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Representative basin study: Sandfly Creek, south-western Tasmania.

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Sandfly Creek is a tributary of the Huon River and flows eastward across the Scotts Peak Road, 8 km north of Scotts Peak. The catchment area covers 22 km^2, including 7 km^2 of button grass plain at an elevation of 300-400 m, the steep northern side of Mt Anne which rises to 1200 m and a lower ridge which separates the Sandfly Creek catchment from the Weld River catchment.

GEOLOGY

The geological succession (fig. 1) is as follows:

QUATERNARY	Clay, gravel and scree
JURASSIC	Dolerite
PERMIAN	Bundella Mudstone
	Tillite
	Unconformity
CAMBRIAN OR PRECAMBRIAN	Argillite, with subordinate quartzite and quartz sandstone
	Argillite, dolomite and quartzite
	Unconformity
	Red conglomerate and sandstone
	Dolomitic limestone

Cambrian or Precambrian

Dolomitic limestone. This homogeneous carbonate rock underlies most of the eastern part of the catchment area. It is a fine-grained rock with yellow to grey fresh surfaces and grey weathered surfaces.

A thin section shows a mass of polyhedral grains about one millimetre across with a cleavage which is confined to individual grains and which is thought to be due to crystallisation pressure.

Chemical analysis and its specific gravity show the rock to be a clean dolomite.

In places the homogeneity is broken by beds of calcareous conglomerate, mineral banding and features of calcite re-deposition. Large scale shearing and veining were not noted.

Red conglomerate and sandstone. This unit is best exposed in a sink hole east of the Mt Anne plateau, and in a distinctive cliff line which runs southwards from the sink. Calcareous reddish purple rocks, about 30 m in thickness, appear to conformably overlie the dolomite succession, they comprise:

Pale quartz sandstone and siltstone
Red-purple conglomerate
Red-purple sandstone
Red-purple conglomerate
Thin band of fissile yellow rock, seen at a distance.

The conglomerates consist mainly of partially rounded pebbles of quartzite, quartz sandstone, argillite and impure dolomite in a matrix of calcareous sand.

The sandstone has 40% carbonate and carbonated lithic fragments and 60% quartz in a calcareous cement. It is an even-grained rock, with a grain size of about one millimetre. The grains show evidence of shearing.

Argillite, dolomite and quartzite. These rocks overlie the purple sandstone and conglomerates with apparent angular unconformity.

Close to the unconformity is a 10 m bed of hard white, grey and purple quartzite, overlain by several siliceous and dolomitic quartz breccias, interbedded with argillite.

Interbedded argillite, impure dolomite and minor quartzite occur higher in the succession. There is much fine veining, including veins of quartz, calcite, pyrite and serpentine.

Argillite with subordinate quartzite and quartz sandstone. The interbedded dolomite and argillite described above, grades into non-calcareous argillite and sandstone which underlies most of the catchment area. This heterogeneous group of rocks includes competent and incompetent argillite with a variety of textures and colour.

Isolated beds of quartzite, quartz sandstone and quartz conglomerate, 8-15 m thick form distinctive features on ridge tops and give a clear indication of strike and dip.

Rhythmic deposition of sandstone and argillite occurs around Deception Ridge where the sandstone to mudstone ratio is 40:60. In places the beds are many metres thick, in others there are rapid alternations with beds about 0.5 m thick. Some of the sandstones are hard and are cemented by quartz. Others have weathered to a friable sugary texture where the cement has weathered away. There are also soft, yellow feldspathic sandstones.

Structures such as graded sequences, graded bedding, cross bedding and ripple marks show that the section is dominantly right way up and dipping north. However these rocks are considerably contorted and sheared.

Pre-Permian structure

There has been insufficient work to define the major structures in the area. The strike is approximately E-W but distorted by folding, thrusting and faulting.

A line of vertical limestone cliffs, occurring at 295° for 2 km across the eastern col could indicate recent faulting.

In view of the unconformity and the stratigraphic position and composition of the red conglomerate and sandstone, this part of the succession may be inverted. Thin sections of the limestone and sandstone show graded bedding, which could be used to orientate the section.

Permian

Tillite. Deeply weathered, pebbly, yellow mudstone occurs on the eastern col, between 530 and 630 m. The mudstone is not sheared, shows traces of fossils and is thought to be Permian tillite.

