandstones with the overlying clays and gravels of the Orinda formation runs through the confluence of these tributary ravines and passes westerly of the drainage that runs down from the Cyclotron. The older shales and sandstones are quite tight and impervious and strike approximately South 45° east with dips varying between 40 and 80° to the northeast. The younger Pleistocene sediments are rather soft and pervious and rest unconformably on top of the older sediments with strikes averaging east and west and dips varying between 15 and 45° to the north. However, there are many local modifications of these dips and strikes especially in the Orinda formation.

The area at the Bevatron is to be excavated and levelled off to elevation 710. The bedrock beneath this bevelled surface will be comprised of poorly consolidated Orinda sediments, which are made up chiefly of red and yellow clays that have a blue green tinge at depth and of interbedded sandy clays and some open sands and gravels. The formation also contains layers of lava and volcanic breccia, much of the lava capping the higher slopes above the area shown on the sketch.

The Orinda formation absorbs water freely and the lava flows and breccia that are associated with it are also quite pervious so that the whole mass becomes readily saturated. In the area adjoining the Wilson Tract to the east, which is comprised of the same formations as those under consideration on the Wilson Tract, the Peoples Water Company had 58 springs from which they once collected water for the domestic supply of Berkeley in the early days.

The Cretaceous sediments are much older than the Pleistocene Orinda formation and they stand at much steeper attitudes. The overlying Orinda sediments contain some rather compact siltstones as well as some fairly tight beds of conglomerate but the formation is quite variable and is comprised for the most part of poorly consolidated clays, sands and gravels, all of which are pervious.

There appears to have been considerable landsliding in this amphitheatre in which the Bevatron is to be located and during periods of heavy rainfall the deep overburden and the underlying Orinda sediments become quite soft from the absorbed water. Seeps come out of the ground in many places, and even now several weeks since any rains have fallen there are about four seeps issuing from the ground in the vicinity of the Bevatron. There are two known permanent springs in the area where tunnels have been driven into the hillside, and pipes leading out from the caved entrances have been flowing water for many years.

A large amount of money is to be expended here for buildings, machinery and equipment and it is necessary that the foundations be free from fluctuating ground waters and from differential settlements resulting therefrom. While surface drains can take care of some of the surface waters after the project is completed there will always be waters percolating through the Orinda sediments upon which the structures are to be founded. The high fills and steep slope-cuts will be subject to landsliding unless the Orinda formation that occupies this amphitheatre is properly drained. The deep fill downstream from the Bevatron will have a maximum depth of 90 feet which will be underlain by soft pervious clays that are now sliding along the general contact with the Cretaceous sediments. This slide material is all unsound and should be removed from beneath the fill and the foundation then drained.

Surface drains will not suffice and drains along the downstream toe of the fill are of little value. The water must be removed upstream such critical areas before it has an opportunity to percolate through the fill or overburden. It is dangerous to place a drain under the fill along the outside of the large culvert that is being constructed down Blackberry Creek because piping of the material along the side of the culvert could cause differential pressures against the pipe that might be disastrous. Surface drains around the entire area would be helpful in diverting some of the surface waters away from the area but there are deep-seated groundwaters that can only be controlled by a deep drainage system. At about elevation 619 along the invert of the culvert the pipe leaves the Cretaceous sediments and upstream from here it is resting upon the Orinda sediments. It is desirable that the water be drained from the sediments in this vicinity and the drainage system suggested will tend to cut off water from softening this area by intercepting it under the upstream edge of the Bevatron excavation.

