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Environmental study : basalt quarry, Bass Point, N.S.W. : a report to Pioneer Concrete (N.S.W.) Pty. Ltd.

ENVIRONMENTAL STUDY
BASALT QUARRY BASS POINT NSW

PIONEER

ENVIRONMENTAL STUDY

BASALT QUARRY, BASS POINT, N.S.W.

A Report to

PIONEER CONCRETE (N.S.W.) PTY. LTD.

D. J. Dwyer & Associates Pty. Ltd.
Consulting Engineers, Town Planners & Landscape Architects

December 1977

D. J. DWYER & ASSOCIATES PTY. LTD.

CONSULTING ENGINEERS, TOWN PLANNERS
AND LANDSCAPE ARCHITECTS

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YOUR REF:

OUR REF:

9th December, 1977.

The Manager,
Metropolitan Quarries Division,
Pioneer Concrete (N.S.W.) Pty. Ltd.,
63 Grove Street,
ST. PETERS, N.S.W. 2044

Dear Sir,

Bass Point Quarry Environmental Study

We have pleasure in submitting this final report on an environmental study of Bass Point Quarry.

The report contains four main sections namely; the existing environment, process operations, assessment of environmental factors and proposals.

A scale model of Bass Point and its surrounding area has been made showing views from Minnamurra and Shellharbour, with lift-out sections of the quarry area, demonstrating proposals outlined in the study.

We have appreciated the opportunity to participate in this interesting assignment and consider the report will facilitate future planning and rehabilitation of Bass Point Quarry.

Yours faithfully,
D. J. Dwyer & Associates Pty. Ltd.

W. R. Keirnan
Study Director.

ACKNOWLEDGEMENTS

We wish to express our appreciation to Officers of Pioneer Concrete (N.S.W.) Pty. Ltd. and the following authorities for their assistance in the preparation of this study:-

Australian Bureau of Statistics
Bureau of Meteorology
Department of Mines
Shellharbour Municipal Council
State Pollution Control Commission

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INTRODUCTION

This study has been prepared to establish guidelines for the future development of a basalt quarry located at Bass Point, a prominent peninsula in the Municipality of Shellharbour along the south coast of New South Wales. The quarry, the largest in the Illawarra area, is operated by South Coast Basalt Pty. Ltd., part of the Pioneer Concrete Services Ltd. Group of companies, who commissioned this study.

The site, which covers approximately 160 hectares, is leased to South Coast Basalt Ltd. by I.C.I. Australia Ltd. for a term of 50 years commencing in 1970. It is estimated to have reserves of 70 to 80 million tonnes of basalt and at present some 2,600 tonnes are quarried daily.

Since operations commenced, the quarry has provided a source of local employment and added substantially to the Region's economy. The Company has also contributed to a number of local projects in the Municipality such as the supply of overburden, the sealing of the adjoining access road and the costs of maintaining the nearby Bass Point Reserve.

However, operations associated with quarrying are noisy and can cause problems of air pollution and visual scar to the natural landscape. It is for these reasons that Pioneer Concrete (N.S.W.) Pty. Ltd. the Division of Pioneer Concrete Services Ltd. responsible for quarrying, have engaged consultants to carry out a management study of their operations at Bass Point.

OBJECTIVES

This study has been prepared to guide the future development of the quarry, having regard to its compatibility with the surrounding environment. The study will set guidelines for the Company's development of the site as well as establish a general approach to development of other quarries operated by the Company.

In particular, the study aims to investigate the following aspects:-

1. THE LOCALITY

To examine the impact of the quarry in the Shellharbour locality and the effects of surrounding population pressures on the long-term future of the site.

2. OPERATIONS

To review existing methods of quarry operations and to suggest means of reducing any undesirable environmental impacts on the locality.

3. APPEARANCE

To examine the shape and direction of future mining and suggest guidelines for the visual appearance of the quarry.

SCOPE

The scope of investigation comprises the following:-

a) Background to quarrying activity on the site and within the Region.

b) Planning proposals for future development in the Shellharbour area.

c) Physical characteristics of the site.

d) Examination of process operations.

e) Investigation of present and future quarrying proposals.

f) Pollution Control.

g) Landscape and Visual Analysis.

h) Quarrying and restoration proposals.

i) Landscaping proposals.

j) Long-term development strategy.

k) Proposals for Variation to Development Consent.

1. BACKGROUND

1.1 DESCRIPTION

Bass Point is located in the Illawarra Region of New South Wales which comprises the City of Wollongong, Municipalities of Bowral, Kiama and Shellharbour and Shires of Mittagong, Shoalhaven and Wingecarribee. The Region is extensively developed and in the 1976 Census contained a population of 270,000 mainly concentrated in Wollongong and the towns of Kiama and Nowra.

The physical features of the Region consist of a narrow coastal plain widening to the south, steep slopes below a cliffline or escarpment, and a dissected plateau to the west. The coast is characterised by cliffs, headlands, crescent shaped beaches, dunes, swamps, lagoons and estuaries.

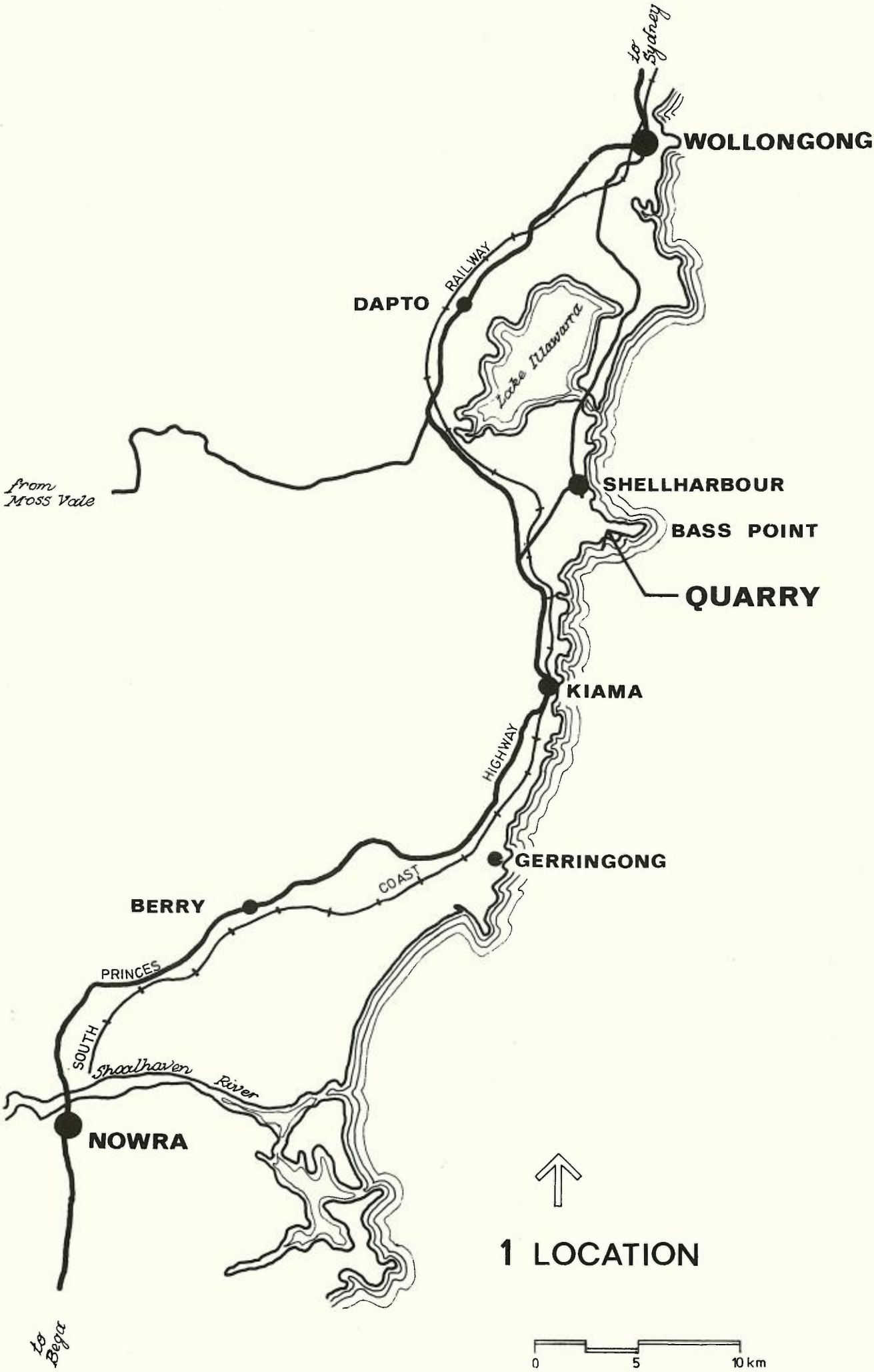
Bass Point is a well-defined though small promontory projecting into the South Pacific Ocean located 2 kilometres south-east of the Town of Shellharbour and some 80 kilometres south of Sydney (see Drawing 1 "Location").

Apart from the seaward extremity of the point, which is low lying and is reserved for Public Open Space, the area has a fairly marked relief dominated by two hills, the Eastern and Western Hills which rise 60 and 75 metres respectively above sea level.

The site of the lease to South Coast Basalt Pty. Ltd. is part of larger holdings owned by I.C.I. Australia Ltd. which have an area of 383 hectares and comprise Lot 4 D.P. 532298 and C.T. Vol. 7281 Fol. 169. These holdings encompass the Eastern Hill, Bass Point Reserve and extend to Shellharbour Beach and Jamberoo Road.

The quarry site leased to South Coast Basalt Pty. Ltd. is contained within the Eastern Hill. It has an area of 157 hectares and comprises part of C.T. Vol. 7281 Fol. 169.

The quarry is well located with ready access by road from the Princes Highway, by rail from the main South Coast Railway and by sea from ship loading facilities on the site's northern side.


to Sydney
WOLLONGONG
RAILWAY
DAPTO
Lake Illawarra
from Moss Vale
SHELLHARBOUR
BASS POINT
QUARRY
KIAMA
HIGHWAY
GERRINGONG
COAST
BERRY
PRINCES
SOUTH
Shoalhaven River
NOWRA
to Bega
0
5
10 km

1 LOCATION

1.2 BRIEF SITE HISTORY

Bass Point was originally used as a quarry in 1880 which continued up to the 1930's. It was subsequently abandoned until after World War II, when the site was purchased by Imperial Chemical Industries of Australia and New Zealand Limited (now I.C.I. Australia Ltd.) for a munitions depot.

With the advent of changing technology, and the introduction of ammonium nitrate for explosives, large areas for munitions storage were no longer required. The Company subsequently planned to develop the site as a factory complex, however these proposals did not eventuate.

The presence of high grade basalt outcrops suitable for aggregate within the property, led the Company to seek town planning approval for the extraction of basalt from Shellharbour Municipal Council in August, 1968 under the provisions of the Illawarra Planning Scheme.

Council granted consent to development for a basalt quarry and ancillary and other purposes, subject to an agreement being entered into between the Company and Council. Details of the conditions of approval are set out in Appendix A.

These conditions also required the dedication to Council of the present Bass Point Reserve and a strip of land adjacent to Shellharbour Beach and Fuller Park for Public Open Space. These are now lodged with the Registrar General's Office.

Subsequently, the quarry site was leased to South Coast Basalt Pty. Ltd., a subsidiary of Pioneer Concrete Services Ltd. for a fifty year period, commencing in 1970. The lease incorporated Council's Town Planning Conditions and levelling of the quarry site to R.L. 15 metres (50 feet) so that the finished level would approximate the level of the surrounding coastline.

Operations commenced in 1970, and in December, 1971 Council granted approval to the use of ship loading facilities for the transport of aggregate by sea to markets, mostly in Sydney (See Appendix B). These facilities were constructed in 1974, and approximately 90% of aggregate is now transported by ship.

