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18th December 1962

THE CHAIRMAN AND DIRECTORS
THE PORTSMOUTH AND GOSPORT WATER COMPANY.

Gentlemen,

GEOLOGICAL REPORT ON THE PROPOSED
STORAGE RESERVOIR AT HAVANT THICKET.

Following a preliminary geological assessment of the site I recommended exploration by means of trial boreholes. I collaborated with Mr. S. R. Raffety and Mr. Hall in the preparation of the Tender documents and afterwards supervised, as necessary, the trial borehole programme.

I now have pleasure to report on the results of the trial boreholes, and three diagrams are appended.

I. GENERAL.

1. It is proposed to impound and store water up to an elevation of 120 ft. A.O.D. or preferably 125 ft. A.O.D. at Havant Thicket by means of a dam founded on the London Clay.

2. On the proposed centre line the maximum depth of water would be 50 ft. (or 55 ft. with the higher T.W.L.) and the maximum height of bank can be taken as about 55 ft., (or 60 ft. with the higher T.W.L.).

3. The storage provided would be largely filled by pumping and during dry seasons it is likely that the water level in the reservoir would be rapidly drawn down.

4. The major part of the reservoir basin including the known site of the intended dam lies on the outcrop of the London Clay. The underlying Reading Beds outcrop in the upper reaches of the various small streams which cross the site. The strata dip to the south-south-west at about 1 in 34 or about $1\frac{1}{2}^{\circ}$ (Plan C).

II. THE TRIAL BOREHOLES.

5. A total of 20 trial boreholes were sunk, 9 on the proposed centre line and 11 within or on the margin of the reservoir basin. A total of 85 4" undisturbed samples were taken, 24 being sent to Manchester and 61 to Pre-Piling Survey's laboratory. The testing of selected samples is still in progress, and when completed a separate report on the Soil Mechanics aspect of the scheme will be submitted.

6. The results of the trial boreholes and details of the strata as indicated by the disturbed samples are shown on Diagram A. This diagram is useful for correlation purposes since it is drawn in a NNE/SSW direction, approximately parallel to the true dip, and most of the boreholes have been projected on to the section in their relative positions.

7. The following generalisations regarding the strata can be made :

- (a) Superficial Deposits: Comprising residual soils, stony and silty clays, and, in places, thin alluvial deposits and 'hillwash'. Most of the superficial deposits examined contained a proportion of silty or clayey material although there was some evidence of interbedded coarser and more sandy material.
- (b) London Clay: Essentially grey silty clays having a tendency to lamination, sometimes with thin layers of fine silt between the laminae and with occasional beds of grey clayey silt. The upper part of the London Clay may be weathered to brown and grey mottled silty clays down to depths of about 15 ft. B.G.L. The bottom 2 to 6 ft. of the London Clay often comprises grey silty or sandy strata with or without stones and with some silty clay, or occasionally a silty clay with stones or gravel.
- (c) Reading Beds: Essentially red and grey clays, sometimes silty and occasionally with a subsidiary amount of sandy material (probably in patches or in very thin layers).

8. During drilling, casing was worked down continuously and ground water, where encountered, appeared to seep from the upper part of the hole, or occasionally from silty layers within the Clay. In the deeper holes, however, the basal beds of the London Clay contained free-flowing water under pressure (e.g. Nos. 3, 5 and 6). In No. 3, in the centre of the valley, water rose to 5'6" above ground level and this hole was converted into an observation hole. In No. 5 the water rose to within 17 feet of ground level.

III. THE PRACTICAL IMPLICATIONS OF THE TRIAL BOREHOLE DATA.

9. Generalised sections showing the geological structure of the proposed reservoir basin are shown on Diagram 'B' and Plan 'C' shows the area within which the Reading Beds and the London Clay outcrop.

10. On Plan C, the line A-A represents the outcrop of a plane within the London Clay located 10 ft. above its base. Below this plane are the more permeable basal beds having a thickness of about 2 ft. to 6 ft., and above it are the more impervious beds of the London Clay. Thus north of the line A-A the more pervious basal beds of the London Clay actually outcrop or are only thinly covered by impermeable clay, and south of the line the thickness of impermeable London Clay cover increase in a southerly direction (See Diagram B).

11. The basal beds of the London Clay require special consideration since they outcrop within the floor of the reservoir basin, where impounded water could gain access to them, and since also they outcrop at lower elevations outside the reservoir basin in the valley to the east at a distance of about 1500 yards from the reservoir. The head difference between these points would be about 30 to 40 ft., so that the average gradient would be low, and the amount of seepage probably negligible. Nevertheless this is a factor to be borne in mind.

