

MEMORANDUM

TO J. C. Foweraker, Head
Groundwater Section
Hydrology Division

FROM A. P. Kohut,
Geological Engineer,
Groundwater Section

Water Investigations Branch

April 29 1976

SUBJECT W.A. Webster complaint re gravel pit development by
Department of Highways on Metchosin Road at Farhill
Road, Metchosin

OUR FILE 0239013

YOUR FILE

Further to the April 1, 1976 memorandum from the Assistant to the Comptroller of Water Rights on the above subject, a field investigation was carried out April 12, 1976 of the Webster property and surrounding area. Mr. W. A. Webster was contacted to review the situation and several other adjacent landowners concerned primarily with erosion along the sea bank were also interviewed. Air photographs of the region were examined to identify surficial geologic features and a review was conducted of all available geologic reports on the area.

The immediate problem as outlined by Mr. Webster on his property concerns a local area (groundwater seepage zone) which tends to be very wet during the winter months but is dry in the summer months. Mr. Webster has excavated two small ponds in this area and has obtained water licenses on these sources. Mr. Webster contends that prior to excavation of the gravel pit upslope of his property, wet conditions were not a problem on his property and his ponds remained full during the summer months. He suggests that excavation of the gravel pit and the removal of the natural vegetation allows rainfall to infiltrate to the water table very rapidly thereby causing the high water table conditions on his property in the winter. On the other hand, the removal of the potential groundwater storage materials (gravel) and destruction of water retention factors (vegetation and soil cover) has reduced the groundwater recharge in the summer months thereby allowing his ponds to go dry. Other landowners state that the sea cliff appears to be eroding much more rapidly than in the past and they feel this has been caused by excavation of the gravel pit. Although rapid erosion along Mr. Webster's property is not his major concern he feels this is also caused by the same factors discussed above.

Prior to commenting on the validity of Mr. Webster's contentions a brief discussion of the geology and natural groundwater conditions of the area is warranted. The gravel pits west and north of the Webster property occur within the Colwood plain which represents an extensive glacial deposit (raised delta) of coarse sands and gravels (Figure 1). Towards the southeast the plain terminates abruptly along a steep seaward facing cliff up to 240 feet in height (Clapp, 1913). The deposit named the "Colwood sands and gravels" by Clapp (1913) represents a deltaic-fluvial sequence deposited during wasting of the last major ice sheet that covered the area. The sands and gravels are well stratified with a large part of the deposit comprised of delta fore-set beds dipping 15 to 25 degrees towards the southeast (Clapp, 1913). Examination of the sea cliff at various sites near the Webster property reveals the following general succession of deposits from the top of the bank to sea level (Figure 2). The complete section however is not always present along the sea bank.

- Unit 1. 10 feet of brown buff, blocky clayey till with pebbles and boulders
- Unit 2. 40⁺ feet of sand and gravel (Colwood sands and gravels) grading downwards to fine hard silty sand
- Unit 3. 60⁺ feet of very hard gray stony clay with sand lenses.

Springs and seepage zones occur at the contact between the sands of unit 2 and underlying stony clay along the sea cliff and also within low areas on the dissected slopes adjacent to the lagoon south of the Webster property (Figure 1). A major spring occurs within a shallow gully on the Burr property south of the Webster residence with the major portion of the spring heading from the toe of the rising upland towards the west. The local wet area on the Webster property appears to be part of the same groundwater discharge area as the Burr spring but being at a slightly higher elevation is not completely inundated. However, fluctuations of the water table and moisture changes in the zone above the water table may be expected to be more pronounced on the Webster property.

Discharge from the springs located on the sea bank tends to remove much of the fine sand from which the springs originate thereby undermining the cliff. Once undermining proceeds, support of the overlying materials is reduced facilitating large sections of the cliff to slump and slough out to sea. Aerial photographs taken in 1954 (Figure 1) prior to excavation of the Highways pit indicate this type of condition has existed in the past. From these photographs it would appear that this erosion is advancing southeasterly along the bank. (see slide scar, Figure 1). Where erosion has taken place in the past it appears that the bank is relatively stable at these locations possibly because the slide material has covered former discharge areas.