In August, 1973 Council granted approval to quarrying below R.L. 15 metres to R.L. 8 metres within the bounds of the existing quarry, subject to a number of conditions, one of which included backfilling and restoration of the site to R.L. 15 metres. These conditions are outlined in Appendix C. This finished level was adopted by Council to preserve the amenity in the vicinity of the coast, and to allow tourist access to the seaward extremity of Bass Point, the beaches and the ocean shores. To date South Coast Basalt Pty. Ltd. have quarried approximately 6 million tonnes of material at Bass Point.

1.3 QUARRYING IN THE REGION

"It can be said that the Illawarra Region contains the largest reserves of aggregate of importance to the Sydney market outside the County of Cumberland ... Due to the depletion of reserves of high-grade aggregate in the County of Cumberland, large tonnages are being imported from sources in the Illawarra Region up to 110 kilometres away". (Geological Survey of New South Wales Report GS 1971/464).

The blue metal industry in the Illawarra Region commenced in the 1870's with the quarrying of latite blocks from Pikes Hill, west of Kiama. By 1881 three quarries, Carsons, Waldrons and one other were operating.

Other quarries were opened by the State Metal Quarry at Bombo west of the Railway Line in 1921, and by Faddens and Roberts at Bombo Point in the 1880's. Quarry activities commenced at Bass Point in 1880 and at Dunmore in 1921.

In 1971 the Geological Survey of New South Wales, Department of Mines in response to a request from The State Planning Authority of New South Wales (now New South Wales Planning and Environment Commission) prepared a report on aggregate resources in the Illawarra Region. The purpose of the report was to locate and define recoverable reserves of material suitable for the manufacture of crushed aggregate within the Illawarra Region and to recommend zoning of these resources as a guide for future planning.

The study reported at that time, annual production from the Region was about 1.5 million tonnes, amounting to one-fifth of the amount produced in the Sydney Region. In order to extend the life of quarries in the

County of Cumberland, production from the Illawarra Region would need to be increased, thus enabling a reduction to be made in production rates from the Sydney area.

The importance of aggregate in the Region was further recognised when the New South Wales Planning and Environment Commission published a report "Landscape and Recreation in Southern Illawarra", in November, 1975. The report stated that the Municipalities of Kiama and Shellharbour contain the largest known reserves of high-grade aggregate in New South Wales. "The commercial importance of these blue-metal deposits is increased by their proximity to the Sydney Region, where reserves are being rapidly depleted".

The Geological Survey of New South Wales recently completed a report "Management of Blue Metal Quarrying in the Illawarra area of N.S.W." prepared at the request of members of a committee representing the N.S.W. Planning and Environment Commission, Shellharbour and Kiama Municipal Councils, Illawarra Regional Advisory Committee and the Department of Mines.

This report reviews reserves of aggregate, previously established for the Illawarra area and discusses existing and future development of each Quarry in the region.

Total annual production of aggregate produced in the Illawarra Area was 2.38 million tonnes in 1975/1976, about 60% of which was marketed in Sydney. This satisfied a quarter of Sydney's requirements for blue metal.

It was emphasised in the report that blue metal quarries in the Kiama-Shellharbour area will continue to be very important. The future of blue metal quarrying will depend to a large extent, on planning decisions taken at both the local and state level.

Would now suggest an increase

For the next 40 years, the level of demand for blue metal from this area is expected to remain the same, based on assumptions that potential reserves at Mittagong and Port Stephens can be developed, a scheme to use large gravel deposits at Penrith is approved and there is an increase in the use of slag* as aggregate.

*Blast furnace slag from Port Kembla is used to satisfy 12% of the market for road base and concrete aggregate. If slag is used as aggregate in concrete, problems of popout (pieces of concrete breaking away), discolourisation and bad surface finish can result.

If these assumptions are not fulfilled, then there will be a greater demand for aggregate in the area. Present quarries in the Region have the capacity to absorb moderate increases in production with existing plant.

An assessment of future demand for blue metal based on recent trends was made in the report. Increases in production were projected to the year 2015 at a compound growth rate of 2% per annum to the year 2000, and thereafter no change to 2015. This calculation was conservative, and was based on assumptions highly sensitive to unpredictable changes in the economy, technology and marketing trends.

It was concluded that the Kiama-Shellharbour area will continue to satisfy a quarter of the Sydney market in the near future.

Principal uses for the crushed aggregate are concrete manufacture, road surfacing and railway ballast. Figure 1 shows the total production of basalt in New South Wales since 1950. However, production has levelled off over the past two years due to the depression in the New South Wales building industry, but is expected to increase at a steady rate in the future.

The report recommends that basalt should continue to be quarried in the Illawarra area subject to adequate measures of control and satisfactory rehabilitation of sites after quarrying has ceased.

1.4 URBAN GROWTH AND CONSERVATION

Shellharbour Municipality is one of the rapidly developing urban areas of the State. Between 1971 and 1976 its population increased from 31,000 to 37,000 which amounts to an average annual increase of 3.7% compared to 1.74% for the Illawarra Region and 0.75% for the State.

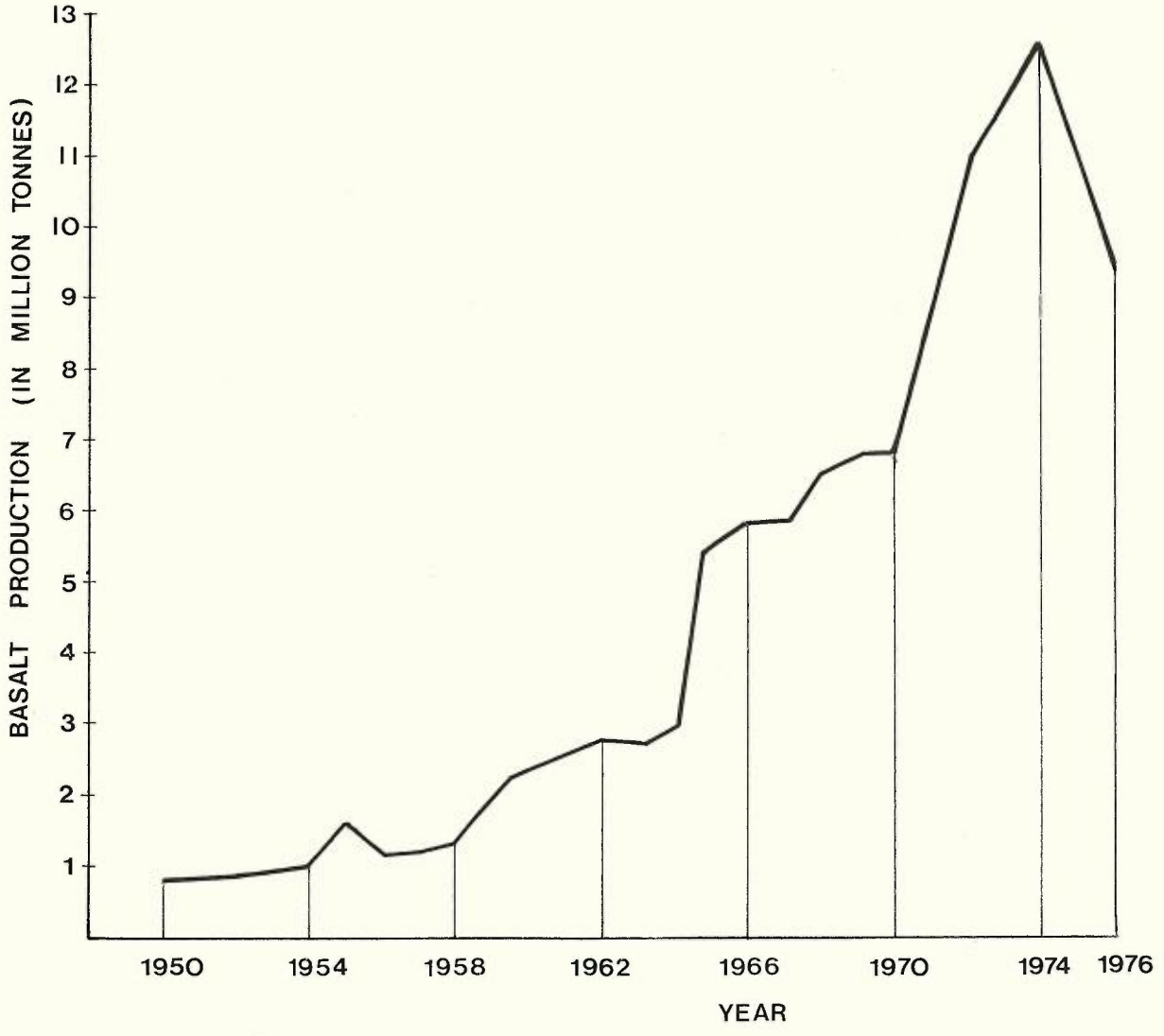


FIGURE 1
BASALT PRODUCTION – NEW SOUTH WALES (1950 – 1976)

Source: Geological Survey of New South Wales and
N.S.W. Planning and Environment Commission

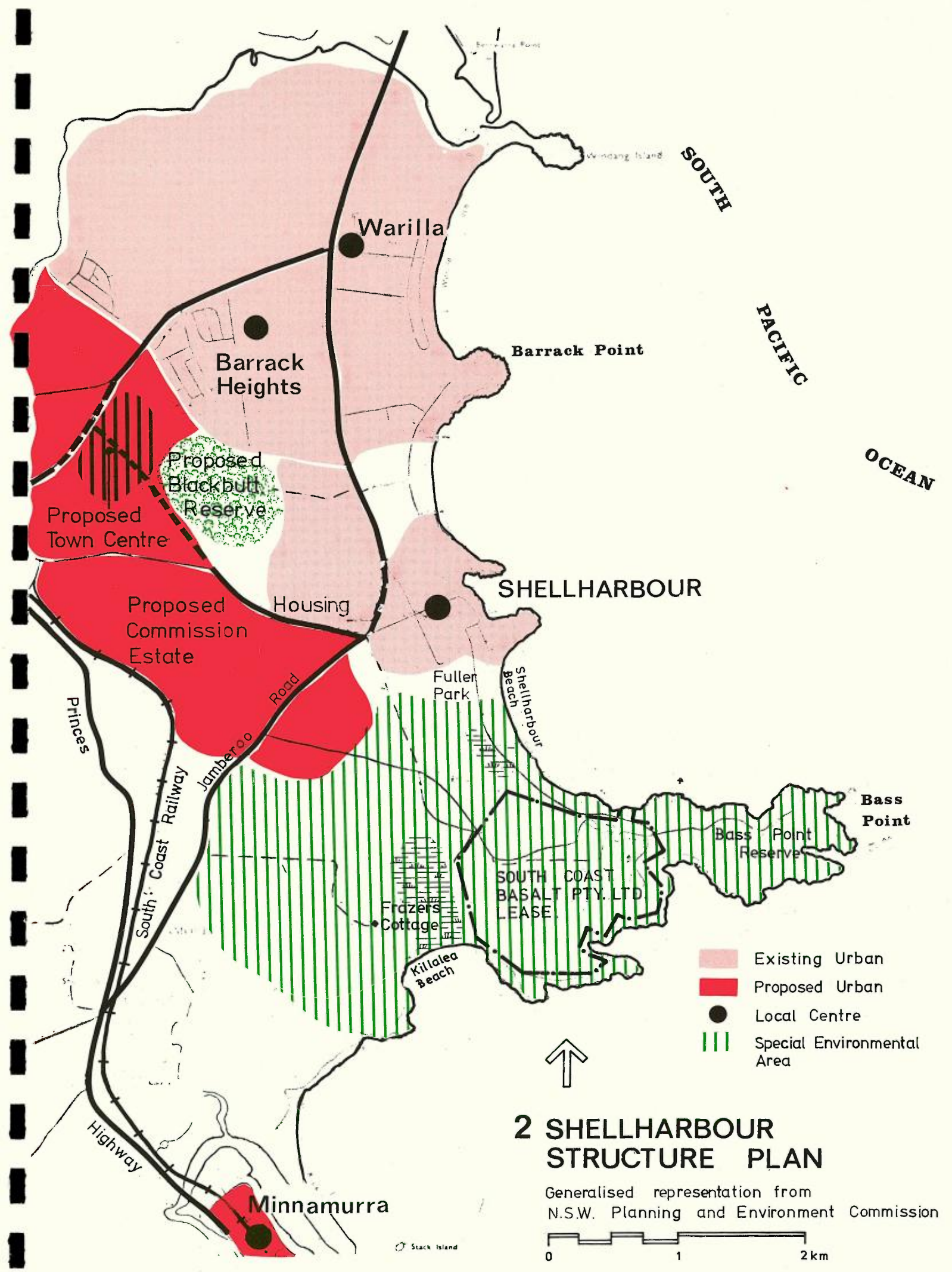
The New South Wales Planning and Environment Commission has estimated that by the end of this century the Municipality will most likely have a population of 80,000 to 90,000 people. Some 24,000 of the additional residents are expected to be housed within a large Housing Commission Estate at Shellharbour known as Site 7200.