12. The fact also that the basal beds of the London Clay pass at depth below the embankment, where they contain water under pressure, has to be considered in relation to the stability of the embankment. In order to prevent the development of uplift pressures beneath the downstream portion of the embankment it may be necessary to construct a number of relief wells

and for this purpose a pumping test may be required to assess the permeability of the basal beds and the number of such relief wells.

13. Since, however, much of the banking material will be excavated from within the reservoir basin it should be feasible to remove most of the basal beds and to blanket the newly-exposed edges of these beds with clay. By this means impounded water would be prevented from gaining access to these beds.

14. A full analysis of the London Clay, both as a constructional and a foundation material, is being made, and the results of the tests when completed will be included in the report by Professor Rowe on the Soil Mechanics aspect of the scheme. Although not wishing to anticipate that report, it is apparent that the bank will have to be built mainly of London Clay, and that any sand or gravel required for drainage blankets will have to be imported.

15. The type of construction which would seem to be appropriate for this site is a rolled claycore rather than a puddle clay core. The rolled clay core could be successfully keyed into the London Clay at a relatively shallow depth below the surface over the major portion of the length of the embankment. Any potential seepage around the two extremities of the dam would be obviated by extending the clay core (at reduced width) into the valley sides for a relatively short distance.

IV. CONCLUSIONS SUMMARISED.

16. The proposal to construct a reservoir at Havant Thicket is feasible, and the geology of the site as proved by the trial boreholes is unlikely to present any undue difficulties.

17. If the permeable basal beds of the London Clay which outcrop over the northern part of the reservoir basin are excavated for banking material and the newly-exposed edge of those beds blanketed with clay, there would be no need for a concrete cut-off and the clay core of the embankment could be founded at a relatively shallow depth in the London Clay.

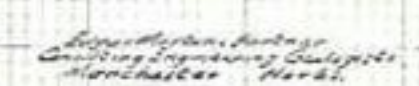
18. A pumping test on a small diameter borehole sunk into the basal beds at the downstream toe of the embankment would be advisable to determine whether or not relief wells are necessary and if so, how many.