Geologic conditions in the area indicate that probably shallow groundwater movement is directed through the Colwood sands and gravels from the northwest to the southeast. In addition, stratification of the deposits with dips toward the southeast favour a preferred groundwater movement in this direction. It would seem probable therefore that rainfall falling within the pits upslope of the Webster property may contribute to discharge flow of the springs downslope. Considering the relative size of the pits in relationship to the area downslope being approximately equal, any mounding of the water table beneath the pits may result in higher water table conditions downslope. Other factors however could give rise to higher water table conditions on the Webster property. These include:

- (a) removal of vegetation on building lots upslope of the Webster property
- (b) the net importation of water to the area; none of the residents utilize wells as water is piped in
- (c) the use of septic tanks for sewage disposal etc., the tile field for example at the Webster residence is located immediately above the wet area on his property
- (d) construction of access roads on building lots; a road for example which impedes drainage has been built across the discharge area between the Webster and Burr properties

With any increase in the height of the water table, seepage along the sea bank would be expected to increase thereby accelerating the erosion rates along the coast.

In summary it would appear that a seasonally higher water table on the Webster property and increased erosion along the sea bank may be related in part to excavation of gravel pits upslope. This however is also compounded by other factors including the removal of vegetation on adjacent building lots, the net importation of water to the area, the use of septic fields and localized construction activities. The relative magnitude of each of these factors cannot be determined without more extensive studies which would involve test drilling, establishment of monitor wells and detailed surveying. Certain steps for example such as the construction of drains and relief wells etc., could be undertaken to improve conditions where the springs are discharging. Erosion along the sea coast however has occurred naturally in the past and will probably continue to be a problem. Due to the fact that several residences are located in the region where natural groundwater conditions exist, certain precautions should be undertaken in any developments within the region upslope to avoid any aggravation of the natural conditions downslope. Planning authorities in the region should be made aware of these conditions so that remedial measures could be undertaken or planned so that development should not adversely affect the downslope residences. Similarly, development along the sea bank and adjacent to the lagoon should be carefully planned and/or regulated to avoid compounding problems in this area.

