# DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

Rept.Bk.No. 79/132

DOLOMITE AGGREGATE DEPOSIT - CRYSTAL BROOK

Section 736 hundred of Crystal Brook - Highways Department -

GEOLOGICAL SURVEY

by

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MINERAL RESOURCES SECTION



<u>Crystal Brook Dolomite Aggregate Deposit. October, 1978</u>

<u>Frontispiece</u> - View of proposed quarry site looking southwesterly.

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# DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

Rept.Bk.No. 79/132 D.M.E. No. 211/79

#### DOLOMITE AGGREGATE DEPOSIT CRYSTAL BROOK

Section 736 hundred of Crystal Brook - Highways Department -

#### **ABSTRACT**

Two deposits comprising gently dipping dolomitic sediments of the Skillogalee Dolomite were located during reconnaissance for construction materials for the Crystal Brook bypass. The southern deposit, 4 km northeast of Crystal Brook, was subsequently chosen for detailed evaluation.

Two diamond drill holes totalling 78.35 m were drilled, and a quarry to yield 132 000 m<sup>3</sup> of useable stone in situ has been outlined. This stone is interbedded with 31 500 m<sup>3</sup> of shaly material and overlain by 29 500 m<sup>3</sup> of overburden, some of which may be suitable for sub-base.

#### INTRODUCTION

In 1978, the Highways Department requested the assistance of this Department in locating a source to supply 80 000  $\text{m}^3$  of crushed rock and 38 000  $\text{m}^3$  of chippings for construction of the Crystal Brook bypass and re-sealing roads in the district.

During reconnaissance in October 1978, two potential sites were located in dolomitic siltstone, dolomitic quartzite, and quartzitic dolomite of the Skillogalee Dolomite of Adelaidean age.

Both sites are substantially hidden from view.

The northern site, 7 km east of Warnertown is within an area designated "Environmental Class A" in the Mid-North Planning Area Supplementary Development Plan for the Southern Flinders Ranges (see Fig. 2). This deposit was mapped on 6th February 1979, and is the subject of a separate report (Pain, 1979).

The southern site, 4 km northeast of Crystal Brook, is under interim development control in the Crystal Brook District Council and in a Rural Area as defined in the Supplementary Development Plan. Two diamond core holes totalling 78.35 m were drilled between 6th February and 9th March 1979.

In July 1979, the Crystal Brook Bypass project, which had been scheduled to commence in late 1979, was deleted from the Highways Department 5 year plan.

LOCATION, ACCESS AND TOPOGRAPHY

The deposit is located 4 km northeast of Crystal

Brook in section 736 hundred of Crystal Brook county Victoria.

Access is via 1 km of unsealed road which runs northwards to Bowman Park recreation reserve from the Crystal Brook-Gladstone road, 4 km east of Crystal Brook.

The deposit occurs on the northeastern part of a spur rising 30 m above two creeks which drain northwards into a tributary to Crystal Brook (See Figs 1 and 4 and Frontispiece).

# ENVIRONMENTAL ASSESSMENT

The deposit is on freehold land in a Rural Area as defined in the Mid-North Planning Area Supplementary Development Plan for the Southern Flinders Ranges.

Most of section 736 is used for cereal farming, but rocky outcrops and steep topography have precluded cultivation of the proposed quarry site.

Vegetation has been cleared from much of the area to be quarried, but some trees remain along the southern bank of the creek at the northern margin of the proposed quarry.

The quarry site cannot be seen from the Crystal Brook-Gladstone road nor the unsealed road into Bowman Park. The deposit is 1 km southeast of the oval at Bowman Park and will have no impact on this recreation area.

#### GEOLOGICAL SETTING

The regional geology of the area is shown on Figure 3 which has been adapted from BURRA (Mirams, 1964).

The deposit occurs within a sequence of dolomitic sediments of the Skillogalee Dolomite, part of the Willouran Group of Adelaidean age.

An anticline with a core of Willouran sediments extends for about 15 km between Wirrabara and Huddleston. Regional dips on the western flank of this structure are commonly around  $60^{\circ}$  but shallow locally to  $7^{\circ}$  in the vicinity of the deposit.

#### SITE GEOLOGY

The deposit consists of interbedded dolomite, dolomitic siltstone, dolomitic quartzite, quartzitic dolomite and carbonate rich shale. The distribution of these rock types is shown on the geological plan and section accompanying this report (Fig. 4). The dolomitic sequence is overlain by interbedded quartzite and siltstone with some dolomitic bands which outcrop poorly on the west of the hill.

The deposit is gently folded and has an overall strike of  $130^{\circ}$  and dips southwesterly at  $7^{\circ}$ .

The dip steepens slightly near the western margin of the quarry site. Two hundred metres east and west of the site, beyond the limits of Figures 4 and 5, dips steepen to  $60-70^{\circ}$ .

Outcrop on the northern edge of the deposit flanking the westerly draining creek is extensive but elsewhere is limited generally to the more resistant quartzitic dolomite and dolomitic quartzite bands.

Weathered overburden on the northern and eastern slopes of the deposit is expected to vary in depth up to about 2 m.

Overburden comprising weathered siltstone and shale reaches a depth of 8 m on the western limit of the proposed quarry (see Fig. 6).

#### DRILLING

A Highways Department rig was used to drill 2 vertical diamond core holes totalling 78.35 m. Logs and photographs of the core are presented in Figures 7, 8 and 9.

The drill holes intersected all the geological units to be quarried, with an overlap of 30 m between the holes.

TESTING OF DIAMOND DRILL CORE

# Petrographic Examination

Selected samples of drill core were examined petrographically by Mr W.O. Harvey (Scientific Officer, Highways Department). No deleterious secondary minerals occur within the rock types to be used for crushed rock and chippings.

# Material Testing

Four samples of diamond drill core were tested in the Highways Department Northfield Laboratory. Detailed results are presented in Table 1 and summarized on the drill logs in Figures 7 and 8.

## Bitumen Stripping Tests

Limited testing has been carried out as detailed in Table II. Stripping up to 85% (wet) and 68% (dry) was obtained without additives. Only one of the 3 samples tested showed significant improvement with 0.5% Megamine B.A., and additional testing of other additives is required.