As a result of the Housing Commission's Project for Shellharbour, the Bass Point area has been the subject of a number of reports prepared by the New South Wales Planning and Environment Commission.

"Shellharbour New Town" The first of these reports "Shellharbour New Town", prepared in February, 1973 dealt with the policy of future planning of the Shellharbour District. It examined the impact of the Commission's project on employment opportunities, transport, retailing, recreation, open space and community facilities. The report highlighted the absence of recreation policies for the Region, particularly in regard to the coastline where it was emphasised that there was a need to preserve coastal areas for passive recreation and scientific study. The proposal for a large coastal resort around Bass Point was considered particularly important in this regard.

"Shellharbour Structure Plan" This further report, prepared in November, 1974, designated Bass Point as a Special Environmental Area. The report stated that this action recognised the importance of providing an attractive landscape setting for existing and proposed urban development, although the area was seen as subject to conflict between the need for landscape protection and the operation of blue-metal quarrying. The report further stated that in the case of Bass Point, there are pressures for intensive recreational use and consideration is being given to the establishment of a coastal park. Clearly, the right balance has to be struck between the need to develop the natural resources of blue-metal and the protection of rural and coastal environments around the urban area. Control of extraction and rehabilitation procedures will be of great importance.

"Southern Wollongong" This third report, the following year, illustrated graphically structure plan proposals for the Bass Point Area (see Drawing 2). It stated that careful and sensitive planning controls would



2 SHELLHARBOUR STRUCTURE PLAN

Generalised representation from N.S.W. Planning and Environment Commission

be required if the Point's qualities were to be retained to any meaningful extent. Further, Bass Point offered "the sole opportunity for the creation of a large Coastal Park".

"Landscape and Recreation" The most detailed of the Planning and Environment Commission reports relating to Bass Point is, "Landscape and Recreation", dated November, 1975. An entire section is devoted to blue-metal quarrying. It states that mining is a relatively important source of employment in the Shellharbour area. Further, the area possesses the largest reserves of high quality basalt, which is of great commercial importance due to its proximity to the Sydney Market.

However, the rich basalt reserves coincide with some of the most attractive scenery in New South Wales. Detrimental effects of quarrying give rise to visual scars on the natural landscape caused by quarrying operations, as well as hazards caused by dust, vibration and heavy traffic. Residents in the immediate vicinity of quarries as well as potential tourists, day-trippers, leisure seekers and the like are all possible sufferers in the loss of amenity. The report states that, in any further quarry development, damaged landscape should be rehabilitated and the area screened by trees. Special measures should be introduced to preserve the landscape as basalt, suitable for potential quarrying, covers the whole of the area between Albion Park and Saddleback Mountain.

In specific reference to Bass Point the report states that it is an important element in the Illawarra Coastline, immediately adjacent to urban Wollongong-Shellharbour and also accessible from the south and west of the Region. "There are substantial deposits of aggregate material at Bass Point, which are presently being quarried. Pioneer Concrete, the Company operating the quarry, considers its quarrying activities here to be long-term and has constructed facilities for bulk sea transport of the quarry products. However, Bass Point's significance extends beyond merely its blue-metal potential. It provides valuable open space and recreation resources for the large urban population to the north."

"Illawarra Region Landscape Survey" The most recent of reports examining problems associated with quarrying is the "Illawarra Region Landscape

Survey", published in 1976 by the National Trust of Australia (N.S.W.). The report seeks to generate a greater understanding and appreciation of issues relating to the value of the Region's scenic landscapes. A number of areas are identified in the report as Scenic Protection Areas and Scenic Landscapes.

While Bass Point does not fall within either of these specific classifications the Trust's report states that it is highly regrettable that the blue-metal quarry on this prominent point (Bass Point) has been reopened. This quarry should be closed at the first opportunity and the entire Point returned to public ownership. Similarly, obtrusive stockpiles and machinery should never be allowed in other prominent positions.

The Trust considers that areas of high landscape and recreation potential are continually being threatened or lost to mining, industrial development and urban expansion. These types of activity are producing conflict and irreparable damage on a large scale.

1.5 SUMMARY

Bass Point has a history of quarrying operations extending from 1880 and this activity recommenced following the granting of approval by Council to the present owner, I.C.I. Australia Ltd., for quarrying at Bass Point in 1968. This approval was subject to a number of conditions, including the dedication of the reserve on the eastern extremity of the Point and the strip of land on the north adjacent to the coast, for public parks and recreation.

Subsequently, the Company in 1970 granted a 50 year lease to South Coast Basalt Pty. Ltd., a subsidiary of Pioneer Concrete Services Ltd., which installed a crushing and screening plant, and commenced operations later that year. Further approval was granted by Council to install ship loading facilities and to quarry below R.L. 15 metres (the previous limit) to R.L. 8 metres within the existing quarry area.

Since the present operations commenced, employment opportunities for people living in the locality have increased and the Company has

contributed to a number of community projects in the Municipality. These include the supply of overburden and aggregate, the sealing of a link road to Jamberoo Road and financial contributions to maintenance of Bass Point Reserve.

The Illawarra Region has been identified as containing the largest reserves of aggregate of importance to the Sydney Region, supplying a quarter of its needs. In particular, the Kiama-Shellharbour area contains the highest grades and it is anticipated that this area will continue to satisfy a quarter of the Sydney market in the future.

An examination of studies of urban growth and conservation in the area highlights the quarry as a sensitive area located close to future urban development in a rapidly growing district. Recommendations have been made to develop Bass Point as a coastal park.

It is now clear that a balance needs to be struck between intensive development of blue-metal deposits for the needs of the Sydney and the Illawarra Regions, and protection of the coastal environment. In further quarry development, operations should seek to be the least visually obtrusive and the landscape should be rehabilitated after quarrying.

2. EXISTING ENVIRONMENT

2.1 GENERAL

This section gives a description of the various natural characteristics of the existing environment at Bass Point. These comprise:-

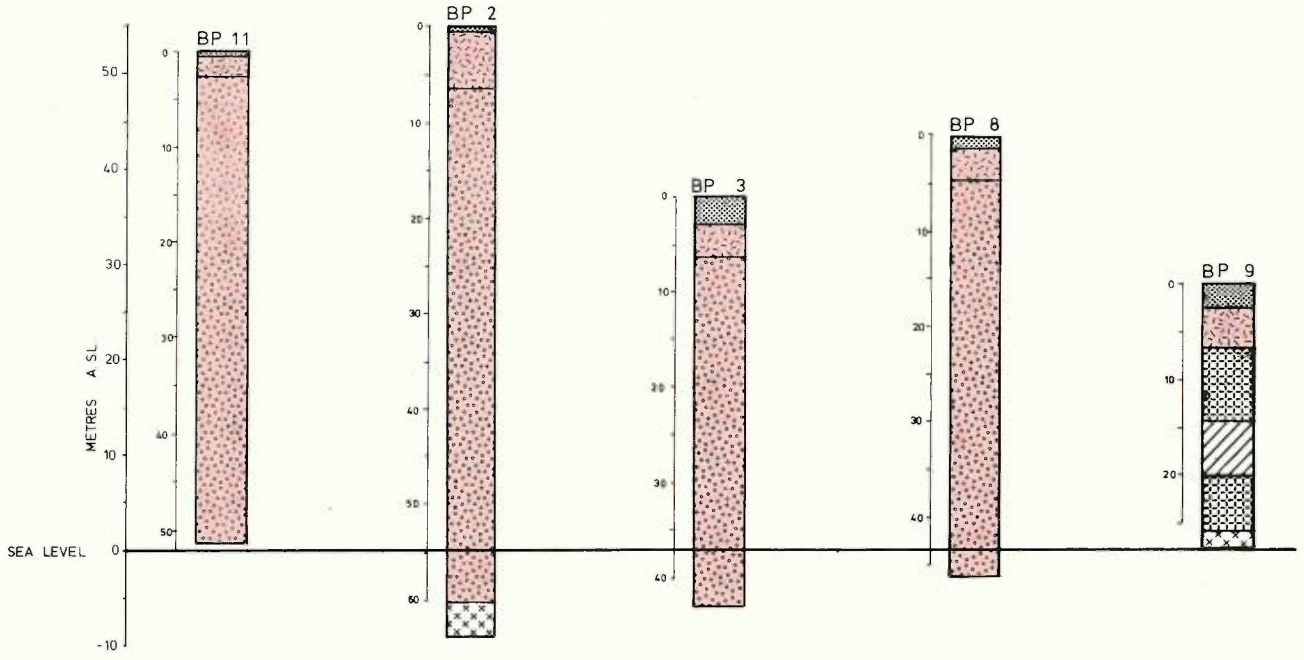
landscape
geology
soils
vegetation
wildlife
climate

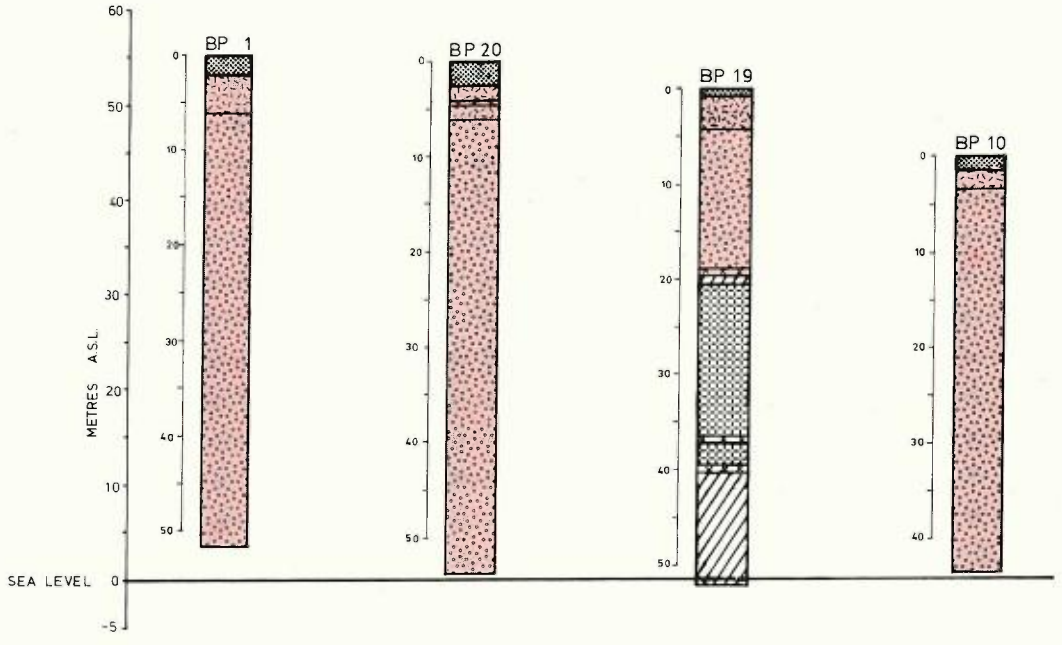
2.2 LANDSCAPE

As described earlier, Bass Point is a well-defined though small promontory projecting into the South Pacific Ocean. It has three distinct landscape patterns - hills, swamplands and a vegetated dune system.

