



EIS 306

AA053480

Environmental impact statement for the extraction of river sand
and gravel from a gravel terrace adjoining the Goulburn River
near Sandy Hollow, part of portion 15, Parish of Arndell, County
of Hunter, being the land contained within conveyance
registered

NSW DEPT PRIMARY INDUSTRIES



AA053480

PALMER BRUYN & WALPOLE, CONSULTING SURVEYORS
MUSWELLBROOK N.S.W.

EIS 306

ENVIRONMENTAL IMPACT STATEMENT

FOR THE EXTRACTION OF

RIVER SAND AND GRAVEL FROM A

GRAVEL TERRACE ADJOINING

THE GOULBURN RIVER

NEAR SANDY HOLLOW

PART OF PORTION 15, PARISH OF ARNDELL

COUNTY OF HUNTER

being the land contained within

CONVEYANCE REGISTERED NO. 416 BOOK 1554

PREPARED BY:

PALMER, BRUYN & WALPOLE
CONSULTING SURVEYORS
P O BOX 404
MUSWELLBROOK 2333

PHONE: (065) 43 3600
D X 7374

ON BEHALF OF:

MR H J RAY
WYBONG ROAD
CASTLEROCK 2333

MARCH 1985

FORM 4

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979
(SECTION 77 (3) (d))

ENVIRONMENTAL IMPACT STATEMENT

This Statement has been prepared on behalf of **MR HAROLD RAY** being the applicant making the development application referred to below.

The Statement accompanies the development application made in respect of the development described as follows:-

THE EXTRACTION OF RIVER SAND AND GRAVEL FROM A GRAVEL TERRACE adjoining the GOULBURN RIVER near SANDY HOLLOW

The development application relates to the land described as follows:-

PART OF PORTION 15, PARISH OF ARNDELL, COUNTY OF HUNTER, being the land contained within CONVEYANCE REGISTERED NO. 416 BOOK 1554

The contents of this statement, as required by clause 34 of the Environmental Planning and Assessment Regulation, 1980, are set forth in the accompanying pages.

Name, Qualifications and Address of person who prepared the Environmental Impact Statement.	G V BOARDMAN REGISTERED SURVEYOR P O BOX 404 <u>MUSWELLBROOK 2333</u>
---	--

CERTIFICATE

I, **GORDON VICTOR BOARDMAN of PALMER, BRUYN & WALPOLE, P O BOX 404, MUSWELLBROOK NSW 2333**, hereby certify that I have prepared the contents of this Statement in accordance with clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

.....
Signature

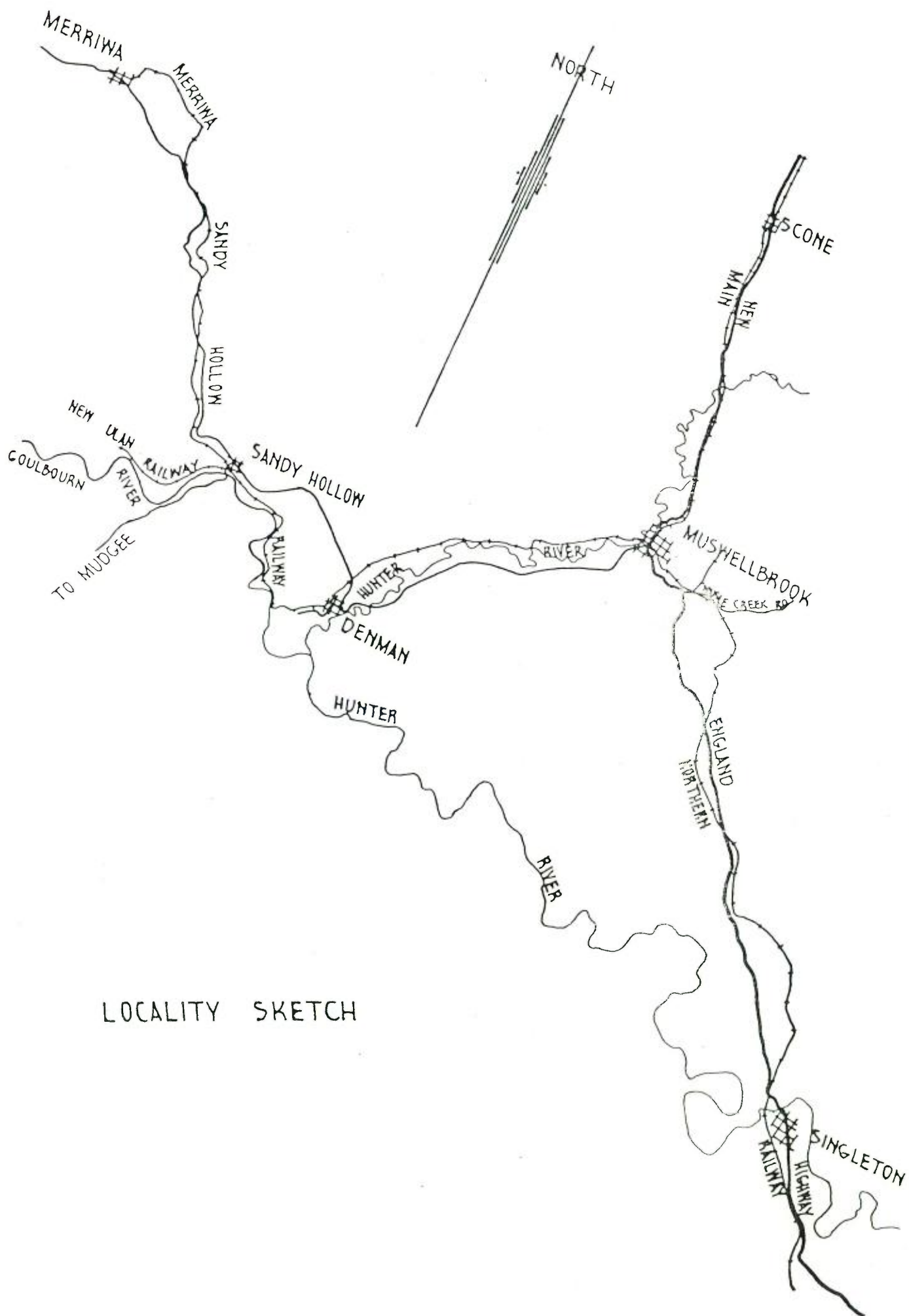
.....
Date

CONTENTS

	PAGE	
1.0	Introduction	
1.1	General Description	1
1.2	Scope of the Environmental Impact Statement	2
1.3	Title Description	2
1.4	Zoning	4
1.5	Land Ownership	4
2.0	Objects	
2.1	Need for Development	5
2.2	River Management and Planning	5
2.3	Life of Operation	6
2.4	Employment	7
3.0	Existing Environment	
3.1	Landscape	8
3.2	Topography	8
3.3.0	River Formation	9
3.3.1	Geomorphology	9
3.3.2	Hydrology	10
3.3.3	Physical Structure	11
3.3.4	Bedload Transportation	12
3.4.0	Climate	13
3.4.1	Rainfall	13
3.4.2	Temperature	13
3.4.3	Wind	14
3.4.4	Air Inversions	14
3.5	Flora	14
3.6	Fauna	15
3.7	Aquatic Flora and Fauna	16

	PAGE
4.0 Proposed Development	
4.1 Limits to Development	17
4.2 Extent of Development	17
4.3 Extraction and Processing	19
4.4 Machinery and Equipment	19
4.5 Access Road	20
4.6 Transport	21
4.7 Hours of Operation	21
4.8 Energy and Energy Conservation	22
5.0 Social and Economic Environment	
5.1 Archaeological Survey	24
5.2 Situation	24
5.3 Existing Land Use	25
5.4 Adjoining Residence	25
6.0 Safeguards to Environment	
6.1 River Protection	27
6.2 Soil Erosion Control	27
6.3 Dust Control	28
6.4 Visual Control	29
6.5 Noise Control	30
6.6 Waste Control	30
6.7 Fumes Control	31
6.8 Weed Control	31
6.9 Future Mining Development	32
7.0 Reformation	
7.1 Preparation for Future Use	33
7.2.0 Revegetation	33
7.2.1 Spring Sowing	34
7.2.2 Autumn Sowing	34
7.2.3 Fertilizer	34
7.3 Screening	35

	PAGE
8.0 Summary	
8.1 Aims	35
8.2.0 Alternatives	36
8.2.1 Alternative Sites	36
8.2.2 Alternative Material	37
8.3 Justification	37



LOCALITY SKETCH

1 INTRODUCTION

1.1

GENERAL DESCRIPTION

This Environmental Impact Statement has been prepared by Palmer Bruyn & Walpole, Consulting Surveyors for Mr Harold J Ray of Castlerock to accompany his Development Application submitted to the Muswellbrook Shire Council. The Application is a Designated Development to extract sand and gravel from the lateral bar and gravel terrace adjoining the Goulburn River near Sandy Hollow. The extraction site is situated within the property "River View" which is beside the Sandy Hollow to Mudgee Road (Main Road 208).

The extraction site is to be cleared of all foreign materials and the light layer of top soil removed and stockpiled. Excavation will be carried out by a front-end loader and the excavated material transported directly from the site or to the nearby processing plant.

The processing plant will wash and sieve the raw material and the resultant graded material will, when required, be loaded into trucks and transported from the site. Material will be transported to Denman, Muswellbrook, Aberdeen, Scone and the Bayswater - Liddell areas. The trucks will travel upon Main Road 208 and 209 and the New England Highway.

The extraction will only take place during daylight hours, during the week days. Some minor maintenance to machinery will be carried out during the weekend.

It is estimated that only very small energy requirements will be necessary for the extraction and processing of the material.

The size and location of the extraction sites will be controlled by the Water Resources Commission and all necessary dust, noise and water pollution controls will be in accordance with the requirements of the State Pollution Control Commission.

The visual aspect of the site will only effect one residence and would be of minimal effect to the traffic using the Sandy Hollow - Mudgee Road. As excavation is completed the site will be rehabilitated as described herein and will be subject to the approval of the Water Resources Commission and the Muswellbrook Shire Council.

Mr Ray has been supplying these basic materials to the building and construction industries of this region for the past ten years. The acquisition of this extraction site will ensure a continuation of supply to his clients and continued work for his present employees.

1.2

SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

The Development Application made by the proponent will be lodged under Clause 77 (1) (b) of the Environmental Planning and Assessment Act, 1919.

The proposed extraction site is a Designated Development within the meaning of Schedule 3 (Clause 70) of the Environmental Planning and Assessment Regulations, 1980.

The required Environmental Impact Statement is prepared in accordance with Clause 34 of the Regulations.

The Direction of the Department of Environment and Planning has been notified and the matters to be addressed in the Environmental Impact Statement are contained in Appendix (B).

The Government Authorities and Organisations which have been notified of the proposed development and have been requested to identify and requirements that are to be taken into account in the preparation of this Environmental Impact Statement are:

- (a) The Muswellbrook Shire Council
- (b) The Water Resources Commission
- (c) The State Pollution Control Commission
- (d) The Department of Mineral Resources
- (e) The Soil Conservation Service
- (f) The National Parks and Wildlife Service
- (g) The Department of Agriculture

Correspondence received from these authorities is contained within Appendix (B).

Mr Denis Byrne was the Consultant Archaeologist for the report on Aboriginal places, relics and artifacts. His statement is contained in Appendix (C).

Hunter Engineering Testing Services prepared the geological log for the description of the deposits. The results are contained in Appendix (D).

1.3

TITLE DESCRIPTION

The development is situated within part of Portion 15, Parish of Arndell in the County of Hunter. The Title to this land is Old System tenure being the land contained within Conveyance Registered No. 416, Book 1554.

As the alienation of the Portion from the Crown occurred prior to the 3rd May, 1918 there is a presumption that the Title extends to the middle thread of the Goulburn River. Portion 15, was originally surveyed in October, 1835 and since that time the river has progressively changed and at present stands westerly of its position as shown in Plan No. 1.

The actual excavation of sand and gravel will occur upon land which originally formed part of the river bed. We are of the opinion that the owner of the land in Conveyance Registered No. 416, Book 1554 has an equitable interest in that old river bed because of:-

1. The presumption of ownership up to the middle thread of the river.
2. The accretion to his property by any gradual and imperceptible movement of the river bed that may have occurred since 1835.
3. The opposite bank of the river was defined as the boundary of the land adjoining to the North West. This land was surveyed in February 1865 and originally was Portions 32, 33 and 34 Parish of Wickham County of Hunter.

The bank or boundary of these Portions would have been fairly stable as the Sandy Hollow - Maryvale Railway Line was constructed in the 1930's at the time of the depression. The railway was constructed close to the original definition of the bank of the river in 1865. (see Plan No. 1).

At this particular part of the river the stream has always followed close to this levee bank. The middle thread of the river would have therefore been in close proximity to this bank when Portion 15 was alienated.

The flood waters which occurred in 1955 have eroded the high bank and washed away part of the land of the railway so that now the river is flowing over the land that was part of the original Portions 32, 33 and 34. This erosion of land was not gradual and imperceptible and therefore the original boundary or bank of the river surveyed in 1865 remains the boundary for the land which adjoins the excavation site.

Between July 1980 and January 1981 the original Portions 32, 33 and 34 have been subdivided to provide a new location for the washed out railway line. The resultant title particulars are shown in Plan No. 1.

The subject land is contained within Coal Authorisation Area No. 286 of the Department of Mineral Resources.

1.4

ZONING

The land upon which the proposed excavation is to be carried out is within the Muswellbrook Shire Council and is currently zoned 1(a) Non-Urban 'A' and part 1(b) Non-Urban 'B' as amended by L.E.P. No. 13 (Government Gazette No. 6, 14th January, 1983). This development may be carried out only with the consent of the Council and the concurrence of the Authority.

The land is also to be zoned 7(d), Environment Protection (Scenic), under the draft Local Environment Plan for the Muswellbrook Shire. Development can also be carried out under the new zoning with Council's consent.

1.5

LAND OWNERSHIP

The subject land of this development application is known as "River View" and the registered proprietor of the property is the Estate of A J Cowan.

The applicant, Mr H J Ray, has entered into a lease agreement with the registered proprietor to extract material from the property.

2 OBJECTS

2.1

NEED FOR DEVELOPMENT

An Environmental Impact Statement was prepared for the proponent in May, 1983, to extract sand and gravel from "The Glen", a property situated on the Rosemount Road at Denman. The sand and gravel extracted from this site was to supply material for his existing clientele.

All necessary consents were obtained for the development and the excavation was about to commence when the property owners imposed further conditions which made the development of the site, within the constraints of the development application, not economically viable.

Since then the proponent has continued to supply his clientele with material from an old extraction site or, wherever possible, by purchasing material from other sources. The clientele specify the Goulburn River sand which is appreciably different to the sand obtained from the Hunter River.

The proponent has been seeking another source of supply since being unable to continue with "The Glen" development. The proposed site was located and preliminary, verbal approvals, from the property owner, the Muswellbrook Shire Council and the Water Resources Commission were sought before this current development application was prepared.

The clientele specify that they require the type of sand found in the Goulburn River. The proponent has established himself as a source of supply for this material. The proposed excavation site is needed from the proponent to continue his business enterprise.

2.2

RIVER MANAGEMENT AND PLANNING

The river systems of the Hunter Valley are an integral part of the region. The management and future planning of this resource is important to the welfare of the people in the area.

The management of the inland river systems are controlled by the Water Resources Commission within New South Wales. The planned management of this resource has been restricted to some extent by the lack of data pertinent to each individual river. Studies of bed load movements and the workings of the river are being carried out but still more precise information needs to be obtained.

The rivers are continually working, eroding and depositing material as they meander through the valley floor. The erosion and deposition will never halt while the river is permitted to remain in its natural state.

The movement of the river system has been controlled in Tokyo and Los Angeles by encasing the rivers with concrete bed and banks. Such drastic measures are not viable to these rivers and controls have been instigated to try and eliminate any major shift in the alignment of the existing river bed from occurring.

Physical controls such as river bank stabilisation programs have been carried out by the Water Resources Commission to prevent the erosion of high levee banks and to keep the stream confined to an existing alignment. Legislation is used to control the indiscriminate excavation of material from within a river system that may lead to future erosion. Planned river deviations and new alignments of the river beds are implemented to create free flow and to minimise the effects of high-flow water within the river.

The physical, legislative and planned controls placed on the river system do have the stabilising effect. To what extent can only be judged after a major flood of one in one hundred years or greater.

The proposed extraction site is situated in a bed load deposition area of the river. Downstream constraints cause the high-flow water to slow down and deposition occurs. (see 3.3.1). Deposition of material on the inside curve of the river has helped to cause erosion of the opposite high levee bank.

River bank stabilisation procedures have been carried out by the Water Resources Commission at the toe of the high levee bank. A new alignment of the river is also planned to widen the existing confinement of the high-flow waters.

This will allow the high-flow waters to proceed downstream at a greater expanse at a less depth and will, to some extent, have a smaller erosive effect on the opposite high levee bank.

The material to be excavated in this proposal will be mainly within the planned alignment of the river.

2.3

LIFE OF OPERATION

The estimated volume of the sand and gravel to be excavated from within the river alignment is approximately 100,000 cubic metres. Another 20,000 cubic metres could possibly be excavated from the water supply hole and the filtration dam site.

The estimated sale of material would be about 20,000 cubic metres per year. This figure would be dependent upon the market's need and would be variable.

Theoretically the excavation of the area would be completed in six (6) years. If a flood should occur in the interim and deposit more material on the site the excavation would be extended until the designed cross sections are achieved.

2.4

EMPLOYMENT

The proposed development will only be extracting relatively small amounts of sand and gravel during any particular period. Because of the size of the operation and the plant and machinery used, it is envisaged that the proponent and two (2) other persons would be employed on the site.

**3 EXISTING
ENVIRONMENT**

3.1

LANDSCAPE

The property "River View" is situated in a rural setting common to the Singleton - Jerry's Plain - Broke - Wybong areas. The rural vista is pleasant though somewhat similar in nature throughout these lower areas which border the high plateaus.

The valley in which the property is located is comprised of gentle undulating grasslands through which the Goulburn River slowly meanders. The lower flat land gives away sharply to the foothills of the higher ranges. The slopes to the higher land are steep and in many cases comprise of sheer rock faced escarpments.

The Goulburn Valley was formed by the river system cutting through the high plateaus in the region, leaving deep incisions still working and transporting sand and to a lesser extent gravel.

The visual appearance of the rural landscape is disturbed near the excavation site by the recently constructed Ulan Railway. A new deviation was constructed around the foothills of the western range after the original route was washed away by the 1955 floods. The civil construction works of the railway line and the adjoining roadway have not blended into the landscape and still appear intrusive to the existing environment.

3.2

TOPOGRAPHY

The excavation site is situated at the bottom of a river valley system, upon the lateral bar and gravel terraces adjoining the flowing stream. The proposal site is located on the inside of a slow sweeping curve about 3 kilometres upstream from Sandy Hollow.

The river bed closely follows the high levee bank on the west and the lateral bar and gravel terraces extend from the river to the high loam and silt bank on the east. The average distance between the high banks is 350 metres and the river and gravel terraces are from 10 metres to an average of 5 metres respectively below the elevation of the high banks.

Flat undulating land extends east from the high bank for about 2 kilometres and west from the other high bank for only about 0.5 kilometres. At the end of the flat undulating land the ground rises steeply into the foothills of the large sandstone plateau common to this region.

The valley floor is relatively wide at this part of the river formation. The river meanders through the valley floor and the excavation site is located on the eastern gravel terraces of the river which is cutting a westward trace or meander.

An armoured riffle within the Goulburn River exists approximately 1.5 kilometres downstream from the excavation site where the high banks of the river narrows sharply and the river gradient greatly increases. The increase in velocity of the stream has cut away the bed of the river washing away the finer sands leaving the larger stones which gives a 'cobble stone' effect on this stretch of the river. The remaining larger stones now provide protection for the river bed.

The junction of Halls Creek with the Goulburn River occurs about 2.0 kilometres downstream from the excavation site. Although the river gradient drops sharply, in periods of high-flow the narrowing of the river banks combined with the runoff waters from the Halls Creek catchment would cause the water upstream from the narrow river banks to slow down.

This decrease in velocity about the excavation site in periods of high-flow is caused by the 'funnelling effect' on the river where the banks narrow and both high-water flows from the Goulburn River and Halls Creek becoming 'bottled up' in the narrow stretch of the Goulburn River.

When the high-flow waters slow down they deposit their bed loads. The excavation site is located in a deposition point in the river system. The heavy material carried by the river is deposited further upstream than the finer materials. This is shown in the geological log prepared by Hunter Engineering Testing Services. (See appendix D).

3.3.0

RIVER FORMATION

The existing use and visual impact of this resource are to be preserved. To accomplish this result an understanding of the nature and workings of the river has been ascertained.

3.3.1

GEOMORPHOLOGY

The Goulburn River Valley is within the western section of the Upper Hunter Valley. It is situated between the Southern Plateau, Merriwa Plateau and the Central Lowlands of the physical divisions of the Hunter Valley. (See diagram No. 1).

The Goulburn River has its headwaters in part of the Great Dividing Range between the towns of Gulgong and Bylong. From its headwaters of deeply cut and narrow gorges it progresses in a north easterly and thence south easterly direction and the river valley broadens into a more varied landscape as it cuts through the softer rocks throughout the sandstone plateaus. The valley then opens into alluvial flats towards Sandy Hollow and continues on to meet the Hunter River south of Denman.

The Southern Plateau which lies between the Goulburn Valley and the Central Lowlands and extends towards Sydney, consists of a sandstone plateau which rises to around 1200 metres. The landform is rugged and broken and deeply cut by narrow valleys and gorges.

The Merriwa Plateau which is north of the Goulburn Valley consists of gently undulating to hilly land and is bounded on the west by the Great Dividing Range which has a low profile at this region. The soil is fertile, being mainly basalt and is about 450 metres above sea level. The plateau is cut by several river valleys which feed into the Goulburn River.

The Goulburn meets the central lowlands near Denman. The central lowlands consists of flat alluvial, undulating and gently hilly land through which the Hunter River flows.