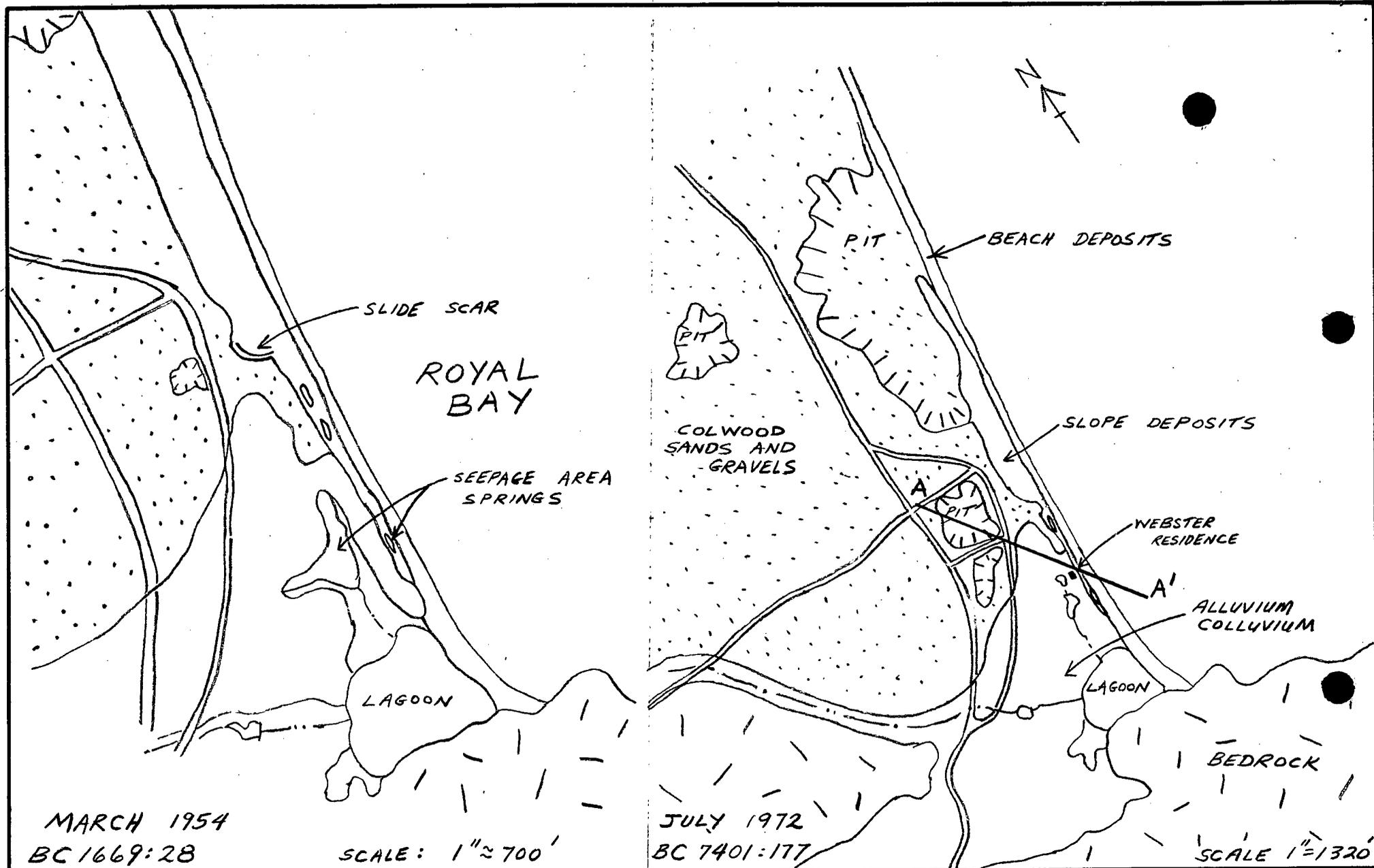
A. P. Kohut

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APK/dmc

REFERENCE:

Clapp, C. H. (1913) Geology of the Victoria and Saanich Map - Areas, Vancouver Island, B.C. Geological Survey of Canada, Memoir 36.