Apart from the seaward extremity of the Point which is low lying, the area has a fairly marked relief featuring two hills, the Eastern and Western Hills which have elevations above sea level of 60 and 75 metres respectively. The Eastern Hill is the site of present quarrying and covers the existing lease. It could be expected that prior to settlement, the Eastern and Western Hills contained some rain forest vegetation. Farming during the early 19th Century would have resulted in the clearing of this vegetation for grazing purposes.

To the north of the lease, a significant feature is the estuarine swampland associated with Shellharbour beach which is formed by stormwater runoff, south of Jamberoo Road and east of Buckley Road. To the west of the lease is Killalea Lagoon which is formed by retaining stormwater runoff from its immediate catchment. Both of these swamplands were caused by alluvial deposits. Shellharbour Swamp consists basically of a salt meadow which is subject to periodic inundation.





Potentially acceptable Aggregate material

Soil, subsoil, very weathered Andesite to be discarded.

Slightly weathered or ironstained Andesite, and ironstaining at joints.

Sound Andesite suitable for Aggregate.

Breccia-agglomerates below main flow.

Highly-vesicular zones associated breccias.

Altered Andesite.

} Potentially inferior or unacceptable Aggregate material

BOREHOLE LOGS

SOUTH

PACIFIC

OCEAN

cool summer breezes

Shellharbour Beach

to Shellharbour

Shellharbour township

swamp

37dB(A)

TOURIST ROAD

to Jamberoo Road

'Sunny Vale'

grazing

strong winter westerlies

MAXIMUM EXTENT OF VIBRATION IF QUARRIED TO LEASE BOUNDARY

MAXIMUM EXTENT OF NOISE IF QUARRIED TO LEASE BOUNDARY 120 dB(L)

extent of noise from existing plant operations 40 dB(A)

LOADER
aggregate shipped to Sydney

office and amenities

QUARRY ENTRANCE

weighbridge

workshop

CRUSHING AND SCREENING PLANT

CONCRETE BATCHING PLANT

primary crusher

secondary crusher

settling ponds

68dB(A)

BASS POINT

BASS POINT RESERVE

BP3

BP11

BP2

BP20

BP8

BP9

BP1

BP19

BP10

ridgeline

existing working face

significant grazing

EASTERN HILL

WESTERN HILL

swamp

Frezers Cottage

Killalea Beach

strong south-westerlies

strong summer winds

SEASONAL WINDS

North

South

SUMMER
AUTUMN
WINTER
SPRING

9 AM
3 PM

- Lease boundary
- Ridgelines
- Creeks
- Steep land
- Vegetation
- Area to be re-quarried
- Filled area
- Aggregate stockpiles
- Overburden stockpiles
- BP2 Location of boreholes
- dB(A) Noise levels

3 SITE FEATURES AND GEOLOGY

0 100 200 300 400 500m

The eastern portion of Bass Point known as Bass Point Reserve, consists of a recent dune system. It comprises wind blown sand overlaying volcanic strata. Time has allowed vegetation to be stabilised resulting in improved soil fertility.

2.3 GEOLOGY

Bass Point was originally the site of a shallow but elongated depression excavated in sandstone. The Point was then subjected to a volcanic intrusion and partially occupied in Permian times by at least three flows of andesitic lava which now provides the source of aggregate. These lava are gently tilted to the north-east with no evidence of faulting or tectonic structure. The lava intrusions can be identified by the prominent landscape elements of the Eastern and Western Hills.

A detailed investigation prior to the commencement of operations established the geological succession comprising the three lava flows separated by two breccia-agglomerate layers. The investigation was carried out by surface inspection of outcropping latite and by inspection of twenty diamond drill hole cores from which subsurface samples were taken. Nine holes were drilled within the lease area and their location and profiles are indicated in Drawing 3 "Site Features and Geology".

It was found that the upper lava flow is thin and of limited extent and forms only a minor part of the potential source of aggregate. The major source of high-quality aggregate is the middle lava flow, which is approximately 60 metres in maximum thickness and is developed over much of Bass Point. Zones of highly vesicular material associated with altered lava occur within this flow. These vesicular zones give rise to rubbly material in the zone of weathering. The lower lava flow, because of its position beneath the two breccia-agglomerates layers and its proximity to sea-level, is not regarded as a potential source of aggregate in this area.

The quarry is developed in the middle lava flow which is of porphyritic, light to mid-grey Bumbo Latite. It is worked on two benches, upper and lower, with face heights of 15 and 9 metres respectively. These face

heights are designed so that mucking and loading of broken stone can be carried out by front-end loaders rather than shovels.

Irregular zones of red-stained, deuterically altered, but sound latite rock occur within the quarry and about twenty percent of the rock being quarried is affected in this way. Intensely deuterically altered breccia zones up to 15 metres wide occur in the north-western and south-western faces of the upper bench. Occasionally, swelling clay minerals are present in the breccia material in sufficient concentrations to render it unsuitable for use as a road-base material due to its excessively high plasticity index. The remainder of the rock exposed in faces developed on the upper bench is fresh grey latite with poorly developed columnar jointing.

Potentially inferior or unacceptable aggregate materials within the lava are restricted to the highly-vesicular zones, the associated altered lava, appreciably mineralised rock, and lava with jasper and quartz veining. Selection necessary to exclude these materials entails an overall wastage in the quarry of about ten percent.

Soil and clay, where present within the lava, require rejection at the quarry face or removal by screening. The rubbly zones must be side-cast; and amount to about five percent of the upper 15 metres of the lava.

Mechanical and chemical testing has shown that the fresh lava is an excellent material for concrete aggregate. Further testing shows that the mechanical properties of the light, transitional and dark varieties of lava are entirely satisfactory for aggregate in road construction. Flakiness tests carried out on Bass Point aggregate are also satisfactory.

It is estimated that the lease area if fully excavated to R.L. 15 metres above sea-level, in accordance with Council's Conditions of Consent, has reserves of approximately 72 million tonnes of good quality basalt.

2.4 SOILS

Bumbo latite forms the predominant parent material of soils at Bass Point. This volcanic lava is more resistant to erosion than sandstones and shales, and forms the elevated stoney central ridge of the Eastern Hill.

Soil profiles are therefore generally shallow with bedrock outcroping along the ridges and water courses. Over most of the unworked section of the lease between the hilltop and seaboard, weathered basalt has developed to an average depth of two metres.

The volcanically derived topsoil over much of the upper slopes is rich in mineral content and is considered a valuable resource for future landscape work. Stockpiling of this topsoil is therefore considered desirable.

The relatively recent and unstable dunes on the easterly extremity of the Point comprise marine and wind deposited sand, blanketing a lava base which has only marginally been changed or improved by the impact of vegetation. The nature of this deposited sand, together with the undulating surface, discourages the retention of water except in hollows, and this is a significant determinant in the resultant poor vegetation.

Soils within the lagoon and swamp areas vary according to the degree of inundation and drainage. Low lying alluvial soils in these areas are heavy textured types derived from silts and organic colluvium deposits. They are generally waterlogged and saline.

2.5 VEGETATION

Existing vegetation within the leased area is poor and consists mainly of degenerated tussocks of Kikuyu grasslands which are of considerable age. However, residue strands and isolated specimens of plant communities established prior to clearing for grazing, can be seen in less exposed areas. Remnants of the original forest covering parts of the quarry can be seen in the higher reaches of gullies on the Western Hill where there are Leptospermum sp. Isolated Ficus sp (figs) are found on the northern section of the lease boundary.

Strands of wind-blown Coastal forest, representative of the vegetation which once covered the lease area are found on the eastern extremity within Bass Point Reserve. Vegetation in the Reserve is generally indigenous and comprises mainly species of Leptospermum, Casuarina,

Acacia, Grevillea, Banksia and Pittosporum, with Leptospermum and Casuarina spp predominating. In protected areas towards the middle of the Reserve, isolated groups of Eucalyptus sp can be found with less significant shrubs and climbers. On either side of the access road into the Reserve, Lantana has overgrown the native vegetation.

In the low lying swamplands of Killalea lagoon and Shellharbour swamp, plants of low stature such as swamp grass and rushes grow in the mud flats.

2.6 WILDLIFE

A variety of wildlife abounds at Bass Point and in 1973 the South Coast Conservation Society carried out a survey of birds found in Shellharbour Swamp to the north of the lease area.

Birds found were White fronted Chats, Cistocola, Black Ducks, Swans, White Ibis, White Egrets, White faced Herons, Godwits, Dotterels, Swamp Harriers, Small Falcons, Black Shouldered Kites, Kestrels and common terns, gulls and ravens. It is considered that measures to preserve these swamp areas are needed to retain the wide range of bird life in their natural habitats.

2.7 CLIMATE

The Bureau of Meteorology has collected meteorological information in the Region and this is analysed below.

Rainfall and Evaporation - The Illawarra Region has a mild marine climate with an average annual rainfall of about 1220 mm per year which varies little from year to year.

Monthly rainfall is generally constant throughout the year except for the July to September period, when less is received. On average, evaporation is about 1000 mm per year. This results in excess runoff taking place during the February to August period. This excess runoff and the need to contain small storm flows require retention ponds for the regulation and settling of water flowing from the quarry to the ocean.

Winds - The action of winds has a significant impact on Bass Point due to effects of high velocities, salt loads deposited on plant material and dehydrating effects on soil when blowing from the inland areas in periods of high temperature.

Westerlies occur generally in June and July when temperatures are low and rainfall is relatively high. Easterlies from the ocean are generally moist and can cause rough seas, whereas northerlies are more mild.

During the early morning, the strongest winds originate from the south-west and blow out to sea across the Point. By mid-afternoon they have turned around and come in from the south and south-east. (See Seasonal Winds Chart on Drawing 3.) During October and January, strong winds blow across the site from the north-east. A notable feature of the site is the low percentage of calm weather, particularly in the afternoons.

Average wind speeds are frequently over 18 km/hr and will disperse any dust remaining after blasting. However, dust from stockpiles and crushers may cause problems in exposed areas especially when viewed from Shellharbour. Measures need to be taken to ensure that all conveyors and crushers are covered, while stockpiles and crushers should be sprayed with water to reduce dust emission.

Temperature - Proximity to the sea and low altitude cause temperatures to be moderate throughout the year. Temperatures vary according to terrain, however extremes are rare on the coast. Summers are generally warm, with cool to mild winters.

Mean daily maximum temperatures range from 24^{o}C during December-March, to 17^{o}C in July. Mean daily minimum range from 18^{o}C during January-March, to 10^{o}C in July.

Ocean Wave Actions - Records taken at Wollongong indicate that large waves occur during late summer and winter. During January and February, three percent of recorded wave heights averaged in excess of 3.5 metres.

In carrying out quarry operations, an effective buffer of in-situ basalt, at least R.L. 15 metres high should be maintained between the seaboard and worked areas to ensure sea water does not inundate the quarry during heavy storms.

2.8 SUMMARY

An assessment of the existing natural environment has highlighted a number of environmental constraints relevant to this study.

- The topography of Bass Point has been largely determined by the underlying geological formation. By being located adjacent to the coastline, this has produced three distinct regimes. These are hills, swamps and sand dunes.

- The leased area of the quarry contains high grade basalt and if fully worked to a depth of R.L. 15 metres above sea level in accordance with Council's Conditions of Consent, will yield approximately a further 72 million tonnes.

- Soils have been derived mainly from the parent Bumbo Latite lava, and are generally shallow. Wind blown sand has accumulated within Bass Point Reserve, while soils within the swamplands are waterlogged and saline. Topsoil found within the upper slopes should be stockpiled prior to quarrying for use in future landscaping.

- Existing vegetation within Bass Point is poor. Some harsh vegetation is found within Bass Point and remnants of the original rainforest covering parts of the area can be seen in pockets to the west. The lease area possesses no vegetation of significance and the central Eastern Hill is highly exposed.