3.3.2

HYDROLOGY

Other than the Hunter River itself, the Goulburn River has the largest water catchment area in the Hunter Valley Region. (See diagram No. 2). Runoff waters flow into the Goulburn River from the headwaters of the Goulburn Valley, part of the southern Plateau and the whole of the Merriwa Plateau.

The bed of the Goulburn River is comprised of fine to coarse graded quartz-sand and some chert pebbles drained from areas of quartzos triassic sandstone. A watertable exists beneath this sand based river bed.

In dry periods the surface stream ceases to flow leaving small shallow waterholes along the river bed. Most of the water supply for irrigation is obtained from spears, bores or wells sunk into the underground watertable. Windmills with bore holes into the watertable are used to water stock. Spear pumps have been driven into the dry river bed near the steel bridge on the Mudgee Road to tap the watertable for the water supply for Sandy Hollow.

In periods of heavy rains large high-flow levels of water are obtained due to the large catchment area of the Goulburn River. The heights, intensities and duration of the high-flow waters are dependant upon the quantity, intensity and location of the rainfall throughout the river catchment area. Plan No. indicates the recorded high flow water heights during the 1955 floods.

It was this flood which eroded the high levee bank west of the excavation site. The western bank of the river had been relatively stable for a period of over one hundred years as shown by the definition of that bank in the 1865 plan of survey. (See Plan No. 1)

3.3.3

PHYSICAL STRUCTURE

There has been a great deal of research conducted as to why a stream meanders. It was thought that only mature rivers or obstructions in the river itself caused a stream to meander. Experiments have shown that it is the movement of high-flow water through a river system that cause meanders.

"Meandering in the absence of obstructions is well illustrated by the experiments on laboratory streams performed at Imperial College, London. A stream trough was lined with granulated perspex, in order to simulate sandy alluvium in a natural valley. Into a straight and symmetrical channel down the centre of the trough, water was fed at a constant rate. After no great length of time, shoals appeared at intervals on the bed of the channel. Winding round the shoals, the stream began to cut into the banks, alternatively on the right and on the left. Meanders had been produced, in absence of obstacles, in uniform material, and with constant discharge." (The Face of the Earth - C H Dury 1959 - p.88).

It was found that hollows and shoals appear in the profile of a river bed. Where the shoals are formed the river tries to cut around it, thus causing the river to meander.

The excavation site is located on such a shoal or a deposition point on the eastern side of the Goulburn River. The river is trying to cut around this shoal eroding the high-levee bank to the west.

Realignment of the river by excavation and removal of material from the deposition area of gravel terraces together with the river protection works already carried out by the Water Resources Commission, will help to limit the erosion of the high levee bank.

3.3.4

BEDLOAD TRANSPORTATION

The movement downstream, along the bed of a river, of water born material such as silt, clay, sand and gravel is known as bedload transportation. As previously stated the river system is continually working and wearing away the land mass by absorbing the soluble components of the earth and eroding others. The eroded materials travel along from gullies to streams and become part of the bed of a river system.

Once within the river system the material is transported downstream and eventually to the mouth of the river. Bedload material is not appreciably moved at times of low-flow discharge. It is in times of high-flow discharge that the bed of the river is eroded by the increased velocity of the rising waters and is deposited when the velocity decreases within the stream and when the high-flow water begins to subside.

The higher the discharge of water the greater the amount of bedload transportation. In the larger floods the silt and clay is washed out over the flood plains and the sand and gravel is usually contained within the river channel.

The Water Resources Commission has carried out investigations of the amount of material being transported within the Hunter Valley river system. The Mean Annual Bed-Material Yield calculated for the Goulburn River at Sandy Hollow, by W D Ershire, P M Geary and D N Outhet in 1983, was 110,000 tonnes (for $d_{50}=0.3\text{mm}$). The calculations have been supplemented by further investigations by the Muswellbrook branch of the Water Resources Commission.

Mr P Collins whose extraction works is between "Rosemount" and the Yarraman Bridge has estimated that 40,000 tonnes of material has been deposited on his workings this year. The Goulburn River had not been flowing for a large amount of time last year. Mr Collins has the only other extraction site on the Goulburn River.

The flood in March 1977 brought down an estimated 307,500 tonnes of material. There is also a large amount of material stored in the upper reaches of the Goulburn River at this present time.

Large amounts of material are being transported from the Goulburn River and the Wollombi Brook and are seen in the lower parts of the Hunter River. Old excavation sites are being filled with fine sand and large amounts of sand have been dredged from Port Hunter.

The Goulburn River is transporting material and is unlike the Hunter River where extraction of material is greater than the bedload transportation.

3.4.0

CLIMATE

3.4.1

RAINFALL

The Upper Hunter Region is subject to variable rainfall throughout any particular year. This is highlighted by the droughts and floods which have occurred over the years.

The average rainfall is 560 millimetres per year. (See diagram 3). Rain is recorded over an average of eighty days per year.

Rainfall large enough to cause flooding occurs due to two major rainfall mechanisms:-

- (a) Inland depressions which usually occur during late Summer and Autumn.
- (b) Coastal cyclonic rains which usually affect the coastal catchments and usually occur between February and September.

Flooding has been recorded more than once in a year and the most common months for floods are February, March, June and July. The river ceases to flow during extended dry periods and droughts as the rainfall is less reliable in this drier western section.

3.4.2

TEMPERATURE

The temperature varies considerably throughout the year from warm to very hot days experienced in the Summer months with a mild to warm Spring and Autumn and cold Winters.

The average temperature is about 25° C during the period of December to January and would have 30 days of temperatures over 35° C throughout the late Spring and Summer months. The average minimum temperature is about -3° C during the months from July to August.

3.4.3

WIND

The wind directions within the Hunter Valley Region are influenced by the ranges and the valley formations. The predominant east-west direction of the Goulburn River Valley and the ridges of the Liverpool Range, which run in a similar direction, to the north of the valley can be seen to have an effect on the direction of the winds recorded at Sandy Hollow. (See diagram 4)

3.4.4

AIR INVERSIONS

Fog is the characteristic of a surface inversion, where condensation of moisture has occurred. Dust pollution may cause the inversions to persist longer as the sun's rays are absorbed by this pollutant matter and the fog is not dispersed.

The minimum number of days of fog recorded at Jerry's Plains is 29 per year. The development site situated at Sandy Hollow is 35 Kilometres north west of Jerry's Plains and would have a similar amount of fog affected days.

Pollution control measures are to be introduced in the processing, stockpiles and transport of material within the development site. The development would have a minimal impact on the existing environment.

3.5

FLORA

With the spread of agriculture along the Goulburn Valley floor most of the native vegetation has been removed to uncover the arable land. There are only a few rough barked apple and white box trees remaining in a cluster at the top of the loam and silt terrace where the access track drops down into the gravel terraces of the river system.

Within the river system itself there are a few scattered oak trees at the toe of the loam and silt terrace. The Water Resources Commission have carried out a river bank stabilisation programme by planting rows of willow trees at the base of the high levee bank on the opposite side of the river to the proposed excavation.

The proposed development will not destroy any of the existing trees.

The existing grasses upon the flat land above the river system contains the natural coverage of couch and wiregrass. The land to the east of the river has been supplemented with pasture improvement legumes and grasses while the land immediately opposite to the west is being cultivated or has established stands of lucerne. Flat land areas are relatively free of weeds.

The river system is covered by the grasses prevalent to this region. The loam and silt bank to the east has an established couch and wire grass coverage to the toe of that bank. This coverage extends along the gravel terrace towards the river with the wire grass stopping where the good topsoil finishes. The couch continues towards the river. About half way along the gravel terrace, where the pegged line for the taking of cross sections is marked (See Plan No. 2), the couch also thins out leaving semi-exposed sand and gravel surface until the top of the bank of the lateral bar is reached.

The lateral bar and river bank has a coverage of river couch. The western river bank and land to the toe of the high levee bank has a coverage of river couch and kikuyu grass.

Types of noxious weeds to be found along the river channel are: Prickly pear, tiger pear, noogoora burr, castor oil plants and stinging nettle.

3.6

FAUNA

With the settlement of the river flatlands and the consequential clearing of the land, for grazing and agricultural purposes, has destroyed or altered the habitats of the original wildlife of the region. Introduced animals have also led to the destruction of wildlife.

Grazing cattle have periodically eaten the area out in times of drought. Rabbits would have also contributed to this in the 1950's. Introduced cats, dogs and foxes would have taken their toll on the smaller indigenous animals.

No observations of wildlife were recorded on frequent inspections of the development site. No doubt some species of the original inhabitants are in existence but are sparsely populated making observations difficult. Even the rabbit population has been well controlled within this area. Wombat burrows were observed in the base of the high levee bank.

The bird life was also scarce. As stated the flatlands adjoining the river have been cleared of most timber. Also the river itself does not encourage the proliferation of bird life. The river was not flowing at the time of preparing this report. Only a few small water holes remained. When the river is flowing it usually flows at a depth of 0.2 metres to 0.3 metres over some varying widths of 15 metres to 30 metres. There are no deep water holes or shady billabongs in this part of the river and with the flow not being continuous not many species are attracted to this area.

Both the flatlands and the river system are mainly used as feeding grounds for bird life which find their nesting places elsewhere.

Species of bird life observed were:

Flatlands-

Sulphur crested cockatoo	Cacatua galerita
Australian magpie	Gymnorhina tibicen
Rosella	Platyeercus eximius
Galah	Cacatua coronoidies
Crow	Corrus coronoidies
Willy wagtail	Phipidura leucophytys

River system-

Heron	Arclea novaelollandiae
Sharp tailed sandpiper	Tringa glareola
Little pied cormorant	Phalacrocorax carbo
Wrens	Malurus leuopterus
Double bar finch	Poephila bichenouii
Zebra finch	Poephila guttata

3.7

AQUATIC FLORA AND FAUNA

The river bed is a surface of bare sand with a proportion of up to 15mm gravel spread through it. Very little aquatic flora is present except where the stream coincides with the main river banks.

The only aquatic fauna observed in the nearly dried up water hole were golden carp and the guppy or mosquito fish.

As the proposed development does not intend to remove any material from the bed of the river it is considered that a concise appraisal of aquatic flora and fauna would be superfluous to the demands of this report.

**4 PROPOSED
DEVELOPMENT**

4.1

LIMITS TO DEVELOPMENT

Extraction of any material from or within 40 metres of a non-tidal river is regulated by the Water Resources Commission under Section 23A of the Rivers and Foreshores Improvement Act. A close liaison has been had with the Muswellbrook branch of the Water Resources Commission throughout the planning of the development application.

The Water Resources Commission have designed a river alignment for this part of the Goulburn River. The proposed extraction will be limited to the formation of the proposed river alignment.

Excavation from the river bed and below the low-flow water level of the river is not permissible. The low-flow level has been defined by the Water Resources Commission.

No excavation will take place within a 10 metre berm from the toe of the eastern high bank and the loam and silt terrace. This precaution will be taken to stabilise the bank. The access road to the processing plant will be constructed on part of that bank and it will be located and constructed to minimise any erosion.

4.2

EXTENT OF DEVELOPMENT

The proposed development consists of:

- i) The upgrading of the existing dirt track to the river
- ii) Excavation of new river alignment
- iii) Extraction of filtration dam and water supply hole
- iv) Construction of a washing and screening plant to grade and stockpile material.

It is proposed to commence the extractive operation by removing the clean sand which is deposited at the northern end of the extraction area. Whilst this area is being excavated the access road will be upgraded and reconstructed to have a gravel surface of 0.2 metres to 0.3 metres thick. A new entry to main road No. 208 and the relocation of the entry down the silt and loam bank to the excavation area will be constructed. (See Plan No. 3).

Once excavation work has commenced, negotiations will be made to buy and install a washing and screening plant similar to that shown in Plan No. 3. If a processing plant cannot be obtained constructed with colour bonded material, the plant will be painted a colour that will not be obtrusive to the area.

A water supply hole will be excavated to about 1 m below the natural watertable and located as shown in Plan No. 3. About 5,000 cubic metres will be excavated from this water hole. This will ensure a continuing water supply to the washing plant. The material excavated will be stockpiled until it can be processed and transported from the site.

The washing and screening plant will be located as shown in the plan and all excess water from the plant and stockpile will be drained in a northerly direction towards the filtration dam. This dam will be constructed by removing 15,000 cubic metres of material progressively northwards from the commencement of its designated area. The excavated material will be processed and transported from the site.

The major excavation will be from the realignment of the river. The river will be realigned as shown in the plan No. 3 to 7 and excavation will commence at the low-flow water level as defined by the Water Resources Commission and continue at a grade of 1:75 until it intersects with a grade of 1:6 which commences at a point 60 metres east of the eastern alignment of the river.

Excavation will be carried out in three sections of the proposed development area. With excavation at the northern section, southern section and in the middle, the samples can be blended to produce a better marketable product. This is because the excavation area is at deposition point in the river and the coarser material is found upstream (south) with the finer samples downstream (north). (See Appendix D).

The excavation areas are to be made perpendicular to the river in an east-west direction. The excavation will continue in a southerly or northerly direction until the whole of the area has been worked. If, in the interim the river deposits more material on site this material will also be removed.

Apart from the short term storage of material excavated from the water supply hole and filtration dam area, a permanent stockpile required as storage for processed material will be located as shown in the plan. The stockpiles will not be over 5 metres in height and their elevation no higher than the top of the silt and loam bank.

The stockpiles of stored processed materials will be kept to a minimum with the stockpile of sand the largest. It is envisaged to store up to 600 cubic metres on site.

This will enable the processing plant to be worked more efficiently and not as often as would be the case of a smaller amount of storage. A supply of this amount of sand would keep the trucks working for a period of six days.

Water used by the processing plant to wash and sieve the raw material will be drained from the plant, stockpiles and associated road works into the filtration dam. The water stored in this dam will then filter through the sand and gravel terraces back to the watertable and thence the stream.

4.3

EXTRACTION AND PROCESSING

A front-end loader will be used to strip the top layer of soil, sand and gravel from the areas of extraction. The material will be stockpiled or spread over the areas where excavation has been completed.

The actual excavation of the sand and gravel will also be carried out by the front-end loader. The extracted raw material will be loaded into a truck for transportation.

At the commencement of the development, the clean sand which is relatively free of gravel will be loaded onto trucks and transported directly from the site. The quantity of sand which can be obtained in this matter is limited.

Throughout the period of the preliminary extraction of clean sand, the washing and screening plant will be obtained and, installed at the site. The hole which will be used as a water supply and the filtration dam will be excavated.

When the processing plant, water supply and filtration dam are established the major part of the excavation can commence. The front-end loader will then load the raw material of sand and gravel onto a truck which will transport it to the processing plant.

The raw material will be washed and screened into stockpiles of sand and gravel by the plant. The stockpiled sand or gravel will then be loaded onto trucks when required, to be transported off site.

4.4

MACHINERY AND EQUIPMENT

The equipment intended to be used in the excavation processing and transportation are:-

- (a) The front-end loader which will be in permanent use at the site to excavate the sand and gravel. It will be used to load the processed sand and gravel onto the trucks for transportation off site. It will be a diesel four wheel drive, rubber tyred machine with a bucket capacity of 2.0 cubic metres.

- (b) A portable washing and screening plant similar to that shown in Diagram No. 5. The plant will be powered by electricity and consist of a hopper or feed bin, conveyor chutes, a vibratory screen with water sprays and an elevator with radial chute.
- (c) Up to four (4) One six wheeled trucks with an 18 to 20 tonne capacity will be used to transport material off site. A similar truck will also be used to transport the excavated raw material to the washing and screen plant.
- (d) A water truck fitted with a 9,000 litre capacity tank will be contracted throughout the dry periods to suppress dust pollution. It will be used to carry water for dust control of stockpiles, access roads and operational areas about the processing plant. The water truck will be fitted with boom spray and water cannon.

4.5

ACCESS ROADS

The material will be transported by road to the proponent's clients in the Muswellbrook area. The routes to be used are Main Roads No. 208 and 209 and the New England Highway.

Access to the excavation site will be as indicated in plan No. 3. The existing dirt track will be upgraded with a gravel surface and drained to prevent erosion.

The point of entry of the existing track to Main Road No. 208 will be altered to give a better site distance. The point of entry will be relocated approximately 60 metres to the south of the existing entry and will be just north of the existing culvert in the road.

Water from this culvert will be redirected into the existing contour banks. The new point of entry will be constructed at right angles to Main Road. No. 208 at the point of commencement for 50 metres and thence follow the general contour of the land to meet with the existing dirt track, which will be upgraded and continue parallel with the fence line towards the excavation site.

At the stand of trees the access track will be redirected to swing to the south and proceed over the silt and loam bank to the processing plant. This part of the road will be constructed to drainage standards which will prevent erosion of the high silt and loam bank.

4.6

TRANSPORT

Diesel powered six wheel trucks will be used to transport sand and gravel from the excavation site or to transport the material from the extraction area to the processing plant. After the sand and gravel has been processed the finished product will be transported off site to the various clientele.

The access road to the plant and the roads about the plant will be gravelled for the ease of operation of the vehicles. The access to the Main Road 208 will be relocated to provide a better sight distance for vehicles approaching the intersection.

The sand and gravel will be marketed locally in Denman, Muswellbrook, Aberdeen, Scone and the Bayswater - Liddell areas. The transportation routes to these areas would be by designated Main Roads No. 208 and 209 and the New England Highway.

Both these main roads are extensively used by road transports for freight and livestock. The additional truck movements which would be added to the existing road system would not average more than two per day. This is two movements of an unloaded truck coming to the site thence returning loaded.

The maximum amount of truck movements in any one day would be twenty and therefore there would be periods with no truck movements at all since the plant would not be operating each day. Since the number of truck movements is relatively small compared with the existing use of Main Roads No. 208 and 209, no detrimental effect on the existing road system should eventuate.

4.7

HOURS OF OPERATION

It is intended that the working hours at the extraction site would be contained within the daylight hours of between 7 a.m. and 6 p.m. Monday to Friday with the exception of public holidays.

It is not envisaged that the excavation and processing plant will be in continuous operation all day and every day between the stated hours. The hours actually worked by the front-end loader and the processing plant will be dependant upon the demand for the products.

The hours worked will be consistent with those of the farming community and therefore should not have any adverse effects on the existing environment.

4.8

ENERGY AND ENERGY CONSERVATION

Diesel fuel will be used by the front-end loader, water truck and haulage trucks. The washing and screening plant will be powered by electricity.

The estimated amount of diesel fuel consumed per year of operation would be:

EQUIPMENT	ESTIMATED ANNUAL FUEL USAGE (LITRES/YEAR)
Front-end Loader	5,500
Water Truck	1,850
Haulage Truck	35,000

	42,350

The consumption rate is less than .001% of the current production of automotive diesel.

The washing and screening plant similar to the one in Diagram No. 5 would have six (6) electrical motor drives.

(1) Screen	-	7.5 KW
(2) No. 1 Conveyor	-	5.5 KW
(3) No. 2, 3 & 4 Conveyors	-	2.2 KW each
(4) Pump	-	45.0 KW

TOTAL		64.6 KW

The processing plant would not be in continual use and the consumption of electricity compared with the present rate of consumption of the State would be minimal.

The choice of machinery has been made to obtain the most efficient implement to carry out each part of the extraction process. By conserving the fuel needed to power these implements the cost of the operation is reduced.

For each machine to work efficiently regular maintenance work is required. The proponent has the workshop facilities upon his property at Castlerock and carries out regular maintenance of the vehicles. The processing plant will also receive regular maintenance.

Energy is conserved by the choice of machines and regular maintenance of them. The conservation of energy will lower the cost of production and enable the product to be more competitive within the market place.

**5 SOCIAL AND
ECONOMIC
ENVIRONMENT**

5.1

ARCHAEOLOGICAL SURVEY

The National Parks and Wildlife Service has been notified of the proposed development application. Representatives of the Muswellbrook branch of the department have inspected the proposed excavation site and have forwarded their report to Sydney.

Some core samples have been found. The fact that all excavation will take place in the deposition area of a flood plain would make the relics found of dubious archaeological importance as the origin of the cores may not be accurately established.

Still the Archaeologist/Historian section of the department of National Parks & Wildlife Service require an archaeologist's report to be prepared for the site. Appendix C contains the archaeologist's report prepared by Mr Denis Byrne.

5.2

SITUATION

Sandy Hollow is a rural township located on the Goulburn River near the intersection of the Denman to Merriwa Road, Main Road 209, with the Sandy Hollow to Mudgee Road and the Sandy Hollow to Wybong Road, both roads forming part of Main Road 208. Also the junction of the Muswellbrook - Merriwa Railway and the new Ulan Railway occurs within the town.

It is a service town for the surrounding rural properties. There are about thirty homes in the town together with the railway station, post office, school, hall, hotel, shop and caravan park. Employment is found within the town's service industries, on the rural properties, wineries and vineyards of the area.

The proposed excavation site is to be situated on the Goulburn River upon the adjoining property known as "River View". The property is located three (3) kilometres south of Sandy Hollow on the Sandy Hollow to Mudgee road.

"River View" consists of flat undulating grass land which has been clear of nearly all of the natural timber since the years of settlement. The property is extensively used for the production of beef cattle and some of the paddocks show signs of former cultivation.

The property adjoining to the north has a similar land use with areas of land used for the cultivation of cereal crops. The land adjoining to the south has been cultivated and mostly sown with pasture grasses. The property is a thoroughbred stud and major improvements have been carried out with regards to stables, fencing and drainage. The property adjoining the western bank of the Goulburn River opposite the excavation site is known as "Dunroven". The land is at present cultivated in preparation for cereal crops and has well established irrigated lucerne crops. The water supply for the irrigation of the pastures is obtained from bores or wells sunk into the watertable.

Bores or wells are mostly used in this area as the water supply for the river is inconsistent. At the time of the preparation of this report the river had stopped flowing and only a few shallow waterholes remained.

5.3

EXISTING LAND USE

The land about the proposed development is used primarily for agricultural purposes. The property on which the excavation will take place is used mainly to graze beef cattle. Cereal crops and pastures are cultivated on adjoining properties. A thoroughbred stud has been developed on the land adjoining to the south.

Vineyards with their associated wineries are located in the surrounding areas. "Richmond Grove" is to the east, "Mount Dangar" at Sandy Hollow and "Hollydeen" is situated north east of Sandy Hollow.

