

TR16-138-147

26. A reconnaissance geological survey of the route of the Bell Bay railway.

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PART 1. LADY NELSON CREEK TO NEAR BELL BAY

At the request of the General Manager of the Tasmanian Government Railways, a reconnaissance geological survey was made of the route of the Bell Bay railway from its junction with the North East Line at Lady Nelson Creek to the point where the route crosses the East Tamar Highway 4 km south of George Town (figs. 43, 44).

The proposed route was indicated by D.K. Lloyd of Maunsell and Partners, the Consulting Engineers.

GEOLOGY AND RELIEF

The eastern flank of the Tamar Valley is formed by hilly, block-faulted, dolerite country which is generally well wooded and is unsuitable for farming. The faults limiting the blocks run sub-parallel with the Tamar and form valleys which, like the Tamar itself, are partially floored by unindurated clays and sands of Tertiary age. The wider parts of these valley floors are in turn covered by a Quaternary alluvium of clay, sand and gravel.

The dolerite is in the form of a sill about 300 m thick which has been faulted and the blocks tilted toward the west; minor cross faults also occur. Triassic sandstones underlie the sill and crop out along the north-east side of the dolerite hills (see 1:63,360 geological sheets 39 Launceston, 31 Pipers River and 30 Beaconsfield).

The geological succession may be summarised as follows:

	metres
Alluvial clay, sand and gravel, here and there in valley floors	0-6
Tertiary clay and sand, except north of Long Reach and south of Rocherlea	<10
Dolerite sill, block faulted and tilted west on Triassic sandstone, dipping about 10°W	300

ENGINEERING GEOLOGY

Two major engineering geological problems exist on the route of the railway from Launceston to Bell Bay.

- (1) The Tertiary clays are of low bearing strength and are subject to landslips throughout the Tamar Valley. This problem is of little importance on the part of the route considered in this report, and will be the subject of a separate investigation.
- (2) The dolerite produces strong landforms and weathers in a manner which is difficult to predict. Since it constitutes the bedrock over three-quarters of the route, cuttings are likely to be expensive. Consideration of this problem will form the bulk of this report.

The dolerite, in the form of an inclined and block-faulted sill, is a hard dense igneous rock emplaced by intrusion into the Triassic sandstone succession. The roof of the intrusion has been removed by erosion and no

trace of it now remains.

The dolerite mass thus uncovered and subsequently faulted has suffered a complex history and the hill slopes which are now seen are also complex. The highest points of the hills at about 300-500 m are often flat and have developed a poor soil cover. The dolerite possesses strong horizontal and columnar jointing originating both from cooling and the subsequent faulting history and at the hill tops the horizontal set is dominant, producing the flat tops.

Erosional unloading has opened the joints toward the margins of the hill tops and rendered them vulnerable to frost and organic weathering. Moving down from the hill tops, the slopes become steeper, the vertical jointing more influential, and the soil cover less developed because of rain-washing. Steep rock slopes and low cliffs are strewn with loose blocks but *in situ* dolerite surfaces are common, and such talus as exists is unstable and easily moved down slope. In this report the whole of the convex part of the slope from the hill tops downwards has been called the cap zone, and is essentially the region where rock is actively being removed. The lower and steeper parts of the cap zone are loaded by the material above and joints are commonly closed. The cap zone may form the uppermost 30-60 m of the hills in this area, and may include small vertical cliffs.

The convex slope of the cap zone passes downward into an even, gentle slope of 5-7° where *in situ* dolerite is still common, but loose blocks which have moved down from above crowd the surface. Soil cover can form on this gentle slope or bench and weathering of *in situ* or loose dolerite is more apparent. The blocks in this zone are smaller and less angular than those in the cap zone.

The origin of the bench is not clear, but it appears to be controlled by horizontal dolerite jointing which may be due to compositional changes in the sill. Geomorphological processes of cliff retreat may also be effective.

Several benches may occur one above the other. An individual bench can often be traced approximately along a contour, and in this lies their significance for this study of a railway route.

The lower parts of the slope and the valley floor have thick soil profiles and may also bear Tertiary sands and clays and Quaternary alluvium. Both these materials are derived mainly from the dolerite, but differ from the dolerite slope deposits in that some extraneous material such as quartz gravels may also be present.

Creek heads form in the cap zone of the slopes and become quite incised, producing sinuous contours. Where the ephemeral creek emerges on to the bench zone however, the incision may be quite slight, but the creek may become more deeply incised again as the edge of the bench is approached. Further down the slopes as stream volume increases the creeks may be very deeply incised (e.g. Symons Creek), but even then when the next lower bench is reached incision again becomes relatively slight.

Local deep weathering of the dolerite is a notorious problem in Tasmania. It is related to the strong vertical jointing, and appears to be controlled by the access of surface water along a preferred joint. This results in a zone following the joint which may be tens of metres deep and may be narrow at the surface by comparison. These areas of localised weathering may be 3 m wide and depths of 35 m are not uncommon in areas of high relief.

Deep weathering over wide areas is also seen but is restricted to areas of relatively flat relief. Surface indications of both widespread and local weathering are few and seismic profiles are necessary in critical situations.

SECTION 1: LADY NELSON CREEK TO SYMONS CREEK

This 5 km section of the route runs from the present North East Line as far as the narrow valley followed by the Tamar highway between Dilston and Mount Direction.