I am, Gentlemen,

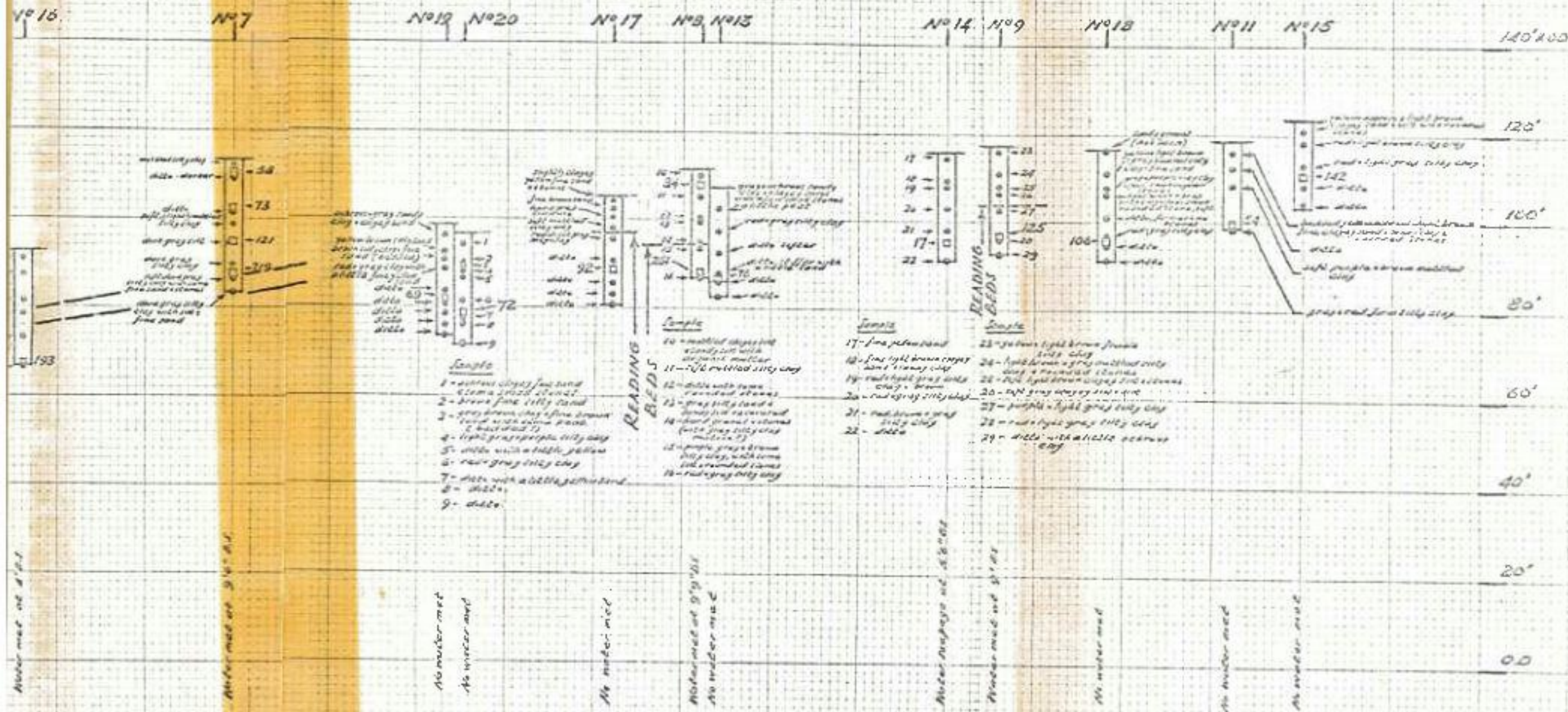
Yours faithfully,

A large black rectangular redaction box covering the signature and name of the sender.

Saccus draca longicauda (opst. n.)



DIAG. 'A'



Upper Merion - Park
Lansing - Lansing
March 1962
JANUARY 1962

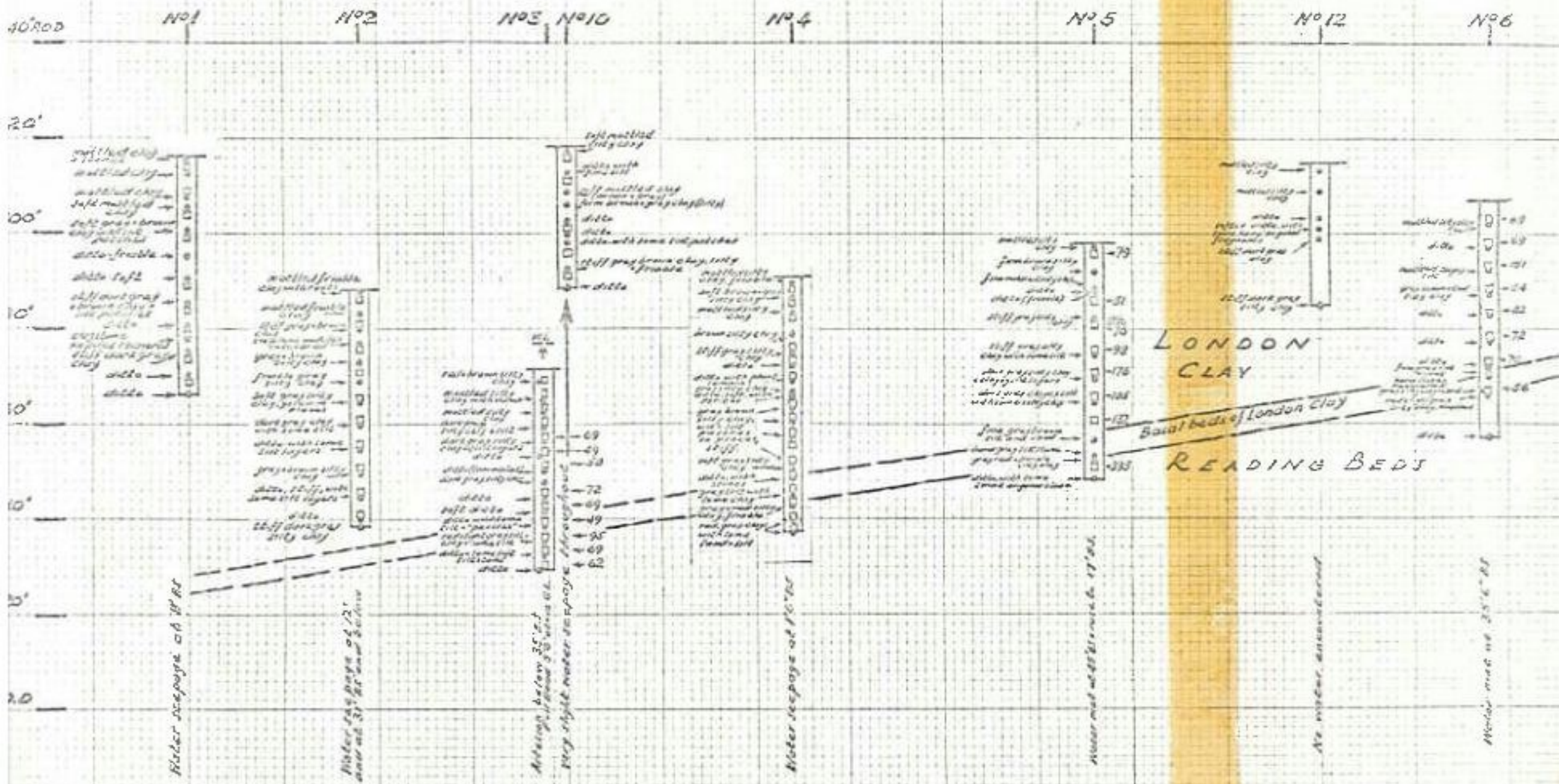
Portsmouth and Gosport Water Harant Thickab ~ Trial Borahole