BRITISH COLUMBIA
DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
WATER INVESTIGATIONS BRANCH

TO ACCOMPANY REPORT ON
**GRAVEL PIT DEVELOPMENT
METCHOSIN**

SCALE: VERT. _____
HOR. AS SHOWN

DATE

APRIL 1976

APK ENGINEER

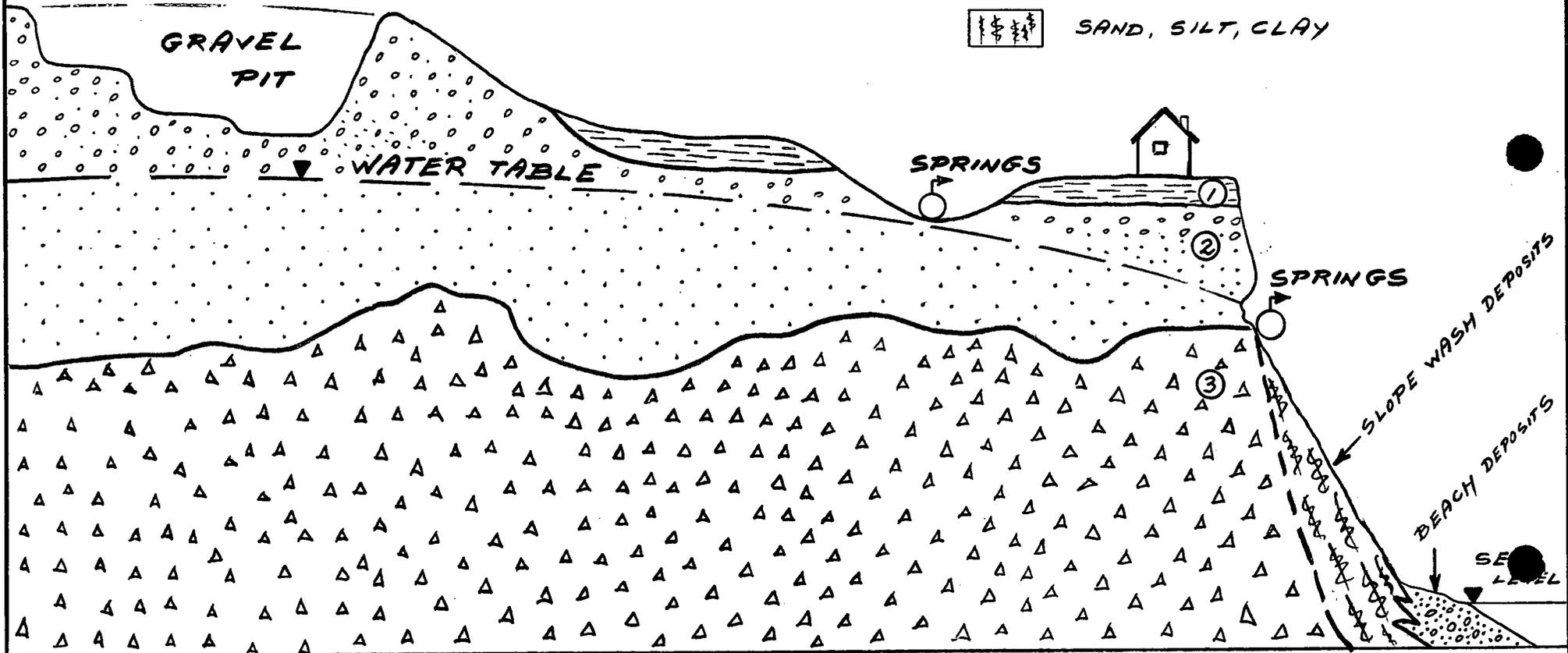
FILE No. 0239013 DWG. No. FIGURE 1

A

LEGEND

A'

- GRAVEL
- SAND
- CLAYEY TILL
- STONEY CLAY TILL
- SAND, SILT, CLAY



GEOLOGICAL CROSS SECTION A A' LOOKING NORTHEAST

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TO ACCOMPANY REPORT ON

GRAVEL PIT DEVELOPMENT
 METCHOSIN

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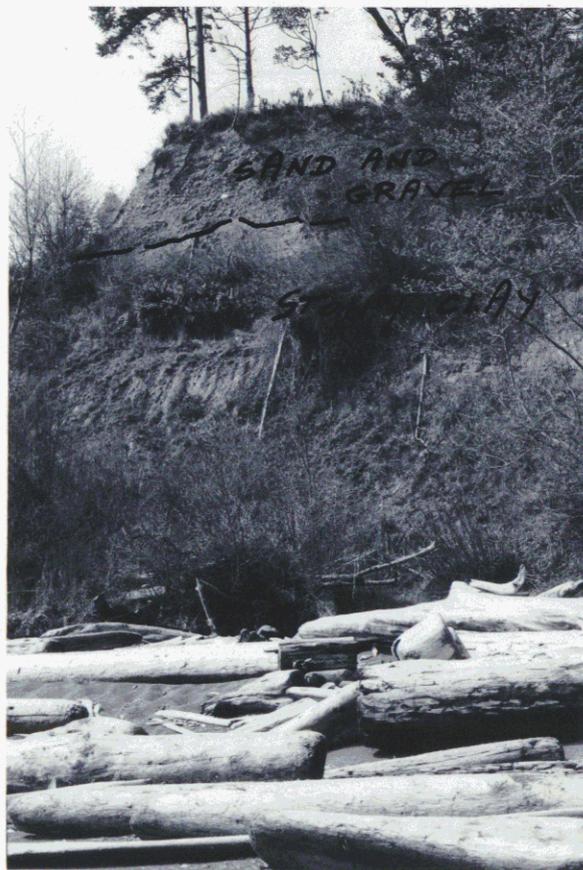
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FILE No. 0239013 DWG. No. FIGURE 2

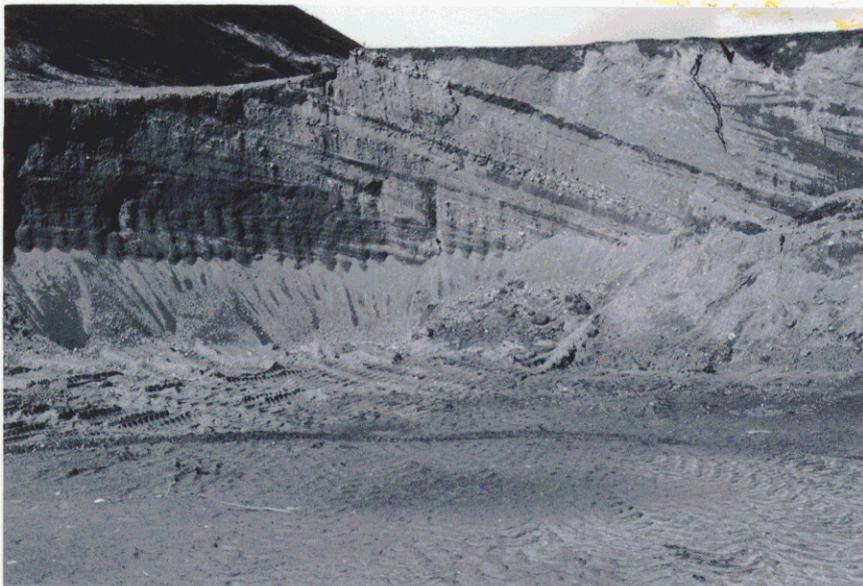


GLACIAL TILL ON BANK
WITH COVERED SECTION
BELOW WEBSTER PROPERTY.