The proposed route leaves the present railway line to cross Lady Nelson Creek at an altitude of 160 m. It climbs over the high flat-topped ridge of dolerite at an altitude of 200 m to reach the narrow valley of the southern headwater tributary of Symons Creek. The route then swings in a wide arc to cross the three major headwater tributaries of Symons Creek and then swings to the north-west descending to 150 m to reach the Tamar Valley near the road to Department of Mines Explosives Magazine at Dilston.

This section is the most rugged part of the route which has deeply incised streams with narrow valleys separated by ridges. This country forms the dolerite mountain block that extends north-west from Rocherlea to Mount Direction and separates Turners Marsh valley from the Tamar Valley.

Dolerite outcrops are frequently encountered and occur along the entire length of the proposed route except where it crosses the ridge top between Symons Creek and Lady Nelson Creek. Large dolerite boulders cover much of the ground surface and are thought to indicate the presence of *in situ* dolerite close to the ground surface.

Even cuttings less than 3 m in depth are likely to encounter solid dolerite as can be seen on the present railway immediately south of Lady Nelson Creek.

An alternative route is proposed which appears to have more gentle gradients and does not appear to require so many deep cuttings. It follows the valley to the west of the proposed route and crosses Symons Creek on a flat area which is thought to separate two fault tilted blocks of dolerite.

Outcrops are so profuse that exploration geophysical work does not appear warranted at this stage. A seismic survey may be required when the construction stage is reached.

The alternative route takes advantage of the gentle grades and flat surface of a bench slope on the dolerite and avoids cuttings in the lower convex slopes of the cap zone.

SECTION 2: SYMONS CREEK TO MOUNT DIRECTION

This section of the proposed route runs in a north-westerly direction along the side of the valley which the Tamar highway follows between the road to the Department of Mines Explosives Magazine and the Mount Direction Post Office. The route then swings to the north around the northern flank of Mount Direction to cross the Turners Marsh-Lilydale-Bangor road junction.

The route follows approximately the 150 m contour and runs on the side of the valley in dolerite outcrop for much of its course. A better route would run along the floor of the valley which is composed of thin Tertiary and/or Quaternary clays and gravels.

The dolerite has frequently very close tight joints and the rock is only superficially weathered. The route appears to follow a rock bench for much of its length with outcrops from 0.5-1.5 m in height which may be up to 10 m² in extent. These bench outcrops often follow the contour and are separated by intervening areas of large dolerite boulders. Dolerite scree is thought to occur in some areas and thin coarse alluvial gravels crop out in such streams as Faheys Creek where the stream crosses from the dolerite on to Tertiary or Quaternary valley sediments.

Some block tilting and rock spalling due to deep weathered zones is also evident in limited areas near the above contact but most of the area followed by the proposed route is thought to be in dolerite outcrop.

The Public Works Department quarries near the proposed route around Mount Direction illustrate the type of outcrop, the thinness of the dolerite talus and limited soil cover of this section. Unweathered hard dolerite occurs on these quarry faces at depths varying from 1-2 m.

It is suggested that the proposed route be re-aligned to run on the valley floor and so avoid numerous small but no doubt expensive cuttings proposed on the present route.

SECTION 3: MOUNT DIRECTION TO EAST ARM ROAD

This 4 km section of the route follows the contours in three wide curves between the 120 and 150 m contour. It follows the lower slopes near the base of the dolerite capped ridge that borders the western margin of the Lower Turners Marsh valley.

This section is less rugged than sections 1 and 2. The Turners Marsh valley is wider than the valley west of Mount Direction. The two valleys are connected by a narrow col through which the Bangor-Lilydale Turners Marsh roads and the proposed railway route pass and which intersect at its summit. The location of this col is probably controlled by a NE-SW cross-fault uplifting the Triassic dolerite contact of the Turners Marsh area against the dolerite of the Mount Direction-Rocherlea block.

Geologically this section of the route is the most complex as the contact between the dolerite overlying Triassic sediments occurs along it and also the contact between dolerite outcrops and overlying Quaternary and Tertiary sediments. In addition large areas of flat angular blocks of dolerite boulders averaging 150 mm across form scree slopes which appear in this region to be of considerable thickness. The rocks of this area are poorly exposed in the region of the railway route and the few exposures are of dolerite. The dolerite forms low bench-like outcrops 0.5-1.2 m in height and the contact between the dolerite and underlying Triassic sediments is not exposed. It can be located approximately within a distance of 6-15 m by the presence of sandy soil and occasional Triassic boulders up to the bench where dolerite crops out. This dolerite contact appears to occur at different benches along this section of the route and this change of the level of the contact is thought to be the result of another NE-SW cross fault occurring approximately one kilometre north of the Bangor-Lilydale-Turners Marsh road junction. North of this suspected fault no further Triassic sandstone boulders were found and sandy soil derived from the Triassic sediments disappears, to be replaced by dolerite scree or heavy brown clay soils with a few dolerite boulders. The clayey rocks are thought to be derived from either deeply weathered dolerite or Tertiary clay sediments underlying Turners Marsh valley.

