DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 84/36

HAPPY VALLEY FILTRATION PLANT: PROGRESS REPORT TO NOVEMBER 1983

GEOLOGCAL SURVEY

by

J.C. BEAL

MAY 1984

DME.667/79

CONTENTS

FIGURES

PLATES	NEGATIVE NO.
1. General view looking north-east across Coffer-dam.	34081
2. General view looking north towards outlet tower.	34082
3. View along cut-off trench looking west. Chainage X640 to X590.	34083
4. Cut-off trench at Chainage X640. Looking northwards.	34084
5. Cut-off trench at Chainage X610. Looking south-eastwards.	34085
6. View westwards along cut-off trench. X680 to X660.	34086
7. View eastwards along cut-off trench. X670 to X715.	34087
8. Looking north eastwards into centre of cut-off trench. Chainage X680.	34088
9. View northwards towards diversion tunnel.	34089
10. General view south eastwards across main embankment of Filtered Water Tanks.	34090
11. View of excavated batter for the Filters.	34091
12. Vuggy quartz vein exposed in main batter of Filter excavation.	34092
13. Looking southeast towards inlet tunnel.	34093
14. Looking eastwards across floor of the By-pass Structure.	34094
15. Looking northwards across Re-cycle Tank.	34095
16. View of access ramp to Re-cycle Tank excavation.	34096
17. Minor rock slide in southern face of Re-cycle Tank Sump	34097
18. Rock slide in northern face of Sump excavation.	34098
19. Looking south towards seepages in Re-cycle Tank excavation.	34099
20. View of south face of Sump excavation.	34100
21. View of Filters floor (trench).	34101
22. Looking south into drain trench at eastern end of By-pass Structure.	34102
23. View showing shear zone traversing the wash water Re-cycle Tank Sump excavation.	34103

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SOUTH AUSTRALIA

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HAPPY VALLEY FILTRATION PLANT: PROGRESS REPORT TO NOVEMBER 1983

ABSTRACT

This report records the involvement of the Dept. of Mines and Energy in the construction of the Happy Valley Filtration Plant over the period October 1982 to November 1983 and is a follow-on from the report on investigations, Rept. Bk. No.: 81/30 D.M.E. 667/79.

Adequate foundations and safe batter slopes occur at all site excavations. Remedial measures have only been necessary along one section of the cut-off trench for the main embankment of the Filtered Water Storage Tanks where concrete was poured along a length of trench which passed through strong, fresh, siliceous metasiltstone. Batters from vertical to 70° have proved stable to date. The 6 metre high east and west faces of the sludge pit in the base of the wash water recycle tank were shored prior to placing of formwork. Minor falls occurred in the north and south faces.

A leakage of 10 litres per second through the coffer-dam for the main filtered-water tank embankment has been attributed to incomplete piling closure.

INTRODUCTION

Over the period October 1982 to November 1983 visits have been made by a Geologist from this Department at the request of the Engineering and Water Supply Department to inspect, record and comment upon geological aspects of construction of the several structures which make up the Happy Valley Filtration Plant. (Location is shown in Figure. 1)

This report consolidates the results of these site inspections and records construction progress up to the end of October 1983. A general lay-out of the plant is shown in Figure 2 and general views are shown in plates 1 and 2.

FILTERED WATER STORAGE TANKS -
Investigation of Coffer-Dam Leakage

To enable construction of the filtration plant an coffer-dam was constructed across the arm of the reservoir leading to the new Happy Valley outlet tunnel. The coffer-dam consisted of driven sheet piling supported by placed coarse aggregate. After dewatering three or four springs (leakages) occurred from the north face of the embankment and two cable-tool holes (CHCD1; CHCD2) were drilled through the coffer-dam embankment (Figure 3 and plate 1) in an attempt to discover the cause.

The holes were drilled between 18th May and 24th May 1983 in order to investigate the possibility of a direct hydraulic connection from borehole to the upstream side of the Coffer-dam.

Possible explanations for the leakage may be summarised:

1. Piles not fully driven either because of intersection with shallow, hard bedrock or coming into contact with buried steel girder(s) left lying across the site from earlier construction work.
2. Pile to pile contact (greased) not fully sealing or the weld between two piles having opened up-allowing water to pass through.
3. The existence of open jointed bedrock beneath the base of the piles providing a direct pathway from one side of the coffer-dam to another.

To test these several possibilites concentrated salt solutions (25000-30000 mg/litre) were placed in both holes at several different levels and continuous conductivity readings taken at the leakages over a period of up to three hours.

Results

All tests proved negative including a 'muddy water' test where at one particular site embankment material was disturbed in an attempt to see if the clear water of the leakages turned cloudy. One further test using an approved dosage of fluorescene also proved negative.

Discussion

The lack of a proven direct contact between one side of the piles and the springs may be explained by:

1. There was a direct contact but the salt solution became diluted beyond the sensitivity of the conductivity meter.

   This is rejected because of the high concentration of the salt solution; because of the short distance the 'slug' would have to travel (approx. 15-20 metres) and because the discharge water was consistently 380-400 mg/litre over a period of six days.

2. There was insufficient head of brine water to allow it to move from the hole into the embankment.

   This may have been the case were water levels dropped slowly but where levels dropped quickly brine solution was constantly added to keep the water level topped up.

   Typical falls of water level were in the order of 30mm/minute.

   Surging was used to encourage mixing of the brine with borehole water; alternatively the holes were baled-out and the brine introduced.

3. The holes were not drilled close enough for the brine to reach the source of leakage within the monitoring period.

   As shown in Figure 2 the holes were located opposite the issue of the springs. However the leakages may have originated far removed from their place of issue.

   This is likely because a bank of silt & mud was moved towards the centre of the coffer-dam as the embankment material was placed on either side of the piles. This bank could well have diverted leaks until the latter emerged beyond the mud bank.

It is believed that leakage was directly through non-watertight linkage of the piles, occurring as many small leaks which emerged as three or four springs at either side of the above mentioned 'mud-bank'.

The international consultant J.B. Cooke on a visit to the site advised that on some sites shredded cellophane was tipped into the 'upstream' water, the shreds finding their way into the piles and sealing their contacts.

The leakage was directed into a sump (Plate 9) and pumped back into the reservoir.

Geology

Hole No. CHCD1

0-6.0 m	embankment gravel
6.0-7.0 m	dark grey/black clay
7.0-10.0 m	brown stiff clay (CL-CH)

Procedure

(i) Brine placed at 7.0 m to top of casing
(ii) Casing raised to 5.50 m
(iii) Probe used to measure rate of drop of water level
(iv) Spring salinity monitored continuously for 1 hour and then every fifteen minutes for a further two hours.
(iv) Hole continued to 10.0 m. No further testing.

Hole No. CHCD-2

0-6.0 m	embankment gravel
6.0-10.0 m	clay (CL-CH)
10.0-11.0 m	river gravel
11.0-14.0 m	clay (CL-ML) becoming stiff

Procedure

(i) Brine placed at 6.0 m to top of casing
(ii) Casing raised to 5.5 m
(iii) Springs monitored (negative)
(iv) Drill to 11.0 m. Hole baled out
(v) Brine placed 11.0 m to top of casing
(vi) Casing raised to 10.5 m

(vii) Fall of water level measured
(viii) Springs monitored
(ix) Drilled to 14.0 metres
(x) Brine added (Later, fluorescene was added)
(xi) Springs monitored
(xii) Left to stand overnight. S.W.D. 1.70 metres from top of casing, i.e.: approx. reservoir level.

Main Embankment Cut-Off Trench

Geology

The cut-off trench (Figures 4 and 5; Plate 3 through to Plate 8) is excavated in steeply dipping dolomitic siltstone which, over the sections X600-X650* (Plate 3) and X705 to Y425 can be broken down by the sheeps foot roller, providing a low permeability foundation for the cut-off trench.

However, siltstone over the section X730 to X755 proved to be stronger than the very soft completely weathered siltstone found between X600 to X650. Over the former section, individual blocks, fist-size and larger, were cleared from the floor of the trench prior to placement of a thin layer of cut-off material whose moisture content, it was intended, should be a little higher than normal to facilitate a better penetration of the small fragments of broken siltstone which covered the trench surface over this section.

Slightly to moderately weathered strong, open jointed siliceous siltstone, occurs over the section X650 to X705, where the roller could not be used (Plates 6, 7 and 8). The trench was excavated to clean, tight bedrock and concrete poured to a thickness which formed a relatively level surface upon which to place the cut-off material.

After construction of the cut-off trench the embankment for the filtered water tanks was placed using highly weathered siltstone taken from excavations elsewhere on the site (Plate 10).

* Construction site reference grid.

A detailed geological description of the rock types is given in Appendix A.

Assessment of Slope Stability

Three backhoe trenches T32, T33, T34 were excavated at the site of the Filtered Water Storage Tanks in order to assess the stability of batters excavated into bedrock. (see Figure 6).

Geology

All three trenches were excavated into cream-pale brown, highly weathered to moderately weathered siltstone of weak to moderate strength. Generally there is a 0.4 to 0.6 metre cover of top-soil plus 'B' horizon overlying the weathered siltstone. The siltstone is blocky, being traversed by planar, smooth, fractures and is classified as an ML to CL. Block sizes seem to rarely exceed fist or hand size.

