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LOWER BRISBANE RIVER

GEOPHYSICAL SURVEY,

QUEENSLAND 1965

by

E.J. POLAK

The information contained in this report has been obtained by the Department of National Development as part of the policy of the Commonwealth Government to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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SUMMARY

The "Sonar-Boomer" seismic system and the seismic refraction method were used to determine the depth and character of the bedrock and overburden in the Lower Brisbane River area. The survey was made at the request of the Coordinator General of Public Works, Queensland.

A reconnaissance traverse from the Victoria Bridge to the mouth of the river revealed several special features such as faults, rock bars, and old valleys. Detailed surveys in three areas revealed the following:

(1) At the site of the proposed new Victoria Bridge, seismic velocities are 11,500 to 13,500 ft/s in the bedrock, which is of Precambrian to Silurian age and is covered by mud, silt, sand, and gravel.

(2) At the proposed Hamilton Crossing, the old river channel is buried beneath 150 ft of alluvium, and is 1000 ft north of the present channel.

(3) At the Swinging Basin, several different beds were detected below the water; it is inferred that expansion of the second bed is responsible for the rising of the dredged floor of the Basin.

1. INTRODUCTION

The Coordinator General for Public Works, Queensland (C.O.G.) is preparing plans for several engineering projects on the lower reaches of Brisbane River. The projects include replacement of the Victoria Bridge, construction of a river crossing (bridge or tunnel) near Hamilton, and reclamation of several areas for industrial sites.

In response to the request from the C.O.G., the Bureau of Mineral Resources, Geology and Geophysics (BMR) made a geophysical survey to determine the depth to bedrock, and the nature of the bedrock and overburden at several sites. The "Sonar-Boomer" seismic method and the seismic refraction method were used. The work was done between 10th May and 21st May 1965, by a party consisting of E.J. Polak, J. Milsom, and A. Radeski and between 7th June and 11th June 1965 by L. Kevi and A. Radeski. Laboratory measurements on cores were made at BMR Laboratory by L. Cookson. Results were computed by E.J. Polak, M. Wainwright, and A.M. Radeski.

It is desired to acknowledge the assistance given by the C.O.G., in providing personnel, a boat, explosives and other services, and doing the topographical surveying. The City of Brisbane Engineering Department assisted by providing drill-hole cores.

As used in this record, the term "bedrock" refers to the deepest refractor with the highest recorded seismic wave velocity. In the "Sonar-Boomer" survey the bedrock represents the first reflecting horizon below mud, gravel, and sand. The term "overburden" refers to soil, mud, gravel, sand, and completely to partly weathered rock *in situ*.

2. GEOLOGY

The geology of the area has been described by Bryan and Jones (1951) and is shown in Plate 2.

West of the area shown in Plate 2, the Brisbane River cuts through rock belonging to the Brisbane Polymetamorphics whose age ranges from Precambrian to Silurian. Three groups of rocks are recognised there: the St Lucia and Hamilton Polymetamorphics and the Neranleigh-Fernvale Group. These constitute the bedrock at the Victoria Bridge site.

Farther downstream, near the Story Bridge, the river cuts through Middle Triassic Brisbane Tuffs and later through Hamilton Polymetamorphics.

In the vicinity of Hamilton wharves, the older rocks dip under Triassic Ipswich Coal Measures. From this point to the mouth of the river the bedrock consists of Ipswich Coal Measures except for a small inlier of Eocene to Oligocene basalt near Lytton. The old bed of the river is buried under Recent Pinkenba Beds.

3. METHODS AND EQUIPMENT

Seismic refraction method

The seismic refraction method, as used in engineering geophysical surveys in Queensland, has been described in many reports (e.g. Polak and Mann, 1959a and 1959b). During the survey for the Hamilton Crossing, geophones were placed in line 25 or 50 ft apart, and shots were fired 25 and 500 ft beyond the end geophones and in line with the geophone spreads. For depth determination the "method of differences" was used (Heiland, 1946). This method allows the true velocity of the longitudinal wave to be established.

A 24-channel refraction seismograph manufactured by South-western Industrial Electronics was used, with T.I.C. land geophones of natural frequency of 20 c/s., or with pressure-geophones adapted for river work.

"Sonar-Boomer" system

This uses the principles of the seismic reflection method. A very short repeating acoustic signal is introduced into the water by a transducer fitted to a boat, and produces a beam of energy (sonar beam) directed towards the bottom of the river. On reaching the bottom of the water, part of the energy is reflected back towards the water surface; the rest penetrates into the rocks. The depth of penetration depends on the strength of the signal and on the acoustic properties of the rocks. At each interface between layers of different acoustical characteristics, part of the sonar beam is reflected upwards and may reach the receiver, which hangs down from the side of the boat. The signals picked up by the receiver are filtered, amplified, and then printed on a moving recording paper. The recorded signals give a cross-section of the underground geological structure with the depth scale distorted. The record contains also any noise picked up by the receiver. The printer is adjusted for a vertical velocity of 4800 ft/s (the velocity in water); therefore the cross-sections must be corrected using velocities characteristic of the separate strata. These velocities may be obtained from

(a) Measurements taken close to existing drill holes. When a drill hole penetrated the bed of thickness d represented on the "Sonar Boomer" cross-section by a thickness h, the velocity V in the bed will be found from the equation

$$V = 4800\ d/h \quad \text{ft/s.}$$

(b) Measurements made on the bank of the river, using a conventional seismic refraction method; this assumes that the geological formation continues from the bank to the river.

(c) Measurements with the "Sonar Boomer" transducer connected to a conventional seismograph.

All three methods were used in the lower Brisbane River survey to determine velocities in the rocks below the river bed.

The instruments used in the "Sonar Boomer" survey consisted of a transmitting transducer model 233 and capacitor bank model 231, with a full output of 1000 watts and used at 1000, 500, and 300W. Both instruments were manufactured by Edgerton, Germeshausen and Grier, Inc., of Boston, Massachusetts. The recording was done with a wet paper recorder manufactured by Alden Impulse Recording Co., of Westboro, Mass.

The equipment was mounted on QGV Pamela a 42-ft ex-army "work-boat" fitted with a Kelvin & Hughes depth-finder and with "Hydrodist" marine position-fixing equipment.

4. TRAVERSE FROM VICTORIA BRIDGE TO MOUTH OF THE RIVER

General

"Sonar Boomer" recordings were taken along parts of the river on four separate occasions. The reasons for making these recordings were:

(1) To become familiar with the "Sonar Boomer" system, which was being used for the first time by the BMR party. Varying geological conditions along the river gave an opportunity to test the gear, to train in its operation, to find how much information can be obtained with this equipment (designed primarily for much deeper work), and to find what modification should be made to the instruments.

(2) To obtain a continuous cross-section from the set of drill holes at the Victoria Bridge and the Hamilton sewer areas, to be used for correlation at the Hamilton crossing.

(3) To test the accuracy of positioning of the boat when repeating lines.

(4) To find any geological subsurface features that could be used in the interpretation of the present survey, or be used as a starting point in any future investigation.

Plate 1 shows the approximate position of the "Sonar Boomer" traverse along the lower Brisbane River. The separate lines of the traverse follow the "sights" between navigation lights. Some modification was required, mostly caused by river traffic, and it was necessary to call at piers to make some adjustments to instruments.

Results

Plate 3 gives the results obtained during the survey in the form of a composite cross- section along the traverse. The numbers on the top of the cross-section indicate the points at which the direction was changed, as shown in Plate 1. Additional identification markers have been inserted to facilitate the location of geological features on plans. The boundaries on the cross-section indicate reflecting horizons; they do not necessarily represent a change from one type of rock to another. The vertical scale is the time scale indicating one-way travel time of the pulse from the transducer to the reflecting horizon.

Along the whole traverse the cross-section indicates a normal sequence of strata. At the bottom of the river is a layer of mud; underneath this mud is a layer of unconsolidated gravel and sand, or a layer of compacted clay. On some locations deeper structures are disclosed. Further details are listed below:

Victoria Bridge to Railways Wharf (1-2)

A bar of rock is indicated downstream of the Milling Company buildings.

Railway Wharves to Police Wharf (2-4)

No additional features revealed.

Police Wharf to Story Bridge (4-5)

Faulted boundary between Neranleigh-Fernvale Group and Brisbane Tuffs near 4.

Story Bridge to Mowbray Park (5-6)

Possible fault near 6.

Mowbray Park to New Farm Park Ferry (6-7)

A rock bar across the river near 6.

New Farm Park Ferry to C.S.R. Wharf (7-9)

A boundary dipping upstream may indicate contact between Brisbane Tuffs and Hamilton Metamorphics.

C.S.R. Wharf to Amoco Jetty (9-10)

Near Bulimba Ferry there is a not very clear indication of a steeply dipping discontinuity.

Amoco Jetty to Game Fishing Jetty (10-11)

A definite bed, probably of compacted clay below the mud layer, appears in this area.

Game Fishing Jetty to Colmslie Wharf (11-12)

There is a clear indication of a fault downthrown to the east. It is probably the boundary between Hamilton Metamorphics and Ipswich Coal Measures.

Colmslie Wharf to Borthwicks Wharf (12-13)

Two uplifts of bedrock are indicated. The indication at the point 13 may have been slightly broadened by the inclination of the equipment during the turn of the boat.