- Measures are needed to preserve the swamplands as wildlife habitats for the wide range of birdlife found in the area.

- The site, especially when quarried, will experience excessive runoff. Measures such as the provision of a retention/filtration pond to regulate water outflow to the sea will therefore be needed to achieve the settling of water and to contain small storm flows.

- Average wind speeds are high, and although dust remaining after occasional blasting will be dispersed quickly, dust blowing from plant areas on a continuous basis is not environmentally desirable due to the close proximity of Shellharbour. Conveyors and crushers should therefore be covered, and stockpiles and crushers watered to suppress dust.

- A strip of in-situ basalt at least R.L. 15 metres high, adjacent to the seaboard should be retained to protect the quarry from inundation during heavy storms.

3. PROCESS OPERATIONS

3.1 GENERAL

The major operational objective in the plant is to achieve a continuous flow of material over the three stages - supply from the quarry, flow through the plant and despatch of the product. These operations comprise the quarrying of the basalt, its crushing into aggregate and its screening into various sizes. These are shown in Figure 2 and described in detail in the sections below.

All standard aggregate sizes from dust to 40 mm are produced at the Bass Point Plant. Aggregate is generally marketed in 10 mm and 20 mm sizes for concrete. A 14 mm size is used for road pavements and dust, and 5 and 10 mm sizes are used in the manufacture of asphalt. Some of the overburden (soil and weathered latite) is also sold for filling or soil. Crushed altered latite material is sold as a prepared road base and 20 mm fine crushed rock sold for the upper courses in road pavements.

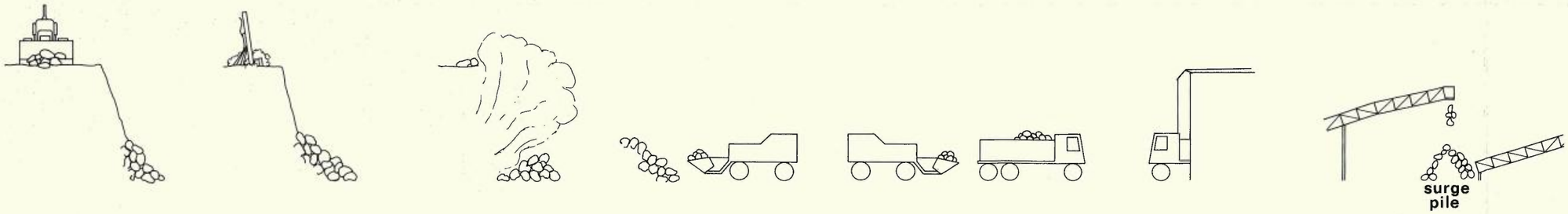
Operations are highly mechanised and are operated over two shifts requiring a total staff of about 36. The Primary Shift operates from 6.30 a.m. to 3.00 p.m. which is a little noisier than the Secondary Shift as it requires greater use of machinery. The Secondary Shift operates from 1.00 p.m. to 9.00 p.m. and these operations are generally dustier as they involve more screening and stockpiling activities.

3.2 REMOVAL OF OVERBURDEN

It is estimated that the weathered upper horizon of the quarry has an average thickness of two metres. This figure varies and is virtually non-existent over the hilltop of the lease area.

The weathered debris and soil overburden are amenable to stripping by bulldozer. After stripping, some of this material is stockpiled for later use in backfilling. Overburden stockpile areas are indicated in Drawing 3.

The surface is now ready for blasting.



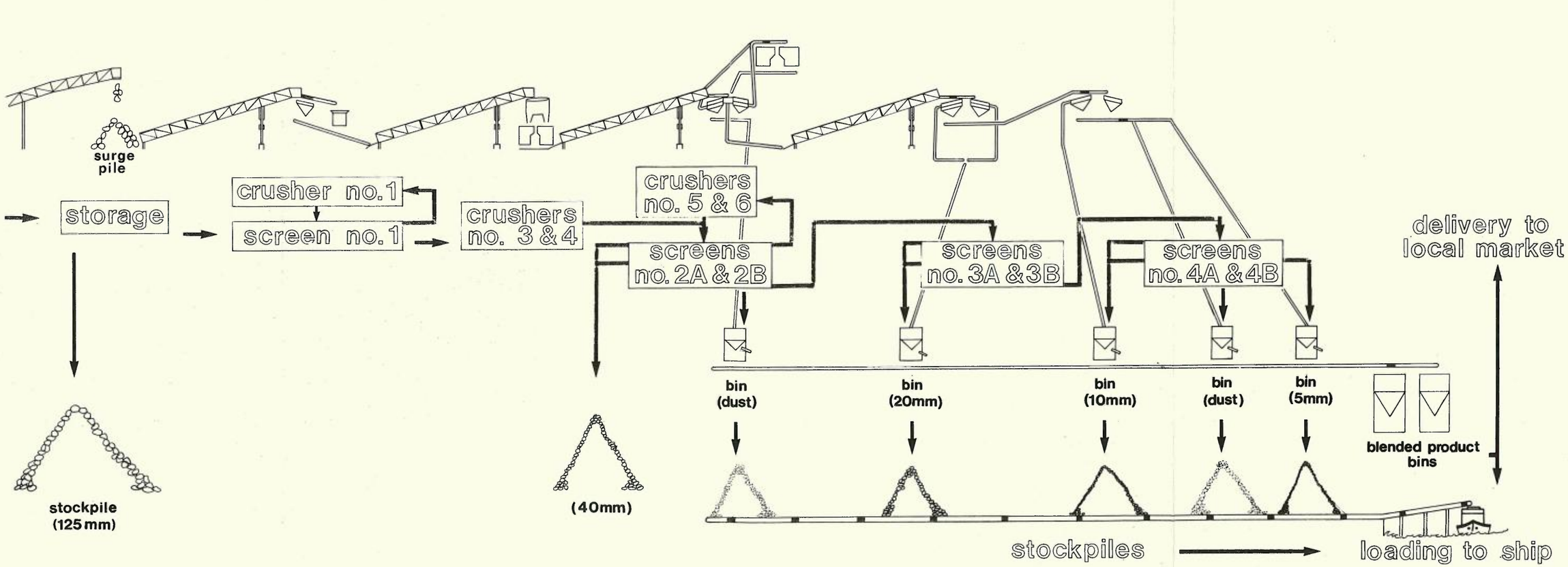


FIGURE 2
FLOW CHART OF QUARRY OPERATIONS – BASS POINT N.S.W.

3.3 BLASTING

Blasting techniques aim to produce broken rock in a size and form that will facilitate subsequent operations at the cheapest cost. The size and physical shape of the rock affect loading, transporting and crushing operations, and influence the choice of equipment. Techniques are determined by two main factors - safety and economics. It is therefore necessary to consider aspects such as the optimum bench height, borehole height, and pattern.

In all quarrying operations, the method selected is mainly determined by the size and disposition of the basalt deposit, and topography. The Bass Point quarry is a benched, side-hill quarry. It is developed over two benches with the average height of upper and lower faces being fifteen and nine metres respectively. These faces are developed so that crushing and loading of broken stone can be carried out by front-end loaders rather than shovels. The depth of the present face is thirteen metres, with drilling being extended a further metre below the quarry floor to ensure that a flat working face is produced. A face angle of 10 degrees to the vertical is considered the best method for drilling to achieve effective rock breakage.

Approximately 0.25 kilograms of charge are required for every tonne of rock blasted. Explosives are stockpiled in a specially designed building located at the southern end of the quarry site. Blasting is carried out about once a week with each blast yielding approximately 15,000 tonnes.

Holes are normally drilled with Track Drills, and 900 c.f.m. Gardner Denver and 1050 c.f.m. Sullair compressors. These machines are designed with noise suppressors. Little provision however, can be made for dust control.

The holes are drilled in a parallel circuit pattern usually 2.7 metres between centres, in rows 2.3 metres apart. Rock jointing and outbreak angles are the main determinants for this spacing.

A cortex detonating cord is then lowered and attached to a Molonite block at the bottom of the hole. Ammonium nitrate fuel oil (ANFO) is poured down the hole and the top 300 mm packed with broken rock. The charge is fired electrically. The bottom section of the face is blown first and this toe out gives better crushing as the rock falls from above.

Secondary blasting is a special process to obtain large (5 tonne) 'armour' rocks and is not normally carried out. This process which is generally noisy, is performed under special supervision, only if 'armour' rock material is required. Armour rocks from normal blasting are presently stockpiled separately near the blasting area and held for special projects, such as base material for breakwaters.

In future, it is proposed to develop quarry faces generally fifteen to twenty metres high. It is also proposed to extend quarrying by working the lower face in a north-westerly direction until deeper economic face heights are achieved.

3.4 LOADING AND TRANSPORT FOR CRUSHING

A rubber tyred 988 loader with a 5.7 cubic metre bucket (440 tonnes per hour capacity) is used to load material into one of four 35 tonne Euclid dump trucks. The material is then transported to the crushers. A water cart is used constantly on all haul roads to settle dust which may be generated.

3.5 CRUSHING

The trucks tip the broken rock into the primary crusher which is housed under cover of a corrugated iron shelter. This commences the first part of the crushing process.

Normally, the output of a quarry is governed by the size, type and number of crushers and the factors governing choice of crushing equipment are - feed to primary crusher, type and size of rock, required size and shape of aggregate, and desired output.

Aggregate size influences the type and number of crushers since the "reduction ratio" for each stage should be kept within limits if good particle size is required. The reduction ratio is the ratio between initial particle size entering the crusher and final size leaving it.

Experience has shown that a high ratio results in poor shape and adversely affects grading. To maintain good particle size reduction ratios of each crushing process should not be greater than 4 to 1.

Overall, the crushing plant has a capacity of 325 tonnes per hour and presently produces 2,600 tonnes per day. The crushing plant and stockpile facilities are positioned so that considerable flexibility in production specification can be achieved with blending of aggregate sizes as required.

The Primary Crusher is a Jacques-Traylor double toggle jaw crusher. It consists of a rectangular frame with a fixed plate inside one end and a stock or lever carrying the moving jaw, arranged to swing internally with a crushing movement in opposition to the fixed jaw. Jaw crushers produce a high proportion of stone, the size of which is nearly that of the jaw setting. While noise levels are high during tipping operations, dust fall-out is minimal.

Following primary crushing, material is then passed to a surge pile by a covered conveyor belt. Part of the 125 mm material is screened and stockpiled.

Material is then reclaimed through a tunnel by a covered conveyor to a secondary Jacques gyratory crusher. Gyratory crushers work on the principal of an inverted pestle and mortar, the stone being crushed between a stationary inverted bowl and a moving cone mounted on a vertical axis. The crushed material then filters down and passes through the first of seven screens.

Subsequently, the material passes to three Jacques model 536 Impact Crushers and a No. 50 Gyracone Cone Crusher.

Material is broken up by a series of blows imparted by hammers either fixed or hinge-mounted on a high speed shaft enclosed in a steel body, the inside of which consists of breaking plates against which stone is flung. The breaking up is by impact and not by pressure.

The product has the best cubical shape produced by any type of crusher and gives a well proportioned range of aggregate sizes.

Crushed material then passes to a series of covered screen houses.

3.6 SCREENING

The purpose of screening is to initially remove overburden and small rubbish from feed to the primary crusher. Later screens are used to return material for recrushing if oversize in closed circuit crushing. They are also used to produce small sizes for either discarding or stockpiling feed for the next crusher stage or to shortcircuit fine material. In addition, screens are used for grading the final product into the required sizes.

To maintain the flow of material within the crushing plant, conveyor belts are used. The return section is enclosed to prevent spill from the loaded belt reaching the upper side of the return belt, where it could cause damage if carried around pulleys.

Covered conveyors transport material to final screens used for separating the aggregate into gradings between specified limits or for scalping fines to prevent them unnecessarily passing through the crusher.

After screening, material is transported to hoppers from where it is conveyed directly to stockpiles and holding bins. Minimal dust occurs from this section of the process.