In trench T32, the bedding agrees with the regional strike of the area, that is, runs approximately N-S, dipping approximately 45°-60° westwards. The dominant fracture dips at approximately 50°-60° towards the east/southeast.

All three trenches were dry, and their logs appear in Appendix B.

Discussion

Earlier fracture surveys have shown that bedding may be expected to dip from 40° to 60° westwards. To reduce the risk of rock falls a batter angle of 45° to 50° is recommended. If this is not possible then a vertical batter is recommended and berms should be widened to 10 metres and be excavated for every 13 to 15 metres of batter height. In summary, for westward facing slopes, the chance of slope failure along a dominant fracture plane is considered to be quite high and design of such batters should be conservative.

All batters will need to be protected from the ingress of storm water by adequate storm water drains. Any drainage channel run along a berm will need to be concrete lined or in some other way rendered water-tight to reduce risk of 'feeding' storm water into lower sections of the excavated face.

Although the Filtered Water Storage Tanks are to be membrane-lined it must be conservatively assumed that the foundations of the tanks will at some time become saturated.

Six backhoe trenches excavated in the Flocculation and Settling Basin area exposed completely weathered siltstone (ML-CL) which could, when saturated and acting as a toe-support for high batters, fail as a soil rather than as a rock. The thickness from ground surface of this completely weathered siltstone varies, but is in the order of 2.0 to 3.0 metres.

Although such thicknesses of completely weathered siltstone were not exposed in trenches T32-T34 the possible presence of a completely weathered siltstone occurring between the trenches should not be overlooked.

It is recommended that the strength properties of completely weathered siltstone saturated with filtered water be investigated by the E.W.S. Soils & Foundations Division.

Conclusion

(1) Preferred batter angle: for westward facing slopes 45°-50°. (If berms are designed to accept some rock falls then vertical batters are considered acceptable).
(2) Proposed maximum batter height: 13 metres.
(3) Preferred orientation of excavated face: NW-SE.
(4) Strength properties of completely weathered, saturated siltstone be investigated.

NEW OUTLET TOWER - FOUNDATION INSPECTION

The Outlet Tower is excavated in moderately weathered, strong, grey-pale brown siltstone which provides an excellent foundation. Water running into the excavations (mainly from the leaking coffer-dam) was pumped out via a vertical culvert which remained in place during construction of the Tower and placement of the embankment; it was then filled with concrete. (Plate 13).

FILTERS - FOUNDATION INSPECTION AND BATTER STABILITY ASSESSMENT

Geology

Geological conditions here are virtually identical with those inspected at the Flocculation & Sedimentation Tank Site (Plates 11 and 12), that is, completely to highly weathered iron stained siltstone; stiff clay to very weak rock. The siltstone is considered non-compressible and will provide an adequate foundation for the Filters (Plate 21). The dominant fracture is the bedding plane: striking approx. N-S and dipping 35-45° to the west. The bedding plane shows pale-cream clay development in places approximately 1 mm thick.

Slope Stability

At one location in the N-S oriented batter, rock sliding has occurred on the bedding plane releasing approx. 1-2 tonnes of batter material. Similar falls must be expected throughout the life of the face and it is advised that adequate safety measures are taken during construction of the Filters when working adjacent to this face; for example covering the face with well secured, interlocking mesh.

It is also advised that the road running between the FILTERS and the FLOCCULATION & SEDIMENTATION Tanks be crowned and all storm water led away from either face.

SLUDGE DEWATERING FACILITIES:- ASSESSMENT OF SLOPE STABILITY

A back-hoe pit was excavated at the proposed site of the sludge processing area (Figure 7) to assist in batter-slope stability assessment.

GEOLOGY

The pit was excavated through 1.0 m to 1.50 metres of topsoil and 'B' horizon and three metres of completely weathered to highly weathered weak, red-brown siltstone.

Three dominant fractured groups were observed.

(i) Bedding 170° dipping 45° to west

(ii) Cleavage 000° dipping 70° to east

(iii) Joint 090° dipping off vertical either to north or to south.

Groups (i) and (ii) will only daylight along E-W orientated batters facing south. A batter angle of 70° will eliminate the majority of potential rock-slide type falls. Vertical batters are acceptable providing berms of sufficient width to catch falling rock (approx. 5.0 metres or no less than 0.75 times the height of the batter) are excavated where structures are to be built close to batters.

RAW WATER FLOCCULATION - SEDIMENTATION TANK BY-PASS STRUCTURE

This structure forms a 'bridge' between the two flocculation and sedimentation tanks (Plate 14).

Geology

The By-Pass foundations are in completely to highly weathered pale brown siltstone. The geology is unvaried across the whole excavation except for a colour change (to mottled red brown) and the occurrence of two iron stained vuggy quartz veins which strike at 010° and dip 40° westward. (Plate 12).

Although the weathered siltstone will give adequate foundations for the main structure some concern would have been expressed had not 1.5 m deep footings been designed for the mobile crane as rock strength is low and crane loadings may have caused foundation bedrock to move out into the embankment of the Flocculation and Sedimentation Tanks. Excavation of the trench for these strip footings is shown in Plate 14.

WASH WATER RECYCLE TANK

Main Excavation

Geology

The geology here is similar to elsewhere on the site except that in the northwestern quadrant of the excavation the normally weak siltstone is less weathered and moderately strong to strong.

The bedding strikes approx. north-south and dips 50° westwards. The bedding plane is smooth and uneven except where ripple-marks are present.

Joint and cleavage planes are well developed, smooth and planar and dip steeply (60°-70°) to the west, south and north (Figure 8).

Because the maximum height of cuts (5m) is along the eastern edge of the excavation it is only here that rock slides are expected to occur on westward facing fractures and a 70° batter for this section is advised. Small falls should also be expected in all other faces of the excavation.

Sump Excavation

Geology

The geology for the southern half of the sump is identical to that observed elsewhere, that is, highly weathered weak pale brown siltstone striking approx. north-south.

At depth in the northwest corner of the sump the siltstone is grey-blue, strong to very strong, slightly weathered to fresh.

The two different rock types are separated by a NE-SW striking shear zone, 300 to 500 mm wide dipping approximately 60° southwards (Figure 8).

Slope Stability

As elsewhere on the site, rock slides are likely to occur, and have occurred, on bedding, joint and cleavage planes, which dip into the excavation.

Two minor rock slides have occurred on the edge of the southern and eastern faces (each of approx. 1.0 tonne). A third rock slide occurred in the northern face (approx. 3-4 tonnes) and was initiated by the weight of the backhoe working adjacent to a backfilled section of the pit. Location of the three slides are shown in figure 8.

The east and west faces have been shored using timbers and struts; the north and south faces have been battered back to approximately 70°. Under-excavation of the east face has resulted in the subsequent removal of 200 to 300 mm of rock from

the base of this face. Providing no shoring is removed until the floor and lower section of the wall have been poured then the east face is considered safe at least over the short period of time between excavation and pouring the concrete. Heavy rains during this period could lead to weakening of the face.

The site engineer was advised that workers should check for open cracks along the top of the east face prior to entering the pit and also to check for the appearance of cracks or evidence of rock movement in the undercut face.

A summary of the fractures exposed in the sump excavation and a proposal lay-out for rock-bolting is shown in Table I and II below.

Design Of Rock Bolting Of Sump Faces

TABLE I

A: DOMINANT FRACTURE ORIENTATIONS

(i)	005/45°W ; 170/45°W ; 160/50°W.	Bedding
(ii)	090/80°S ; 100/60°N. (Discontinuous)	Joint
(iii)	000/70°E ; 000/70°W ; 015/75°E.	Joint

B: Advised Rock Bolting Pattern
(Based on above orientations)

TABLE II

Detail	FACE			
	N	S	E	W
	FROM TOP OF SUMP EXCAVATION (METRES)			
1st Row	1	1	1	1
2nd Row	3	3	3	3
3rd Row	5	5	5	5
	BOLT LENGTH (METRES)			
1st Row	4	4	5	4
2nd Row	3	3	3	3
3rd Row	2	2	2	2
Angle from Horizontal for all Rows.	30°	30°	40°	5°

GROUNDWATER SAMPLING

Water seeps from two places in the excavation:

- from approximately 1.0 m above the base of the sump (EL 136.0) from open fractures. The salinity (2000 mg/litre) indicates that this is groundwater. The rate of seepage is not known but is estimated to be in the order of one or two litres per minute.

- from the base of the southern face of the main excavation (approx. 1 litre per minute). The salinity, (760 mg/l), indicates that this is reservoir water (approximately 530 mg/l) which is entering the excavation via fill and weathered bedrock from the reservoir (now at F.S.L.).

The low volumes of water entering the excavation indicate that drainage of water will not create a major problem in the design of the wash water Recycle Tank.

John C Beal.

JCB:DP

J.C. BEAL
SENIOR GEOLOGIST

APPENDIX A

GEOLOGICAL LOG OF THE CUT-OFF TRENCH

(MAIN EMBANKMENT; FILTERED WATER STORAGE TANKS)

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA
ENGINEERING DIVISION

LOG OF CUT-OFF TRENCH

PROJECT: HAPPY VALLEY RES. EWS TANK EMBANKMENT
LOCATION OR CO-ORDS: SOUTH BANK OF TRENCH
SEC HD. EL Surface EL ref. point Datum

UNIT/STATE NO:
SERIAL NO:
FOLDER NO.