Because of the difference in the hardness between the dolerite and

Triassic sediments it appears advantageous to keep the railway route on these sediments and below the dolerite contact. The proposed route from the Bangor-Lilydale-Turners Marsh road junction keeps above this contact on its sweeping curve to the west. For geological reasons and to achieve better gradients the proposed route should be lowered some 6-15 m.

For the remainder of the route north of the above fault the contact between the dolerite scree and clay of possible Tertiary age is difficult to locate. Dolerite appears to crop out some 6-9 m below the proposed route on two small spurs north of Mountain Vale farm homestead.

It is possible that this section of the route is also in dolerite. If deep cuttings are envisaged along the proposed route north of Mountain Vale farm boundary some geophysical investigations (seismic and possibly magnetic) will be required followed by trenching and perhaps auger and diamond drilling. Even if no cuttings are envisaged the amount of groundwater seepage occurring in this region may warrant further investigation.

SECTION 4: EAST ARM ROAD TO TAMAR HIGHWAY

The route is close to the 100 m contour but approaching Fourteen Mile Creek it descends to about 80 m and climbs on the other side to 120 m; from here it runs in an almost straight line to the north-west for about 5 km and crosses Tamar Highway near the junction with the road to the woodchips plant (the last 1.2 km of this distance is in Section 5). The route from the 120 m contour to Section 5 is relatively flat and runs along bench zone slopes for most of the way.

All the bedrock in this section is dolerite. From East Arm Road to Fourteen Mile Creek there are no outcrops. The overburden is silty with some gravel. On the mountain slope on the other side of the creek are outcrops of superficially weathered well-jointed dolerite. From here the route descends and crosses a small unnamed creek. This area has no true outcrops and is partly covered with dolerite boulders. From the creek the route climbs up to 120 m and crosses a small spur covered mainly with talus. From here it descends gently to a flat area with some gravel and crosses a small creek at the junction with the alternative route. From this latter creek to Section 5 the route mostly remains close to the 100 m contour. Most of this section is covered with talus which consists of superficially weathered dolerite boulders approximately 150 mm-1 m across. No outcrops could be found here although some probable outcrops about 100 m further up slope indicate near-surface solid rock. The alternative route is fairly flat as far as the highway and there are no outcrops except in the highway cutting which shows very weathered dolerite overlain by 0.6 m of silt. The soil consists of silt with some gravel derived from the dolerite. Close to the junction between the main route and the alternative route is an old quarry with quartz gravel. Much of the gravel has been removed but possibly 200,000 m³ remain.

In this section some seismic geophysical work may be required to find the thickness of the overburden.

SECTION 5: WOODCHIPS PLANT AREA

This section extends from about 1 km south-east of the junction between the Tamar Highway and the woodchips plant road, to the hill north of Williams Creek. This section is the most rugged in the northern part of the rail route. Some hundred metres from the boundary with Section 4 the main route descends from 115 m to 90 m, climbs to 125 m and descends again to 100 m over a distance of less than 730 m. It climbs relatively gently up to a

ridge north-east of the woodchips plant some hundred metres before the crossing with the power line. From this ridge (90 m) it falls steeply to the valley bottom (38 m) where it crosses the power line and Williams Creek and climbs the hill (75 m) on the other side. The alternative route is relatively flat except in two places. It runs down from 60 m to Cummings Creek and up again to 68 m over a distance of 450 m. Near the woodchips plant it descends from 60 m to 22 m.

From the boundary with Section 4 to the highway the route runs almost entirely in slightly weathered well-jointed dolerite and consequently some very deep cuttings will be required. Slightly weathered well-jointed dolerite outcrops along the woodchip road. Where the route crosses the ridge north-east of the woodchips plant cuttings will probably be required in slightly weathered well-jointed dolerite. It is difficult to predict the state of weathering of the dolerite since this varies considerably over short distances. Some of the road cuttings indicate that locally the dolerite may be very weathered. Superficially weathered dolerite crops out in the creek north of the woodchip plant. There are no outcrops between the creek and Section 6. The alternative route is flat and lies adjacent to the power line from the highway to Cummings Creek where it descends steeply. The highway cutting shows very weathered dolerite overlain by 0.6 m of dolerite-derived silt. Dolerite crops out in several places in the creek and on the steep slopes to the north-west. Since this dolerite is only superficially weathered, and not well-jointed cuttings will be expensive. From here to the woodchip plant there are no exposures and the ground is covered with silty soil and dolerite boulders. Geophysical work could be employed in this area to find the depth to bedrock. At the woodchip plant weathered dolerite is exposed.

It appears that the very rugged section of the main route between Section 4 and the road to the woodchip plant can be avoided by moving the railway alignment about 180 m to the south-west.

Geophysical work could be used to find the depth to bedrock from Williams Creek to Section 6 since there are no exposures in this area.

SECTION 6: BIG BAY AREA

This area extends from the hill north of Williams Creek to the dam at Donovans Bay, a distance of about 3 km.

The railway route runs from an altitude of 75 m along a curve down to 45 m and crosses the two small creeks draining into Dirty Bay, climbs up again to 60 m at the crossing of the power line. It then descends to about 15 m at the Big Bay Creek crossing. The route climbs to 45 m opposite Big Bay and remains within 180 m of the power line. After crossing the spur it is almost level to the point at which the power line crosses the Tamar Highway. It follows the 30 m contour between the Tamar Highway and the power line and descends to the dam at 20 m.