Sandy Hollow is a service town for the surrounding rural properties. Some of the rural workforce of the properties reside in the town.

The proposed development will have no significant impact on the economy or existing landuse of this area.

5.4

ADJOINING RESIDENCE

There is only one residence that is close to the proposed excavation site. This is the dwelling erected upon the property "Dunroven" which is immediately opposite the excavation site.

The dwelling has outbuildings, trees and shrubs surrounding it at the present time. The buildings have been erected for the convenience of use and are garages, workshops and storage sheds. The trees and shrubs have been planted to provide a wind break and visual barrier from the surrounding cultivated land, for the residence.

The majority of excavation will take place in the new alignment of the river. This work will be below the elevation of the high-levee bank and adjacent to willow trees on the western side of the river. These excavated areas will not be readily observed from the dwelling and the bank and trees will disperse the noise of the front-end loader and truck working the excavation site.

The washing and screening plant will be observed from particular parts about the residence. The view of the plant and filtration dam from the dwelling itself would be intermittent, broken by the outbuildings, trees and shrubs, and distanced by the visual barrier of the river. The processing plant will be powered by electric motors and as no crushing operation is planned it will be of minimal impact to the environment.

**6 SAFEGUARDS TO
ENVIRONMENT**

6.1

RIVER PROTECTION

River protection policies are not designed to protect the river, per se but to protect the interests of the property owners, both private and public, who adjoin the river. It is not so much to protect the river but to confine the river.

To confine a river system is against its nature. Rivers are continually working, as with this particular section of the Goulburn River at the proposed excavation site.

A shoal has developed on the eastern side of the river as it meanders in a westerly direction. It is the nature of a river system to meander. (See Section 3.3.3).

It is the intention of the proposed development to realign the river by the removal of the deposited sand and gravel on the lateral bar and gravel terraces that make up the shoal on the eastern side of the river. When this excess material is removed it will produce a more suitable cross sectional area through which the high-flow water may move more freely.

The high levee bank on the west had not been severely eroded for over a hundred years before the 1955 floods. With the excavation to the new alignment the river will be back dated in time and theoretically would need years of deposition of material to build up the shoal to again produce the meander to the west.

The silt and loam terrace high bank on the eastern side of the river will also be protected. A berm of at least 10 metres in width will be left from the toe of this bank towards the river. No excavation for the filtration ponds or water supply hole will occur within this area. The processing plant, internal and access roads will be constructed to have minimal effect on the bank.

The excavation area does not extend to the river bed and therefore it will be left unaltered. There are no river crossings proposed in the development and the river stabilisation works on the western bank will not be affected by the development.

6.2

SOIL EROSION CONTROL

To prevent erosion of the alluvial high levee bank on the opposite side of the river to the extraction site, the Water Resources Commission has carried out river bank protection work. One or two rows of willow trees have been planted at the

toe of the high levee bank for the length of the badly eroded section. Wire mesh netting has also been placed along the river bank adjoining these willows to stabilise the river bank.

The development area does not include this side of the river and therefore this section will remain in its present state. The excavation will widen the river alignment so that in times of high flow the pressure of water will be taken, to some extent, off the high levee banks.

It is not intended to excavate near the toe of the loam and silt bank to the east of the extraction site. This area is proposed to be the site of the processing plant and the filtration pond. The access road at this point will be constructed to eliminate the possibilities of erosion.

The small amount of topsoil to be stripped from the extraction areas will be used as banks around the filtration pond. These banks will be watered to encourage the growth of the natural grasses thereby stabilising the banks.

Stockpiles of sand from the processing plant will be situated on the flat area above the plant and below the top of the loam and silt bank. It is in the proponents interests to keep them free of all erosion. These stockpiles will be situated above all but the major floods.

6.3

DUST CONTROL

The excavation sites will be situated in that part of the river formation which at present consists of semi-exposed sand and gravel surface and that which has good grass cover.

Excavation will not be carried out during extremely windy days. It is anticipated that the dust generated by the front-end loader when excavating the material will be minimal as there is "clean" sand at the site.

The excavated material to be transported from the site will be covered by tarpaulin or similar material and trucks will not be loaded above the sideboard of the bins. The access road will be dampened by the water truck in times of dusty conditions.

Also the internal roads about the processing plant will be maintained and dampened to control dust pollution. The processing plant will wash the sand and screen the gravel. By its nature the stockpiles of sand and gravel will be wetted. Should the stockpiles become dry enough to cause a dust problem, they will be wetted by sprays or the water cannon attached to the water truck.

6.4

VISUAL CONTROL

The extraction site by the nature of its operation is situated in the lower part of the river formation. The fact that the area to be excavated is between the high levee bank and the loam and silt terrace has a screening effect in itself.

Some parts of the excavated area will be visible from the dwelling opposite on the property "Dunroven". The residence has outbuildings and is surrounded by shrubs which will act as an existing visual barrier. Together with the high levee bank, which has willows planted at the toe, they will provide visual screening for the major part of the exposed excavated area.

There will be only one front-end loader operating on the site. Three excavation pits will be worked in conjunction with each other so that at any one time the working areas in the pits will not be large. Together with the fact that the area surrounding the residence is under cultivation the proposed development will not have a great visual impact upon the residence.

The screening and washing plant will be situated at the toe of the loam and silt terrace. The stockpiles of sand will be situated on the level ground below the top of that bank. (See Plan 2 & 3). The plant and stockpile situated in the position as indicated in the plan will be partly concealed from the view of the residence of "Dunroven" by the existing screening trees and outbuildings about the residence.

The excavated area will not be seen from the Sandy Hollow - Mudgee Road, as the general contour of the land will not permit observation. The higher part of the vibratory screen and the radial chute of the screening plant will be likely to be seen from certain sections of this road. The visual impact of the screening plant will have minimal effect on the scenic aspect when viewed from the road, considering the existing landscape which includes the Ulan Railway line, wind mills and water tanks and the newly constructed concrete brick horse stables upon the property to the south.

The screening plant and excavation areas will be visible from Peberdys Road to the west. The road is not a major scenic route as it is a gravel formation which is about 7 kilometres in length and is used as a service road to the adjoining properties.

6.5

NOISE CONTROL

The noise generated from the extraction site will emanate from the front-end loader, the processing plant and the trucks used for transportation of the material.

The noise emission by the front-end loader and trucks working at the site is reduced by the manufacturers' spark arrestors and exhaust systems fitted to the vehicles. The equipment will be serviced and maintained at the workshop area at the proponent's property at Castlerock.

The processing plant, when established, will be powered by electric motors. The plant will only wash and sieve the raw material. The water supply to the plant will be pumped by an electric motor.

The fact that the excavation site is in the channel area of the river formation will help to disperse noise emissions. The processing plant will be lower than the high loam and silt bank and the excavation area is beneath the high levee bank. The screening of willows at the toe of the high levee bank will help to disperse noise emissions.

The site will not be worked constantly and only two to twenty loads of material would be anticipated some days and other days nil. Main Road No. 208 is situated east of the site and Peberdy's Road and the new Ulan Railway is to the west. The machinery used is similar to the existing machinery used on the adjoining properties so that overall the development should not have an adverse affect on the existing environment.

6.6

WASTE CONTROL

The area to be excavated will be cleared of all foreign material before commencement of excavation. This material will be burnt, when permissible, or be transported from the site to be dumped in a suitable location.

Very little waste products will emanate on site when the excavated material is loaded directly onto the trucks and transported off the site. When the processing plant is installed, a ponding dam will be constructed. Water emanating from the plan and the associated stockpiles will be drained into the ponding dam and then will gradually filter from the dam through the existing sand and gravel back to the stream.

The proposed rate of extraction would not justify an employee being permanently stationed at the site at present. If there is an increase in demand when the processing plant is installed a small lunch room and storage shed will be located on the high loam and silt bank off the access road near the cluster of existing trees. This amenity would have a garbage disposal unit and "pit" type latrine.

A diesel fuel tank is to be situated in this area to store fuel for the front-end loader. There will also be facilities at this point to enable regular services to the front-end loader to be carried out. All used oil and lubricants will be gathered and stored in drums and transported off site for disposal.

6.7

FUMES CONTROL

Fumes generated by the extraction operation will be those emitted by the machinery working on the site. All the equipment is powered by diesel engines. Fumes from these engines are not generally of a polluting nature.

The site is isolated in comparison to an industrial area and any minor fallout from this source will be negligible.

6.8

WEED CONTROL

The spread of noxious weeds and weed growth in general is to be kept to a minimum by:-

- (a) Keeping all excavated areas, processing plant areas and stockpiles clear of weed growth.
- (b) Maintaining minimum dust pollution over the site thus eliminating weed distribution by wind blown seeds.
- (c) Transporting only dry or moist material from the site thus preventing unwanted seeds from draining onto the access roads.
- (d) Covering the material being transported from the site with a tarpaulin or similar material to prevent dust and seeds being blown from the loaded bins.

- (e) Inspecting all vehicles leaving the site so that they do not carry noxious weeds on their undercarriage or tyres.

6.9

FUTURE MINING DEVELOPMENT

The land upon which the development is proposed is contained within Coal Authorisation No. 286 held by the Department of Mineral Resources. The Authorisation does not preclude the extraction of sand and gravel.

Coal underlies the whole of this area. Much of the area is wilderness and part of the land to the south of the Goulburn River is included in the Wollemi National Park.

This area has not been mined as the coal is well below the land surface. Another factor being the more economical source of coal found in the Warkworth - Ravensworth and Muswellbrook areas.

Development of this area by coal mining companies is not foreseen in the immediate future. Permits to extract the material are granted by the Water Resources Commission, for a two year period, after development consent has been obtained from the Muswellbrook Shire Council. The Water Resources Commission's consent is required each second year so that permission to develop the land is virtually for a two year period.



7 REFORMATION

7.1

PREPARATION FOR FUTURE USE

The existing use of the gravel terraces adjoining the river is grazing pasture for the beef cattle raised on the property "River View". The excavation area when completed will be revegetated to provide pasture for the cattle and to stabilise the new alignment of the river.

The new alignment of the river will be the major future use of note this development will produce. A more favourable cross sectional profile of the river will be excavated to allow the high-flow waters to proceed down stream without eroding the high levee bank on the opposite side of the river.

7.2

REVEGETATION

Before the actual extraction of sand and gravel occurs from the excavation areas as they are progressively worked, the surface layers of the ground will be stripped to a depth of 200 to 300 millimetres. These surface layers of material contain the topsoil, the naturally occurring grasses and herbs and their respective seeds.

At the beginning of the development this material will be stockpiled on the higher ground about the filtration dam and processing plant where it will be above all but the major floods. The stockpile will be watered to encourage the natural growth of grasses and herbs upon them and thus prevent erosion by wind and rain.

As stated in Section 4.2 (Extent of Development), it is intended to work three excavation areas along the river alignment. The three excavation areas will be worked in conjunction with each other as the material from different areas will be blended. The areas will be progressively worked until the whole of the river alignment has been excavated.

Once a strip of land at least 20 metres in width has been excavated to the designed new alignment cross section, revegetation of that strip may commence. The surface layers of the topsoil are firstly replaced upon the completed excavated area. The topsoil can be brought from the stockpiles or directly from areas being stripped in preparation for extraction.

The topsoil is spread to a depth of 200 to 300 millimetres upon the excavated surface. The soil is watered to encourage natural growth of grasses and herbs. This area will also be fertilized as recommended by the Soil Conservation Service. (See letter Appendix B).

When the whole river alignment has been excavated, the land disturbed at the completion of the development will be sown with river couch grass and clover legumes. The varieties of grass and legumes will be dependent upon the advice of the Water Resources Commission or the Soil Conservation Service.

The variety of grass, legumes and the fertilizer type and quantity, would be:-

7.2.1

SPRING SOWING

The following mixture to be used for sowing from late August to late October.

River couch grass	- 10 kg/ha
Rhodes grass	- 8 kg/ha
White clover	- 12 kg/ha

The couch grass and white clover to be sown as the main pasture. The rhodes grass will need to be sown on the batter of 1 in 6 at the edge of the new alignment.

7.2.2

AUTUMN SOWING

The following mixture to be sown after the first good rain in mid-February to the end of March.

River couch grass	- 10 kg/ha
Murray subclovers	- 12 kg/ha
Wimmera rye grass	- 6 kg/ha

7.2.3

FERTILIZER

The soil will be sandy and of a well drained nature. The plants will be readily leached of nutrients as the layer of topsoil is only shallow. A fertilizer is to be added with the sowing and another further application to be made 6 months later.

Advice will be obtained from the Agricultural Department of Soil Conservation Service as to the type of fertilizer and application rate to suit the particular area. The fertilizer used would most probably be Grower 12 (Trade mark) compound fertilizer, or its near equivalent, spread at a rate of 100 g/ha.

8 SUMMARY

As stated the type of revegetation application rate, variety and fertilizer will be subject to the consent of those Government Authorities when the excavation is finished.

7.3

SCREENING

The excavation site by the fact of its very nature is contained within the channel of the river and is screened from all but one dwelling and the people travelling along Peberdys Road. Trees would have to be planted along the high banks of the river to screen the excavation site. The length and shape of the excavation site compared with the estimated life of the operation would make the screening of the area impractical.

The adjoining property exposes areas of land to the elements by ploughing and cropping. The high banks have been previously cleared to make way for cultivation paddocks and grazing pastures.

Planting of trees is not permitted within the new river alignment. The Water Resources Commission will allow trees to be planted on the remaining gravel terraces.

The life of the operation is estimated to be about six (6) years. As most trees planted would be from tube stock, any screening planted in this gravel terrace area would not grow to a size useful enough for a visual screen before the development ceased.

8.1

AIMS

The dominant aim of the development application is to secure a place where the proponent may extract Goulburn River sand and therefore continue the supply of this material to the clientele he has accumulated over the years of trading.

It is the new river alignment, which has been designed by the Water Resources Commission with the aim to contain the Goulburn River to its present trace, that will give purpose to the development.

8.2

ALTERNATIVES

The alternatives which are available for consideration by the proponent are alternative sites and alternative materials.

8.2.1

ALTERNATIVE SITES

Sand is produced from other river gravel excavation sites along the Hunter River. This sand could be graded and a comparable sample to that extracted from the Goulburn River obtained.

The sand extracted from sites above Denman, the junction of the Hunter and Goulburn Rivers, contains more fines and is a "dirtier" sample. This is the reason that Goulburn River sand is stipulated by the proponent's clientele.

Sand extracted from below the Denman junction of the river contains a good portion of Goulburn River sand. This sand still contains the fines from the Hunter River and most of the workable extraction sites have been developed, the remaining have had access and a greater distance from the clientele.

Alternative extraction sites could be obtained along the Goulburn River itself. In fact the proponent prepared a development application to extract sand from the property "The Glen" on the Rosemount Road, west of Denman. The development application was approved by all Government Authorities. It was only after this that the property owner placed restrictions upon the lease agreement and the extraction from the site was found to be uneconomic to develop.

The proponent searched for another site along the Goulburn River and this one was chosen. The Goulburn River sand may not be the ultimate, but it is the preferred material by the proponents clientele.

Sand can be produced in other areas but the cost of transportation to the Upper Hunter Regions places additional expense. The excavation site at Sandy Hollow only gives the product a marginal profit when the haulage to the markets is taken into account.

8.2.2

ALTERNATIVE MATERIAL

Alternative material can be found to replace the Goulburn River sand. "Fines" can be obtained from hard rock quarries or produced from conglomerate rock. Sandy soils could be processed into a workable sample but all these alternatives have additional production cost that would make the product uneconomical and would not compete in the present market.

But why turn to alternative materials in this case? The extraction of the material of the Goulburn River will produce an alignment of the river which is desirable to the Water Resources Commission. The material produced can be marketed in the existing economic conditions.

8.3

JUSTIFICATION

The proposed development is fortunate in the respect that the need of the proponent to procure a source of raw material for business purposes can be used advantageously to widen the alignment of the Goulburn River and thus complement the river bank stabilization program designed by the Water Resources Commission. Any works to help stabilize the western bank of the river at this point must benefit the adjoining property "Dunroven".

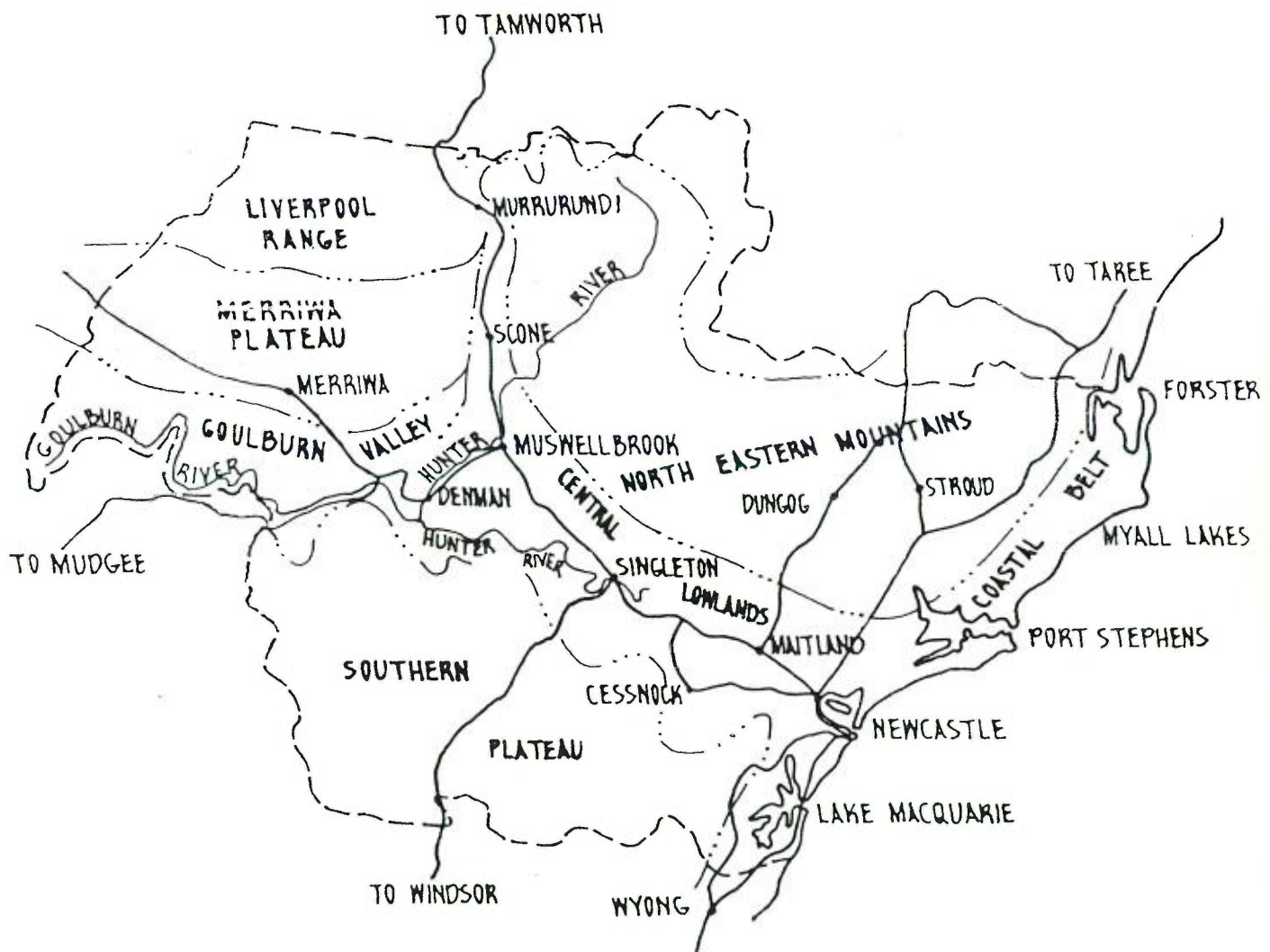
The proposed excavation site is not extensive and is situated in the lower region of a river channel, in an isolated area south of Sandy Hollow. Environmentally the development will not have a great impact upon the area. The machinery used on the excavation site is not all that dissimilar to the machinery used in the cultivation of pastures in this rural area.

Only a part of the processing plant will be observed from Main Road No. 208 and the plant will be painted a colour compatible with its surroundings. The excavation site would be visible from Peberdys Road and partly visible from the dwelling upon the property "Dunroven". A very small amount of vehicles use Peberdys Road and the owner of the property "Dunroven" had no objections to the proposed development when contacted by the proponent regarding this matter.

Access to the extraction site is by way of an existing track which will be upgraded. The processed material will be transported from the site to clientele over main Roads No. 208 and 209 and the New England Highway. These roads are at present being used as haulage routes by road transport vehicles.

With the development of the extraction site carried out as described herein, the potential destructive nature of an excavation industry can be made beneficial for the area.