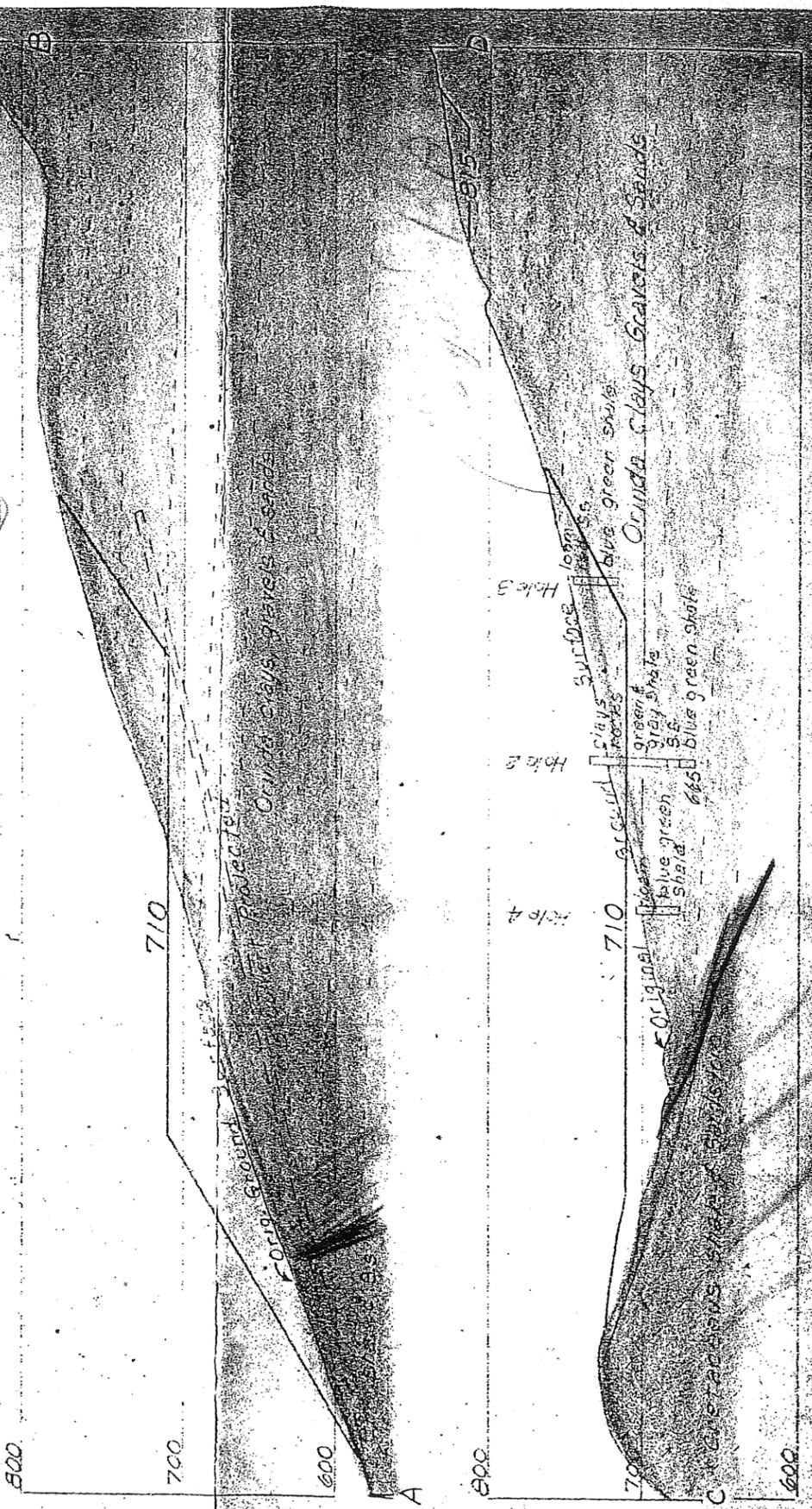
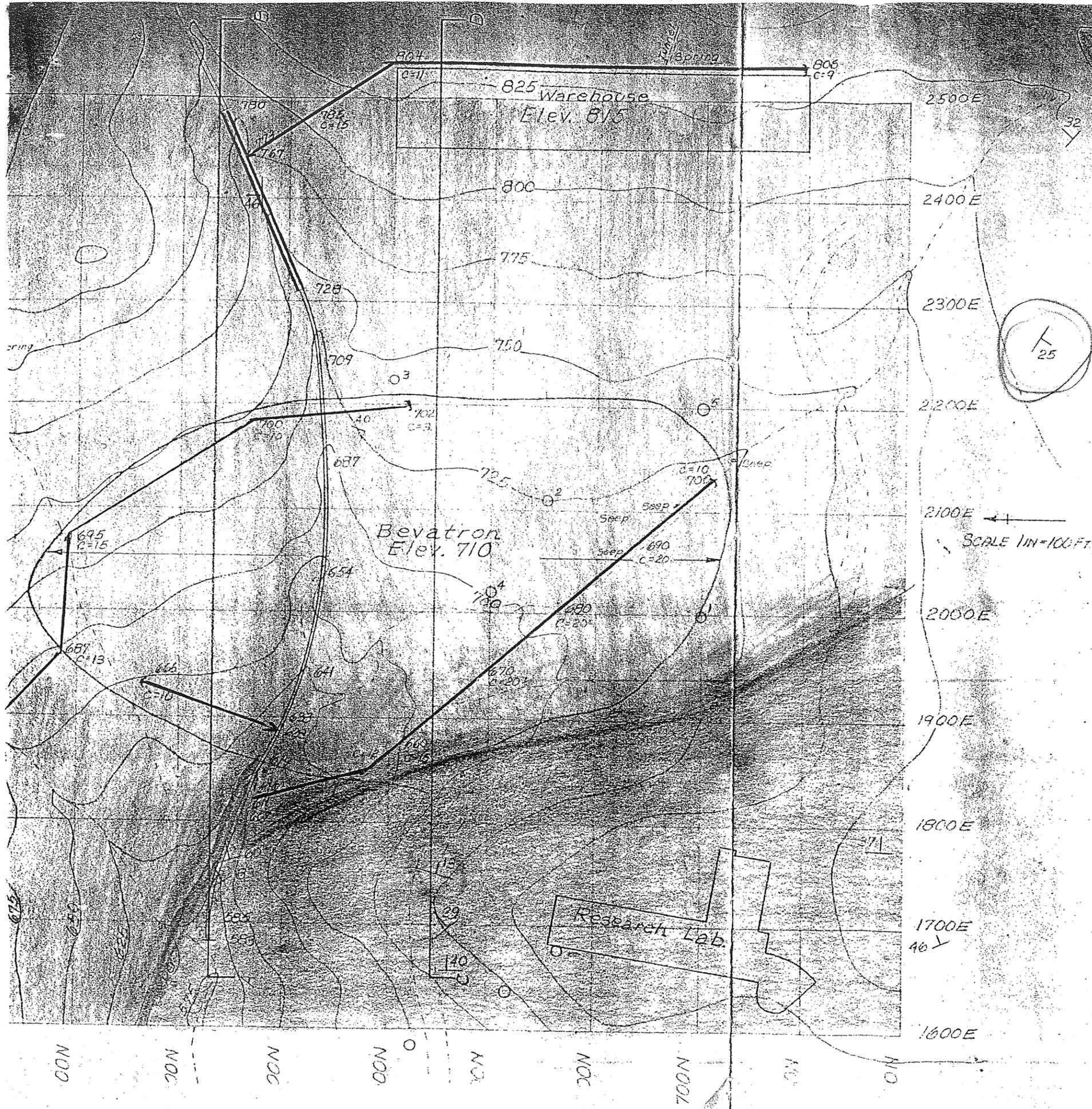
Both the older Cretaceous sediments and the later Orinda sediments dip toward the hills and thus tend to hold back the absorbed water till the water table rises and allows it to seep out to the surface. There is no major fault passing through the Bevatron site but the area is subject to occasional heavy vibrations from earthquakes emanating on the Hayward fault located a short distance to the west and from some of the cross faults in the vicinity that are associated with it. The western slopes of the Berkeley are notorious for slides. The area under consideration is not exempt from them and is really rather susceptible to them due to the character of the surface formations and to their ability to become saturated. There is one unconformable contact passing through the Bevatron site where the older sediments and the later ones are seen at the surface to be in close proximity to each other. Here the sliding could easily be induced by the presence of percolating ground waters, which is found to be the case near elevation 607 of the invert of the culvert.