Bins are designed for easy loading into trucks: the chute doors to the bins are located immediately above the trucks to drop the crushed material vertically.

Final screens are usually located above bins and the various size products are directed by shutes to individual bins. These bins generally contain at least one hour's running capacity of the plant.

3.7 STOCKPILING

When capacities are exceeded, trucks collect excess material and transport it from the bins to stockpile areas located to the south of the main conveyor (see Drawing 3). These stockpiles are periodically removed by use of a front-end loader.

To prevent excessive dust, totem covers have been installed on stockpiles.

3.8 DELIVERY TO MARKETS

Final crushed and graded material is transported by covered conveyor to a jetty where material is loaded and shipped to various Sydney markets. The finished product is transported in this way about three times a week and off-loaded at Blackwattle Bay in Sydney Harbour.

The time taken for loading a ship such as the "Liza Miller" with a capacity of 3000 tonnes, is about 3 hours. Approximately ninety percent of material is transported in this way with the remainder trucked to local markets.

The alternative to the use of shipping facilities for transport of the material to Sydney is either road or rail transport. By road this would involve over two hundred (200) trips daily to and from the quarry using twenty three tonne trucks. By rail close to seventy (70) railwaggons, each of forty tonne capacity would be required together with construction of a rail link to the main South Coast Line. Transport by ship is therefore considered highly desirable from both environmental and economic viewpoints.

3.9 SUMMARY

Operations carried out at Bass Point are quarrying of the basalt, its crushing into aggregate and its screening into various sizes from dust up to 40 mm. Large armour rocks are also available as required.

Overburden is first removed and stockpiled. The base rock is blasted and material loaded and transported to crushers. After crushing, material is screened into various sizes and stockpiled prior to delivery by ship to the Sydney market. Transport of material by ship is considered to be far superior than haulage by road or rail to Sydney.

Activity areas are well-designed to fulfill the sequence of operations with a continuous flow of material produced over the three stages of:-

supply from the quarry,
flow through the plant, and
removal of the product.

At present, 2600 tonnes of aggregate is being produced daily.

The lower portion of the quarry is being worked in a north-westerly direction. It is proposed to continue in this direction and develop faces more economically between 15-20 metres high.

4. ASSESSMENT OF ENVIRONMENTAL FACTORS

4.1 GENERAL

Four major factors associated with quarrying at Bass Point are identified as having a potential impact on the environment.

These are noise, water pollution, dust emission, and visual impact.

4.2 NOISE

Problems concerning noise usually occur when they are abrupt, louder than normal, background sounds or interfere with daily activities. Noise at the quarry is generated from two sources, blasting activities and the plant.

BLASTING

Blasting and plant operations can give rise to unsatisfactory noise levels. At present there are no prescribed levels for blasting operations, however noise should be below 120 dB(C), the instantaneous level generally accepted as a maximum for residential areas. Readings taken in two separate sections of the quarry site late in 1976 were below this accepted level.

If the maximum recommended instantaneous charge of 64 Kg is used in blasting, it has been calculated that a maximum permissible noise level of 120 dB(C) is reached 330 metres from the point of blasting. Maximum permissible vibration levels are found 550 metres from the point of blasting if the same charge is used. Drawing 3 shows these levels if quarrying was extended to the lease boundary. Land between these levels and the lease boundary should be reserved as a buffer area to protect any future urban development developed on the north.

Occasionally noise problems arise due to low cloud cover and undesirable wind directions. Blasting has therefore been limited to the period 9 am to 4 pm, with no more than two primary blasts being carried out each week.

PLANT NOISE

In Section 3 it was established that future operations will take place along a working face moving in a north-westerly direction. This will ensure that noise from blasting is reflected back to the ocean and not to Shellharbour

and that the maximum permissible noise levels will be located considerably closer to the lease boundary.

The processing plant generates sound waves by the steady operation of crushers, screen elevators, conveyors and vibrators. Further noise is generated by loading and transport of basalt to crushers.

Drawing 3 shows existing noise contours recorded when both primary and secondary crushers were operating in June, 1977. Although noise levels outside the lease area are low, they reflect only the general background level.

A level of 47 dB(A) was recorded at the first house along the tourist road from Bass Point to Shellharbour. This level was higher than near Shellharbour swamp, which indicates that noise from Bass Point quarry operations does not reach the outskirts of the town.

Plant noise levels of 50 dB(A) along the tourist road adjacent to the eastern boundary are acceptable, especially when the background noise of the surf is often above 50 dB(A). The plant, being in a fixed position, will continue to generate these low levels.

4.3 WATER POLLUTION

The conditions of consent require that any runoff water flowing to the quarry from outside the lease be diverted around the boundary.

The only potential source of water pollution which requires consideration therefore, is from runoff originating within the lease area. As a result, a silt trap has been provided to the south of Bass Point Reserve to prevent water runoff discharging to the ocean.

The State Pollution Control Commission requires that in any new plant, the runoff from the first ten minutes of a one in one year Recurrence Interval storm be retained within the lease area.

It is proposed to contain water runoff by providing a sedimentation and runoff control pond within the excavated area. This pond is illustrated later in Drawing 6 "Proposals". It has an area of 2.2 hectares with a depth averaging between 0.5 and 1.0 metres.

Initially, water is intended to gravitate to a settling pond where inert and suspended solids settle. Water would then overflow to a second pond at a lower level, from which clarified water could be pumped back and recycled within the plant for dust suppression and watering vegetation. The clarified water will have a suspended solids loading of less than the maximum allowable level of 50 parts per million, and excess treated water will be discharged periodically to the ocean.

4.4 DUST EMISSION

In normal circumstances, dust does not constitute a problem in quarry operations, however, in the past some complaints have been made. This has usually occurred during unusual weather conditions, where on-shore winds have blown dust inland or a heavy cloud cover has confined dust laiden air.

Also in the past, dusty trucking operations have caused complaints. However, since the access road from Jamberoo Road has been sealed, few complaints have been received.

Flood lighting used for controlling the stockpiling of aggregate from conveyors at night has aroused some concern from local residents. The effect seen is, however, only illusionary and is caused by light on falling aggregate.

Measures taken by the Company to suppress dust include constant use of water cart to settle dust on all haul roads, dampening dust during crushing, and use of water sprays to dampen aggregate prior to trucking to local markets. Aggregate is watered after primary, and again after secondary crushing, which is sufficient to ensure that dust is kept down during the whole of screening and stockpiling operations until transportation by ship.

Crushers have been designed to ensure that dust is reduced to a minimum. Dust arrestors have been placed over hoppers, where crushing and screening is carried out; roofs have been placed over conveyors and a specially designed hood is provided at the end of the jetty conveyor to ensure that little dust occurs during ship loading operations.

Generally, particulate matter in the atmosphere outside the quarry is not in excess of the allowable limit of 0.4 grams per cubic metre and it is considered that the existing methods of dust control are adequate and conform to the requirements of the State Pollution Control Commission by the best practical means.

4.5 VISUAL IMPACT

Open cut quarry operations present a visual problem in a soft agricultural landscape setting. The shape, colour and texture of operations are generally in discord with the character of the surrounding environment.

The impact of quarrying can be modified by giving proper thought initially to the location of mining operations, and to the method of quarrying. Both techniques have the effect of screening potential viewers by distance and screening devices such as landform and vegetation.

To assess the visual impact of quarrying operations at Bass Point an analysis was carried out of the Bass Point Peninsula within the surrounding region which comprised:-

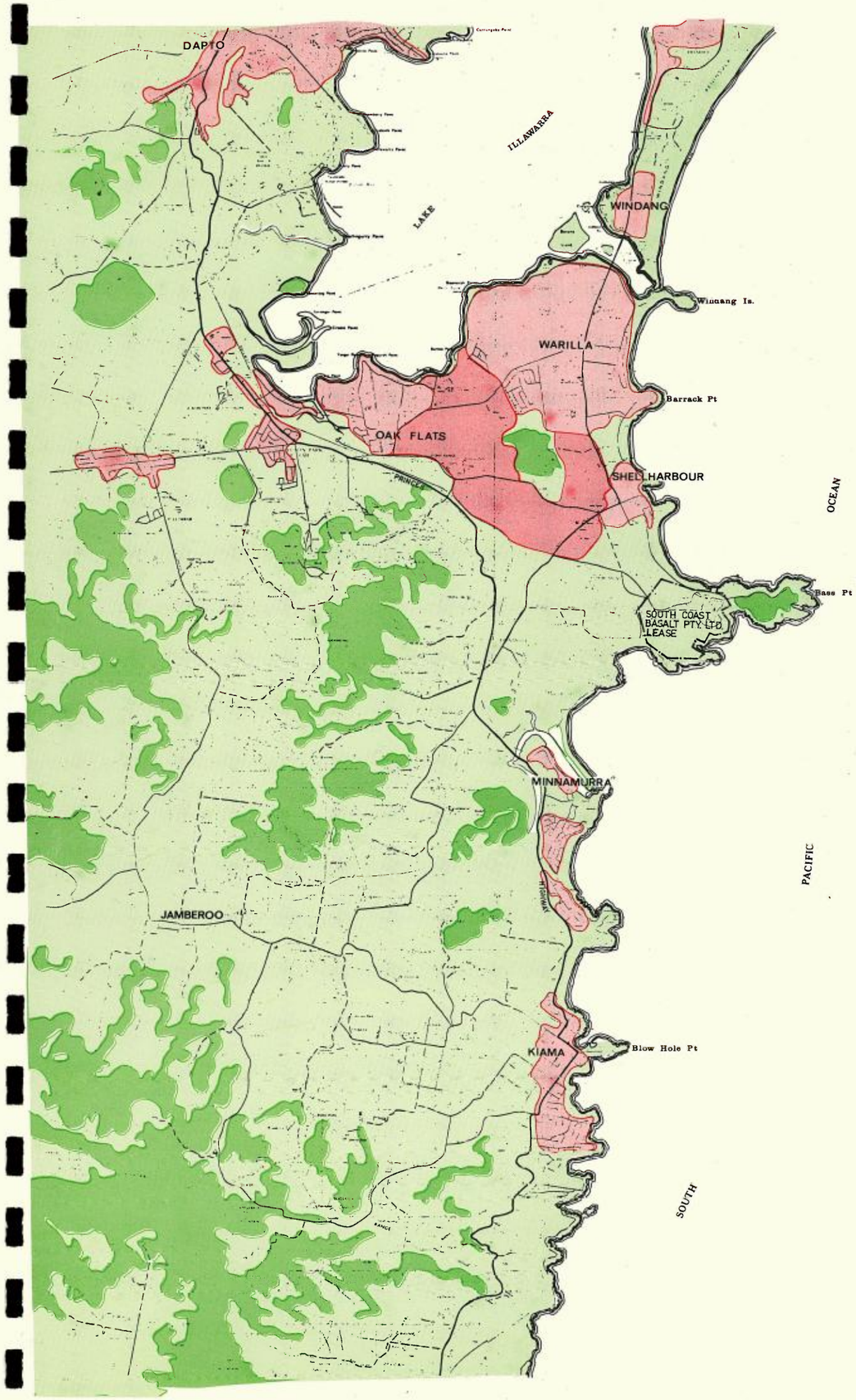
1. assessing the landscape patterns into which the quarry must be assimilated, and

2. assessing viewing areas of the quarry.

LANDSCAPE PATTERN

To determine the impact of existing mining, proposed mining, and develop restoration techniques, the Region was assessed for its values of landscape patterns and texture.

The Illawarra Region around Shellharbour is characterised by a landscape pattern of ocean, cleared grazing land, vegetation clumps, forests and urban areas. The coastline forms a dramatic edge between the ocean and land patterns, and is a unique and dramatic landscape for seaside land areas. This is shown in Drawing 4 "Landscape Patterns".



Open grasslands
Vegetation cover
Existing Urban development
Proposed Urban development (Shellharbour)

4 LANDSCAPE PATTERNS

0 1 2 3 4 5km

Both the town of Shellharbour and Bass Point are elements of unique value within this pattern. Shellharbour is an interesting composition of townscape. Its hill location beside the water is enhanced by a strong grouping of exotic trees surmounted by the spire of St Pauls Anglican Church. Its water edge is delineated by a strong planting of Norfolk Island Pines.

