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MINERAL RESOURCES SURVEY.

REPORT No. 1945/17 .

(Plan No.1190).

PROSPECTS OF OBTAINING UNDERGROUND WATER AT THE HOG FARM, BLOCK 66, GUNGAHLIN DISTRICT, A.C.T.

By

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I. INTRODUCTION.

A. General:

A geological examination of the Hog Farm and its vicinity in Gungahlin District was undertaken in response to a request from the Property and Survey Branch, Department of the Interior. The object of the survey was to determine the possibilities of obtaining underground water and to indicate any areas considered favourable.

B. Location and Extent of Area Surveyed:

The Hog Farm occupies Block 66 in Gungahlin District, and has an area of 122 acres. The block is situated on the south side of Federal Highway about 4½ miles north from Civic Centre.

It was found necessary to include in the survey a larger area than that of the farm and the total area covered amounts to 260 acres, of which, 120 acres lie to the east and southeast of the farm and 18 acres to the south. Owing to the absence of any obvious favourable features the examination was carried out in greater detail than might otherwise have been necessary.

C. Topography:

The farm is at the foot of the northwestern slope of Mount Majura. The ground slopes to the west and northwest and merges into an alluvial plain. The area surveyed is crossed by three well defined watercourses and two smaller channels. Topographic contours with a vertical interval of 10 feet are shown on the geological plan which accompanies this report. The elevations shown against these contours are referable with close approximation to a bench-mark cut in a tree near the entrance to the farm.

II. GEOLOGY. (See Plate 1).

A. General:

The rocks observed in the area have not been submitted to petrological examination and the ensuing descriptions are to be regarded as appropriate to use in the field and by no means complete.

The following rocks are present –

1. Recent: Alluvium; clay, sand, gravel, soil.
2. Silurian: Slate, limestone, quartzite and alteration products thereof.
3. Intrusive: Porphyry.

B. Description of the Rocks:

1. The alluvium in the eastern portion of the area has a maximum thickness of 10 feet as exposed in portions of the creek channels. These exposed sections show alternating beds of clay, gritty clay and gravel. The gravel beds contain boulders, generally of porphyry, up to 8 inches or more in diameter. The clay has a considerable range in colour from light grey to dark brown.

It is highly probable that the thickness is much greater in the alluvial plains occupying the western portion of the area.

2. In the area under consideration the Palaeozoic sedimentary rocks are more or less calcareous and consist mainly of slates. At the surface the slate is light brown or greyish-brown in colour and fairly soft, but the more calcareous bands are dark grey and comparatively hard. The slate is fine-grained over most of the area but finely gritty bands occur in places.

The limestone is represented by thin beds of dense crystalline siliceous limestone containing fragments of what appear to be corals and crinoid stems. The thin beds of limestone, whichrange in thickness from less than one to about 4 inches, occur in a zone about 50 feet wide and traceable for 450 feet along the strike. Much of the limestone has been replaced by silica.

The quartzite is a fine-grained, hard rock with the quartz grains cemented with argillaceous material. The rock contains a few flakes of mica. The quartzite overlies the slate to the south of the farm-stead and apparently the junction is conformable. The slate immediately underlying the quartzite contains several narrow gritty bands.

3. The porphyry in its weathered state at the surface is a light coloured massive rock, sometimes stained brown externally. Hand specimens show phenocrysts of quartz, felspar and an altered ferromagnesian mineral, probably chloritized biotite. The groundmass is finely crystalline and highly felspathic. The quartz phenocrysts a are much corroded. Field relations show that the rock is intrusive into the sediments and not interbedded.

C. Structure:

The textural and structural features of rocks and the general geological structure of an area have a profound influence on the occurrence of underground water.

1. The Recent alluvium is unconsolidated material and lies on the bedrock in nearly horizontal sheets which dip gently in the direction of the topographic slope. There are no joints or faults or similar structural features and bedding planes are not prominent.

Alternations of permeable beds of gravel with relatively impervious clay provide the only structure suitable for the accumulation of water. The beds of gravel are not continuous sheets over wide areas but are lenticular in form and are confined to the heads of alluvial fans and stream channels now buried beneath finer sediments.

2. Structural features displayed by the older sedimentary rocks include bedding and joint planes and slaty cleavage.

Bedding of the sedimentary rocks is partly masked by the development of cleavage but bedding planes may be discerned where the usually fine-grained slate contains gritty bands and where thin beds of limestone outcrop.

It is considered that the bedding and joint planes and cleavage are features that are not likely to hold much, if any, water. They would probably play a greater part in limestone or quartzite, bu all the limestone beds that are exposed in the area are very narrow

and dip to the east, that is into the hill. The quartzite on the other hand, dips westerly but has not been found outcropping on or east of the farm.

Strike of the sedimentary beds is generally northerly and ranges from N10°W to N35°E with an average strike of about N20°E. The trend of the cleavage of the slaty rock is slightly more easterly than the strike and probably averages about N30°E. Cleavage planes dip at a high angle from the horizontal.