Borthwicks Wharf to Power Station (13-14)

There is a very clear indication of a buried valley cutting the traverse. It is interpreted as the old Doboy Creek channel cutting towards the old Brisbane River (located about 1000 ft farther north and more than 100 ft below the present level). The sharp features of this channel led to the conclusion that the bed below mud in this area consists of compacted clay.

Power Station to Phillips Wharf (14-16)

There is an indication of an uplift near the bulk wheat loader.

Phillips Wharf to Pumping Out Station (16-17)

A fault downthrown to the east is indicated.

Pumping Out Station to Quarantine Jetty (17-18)

The results give a very clear picture of a fault near Pumping Out Station; farther downstream, close to the Quarantine Jetty, a faulted edge of the basalt sill is shown.

Quarantine Jetty to Bulwer Island Lights (18-19)

The basalt sill is clearly shown extending towards the Clara Rock; farther downstream another fault is indicated.

Bulwer Island Lights to Swinging Basin (19-20)

The results indicate that several new beds appear under the layer of mud.

5. VICTORIA BRIDGE

General

To remove the worst traffic bottleneck at Brisbane the City Council proposes to replace the old Victoria Bridge with a new structure placed farther upstream. The Coordinator General's Department is carrying out the investigation and preparing the plans for the bridge.

The bridge (Plate 4) will consist of a six-lane roadway supported on two piers, and a tunnel-underpass, which will take the North Quay to William Street traffic.

Geology

The bedrock in the area (Plate 2) consists of Brisbane Metamorphics of Precambrian to Silurian age (Bryan & Jones, 1950). On the right (south) bank of the bridge, St Lucia Polymetamorphics have been located in outcrops and drill holes; on the left bank, rocks of the Neranleigh-Fernvale Group crop out.

The predominant rock is a mica schist or phyllite; there are also clay schist, quartzite, sandstone, and shale (Richards, 1922). The rocks are mostly fine-grained. They are very strongly deformed; the white quartz veins, which have clearly invaded the rock subsequent to its original deformation, have been involved in a further deformation which has folded and strained them considerably (Bryan & Jones, 1954). The quartz veins are also stained by minute chloritic crystals whose presence results from mechanical forces. The rock is very strong when fresh, but weathers easily - especially the clastic beds, which swell in the presence of water. The rocks are heavily jointed, generally in two directions at right angle to each other and at an angle of 45° to the bedding (Richards, 1922).

The deep valley of the river contains mud, silt, sand, and gravel; each grade is mainly fine, but with some coarse fractions nearer to the bottom. Several drill holes were put down to determine the thickness of the unconsolidated material in the river and on both abutments. The positions of drill holes are shown in Plate 4.

Survey

"Sonar Boomer" lines were placed to cover the area completely (Plate 4). Lines C1 to C6 were placed parallel to the centre line of the proposed bridge, and lines D1 to D10 were located over the two proposed piers. Lines U1 to U3 are parallel to the centre line of the proposed underpass tunnel. All the measurements are relative to the Brisbane City Datum; the river levels were corrected using a water gauge placed under the bridge. Reflections were obtained from several separate beds in the unconsolidated deposits; their interpretation was effected by correlation on special "Sonar Boomer" lines - bore lines B1 and B2. (Line B3 also was run, but did not pass close to any drill holes). To obtain velocities in the bedrock, several measurements were made using the "Sonar Boomer" transducer and the SIE seismic recorder.

Results

Plate 4 shows the arrangement of the geophysical lines, and Plates 5 to 9 show the interpretation of the geophysical results.

Seismic velocities. The seismic velocities may be arranged in two groups corresponding to the following two layers:

(1) Top layer - unconsolidated deposits.
This layer is characterised by a velocity of 5000 ft/s. and was found to be the same wherever measured. This velocity is slightly higher than the velocity in the water. It represents fine material, in non-compacted beds. The same kind of material with the same velocity has been encountered on several surveys, e.g. at Hobart Bridge (Polak & Moss, 1958).

(2) Bottom layer - bedrock.
This layer is characterised by velocities of 11,500 to 13,500 ft/s. Similar velocities in Neranleigh-Fernvale Group rocks were recorded by Mann (1961a).

Depth to bedrock. In Plates 5 to 9 the interpretation of the "Sonar Boomer" lines is shown in the form of cross-sections indicating the thicknesses of different beds of unconsolidated materials. Near the drill holes it was possible to subdivide unconsolidated material into several beds according to the drill hole evidence. Away from the drill holes this process would be subject to some uncertainties, and therefore has not been attempted. The error in depth determination is considered to be less than 10 percent. This estimate is based on comparison of geophysical data with the drill hole evidence.

The properties of the unconsolidated deposits. The logs of the drill holes indicate that the material of the unconsolidated deposits ranges from very fine mud and silt to fine gravel. Uniform seismic velocity extends this evidence to areas away from the drill holes.

The properties of the bedrock. Seismic velocities in the bedrock are shown in Plate 4. The velocities in the bedrock range between 11,500 and

13,500 ft/s. Seismic velocities were determined only in a direction parallel to the flow of the tide, to avoid tangling geophone cables. It has been mentioned before that the joint systems in the "Brisbane Schist" are generally at right angles to each other; therefore it is expected that the velocity measured along one system of joints will be the maximum velocity. The velocity at the Victoria Bridge area was measured along one system of joints.

The dynamic properties of rocks have been determined by the BMR on several past engineering projects, using the longitudinal and transverse velocities. From these measurements Polak (1963) established empirical formulae relating longitudinal seismic velocities to various dynamic properties. Table 1 gives the values of dynamic properties of the bedrock at the Victoria Bridge site, calculated from field determinations in this way.

TABLE 1

Seismic velocity	V_L	(ft/s)	11,500	12,200	13,500
Young's modulus	E	($lb/in^2 \times 10^6$)	4.5	5.1	6.1
$E = 0.76V_L - 4.2$					
Bulk modulus	B	($lb/in^2 \times 10^6$)	3.2	3.5	4.1
$B = 0.46V_L - 2.1$					
Modulus of rigidity	G	($lb/in^2 \times 10^6$)	1.7	1.9	2.3
$G = 0.29V_L - 1.6$					

Laboratory determination

Dynamic properties of the rocks were determined on four core samples obtained from the drill holes in the bridge area and one core sample from the drill hole in the Hamilton sewer. The usual technique (Polak, 1963) was used. Each sample was measured twice: the first time dry (dried for 48 hours at 105°C), the second time wet (48 hours in water, under partial vacuum). The results are given in Table 2.

TABLE 2

Sample number		1	2	3	4	5
Location		Sewer	Bridge	Bridge	Bridge	Bridge
Drill hole number			20	24	28	40
Depth below datum (ft)		165	76	83	74	96
Long. velocity ft/s ($lb/in^2 \times 10^6$)	dry	15,820	15,540	21,800	18,500	15,200
	wet	16,300	15,800	22,000	19,700	15,600
Poisson's ratio	dry	0.35	0.41	0.26	0.23	0.25
	wet	0.42	0.44	0.33	0.33	0.33
Specific gravity	dry	2.72	2.63	2.98	2.94	2.49
	wet	2.74	2.64	2.98	2.94	2.55
Young's modulus ($lb/in^2 \times 10^6$)	dry	5.6	3.8	16.3	11.6	6.4
	wet	4.0	2.9	13.4	10.3	5.2
Percent change		-28.6	-23.6	-17.8	-11.2	-18.7
Bulk modulus ($lb/in^2 \times 10^6$)	dry	6.2	5.0	12.1	7.1	4.3
	wet	6.0	4.4	13.4	10.3	5.2
Percent change		-3.2	-12	+10.7	+ 45	+ 21
Modulus of rigidity ($lb/in^2 \times 10^6$)	dry	2.1	1.4	6.5	4.7	2.6
	wet	1.4	1.0	5.0	3.9	2.0
Percent change		- 33	-28.6	-23	-17	-23

Comparison of data for wet and dry cores indicates that:

(a) Seismic velocities in wet rock tend to be slightly higher than in dry rock.

(b) Poisson's ratio values for wet rock are higher than for dry rock.

(c) Young's modulus for wet rock is on average 20 percent lower than for dry rock.

(d) Bulk modulus is generally higher for wet rock than for dry rock.

(e) Modulus of rigidity is lower for wet rock by an average of 25 percent.

These changes, which are typical for rocks containing clastic material, have to be taken into consideration. Introduction of water into the rocks when piling for piers will change the properties of the rocks.

Onodera (1963) introduced a "coefficient of soundness" of the rock which is expressed as the ratio of the field-determined Young's modulus value to the laboratory-determined value. For the bridge site the soundness coefficient is 5.1/7.2 = 0.7 which according to Onodera represents material "more or less jointed or cracked, but with only slight parting; more or less weathered only on the surface along the parting, but the inner part is fresh and compact, i.e. good foundation rock".

6. HAMILTON CROSSING

General

The increased industrial activities along the lower reaches of the Brisbane River has made a permanent crossing imperative. At present traffic across the river depends on several passenger ferries and vehicular traffic has to use the Story Bridge. The construction of a permanent crossing at Hamilton (Plate 1) is under consideration, but the type of crossing (whether a bridge or tunnel) has not yet been decided.

Geology

At Hamilton (see Plate 2) the Brisbane River cuts an alluvial plain. The banks of the river are very dis-similar. The left (north) bank of the river, occupied by the Royal Queensland Golf Course, is flat and low-lying (maximum 17 ft above sea level), and the alluvium is thick - up to 137 ft, as proved by drill hole No.F3 (Plate 10). Alluvium consists of black mud, sand, and silt, with sand and gravel at the bottom.