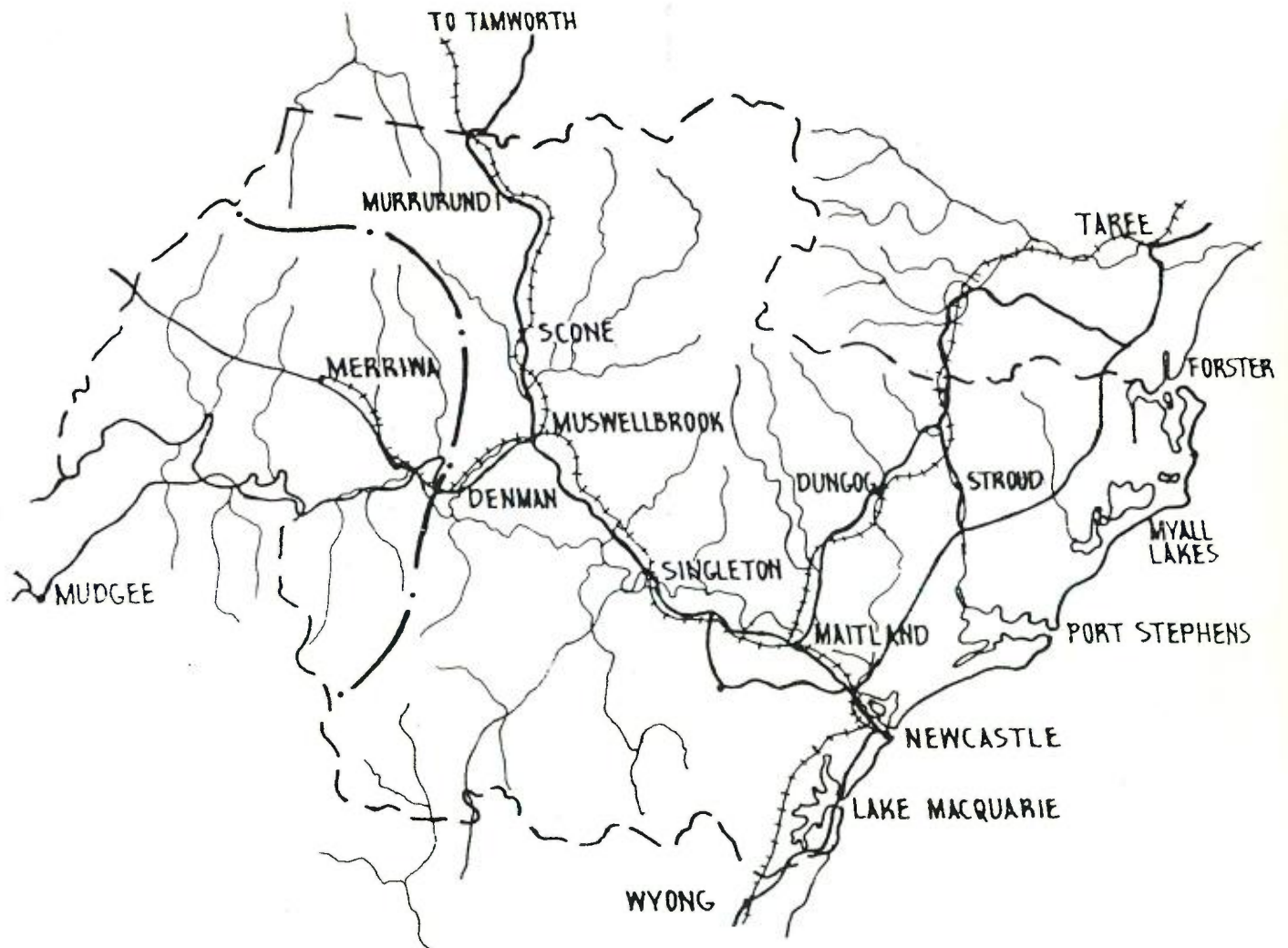
HUNTER VALLEY LANDFORMS



0 24 KM.

— THE HUNTER VALLEY

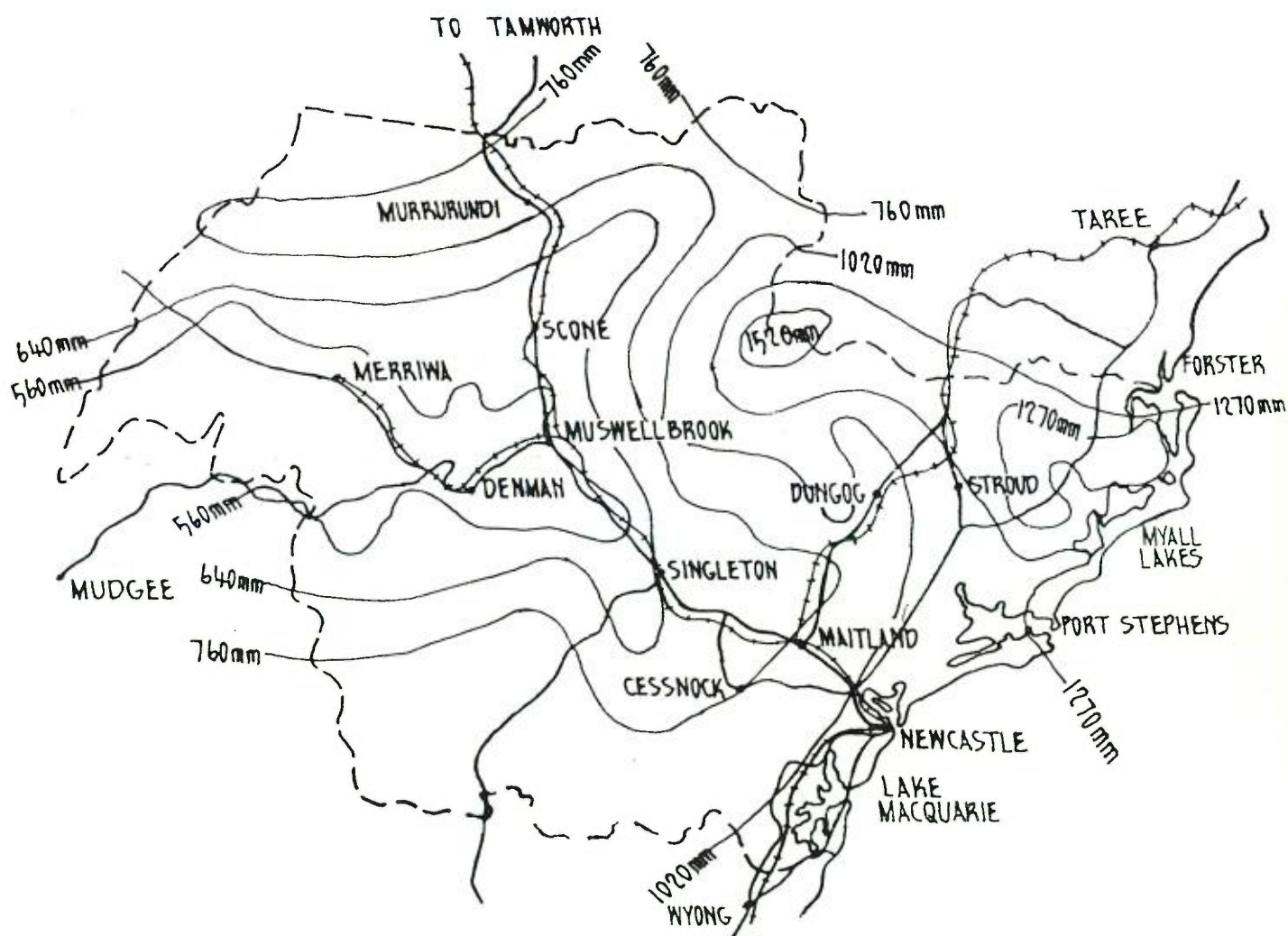
GOULBURN RIVER CATCHMENT AREA



0 24 KM

- THE HUNTER VALLEY
- . - THE GOULBURN RIVER CATCHMENT AREA

AVERAGE ANNUAL RAINFALL



0 24 KM

DIAGRAM N°3

WIND ROSES

SANDY HOLLOW

JANUARY

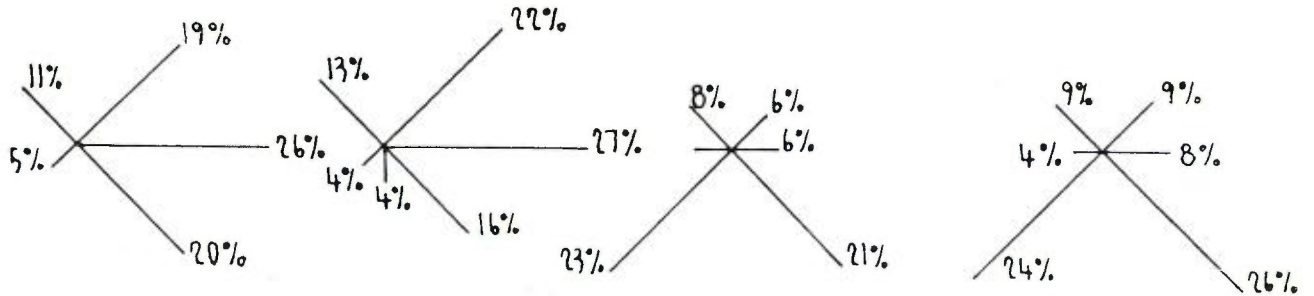
APRIL

9 A.M.

3 P.M.

9 A.M.

3 P.M.



JULY

OCTOBER

9 A.M.

3 P.M.

9 A.M.

3 P.M.

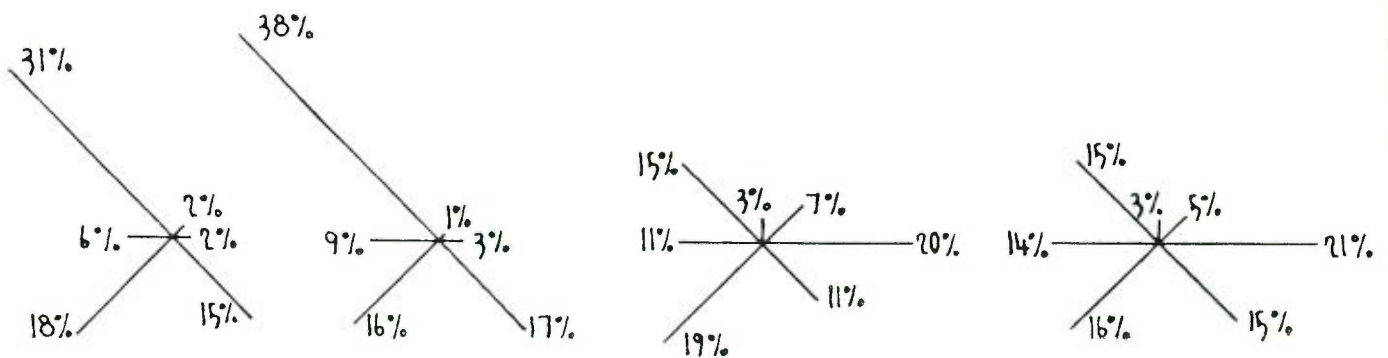


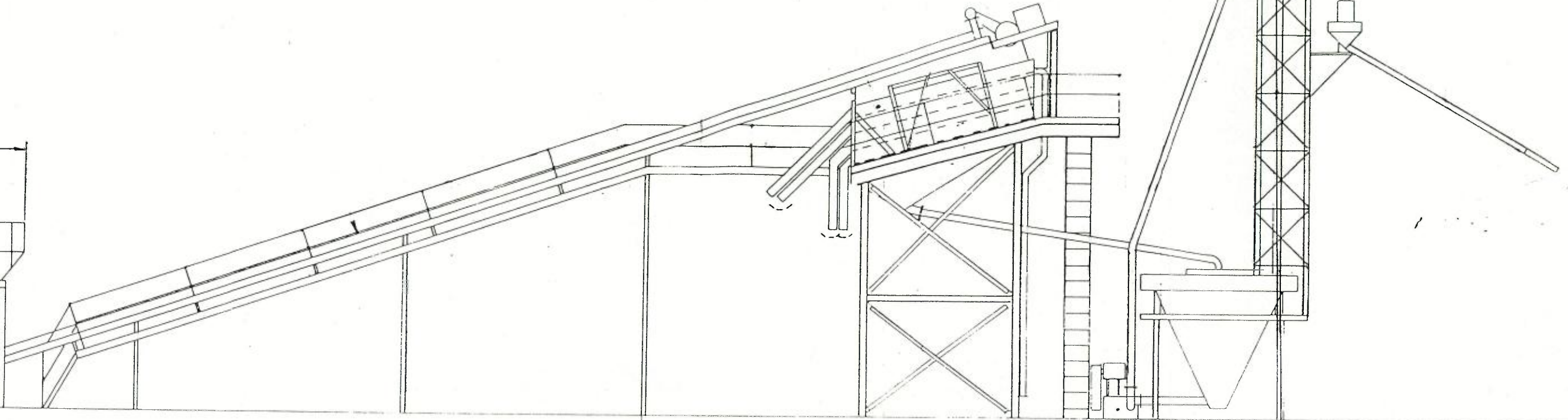
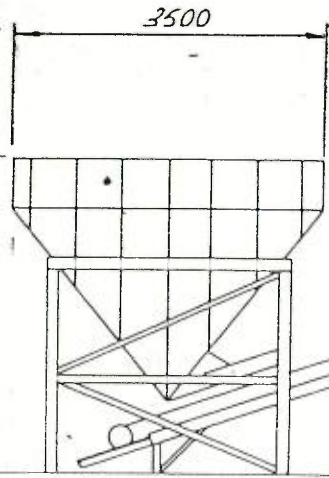
DIAGRAM N°4

VIBRATORY SCREEN
 3m x 1.2m 4 DECK 2 BEARING
 WATER SPRAYS ON ALL DECKS.

φ 610 CYCLONE
 WITH RADIAL CHUTE

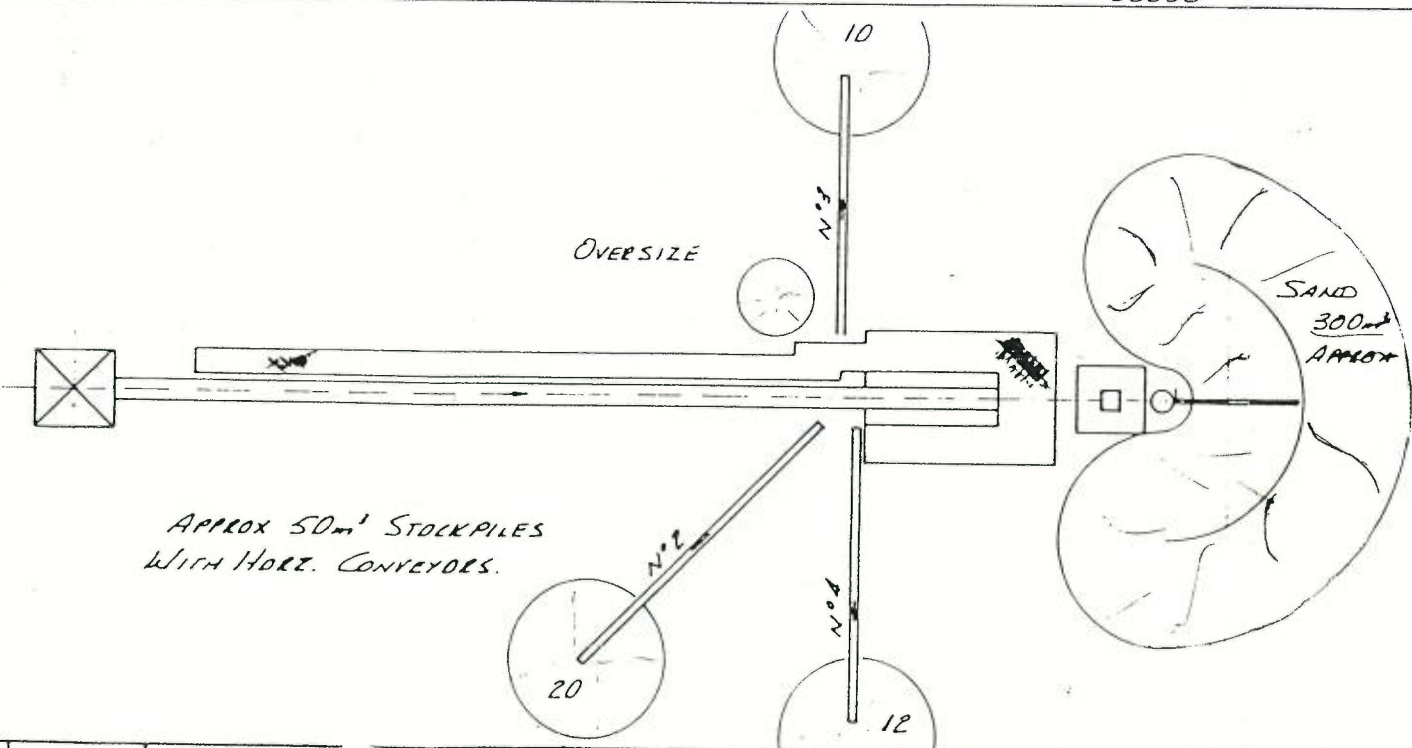
N°1 CONVEYOR
 450 WIDE x 23000 LG.

5m³ FEED BIN



6/4 SOLIDS PUMP

33000



ALL ELECTRIC MOTOR DRIVE
 SCREEN - 7.5 kW.
 N°1 CONV. - 5.5 kW.
 N°2,3,4 CONV. - 2.2 kW EACH
 PUMP - 4.5 kW.
 TOTAL 164.6 kW

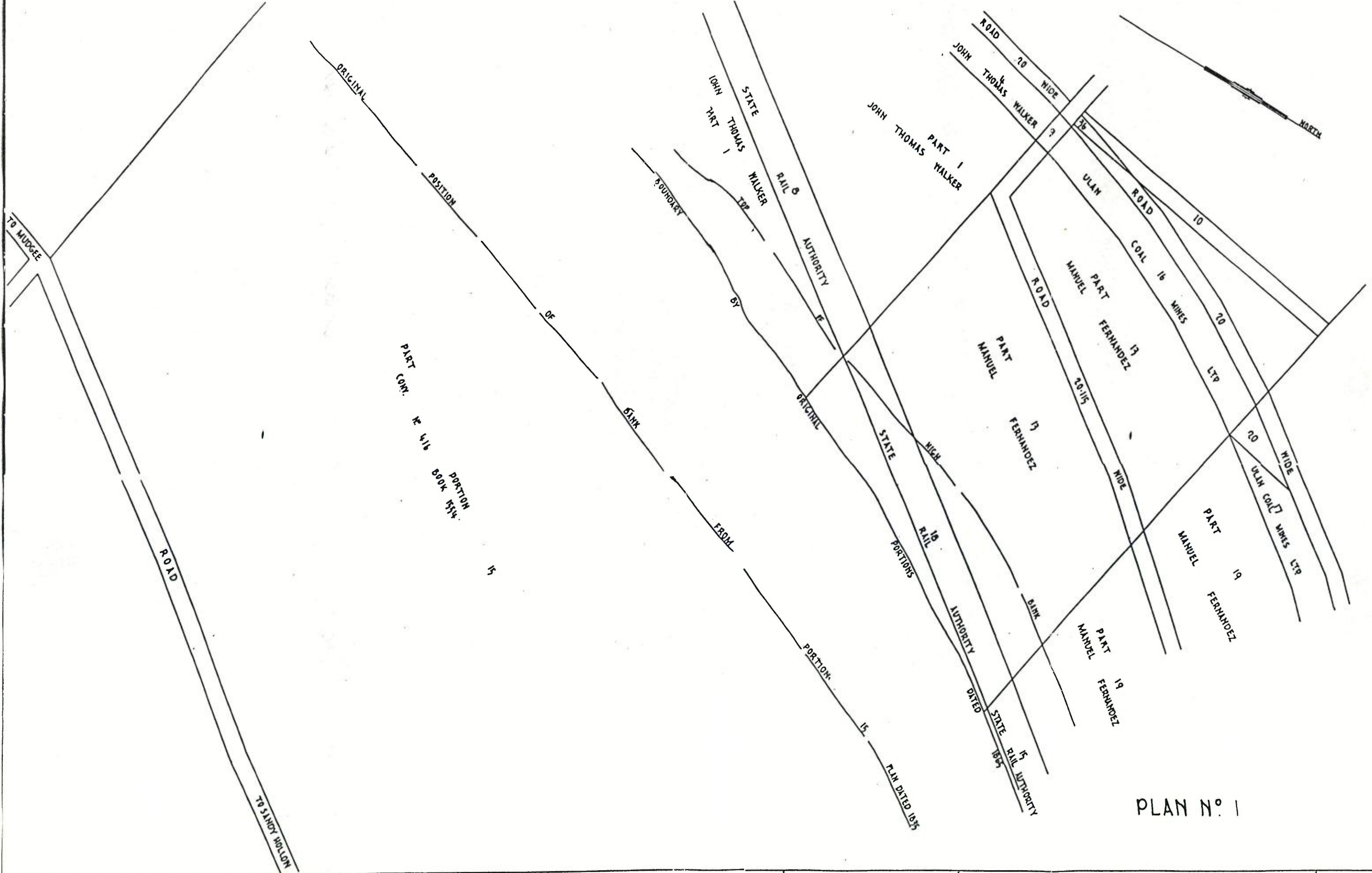
APPROX 50m³ STOCKPILES
 WITH HORIZ. CONVEYORS.

N°2,3,4 STOCKPILE
 CONV. 400 WIDE x 7000 LG.