TABLE I

MATERIAL TESTING

Sample No.	789-A-3906	789-A-3907	789-A-3908	789-A-3909
Drill Hole No.	DDH1	DDH1	DDH2	DDH2
Interval (m)	4.78-8.74	14.84-18.80	0.61-5.79	12.19-15.85
Use Category*	С	D	D	D
Proposed Quarry Bench	Middle	Bottom	Midd1e	Bottom
Los Angeles %loss	N.D.	21	21	20
Sulph. Sound.+ %loss	N.D.	2	2	0.8
Soil Constants+ (Crusher fines) Plast. Lim. Liq. Lim. P.I. Lin. Shr.	18 29 11 4.0	15 24 9 3.6	17 25 8 4	16 18 2 1
Soil Constants+ (L.A. fines) Plast. Lim. Liq. Lim. P.I. Lin. Shr.	N.D. N.D. N.D. N.D.	14 18 4 1.4	14 17 3 1.4	16 18 2 0.8

TABLE II

BITUMEN STRIPPING TESTS (% stripping)

Sample No.	Without a	dditive	With 0.5% Megamine B.A.				
	$\underline{\mathtt{Dry}}$	Wet	$\underline{\mathtt{Dry}}$	Wet			
3907 3908 3909	59 68 36	85 77 51	24 15 37	35 83 69			

<sup>\*</sup> See under STONE QUALITY AND USAGE

P.I. - Plasticity Index Lin. Shr. - Linear Shrinkage

<sup>+</sup> Plast. Lim. - Plastic Limit Liq. Lim. - Liquid Limit Sulph. Sound. - Suphate Soundness

## STONE QUALITY AND USAGE

Based on detailed examination of the drill core, petrographic examinations and laboratory testing, four main categories have been determined, and are shown on cross sections in Figure 6 and detailed below:

## A. Overburden

On the flanks of the hill, this unit which comprises weathered dolomitic sediments is expected to vary in depth up to about 2 m. On the crest of the hill, thickness of weathered siltstone, shale, dolomitic quartzite and quartzite comprising this unit reaches 8 m within the area to be quarried.

In general, overburden is expected to be rippable. Indurated layers near the hill crest may be of sufficient quality for use as sub-base.

#### B. Waste

Thin bands of fissile shale, deeply weathered in parts, occur throughout the sequence. The thickest bed reaches 3 m as shown on cross sections in Figures 4 and 6. The material in the drill core appeared to be sufficiently weathered to be scalped out during crushing and screening operations. However, partly weathered fragments may pass through the plant in the crushed rock, increasing the P.I. of the product.

#### C. Crushed rock

Material in this category comprises quartzitic dolomite, dolomitic quartzite, quartzite and shale, in general moderately to slightly weathered. Scalping of the more weathered, friable shale should produce a suitable crushed rock for pavement construction. Sample 789-A-3906 in Table I is representative of this material.

Limited quantities of sealing aggregate may be obtained during production of crushed rock by screening out material in the 7-14 mm size range.

# D. Chippings and crushed rock

Quartzitic dolomite, dolomitic quartzite, dolomitic siltstone and shaly interbeds comprise this material. With scalping of the weathered friable shaly material, rock in this category should be suitable for production of sealing aggregate or concurrent production of sealing aggregate and crushed rock. Samples 789-A-3907, 3908, 3909 in Table I represent material in this category.

# RESERVES AND QUARRY DEVELOPMENT

A quarry designed to yield a total of 193 000  $\mathrm{m}^3$  of in situ material is outlined in Figure 5.

Table III details the quantities of material in each category which could be won from each bench.

$\frac{TA}{T}$	AB LI	Ι	II
RI	ESEI	RVE	S
(m <sup>3</sup>	in	si	tu)

	A Overburden	B Waste	C Crushed rock	D Chippings and crushe rock	Totals
Top Bench	14 000	. <del>-</del>	-	-	14 000
Middle Bench	10 500	9 000	24 500	19 500	63 500
Bottom Bench	5 000	22 500	<u>-</u>	88 000	115 500
Totals	29 500	31 500	24 500	107 500	193 000
Composite Total	61 0	00	132 000		

Material from the top bench is almost entirely overburden, most of which is expected to be rippable, although some blasting may be required. Some sub-base may be won from this bench.

The second bench will be suitable for crushed rock (Category C) but higher quality (Category D) material near the bottom of the face will enable the concurrent production of crushed rock and small quantities of chippings.

The bottom bench will provide the highest quality (Category D) material, suitable for the production of chippings, or the concurrent production of chippings and crushed rock.

The contract specifications for production rates and delivery dates of the various products will determine the relative development rates of each of the quarry benches.

The quarry outlined in Figure 5 has been specifically designed for the Crystal Brook Crushing Contract No. 2. The overall rock quality is not high enough to supply a "chippings only" contract, particularly from the top two benches, but is capable of supplying stone for this contract of mainly crushed rock. If the site is being considered as a future source of re-seal aggregates, advantage should be taken of the large quantity of crushed rock required in this contract to develop the top two benches to a greater extent than shown in Figures 5 and 6. A higher proportion of Category D material would be exposed in the bottom face for future crushing contracts for re-seal aggregate.

#### CONCLUSIONS AND RECOMMENDATIONS

A quarry to yield a total of 193 000 m $^3$  of in situ material comprising 132 000 m $^3$  of useable rock interbedded with 31 500 m $^3$  of shaly waste, and overlain by 29 500 m $^3$  of overburden has been

outlined 4 km northeast of Crystal Brook.

The quarry has been designed to satisfy a crushing contract to supply 80 000  $\rm m^3$  of crushed rock and 38 000  $\rm m^3$  of chippings.

Since the project has been posponed indefinitely, the quarry development proposed in Figures 5 and 6 should be reconsidered when the contract is called eventually.

If the site is to be considered as a future source of re-seal aggregates, the top two benches should be extended further than has been proposed in this report, thus leaving higher quality material exposed in the bottom face for future contracts.

The quarry is located on the northeastern flank of a spur, and could be worked out of sight of all main roads with minimal impact on the environment. The only known alternative site occurs in a Class A Environmental Area, in the Southern Flinders Ranges, 7 km east of Warnertown.

As the deposit is on freehold rural land appropriate action is recommended by the Highways Department to secure future access to the deposit.