The right bank of the river, occupied by several meat works, is higher than the left bank (up to 65 ft above sea level) with several outcrops of sandstone and shale. In other places the rocks are buried under as much as 16 ft of yellow clay and sand (as in drill hole No.R32, Plate 10).

The bedrock under the whole area consists of freshwater shale and sandstone (some coal bearing), with conglomerate and tuff. These beds belong to the Ipswich Coal Measures of Middle Triassic age (Bryan & Jones, 1950).

Methods

In all, 12,300 ft of seismic refraction line was shot, all on the golf course. In addition, 25,000 ft of line was surveyed with the "Sonar Boomer". To determine the seismic velocities in the bedrock below the river, the "Sonar Boomer" transducer was used to produce a record on the SIE seismic recorder.

Cross-sections plotted on "Sonar Boomer" lines are related to the river level existing during the measurement; the measurements were made at the following times, from which the depths below datum can be derived:

Date	Time	Lines
14/5/1965	13.00 - 13.22	J, K, L and M
	14.20 - 14.50	C and H
15/5/1965	13.00 - 13.10	Q, P and O
	13.15 - 13.40	A, B and N

The lines on the golf course are related to the Brisbane City Council datum.

Results

Plate 10 shows the arrangement of the geophysical lines and Plates 11 to 13 give the interpretation of the geophysical results.

Seismic velocities. The seismic velocities may be arranged in three groups, corresponding with the following three layers:

(a) Top layer - This layer with seismic velocity about 1000 ft/s is interpreted as soil, mud, and fill material above the water-table.

(b) 2nd layer - This layer with velocity of about 5000 ft/s is interpreted as alluvium fully saturated with water.

(c) 3rd layer - This layer with seismic velocities of 6500 to 12,500 ft/s is interpreted as bedrock.

Depth to bedrock. The depth to bedrock was calculated using the above velocities. Calculated cross-sections are shown on Plates 11 to 13.

The error in depth determination is considered to be less than ten percent, for lines surveyed with seismic refraction. This estimate is based on experience in other areas with comparable geological conditions.

Properties of alluvium. A constant velocity of 5000 ft/s was recorded in alluvium on seismic refraction lines; it indicates that the alluvium consists of silty mud, fine sand, and gravel. Any increase in the size of gravel particles would increase the velocity. (Hamilton, Shumway, Menard & Shipek, 1956).

Properties of the bedrock. Seismic velocities in the bedrock are shown in Plates 10 to 13. The velocities in the bedrock range between 6500 and 12500 ft/s. These values are quite low, but this was expected since Mann (1961b) recorded rather similar values in similar rocks (slightly younger, Walloon Coal Measures of Jurassic age).

The velocities measured in the river along lines O, P, and Q are very low (with exception of probe No.2). As those velocities were established on spreads which were not shot in reverse directions, it is possible that they represent down-dip velocities. On the other hand it is possible that they represent a bed of compacted clay, especially as some of the "Sonar Boomer" lines show an additional reflecting bed (e.g. line L).

Velocity anisotropy is shown in places where two seismic lines intersect. For example, the seismic velocity along line A is 9000 to 9700 ft/s while along line E it is 10,000 ft/s. It is possible that line E lies at a small angle to the strike. Similar differences were found on other lines.

Conclusions

(a) The old Brisbane River made a wide, deep valley. This valley was filled with alluvium to a depth of about 150 ft (A6).

(b) The present Brisbane River channel is displaced towards the south from the deepest part of the old Brisbane River.

(c) The properties of alluvium are uniform throughout the area; this is indicated by very uniform seismic velocity.

(d) The velocities in the bedrock are quite low, but are rather similar to velocities in similar rocks in other areas.

(e) It is possible that under a part of the river there is a bed of compacted clay.

7. SWINGING BASIN

General

In the mouth of the river, east of Bulwer Island, a wide area has been dredged to a depth of 40 ft. This area, called the "Swinging Basin", enables oil tankers up to 40,000 tons to turn around. During dredging operations a bed of clay was exposed. This clay, now in contact with the sea water, is swelling rapidly, thus limiting the depth of water and requiring continuous dredging operations. The swelling rate is up to one foot per week.

The purpose of the "Sonar Boomer" survey here was to try to provide additional information that might help to solve the problem.

Survey

A set of "Sonar Boomer" recordings was made; positions were fixed by the "Hydrodist" equipment, and a 25-metre grid was run over the entire basin area. Depth recordings were made with the Kelvin & Hughes depth finder on all of the grid lines, but the "Sonar Boomer" equipment was used only on some of these lines. The plan of the Swinging Basin is shown in Plate 14.

Results

The results of the "Sonar Boomer" recording are shown in Plate 15, and they indicate several layers. The top layer has a very uneven surface, but it seems to be horizontally bedded. The "thickness" of this bed is about two milliseconds. It is underlain by a much thicker bed (approximately five milliseconds) that shows no lamination. In some places, the boundaries form an inverted triangle; as this shape might result from the expansion of a formation free to move upwards only, it is inferred that this bed is responsible for the lifting of the floor of the basin.

8. CONCLUSIONS AND RECOMMENDATIONS

River traverse

Several geological features were discovered on the line along the river (Plate 3). No attempt has been made to correlate all findings with the known geology.

Victoria Bridge site

On the site of the proposed Victoria Bridge the drill hole information has been extended over the whole area, and no indication of unsuspected features was found.

Hamilton crossing site

The present Brisbane River is located about 1000 ft north of the old channel, which is located under the golf course. The continuation of this channel towards Moreton Bay should be followed by examination of drilling records and possibly by geophysical surveys. If any gravity work is done, all the bench marks and known elevation points in the area up to five miles from the river should be noted on a map. For the "Sonar Boomer" work, the use of an amphibious DUKW vehicle should be considered.

The area east of the Power Station should be examined for any evidence of a buried channel of the old Doboy Creek.

The bar across the river (Plate 3), upstream of Borthwicks wharf, should be further examined.

Swinging Basin

Samples from drill holes in the area should be examined to determine whether the clay has swelling properties, since the lifting of the floor may be only the result of release of pressure.

The possibility of shifting the Swinging Basin north towards the old river channel should be examined.

"Sonar Boomer" equipment

The following improvements to the "Sonar Boomer" should be considered:

(1) Adapt the capacitor bank for quick change of working output.

(2) Remove the cross-feed which occurs in the first 10 milliseconds after the signal is emitted, even when the receiver is disconnected.

(3) Incorporate arrangements for recording the instant of the signal on SIE seismic equipment (shot instant).

(4) Incorporate an external filter for ranges 200 c/s to 2kc/s.

(5) Incorporate two stages for "ON" switch, to avoid burning of recording paper.

9. REFERENCES

BRYAN, W.H. and JONES, O.A. 1950 Contributions to the geology of Brisbane. No.1. Local applications of the standard stratigraphical nomenclature. Proc.Roy.Soc.Qld 61,13-18.

BRYAN, W.H. and JONES, O.A. 1951 Explanatory notes to accompany a geological map of the City of Brisbane. Pap.Dep.Geol.Univ.Qld 3(N.S.), No.13.

BRYAN, W.H. and JONES, O.A. 1954 Contributions to the geology of Brisbane. No.2. The structural history of the Brisbane Metamorphics. Proc.Roy.Soc.Qld 65,25-50.

HAMILTON, E.L., SHUMWAY, G., MENARD, H.W. and SHIPEK, C.J. 1956 Acoustic and Other Physical Properties of Shallow Water Sediments of San Diego. J.Acoust. Soc.Amer. 28,1-19.

HEILAND, C.A. 1946 GEOPHYSICAL EXPLORATION, New York, Prentice Hall.

MANN, P.E. 1961a Logan River 2.3M and 13.5M tidal barrage sites seismic refraction survey, Queensland 1959. Bur.Min.Resour.Aust.Rec. 1961/95.

MANN, P.E. 1961b Albert River 54.5M seismic refraction survey for underground water, Queensland 1959. Bur.Min.Resour.Aust.Rec. 1961/99.

ONODERA, T.F. 1963 Dynamic investigation of foundation rocks in situ. In ROCK MECHAICS (ed. C. Fairhurst). Oxford, Pergamon Press.

POLAK, E.J. 1963 The measurements of, relation between, and factors affecting the properties of rocks. Fourth Aust. and N.Z. Conference on Soil Mechanics and Foundation Engineering, Adelaide 1963.

POLAK, E.J. and MANN, P.E. 1959a A seismic refraction survey at the Moogerah dam site near Kalbar, Queensland. Bur.Min.Resour.Aust. Rec. 1959/62.

POLAK, E.J. and MANN, P.E. 1959b Geophysical survey at the Barron Falls Hydro-Electric Scheme, Kuranda, near Cairns. Queensland. Bur.Min.Resour.Aust.Rec. 1959/93.

POLAK, E.J. and MOSS, F.J. 1958 Preliminary report on the seismic survey of the Derwent bridge site, Hobart, Tasmania. Bur.Min.Resour.Aust.Rec. 1958/42.

RICHARDS, H.C. 1922 A study of the Brisbane Schists from the point of view of the engineer. spec. Pap.Inst.Engrs. Aust., Brisbane Div.