The importance of the project warrants a careful treatment of the foundation material since the soft pervious sediments which comprise it are not sound bedrock and are subject to landsliding and

differential settlement especially when it is saturated with water. The groundwaters are the chief potential hazard in connection with the stability of this foundation material and therefore an effort should be made to control them at depths before the structures have been erected. It is believed that these waters should be tapped at strategic locations and drained off from depths well below the ground surface. It is felt that the construction of drains using a chain bucket digger capable of excavating to depths of 18 feet would be very suitable in this formation and that 6 or 8 inch tile drains packed with gravel should be laid in the trenches.

The writer has studied the geologic conditions in the area where construction is now in progress as well as in the areas where future extensions of the project will be carried on and believes that a drainage program should be initiated at this time not only to care for the present needs but to insure stability of other areas in the vicinity of the Bevatron building. Toward this end the following suggestions are offered:

- (1) Connect the culvert along Blackberry Creek under the fill near the Warehouse site with the culvert along the creek under the Bevatron area. The bedrock in this open stretch of the creek is soft and contains some open gravel beds. The high velocity of the water from the end of the upper culvert would scour this section and wash the material into the lower culvert, possibly plugging it if boulders and roots were involved. This scouring action would expose the area to saturation which we are attempting to eliminate and would encourage water to percolate around the outside of the culvert under the big fill.
- (2) Carry a 570 foot drain along the upstream side of the Warehouse site to connect with the existing tunnel and spring so as to intercept percolating water from the hill above. This drain would discharge into the top of the culvert at about elevation 775.
- (3) Construct a 575 foot drain along the upper side of the Bevatron area deep enough so that it will pass under the main culvert and continue it around the northern end of the area as deep as it is practical, coming to the surface at about elevation 680 where the drain crosses the creek that flows southwesterly. At this point a temporary diversion should be made that would divert the flow from this ravine as well as that from the suggested drain along the hill slope so as to allow it to discharge back into Blackberry Creek downstream from the end of the main outlet under the fill.
- (4) Construct a 150 foot drain commencing at about elevation 665 that would drain the slope of the hill under the north end of the big fill. This would discharge into the top of the main culvert at about elevation 635.



VICINITY OF SEVATRON  
UNIVERSITY OF CALIFORNIA  
SHOWING  
GENERAL GEOLOGY AND PROPOSED FOUNDATION DRAINS