Bundella Mudstone. Below the dolerite, east of Mt Anne a wedge of well-bedded silty mudstone, dips very gently north-west. The maximum thickness of this unit is about 15 m. Fossils of Bundella age were found.

Jurassic

Dolerite. A dolerite intrusion caps the ridge which extends north-east from the summit of Mt Anne. The ridge is bounded to the north-west by cliffs of dolerite.

Quaternary

Peat, gravel and clay of the alluvial plains. Seismic and resistivity methods were used to investigate accessible areas, and indicate that there is 1-4 m of gravel and clay overlying deeply weathered argillite.

Seismic velocity (m/s)	*Resistivity* (Ω-m)	*Interpretation*	*Thickness*
350-500		peat	0.5-0.75 m
500-1000	100-300	gravel and clay	4 m near hills, on the plain 0.5 m of gravel and >2 of clay
1150-1700 (often stepped)		weathered argillite	5 m near hills, 10 m on the plain
2600		unweathered argillite	

Three sites were geophysically investigated. Interpretation was aided by observation of cuttings.

The gravel generally consists of angular fragments of quartzite and quartz sandstone, in the size range 0.3-0.6 m. On the flats there tends to be a layer of mixed gravel and clay beneath the peat. Towards the hills gravel predominates over clay.

The lowlands have an irregular topography, and it is not certain whether the irregularities reflect bedrock relief, or varying thicknesses of superficial deposits. Occasional rock outcrops are found in the low country, and considering the geophysical results, the larger features probably reflect bedrock, under thin superficial deposits.

Scree. The quartzite and dolerite have both produced thick screes. Road cuttings through quartzite areas show scree accumulations 6 m thick. Where the rocks are predominantly argillite, there are thin quartz screes.

There are many dolerite boulders on the slopes of Mt Anne; on the top 200 m patches of scree are common. Areas of fallen blocks and deep rock piles without vegetation occur beneath the dolerite cliffs.

SOILS

Soils (fig. 2) in this area tend to be shallow, acid (pH 3.5-5.5) and leached, a common feature being a pale, wet clay layer beneath the surface humus. Soil type is controlled more by altitude and vegetation, than by rock type, although resistant rock fragments make for a more sandy texture.

Soil types

Plateau Podsols are found on the high plateau where there is low vegetation. They are usually less than 0.3 m thick and there is no true horizonation. They are clayey and poorly drained.

Rainforest Gleys are found on steep hillsides with thick vegetation. They are less than 0.75 m thick and consist of humus overlying a saturated true gley horizon. Clay and weathered bedrock underlie the gley. Interflow occurs between the humus and the gley horizon.

Sclerophyll Podsols are found on the lower slopes and are more affected by parent rock material. These soils are generally fairly thin, show vague horizonation, and have a high content of bedrock fragments. They are thinner, darker, more sandy and more acidic on quartz colluvium than on argillite. The absence of an impermeable gley layer is hydrologically important.

Peaty Moor Podsols are found in the lowland button-grass and tea tree areas. They are 0.5-1 m thick, and have three distinct horizons. The upper two very acid (pH 3.5) peat layers, overlie a less acid clay layer (pH 5). This lower layer ranges from a sandy to a heavy clay, depending on the underlying material.

Cracks in these soils are common, especially after dry conditions; they may be 5 mm wide, and permit considerable flows of subsurface water.

HYDROLOGY

Cambrian or Precambrian

Dolomitic limestone. The dolomite area is characterised by karst features. This karst topography is especially striking on the south-eastern ridge top, where sink holes 30 m deep are separated by knife edges of rock. In view of their present topographic position these sinks are probably ancient features.

On mountain slopes the karst features are less striking and are often hidden by thick vegetation. However areas of sinks are seen, and surface drainage ceases soon after a storm.

Despite exploration by cavers, no open cave systems have been found to lead from the sinks. Underground water movement is probably by way of solution-widened joints, rather than large channels.

Underground flow in the dolomite could cause water to cross the divide, especially if the sinks on the north-eastern ridge are part of an ancient drainage system. This possibility could be investigated by using a tracer dye.

Argillite, dolomite and quartzite. Although the cleaner calcareous rocks show solution features, these interbedded rocks weather easily and generally retain water in pools on the plateau surface.