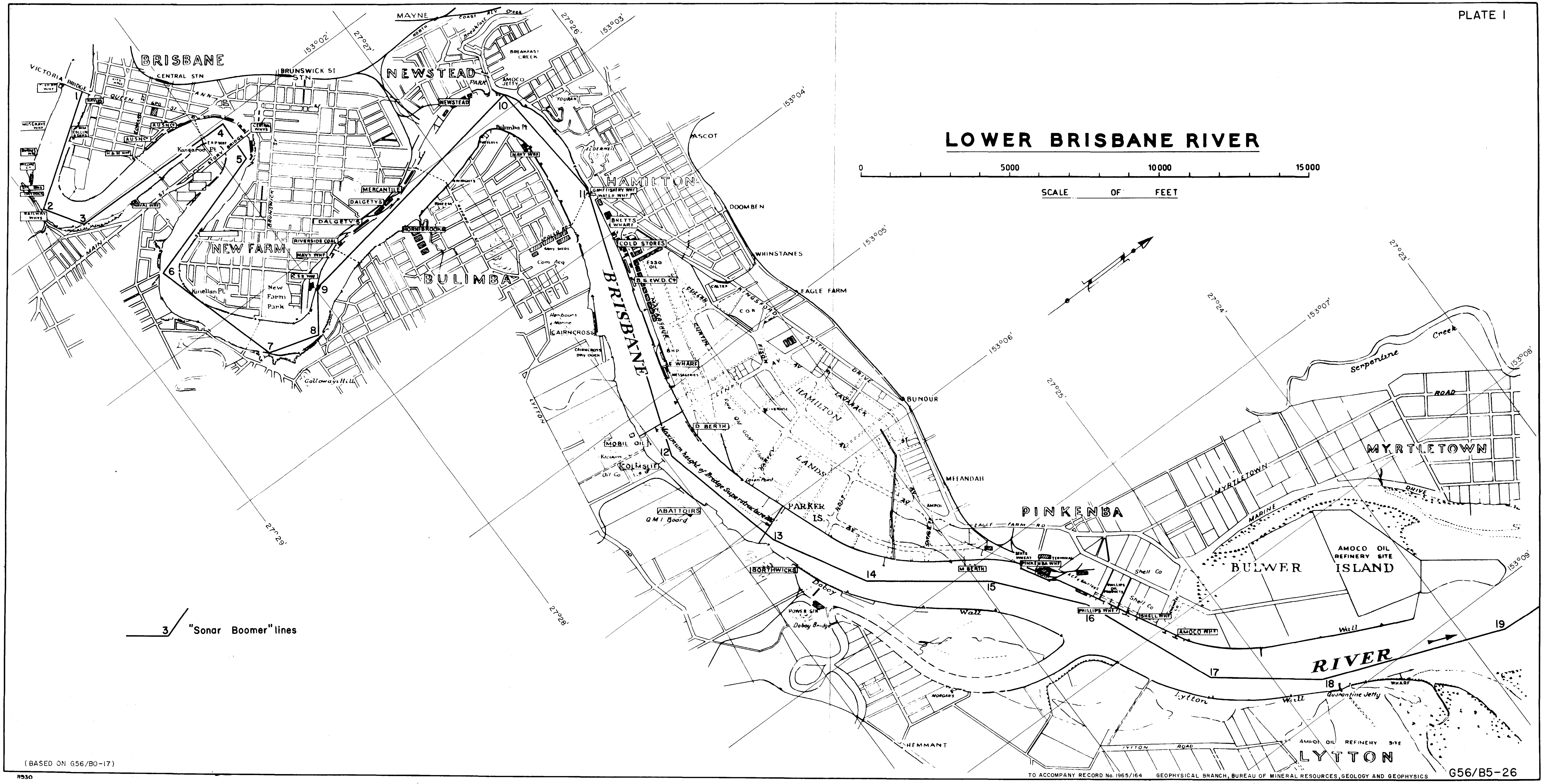


PLATE I
LOWER BRISBANE RIVER
0 5000 10000 15000
SCALE OF FEET
"Sonar Boomer" lines
BRISBANE
NEW FARM
BULIMBA
NEWSTEAD
HAMILTON
ASCOT
DOOMBEN
WHINSTANES
EAGLE FARM
BUNOUR
MEEANDAH
PINKENBA
MYRTLETOWN
BULWER ISLAND
AMOCO OIL REFINERY SITE
HEMMANT
LYTTON
AMPOL OIL REFINERY SITE
BRISBANE
RIVER
Serpentine Creek
Maximum height of Bridge Superstructure
PARKER IS.
HAMILTON LANDS
VICTORIA BRIDGE
CENTRAL STN
BRUNSWICK ST STN
MAYNE
BREAKFAST CREEK
AMOCO JETTY
Kangaroo Pt
Bulimba Pt
Kinellan Pt
New Farm Park
Galloways Hill
MOBIL OIL
COLMSLIE
ABATTOIRS
Q.M.I. Board
BORTHWICKS
Doboy
Doboy Bridge
POWER STN
Wall
Lytton Wall
Quarantine Jetty
LYTTON ROAD
EAGLE FARM RD
MORGAN'S
MERCANTILE
DALGETYS
RIVERSIDE COAL
HORNIBROOK
NAVY WHF
COLD STORES
D BERTH
E WHARF
M BERTH
PINKENBA WHF
PHILLIPS WHF
SHELL WHF
AMOCO WHF
Shell Co
CAIRNCROSS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
153°02' 153°03' 153°04' 153°05' 153°06' 153°07' 153°08' 153°09'
27°21' 27°23' 27°24' 27°25' 27°26' 27°28' 27°29'
(BASED ON G56/B0-17)
TO ACCOMPANY RECORD No. 1965/164 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
G56/B5-26

11930


ROMA ST STN
CENTRAL STN
BRUNSWICK ST STN
MAYNE
VICTORIA BRIDGE
STORY BRIDGE
HENDRA
ASCOT
DOOMBEN
WHINSTANES
EAGLE FARM
BUNOUR
MEEANDAH
HAMILTON
BRISBANE
RIVER
Norman Ck
Serpentine Creek
Boggy Ck
SWINGING BASIN
BULWER ISLAND
FISHERMAN ISLANDS
GIBSON ISLAND
LYTTON
WHYTE ISLAND
DOBOY
Creek
Bulimba
HEMMANT
WYNNUM NORTH
WYNNUM
MN
TN
10° 30'
Fault
RECENT
Pinkenba Beds
EOCENE TO OLIGOCENE
Basalt
JURASSIC
? Bundamba Sandstones
MIDDLE TRIASSIC
Ipswich Coal Measures
Brisbane Tuffs
PERMO-CARB. TO PERMIAN
Indooroopilly
St Lucia
Hamilton Polymetamorphics
Brisbane Metamorphics
PRECAMBRIAN? TO SILURIAN
Neranleigh-Fernvale Group
FEET
2000 1000 0 2000 4000
Geology after W.H.Bryan and O.A.Jones, 1951
BASED ON G56/B0-16
LOWER BRISBANE RIVER
GEOLOGY
TO ACCOMPANY RECORD No. 1965/164
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
G56/B5-13