COLWOOD SAND AND GRAVEL
OVERLYING STONY CLAY
BURR PROPERTY.

APRIL 1976
ALBERT HEAD
WEBSTER COMPLAINT
92B/6



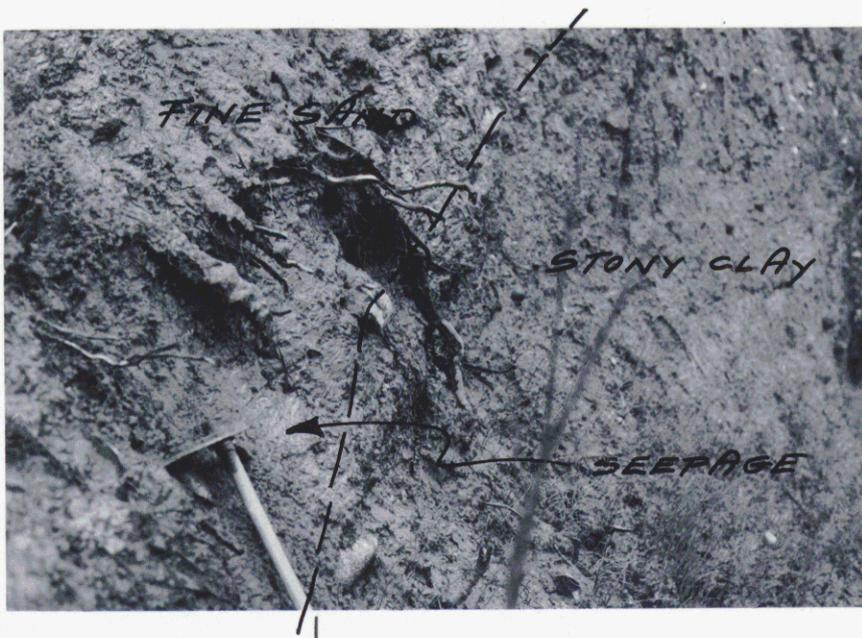
APRIL 1976

ALBERT HEAD

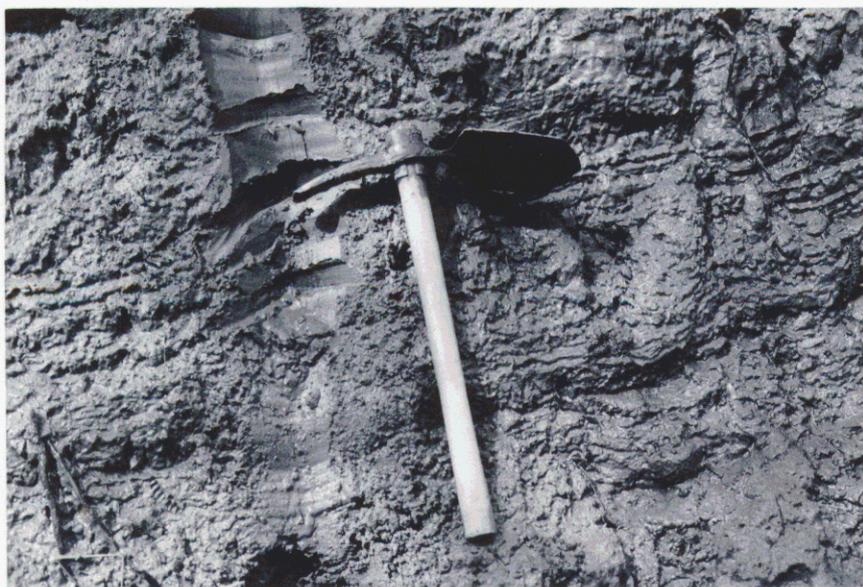
WEBSTER COMPLAINT

92B/6

HIGHWAYS GRAVEL
PIT. COLWOOD SANDS
AND GRAVEL. NOTE
DIP OF SANDS AND
GRAVEL TO S.E.



FINE SAND
OVERLYING HARD
STONY CLAY.
NOTE SEEPAGE
FROM SAND AT
CONTACT.



SEEPAGE FROM
FINE SAND.