AMP/DCS: GU

A.M. Pain

Senior Geologist

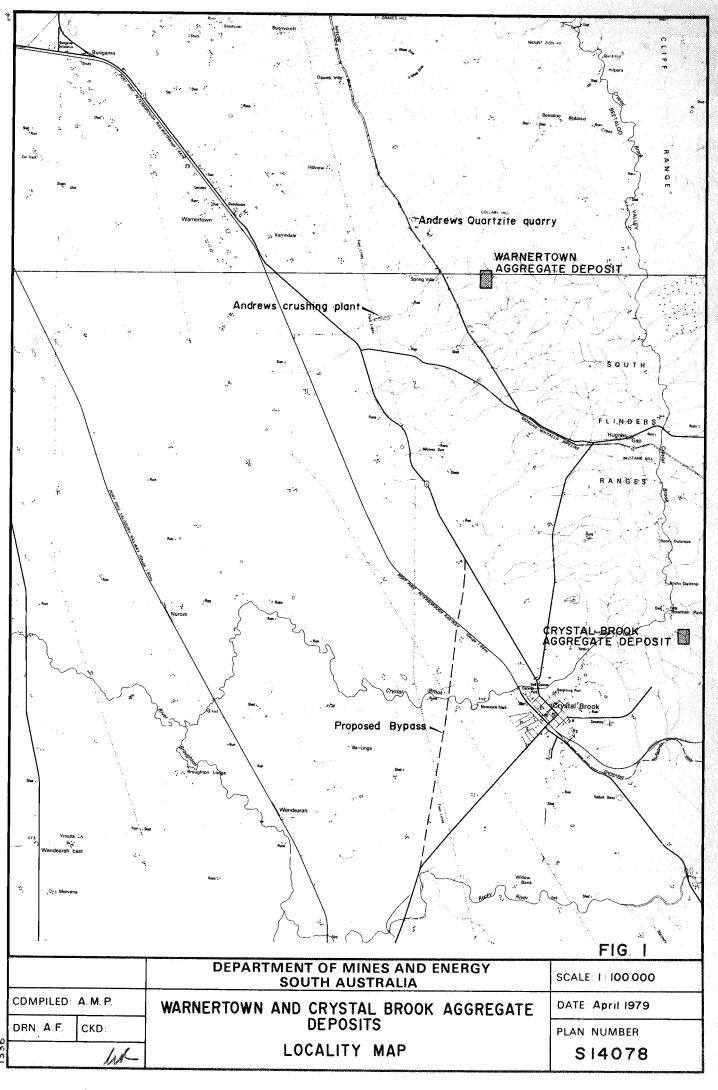
D.C. Scott Geologist

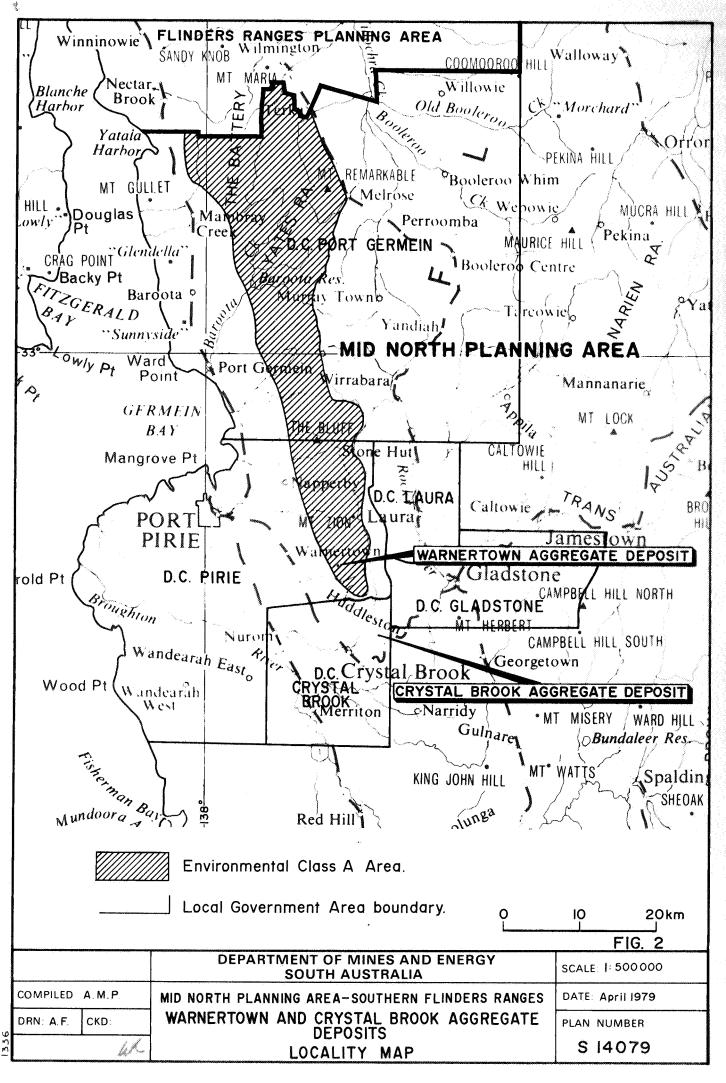
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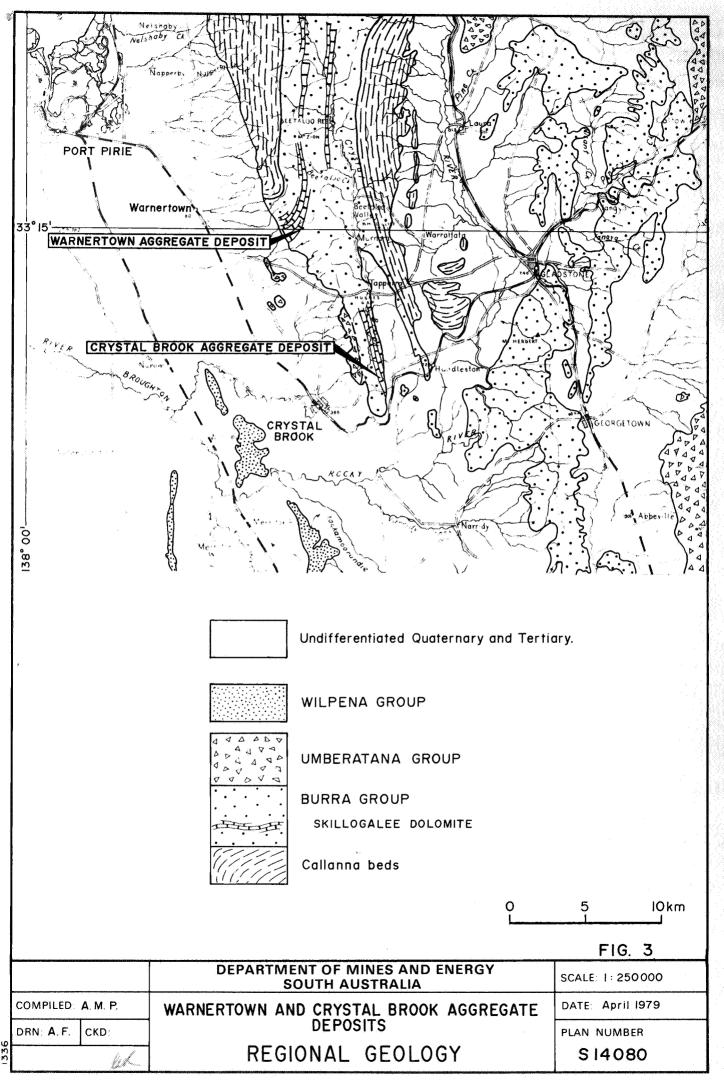
## REFERENCES