PLATE 3

LEGEND

(6500) Seismic velocity (ft/s) in formation
U/s Upstream
D/s Downstream

Horizontal 1000 500 0 1000 2000 3000 Feet
Vertical 20 10 0 20 40 60 Milliseconds

"SONAR BOOMER" TRAVERSE
VICTORIA BRIDGE TO MORETON BAY

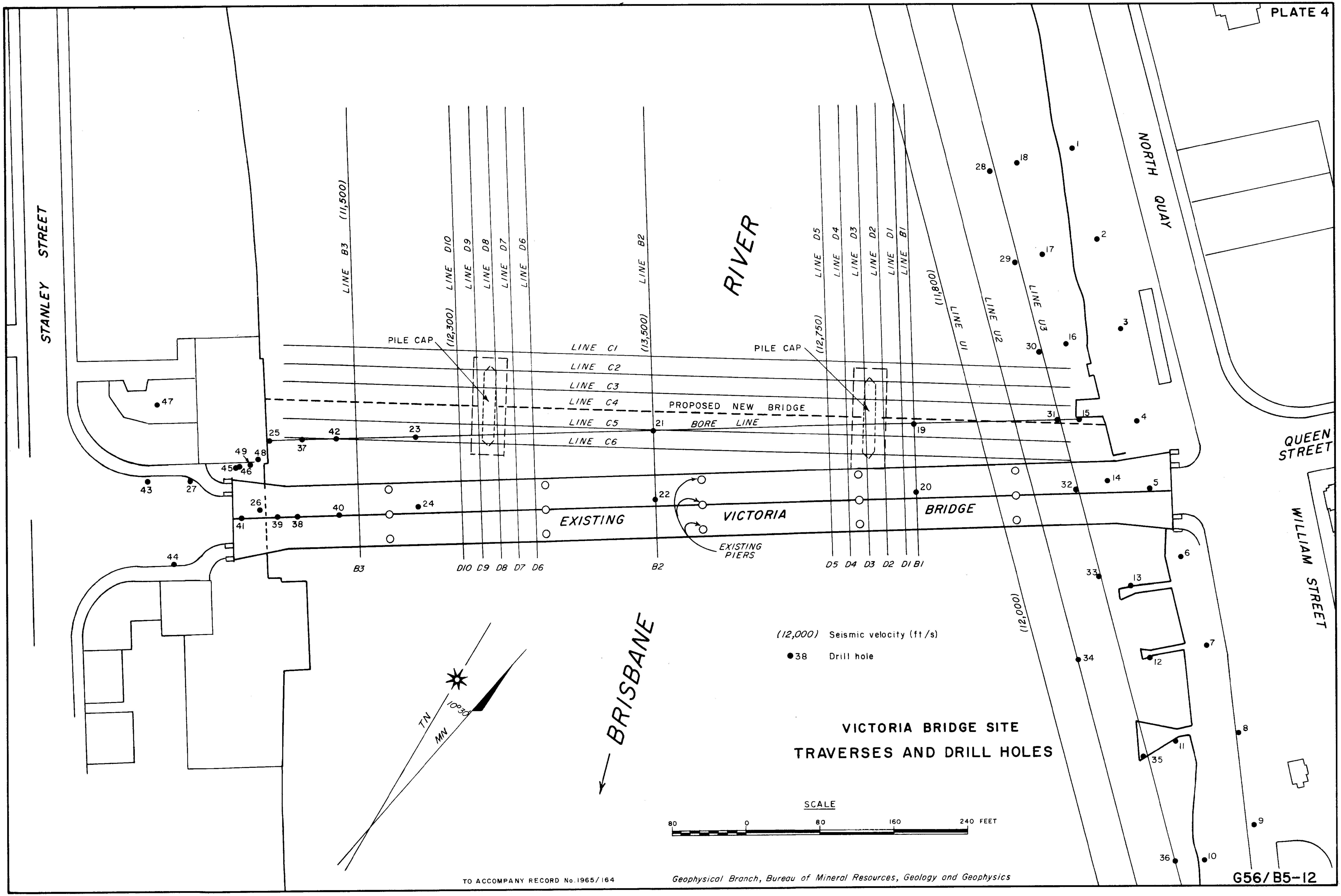
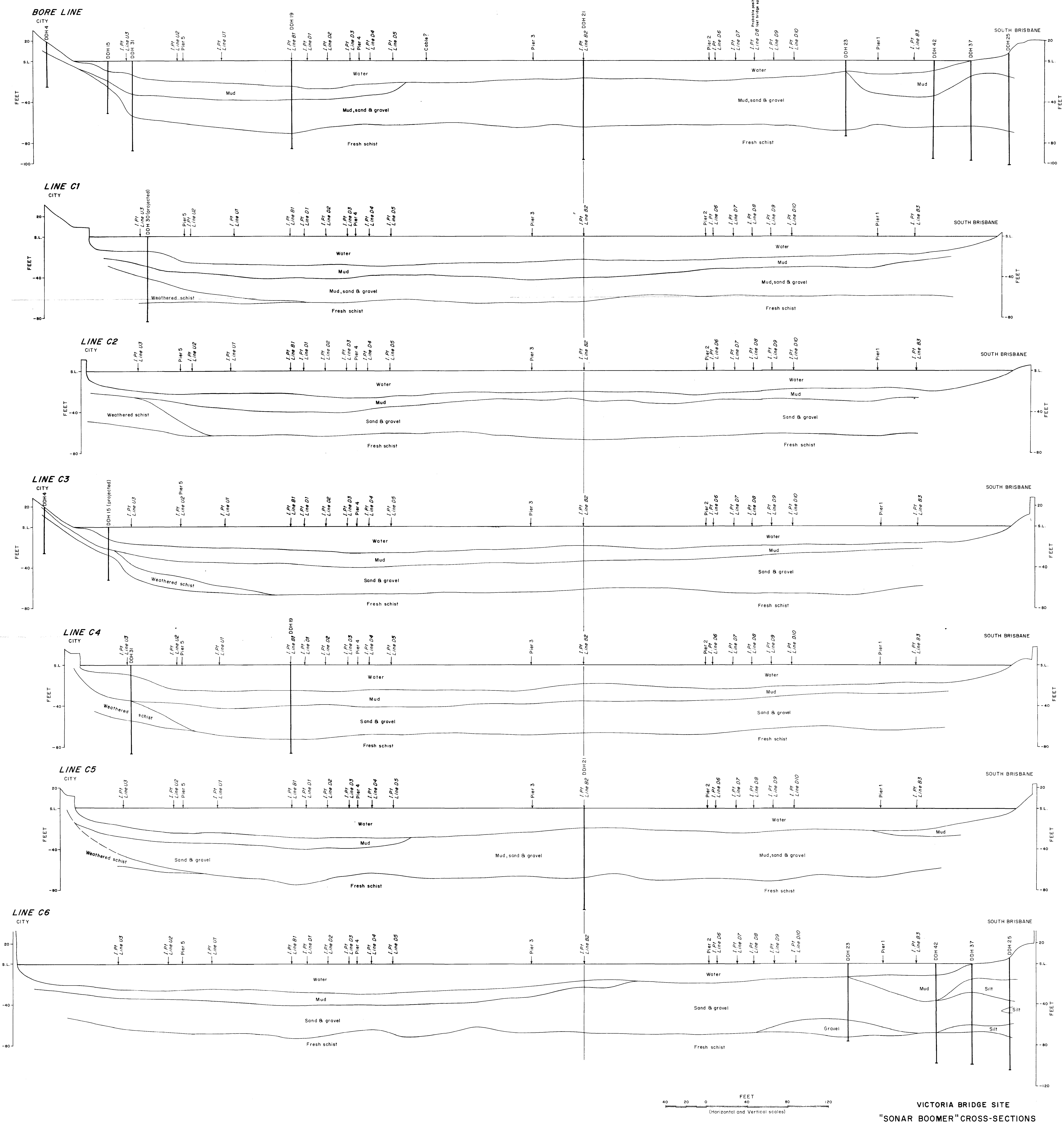


PLATE 4
STANLEY STREET
NORTH QUAY
QUEEN STREET
WILLIAM STREET
RIVER
BRISBANE
LINE B3 (11,500)
LINE D10 (12,300)
LINE D9
LINE D8
LINE D7
LINE D6
LINE B2 (13,500)
LINE D5 (12,750)
LINE D4
LINE D3
LINE D2
LINE D1
LINE B1
LINE U1 (11,800)
LINE U2
LINE U3
(12,000)
LINE C1
LINE C2
LINE C3
LINE C4
LINE C5
LINE C6
PILE CAP
PILE CAP
PROPOSED NEW BRIDGE
BORE LINE
EXISTING VICTORIA BRIDGE
EXISTING PIERS
B3
D10 D9 D8 D7 D6
B2
D5 D4 D3 D2 D1 B1
TN
MN
10°30'
(12,000) Seismic velocity (ft/s)
●38 Drill hole
SCALE
80 0 80 160 240 FEET
VICTORIA BRIDGE SITE
TRAVERSES AND DRILL HOLES
TO ACCOMPANY RECORD No. 1965/164
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics
G56/B5-12
VICTORIA BRIDGE BRISBANE 1965

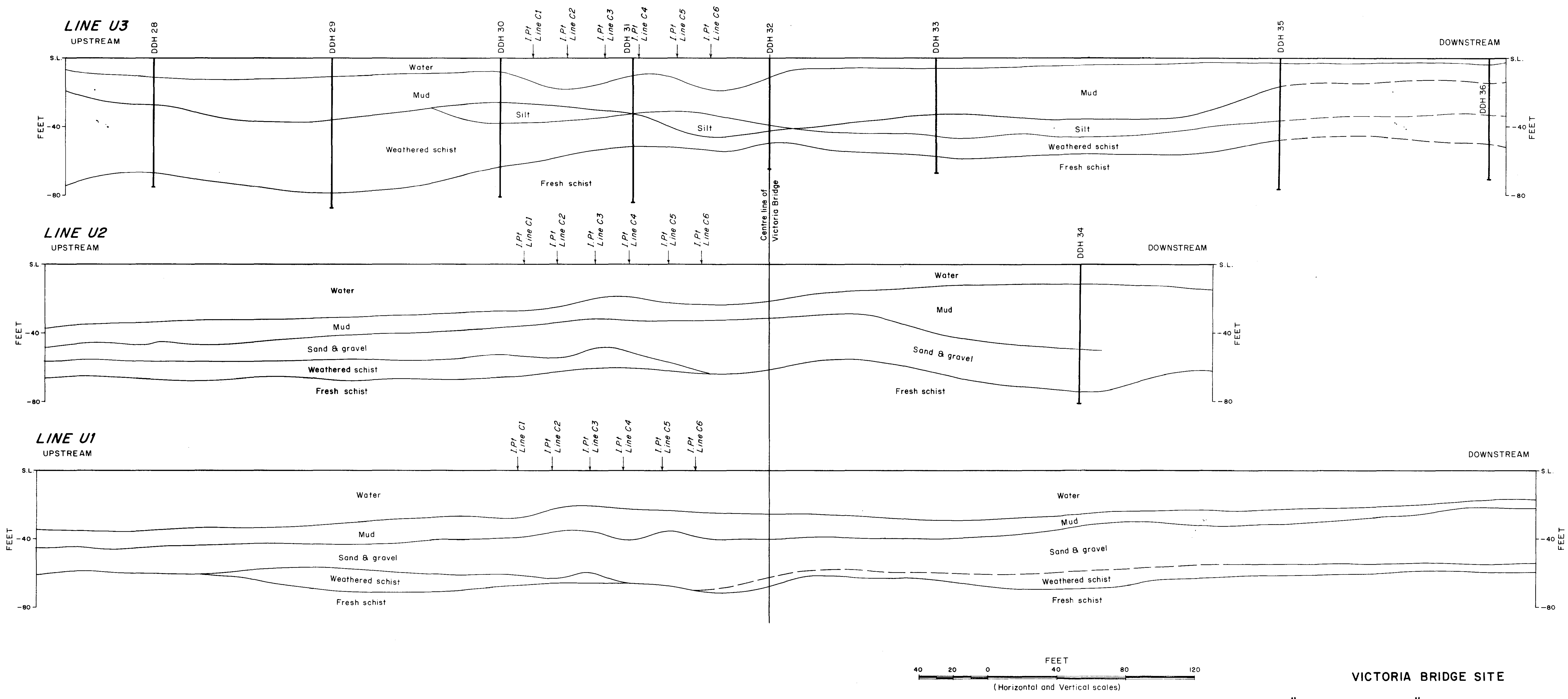
PLATE 5



NOTE: SECTIONS SHOWN LOOKING DOWNSTREAM

VICTORIA BRIDGE SITE
"SONAR BOOMER" CROSS-SECTIONS
BORE LINE AND
LINES C1, C2, C3, C4, C5, C6

TO ACCOMPANY RECORD No 1965/164 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G56/B5-16