GEOLOGICAL DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	HOLE Dia.	DEPTH m	GRAPHIC LOG	③ R.Q.D.% 75 50 25	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS % 0 100	④ WATER PRESSURE TESTS LUGEONS 0.5 1 5 10 50 180
Chainage X600 – X605				2			Not excavated					
X605 – X614 DOLOMITIC SILTSTONE Fractures planar, even clay coated (1mm or so) 095 fractures parallel 50mm – 200mm apart. Blocks typically fist size (20mm X 20mm X 40mm up to 100mm X 100mm X 100mm)				4 6 8 10 12 14			Brown – ochre with some mottled cream/grey leached zones (CW); VW Siltstone to ML Soil properties Typical fractures 095/48° NE; 033/90° (to 70° E or W); 150/035° SW					
X614 – X630 (CW – HW) VW – W				16 18 20 22 24 26 28			White/cream; leached; mottled with some brown otherwise as above (605 – 614). As for (614 – 619) but redder appearance of stained joint surface Weak to slightly strong. As for 614 – 619					
X630 – X637 (HW); W – MS				30 32 34 36			Comparatively little leached material. Hard ridge X631 – X631·5 (MS)					
X637 – X639 (MW); S				38			Dark grey where fresh. Blocks: 300mm X 300mm X 300mm Jointing typically 000°/30°W (bedding); 025/90° (or to W or E); 075°/70°N					

① ROCK SUBSTANCE

STRENGTH TERM
VS–Very Strong
S–Strong
MS–Medium Strong
W–Weak
VW–Very Weak
SO–Soil properties

CONDITION TERM
Fresh
Weathered
Altered
Soil properties

Numbers give diametral point load strength (Is) in MPa.

② Substances with soil properties remoulded and classified by Unified System

③ ROCK QUALITY DESIGNATION
0–25% Very poor
25–50% Poor
50–75% Fair
75–100% Good to excellent

④ (350) Maximum effective pressure (kiloposcals) reached during test.

DRILL TYPE	LOGGED BY: J.C. Beal
CIRCULATION:	DATE: 25 June 83
HOLE ANGLE:	BEARING:
START:	TRACED BY:
FINISH:	DATE:
SHEET 1 OF 5	PLAN S17317a

3395

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

LOG OF CUT-OFF TRENCH

PROJECT: HAPPY VALLEY RES. EWS TANK EMBANKMENT
LOCATION OR CO-ORDS: SOUTH BANK OF TRENCH
SEC. HD. EL Surface EL ref. point Datum

UNIT/STATE NO.
SERIAL NO.
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GEOLOGICAL DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	HOLE Dia.	DEPTH m	GRAPHIC LOG	③ R.Q.D.% 75 50 25	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS% 0 100	④ WATER PRESSURE TESTS LUGEONS 0.5 1 5 10 50 100
X639-X641 (CW)-(HW); VW Base of previous stratum X641-X650 (CW); ML-CL to VW Siltstone				42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78			Angular blocks still discernible Brown/Grey Brown - ochrous with mottled grey/cream leached zones					

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DRILL TYPE	LOGGED BY: J.C. Beal
CIRCULATION:	DATE: 25 June 83
HOLE ANGLE:	BEARING:
START:	TRACED BY:
FINISH:	DATE:
SHEET 2 OF 5	PLAN S17317b

3395

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

LOG OF CUT-OFF TRENCH

PROJECT: HAPPY VALLEY RES. EWS TANK EMBANKMENT
LOCATION OR CO-ORDS: SOUTH BANK OF TRENCH
SEC. HD. EL Surface EL ref. point Datum

UNIT/STATE NO:
SERIAL NO:
FOLDER NO.

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				82								
				84								
				86								
				88								
				90								
				92								
				94								
				96								
				98			Poured Concrete					
Completely weathered, very weak siltstone.				700			Easily puddled by sheep's foot roller.					
				2								
				4								
				6								
				8								
				10								
				12								
				14								
				16								
				18								

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CIRCULATION:	DATE: 25 June 83
HOLE ANGLE:	BEARING:
START:	TRACED BY:
FINISH:	DATE:
SHEET 3 OF 5	PLAN S17317c

3395

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA
ENGINEERING DIVISION

LOG OF CUT-OFF TRENCH

PROJECT: HAPPY VALLEY RES EWS TANK EMBANKMENT
LOCATION OR CO-ORDS: SOUTH BANK OF TRENCH
SEC. HD. EL Surface EL ref. point Datum

UNIT/STATE NO:
SERIAL NO:
FOLDER NO.

GEOLOGICAL DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	HOLE Dia.	DEPTH m	GRAPHIC LOG	③ R.Q.D.% 75 50 25	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS% 0 100	WATER PRESSURE TESTS LUGEONS 0.5 1 5 10 50 100 ④
X730				22 24 26 28 30 32 34 36 38 40 42 44 46 48 750								
Transition to moderately weathered, medium strong pale brown siltstone							Trench traversed by strong, tight siltstone at X730 to X750 forming a ridge at X745 to X750 Approximately 1·5m high removed by crowbar and hand pick					
							Y475					
				y 473 471 469 467			Trench has very sharp turn to south to curve around base of Wash water recycle tank.					

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DRILL TYPE	LOGGED BY: J.C. Beal
CIRCULATION:	DATE: 25 June 83
HOLE ANGLE:	BEARING:
START:	TRACED BY:
FINISH:	DATE:
SHEET 4 OF 5	PLAN S17317d

3395

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: HAPPY VALLEY RES EWS TANK EMBANKMENT

LOCATION OR CO-ORDS: SOUTH BANK OF TRENCH

LOG OF CUT-OFF TRENCH

SEC. HD. EL Surface EL ref. point Datum

UNIT/STATE NO:

SERIAL NO:

FOLDER NO.

GEOLOGICAL DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	HOLE Dia.	DEPTH m	GRAPHIC LOG	③ R.Q.D.% 75 50 25	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS % 0 100	④ WATER PRESSURE TESTS LUGEONS 0.5 1 5 10 50 100
Highly weathered weak siltstone				463 61 59 57 55 53 51 49 47 45 43 41 39 37 35 33 31 29 27			Shallow trench only excavated into this material owing to long leakage path for low hydraulic head. Easily puddled by sheep's foot roller. Y425 End of log					

① ROCK SUBSTANCE

STRENGTH TERM
VS–Very Strong
S–Strong
MS–Medium Strong
W–Weak
VW–Very Weak
SO–Soil properties

CONDITION TERM
Fresh
Weathered
Altered
Soil properties

Numbers give diametral point load strength (Is) in MPa.

② Substances with soil properties remoulded and classified by Unified System

③ ROCK QUALITY DESIGNATION
0–25% Very poor
25–50% Poor
50–75% Fair
75–100% Good to excellent

④ (350) Maximum effective pressure (kilopascals) reached during test.

DRILL TYPE	LOGGED BY: J.C. Beal
CIRCULATION:	DATE: 25 June 83
HOLE ANGLE:	BEARING:
START:	TRACED BY:
FINISH:	DATE:
SHEET 5 OF 5	PLAN S17317e

3395

APPENDIX B

GEOLOGICAL LOG OF BACK-HOE PITS T32, T33 AND T34

(FILTERED WATER STORAGE TANKS)

DEPARTMENT OF MINES SOUTH AUSTRALIA
ENGINEERING DIVISION

EXCAVATION NO. T32

LOG OF EXCAVATION

PROJECT HAPPY VALLEY WATER TREATMENT WORKS

SECTION . . . . . SURFACE ELEV. . . . . LOCATION . . . . .

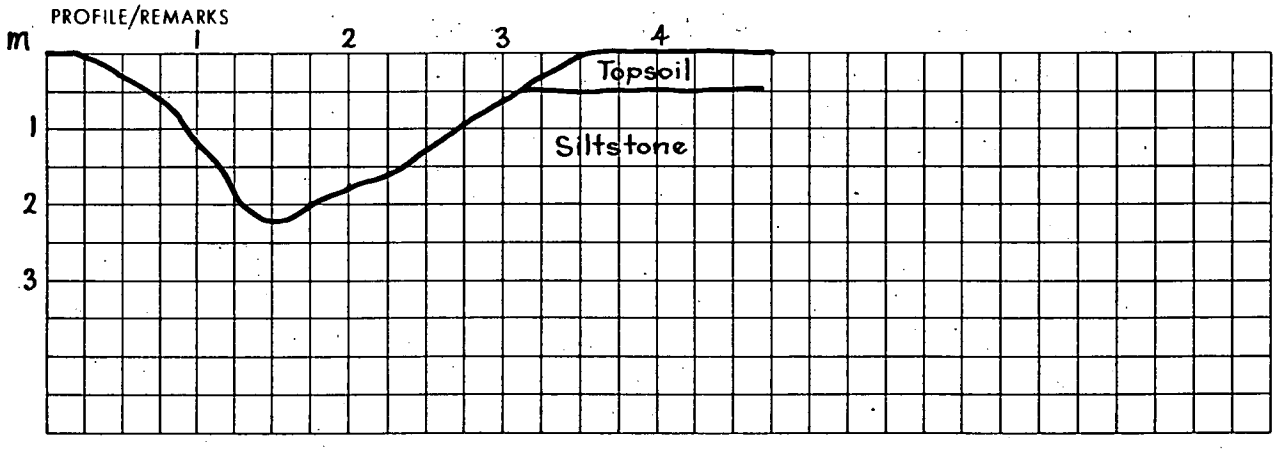
HUNDRED . . . . . DATUM . . . . . OR CO-ORDS . . . . .