The whole route in this section is in dolerite. The first part of this route to the crossing with the power line is covered with thick bush and no outcrops could be seen. Slightly weathered dolerite with irregular jointing crops out at the crossing. From this point to the spur opposite Big Bay are a few possible and probable outcrops of dolerite with a similar appearance to the outcrop at the crossing with the power line. A few probable outcrops of widely jointed superficially weathered dolerite occur at the spur. From this point to the highway/power line crossing, there are hardly any outcrops, and as far as the dam the route runs in well-jointed slightly

weathered dolerite. Judging from the relief and the surface geology the route could probably be shortened and straightened from the southern crossing with the power line to the valley north of the woodchip plant by crossing the spur.

SECTION 7: GOLF COURSE AREA

In Section 7 the railway runs from the dam situated north-west of Donovans Bay, along the golf course and close to the junction between Tamar Highway and the Bell Bay road.

The whole route in this section is level or gently sloping. The steepest climb is about 15 m over a distance of 230 m about a few hundred metres north-west of the dam. Almost the whole area consists of Tertiary sediments except in the southern part past the dam where the route encounters Quaternary sediments. The Tertiary sediments are prone to develop landslips in many places in the Tamar Valley. Where the ground is almost level this is no problem but earth movements could occur in the area past the dam unless the railway is founded on underlying rock. Should this problem arise the railway could easily be re-routed on to dolerite to the north of the present route.

SUMMARY OF RECOMMENDATIONS

Section 1: Alter route to the next valley to the west.

Section 2: Move route downslope onto the valley floor.

Section 3: Move route downslope onto Triassic sandstone.

Three seismic spreads and some magnetometer work would be useful and should be followed by pitting and drilling to determine groundwater conditions.

Section 4: No re-routing is necessary but seismic work would be useful to determine depth to bedrock. Four spreads would be required.

Section 5: Avoid the steep spur by re-routing to the west. Seismic work would be useful to determine the depth to bedrock. Four spreads would be required.

Section 6: Re-route toward the north-east.

Section 7: Re-route to avoid Tertiary sediments near the dam. Test pits would be required if re-routing is undesirable.

PART 2. LADY NELSON CREEK TO ROCHERLEA

W.R. Moore

This section of the proposed route lies between Lady Nelson Creek and Rocherlea where the existing railway is to be re-routed to eliminate the tight curves near Lady Nelson siding. The present railway line runs in a northerly direction along the eastern side of the valley of Cold Water Creek, a major southern tributary of Lady Nelson Creek; it climbs along the flank of Rocherlea Hill and has five cuttings, two of which are 6-10 m high, cut in hard dolerite.

The proposed alignment is about 140 m to the east of the present railway and is higher up the slope of Mount Rocherlea. It appears to require two cuttings over 30 m deep with lengths of 140 m and 600 m and a third at least 15 m deep and 680 m long. These cuttings will have to be excavated in hard unweathered dolerite as were the existing nearby cuttings. Rock drill paths and explosive fracture marks are clearly visible on these existing cuttings and are as close as 1 m apart in certain sections. Explosive fractures are visible even where low banks 0.6-1.2 m high have been trimmed back on the present railway line.

The dolerite on the faces of these cuttings is unweathered except for one zone of deep chemical weathering on the southern half of the long curved cutting. Here a zone of chemical weathering 1-2 m deep occurs along a sub-horizontal joint for about 140 m.

Also of interest was the presence of two small rock falls in these cuttings. Blocks 0.6-1 m² were cleared to the side of the rail at the entrance to the cuttings. The falls had occurred where a joint-bounded block had fallen out from the top of the cutting - probably associated with the heavy rains known to have occurred during the previous week. It should be noted that no drains were seen on top of these present cuttings.

In view of the anticipated hardness of the dolerite here it would appear prudent to keep any re-routing to the minimum and make the maximum use of the present cuttings by widening on the down slope side.

PART 3. RECONNAISSANCE SEISMIC SURVEY OF THE SOUTHERN SECTION OF THE ROUTE

W.R. Moore

Six seismic spreads were fired between Lady Nelson Creek siding and East Arm road. Their location is shown in Figure 45.

Spread 1 was fired across the Explosives Magazine road along the top of a bench of discontinuous outcrops of dolerite. Such a dolerite bench is typical of much of the outcrop pattern between Symons Creek and Mount Direction Post Office. This spread is discussed in detail by Leaman (this publication, article 27, locality 10).

The remaining five spreads were fired in the geologically most complex section of the proposed route between Mount Direction and the East Arm road.

Spreads 2, 3 and 4 were fired in the vicinity of the Mount Direction col where the railway line will pass from the Tamar Valley into the Turners Marsh Valley at the Mount Direction-Bangor-Lilydale-Turners Marsh crossroads. Here it was necessary to try and find the type and hardness of the underlying rocks where there are no exposures below the dolerite contact. The type and hardness of the rock will determine whether the railway line will be designed to cross the road junction by an overpass or by an underpass.

Spread 5 was fired near the proposed rail route 600 m north of the col on a low flat spur covered with sandy soil and a few sandstone and dolerite boulders. This area was thought to be underlain by sandstone of Triassic age when the route was geologically mapped (see Part 1 of this report). A series of auger holes had been drilled at this locality by Maunsell and Partners: these gave some lithological control to the seismic interpretation.