VICTORIA BRIDGE SITE

"SONAR BOOMER" CROSS-SECTIONS
LINES U3, U2, U1

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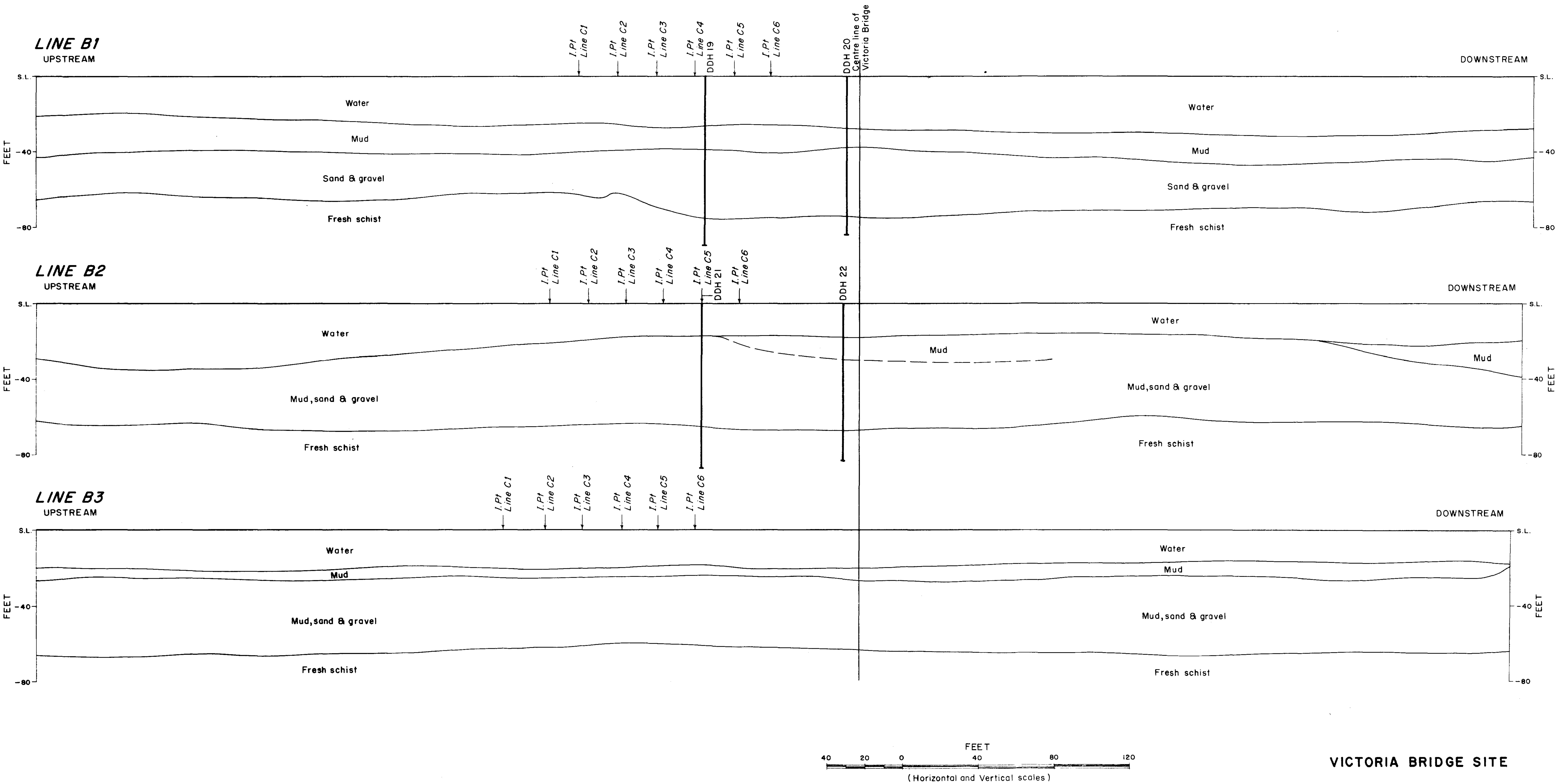
BRISBANE RIVER, QLD, 1965

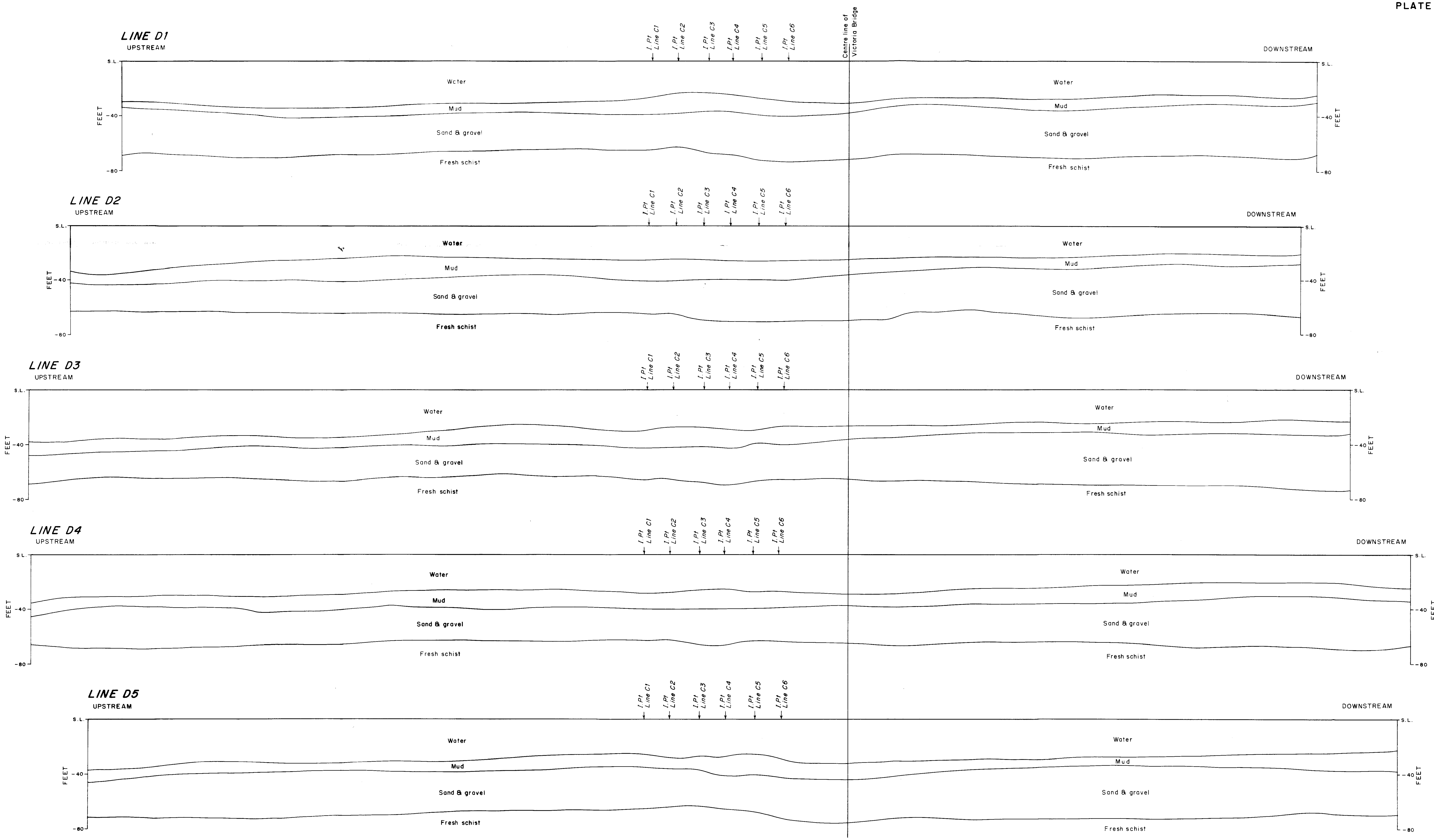


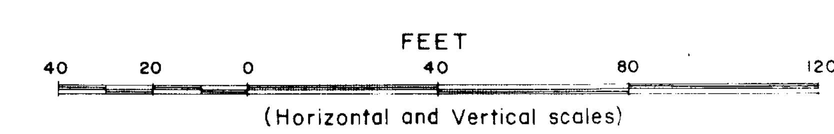
VICTORIA BRIDGE SITE

"SONAR BOOMER" CROSS-SECTIONS LINES B1, B2, B3

TO ACCOMPANY RECORD No. 1965/164 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G56/B5-15