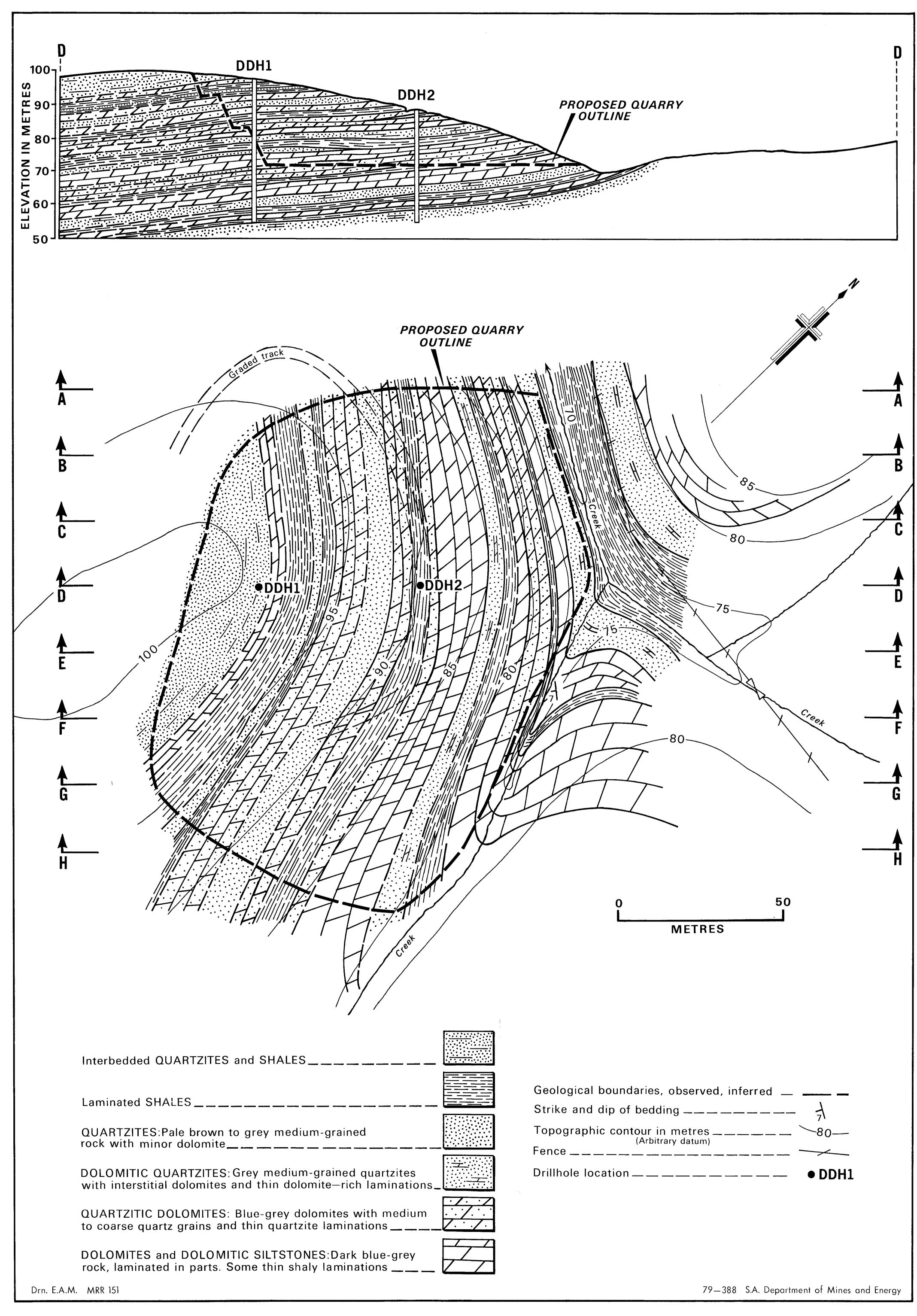
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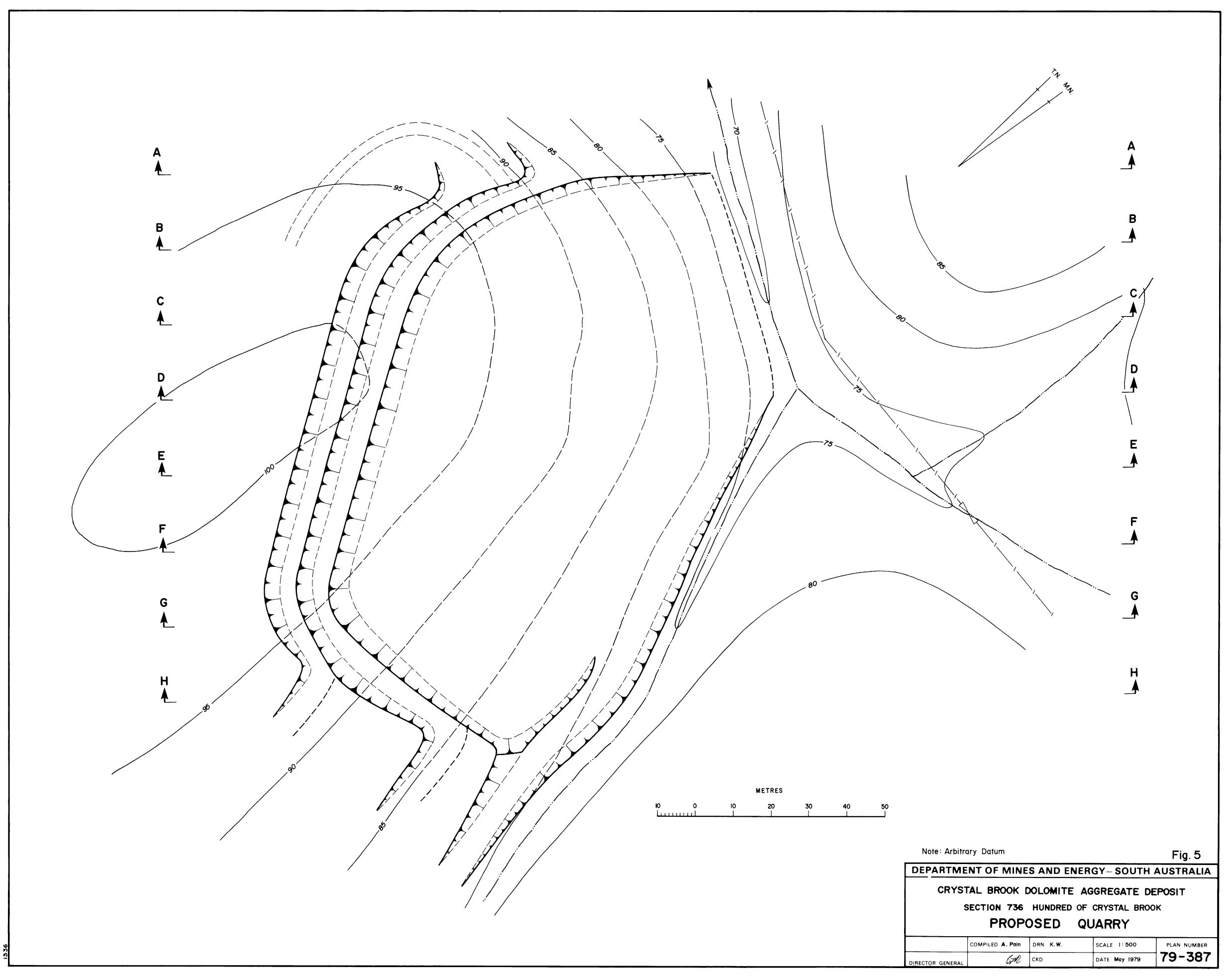
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DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