Prior to the intrusion of porphyry, the rocks had been thrown into a series of symmetrical folds with their axes trending north. The folds appear to be restricted to the portion of the area that lies to the east of the farm, and the sedimentary rocks, where not displaced by porphyry, pass under the farm with a dip of probably 5 to 10 degrees to a little north of west.

The quartzite, at the small exposure south of the farm, has a dip of 6 degrees to the west-northwest. This rock does not display any cleavage but is intersected by joints perpendicular to the bedding and trending about N30°E and N60°W.

In proximity to igneous contacts the slate is intersected by numerous joints trending about N15°W and N50°E. These joints are closely spaced near the contacts and dip at high angles. They cause the rock to break into triangular fragments which commonly are 2 to 6 inches long by 1 or 2 inches thick. As the distance from the contacts increases, the spacing of the joints becomes wider until in some areas they are scarcely noticeable.

3. The porphyry is divided by three sets of joint planes which, intersecting at right angles, divide the rock into rectangular blocks. While the three sets of joints maintain their mutual relationship, the attitude of the joints is not constant over the whole area, but the commonest arrangement is that in which there are two vertical joints striking about north and east respectively and the third joint is horizontal. In the extreme northeast corner of the area mapped the porphyry is sheared. The planes of shearing dip at a high angle and trend north.

4. Faults: Faults were observed in two exposures in stream beds east of the farm. It is probable that faulting is more common in the area but is not detectable because the rocks are obscured by soil and alluvium. The observed faults occur in slate, and strike at N20°E, but are not quite parallel to the strike of the bedding in their vicinity. They are in the limbs of folds to the west of a contact with porphyry, and both dip steeply to the west-northwest, the northern one at 55°, the southern at 80°. As the two examples have so much in common and are approximately on the same strike it is possible that they represent two exposures of the same fault. There is no appreciable crushing or brecciation at either exposure and is not thought that these features are likely to have much effect on the amount of water conducted and stored underground.

III. POSSIBILITIES OF OBTAINING SUPPLIES OF UNDERGROUND WATER.

In the past water has been obtained from a shallow well sunk in the alluvium near the northeast corner of the farm, but on the block adjoining on the east. The yield from this well, never wholly sufficient for the purposes of the farm, is subject to seasonal fluctuations. The question of obtaining from the alluvium a supply better in volume and constancy of yield, by the selection of another well site is worth discussion before proceeding to recommend attempts to tap supplies from a greater depth, but it is improbable that one shallow well would yield a sufficient supply.

A. Water in the Alluvium:

For the purpose of tapping a large and constant supply of water from the alluvium the site of the present well is rather poorly chosen. It could have been located further downstream with probably enhanced chances of success. In that direction at about 1500 feet southwest from the well the thickness of alluvium is probably greater, and though not known, is estimated to be 15 or 20 feet in the deepest places. This area receives water from a much greater catchment area than the vicinity of the existing well, and it is likely that the dip of the gravels is less than near the well where the westerly to southwesterly dip of the alluvium would allow drainage of water from the area round the well to the flatter ground within the farm.

To underground water entering the farm from the northeast is added the drainage of the well-defined creek which floods out near the centre of the eastern boundary. The resulting total water is confined between areas of bedrock at a higher level on the southern and northern sides, namely that along the entrance road and near the northeastern corner of the farm respectively. In view of the foregoing it is recommended that shallow holes should be sunk through the alluvium in the area which is indicated on the accompanying plan. Four tentative sites for testing are shown marked A, B, C and D and it is recommended that Site A be tried first. The order of testing the others will depend on the results of the first test. (The area recommended for testing is a right-angled triangle of 19 acres with nearly equal sides and with its hypotenuse resting along the highway for a distance of 1280 feet commencing from a point about 220 feet northeast from the entrance gate).

If attempts to locate sufficient water in the area recommended are not successful, some testing of the alluvial flat which forms the western half of the farm could be carried out. The alluvium is deeper over this area but it does not receive drainage from as large a catchment, and consequently is not regarded as favourably as the area indicated in the preceeding paragraph.

B. Supplies from the Bedrock:

There are no records of any deep bores or wells in the district and consequently there is no definite knowledge regarding the water which may be available in the bedrock and the depth to any such water. It is believed that the depth to the water, where favourable rocks or structures exist, will be 100 to 200 feet.

To obtain an adequate supply it is necessary for a bore when reaching water level to enter porous and permeable rocks or to encounter structural features which permit a relatively free passage of water. The desirable structural features include openings along joint or bedding planes or faults, and solution cavities in limestone or other similar rocks. It has been pointed out above that these features are poorly developed or absent in the immediate vicinity of the Hog Farm.

The rock types represented among the older rocks are considered separately below from the viewpoint of water supply.