Argillite, with subordinate quartzite and quartz sandstone. On lower ground the dominantly argillitic rocks weather deeply and this would tend to seal joints against water access. Where there is rapid erosion the deeply weathered layer would not be able to develop and factors such as cracking by tree roots could allow some water penetration.

In areas of interbedded mudstone and sandstone the competent rocks have been severely fractured and the incompetent rocks have been squeezed out, thus leaving voids. These rocks would therefore be comparatively permeable.

Quaternary

Gravel and scree slopes are hydrologically significant in retarding storm runoff, and also evapotranspiration. On the low country the gravel is mixed with clay, but could aid subsurface flow between streams.

Surface flow

On the flat ground it is difficult to know the direction of water flow as surface drainage is only evident after heavy rain and much of the water travels through subsurface soil channels.

Any shallow depression or cutting has a considerable effect on drainage direction and the building of the Scotts Peak road has changed the boundaries of the catchment.

The road embankment blocks and deflects flow whilst the drains and ditches attract water and even cause reverse flow.

Information on surface flow gathered during this study has been incorporated in the base map used for Figures 1-3.

Drainage behaviour

Areas of drainage behaviour are shown in Figure 3 and are defined in Table 1. The numbers correspond to those used on Figure 3.

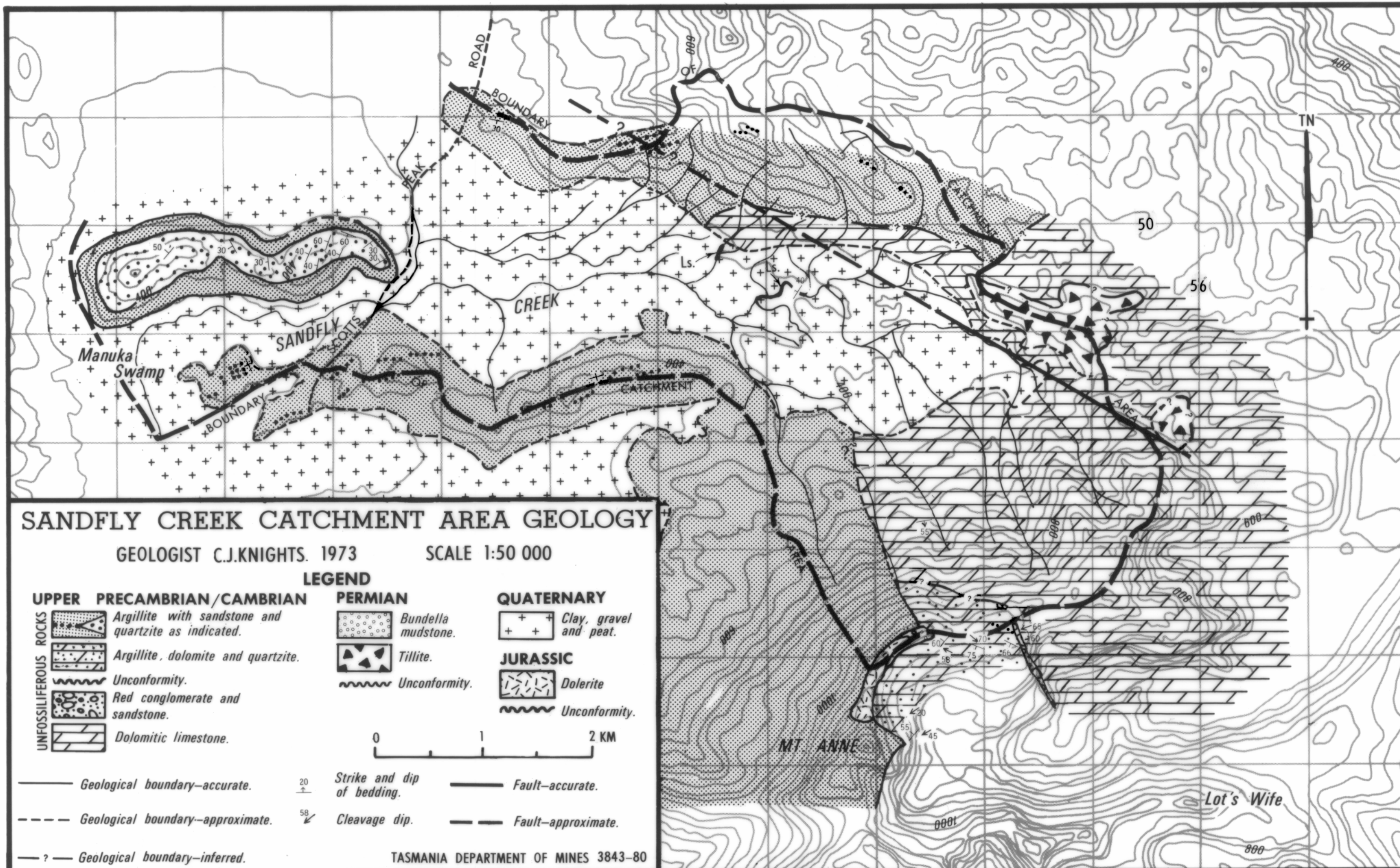
Table 1. DRAINAGE BEHAVIOUR

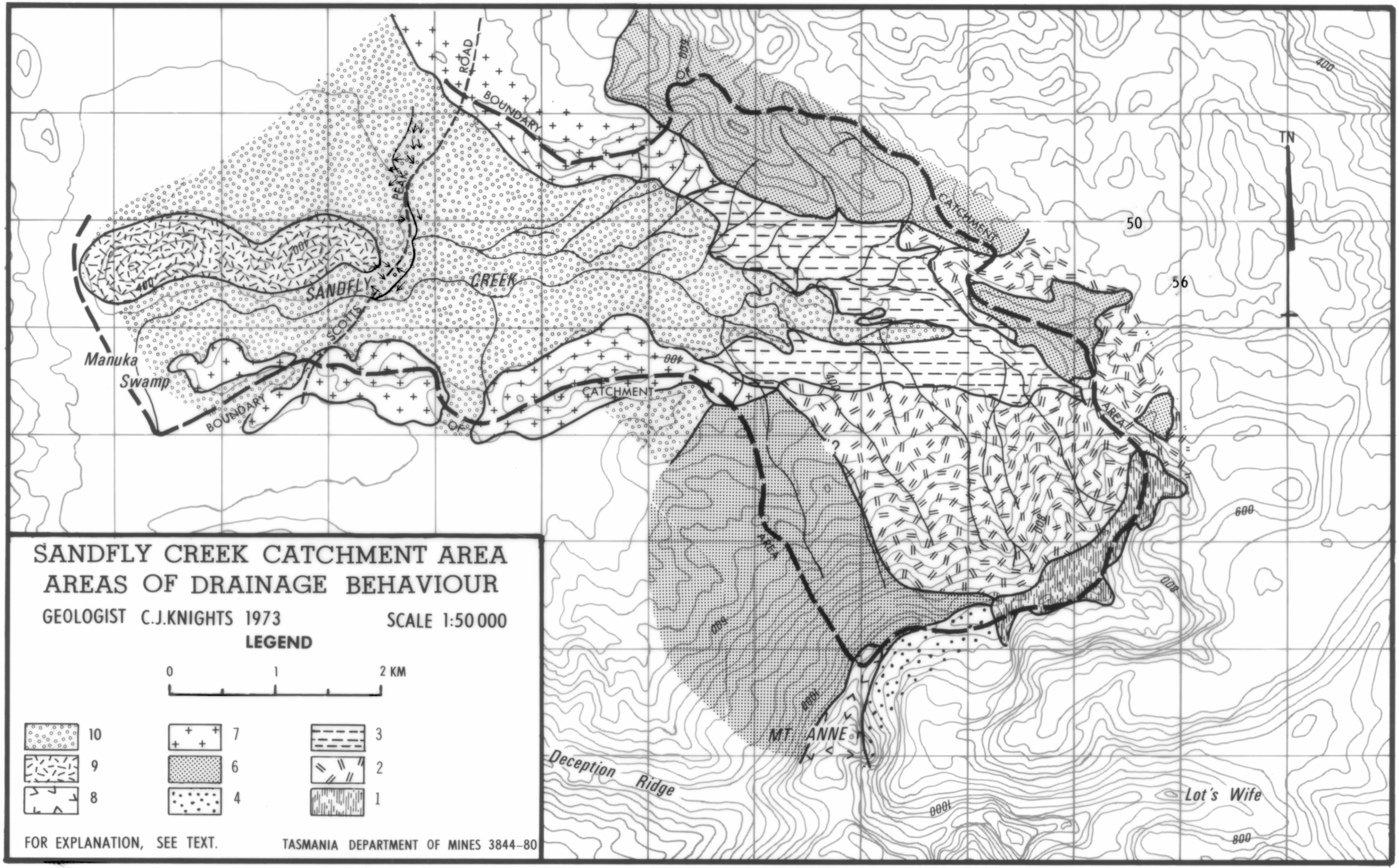
Rock type	Topographic position	Remarks
Dolomite		Permeability is due to solution-widened joints and fractures.
	1 Ridge	Karst area, no surface detention.
	2 Steep slopes	This is predominantly a permeable situation. Steep slope and sub-humus clay layer cause some surface flow and soil interflow. Surface flow ceases soon after a storm.
	3 Colluvial area towards the base of slopes	Rock detritus increases soil permeability. There is little surface drainage, or soil interflow.
Argillite and dolomite	4 Plateau	Clay soil and lower rock permeability permit surface detention. Some solution features are present.