TYPE OF EXCAVATION BACKHOE TRENCH . . . . . DATE . . . . .

MAXIMUM DEPTH 2·2 m . . . m WIDTH . . . . . m LENGTH . . . . . m

FORMATION / SOIL HORIZON	PROFILE: ELEV. m / DEPTH m	PROFILE: GRAPHIC LOG	UNIFIED SYMBOL	DESCRIPTION AND STRUCTURE (UNIFIED SOIL CLASSIFICATION)	WATER LEVEL	MOISTURE CONTENT	CONSISTENCY / REL. DENSITY	TEST – ✱ / SAMPLE – ■
A/B			ML CL	Topsoil + 'B' horizon				
	1			Siltstone Pale brown (MW); MS, blocky Bedding dip 60°S.E. (approx.)		DRY		
	2							

PROFILE/REMARKS



WATER LEVEL	MOISTURE CONTENT	CONSISTENCY (CLAY)	RELATIVE DENSITY (ESTIMATED)	✱TEST, ■SAMPLE DESCRIPTION
Water level (date) Water cut Sp=Seepage	D - Dry M - Moist W - Wet LL - Liquid limit PL - Plastic limit	S - Soft F - Firm St - Stiff H - Hard	L - Loose MD - Medium Dense D - Dense	SHEET 1 OF 1

LOGGED J.C. Beal
DATE 19·10·82
TRACED R.H.
DATE Apr. 1984
DRG. NO. S17314

3395

DEPARTMENT OF MINES SOUTH AUSTRALIA
ENGINEERING DIVISION

EXCAVATION NO. T33

LOG OF EXCAVATION

PROJECT HAPPY VALLEY WATER TREATMENT WORKS

SECTION ... SURFACE ELEV. ... LOCATION ...

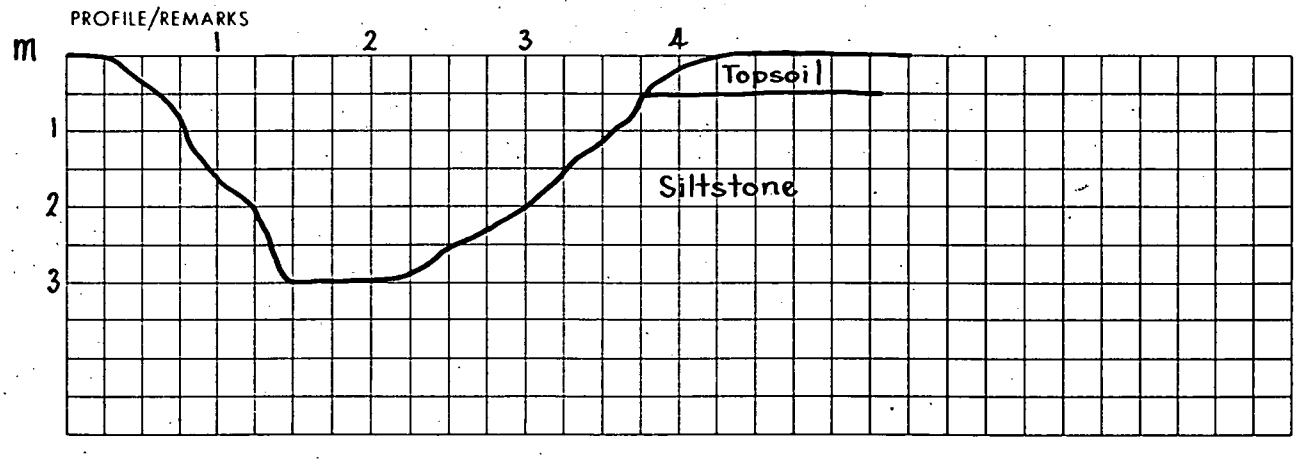
HUNDRED ... DATUM ... OR CO-ORDS ...

TYPE OF EXCAVATION BACKHOE TRENCH ... DATE ...

MAXIMUM DEPTH 3·0m ... m WIDTH ... m LENGTH ... m

FORMATION SOIL HORIZON	PROFILE ELEV. m / DEPTH m	GRAPHIC LOG	UNIFIED SYMBOL	DESCRIPTION AND STRUCTURE (UNIFIED SOIL CLASSIFICATION)	WATER LEVEL	MOISTURE CONTENT / CONSISTENCY REL. DENSITY	TEST - * / SAMPLE - ■
A/B			ML CL	Topsoil + 'B' Horizon			
	1			Siltstone Cream/pink - pale brown (HW) - (MW); W-MS		DRY	
	2						
	3						

PROFILE/REMARKS



WATER LEVEL	MOISTURE CONTENT	CONSISTENCY CLAY	RELATIVE DENSITY ESTIMATED	*TEST, ■SAMPLE DESCRIPTION	
Water level (date) Water cut Sp=Seepage	D - Dry M - Moist W - Wet LL - Liquid limit PL - Plastic limit	S - Soft F - Firm St - Stiff H - Hard	L - Loose MD - Medium Dense D - Dense		LOGGED J.C. Beal DATE 19·10·82 TRACED R.H. DATE Apr 1984 DRG. NO. S17315 SHEET 1 OF 1

3395

DEPARTMENT OF MINES SOUTH AUSTRALIA
ENGINEERING DIVISION

EXCAVATION NO. T34

LOG OF EXCAVATION

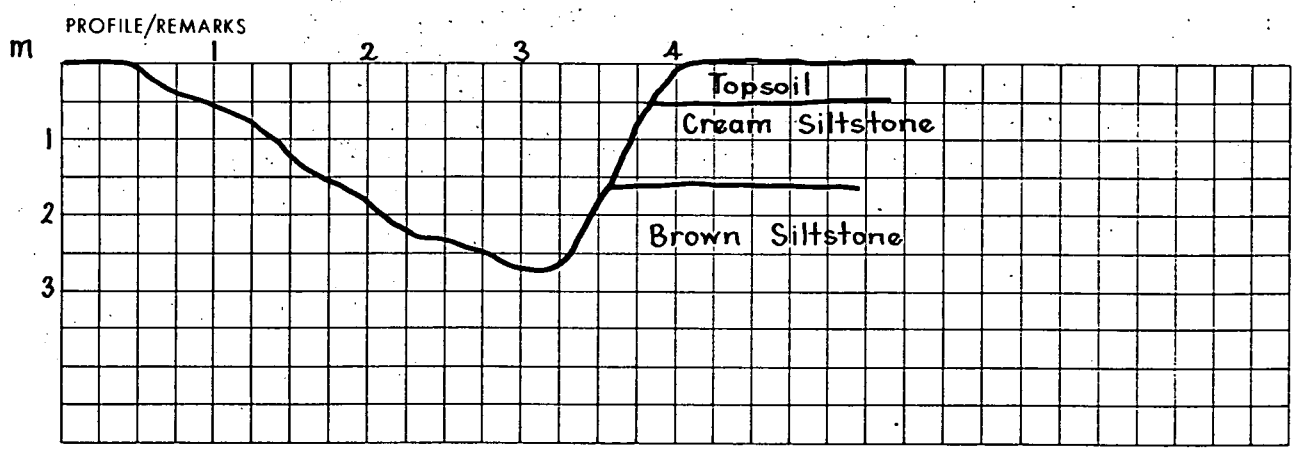
PROJECT: HAPPY VALLEY WATER TREATMENT WORKS

SECTION . . . . . SURFACE ELEV. . . . . LOCATION . . . . . .
HUNDRED . . . . . DATUM . . . . . OR CO-ORDS . . . . . .