Spread 6 was fired along the route immediately below the Mountain Vale Farm homestead where large flat blocks of dolerite occur in a clayey soil. It was difficult from surface mapping to decide if these blocks were *in situ*.

GEOPHYSICAL INTERPRETATION

Spread 2 was fired in a N-S direction 15 m south of the crossroads and showed a surface layer with a seismic velocity of 915-1,220 m/s and a second layer with a seismic velocity of 2,440-3,050 m/s. The depth to the interface separating the two layers was calculated as 23-29 m.

Cross-spread 3 was fired parallel with the Mount Direction-Bangor-Lilydale road. It showed a surface layer with a seismic velocity of 915 m/s and a second layer with a seismic velocity of 2,740-3,050 m/s. There is some evidence for an intermediate layer with a seismic velocity of 1,525-1,830 m/s occurring in this spread on the western section. The depth of the interface was calculated as 20-24 m assuming that two layers were present.

Spread 4 was fired parallel with the Mount Direction-Turners Marsh road 90 m north of the crossroads. It showed three seismic velocity layers: a surface layer (915 m/s), an intermediate layer (1,525 m/s) and a third layer (2,285-2,440 m/s). The depth to the two interfaces was calculated as 5.5-6 m and 21-23 m.

Spread 5 was fired on a low flat spur parallel with the proposed railway route and 45 m downhill from the lowest auger hole at this locality. Three seismic velocity layers were present: a surface layer (915 m/s), an intermediate layer (1,830 m/s) and a third layer (3,050-3,660 m/s). This third layer appears on all three shots fired, although it is not particularly well defined on the extended shot to the north. The depth to the upper interface was calculated as 20-24 m with the lower interface occurring 21-27 m below the upper interface.

As the data available make the depth prediction of this lower interface uncertain, this third layer is not shown on interpretation diagram for Spread 5 in Figure 55.

The three spreads fired at the col and on the sandy spur to the north, although differing in detail have an overall general similarity in the type of seismic velocity layering present and the general order of thickness of these layers.

Spread 6 fired at the Mountain Vale Farm homestead differs from the above spreads. A sharp contrast was present between the surface layer with a seismic velocity of 760 m/s and the underlying layer with a seismic velocity of 3,360 m/s with the interface at a depth of 9-11 m. There is no sign of any intermediate layer.

GEOLOGICAL INTERPRETATION

The depth of the auger holes near Spread 5 is unknown but no consolidated rock appears to have been encountered. The spoil heaps from the eight holes found at this locality were composed of unconsolidated, fine sand with a small but variable percentage of clay and would represent the upper seismic velocity layer. The fine iron-stained yellow sand is derived from the weathering of Triassic sandstone. Much of the sand appears to be windblown but the calculated thickness of 20-24 m for this material appears far too great for this type of sand to have weathered *in situ* from sandstone bedrock. More likely this windblown accumulation is underlain by very deeply weathered and decomposed clay and sand of probable Tertiary age overlying sandstone of Triassic age. This sandstone is thought to represent the second (1,830 m/s) seismic velocity layer.

Elsewhere the seismic velocity of both the Tertiary and Triassic sediments was found to be very variable especially where the Tertiary sediments are derived from Triassic sediments. Tertiary sands are known to have seismic velocities varying from 610-1,525 m/s and it is known that the seismic velocity of unconsolidated sands can increase from 760-915 m/s to 1,370-1,525 m/s below the water table. Seismic velocities in Triassic sandstone are known to vary from 2,440-3,660 m/s. It appears likely that the unconsolidated sands from the auger holes occur below the surface at the Mount Direction col. They form the thick 915-1,220 m/s surface layer in Spreads 2 and 3 and the two upper seismic layers in Spread 4 on the northern side of the col. The 2,440-3,050 m/s layer occurring below the surface layer is thought to be Triassic sandstone.

Spread 6 is interpreted as a surface layer, approximately 10 m thick, of large dolerite blocks in a matrix of clay. There is no surface evidence of deep weathering with kernels of hard dolerite. The seismic velocities present are similar to those that occurred at Leaman's locality 5, about which he says 'massive chunks of fresh rock are visible although there are significant gaps between them. The small quarry shows that the clay zones are the reason for the gaps in the outcrop.'

CONCLUSIONS

A surface layer of soft unconsolidated sands and clays about 18-24 m thick appears to occur at the Mount Direction col. The ease with which this material could be excavated would appear to make a rail underpass more economical than an overpass at this locality.

The bench on which the Mountain Vale homestead is situated and which the railway route follows to reach the East Arm road is likely to consist of a high percentage of clay. In this clay large dolerite blocks are likely to be excavated which will require heavy machinery to move.

Explosives may be required to break up some of the larger dolerite blocks in this area.