PLATE 8





VICTORIA BRIDGE SITE

"SONAR BOOMER" CROSS-SECTIONS
LINES D1, D2, D3, D4, D5

TO ACCOMPANY RECORD No 1965/164
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
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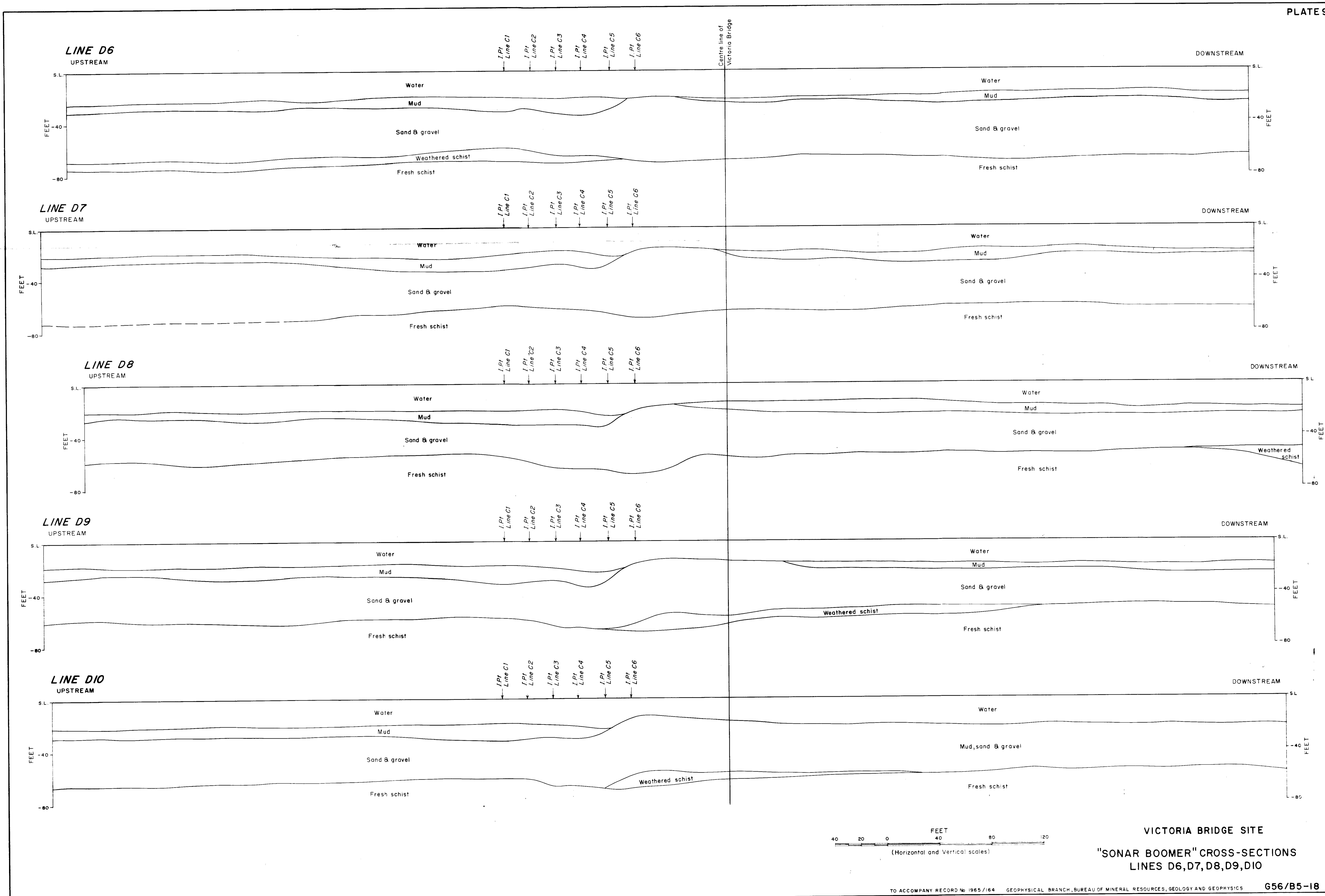
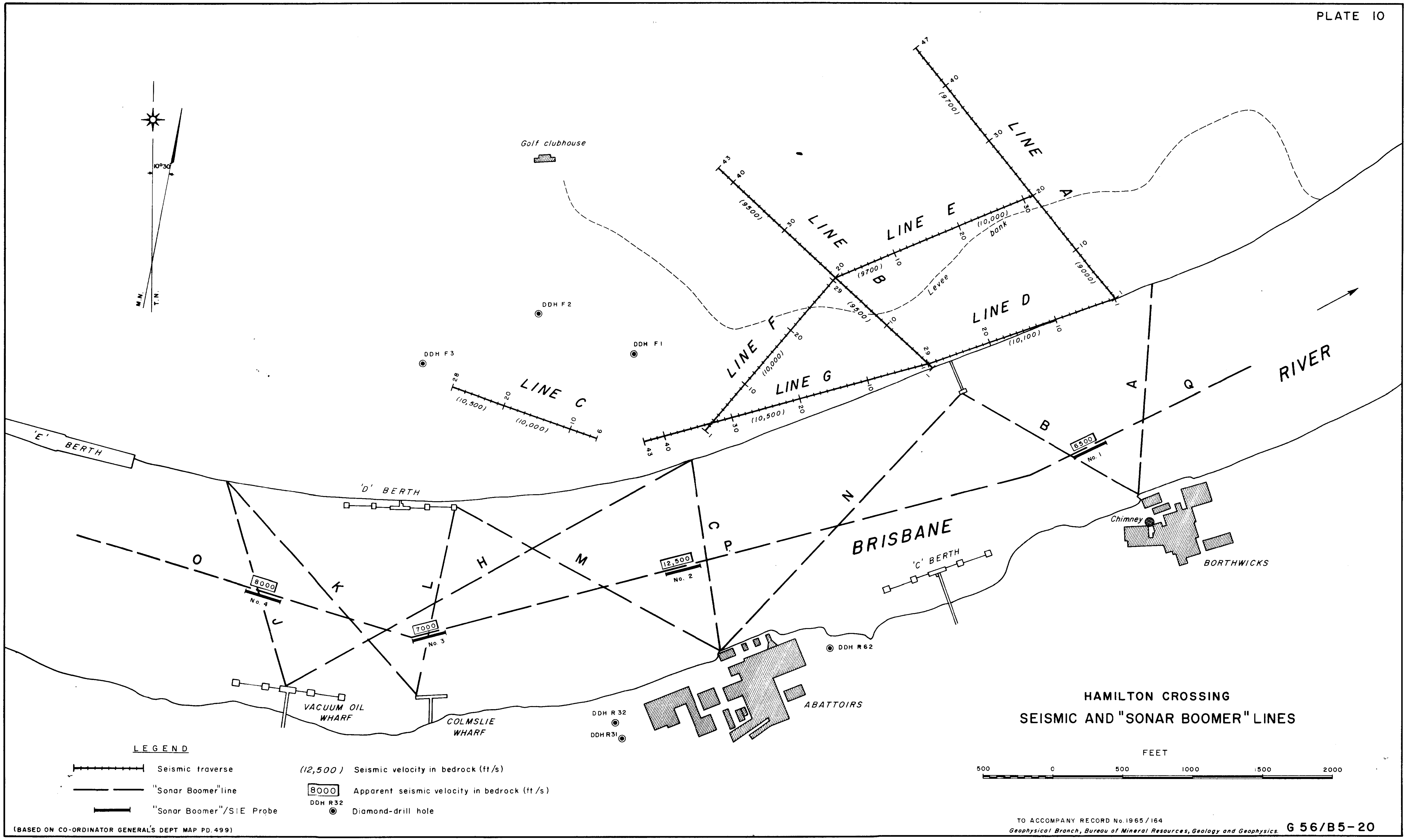


PLATE 9
LINE D6
UPSTREAM
DOWNSTREAM
Centre line of Victoria Bridge
I.P1 Line C1
I.P1 Line C2
I.P1 Line C3
I.P1 Line C4
I.P1 Line C5
I.P1 Line C6
S.L.
FEET
-40
-80
Water
Mud
Sand & gravel
Weathered schist
Fresh schist
LINE D7
UPSTREAM
DOWNSTREAM
Water
Mud
Sand & gravel
Fresh schist
LINE D8
UPSTREAM
DOWNSTREAM
Water
Mud
Sand & gravel
Weathered schist
Fresh schist
LINE D9
UPSTREAM
DOWNSTREAM
Water
Mud
Sand & gravel
Weathered schist
Fresh schist
LINE D10
UPSTREAM
DOWNSTREAM
Water
Mud
Sand & gravel
Mud, sand & gravel
Weathered schist
Fresh schist
FEET
40 20 0 40 80 120
(Horizontal and Vertical scales)
VICTORIA BRIDGE SITE
"SONAR BOOMER" CROSS-SECTIONS
LINES D6, D7, D8, D9, D10
TO ACCOMPANY RECORD No 1965/164 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
G56/B5-18