# LOG OF DIAMOND DRILL HOLE MINERAL RESOURCES DIVISION

HOLE No. DDH1

	<b>4</b> 0		black carbonaceous bands. Strongly laminated at 70-75° to core axis.  41-35-43-49 DOLOMITE and DOLOMITIC SILTSTONE- Blue-grey with white carbonate filled fractures. Few, short, paler shale bands up to 10 cm. at 75° to core axis.  43-49-43-79 SHALE- Dark arey to black. Carbonaceous.  43-79 m End of hole.				Consil cons				nes.	
		·±.·.	37.44 - 39.83 DOLOMITIC QUARTZITE - Dark grey with paler bands; weak, wavy, banding at 65 - 80° to core axis. Hard, fresh.  39.83 - 41.35 SHALE - Dark grey with paler, partly weathered zones. Dolomitic, few									
	35		32.88 - 33.79 Care lass.  33.79 - 35.6! POLOMITIC SILTSTONE - Dark grey with paler inter-bands up to 5mm. Hard, fresh. Silicious in part, strongly laminated at 70-75° to care axis.									
	30 		75° to core axis. Hard, with carbonate filled joints. Intraformational brecciation to 29.5. Jointed at 30° and 50° to core axis.  31.55-32.88 SHALE- Dark grey, dolomitic. Some quartz-rich bands up to 5 cm. Laminations at 75° to core axis.									
			26-11 - 27-33 SHALE - Yellow-brown. Weathered, soft, clayey.  27-33 - 28-45 DOLOMITIC QUARTZITE - Fine to coarse grained. Grey, hard.  28-45 - 31-55 QUARTZITIC DOLOMITE - Blue-grey with lighter quartz-rich bands at 65-			<b>\</b>						
			dolomite rich bands. Bedding at 80° to core axis.  23-10-24-74 DOLOMITE and DOLOMITIC SILTSTONE- Dark blue-grey with lighter silty bands. Few, short, soft, shaley bands at 80° to core axis.  24-74-26-11 QUARTZITE- As at 21-90-23-10.									
	<b>-2</b> 0		19-71-21-30 SHALE-Yellow-brown. Highly weathered in part, clayey, soft. Laminated at 75 to 80° to core axis.  21-90-23-10 QUARTZITE- Fine to medium grained. Slightly dolomitic. Brown with grey				To the state of th					
		7 / / 7 / / 7 / / 2 · . ± . ±	16.21-17.89 DOLOMITIC SILTSTONE-Blue-grey, laminated. Few shaley bands up to 30 cm. Variable banding at 65 to 75°.  17.89-19.71 DOLOMITIC QUARTZITE- Fine to coarse grained. Grey with darker blue-grey dolomite rich bands.	 18·80 	21	2	24	9	3.€	18	4	1.4
	_ 15	7.7 7.7 7.7 7.7 7.7 7.7 7.7 7.7 7.7 7.7	13-31-16-21 QUARTZITIC DOLOMITE-Blue-grey with lighter quartz, rich patches.  Vughy in part with intraformational brecciation. SHALE band 14-9 to 15-0. Moderately hard to hard. Jointed at 5-20°.	14· <u>84</u>	-							
	10		some iron-stained joints at 10-20° to core axis.  II-56 - 13-31 SHALE - Brown, laminated. Highly weathered, clayey in part. Bedding at 75-80° to core axis.									
		•/ •/	7.52-9.25 QUARTZITE- Fine to coarse grained. Pale grey to brown. Moderately hard with a few softer friable zones.  9.25-11.56 QUARTZITIC DOLOMITE- Blue-grey, some Yughy, porous bands and mattled zones with intraformational breediation, weak, wavy banding,	- 8·74 -								
	<u> </u>		4.04-4.78 SHALE- As at 1.78 to 3.56. Bedding at 80° to core axis.  4.78-7.52 QUARTZITIC DOLOMITE- Blue grey. Vughy, hard with soft, weathered shale bands up to 10 cm.	4·7 <u>8</u> _	ND	ND	29	11	4.0	N.D.	N.D.	N.E
		./; /.; ====================================	i-12-1-78 QUARTZITIC DOLOMITE- Blue- grey. Weathered, porous, moderately hard, weakly banded at 75-85° to core axis.  I-78-3-56 SHALE- Brown with few dolomitic zones up to 10 cm. soft, weathered. Bedding 80° to core axis.  3-56-4-04 QUARTZITE- Pale grey to yellow brown. Soft, friable in part.									
50 100	DEPT (m.)	LOG.	LITHOLOGICAL DESCRIPTION  D.O - 1-12 No recovery.	INT.	L.A.	S.S.	Liq Limit (1)	P. 1. (1)	Lin. Shr. (1)	Liq.Lim (2)	P.1. (2)	Lin. 9 (2)