GEOLOGY ALONG BELL BAY RAIL ROUTE SOUTH SHEET

0 1 2 3 4 5 Kilometres

5 cm

- | | | |
|---------------------|--|---|
| Quaternary | | River gravel, sand and silt |
| | | Dolerite scree |
| Quat. or Tert. | | Dolerite cobbles and boulders |
| Quat. and Tert. | | Ironstone cobbles and pisolitic ironstone gravel |
| Tertiary | | Silt and clay with occasional boulders |
| Triassic | | Sandy soil with occasional sandstone boulders |
| Triassic or Tert. ? | | Sandy soil with mudstone and clay |
| | | Outcrops forming almost continuous benches of dolerite |
| Jurassic | | Near outcrops of dolerite. Large dolerite slabs and cobbles, 1 metre ² |
| | | No outcrops, area underlain by dolerite |

GEOLOGIST : W. R. MOORE
Draughtsman : T. R. Bellis
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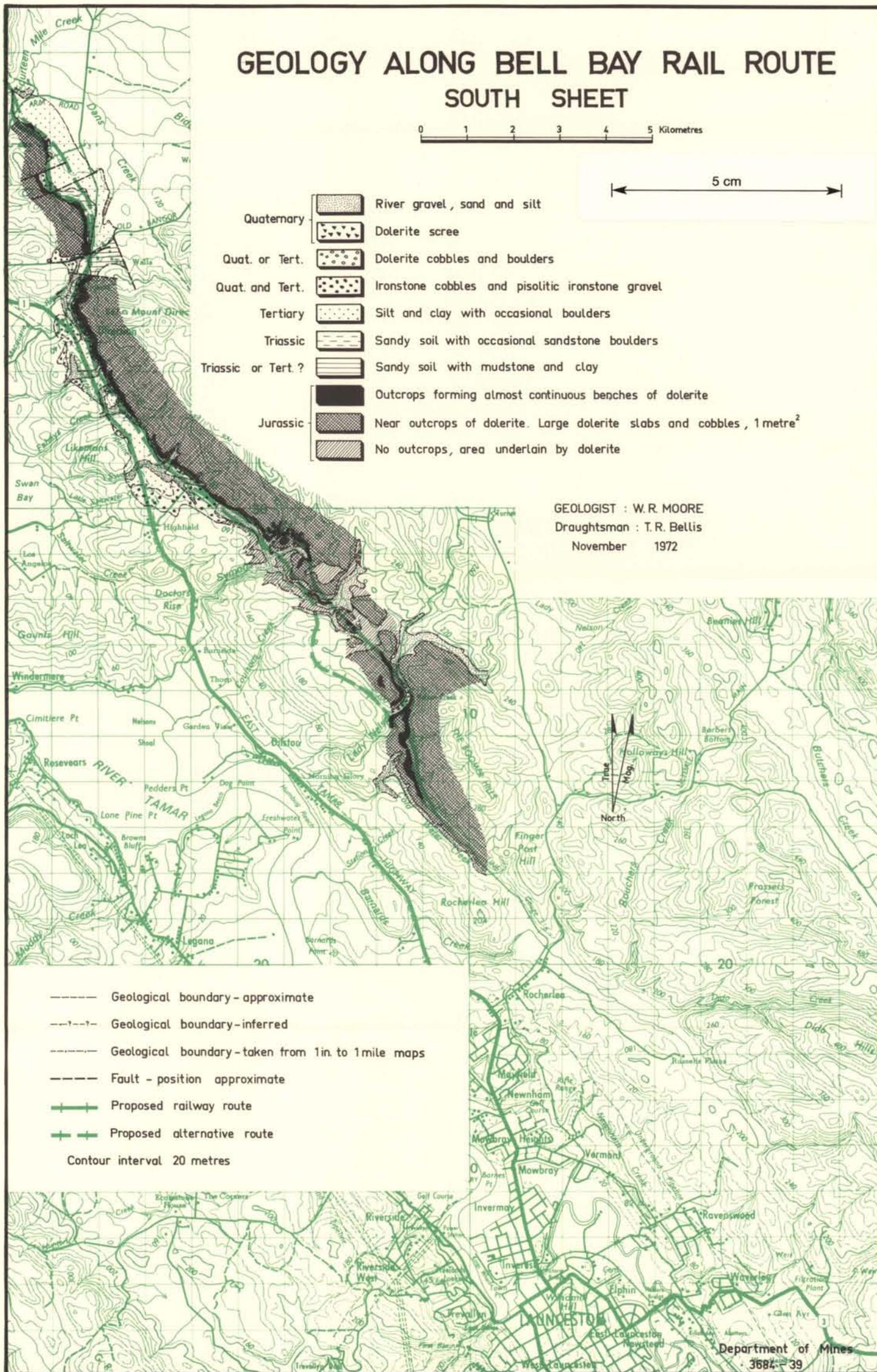
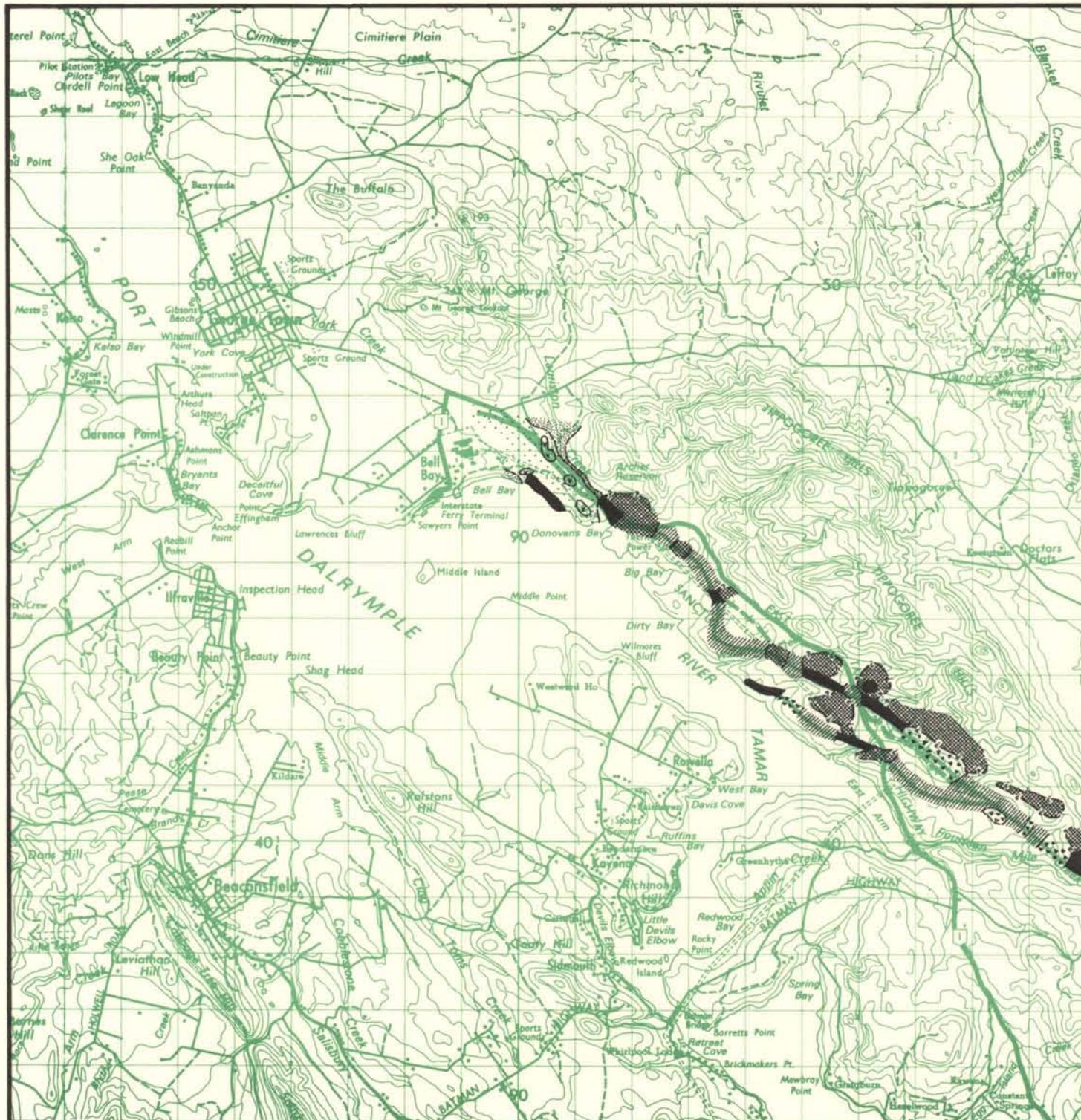