TYPE OF EXCAVATION BACKHOE TRENCH . . . . . DATE . . . . . .
MAXIMUM DEPTH 2·7m . . . m WIDTH . . . . . m LENGTH . . . . . m

FORMATION / SOIL HORIZON	PROFILE: ELEV. m / DEPTH m	PROFILE: GRAPHIC LOG	UNIFIED SYMBOL	DESCRIPTION AND STRUCTURE / UNIFIED SOIL CLASSIFICATION	WATER LEVEL	MOISTURE CONTENT	CONSISTENCY / REL DENSITY	TEST – * / SAMPLE – ■
A / B			ML CL	Topsoil + 'B' Horizon				
	1			Siltstone Cream - pale brown (HW) - (MW); MS. Blocky, up to fist size		DRY		
	2			Brown				

PROFILE/REMARKS



WATER LEVEL	MOISTURE CONTENT	CONSISTENCY (CLAY)	RELATIVE DENSITY (ESTIMATED)	*TEST, ■SAMPLE DESCRIPTION
Water level (date) Water cut Sp=Seepage	D - Dry M - Moist W - Wet LL - Liquid limit PL - Plastic limit	S - Soft F - Firm St. - Stiff H - Hard	L - Loose MD - Medium Dense D - Dense	SHEET 1 OF 1