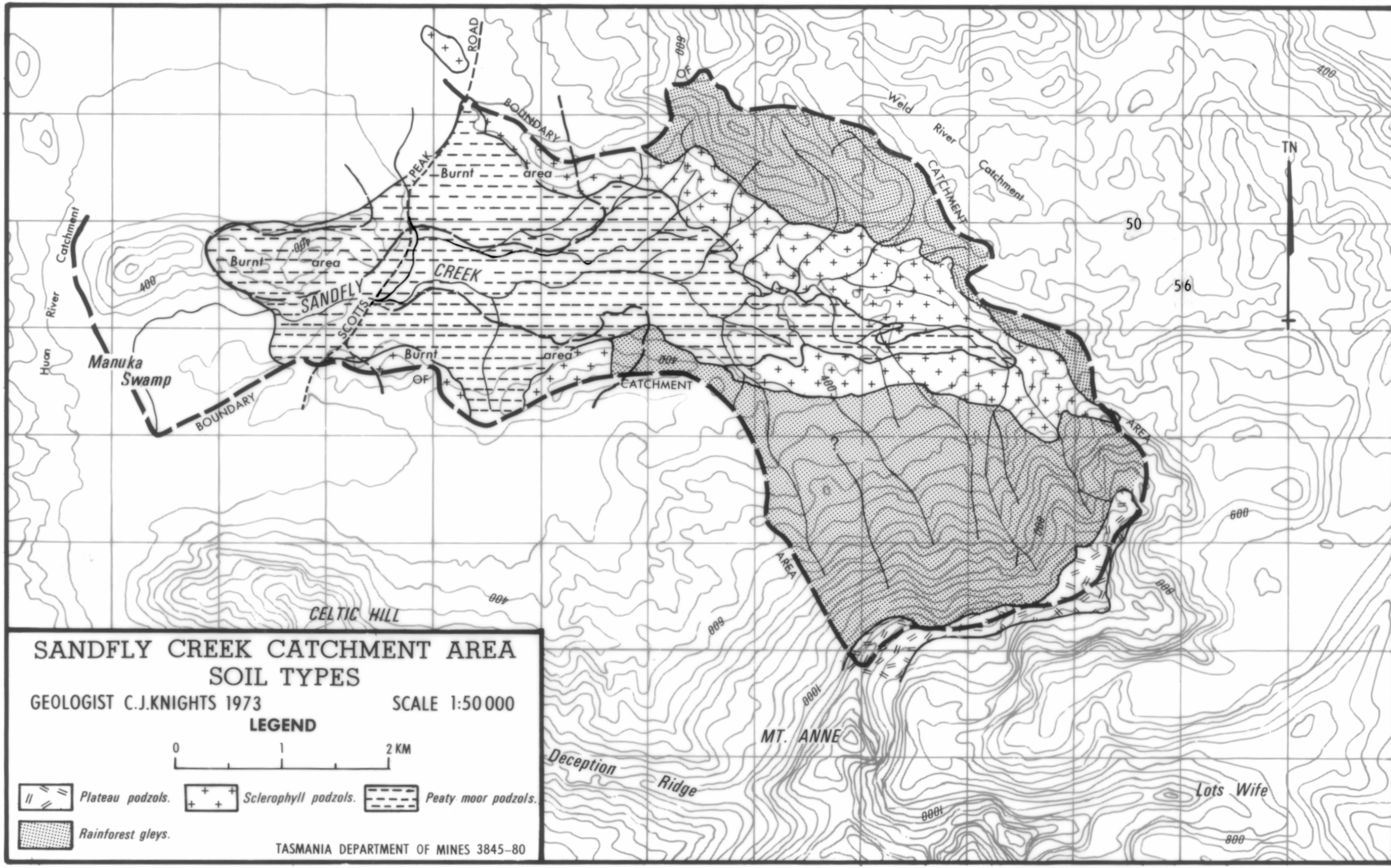
Table 1. (continued)