1. The quartzite which outcrops south of the farm, and dips gently to the west, is underlain by slate containing narrow sandy bands in proximity to the base of the quartzite. Both the quartzite and the sandy slate are likely to contain water; the former is well jointed and the latter is porous. It is unfortunate that along the strike in a northerly direction, that is towards the farm, these favourable beds are not present and their place is occupied by porphyry. It is not known whether the quartzite and the closely associated gritty bands in the slate occur within the farm boundaries, but it is possible that one or both lie beneath the alluvium to the north and northwest of the farm buildings and under the area recommended for shallow testing.

If the conditions shown towards the western end of Section B-B' can be assumed to exist in the area west of Section A-A', the

base of the quartzite might be expected to lie at about 100 feet below the surface in the vicinity of the bench-mark near the farm gate. It must be pointed out however, that there is no direct evidence to support the suggestion that conditions on a western prolongation of Section A-A' are similar to those existing south of the farm.

2. The limestone occurs in a calcareous zone only as narrow discontinuous beds which outcrop 1100 feet farther east than the eastern boundary of the farm and dip steeply in an easterly direction. These beds have not been recognised amongst the westerly dipping sedimentary rocks which may pass under the farm.

3. The slate is not regarded as a favourable rock unless special local conditions prevail. Normally the rock is dense and fine-grained and contains very little free space for the passage of water.

Contacts between slate and porphyry afford some chance of water storage as the contact effects include the development of numerous closely spaced joints. In a few places near contacts the slate has undergone alteration which involved the introduction of iron minerals. Weathering of the altered slate results in a mottled rock containing patches of limonite and still retaining traces of its original slaty structure. This rock as exposed at the surface contains an appreciable degree of pore space and can be regarded as more suitable as a potential aquifer than the unaltered slate, provided that its porous nature continues to a suitable depth, and is not merely a result of superficial weathering. The more highly jointed slate may also serve to store water.

4. The porphyry is considered to be the least favourable of the rock types occurring in the area. Water would occur only in joints in it, and a supply could be obtained from any major joints, if they exist and could be found.

IV. CONCLUSION.

In general, water supplies for stock are obtained from surface catchments or very shallow wells. There are no deep wells or bores and for that reason there is little or no information available regarding the occurrence of ground water in the district. It is strongly recommended that a bore or bores should be drilled on the Hog Farm for two purposes - viz. to attempt to secure a supply of water for the farm, and to furnish information for future guidance regarding underground water. Such drilling will have to be done with Government funds.

To make the testing complete it will be necessary to have holes put down in porphyry and in slate. Although it has been stated in this report that neither type of rock is favourable for the occurrence of large volumes of water, this statement does not imply that supplies will not be obtained. The statement must be regarded as a general one based on the rocks present and experience of conditions elsewhere.

Porphyry and slate occupy the greater part of the Australian Capital Territory and, because of shortage of surface water, supplies may have to be sought in these rocks in many places. It is therefore most important that some Governmental testing should be conducted to assist the search for underground water as the search is hampered by lack of information relating to the underground conditions which exist in the Territory.

Prospects of obtaining an adequate supply of water for the Hog Farm (i.e. about 10,000 gals. per diem) from a well in the alluvium are not considered to be good, but it is probable that a better supply than the present one could be obtained from a shallow well northwest of the farm buildings. Water so obtained could be used to augment the supply from the existing well.

Sites recommended for shallow testing are shown on the plan.

The question of a suitable supply from a greater depth in the bedrock depends chiefly upon the presence or otherwise of quartzites and sandy bands in the slates underlying the farm. There is some evidence to indicate that these beds may occur beneath the farm, but their presence cannot be inferred with any certainty. Should they exist, however, the chances of obtaining a supply of water may be regarded as good. If the gritty beds are not encountered in a bore sunk at this site the bore would serve as one of those recommended above to test the slate and porphyry.

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26th Feb., 1945.

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GEOLOGICAL PLAN — OF — BLOCK 66 & VICINITY. GUNGAHLIN DISTRICT A.C.T.

0 200 400 600 800 FT.
REFERENCE
Alluvium: Gravel, Sand, Clay, Soil.
Slate with calcareous bands & ferruginous contact rock (ironstone)
Quartzite
Porphyry
Geological Boundaries: Definite
do do Probable
do do Conjectural
Soil Boundary
Trend of schistosity
Strike & dip of bedding
Fault
M.N.
FEDERAL HIGHWAY
STOCK ROUTE
Area recommended for shallow testing
Probably porphyry at shallow depth
Limonite (ironstone) probably overlying sediments
Approx edge of alluvial plain
Cultivated
Brown soil
Grey soil
To Canberra
Ironstone
66
Dam
Boiler
Garage
House
Tanks
Motor Track
Telephone line
Probably slate at shallow depth
Sand & boulders of porphyry
Light grey clay
Alluvium 10' thick
Alluvium 8' thick
Alluvium 2'
Alluvium 3'
Alluvium 6'
Slate in creek
Quartzite exposed in creek bed
Calcareous bands
Gritty bands
Chert
Ironstone & limestone
Sheared porphyry
Well
Gate
SECTION A - A'
SECTION B - B'
Hor. Scale 0 200' 400'
Vert. Scale 0 100' 200'

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Mineral Resources Survey
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