PLATE 10



HAMILTON CROSSING
SEISMIC AND "SONAR BOOMER" LINES

PLATE II

HAMILTON CROSSING

SEISMIC CROSS-SECTIONS
LINES A,B,C,D,G

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HAMILTON CROSSING
SEISMIC CROSS-SECTIONS, LINES E,F,H,J,K,L

TO ACCOMPANY RECORD No. 1965/164
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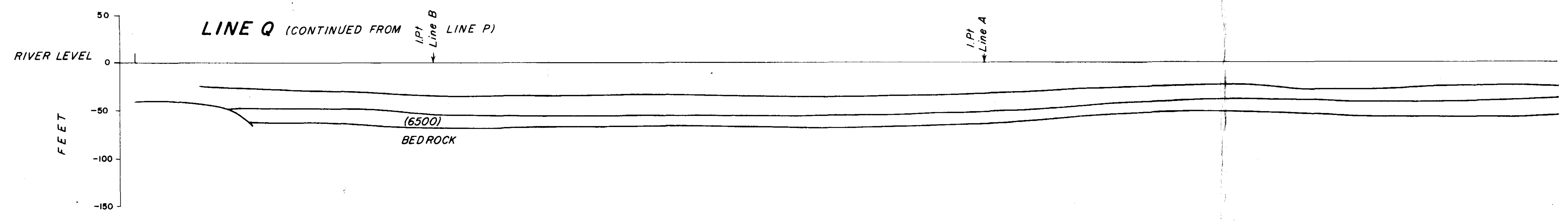
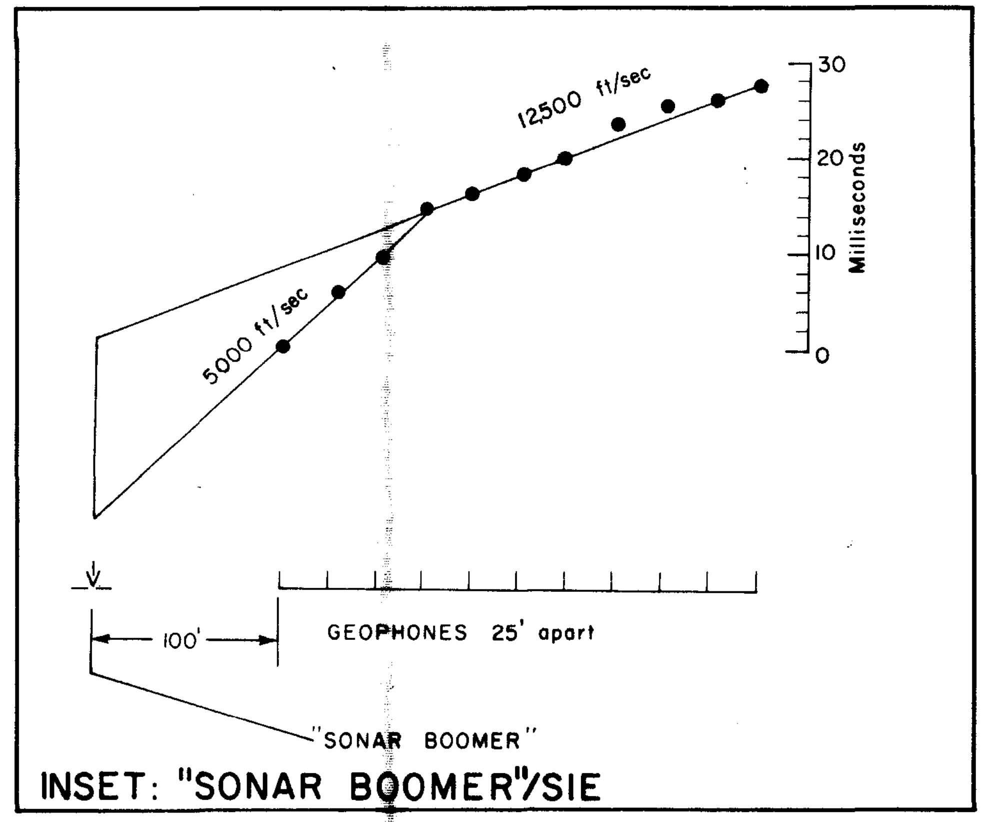
G 56 / B5 - 24

PLATE 13





INSET: "SONAR BOOMER" SIE

LOWER BRISBANE RIVER

GEOPHYSICAL SURVEY 1965

HAMILTON CROSSING

FEET

100 0 100 200 300 400

Horizontal and vertical scales

"SONAR BOOMER" SECTIONS, LINES N, O, P, Q

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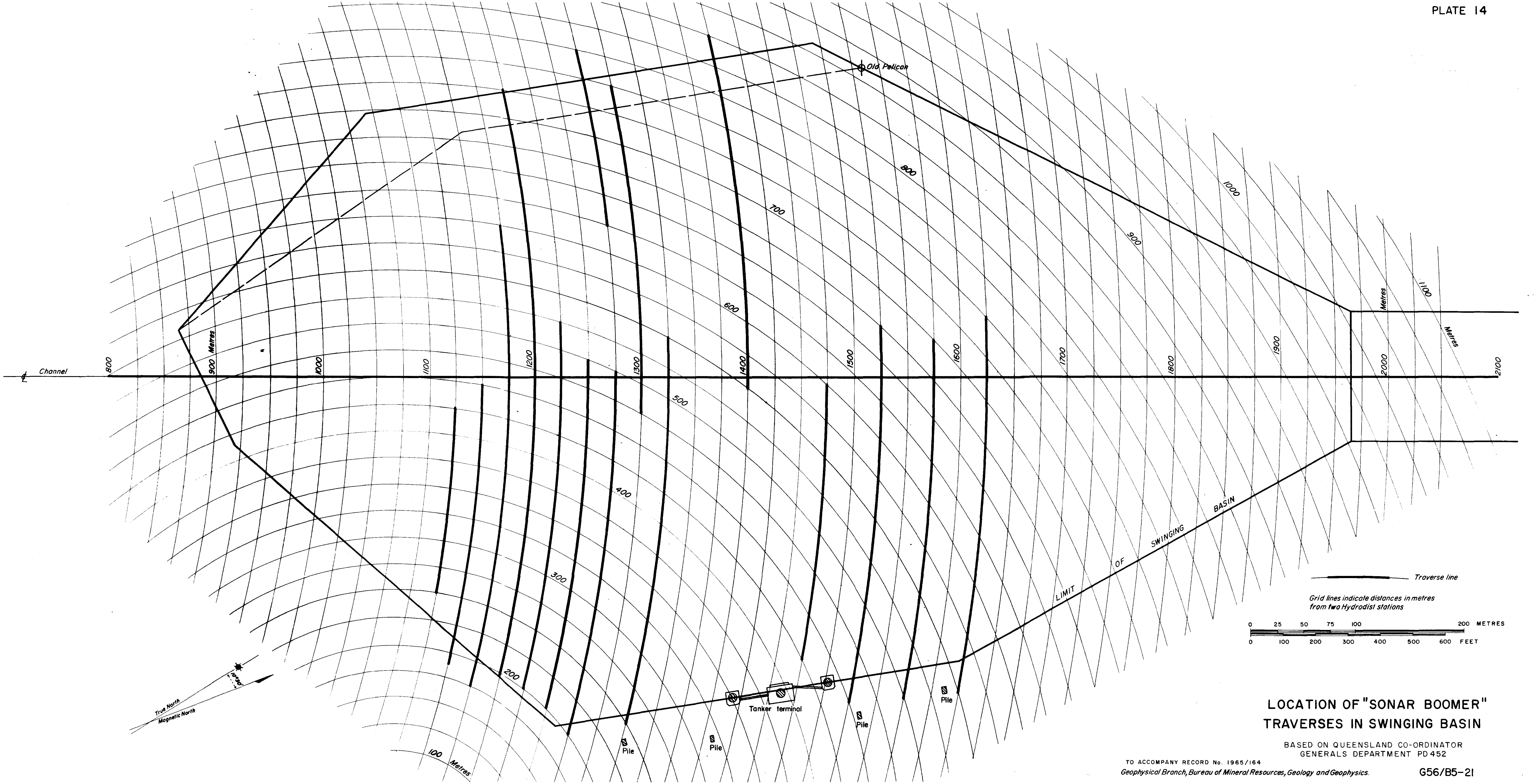
G56/B5-25



LOCATION OF "SONAR BOOMER" TRAVERSES IN SWINGING BASIN

BASED ON QUEENSLAND CO-ORDINATOR GENERALS DEPARTMENT PD 452

TO ACCOMPANY RECORD No. 1965/164

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G56/B5-21


ALL SECTIONS PLOTTED WEST-EAST (EXCEPT CENTRELINE)
PLATE 15
LINE 1125
LINE 1150
LINE 1175
LINE 1200
LINE 1225
LINE 1250
LINE 1275
LINE 1300
LINE 1325
LINE 1400
LINE 1475
LINE 1525
LINE 1575
LINE 1625
CENTRE LINE
CENTRELINE
SOUTH-WEST
NORTH-EAST
WATER
MILLISECONDS
LOWER BRISBANE RIVER
SWINGING BASIN
"SONAR BOOMER LINES"
FEET
METRES
TO ACCOMPANY RECORD No. 1965/164
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G56 / B5-29