Rock type		Topographic position	Remarks
		Steep slopes and colluvial areas	See 6, 7.
Argillite and quartzite			A degree of permeability is present due to joints and fractures, especially if quartzites or sandstones are present. Low lying argillite is deeply weathered and has low permeability.
	5	Plateau	Surface detention.
	6	Steep slopes	Surface flow and soil interflow are evident after rain. Surface stream flow except after a dry period.
	7	Colluvial areas	Flow rate is retarded in areas of heavy scree. Where quartz-rich colluvium is present the soil is permeable, with little horizonation. The underlying weathered argillite has low permability unless there are sandstone beds. There is generally sub-soil or surface drainage.
Dolerite	8	High plateau	A well-jointed rock. There is some water percolation which issues as seepages at the foot of the cliffs. There is surface retention on clayey soil and run-off on sloping areas.
Quaternary deposits	9	Slopes	Where there is well horizonated peaty soil there is considerable soil interflow. Burnt areas suffer erosion gullying.
	10	Lowlands	Towards the hills, gravels are thicker, and there is subsurface flow. On flats the gravels appear to be thin and mixed with clay. Considerable flow occurs through the soil, by erosion-widened cracks in the peat and clay.

[5 February 1974]


SANDFLY CREEK CATCHMENT AREA GEOLOGY
GEOLOGIST C.J.KNIGHTS. 1973
SCALE 1:50 000
LEGEND
UPPER PRECAMBRIAN/CAMBRIAN
UNFOSSILIFEROUS ROCKS
Argillite with sandstone and quartzite as indicated.
Argillite, dolomite and quartzite.
Unconformity.
Red conglomerate and sandstone.
Dolomitic limestone.
PERMIAN
Bundella mudstone.
Tillite.
Unconformity.
QUATERNARY
Clay, gravel and peat.
JURASSIC
Dolerite
Unconformity.
0 1 2 KM
Geological boundary–accurate.
Geological boundary–approximate.
Geological boundary–inferred.
Strike and dip of bedding.
Cleavage dip.
Fault–accurate.
Fault–approximate.
TASMANIA DEPARTMENT OF MINES 3843–80
ROAD
PEAK
SCOTTS
BOUNDARY
OF
CATCHMENT
AREA
SANDFLY
CREEK
Manuka Swamp
Ls.
MT ANNE
Lot's Wife
TN
50
56
400
600
800
1000


SANDFLY CREEK CATCHMENT AREA
AREAS OF DRAINAGE BEHAVIOUR
GEOLOGIST C.J.KNIGHTS 1973
SCALE 1:50 000
LEGEND
0
1
2 KM
10
9
8
7
6
4
3
2
1
FOR EXPLANATION, SEE TEXT.
TASMANIA DEPARTMENT OF MINES 3844-80
TN
50
56
400
600
800
1000
ROAD
BOUNDARY
PEAT
SANDFLY
CREEK
SCOTTS
CATCHMENT
AREA
Manuka
Swamp
MT ANNE
Deception
Ridge
Lot's Wife


SANDFLY CREEK CATCHMENT AREA
SOIL TYPES
GEOLOGIST C.J.KNIGHTS 1973
SCALE 1:50 000
LEGEND
0
1
2 KM
Plateau podzols.
Sclerophyll podzols.
Peaty moor podzols.
Rainforest gleys.
TASMANIA DEPARTMENT OF MINES 3845–80
SANDFLY
CREEK
SCOTTS PEAK ROAD
Burnt area
Burnt area
Burnt area
BOUNDARY OF CATCHMENT AREA
Weld River Catchment
Huon River Catchment
Manuka Swamp
CELTIC HILL
MT. ANNE
Deception Ridge
Lots Wife
TN
50
56
400
600
800
1000