DIAGRAM N°5

REFERENCE DRAWINGS	NUMBER	ISSUED TO	DATE	DATE	REVISIONS	BY

ITEM	DESCRIPTION	REQ'D	MATERIAL
	AUSTRAL MINING PTY. LTD. 496 BOUNDARY ROAD, ARCHERFIELD		
	PROPOSED GENERAL ARRANGEMENT OF SCREENING PLANT		
		DRAWN	A.L.W.
		SCALE	1:50/1:100
		DATE	17-6-82
		CHECKED	
			A B C D E F G
			5839



PLAN N° 1

Amendments

Scale	1:2000
Datum	
Date	

PALMER BRUYN & WALPOLE
 CONSULTING SURVEYORS
 NEWCASTLE SINGLETON MUSWELLBROOK SCONE

Sheet No.
 of Sheets
 Ref. No.
 53087



PLAN N°2

P.M. 60596

Amendments

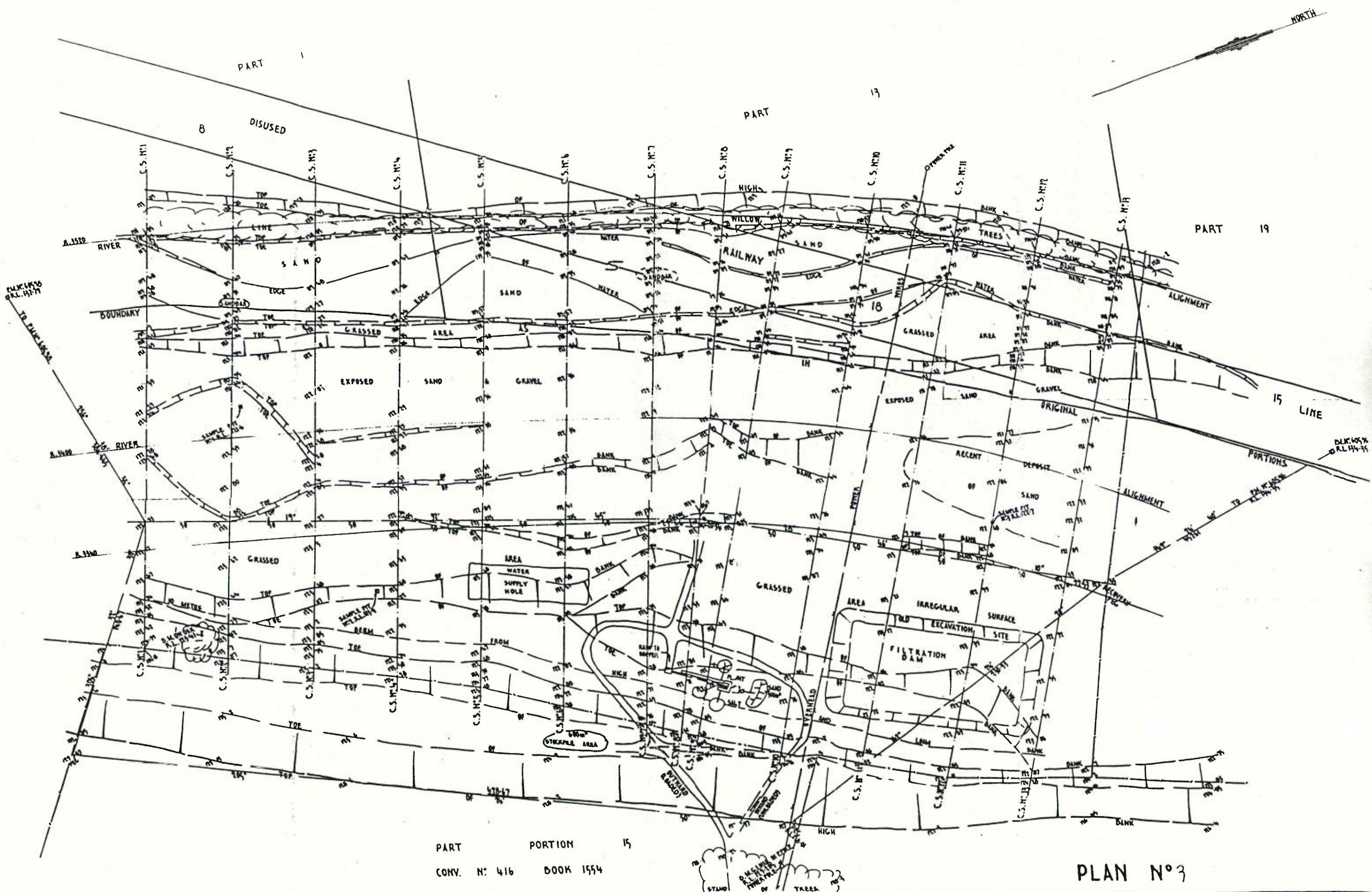
Scale
1:2000

Datum

PALMER BRUYN & WALPOLE
CONSULTING SURVEYORS
NEWCASTLE SINGLETON MUSWELLBROOK SCONE

Sheet No.

of 7 Sheets



PART PORTION 15
 CONV. N° 416 BOOK 1554

PLAN N° 3

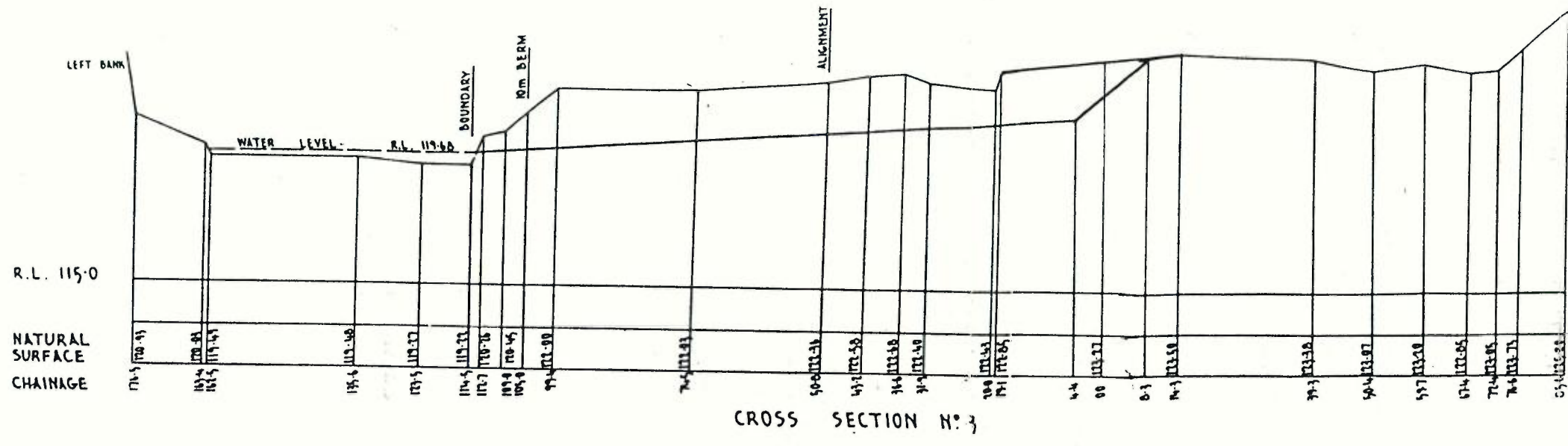
Amendments

Scale 1:1000
 Datum A.H.D.
 Date FEBRUARY 1965

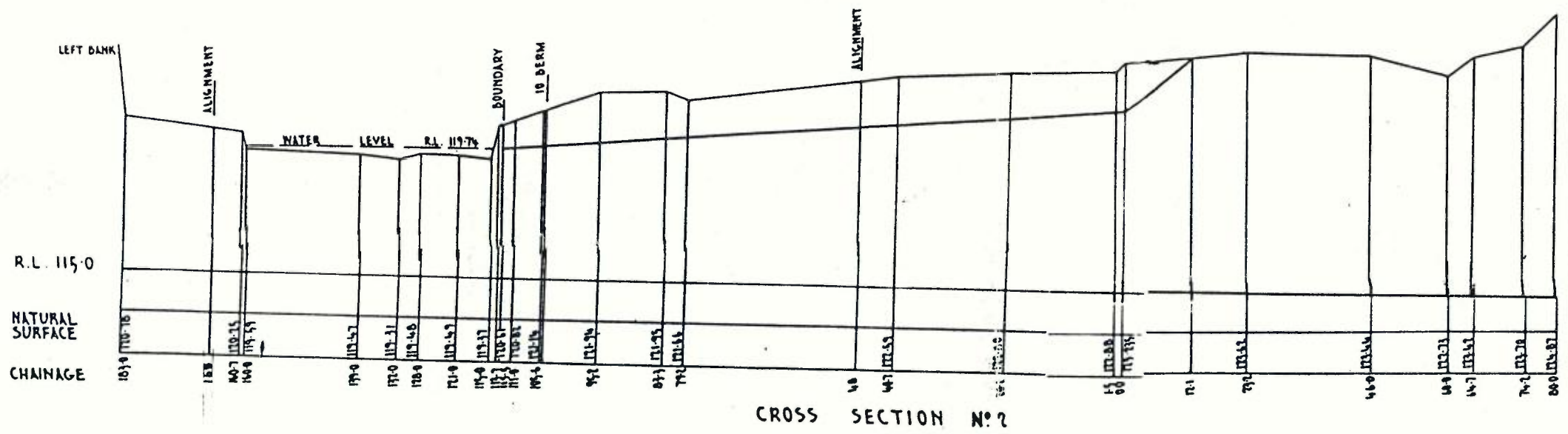
PALMER BRUYN & WALPOLE
 CONSULTING SURVEYORS
 NEWCASTLE SINGLETON MUSWELLBROOK SCONE

H.G. RAY
 PLAN SHOWING DETAIL AND LEVELS OF EXCAVATION SITE
 'RIVERVIEW' - SANDY HOLLOW

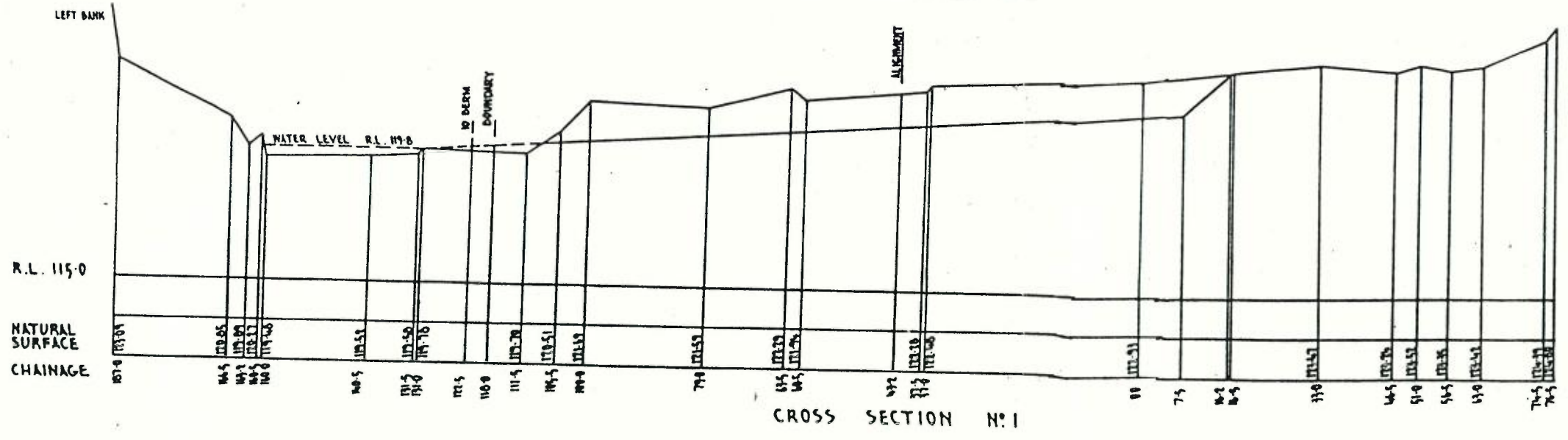
Sheet No. 2
 of 7 Sheets
 Ref. No. S. 3087
 Plan No.



CROSS SECTION N^o 3



CROSS SECTION N^o 2



CROSS SECTION N^o 1

PLAN N^o 4

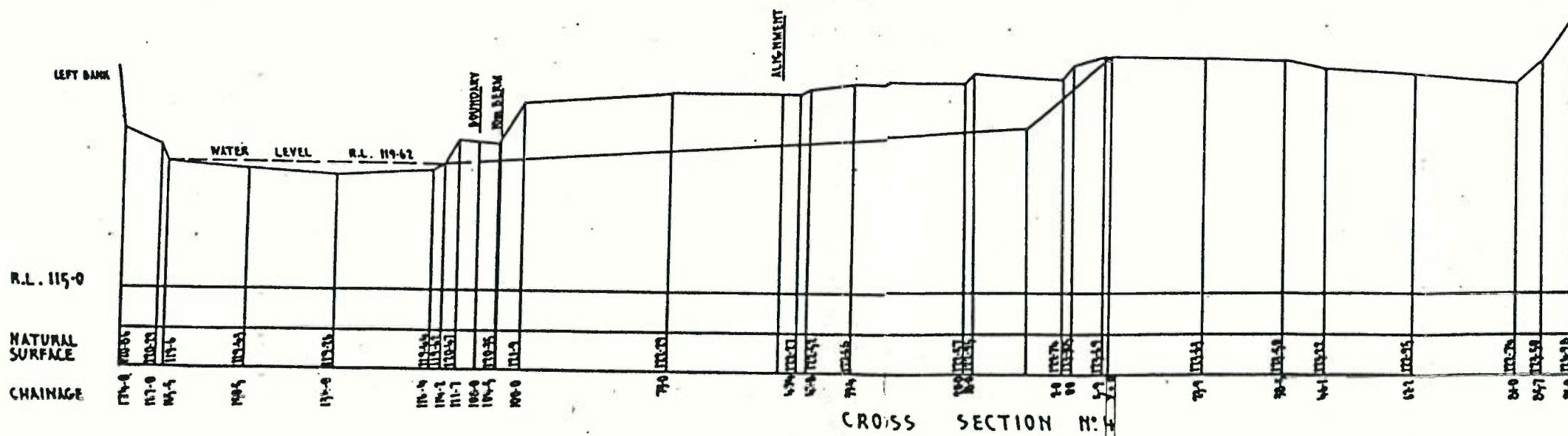
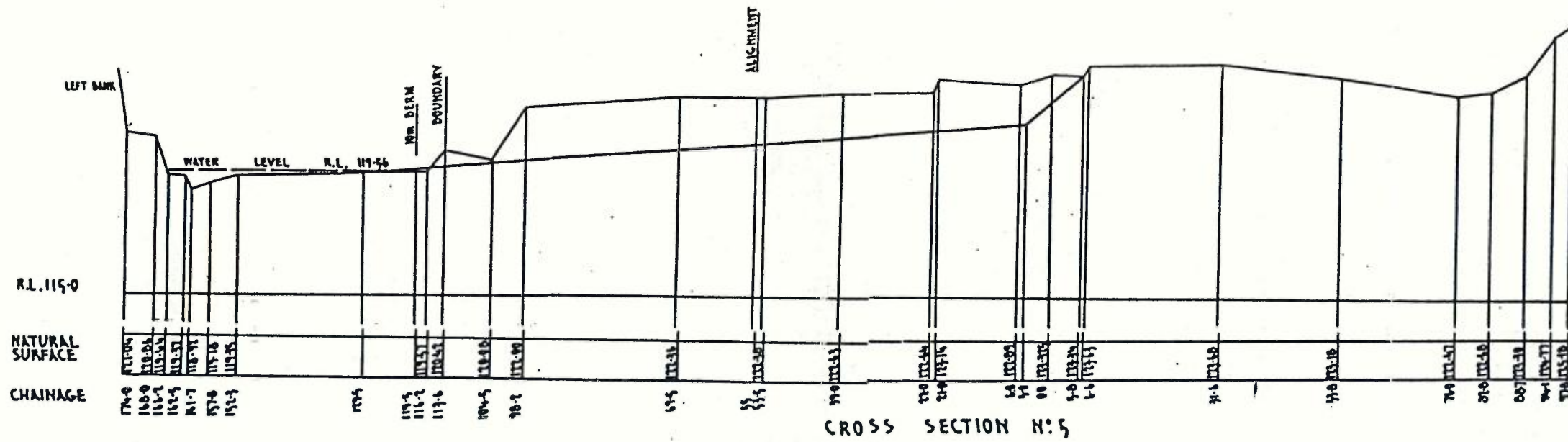
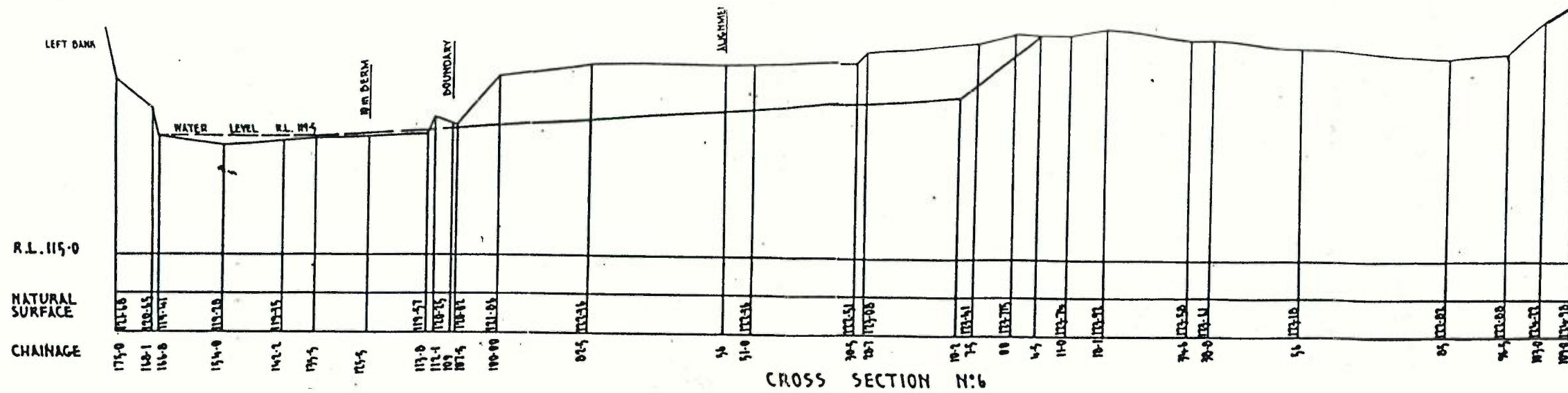
Amendments

Scale 1:500 Horizontal.
1:100 Vertical.
Datum

PALMER BRUYN & WALPOLE
CONSULTING SURVEYORS
NEWCASTLE SINGLETON MUSWELLBROOK SCONE

Sheet No. 1
of 7 Sheets

CROSS SECTIONS
Nos 1-3



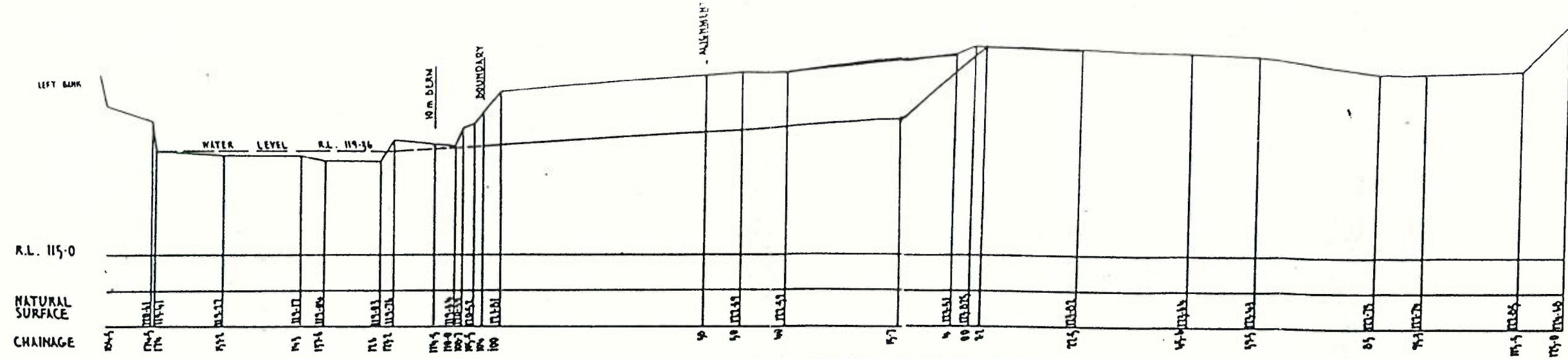
PLAN N°5

Scale 1:500 HORIZONTAL
 1:100 VERTICAL
 Datum
 Date

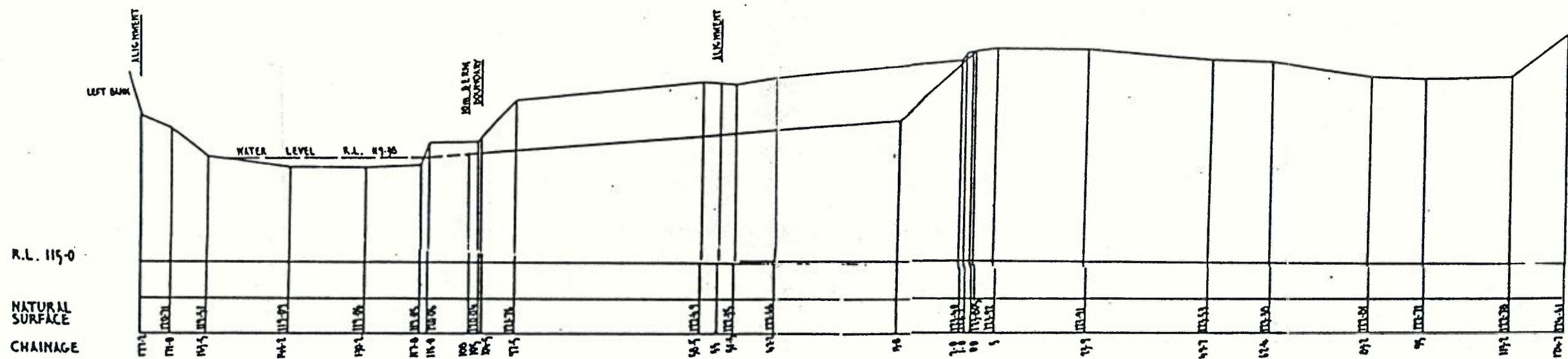
PALMER BRUYN & WALPOLE
 CONSULTING SURVEYORS
 NEWCASTLE SINGLETON MUSWELLBROOK SCONE

CROSS SECTIONS
 N°s 4-6

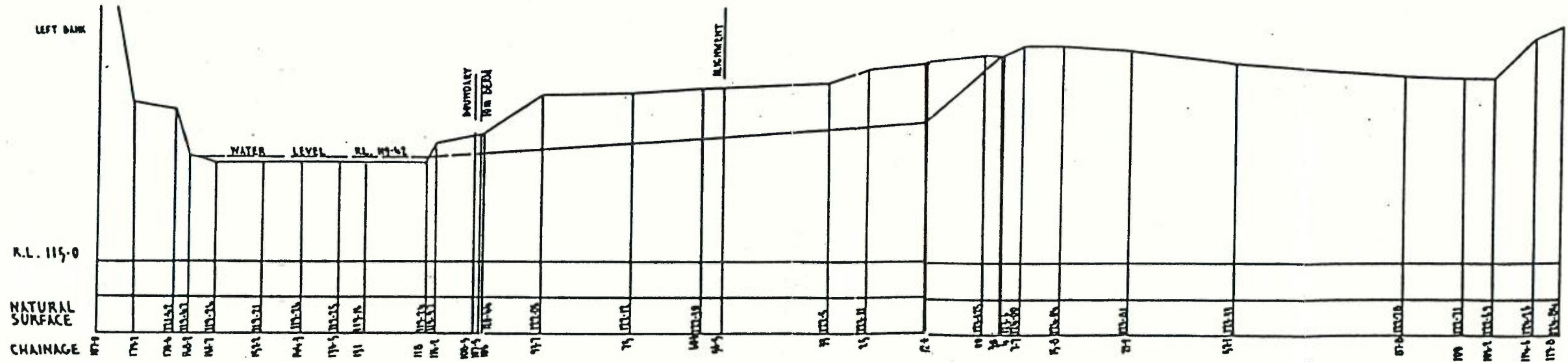
Sheet No. 4
 of 7 Sheet
 Ref. No.
 S. 3087