Bass Point Peninsula is the largest and most prominent headland along the south coast between Wollongong and Kiama. When seen from Shellharbour, the peninsula is an integral part of the town's setting. It defines the harbour and is an important part of the landscape background to the town. Its vegetation cover places it within the grassland and shrubland pattern of the Region.

The areas of Bass Point Peninsula, potentially able to be mined as an extension to existing quarrying operations, are important components of the following local landscape/townscape compositions: views from Minnamurra, Shellharbour Beach as a backdrop to the town of Shellharbour, and views from Bass Point Roads.

The present grassland and low shrub cover make Bass Point an integral and harmonious part of the local landscape pattern. Proposals for changing this scene require consideration to be given to the landform value of the peninsula, the vegetation pattern of the Region and the unique townscape setting of Shellharbour.

VISUAL ANALYSIS

A detailed site survey of the Region determined the viewshed, or area from which every possible view point of the peninsula could be plotted. Regionally this extends from 12 km in the north to 14 km in the south and as far west as 11 km. Views from the water of the eastern side within a radius of 4 km were also considered. (See Drawing 5 "Regional View Analysis".)

Many ridges and ranges form large, contained valleys which are typical of the landform within the designated viewshed. Also, areas quite close to each other are often visually screened.

High elevations to the south and west provide spectacular panoramas over extensive areas of the Illawarra coast. Bass Point Peninsula is potentially able to be seen from many vantage points, but its actual viewshed is limited to several relatively smaller patches within the Region. These have been plotted on Drawing 5 and a value rating of 1, 2 and 3 adopted to give these areas a ranking of visual significance.

Value 3 - Least Significant Views. These are areas from which the Bass Point Peninsula is just visible and any quarrying operations will not affect views. A typical view is shown in Plate 5.

Value 2 - Less Significant Views. In these areas, Bass Point Peninsula is visible and is an important part of the view however, quarrying operations will not affect views. Plate 5 shows a typical view.

Value 1 - Significant Views. These are areas which are close to Bass Point Peninsula and from which the Peninsula or part of it is the major element in the landscape composition. Any alteration to the landform by quarrying operations which is able to be seen from within these areas has been studied in detail. Typical views are depicted in Plates 1-4.

Five areas have been assigned this value:-

1. Minnamurra Township - Minnamurra is an attractive town with a high quality of visual amenity in its outward views over coastal landforms to the cliffs and the steep slopes of Bass Point Peninsula. The cliffs contain a small bay with the Minnamurra River estuary, large sand bar, beaches and mangroves as elements forming this view. This area comprises natural reserves and high quality residential land. The Bass Point Peninsula forms the background containing a horizon line to views across the bay, and is a very significant and important part of the view amenity of Minnamurra. This is shown in Plate 1.

2. Shellharbour Township - The town of Shellharbour is located on a knoll, over which a grid pattern of streets has been laid. The town thus gains its landscape view amenity from straight streets terminating to the east in the waters of the South Pacific Ocean or in the nearby open spaces of surrounding hills. The Western Hill of the Peninsula is an important terminating view to north-south streets of the town, particularly Mary Street and Wentworth Street. The hill face is also exposed to view from open space, south of the town, particularly from Fuller Park Oval and is shown in Plate 2. This hill face is both an important element in the townscape of Shellharbour and a screening device to present quarry operations.

SIGNIFICANT VIEWS (VALUE 1)
Quarry operations potentially affect visual amenity.

LESS SIGNIFICANT VIEWS (VALUE 2)
Bass Point Peninsula visible and important part of view but any quarrying operations will not affect views.

LEAST SIGNIFICANT VIEWS (VALUE 3)
Bass Point Peninsula just visible but any quarrying operations will not affect views.

5 REGIONAL VIEW ANALYSIS

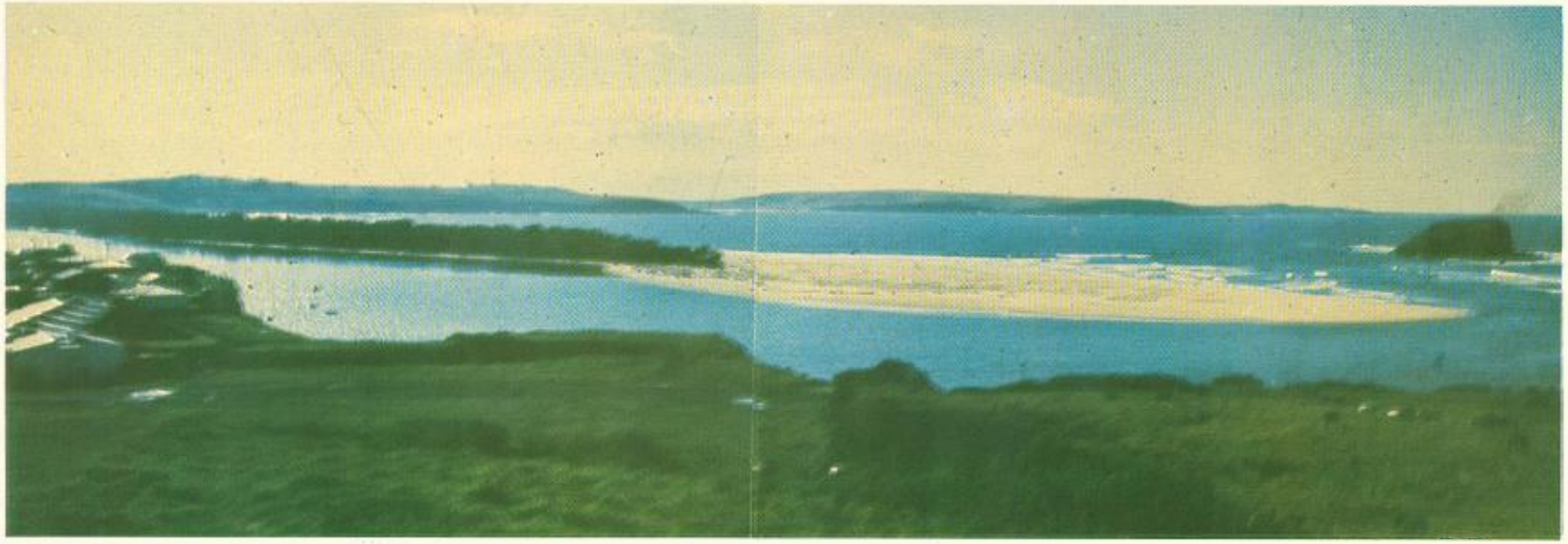
0 1 2 3 4 5 km

3. Shellharbour Beach - Bass Point Peninsula is also seen from Shellharbour Beach, and from this location, stockpiles of aggregate, conveyor belt machinery and jetty are all noticeable. These are depicted in Plate 3. However, the scale of these elements in contrast to the water and enclosing landform scale, is such that these quarry elements do not intrude significantly on the view, and the open cut of quarry operations, themselves, are not able to be seen from this point.

4. Barrack Point - Looking south from Barrack Point, the Bass Point Peninsula is a prominent part of the view. The stockpiles and loading machinery are readily visible. However, the 4 km distance and the large expanse of water diminishes any impact that these elements might have. Therefore, this is not considered to be a significant view as any alternatives brought about by quarry operations would have little effect. Views are shown in Plate 3.

5. Tourist Road - The road linking Shellharbour and the Bass Point Reserve brings the viewer in close contact with the quarrying operations, conveyor systems, buildings, entrance gateway and other miscellaneous objects. From this area, the most adverse visual aspects of the quarry are experienced and are shown in Plate 4.

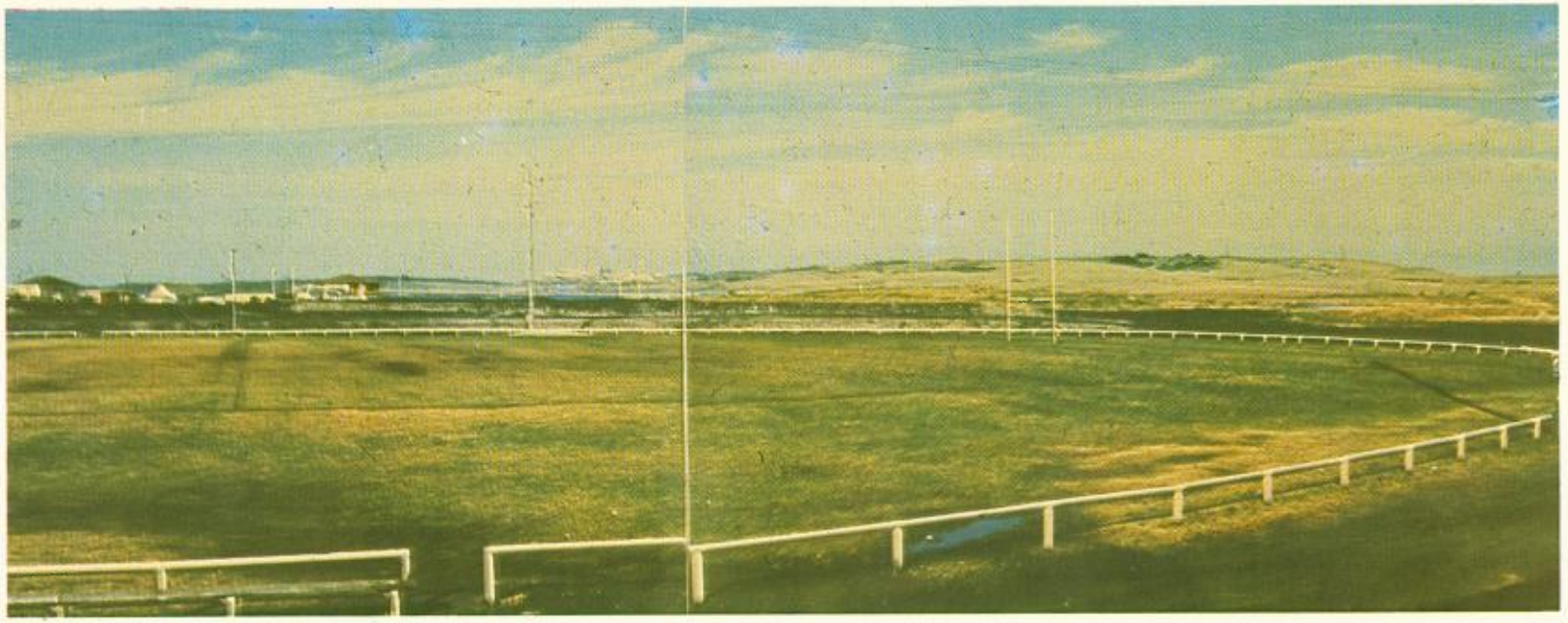
Close views of the Peninsula from the water do not reveal quarry operations. The water is such a strong foreground element that the surrounding landforms become less important than similar distance views on land. More distant water views place the Peninsula against a backdrop of the Illawarra Escarpment and negate its visual importance.