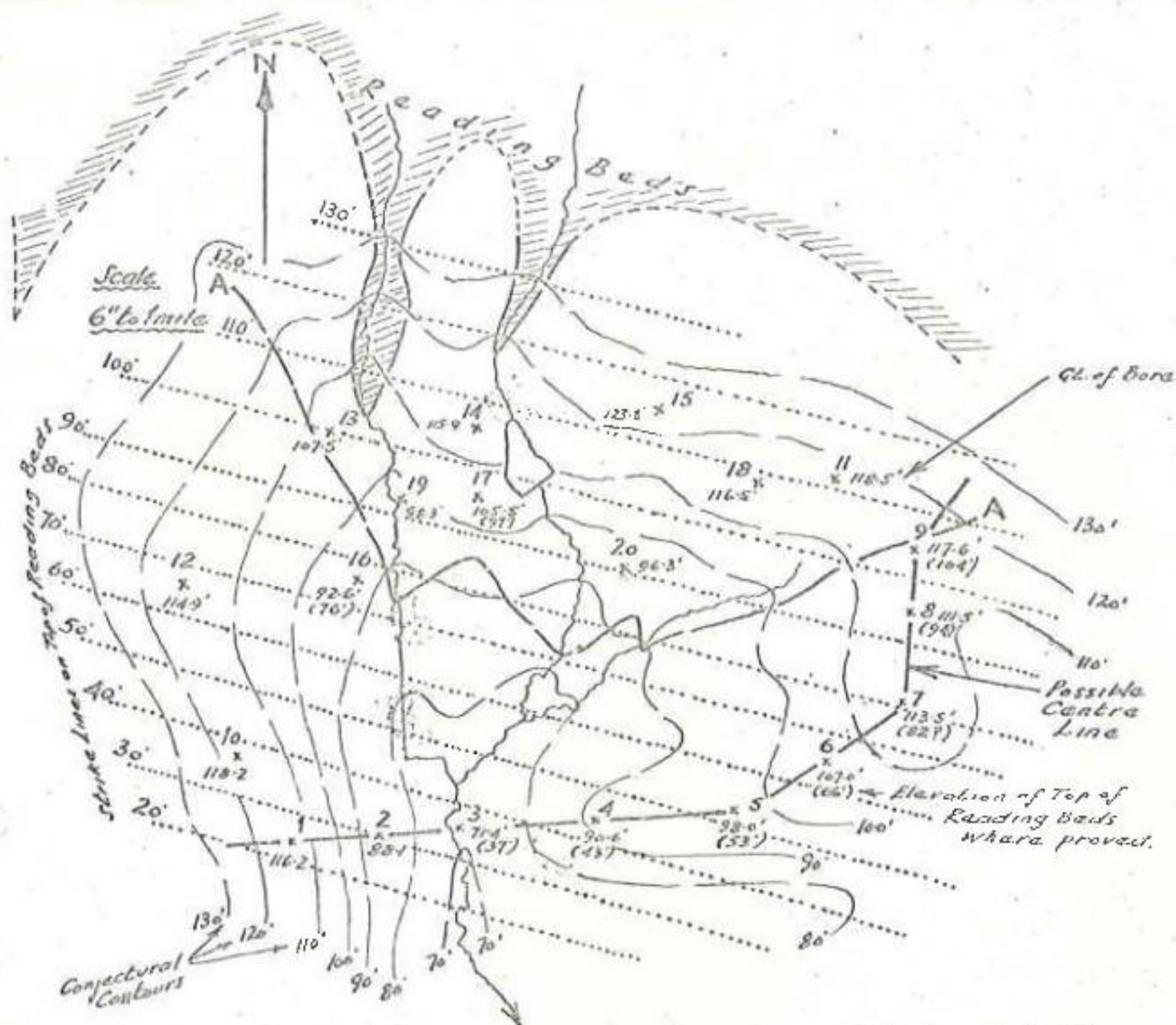
Position of boraholes, projected onto a section
 drawn parallel to direction of True dip

Horizontal Scale ~ 1/1250; Vertical Scale ~ 1/125

Reference

- 122□ - 2" dia. undisturbed samples
 No. of blands required to take
 sample, where known
- - Disturbed Samples
 (retained in jar)





Pertsmouth and Gosport Water Company
- Harant Thicket -

Bygar Morley & Partners
Consulting Engineers & Surveyors
Manchester, Nov '62