INCLINATION 90° COMMENCED 27-2-79 [ LOCATION 4tm ENE of Crystal Brook AZIMUTH COMPLETED 9-3-79 [ HUNDRED BROOK SECTION 736 DEPTH 34-56 m LOGGED D.C.S, B. A.M.P. [ RE LOSS A GRAPHIC LOG LOG LOG LITHOLOGICAL DESCRIPTION TEST INT.  O-0-0-61 No recovery.  O-61-147 QUARTITIC DOLOMITE - Grey with yellow-brown, quartz-rich bands. Weathered, mederately hard. Some narrow gritty bands at 75° to core axis.  147-2-03 SHALE - Brown, weathered, claysy soft. Laminated at 80° to core axis.  147-2-03 SHALE - Brown, weathered, claysy soft. Laminated at 80° to core axis.  77-2-2-2-2-44 QUARTITIC DOLOMITE - Blue-grey. Vughy bands. Hard.  2-14-2-14-2-14-2-14-2-14-2-14-2-14-2-1	MICHARTON 90? COMMENCE 27-2-79. SOCKE CONTINUED CONTINUED With Continue to the	NOCHENCED 27-279 DOCKET MUNICIPATION 90° COMMENCED 27-279 DOCKET MUNICIPATION CONTROL 9-3-79 AND REFERENCE OF THE STATE OF	PROJECT CRYSTAL BROOK  ELEVATION 99-6 DATUM Architect PLOCATION 99-5-79 PLOCATION PAGE 1884 PAGE	PROJECT CRYSTAL BROOK ELEVATION 894-80 DATUM Arbitrory DRILLER HIGHWAYS DEPT UNIT/STATE NO MICHAEL OF STATE AND MICHAEL STATE OF COMMETTED 95-75-78. FLAM P COMMETTED 95-75-75-75-75-75-75-75-75-75-75-75-75-75	PROJECT CRYSTAL BROOK  ELEVATION 89-0- DATUM Architect District State Of the Companies of t	Description (CRYSTAL BROOK)  ELEVATION 8949 DATUM Anteriory DRILLER MICHAN'S DEPT  MICHAELON 907 - COMMENCE 27-2-79  TOCATION 4 the field of Driver Brook 2 A MUTH A TO COMMENCE 27-2-79  TOCATION 4 the field of Driver Brook 2 A MUTH 7 COMMENCE 27-2-89  BUILDER CONTROL 736 DEPTH 34-55 M LOCADO 0.0.5.8 A MM 7. PLAN RESPECTIVE 77-369  FIEL 100 2 - OS BAPPOIT  TOTAL 1 TO COMMENCE 27-2-89  TOTAL 1 TO COMMENCE 27-2-89  TOTAL 2 TO COMMENCE 27-2-89  TOTAL	### CRYSTAL BROOK  ELEVATION 804** DATE IN A PROJECT CONTROL 27-2-79  COMMINISTRATE NO. UNITYSTATE NO. MICHAELON 50° COMMINISTRATE PROJECT CONTROL 27-2-79  COMMINISTRATE NO. CONTROL 27-2-79  EAST PROJECT CONTROL 27-2-79  FROM REPORT OF COMMINISTRATE PROJECT CONTROL 27-2-79  FROM REPORT CONTROL 27-2-79  FR
NCLINATION 90° COMMERCED 27-2-79.  OCATION Ass INTER of Crystal Brook A CAINITH STORE CONFIGURATION OF STATE OF	DOCATION 4-PEWE AT Crystal Bross AZIMUTH TO COMMENCE 97-2-79 P.S. AM P. COMMENCE 97-3-79 P.S. AM P. COMMENCE 97-3-	DOCATION Services Breesh AZIMUTH CONSISTENCE Compared to the Constitution of the Const	ROJECT CRYSTAL BROOK  ELEVATION 89-6 DATUM Arbitrary DRILLER HIGHWAYS DEFT. UNIT/STATE NO. NOLLARIDO. 90° COMMERCE 27-2-79 DOCKET HOUses.  DOCATION. 49-6-6 Create Brook. 27-MUTH. COMPLETED. 39-7-79 P.A. P.A. P.A. P.A. P.A. P.A. P.A. P.A	ROSET, CRYSTAL BROOK ELEVATION 99-90, DATUM Architects DRILLER HIGHWAYS DEPT UNITY STATE NO DOCET IN MARK OF STATE NATIONAL 1909 Process A ANNUTH TOWNS OF THE PROPERTY OF THE	ROJECT CRYSTAL BROOK  ELEVATION 894* DATUM Archivery DRILLER PREMIUMANS DEPT UNIT/STATE NO DOCK I WILLIAM ON SO. COMMENCE 27-27-39. DOCK I WILLIAM ON SO. COMMENCE 27-27-39. DOCK I WILLIAM ON SO. COMMENCE 27-27-39. PLAN REFERENCE 73-38-38. DOCK I WILLIAM ON SO. T.73-31. DOCK I WI	NO.   CRYSTAL   BROOK	ROUGET CRYSTAL BROOK
INCLINATION 90° COMMERCED 27-2-79 COMPLETED 9-3-79 INTO 415 MRE of Crystal Proces. AZMUTH COMPLETED 9-3-79 INTO MODE SECTION 736 DEPTH 34-56 m LOGGED D.C.S. B. AMP. I COMPLETED 9-3-79 INTO MODE SECTION 736 DEPTH 34-56 m LOGGED D.C.S. B. AMP. I COMPLETED 9-3-79 INTO MODE SECTION 736 DEPTH 34-56 m LOGGED D.C.S. B. AMP. I TEST INTO D.C. COMPLETE Grey with representation of 15° in cere cuits.    100	NOLLARION 90° COMMERCE 27-2-78 DODES  TO CHIEF M. SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 736. DEPTH 34-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN DRD BROOK SECTION 74-56 m LOGGE D.C.S., 8. A.M.P. DRAWN SECTION 74-56 m LOGGE D.C.S., 8.	INCLARION SCION 736  BETT CONFIDERCY AZIMUTH TO CONFIDERCY P3-7-79 P. PLAN REFERENCE PROVIDERCY PART CONFIDERCY P3-7-79 P. PLAN REFERENCE PROVIDERCY PART CONFIDERCY P3-7-79 P. PLAN REFERENCE PART CONFIDERCY	RECT. CRYSTAL BROOK  RELEVATION 89° DATUM Architery DRILLER HIGHWAYS DEPT  UNITYSTATE NO  INCLINATION 90° COMMERCED 27-2-79  DOCKT NUMBER  THOM  SECTION 736 DEPTH  34.56 m  LOGGED D.C.S. B. AMR DRAWING NO  LITHOLOGICAL DESCRIPTION  LOGGED D.C.S. B. AMR DRAWING NO  OO-0-81 No rescorery.  COMMERCED 75-79  SECTION 736 DEPTH 34.56 m  LOGGED D.C.S. B. AMR DRAWING NO  OO-0-81 No rescorery.  OO-0-0-81 No rescorery.  OO-0-0-81 No rescorery.  OO-0-51 No rescorery.  OO-0-0-81 No rescorery to rescore a secure of the rescore of	ELEVATION 894** DATUM Anthrony DRILLER HIGHWAYS DEPT. UNIT/STATE NO DOCKET NUMBER DATUM AND DEPT. UNIT/STATE NO DOCKET NUMBER DATUM AND DEPT. UNIT/STATE NO DOCKET NUMBER DATUM AND DEPT. DATU	ELEVATION 89-00 DATUM Anothery DRILLER HIGHWAYS DEPT UNIT/STATE NO NO. NO. NATION 90-1 COMMERCED 27-2-79 DOCKET NUMBER DRILLER STATE AND	ELEVATION   BOOK   ELEVATION   BOOK   DATUM Architery   DRILLER HIGHWAYS   DEPT.   UNIT/STATE NO   INCLUDION   SO   COMMENCED   27-2-79   DOCCET NUMBER   DRILLER HIGHWAYS   DEPT.   DRILLER HIGHWAYS   DRILLER HIGHWAYS   DEPT.   DRILLER HIGHWAYS   DRILL	ECI CRYSTAL BROOK  ELCATION 90° COMMENCE 12-7-79 DONCT MAKE DWG 27/79  MICHAEL of Crystal Brown  AND MODE  SECTION 736 OFFI  34-56 M LOSEC D.C.S. 8 AMP DEAWING NO 79-385  LITHOLOGICAL DESCRIPTION  TEST TEST STATE  TEST STA