LOGGED J.C. Beal
DATE 19·10·82
TRACED R.H.
DATE Apr 1984
DRG NO. S17316

3395

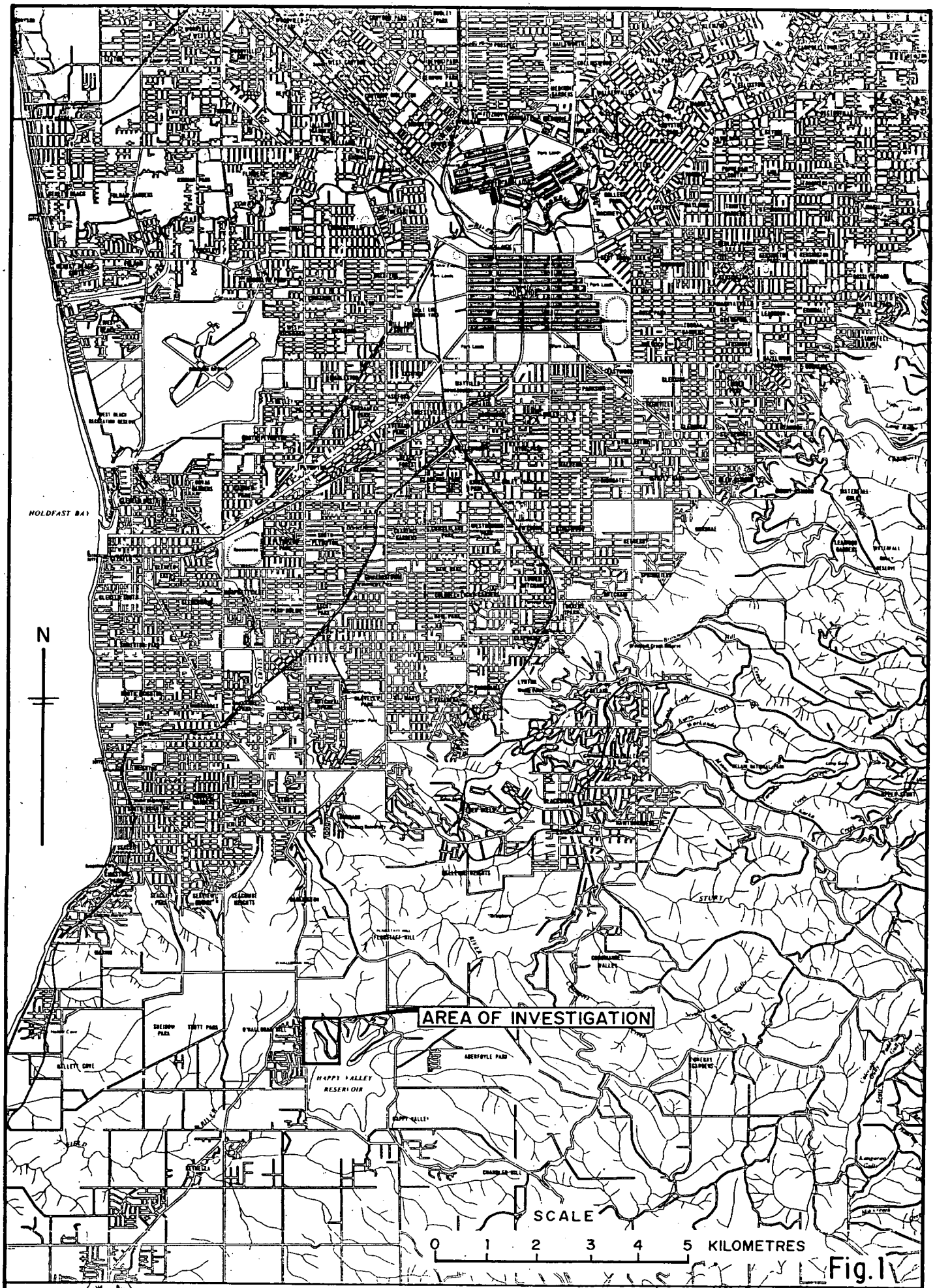


Fig. 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

HAPPY VALLEY FILTRATION PLANT

LOCALITY PLAN

COMPILED J. B.	C.D.O 5.7.84 DATE
DRAWN M. B.	SCALE 1 : 100000
DATE Dec '83	PLAN NUMBER S17181
CHECKED	

3395

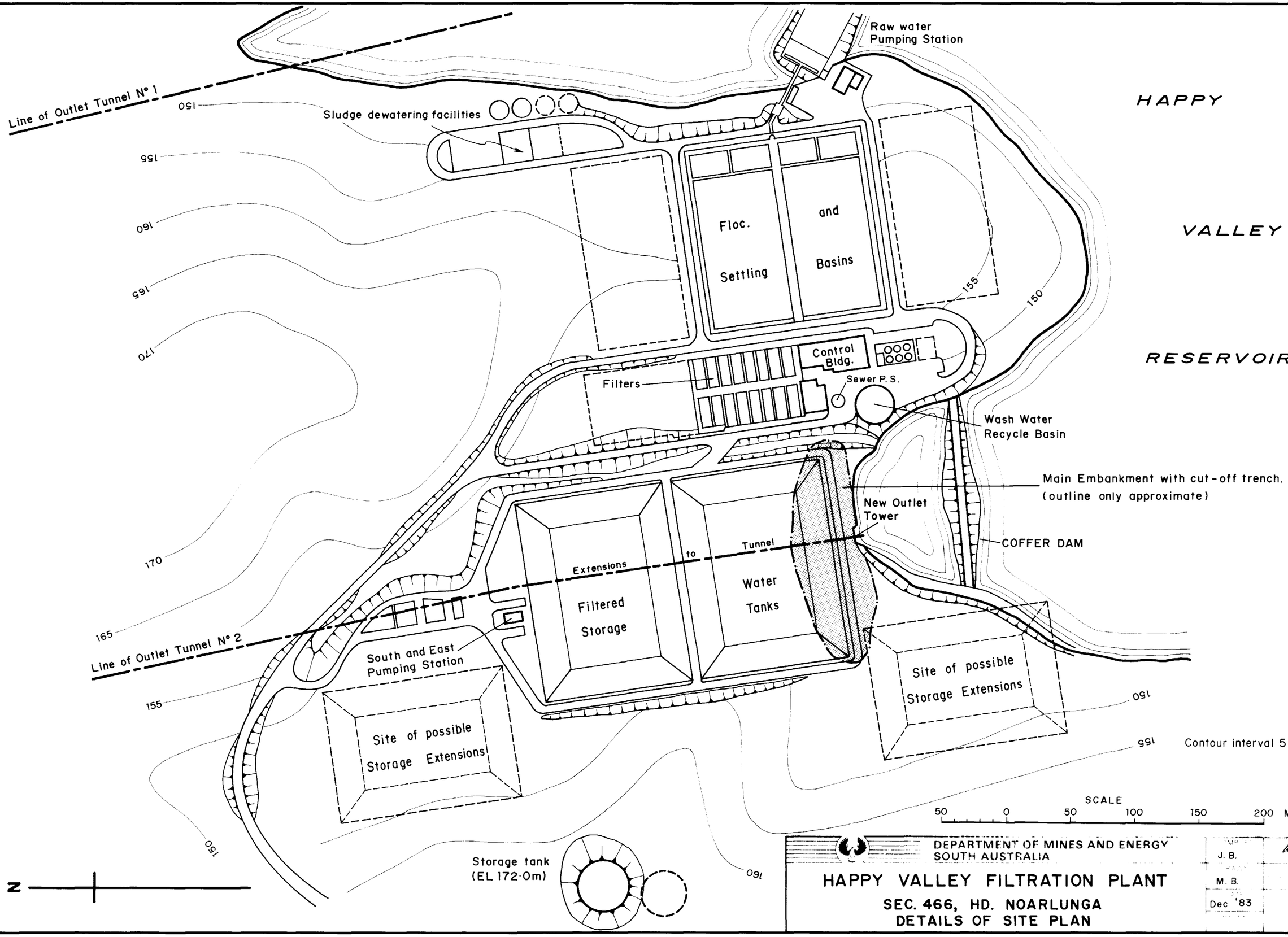


Fig. 2

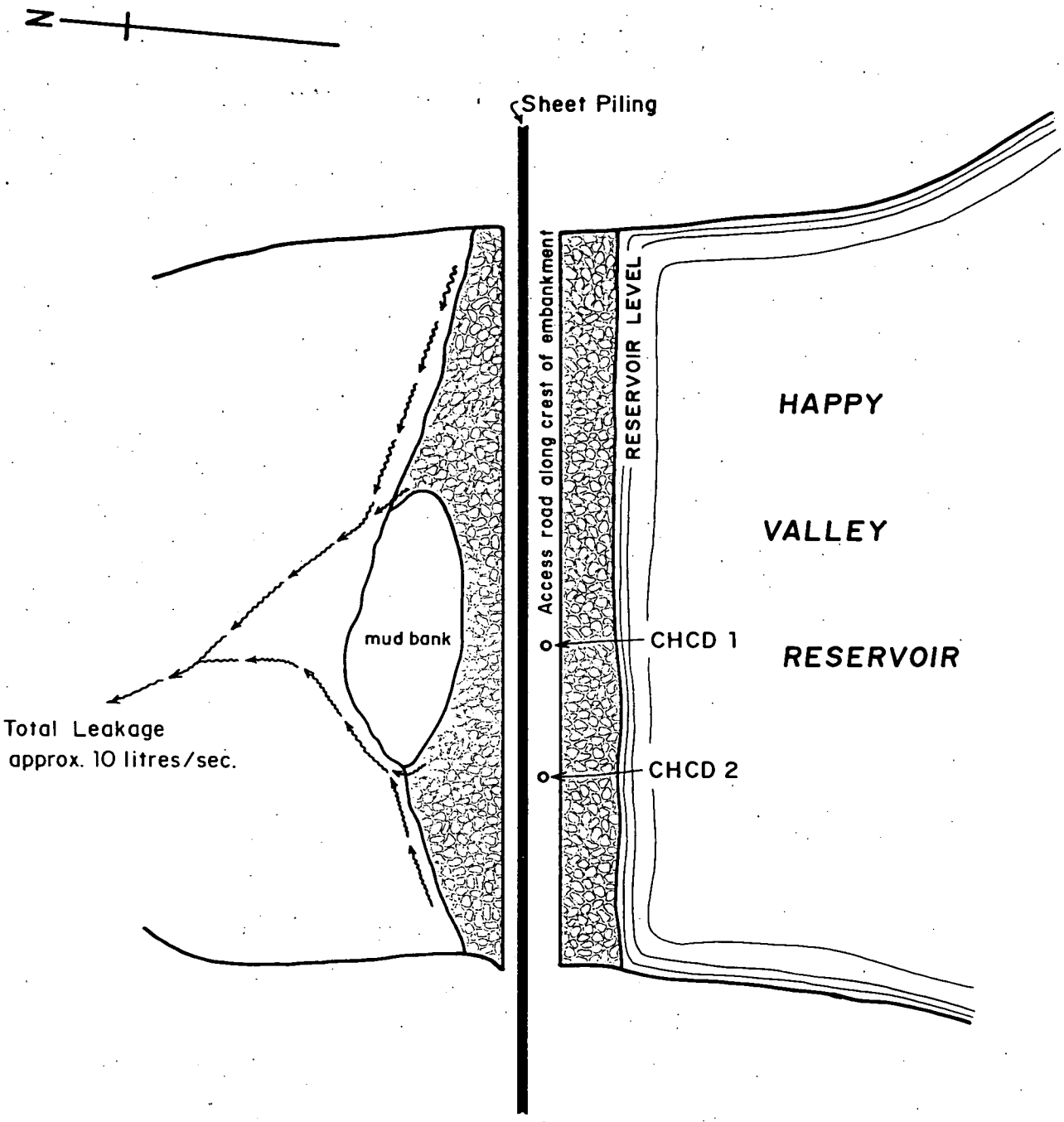
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

HAPPY VALLEY FILTRATION PLANT

SEC. 466, HD. NOARLUNGA
DETAILS OF SITE PLAN

J. B.	5·7·84
M. B.	1:2500
Dec '83	84-11

3395



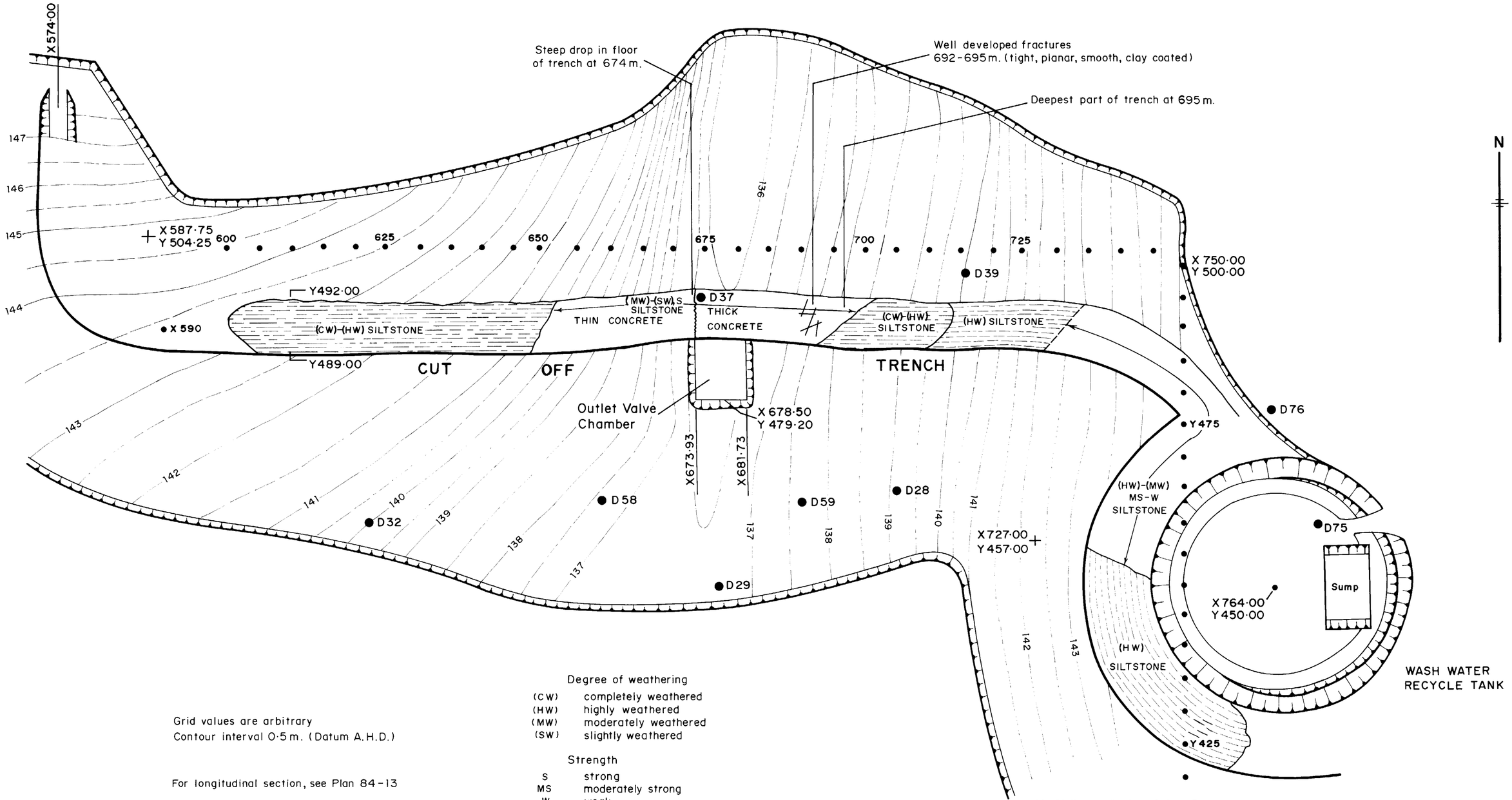
o CHCD 1 Cable Tool Testhole

For location of Coffer Dam, see Plan 84-11

Fig. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED J.B.	C.D.O 5.7.84 DATE
HAPPY VALLEY FILTRATION PLANT	DRAWN M.B.	SCALE
DIAGRAMMATIC PLAN OF COFFER DAM	DATE Dec '83	PLAN NUMBER S17182
	CHECKED	

3395



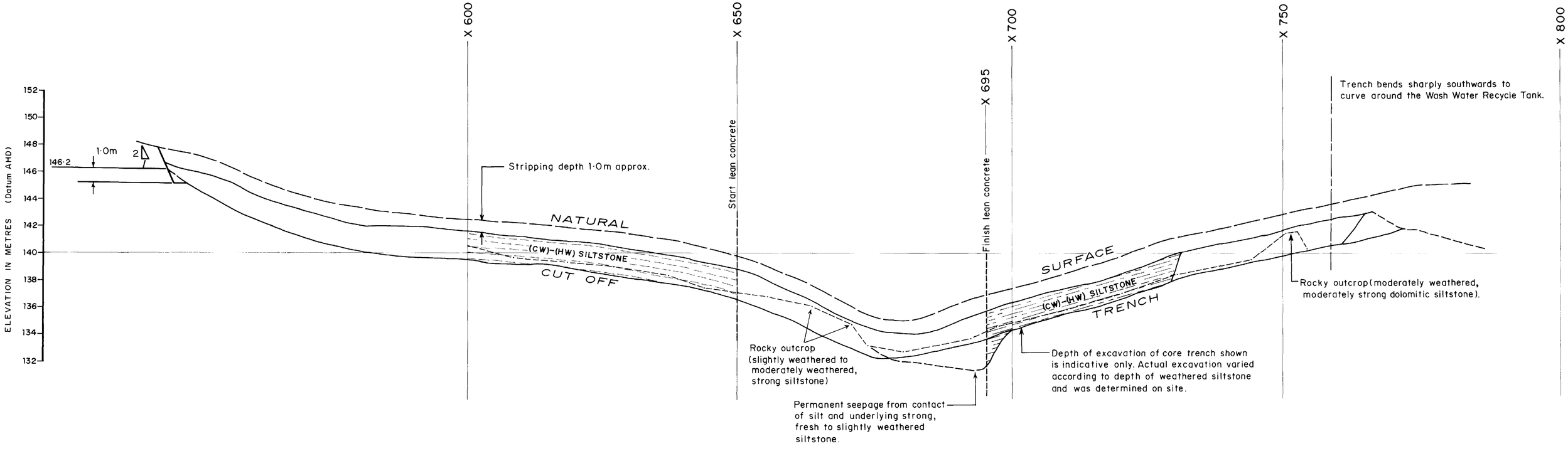
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