Figure 43.

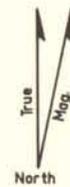
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GEOLOGY ALONG BELL BAY RAIL ROUTE NORTH SHEET

0 1 2 3 4 5 Kilometres



- | | | | | |
|--------------|--|--|-----------|-----------------------------------|
| Quaternary | | River gravel, sand and silt | ----- | Geological boundary - approximate |
| | | Dolerite scree | - - - - - | Geological boundary - inferred |
| Quat / Tert. | | Quartz gravel | —+—+—+— | Proposed railway route |
| | | Silt and clay with occasional boulders | —+—+—+— | Suggested alternative route |
| Tertiary | | Basalt | | Contour interval 20 metres |
| | | Outcrops forming almost continuous benches of dolerite | | |
| Jurassic | | Near outcrops of dolerite. Large dolerite slabs and cobbles, 1metre ² | | |
| | | No outcrops, area underlain by dolerite | | |

GEOLOGIST : S. ELMER

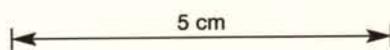
Drawn : TR. Bellis

November 1972

Department of Mines

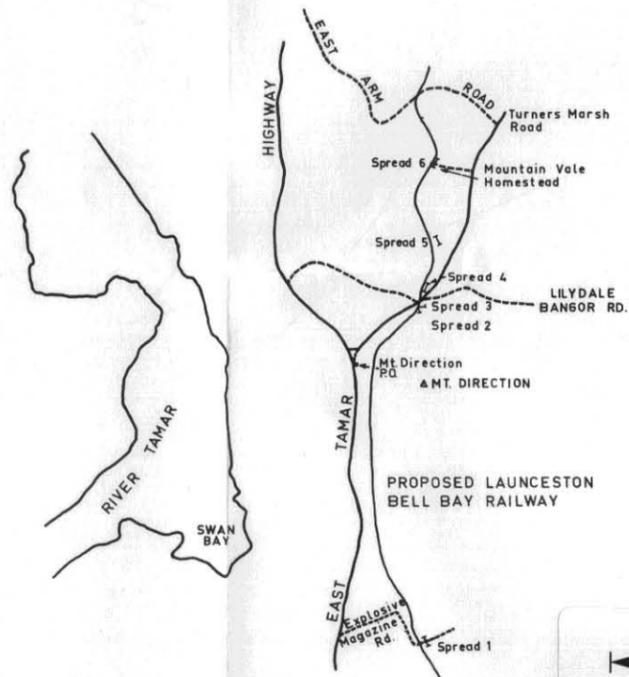
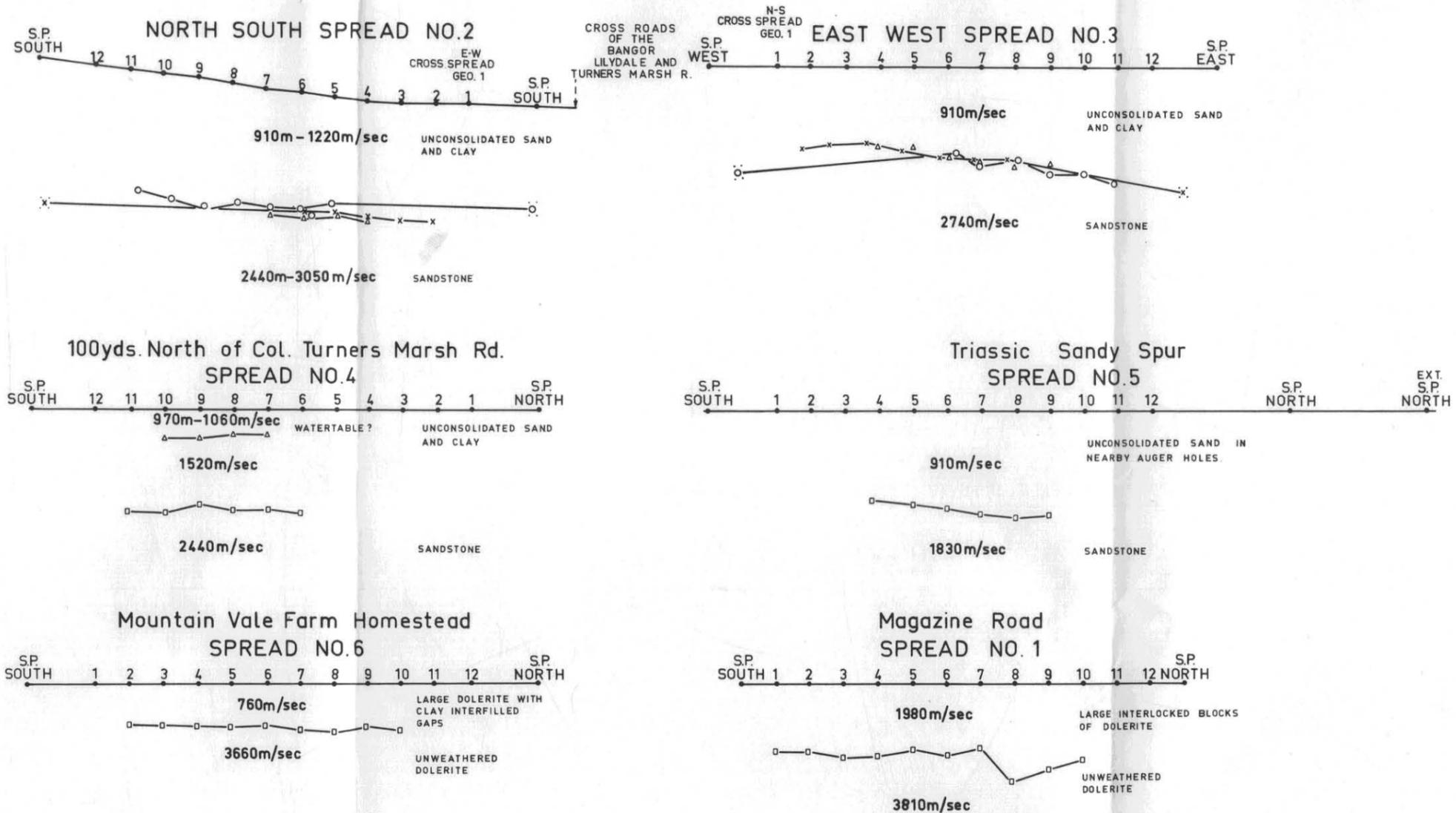
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Figure 44.



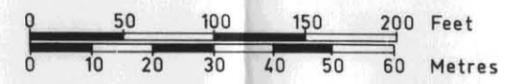
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TURNERS MARSH - MOUNT DIRECTION COL.

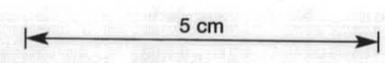


- 1 2 GEOPHONE POSITION & NUMBER
- S.P. SHOT POINT POSITION
- INTERFACE CALCULATED
- x—x BY TIME DELAY METHOD
- ⊗ ⊗ CALCULATED DEPTH OF SHOT POINT
- INTERFACE CALCULATED BY
- △—△ TIME DEPTH METHOD

RECONNAISSANCE SEISMIC SURVEY
 SOUTHERN SECTION
 BELL-BAY RAILWAY LINE



GEOLOGIST W.R. MOORE
 Draughtsman P.J. DONNELLY
 JUNE 1971



DEPT MINES
 3478

Figure 45.

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