CROSS SECTION N° 9



CROSS SECTION N° 8



CROSS SECTION N° 7

PLAN N° 6

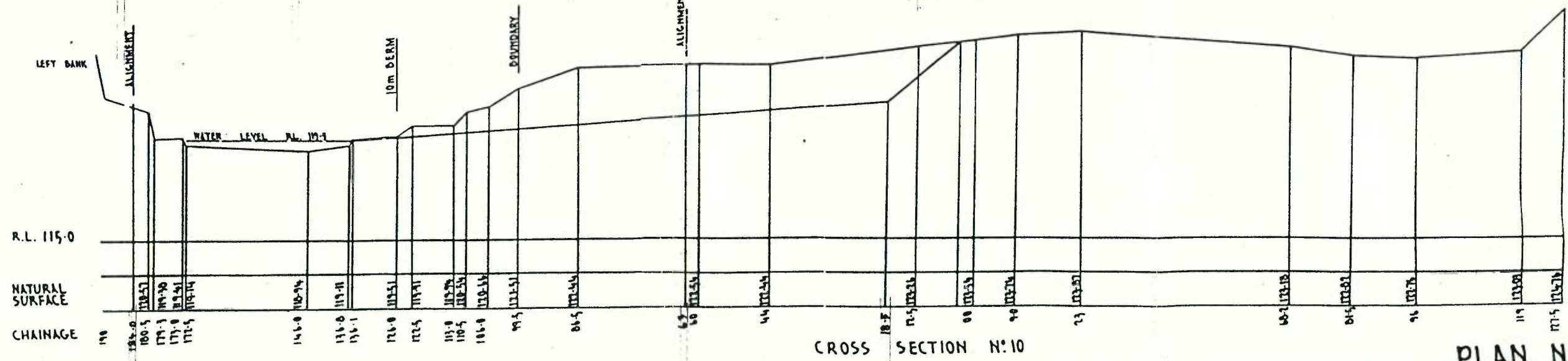
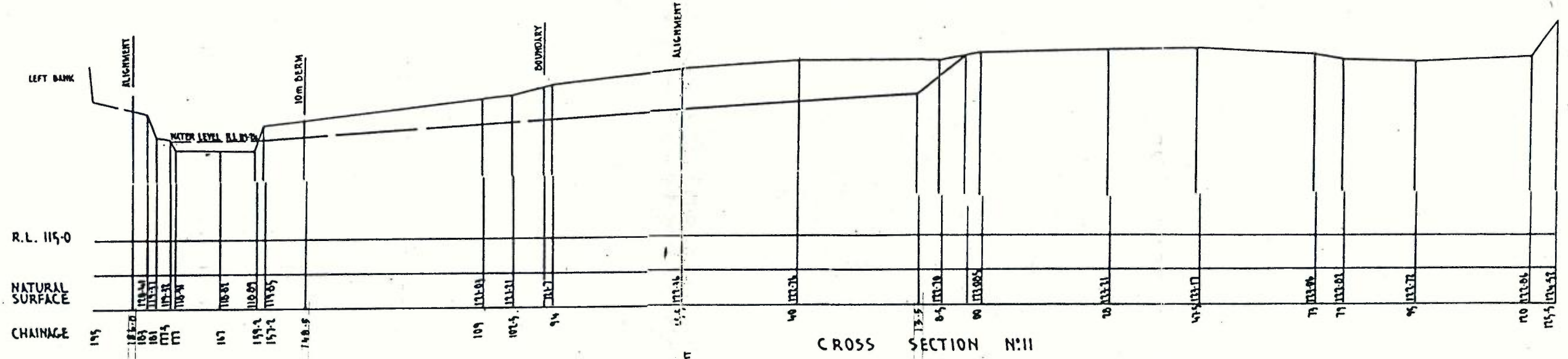
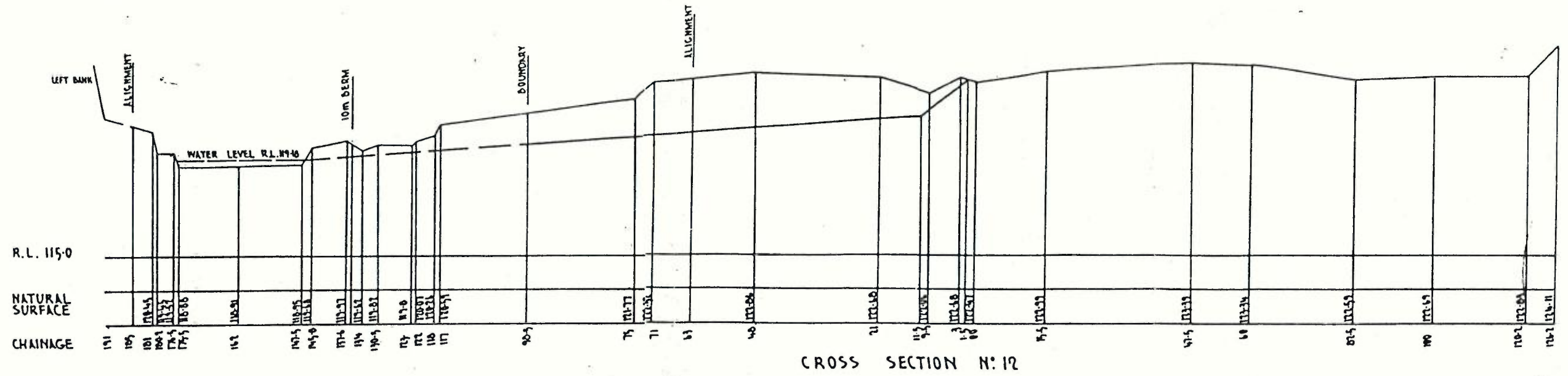
indments

Scale 1:500 HORIZONTAL
1:100 VERTICAL
Datum

PALMER BRUYN & WALPOLE
CONSULTING SURVEYORS
NEWCASTLE SINGLETON MUSWELL BROOK

Sheet

CROSS SECTIONS
N°s 7-9



Amendments

Scale 1:500 HORIZONTAL
1:100 VERTICAL

Datum

PALMER BRUYN & WALPOLE
CONSULTING SURVEYORS
NEWCASTLE SINGLETON MUSWELLBROOK SCOTLAND

CROSS SECTIONS
N°s 10-12

PLAN N°7

APPENDICES

APPENDIX A

Reference Material

REFERENCES

- (i) The Industrial Mineral and Rock Resources
of the Upper Hunter Valley.
J. W. Brownlow, November 1980.

- (ii) Environmental Newsletter,
P. Geary, Vol 8. No.2 June 1983.

- (iii) Management of Sand and Gravel Extraction
in the Hunter River, N.S.W.
W. D. Erskine, P. M. Geary and D. N. Outhet,
River Management Branch
Water Resources Commission of N.S.W.

- (iv) The Face of the Earth
G. H. Dury, 1959.

- (v) HUNTER REGION 1972
Growth and Change : Prelude to Plan.

- (vi) Muswellbrook Environmental Study (Technical Report)
Jackson Teece Chesterman Willis & Partners Pty. Ltd.
April 1981.

APPENDIX B

LETTERS RECEIVED FROM CONSULTED GOVERNMENT AUTHORITIES,

Muswellbrook Shire Council

Department of Environment and Planning

Water Resources Commission

State Pollution Control Commission

National Parks and Wildlife Service

Soil Conservation Service

MUSWELLBROOK SHIRE COUNCIL

QUEEN ELIZABETH 11 SQUARE, MUSWELLBROOK. 2333

TELEPHONE (065) 432866

TELEPHONE - PERSONAL ENQUIRIES
PLEASE ASK FOR SHIRE PLANNER/DS
FILE NO. 347/00

16 November 1984

Palmer Bruyn & Walpole
Consulting Surveyors
P O Box 404
MUSWELLBROOK NSW 2333

Dear Sir,

Proposed Sand and Gravel Extraction Pt Por 15 Parish of Arndell
MR.208 Sandy Hollow

I refer to your letter dated 7th November 1984, with regard to the above.

Council's requirements with regard to an Environmental Impact Statement would include compliance with Clause 34 of Part iv of the Regulations to the Environmental Planning and Assessment Act, 1979. Compliance with all the requirements of the Department of Environment and Planning The State Pollution Control Commission, Water Resources Commission and any other Government Authorities would also be necessary. It is recommended that you consult with Council regarding possible requirements for the upgrading of roads in the area and any landscaping proposals for the site.

The visual impact of the proposed extraction on the surrounding area and possible methods of overcoming any problems should be addressed.

Please find enclosed a 149 Certificate for the site as requested.

Yours faithfully,



L P Fisher
SHIRE CLERK

Encl.



Department of Environment and Planning



Palmer, Bruyn and Walpole,
P.O. Box 404,
MUSWELLBROOK N.S.W. 2333

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
DX. 15 Sydney

Telephone: (02) 266 7111 Ext. 7134

Contact: J. Shields

Our reference: 84/845

Your reference:

Dear Sir,

Proposed Sand and Gravel Extraction adjacent to Goulburn River
near Sandy Hollow

Thank you for your letter of 6 November, 1984 which indicated that you are consulting with the Director with regard to the preparation of an environmental impact statement (E.I.S.) for the above proposed development.

2. As development consent for the proposal is necessary and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, it is necessary that an E.I.S. accompany the development application to Council and to assist in comprehension, a copy of the Director's requirements should be appended to the E.I.S.
3. The basic requirement is that the E.I.S. is to be prepared in accordance with Clause 34 of the Environmental Planning and Assessment Regulation, 1980, and that it shall bear a certificate required by Clause 26(1)(b) of the Regulation.
4. With regard to the form and content of the E.I.S., it is advised that the Director requires that you should take into account those matters specified in the attachment to this letter. These matters are to be adequately addressed in the statement, and should be taken into account in the determination of the proposal by Council with whom we suggest you confer.
5. Further, the National Parks and Wildlife Act contains legislative requirements for the preservation of relics and aboriginal places. The advice of the National Parks and Wildlife Service should be sought on the need for a professionally conducted aboriginal archaeological survey for inclusion in the E.I.S. and on the appropriate manner for carrying out such a survey.

6. Where matters are likely to come within the scope of legislation relative to air, water and noise control as administered by the State Pollution Control Commission, the views of the Commission should be sought and taken into account in preparing the E.I.S. If aspects of the proposal significantly affect agricultural land or agricultural industry, the views of the Department of Agriculture should also be sought and appropriately addressed in the E.I.S.

7. Should you require any further information regarding this matter, please do not hesitate to contact us again.

Yours faithfully,

J. D. Shields 11/12/64

J. D. Shields
Assessments Branch
As Delegate for the Director



Water Resources Commission

Phone (065) 432755



Palmer, Bruyn & Walpole,
P.O. Box 404,
MUSWELLBROOK 2333

Ref: 84/4276
Contact: A. Parfait

ATTENTION: Mr. G. Boardman

River Management Branch,
Box 297 - Post Office,
Muswellbrook 2333

5.12.84

Dear Sir,

re: Proposed Extraction of Sand and Gravel from the
Goulburn River at 'Riverview', Sandy Hollow
by Harold Ray

Reference is made to your letter, S3087, dated 7th
November, 1984 in which you request comments concerning the above
proposal.

The E.I.S. should contain sufficient information
concerning the property upon which the excavation is to be done, the
quantity and quality of materials in the deposit, the method of
operation, the impact of the extractive operation on the river and a
suitable restoration plan.

1. PROPERTY: This Office would prefer if the relevant information
is given on an accurately surveyed plan (Scale of 1:1000 and of
a maximum size of 840mm x 590mm but preferably to Australian
Standard Sizes). The plan should show the property boundaries,
land ownership, the high and low banks, the low flow channel, the
gravel and sand deposits, vegetation, eroding banks or slopes,
major snags in the stream, direction of stream flow, highest
known flood height and date, pumps and their intake pools (all
pumps within 1km - upstream and downstream - must be indicated),
buildings and any relevant features. The location of samples
used for grading analysis as well as sedimentation ponds,
stockpile site, processing plant, access tracks and causeways
should also be given.

Cross-section (scale 1:100 vertical and 1:500
horizontal) must be given at 50 metre spacing.

2. RICHNESS OF DEPOSIT: A geological log (for the vertical
distribution) covering at least 1 metre below water level should
be provided to give the sizes of material at different depths as
well as a graph of particle size distribution.
3. METHOD OF OPERATION: Please supply as accurately as possible the
proposed yearly volume of extraction. The type of machinery to be
used and the period over which the excavation will take place will
have to be provided. The E.I.S. should adequately describe the
programme of operations.

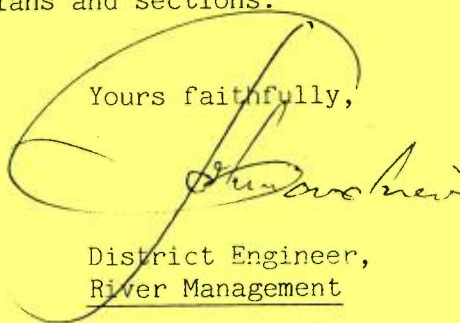
4. IMPACT ON RIVER: Information on the present state of the river banks and bed is required. The E.I.S. should consider whether the excavation will
- i) cause bed degradation or aggradation
 - ii) affect river bank stability and cause erosion
 - iii) initiate channel change during floods
 - iv) influence the continuity of bed load transport through the river system.

It would be desirable to have an assessment of sediment transportation rate in the Goulburn River as well as a balance of Extraction - Transportation for the river system. It is pointed out that the objective should be to find out whether or not transportation rate exceeds extraction rate for all extractors on this particular river.

5. RESTORATION: The E.I.S. should describe in detail a practical restoration programme.

This Office would be pleased to receive two copies of the E.I.S. together with relevant plans and sections.

Yours faithfully,



District Engineer,
River Management



State Pollution Control Commission



Mr G V Boardman
Palmer, Bruyn & Walpole
PO Box 404
MUSWELLBROOK NSW 2333 62

New South Wales
Government Offices
117 Bull Street
Newcastle 488G
P.O. Box 5 2300
Newcastle West 2302

Our reference: 271230:CC:LW

Your reference: S3087

Telephone: (049) 26 9711
Telex: AA 28110

20 NOV 1984

Dear Mr Boardman

Proposed River Sand and Gravel Extraction
Operation at Sandy Hollow by Mr H Ray.

We refer to your letter dated 7th November 1984 seeking identification of our requirements on the above proposal.

Without more specific information on the project our comments can only be of a general nature. We would expect that, in due course, Muswellbrook Shire Council would request our comments on the completed Environmental Impact Statement (E.I.S). Our interests lie in the following:-

Air Pollution

You should identify the potential sources of dust from the operation and propose methods for it to be controlled. Particular areas of concern are material handling generally, crushing and screening operations as well as unsealed roads and manoeuvring areas subject to truck and plant movement.

If the material is crushed and/on screened, the premises will be scheduled under the Clean Air Act and dust control is our responsibility. Under these circumstances the installation will require our prior approval and must be licenced to operate. If the activity involves extraction and removal only, dust control will be the responsibility of the council.

Water Pollution

If the process involves the use of water for screening and removal of organic material, settling ponds should be installed and the water recirculated. The latter point is important as we would be most reluctant to approve of any dry weather, surface discharge to the Goulburn River.

The nature and location of the site will dictate the need and scope for erosion and sedimentation control works. Stormwater must be diverted around disturbed and working areas and drains maintained throughout the life of the operation.

If applicable, the treatment and disposal of contaminated water from fuel storages, workshop and sewage treatment or vehicle washing facilities will also need to be addressed in the E.I.S.

Settling ponds, contaminated water control works and erosion control facilities may require our prior approval under the Clean Waters Act. A decision in this regard can only be made after consideration of specific information contained in the E.I.S.

Noise Pollution

The premises will be "scheduled" under the Noise Control Act and your client must obtain our approval before any plant is installed or excavation commenced.

The E.I.S should identify all potential individual noise sources and describe the effect of noise emitted on adjoining residents. This, in turn, will determine the need and extent to which the proponent will have to implement noise control techniques.

Noise (as well as dust) caused by haul trucks on the access roads will need to be addressed in the E.I.S. The effect on residents will be a matter for assessment by the Council as part of development approval.

.../3

To minimise the adverse impact of noise it is likely a minimum requirement of approving authorities would be to limit operating hours to, perhaps, 8.00 am to 6.00 pm on week days only and not public holidays. If there is a perceived need to work outside these hours, supporting argument should be made in the E.I.S.

Rehabilitation

This is a matter for other instrumentalities, particularly Council and Water Resources Commission and with possible involvement of the Soil Conservation Service. Nevertheless, we are anxious to see that rehabilitation is adequate and progressive so as to minimise dust generation in the river. Specific details for on-going rehabilitation and final abandonment of the site should be contained in the E.I.S.

If you have any enquiries on any of the above matters, particularly in respect of the statutory approvals required by the Commission, please do not hesitate to contact Mr C Charters at this office.

Yours faithfully



B.M. Gibbs
Regional Co-ordinator
Newcastle
for Secretary



National Parks and Wildlife Service



CENTRAL REGION

Lee Nash House
7 Charles Street
Parramatta

P.O. Box 95
Parramatta, 2150

Our reference: CR/1177 DB:JI

Your reference:

Telephone: 633 0576

Mr. Gordon Boardman,
Palmer, Bruyn and Walpole,
20 Watt Street,
NEWCASTLE. N.S.W. 2300

Dear Mr. Boardman,

PROPOSED SAND AND GRAVEL EXTRACTION, GOULBURN RIVER NEAR SANDY HOLLOW

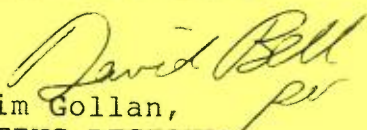
The Service's Central Region has recently received a report from the Upper Hunter District concerning an investigation of the abovementioned development proposal. This investigation resulted in the location of one surface scatter of stone artefacts.

Because of the presence of this site, the Service considers that further investigation of the site by a qualified archaeological consultant is warranted. Such an investigation would not require a survey of the entire development area since this has already been carried out, but would rather involve more detailed recording and assessment of the surface scatter located during the first survey. Such recording and assessment will be required before an application for Consent to Destroy the site can be considered by the Service.

A register of qualified archaeologists may be obtained by writing to the Australian Association of Consulting Archaeologists Inc., P.O. Box 214, Holme Building, University of Sydney, 2006. The President of the Association is Dr. Helen Brayshaw (Phone: 819 7962).

Please do not hesitate to contact me on 633 0576 should you have any queries. I look forward to receiving a copy of your consultant's report.

Yours faithfully,


Klim Gollan,
ACTING REGIONAL
ARCHAEOLOGIST/HISTORIAN,
CENTRAL REGION.

22nd April, 1985.



Soil Conservation Service

P.O. Box 249, MUSWELLBROOK NSW 2333



Palmer, Bruyn & Walpole,
P.O. Box 404,
MUSWELLBROOK NSW 2333

Our reference: D.D. 30

Your reference:

(065)

Telephone: 431735

Dear Sir,

PROPOSED RIVER SAND AND GRAVEL EXTRACTION - ADJACENT TO GOULBURN RIVER AT SANDY HOLLOW - Your letter Ref: S3087 of 7/11/84.

The proposed site was inspected on December, 5, Without knowing the proposed final contours and profile of the extracted area, particularly in relation to the eastern river bank, I can only make general comments. There would appear to be no great rehabilitation problems providing runoff water from the eastern river bank, into the final void, be controlled, or erosion of that bank could occur. The following rehabilitation recommendations are given for your information:-

1. that grass/legume species to be sown on all disturbed areas be those recommended by the Soil Conservation Service;
2. that fertilizer types and rates to be applied with the grasses and legumes mentioned in 1. be as specified by the Soil Conservation Service;
3. the surface 20-30cm of material (at present having a variable herbage cover) should be removed and stockpiled. This material contains large quantities of seed and should therefore progressively respread after final reshaping. The area should then be sown and fertilized as per 1. and 2. above.

The Water Resources Commission is aware of the general rehabilitation methods and standards of the Soil Conservation Service, in relation to extraction of river sand and gravel beds. The applicants should therefore liaise with the Water Resources Commission as works proceed.

Should specific advice be required on rehabilitation procedures this office will be pleased to assist.