HAPPY VALLEY FILTRATION PLANT

FILTERED WATER STORAGE TANKS-MAIN EMBANKMENT
GEOLOGICAL SUMMARY OF CUT OFF TRENCH

J. B.	AR 5·7·84	Fig. 4
M. B.	1:500	
Dec '83		84-12

3335



SCALE

10 0 10 20 30 40 50 Metres

For location of Section, see Plan 84-12

Fig. 5

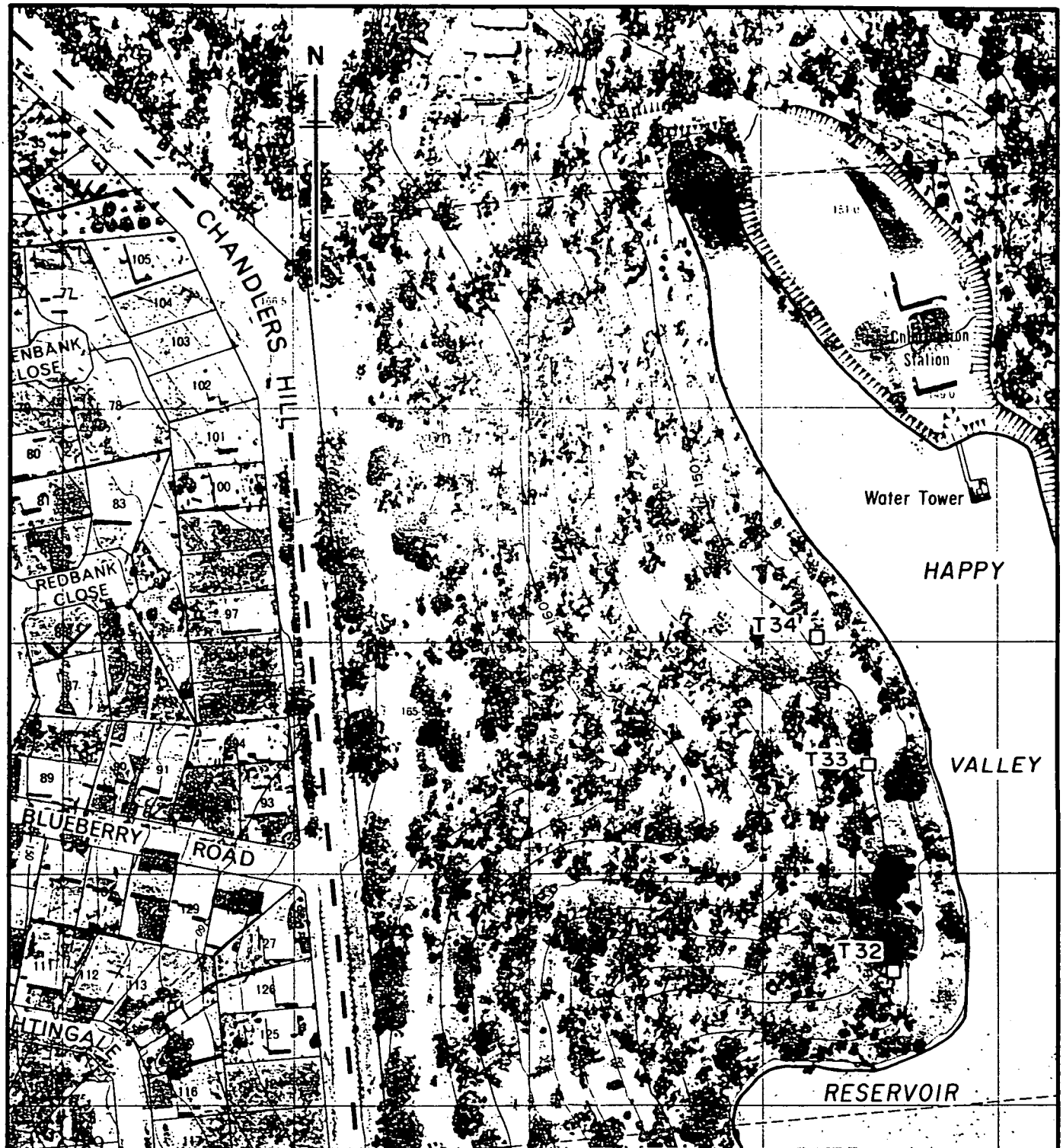
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

HAPPY VALLEY FILTRATION PLANT

GEOLOGICAL PROFILE OF CUT OFF TRENCH

J. B.	5·7·84
M.B.	1 : 500
Dec '83	84-13

3395



—150— Topographic Contour (metres, AHD)

□T32 Backhoe Pit

SCALE

50 0 50 100 Metres

Fig. 6

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

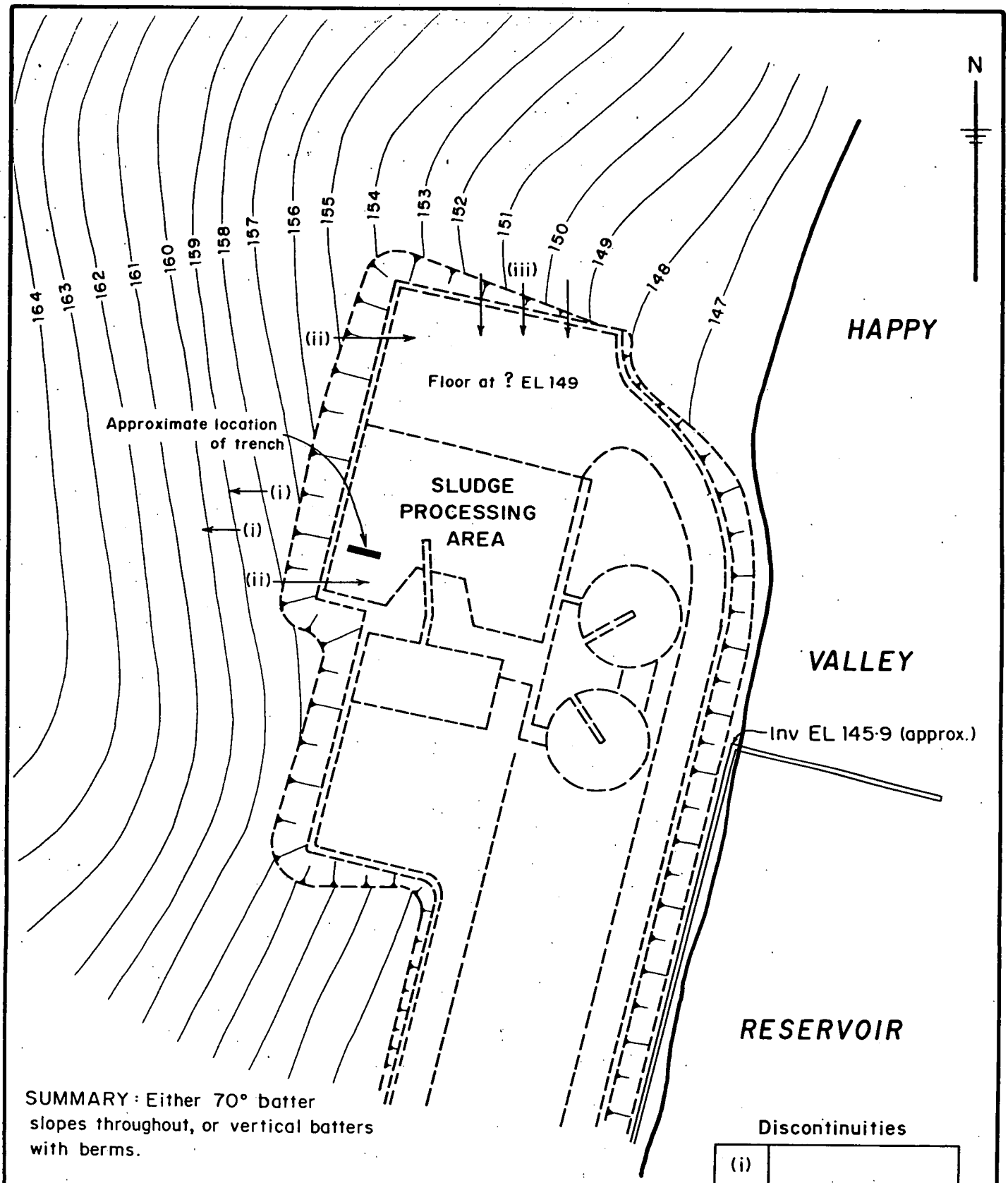
COMPILED J. B.	C.D.O. 5·7·84 DATE
DRAWN M. B.	SCALE 1:2 500
DATE Dec '83	PLAN NUMBER S17183
CHECKED	

HAPPY VALLEY FILTRATION PLANT

SEC. 466, HD. NOARLUNGA

LOCATION OF BACKHOE PITS

3395



SUMMARY : Either 70° batter slopes throughout, or vertical batters with berms.