NICLINATION 90° COMMERCED 27-2-79 ( BREYNAL of Crystal Brok AZIMUTH 54-56 M LOGGE D.C.S. & A.M.P. I  BROK SECTION 736 DEPTH 54-56 M LOGGE D.C.S. & A.M.P. I  COMMERCED 2-3-79 ( BROK)  SECTION 736 DEPTH 54-56 M LOGGE D.C.S. & A.M.P. I  COMMERCED 1.C.S. & A.M.P. I  COMMERCED 1.C.S. & A.M.P. I  COMMERCED 1.C.S. & A.M.P. I  BROK  O 0-0-61 No recovery  O 0-1-61 No recovery  O 0	ALSENS of Cyranic Brook. AZIMUTH 3-00 COMMPLETED 9-3-79 PLAN DRYSTAN. BECTION 736. DEPTH 3-56 M DOGED D.C.S. B. A.M.P. PLAN D.C. B.C. B.C. B.C. B.C. B.C. B.C. B.C.	AND THE SECTION 736 DEPTH 34.56 m LOGGED D.C.S. 8. A.M.R. DRAWN N  BRIGARY  SECTION 736 DEPTH 34.56 m LOGGED D.C.S. 8. A.M.R. DRAWN N  LITHOLOGICAL DESCRIPTION  LITHOLOGICAL DESCRIPTION  TEST  LA C.S.  CHILDREN OF CONCERN NO. CONCERN	CRYSTAL BROOK ELEVATION 89 6m DATUM Arbitrory DRILLER HIGHWAYS DEPT UNIT/STATE NO. INCLINATION 90° COMMENCED 277-2-79  AND STATE OF COMMENCED 277-2-79  COMMENCED 277-2-79  PLAN REFERENCE 1985  DEPTH 34-56 m LOGGED D.C.S. A.M.R. DEARNING NO. 1178 COMMENCED 198-3-79  PLAN REFERENCE 1985  DEPTH 34-56 m LOGGED D.C.S. A.M.R. DEARNING NO. 1178 COMMENCED 198-3-79  PLAN REFERENCE 1985  DEPTH 34-56 m LOGGED D.C.S. A.M.R. DEARNING NO. 1178 COMMENCED 198-3-79  DEPTH 198-3-79  DEPTH 34-56 m LOGGED D.C.S. A.M.R. DEARNING NO. 1178 COMMENCED 198-3-79  DEPTH 198-3-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8	CRYSTAL BROOK  ELEVATION 59-9 m DATUM Afforders DRILLER PIGHWAYS DEPT  INCLINATION 90-1 COMMENCE 27-2-79  OOCET NUMBER DATA  AUTHOR 7-1 COMMENCE 27-2-79  DATE 14-7-1 COMMENCE DEPTH 34-56 m LOGGED D.C.S. & AM.P. PLAN REFERENCE 79-10-10-10-10-10-10-10-10-10-10-10-10-10-	CRYSTAL BROOK  ELEVATION 89-69 OATUM Arbitrory DRILLER HIGHWAYS DEPT. UNIT/STATE NO.  NCLINATION 99-7 COMMERCED 27-2-79 DOOLEY INMERE DMC 20/7-  185 M. C. CARRIER Rook. A 24/MITH. COMPLETED 9-3-77 DOOLEY INMERE DMC 20/7-  SECTION 736 DEPTH 34-56 M LDDGED, D.C.S. S. A.M.P. ORAWING NO.  186 C.	CAPSTAL BROOK   ELEVATION 89-6"   DATUM APPLIES HIGHWAYS DEPT   UNIT/STATE NO.   DOCK TAMBER   DATUM APPLIES   DATUM STATE   DOCK TAMBER   D	CRYSTAL BROOK  ELEVATION 89-9" DATUM Ambirmary DRILLES HIGHWAYS DEPT.  MICHATION 99-1 COMMERCE 27-2-79  MICHATION 99-1 COMMERCE 27-2-79  MICHATION 99-1 COMMERCE 27-2-79  MICHATION 75-8 DEPTH 34-56 m LOGGED D.C.S. B. A.M.P. DRAWNER NO. 79-395  EADMONE  SECTION 75-8 DEPTH 34-56 m LOGGED D.C.S. B. A.M.P. DRAWNER NO. 79-395  EADMONE  LUTHOLOGICAL DESCRIPTION  TEST LA. S.S. Name 17-2-395  LA. S.S. Name 17-2-395  LA. S.S. Name 17-2-395  TEST RESULTS  T
INCLINATION 90° COMMENCED 27-2-79 E  E of Crystol Brook AZIMUTH COMPLETED 9-3-7-9 E  SECTION 736 DEPTH 34-56 m LOGGED D.C.S. S. A.M.R. E  LITHOLOGICAL DESCRIPTION  D-0-0-81 No recovery.  D-61-147 QUARTIFIC DOLORITE - Grey with yellow-brown, quarta-rich blands. Westhered, medicartely hard, Some narrow gritty blands at 75° to ears quis.  147-2 D3 SHALE - Brown, weethered, closey-grey, Vergly, blands. Heard.  27-3-4-4 QUARTIFIC DOLORITE Blue-grey. Vergly, blands. Heard.  27-3-4-50 QUARTIFIC DOLORITE Blue-grey, Few narrow shale bonds up to 3 cm. 30ms vegles of 50° to cere quis.  27-3-4-6-20 QUARTIFIC DOLORITE Blue-grey, Few narrow shale bonds up to 3 cm. 30ms vegles of 57-3 to 20 QUARTIFIC COLORITE Blue-grey, Few narrow shale bonds up to 3 cm. 30ms vegles of 57-3 to 20 QUARTIFIC BLUE-grey bends grey, paler querts rich bands. Heard, with some introformational bracciotism. Bedding at 75-85°, Hard.  57-3-7-98 DOLORITIC GUARTIFIC Grey to pelle grey, paler querts rich bands. Heard, with some introformational bracciotism. Bedding at 75-85°, Hard.  57-3-7-98 DOLORITIC GUARTIFIC Grey to pelle grey, paler querts rich bands, slightly delimite. Rew narrow shales fends at 75° to cere quis.  58-14-9 DI QUARTIFIC Fine to cacers grained. Bale grey with district bands, slightly delimite few narrow shales fends at 75° to cere quis.  11-98-91 QUARTIFIC BLUE STATE COLORITIC Blue-grey with occasional gales quertific xones. Fine the care and the state of the sta	E of Crystol Brook AZMUTH — COMPLETED 9-3-79 DOCKE E of Crystol Brook AZMUTH — COMPLETED 9-3-79 PLAN SECTION 736 DEPTH 34-56 m LOGGED D.C.S. B. A.M.R. PRAWN  LITHOLOGICAL DESCRIPTION  LITHOLOGICAL DESCRIPTION  LITHOLOGICAL DESCRIPTION  TEST INT L.A.  0-0-9-81 No recovery.  0-61-97 QUARTETITE DOLOMITE—Grey with yellow-brown, goots-rich bands. Weethered, into the content by hard Some norrow grity bends at 15" to core auts.  147-2 03 SMALE—Brown, weathered, claypy soft, Lominoted at 80" to core auts.  279-9-12 DOLOMITE SUSTINES—Bock Blue-grey. Vinghy bands. Hard.  244-2-75 Care Issue.  