Yours faithfully,

P. J. Dwyer
P. J. DWYER
District Soil Conservation
Muswellbrook. -ist.

17/12/84

APPENDIX C

INVESTIGATION OF AN ABORIGINAL ARCHAEOLOGICAL SITE
AT SANDY HOLLOW, GOULBURN VALLEY, NSW

A Report
to

PALMER, BRUYN & WALPOLE
CONSULTING SURVEYORS

By

DENIS BYRNE

June 1985

CONTENTS

THE DEVELOPMENT	2
SCOPE OF THE PRESENT STUDY	2
ENVIRONMENTAL BACKGROUND	2
ARCHAEOLOGICAL BACKGROUND	3
SITE INVESTIGATION	6
SALVAGE	7
ARCHAEOLOGICAL CONTEXT	7
MANAGEMENT RECOMMENDATIONS	8
ABORIGINAL VIEWPOINT	9
APPENDIX 1: ASSEMBLAGE ANALYSIS	10
APPENDIX 2: PHOTOGRAPHS	20
REFERENCES	25

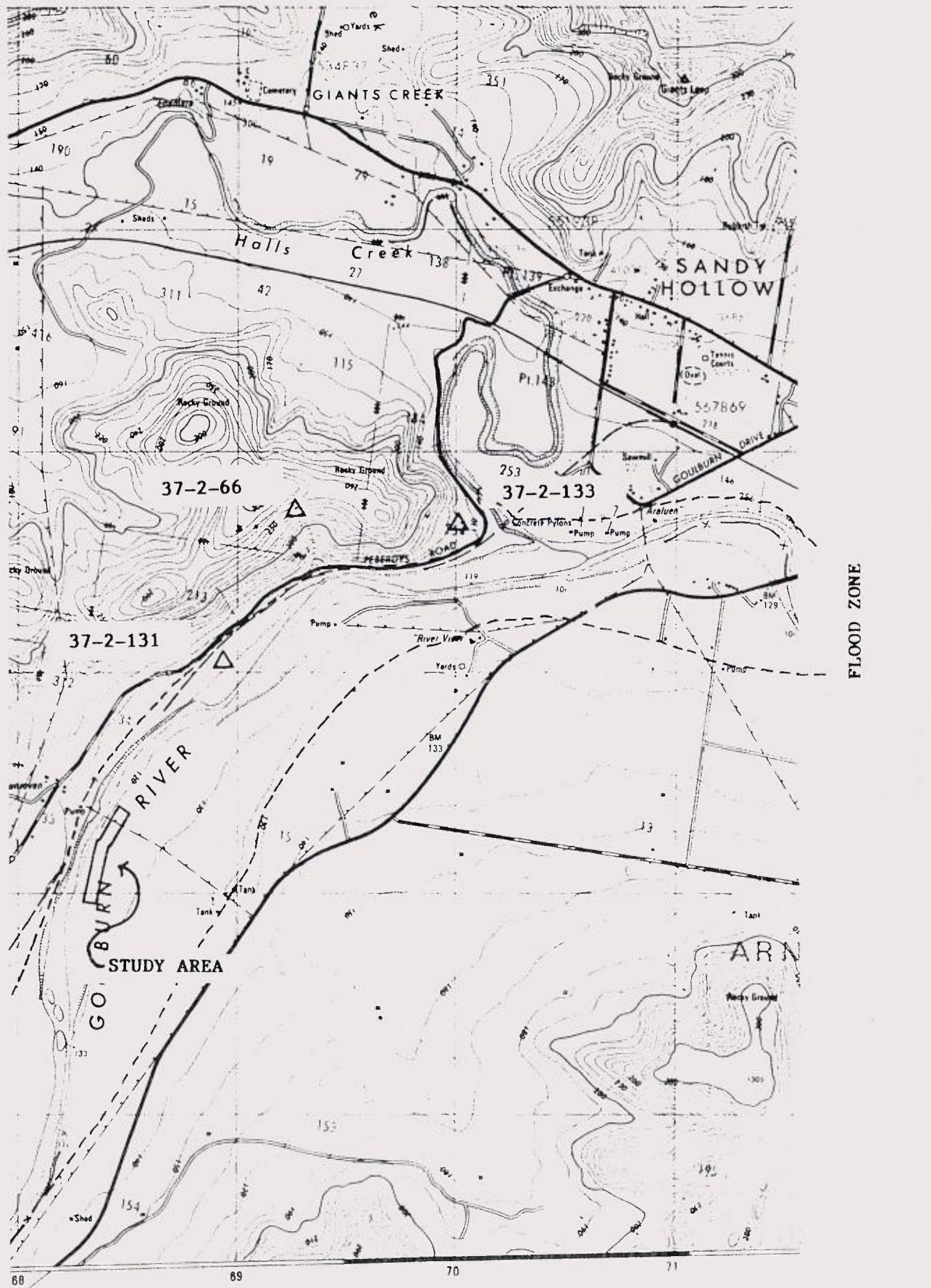


Figure 1: The Study Area and nearby sites.
(Sandy Hollow 1:25,000 Topo.)



THE DEVELOPMENT

Palmer, Bruyn, and Walpole, Consulting Surveyors, are preparing an Environmental Impact Statement on a proposed sand and gravel quarrying operation on a section of the south terrace of the Goulburn River at Sandy Hollow, west of Muswellbrook in the Upper Hunter area.

The development proposal covers a rectangular area c.600 x 250m, taking in the old river terrace from the bank of the present river bed south to a bank belonging to a former bed of the river (see Figure 2).

SCOPE OF THE PRESENT STUDY

A preliminary survey of the development area was undertaken by Glen Morris, Aboriginal Sites Officer, National Parks and Wildlife Service (NSW), in April 1985. He reported the presence of flaked-stone artefacts, including flakes and cores, on the surface of the old terrace. In view of the absence of early (i.e., Pleistocene or Early Holocene) sites in the Hunter Valley and the possibility that the material observed by Morris might belong to such an early site part, of an *in situ* site in an old river terrace, the NPWS Regional Archaeologist recommended that a more detailed investigation of the site be undertaken by an archaeologist.

The present study was designed to clarify a number of points: the nature of the stone artefact assemblage, the archaeological context of the assemblage, and the context of the site within the regional prehistory of the Hunter.

ENVIRONMENTAL BACKGROUND

The site is situated 9km west of the junction of the Goulburn River with the Hunter. The Goulburn River, at Sandy Hollow, is

flanked to the south by a band of the Singleton Coal Measures, the coal seams occurring in a context of sandstone, shale, mudstone, and conglomerate. On the south side of the river, in the vicinity of the site, is an exposure of the Narrabeen Group of sedimentary rocks (sandstone, conglomerate, claystone, and shale) which overlies the Singleton Coal Measures.

Opposite the site and within 500 metres of the north side of the river the ground rises sharply to a ridge 360 metres above sea level. The meandering bed of the river has been moving in this direction. On the south side of the river the flats are more extensive, stretching some two kilometres to the nearest ridge. These ridges, on either side of the river, are part of a plateau which has been deeply incised by the Goulburn River.

The history of the river bed in the area of the site is discussed later in this Report.

ARCHAEOLOGICAL BACKGROUND

The Hunter Valley has been subject to more archaeological investigations in the last decade than any other area of the State with the exception of Sydney. These investigations have almost all been undertaken in the context of Environmental Impact Statements. Mostly they have consisted of surveys to locate sites on the ground. Culminating in a major project by ANUTECH Archaeological Consultancies, they have provided a basis for modelling prehistoric settlement patterns and for predicting site distribution.

I will refer here to only a single, though major, survey, that of Saltwater Creek/Mt Arthur North and South (Koettig and Hughes 1985). A total of 316 sites were recorded in these three areas. All but three of three of the sites were in the 'open' category, consisting of scatters of flaked-stone artefacts, sometimes accompanied by archaeological deposits. The exceptions were axe-grinding groove sites. There was a clear tendency for sites to be located close to

watercourses (Saddlers Creek, White Creek, Saltwater Creek, and their tributaries). Also, the density of sites tended to increase in the lower reaches of the creek systems - i.e., with increasing proximity to the Hunter River.

A feature of the open sites recorded in the above and earlier surveys (e.g., Hughes 1982), was the fact that they occurred in the A horizon of a texture-contrast soil sequence. Hughes has argued the the coarse-textured A horizon soils are sedimentary in origin and are likely to have accumulated within the last 5,000 years. The dating was inferred from the presence of 'small tool' artefacts at the sites, artefacts which elsewhere in Australia have been found to date within this timespan. The weathered nature of the B horizon forms a contrast with the overlying sediments and is considered by Hughes to be Pleistocene in age. All the open sites recorded were found to be either within the A horizon soils or to be resting on the surface of the B horizon. It would appear, then, that these sites, together with all Hunter Valley sites for which there are absolute dates, are Holocene in age.

Elsewhere in the region surveys have located a wider variety of sites including rockshelters featuring art and/or occupation deposits. Haglund's (1981) survey in the Central Goulburn Valley may serve as an example.

Turning to the area of the present investigation, the salient feature, by way of background, is the rockshelter site Sandy Hollow #1 (37-2-66), excavated by David Moore in the 1960's (Moore 1970: 35-37). The site, situated 330 metres north of the Goulburn River and 800 metres west of Halls Creek, was dated to 1,300 years ago. It contained a microlithic assemblage featuring Bondi points together with miscellaneous backed blades. Among the fauna represented were kangaroo, wallaby, and possum. Of particular interest for the present investigation was Moore's

conclusion that the bed of the Goulburn River was the source of raw material for the site's assemblage (ibid.: 35).

Also of obvious relevance to the present investigation are Moore's test excavations on the '200 foot terrace' of the Hunter River south of Singleton. Moore was following up earlier reports of the presence of flaked-stone artefacts in the terrace. No dates were obtained from the series of test squares which Moore excavated but it was established that artefacts were present in the body of the terrace and he was inclined to believe that their presence there, in what appeared to him to be an unsuitable campsite location, was directly related to the availability of 'chert' and 'quartzite' cobbles as raw material for artefacts (ibid: 40-41). The 'chert' and 'quartzite' rock classifications, in common use among archaeologists at the time, were later to be reallocated as indurated mudstone and silcrete respectively (see Koettig and Hughes 1985: 8).

In 1984 Hughes and Lance (1984) reported on a flaked-stone assemblage located on a gravel terrace on the north side of the Hunter River at Rosepark, between Denman and Jerry's Plains (NPWS Site No. 37-2-287). An examination of early survey records revealed a considerable migration of the river bed in recent times and indicated to the authors that the present gravel terrace belonged to the period after European settlement. The artefact assemblage was considered not to be *in situ* but, rather, to have been transported from some distance upstream. The artefacts were all found to be waterworn. The artefacts and their context within the terrace both appear to be highly comparable to the situation at the Sandy Hollow site.

Finally, reference is made to two sites in the Sandy Hollow area recorded in 1981 by Wayne Cook, Aboriginal Sites Officer of the National Parks and Wildlife Service (NSW). One of these, an open site is on the opposite side of the river and close to Halls Creek (NPWS 37-2-133 - see Figure 1). A scatter of 'red and yellow

chert flakes' were found, a description suggesting they may in fact be indurated mudstone. The other site, one kilometre further upstream, consists of an occupation deposit in a shelter within a minor outcrop of sandstone conglomerate (NPWS 37-2-131). Again, 'flakes of chert' are mentioned in the site record, but there was also shell and charcoal visible at the surface.

In summary, large numbers of Holocene Aboriginal occupation sites have been recorded in the Hunter region. Indurated mudstone is an important component of flaked-stone assemblages at these sites and there are two river terrace sites (Moore 1970: 40-41; Hughes & Lance 1984), previous to that at Sandy Hollow, where this stone appears to have been obtained in the form of rolled cobbles.

SITE INVESTIGATION

The site investigation consisted of recording the extent and context of the artefact scatter and of salvaging the artefacts themselves. The artefacts were found to be present over most of the length of the terrace covered by the development proposal (Figure 2). They were, however, concentrated between survey pegs #1 and #11, a distance of some 450 metres (see Figure 3). The artefact scatter was observable, with some variation, from the edge of the terrace which fronts the present river bed, west for about 80 metres towards the peg-line. The artefact scatter thus extended over about 36,000m² of the terrace.

The artefact scatter seemed to coincide with the area of least ground-cover vegetation. Vegetation on the gravel terrace consisted exclusively of grasses and weeds serving as pasture for stock. Ground-cover vegetation and, hence, surface visibility, varied from 0 - 100%. It follows that the artefact scatter recorded was simply the 'visible' portion of a scatter of unknown but almost certainly larger extent.

The context of the artefacts within the alluvial terrace deposit is discussed later. Suffice to say that deflation is likely to have caused some vertical concentration of artefacts on the present terrace surface. Also, it is likely, but has not been demonstrated, that similar artefacts are present through the body of the terrace which, at this point, is some two metres high.

The artefacts themselves were exclusively of indurated mudstone, yellowish-brown in colour and more or less waterworn. The results of the artefact analysis are presented in Appendix 1 of this Report.

SALVAGE

A salvage collection of the artefact assemblage was carried out. The rationale for the salvage collection is given under Management Recommendations below.

Since the artefacts were waterworn they had clearly travelled from some distance upstream. On the present site they were thus in a secondary context and their distribution pattern within the site had no significance at a cultural or behavioural level. For this reason there was nothing to be gained by employing rigorous spatial controls during collection of the artefacts.

The collection units used consisted of a series of rectangles which were created by projecting perpendicular lines from each survey peg along the peg-line towards the river-edge of the terrace (see Figure 3).

ARCHAEOLOGICAL CONTEXT

Two matters are addressed here: the origin of the terrace and the origin of the artefacts.

The gravel terrace is well within the Goulburn flood zone (see Figure 1) and the site would thus periodically be under water. An early survey plan dated 1835 shows the south bank of the river to be some 150 metres east of its present position (see Figure 2). The major portion of the present terrace, and the entire area of the present site, must at this time have been within the river bed. However, since that time the river has moved its bed progressively westward and the gravel terrace, like that at Rose Park (Hughes & Lance 1984), has presumably accumulated in this later period. In this case the terrace would be a post-European feature.

The artefacts themselves are clearly not *in situ* (see elsewhere - this Report). To test for a possible *in situ* deposit or artefact horizon in the body of the terrace a test pit was dug into the bank of the terrace adjacent to the present river bed (see Figure 2). The pit was dug to a depth of 150cm through the loosely-packed coarse-grained sand of the terrace. No stratigraphic archaeological features were encountered nor were any artefacts exposed in the section of the pit. The absence of artefacts was not surprising given their very low density on the surface - $1:562\text{m}^2$.

On the surface of the terrace the artefacts were mixed with a variety of pebbles and cobbles. An analysis of the gravel composition was not available but it is assumed to include sandstone conglomerate, shale, claystone, as well as indurated mudstone. The mudstone on the site accounted for the largest cobbles. Only a fraction of the mudstone pebbles and cobbles were artefactual.

MANAGEMENT RECOMMENDATIONS

The management of the archaeological value of the site is no longer an issue since the artefact assemblage, at least from the surface,

has been salvaged. The artefacts, given the fact that they were not **in situ**, were not deemed to be a sufficient basis for opposing or altering the proposed development. They were, however, deemed to be of interest in their own right, as a collection, and to be worth salvaging. In the case of this site it was the artefacts themselves rather than the site which were significant.

The artefacts will be lodged, as a collection, with the Australian Museum, Sydney.

While further artefacts are almost certainly contained within the body of the terrace it is unrealistic to suggest that they be recorded or collected during the quarrying operation, particularly given their low-density. The site itself seems likely to extend north and south along the terrace beyond the limits of the Study/Impact Area. Also, it can be expected that similar such artefact scatters will be located on other gravel terraces of the Goulburn.

ABORIGINAL VIEWPOINT

Aboriginal consultation regarding this site was carried out prior to the present investigation by Glen Morris, Aboriginal Sites Officer, National Parks & Wildlife Service (NSW), Upper Hunter District. In his Report to the Regional Archaeologist Morris concludes:

The site is of low contemporary significance to the Wonaruah Local Lands Council. The Local Lands Council do not wish to collect the artefacts, and they do not object to the proposed development. The area of land in question is not subjected to any land rights claim.

8

P.M. 60597

PART 19

HIGH

POWER POLE

BANK

18

BY

ORIGINAL

PORTION

15

DATED

1865

74° 45' 26"

256'

C.S. N° 1

C.S. N° 2

C.S. N° 3

C.S. N° 4

C.S. N° 5

C.S. N° 6

C.S. N° 7

C.S. N° 8

C.S. N° 9

C.S. N° 10

C.S. N° 11

C.S. N° 12

C.S. N° 13

2

3

4

5

6

7

8

9

10

11

12

B.M. ON OAK
R.L. 72341
OF

BANK

FROM

PORTION

15

PLAN

DATED

1875

74° 45' 26"

146' 6"

205'

128' 57"

50'

POWER POLE

Scale 1:2000

Datum

FEBRUARY

APPENDIX 1: ASSEMBLAGE ANALYSIS

ASSEMBLAGE ANALYSIS

Three categories of artefact were recognized: flakes, cores, and flaked-pieces. A flake is a piece of stone struck off a core. It carries a positive flake scar on the ventral surface corresponding to a negative scar on the core from which it was struck. A core has one or more negative flake scars but no positive scars. A core is thus a unit of raw material for the manufacture of flakes. Flaked-pieces are pieces of stone which have signs of percussion flaking on them but which cannot be classified as flakes or cores.

The artefacts were measured and grouped into size-classes according to their longest single dimension. An estimate of the percentage of the artefact's surface covered by cortex was also made. The cortex is the original surface of the rock before it was flaked. Because this surface is necessarily older than the flaked surface it may be distinguished by colour difference due to patination (with the mudstone the older surfaces were darker) or by the texture of the surface, the flaked surfaces tending to be smoother and to be shaped in particular ways as a result of the flaking process.

FLAKES

The flakes were characteristically large. Sixty-seven percent were between 4 and 8 centimetres long. Twenty-one percent were larger than 8 centimetres. Eighteen flakes (53%) were 'retouched', i.e., flakes had been knocked off the flake after the flake had been knocked off the core. These retouch-flakes may have been purposefully removed in order to resharpen or reshape the cutting edge or they may have been removed incidentally in the course of artefact use. There is also the possibility, especially strong in an assemblage such as the present, that the retouch-flakes could result from damage to the artefacts' edges by natural phenomena subsequent to their being discarded by Aborigines. The 'rolling' of artefacts down a river bed might certainly be expected to result in such damage.

Eight flakes were retouched on the distal edge, 15 on the lateral edges. The length of the retouch flake scars ranged from 0.2cm to 1.4cm with a mean of 0.5cm. They are thus quite small and this might support the view that many of them represent damage by non-cultural processes.

A surprising discovery was that all 34 flakes had some cortex. In terms of core-reduction this suggested the flakes were among the first knocked off the raw cores. The seven flakes which have cortex on 40-60% of their surface were certainly the first flakes taken off the surface of raw cores since the 40-60% accounts for all or most of their dorsal surfaces. A number of these latter flakes showed the square/block-like characteristics on their dorsal surfaces which are typical of many of the cores (see below).

CORES

Seventy percent of the cores are between eight and sixteen centimetres in their longest dimension. These, and the two cores which are larger still, are quite large units of raw material. A count of the negative flake scars on each core produced a mean of five scars per core within a range of 4-10 scars. Only scars longer than 0.5cm were counted. Scars smaller than this may have related to non-cultural damage. Ten of the 13 cores exhibited these small scars.

All 13 cores had cortex over part of their surface. On five of them the cortex covered between 40% and 80% of the surface. These were thus raw cobbles, substantial parts of the surfaces of which had not been flaked.

A number of the cores had a characteristically 'squared', block-like original form, discernible on the unflaked surface.

The mean number of platforms per core was three, within a range of one

to five.

FLAKED PIECES

The flaked pieces were more within the size range of the flakes rather than the cores. Thirty-five percent were larger than eight centimetres but none were larger than 12 centimetres. Nine had 'retouch' flake scars. The proportion of surface covered by cortex was more in line with the flakes than the cores.

CONCLUSIONS

The main proposition regarding the behavioural origins of the assemblage is that it represents the procurement stage of the 'flow' of stone tool elements through Aboriginal culture. In other words, people went to the river bed or terraces to procure mudstone for use as flaked-stone artefacts. There are a number of features of the present assemblage which bear upon this proposition.

The first is the high incidence of cortex on the surface of the artefacts. This is an obvious indicator that the material had not been greatly reduced (in the context of a reduction sequence) and that it represents debitage from the procurement and manufacturing stages or items discarded at these stages. Similarly the large size of the material is an indicator of 'proximity' to the early stages of the 'flow' process. In the present case, however, it was necessary to weight this against the possibility that, in being moved downstream, the artefacts have been 'sorted' according to size, the small items being carried further than the larger.

A comparison with other Hunter Valley assemblages may be useful here. Ninety-nine percent of flakes and flaked pieces from Koettig's (1985) surface assemblage from Saltwater Creek #24 were under five centimetres. This figure is for indurated mudstone artefacts only. Ninety-eight percent of indurated mudstone artefacts (excluding cores) at her Saltwater Creek #52 site were less than five centimetres in size

(Koettig *ibid.*). Similarly the great majority of indurated mudstone flakes in the assemblages from Redbank Creek #5, #12, and #13, were smaller than 2.5cm (Hiscock 1984). Both these site groups may be classed as occupation sites and both are at a distance from the Hunter River bed, the main source of raw material.

Hiscock's figures for the incidence of cortex on the Redbank Creek artefacts also stand in contrast to those for the present Sandy Hollow assemblage. Only 35 of the 42 flakes at Redbank Creek #13 exhibited cortex and, of these, on 28 the extent of cortex coverage was less than 25% (Hiscock *ibid.*).

On viewing the artefacts on the site it was noticed that a number of the flake scars were quite fresh. This was in marked contrast to the waterworn flaked surfaces elsewhere on the artefacts. It was assumed that the 'fresh' scars were the result of damage to the artefacts' edges in the time since they had been lying on the present site, due to stock and/or vehicle traffic. During analysis, ever, there was seen to be wide variation in the degree of waterwear on the artefacts. Instead of a simple dichotomy between old waterworn flaked surfaces and fresh, unworn flake scars, there were often found to be clear differences in the amount of 'wear' which different flaked surfaces on the same artefacts had undergone. It appeared, in certain cases, that waterworn flaked surfaces on cores had been subject to a second and later flaking event and then the freshly flaked surfaces had themselves been waterworn, but in such a way that the two 'events' remained distinct by virtue of the amount of wear each had undergone. The following seemed a likely scenario: a raw mudstone cobble had been flaked and then discarded on the river bed or terrace, it had then been 'rolled' downstream for some distance only to be picked up, flaked, and discarded again. The same cobble could thus be subject to numerous geographically separate flaking events as it move downstream and, by the same token, at any one point along the river might be found some unflaked cobbles, some

which had been flaked at the present point, some which had been flaked at this point in addition to having been flaked previously at points upstream, and so on.

The presence of flakes in the Sandy Hollow assemblage which had dorsal surfaces which had been obviously more waterworn than either the edges of the flakes or their ventral surfaces tends to fit with the above scenario.

The analysis undertaken for this report cannot be taken as exhaustive. A small number of attributes were looked at and the data on these have generated the comments above. It needs to be noted, also, that the waterworn nature of the artefacts has 'blurred' the characteristic features measured in the analysis - e.g., striking platforms, the boundary of retouch scars. Such measurements are consequently approximations.