Discontinuities

(i)	
(ii)	
(iii)	

Contour interval 1m (Datum AHD)

SCALE

20 0 20 40 60 80 100 Metres

Fig. 7

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED J. B. — CDO — 5·7·84 DATE

DRAWN M. B.

DATE Dec '83

CHECKED

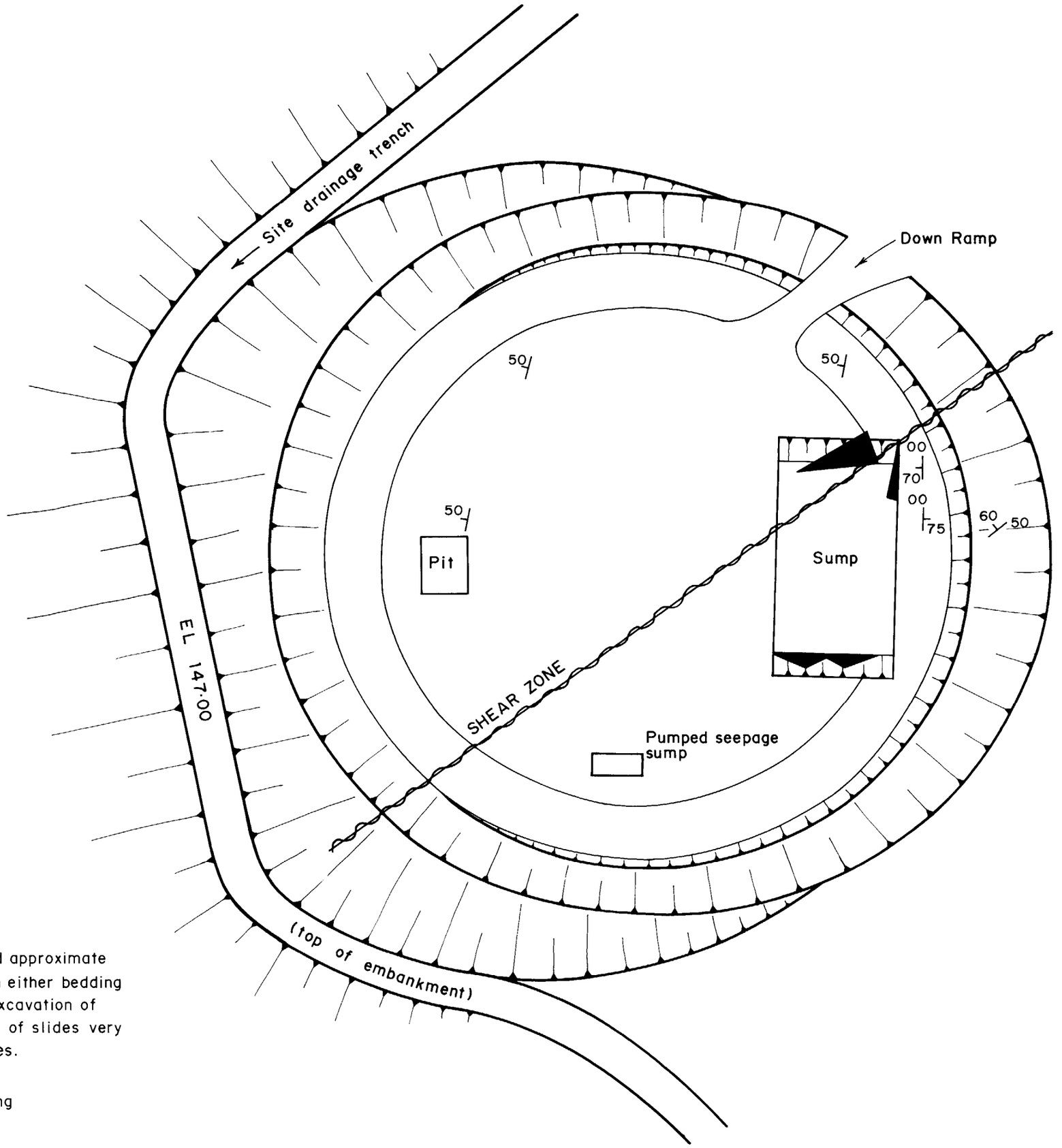
SCALE 1:1000

PLAN NUMBER S17184

HAPPY VALLEY FILTRATION PLANT
SLUDGE DEWATERING FACILITIES
SHOWING LOCATION OF BACKHOE TRENCH

3395

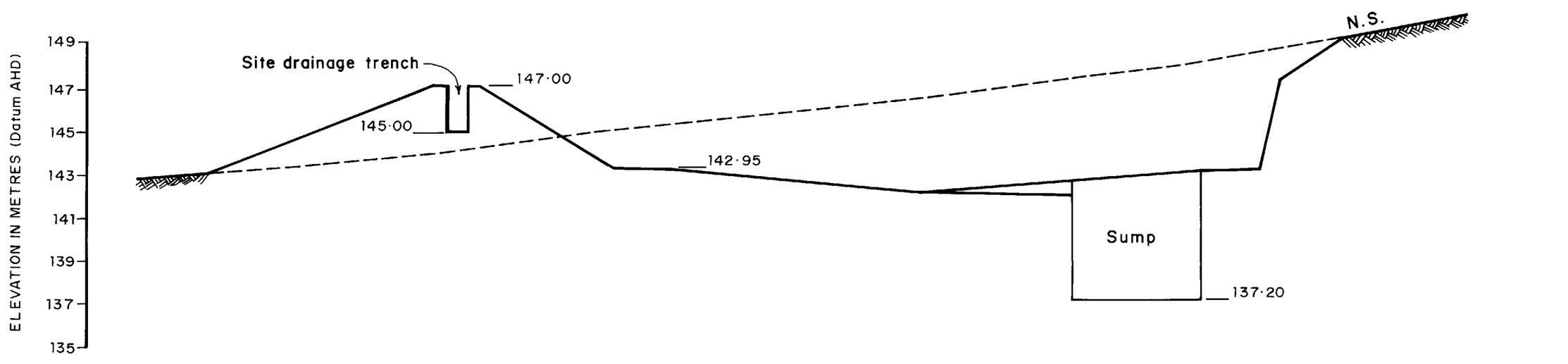
N



Represents location and approximate extent of rock slides on either bedding plane or joint during excavation of the sump. Total volume of slides very approximately 5 tonnes.

70/110 Strike and dip of bedding

WEST — EAST



SCALE

5 0 5 10 15 20 25 Metres

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

HAPPY VALLEY FILTRATION PLANT

WASH WATER RECYCLE TANK PLAN AND SECTION

COMPILED J. B.	5·7·84
DRAWN M.B.	As Shown
Dec '83	84-14

Fig. 8

3395

PLATE 1 General View Looking N.E. across Coffer-dam Neg. No. 34081

PLATE 2 Looking North towards Outlet Tower Neg. No. 34082

PLATE 3 Cut-off trench looking west (X650 to X600).
Neg. No. 34088

PLATE 4 Cut-off trench at X640*. Looking northwards.
Neg. No. 34084

*construction site reference grid.

PLATE 5 Cut-off trench at X610 m. Looking south eastwards
Neg. No. 34085

PLATE 6. Cut-off trench looking westwards.
X680 to X660.
Neg.No. 34086

PLATE 7 Cut-off trench looking eastwards. X670 to X720
Neg. No. 34087

PLATE 8 Cut-off trench looking north-eastwards. X680
Neg. No. 34088

PLATE 9 Diversion tunnel looking northwards.
Neg.No. 34089

PLATE 10 Main filtered water tank embankment looking south-east.
Neg. No. 34090

PLATE 11 Excavated batter for the Filters Neg. No. 34091

PLATE 12 Vuggy quartz vein in Filters batter Neg. No. 34092

PLATE 13 Inlet tunnel looking south-east Neg. No. 34093

PLATE 14 Floor of By-pass structure looking east Neg. No. 34094

PLATE 15 Wash water Re-cycle Tank looking northwards Neg. No. 34095

PLATE 16 Access ramp to Re-cycle Tank excavation Neg. No. 34096

PLATE 17 Minor rock slide in southern face of Sump excavation. Neg. No. 34097

PLATE 18 Rock slide in northern face of sump excavation. Neg. No. 34098

PLATE 19 Looking south. Seepages in Re-cycle Tank excavation Neg. No. 34099

PLATE 20 South face of sump excavation Neg. No. 34100

PLATE 21 Trench in Filters floor Neg. No. 34101

PLATE 22 Looking south. Drain trench at eastern end of By-pass structure Neg. No. 34102

PLATE 23 Shear Zone traversing Re-cycle Tank Sump excavation Neg. No. 34103