279-9-13 DOLOMITE SUSTINES—Dork blue-grey with introfermational breccipition, Laminoted Phrongly Journals.  437-3-31 DOLOMITE SUSTINES—Dork blue-grey with introfermational breccipition, Laminoted Phrongly Journals.  579-7-7-89 DOLOMITE SUSTINES—Bock Blue-grey with open outside up to 5 cm. Some literature professional Bedding of 73-85". Hard.  579-7-89 DOLOMITE SUSTINES—Dork blue-grey with open outside the professional grade ground professional grade ground professional grade ground professional pasts and professional grade ground grade grad	INCLINATION 90° COMMENCED 27-279 OCCRET NUMBER OF COMMENCED 9-3-79 PLAN REFERENCE OF CONTROL 9-3-3-79 PLAN REFERENCE OF CONTROL 9-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3	AL BROOK ELEVATION 89 or DATUM Arestrory DRILLER HIGHWAYS DEPT INCLINATION 90 COMMERCED 27-2-79. DOCKET NUMBER INCLINATION 90 COMMERCED 27-2-79. DOCKET NUMBER AND AREA ALMUTH. COMMERCED 27-2-79. PLAN REFERENCE SECTION 736 DEPTH 34:36 m LOGGED.D.C.S. 8.A.M.P. PRAWING NO. DEPTH 34:36 m LOGGED.D.C.S. 8.A.M.P. PRAWING NO. DEPTH 34:36 m LOGGED.D.C.S. 8.A.M.P. PRAWING NO. DO-0-81 No recovery.  LITHOLOGICAL DESCRIPTION ITEM TEST INT. COMPLETE THE PROPERTY OF THE PR	AL BROOK ELEVATION 894m DATUM Architorry DRILLER HIGHWAYS DEPT UNIT/STATE NO INCLINATION 90.1 COMMENCED 27-2-79. DOCKET MUMBER DME of Crystal Break AZMUTN COMPLETED 9-3-79. THAN REFERENCE 79. SECTION 736. DEPTH 34-36m. LOGGED 0.5.9. A.A.M.P. DRAWMIN NO. 75 SECTION 736. DEPTH 34-36m. LOGGED 0.5.9. A.A.M.P. DRAWMIN NO. 75 SECTION 736. DEPTH 34-36m. DEP	AL BROOK ELEVATION 694** DATUM Arestrary DBILLER HIGHWAYS DEPT  NICOLNATION 905** COMMENCED 27-2-79  DOCKET NUMBER DME 2/7-79  SCITION 736 DEPTH. 34.56 m LOGED D.C.S. 8 A.M.R. DRAWING NO. 79-38  SCITION 736 DEPTH. 34.56 m LOGED D.C.S. 8 A.M.R. DRAWING NO. 79-35  LITHOLOGICAL DESCRIPTION  LITHOLOGICAL DESCRIPTION  TEST TEST RESULTING LOGGICAL OF Corp. with pulsion-broats, quest to-risk bends, Westhered, 90-5  107-220 BIALE-Brown, seathered, player, fact, Laminosted of 170 to seat out.  207-244 QUARTETIC DOCUMETE: Blue-gray, New narrow shoke bends up to 5 cm South upges through years are previously bends, and the seathered player part, Laminosted of 170 to seat out.  211-4-42 DATE COLLINE STATE DECOMETE: Blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray, New narrow shoke bends up to 5 cm South upges through years are part blue-gray with interferentianal brecording through the sorte out.  21 2 2 2 5 8 4 4  22 2 2 5 8 4 4  23 3 3 00.0001776 COLLINATION Short of the sorte out.  24 3 3 3 00.0001776 COLLINATION Short of the sorte out.  25 3 3 00.0001776 COLLINATION Short of the sorte out.  26 3 3 3 00.0001776 COLLINATION Short of the sorte out.  27 3 5 3 00.0001776 COLLINATION Short of the sorte out.  28 3 3 00.0001776 COLLINATION Short of the sorte out.  29 3 14 5 15 00.0001776 Short of the sorte out.  20 4 3 2 10 00.0001776 Short of the sorte out.  20 4 3 2 10 00.0001776 Short of the sorte out.  20 4 3 2 10 00.0001776 Short of the sorte out.  20 5 3 2 2 10 00.0001776 Short of the sorte out.  20 6 3 2 2 10 00.0001776 Short of the sorte out.  20 6 3 2 2 10 00.0001776 Short of the sorte	L BROOK ELEVATION 894** DATUM Arestorary DBILLER HIGHWAYS DEPT  NOLINATION 905** COMMENCED 27-2-79  COMMENCED 97-3-79  E of Crystal Breas AZ-MUTH COMMENT OF COMMENCED 27-2-79  COMMENCED 97-3-79  SECTION 736 DEPTH 34-156** COMMENT OF COMMENT O	AL SROOK ELEVATION 59-4m DATUM Another population Processing Commences of the Commence of the
TEST INT.  0.61  12.19  15.85	DOCKE PLAN PLAN PLAN TEST INT. L.A.  0.61	DOCKET NUMPLAN REFERENCE PLAN REFERE	PT UNIT/STATE NO  DOCKET NUMBER.  PLAN REFERENCE  P DRAWING NO  TEST	PT UNIT/STATE NO.  DOCKET NUMBER DME PLAN REFERENCE 79: P DRAWING NO. 79  TEST	PT. UNIT/STATE NO.  DOCKET NUMBER DME 211/7 PLAN REFERENCE 79-388 P. DRAWING NO. 79-33  TEST TEST RESULT L.A. S.S. Liq.Lim P.I. Lin.Shir O-G1	PT. UNIT/STATE NO.  DOCKET NUMBER DME 211/79  PLAN REFERENCE 79-388  P. DRAWING NO 79-395  TEST RESULTS  INT. L.A. S.S. Liq.Lim P1. Lin.Shd Liq.Lim (1) (2)  - 21 2 25 8 4 17  - 5.79  - 12-19  - 20 0-8 18 2 1 18  15-85	PT. UNIT/STATE NO.  DOCKET NUMBER DME 211/79 PLAN REFERENCE 79-388 P. DRAWING NO. 79-395  TEST RESULTS  TEST RESULTS  L.A. S.S. Liquim P.I. Lin.Shr Liquim P.I. (1) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2
	L.A.	PLAN REFEIORAWING NO.	UNIT/STATE NO DOCKET NUMBER PLAN REFERENCE DRAWING NO  T L.A. S.S. Liq.Lim (1)  21 2 25	TEST	UNIT/STATE NO. DOCKET NUMBER DME 211/7 PLAN REFERENCE 79-388 DRAWING NO TEST RESULT  L.A. S.S. Liq.Lim P.1. Lin.Shr. (1)  21 2 25 8 4  20 0-8 18 2 1	DISTRIBUTE NO. DOCKET NUMBER DME 211/79 PLAN REFERENCE 79-388 DRAWING NO. 79-395  TEST RESULTS  L.A. S.S. Liq.Lim P.I. Lin.Shr Liq.Lim (1) (2)  21 2 25 8 4 17	DISTRIBUTION OF THE PROPERTY O