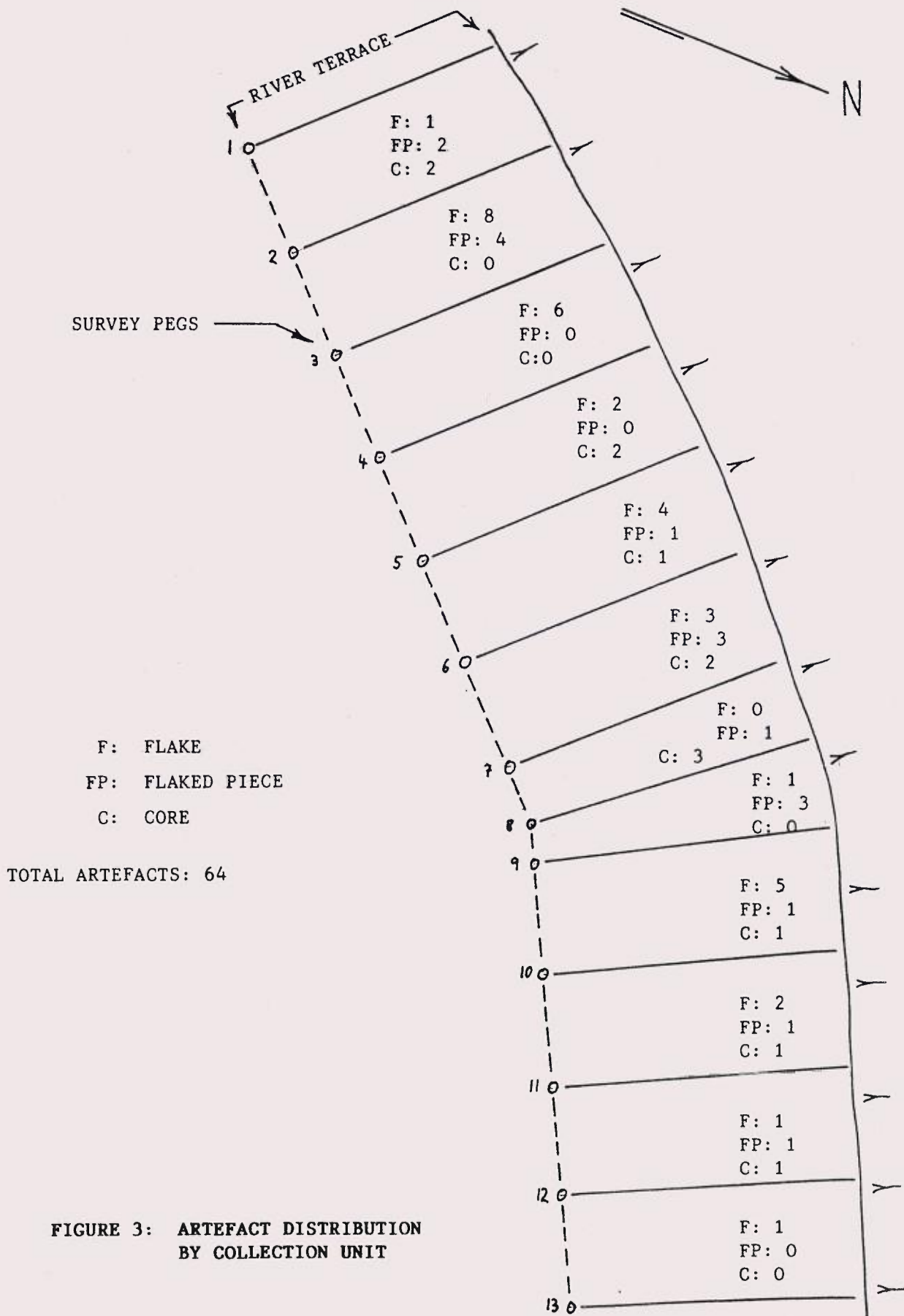


FIGURE 3: ARTEFACT DISTRIBUTION BY COLLECTION UNIT

SIZE

The tables below give the distribution of artefacts according to the size classes used in the analysis.

FLAKES	0-2	2-4	4-6	6-8	8-10	10-12cm
No.	-	4	11	12	5	2
%	-	12	32	35	15	6

Total: 34

FLAKED PIECES	0-2	2-4	4-6	6-8	8-10	10-11cm
No.	-	2	3	6	3	3
%	-	12	18	35	18	18

Total: 17

CORES	0-4	4-8	8-12	12-16	16-20	20-24cm
No.	-	2	5	4	1	1
%	-	15	38	31	8	8

Total: 13

CORTEX

The tables below give the amount of cortex on the surface of the artefacts. The percentage classes indicate the proportion of surface covered by cortex. A question mark indicates those artefacts on which it was impossible to cortex from flaked surfaces. On the other artefacts cortex was identified on the basis of colour and texture.

FLAKES	?	0-20	20-40	40-60	60-80%
No.	3	11	13	7	
%	9	32	38	21	

Total: 34

FLAKED PIECES	?	0-20	20-40	40-60	60-80%
No.	3	4	3	3	4
%	18	24	18	18	24

Total: 17

CORES	?	0-20	20-40	40-60	60-80%
No.	-	3	5	2	3
%	-	23	38	15	23

Total: 13

RETOUCH/UTILIZATION

The table below gives the incidence of retouch/utilization on flakes. The location (distal or lateral) is given together with the number of retouched edges.

FLAKES	Distal	Lateral	1	2	3 (edges)
No.	8	15	8	9	1
Total: 18					

APPENDIX 2: PHOTOGRAPHS



View south along the site showing survey peg line.



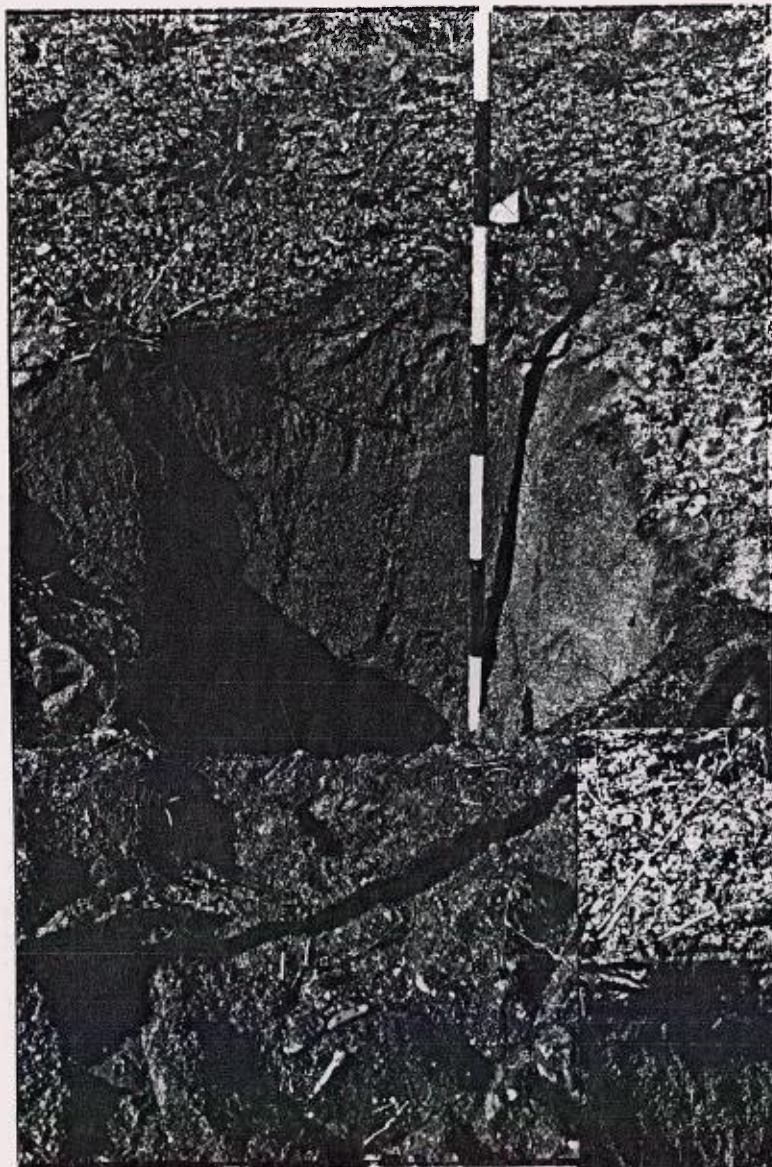
View south along the edge of the gravel terrace with the river bed to the right. Ranging pole marks the top of the terrace.



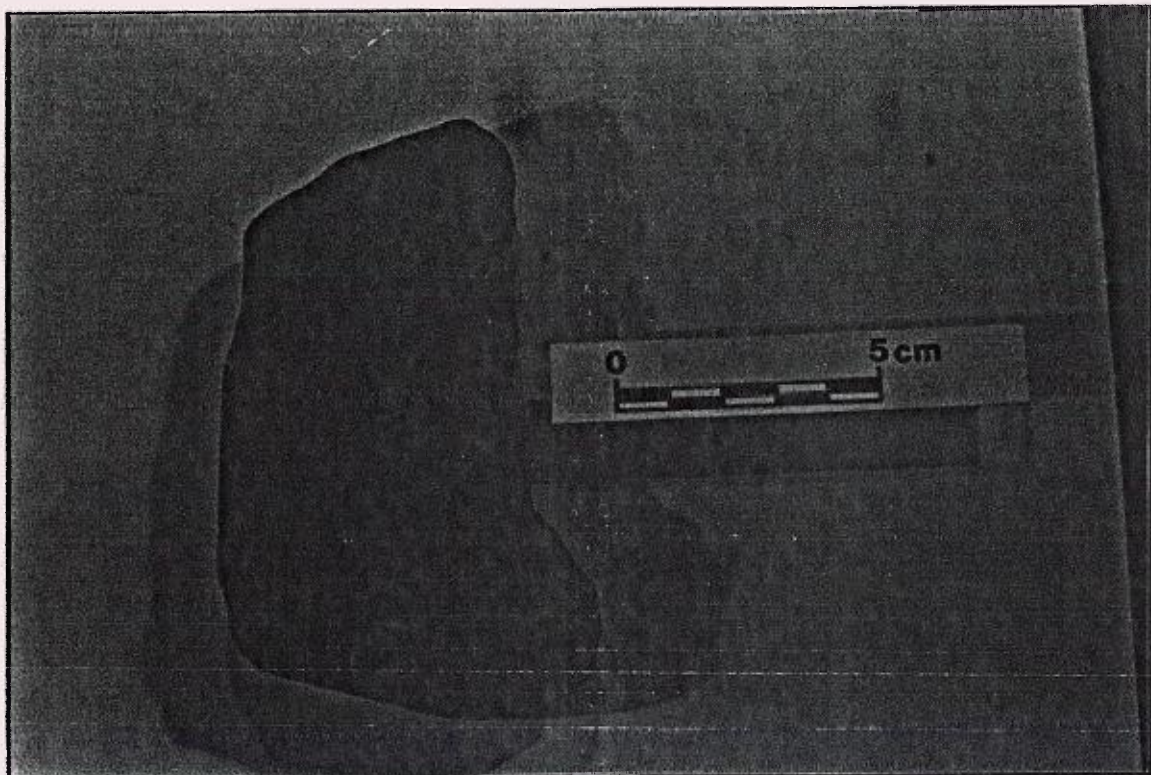
Silicified mudstone artefacts on the surface of the gravel terrace.



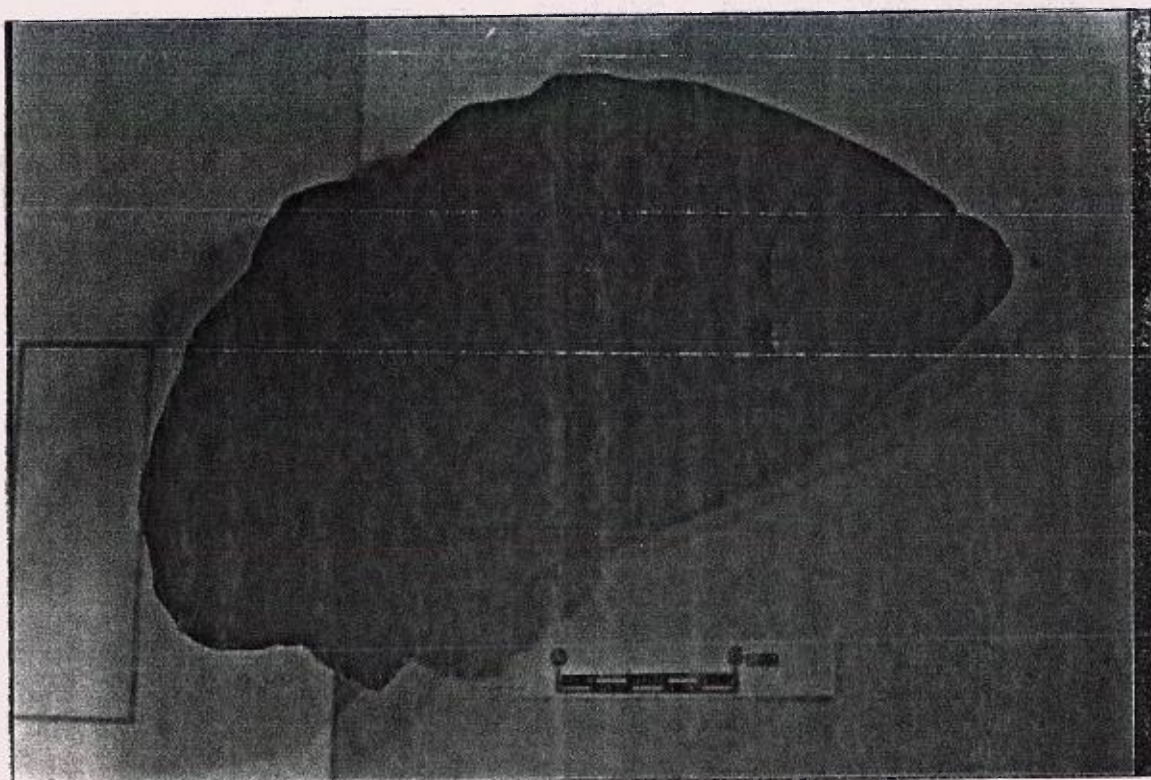
Silicified mudstone cobble at the site disintegrating from natural
These fracture surfaces can be distinguished from percussion-flaked
surfaces.



Test pit at western edge of terrace



Indurated mudstone core



Indurated mudstone core

REFERENCES

- Haglund, L. 1981 Archaeological survey and sampling at the site of the Ulan Coal Mine, Ulan, NSW. Report to Longworth & McKenzie Pty Ltd.
- Hiscock, P. 1984 An analysis of the prehistoric stoneworking technology represented at Sites 5, 12, and 13 at Redbank Creek, United Collieries Lease, Hunter Valley, NSW. Report to United Collieries Pty Ltd.
- Hughes, P. 1982 A preliminary report on archaeological survey and salvage work in the Saltwater Creek/Plashett Dam site area, Hunter Valley, NSW. Report to the Electricity Commission of NSW.
- Hughes, P. & A. Lance 1984 An investigation of an archaeological site at 'Rose Park' via Denman, Hunter Valley, NSW. Report to R.J. Cross.
- Koettig, M. 1985 Report on survey and excavation programme in the Saltwater, Saddlers, Whites Creeks area, Hunter Valley. Forthcoming.
- Moore, D. 1970 Results of an archaeological survey of the Hunter River Valley, New South Wales, Australia. **Records of the Australian Museum** 28(2): 25-64.

APPENDIX D

Material Analysis for the
Geological Log of
Vertical Distribution
of Sand and Gravel

Hunter Engineering Testing Services

RECORD OF BOREHOLE

CLIENT Harold Ray JOB NO. 85.0004 HOLE NO. 1 GS RL 121.6
 PROJECT Proposed Sand & Gravel Deposits
 LOCATION Riverview Estate - Castle Rock NSW DATE 1.3.85

PENETRATION RESISTANCE	DEPTH OF STRATA CHANGE (m)	CLASSIFICATION AUSTRALIAN STANDARD 1726 - 1981	SAMPLE & FIELD TESTING		
			DEPTH (m)	TYPE	FIELD TEST RESULTS
	0-1.2	Gravelly Sand - Well graded, fine to coarse gr., angular, light brown. Gravel is fine to coarse gr., Sub-angular to Sub-rounded, dark grey.			
	1.2-2.5	Sand - poorly graded, fine to med. gr., light brown.			
	2.5-4.5	Gravelly Sand - as for 0-1.2m			

DRILL TYPE Backhoe DRILLER: _____ WATER NOTED 3.2m
 DATE 22.2.85 REPORT CHECKED BY S.L. STEADY LEVEL _____

SRE 59

VS -- Vane Shear (Cohesion - kPa)
 U 50 -- Undisturbed 50 mm diam. tube sample.
 D -- Disturbed Sample
 SPT -- Standard Penetration Test - N. Value is number of blows per 150 mm
 DC -- Dynamic Cone Penetrometer. Number of blows per 150 mm
 P -- Hand penetrometer estimate of shear strength. kPa.

HUNTER ENGINEERING TESTING SERVICES

OFFICE
82 Bridge St
Muswellbrook
Phone (065) 43 3600
P.O. Box No 295,
Muswellbrook, 2333.

LABORATORY LOCATION
Bayswater Power Station Site
Phone: (065) 431074

QUALITY OF MATERIALS CERTIFICATE

CLIENT Harold Ray JOB No. 85.0004
 PROJECT Riverview Estate, Castle Rock NSW ORDER No.
 LOCATION Wybong Road DATE 22.2.85

NOTE: All testing carried out to Standard Test Procedures.
Sample Identification: Hole No. 1

Particle Size Distribution Sieve Sizes (mm)	PERCENT PASSING		
	0-1.2m	1.2-2.5	2.5-4.5
53.00mm			
37.50mm			
26.50mm	100		100
19.00mm	81		82
13.20mm	77		77
9.50mm	72		74
6.70mm	67		70
4.75mm	63	100	66
2.36mm	50	96	51
1.18 mm	32	90	34
600 mic	12	75	22
425 mic	6	48	15
300 mic	3	18	7
150 mic	1	3	1
75 mic	1	2.5	0.5

Remarks: LEGEND: Bottom Course (B)
 Intermediate Course (I)
 Top Course (T)



This laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with the terms of registration. This document shall not be reproduced except in full without the prior approval of the laboratory

Authorised Signature

RECORD OF BOREHOLE

CLIENT Harold Ray JOB NO. 85.0004 HOLE NO. 2 GS RL 123.5
 PROJECT Proposed Sand & Gravel Deposits
 LOCATION Riverview Estate - Castle Rock NSW DATE 1.3.85

PENETRATION RESISTANCE	DEPTH OF STRATA CHANGE (m)	CLASSIFICATION AUSTRALIAN STANDARD 1726 - 1981	SAMPLE & FIELD TESTING		
			DEPTH (m)	TYPE	FIELD TEST RESULTS
	0-2.5m	Sand - Well graded, fine to med. gr. brown.			
DRILL TYPE <u>Backhoe</u> DRILLER: _____			WATER NOTED <u>N/A</u>		
DATE <u>22.2.85</u> REPORT CHECKED BY <u>S.L.</u>			STEADY LEVEL _____		

SRE 59

VS - Vane Shear
(Cohesion - kPa)

- U 50 - Undisturbed 50 mm diam. tube sample
- D - Disturbed Sample
- SPT - Standard Penetration Test - N. Value is number of blows per 150 mm
- DC - Dynamic Cone Penetrometer. Number of blows per 150 mm
- P - Hand penetrometer estimate of shear strength, kPa.

RECORD OF BOREHOLE

CLIENT Harold Ray JOB NO. 85.0004 HOLE NO. 3 GS RL 122.7
 PROJECT Proposed Sand & Gravel Deposits
 LOCATION Riverview Estate - Castle Rock NSW DATE 1.3.85

PENETRATION RESISTANCE	DEPTH OF STRATA CHANGE (m)	CLASSIFICATION AUSTRALIAN STANDARD 1726 - 1981	SAMPLE & FIELD TESTING		
			DEPTH (m)	TYPE	FIELD TEST RESULTS
	0-1.0	Sand - Well graded, fine to coarse gr., light brown with 20% of predominantly coarse gravel.			
	1.0-1.1	Sand - Poorly graded, fine to med. gr., brown.			
	2.0-2.5	Sand - As above, with lenses & pockets of silty clay.			
	2.5-4.0	Sand - Poorly graded, fine to med. gr., brown.			

DRILL TYPE Backhoe DRILLER

DATE 22.2.85 REPORT CHECKED BY S.L.

WATER NOTED 4.0m
STEADY LEVEL 4.0m

VS — Vane Shear (Cohesion - kPa)
 U 50 — Undisturbed 50 mm diam. tube sample
 D — Disturbed Sample
 SPT — Standard Penetration Test - N. Value is number of blows per 150 mm
 DC — Dynamic Cone Penetrometer. Number of blows per 150 mm.
 P — Hand penetrometer estimate of shear strength, kPa.

HUNTER ENGINEERING TESTING SERVICES

OFFICE
82 Bridge St
Muswellbrook
Phone (065) 43 3600
P.O. Box No 295,
Muswellbrook, 2333.

LABORATORY LOCATION
Bayswater Power Station Site
Phone: (065) 431074

QUALITY OF MATERIALS CERTIFICATE

CLIENT Harold Ray JOB No. 85.0004
 PROJECT Riverview Estate, Castle Rock ORDER No.
 LOCATION Wybond Road DATE 22.2.85

NOTE: All testing carried out to Standard Test Procedures.
Sample Identification: Hole No. 3

Particle Size Distribution Sieve Sizes (mm)	PERCENT PASSING			
	0-1.0m	1.1-2.0	2-3.0m	3.0-4.5
53.00mm				
37.50mm				
28.50mm	100			
19.00mm	86			
13.20mm	84			
9.50mm	83			
6.70mm	82			
4.75mm	81			100
2.36mm	78	100	100	99
1.18 mm	70	99	98	94
600 mic	50	86	90	82
425 mic	33	61	79	71
300 mic	14	30	56	48
150 mic	1	5	3	5
75 mic	0.5	2.0	0.5	2.0

Remarks: LEGEND: Bottom Course (B)
 Intermediate Course (I)
 Top Course (T)



This laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with the terms of registration. This document shall not be reproduced except in full without the prior approval of the laboratory

Authorised Signature

RAY, M J

EIS
306

Extraction of river sand and gravel,
Goulburn River near Sandy Hollow

RAY, M J

EIS

306

Extraction of river sand and gravel,
Goulburn River near Sandy Hollow

Borrower's name	Date	Ext