Value Rating 1 – View from Carson Place, Minnamurra. (View 1)

PLATE 1 – VIEW FROM MINNAMURRA

Value Rating 1 — View from Mary Street, Shellharbour. (View 2)

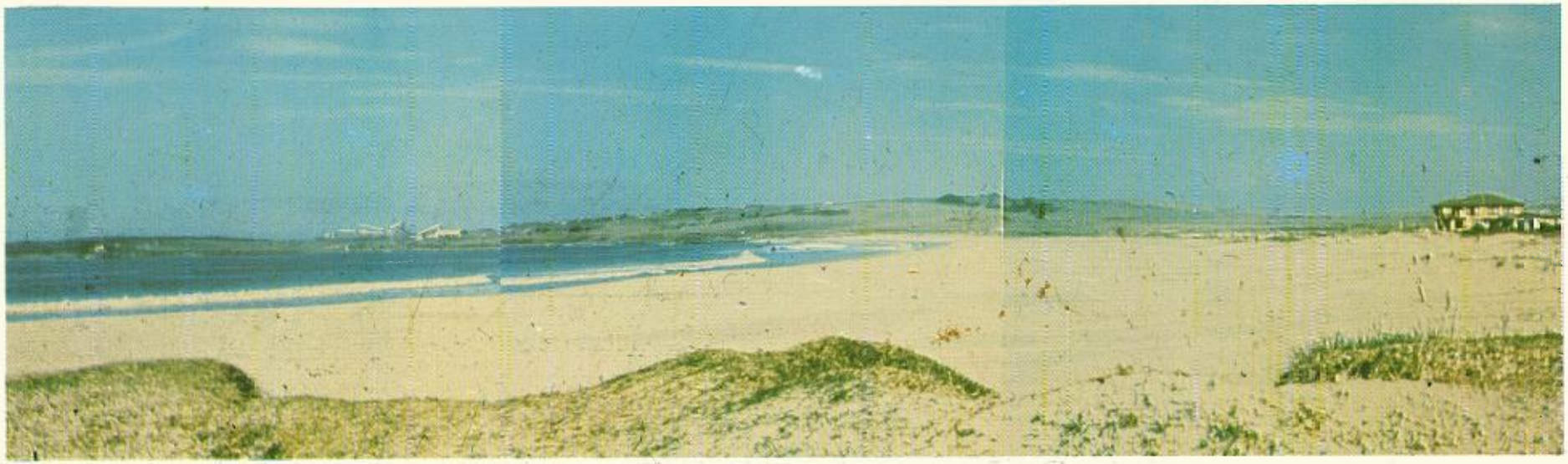


Value Rating 1 — View from Fuller Park Oval, Shellharbour. (View 2)

PLATE 2

VIEWS FROM SHELLHARBOUR TOWNSHIP

Value Rating 1 – View from Barrack Point: This shows unique townscape/landscape qualities of the town of Shellharbour.



Value Rating 1 – View from Shellharbour Beach showing Eastern Hill as significant.

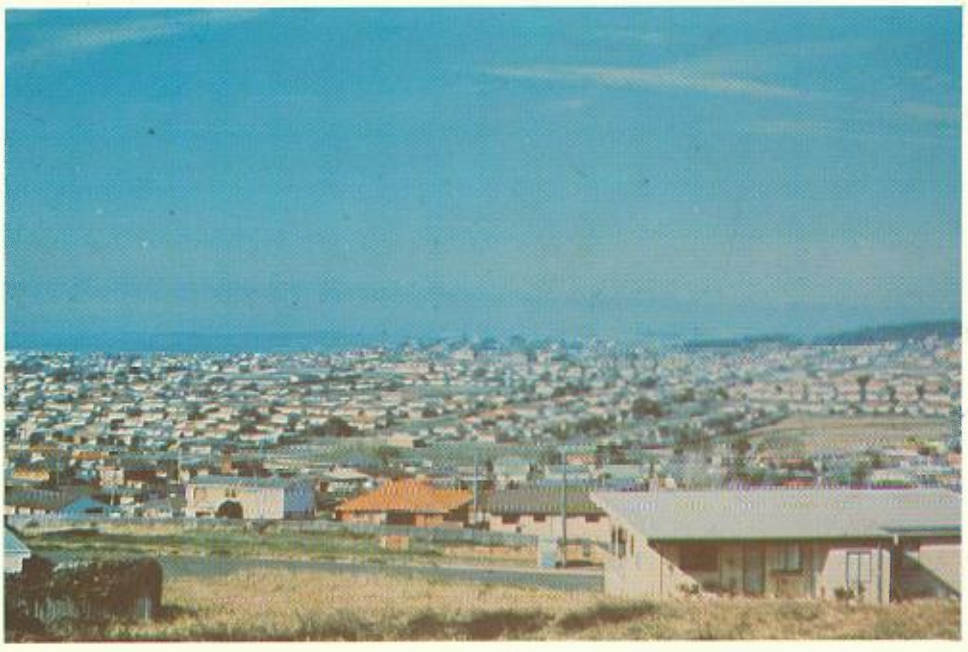
PLATE 3 – VIEW FROM SHELLHARBOUR BEACH AND BARRACK POINT

Value Rating 1 — View from Bass Point Reserve.

Value Rating 1 — View from Road to Frazer's Cottage.

PLATE 4

VIEWS FROM TOURIST ROADS AROUND BASS POINT



Example of Value Rating 2.
View from north-west of Shellharbour.
Bass Point can just be seen and any change is negligable.

Example of Value Rating 3.
View from Saddle Back Road, south of Kiama.
Bass Point is just able to be seen and any change is not noticeable.

PLATE 5 – EXAMPLE OF VALUE RATINGS 2 AND 3.

4.6 SUMMARY

The problems of both blasting and plant noise associated with the quarrying of Bass Point have been assessed. Noise from blasting is limited to normal working hours and occurs no more than twice weekly. Readings taken at the quarry are below prescribed levels, and projections of blasting and vibration levels from the lease boundary closest to Shellharbour township indicate that these levels would not reach existing or future urban areas.

Water pollution can originate from run-off within the lease area and a silt trap has been provided to prevent polluted discharge to the ocean. As quarrying proceeds, a larger sedimentation and runoff control pond is proposed to clarify water to prescribed levels before ocean discharge.

Dust emission occurs from all aspects of quarry operations, particularly trucking, screening and stockpiling. The Company has taken a number of measures to suppress dust and these include use of water sprays, carts and specially designed covers and hoods. Generally, particulate matter in the atmosphere outside the quarry does not exceed the prescribed limit and measures to control dust emission are adequate and conform to State Pollution Control Commission requirements.

During the operational life of the quarry, it is essential that a buffer zone be established around the leased area to protect future land owners and allow the company to have a greater degree of flexibility in operations.

Within the buffer area, any air or noise pollution could be contained, with the land reserved for agriculture, recreation or other non-urban uses.

The visual impact of the quarry is considered the most important of the environmental factors and of the five areas considered to have significant views of the Bass Point Quarry, Minnamurra Township, Shellharbour Township and the Tourist Road are likely to experience adverse effects from quarry operations. Views from these areas require careful consideration in determining future development within the lease area.

5. PROPOSALS

5.1 GENERAL

The previous Sections have identified that quarrying of basalt at Bass Point is firmly established and is necessary for the future needs of the Sydney and Illawarra Regions. Bass Point peninsula is, however, an important visual feature in the Region and quarry operations are likely to be particularly apparent from the populated areas of Minnamurra and Shellharbour. Proposals for development of the quarry should therefore seek to be as least visually obtrusive as possible from these areas. Any problems resulting from noise, air and water pollution are controlled by regulation and these are discussed in Section 4.

The policy for the future development of the quarry can now be grouped under the following headings:-

Operations
Preservation of Views
Restoration
Staging
Future Use After Quarrying

5.2 OPERATIONS

Quarrying operations described in Section 3 are carried out in accordance with the requirements of the various responsible authorities and, in general, these existing procedures will continue in future.

The six million tonnes of material which has been excavated from the lease area since the Company commenced operations included approximately 700,000 tonnes of overburden material. The overburden layer for the future area to be quarried is thin and it is anticipated that approximately only 10% of excavated material will be used for backfilling and restoration work. This material can be stockpiled and used progressively over the years to restore areas where quarrying has been completed.

SOUTH

PACIFIC

OCEAN

Shellharbour Beach

Elevation (figure 4)

View 2 from Shellharbour

"Sunny Vale"

Section

BASS POINT

BASS POINT RESERVE

7

6

2

1

preserved swamp

5

proposed settling pond

3

4

(figure 4)

"Frozen Cottage"

Killalea Beach

1 Proposed stages 1 to 7 for quarrying and restoration

Quarry floor restoration
Proposed regrading and revegetation

Quarry face restoration
Proposed revegetation

Proposed planting

6 PROPOSALS

0 100 200 300 400 500m

In future operations, the quarry excavation will be deeper and an orderly face will be maintained to ensure a clean quarry floor. The working face will be excavated as shown in Drawing 6 and figures 3 and 4 in Section 5.4 of this report.

With the face towards the sea the blast from the explosives is directed away from the urban areas of Shellharbour and this action will therefore minimise any nuisance from noise.

The existing crushing and screening plant will be maintained in its present position and haul roads will be constructed to the quarry face as required.

The increased runoff from the quarry workings will require the construction of stormwater sedimentation and runoff control ponds. Drawing 6 shows the location of proposed structures and this method will be adopted for stormwater runoff from the future quarry areas. The slope of the quarry floor will be from the limits of quarrying to a sedimentation pond draining to the ocean.

The location of quarry operations adjoining the ocean and away from natural watercourses and urban development ensures minimal environmental impact from water pollution.

The transport of material from the quarry will continue to be by ship from the existing loading facilities. The advantages of this method from an environmental viewpoint are clear and the location of the quarry on the foreshores has enabled movement of material without impact on urban areas by conventional trucking or rail transport.

5.3 PRESERVATION OF VIEWS

It is considered that any continued quarrying operations should preserve the integrity of those views discussed in Section 4.5 which have a value rating of 1.

The lease proposal of quarrying to R.L. 15 metres does not attempt to preserve these views. It will allow the reduction of the whole of the lease site to a flat plain, remove the hill face as backdrop to

Shellharbour and significantly reduce the height of the cliffs seen from Minnamurra. The combined impact of this process will adversely affect the landscape amenity of the Bass Point Peninsula and the value of critical views towards it.

Preservation of important views can be achieved by not exposing any more of the operations to view, other than that able to be seen at present. By maintaining, or minimally altering the ridgelines of hills, cliffs and hill faces within the lease boundary, it is possible to achieve a screening crater around the operations.

To maximise the extraction of available basalt, a series of trial and error calculations of sight lines and volumes were made to define an extreme limit of operations which would not adversely affect views.

Extraction of basalt to this limit will create a quarry with a screening crater wall to conceal all quarry operations over the anticipated 40 to 50 years of production. In order to maintain the crater and produce an equivalent required quantity of material available within the lease area extraction to R.L. 7.5 metres is required. Apart from the existing quarried areas this is 7.5 metres below the level set out in the Conditions of Approval. (Levels are shown in figure 4 Section 5.4 of this report).

The quantities calculated were:-

1. Excavation to R.L. 15 metres over the total lease area - 72 million tonnes.

2. Excavation to R.L. 15 metres over portion of lease area with the retention of a crater and preservation of views - 54 million tonnes.

3. Volume of the crater is therefore 72-54 = 18 million tonnes.

4. Excavation to R.L. 7.5 metres over portion of the lease in 2 above - 70 million tonnes.

Approximately 10% of these quantities are unsuitable for aggregate. Unsuitable material comprises topsoil and weathered or breccia material which is suitable only for backfilling.

Views 1 from Minnumurra and 2 from Shellharbour were used as the critical views. Both of these have been rated as significant, and have permanent populations of people constantly experiencing views towards the quarry. (The impact of other rated areas are discussed below.)

The proposed new ridgeline is well within the limits of the lease area, but in most cases will present a new skyline profile, reducing the existing natural skyline by up to 20 metres.

View 1: From Minnumarra the view of the hill to be quarried is approximately 50 metres comprising a 25 metre cliff topped with a further 25 metres of steep grassed slope set against the ocean waters. On the southern side of the lease, the extent of quarrying varies and will be up to 100 metres in from the lease boundary. Quarrying will effectively reduce the height of grassed slopes to an almost constant 30 metre height above sea level.

However, it was felt that the scale of cliffs seen 4.5 kilometres away and from Minnamurra will diminish the effect of the 20 metre height reduction, and will produce a negligible perceived change to the value and amenity of this strategic view. This view is shown in Plate 1.

View 2: From Shellharbour, the north-west flank of the Eastern Hill is prominent in views outward from the town. Quarrying to the proposed limits of excavation will reduce the height of this hill from 50 metres to 40 metres above sea level. However, like Minnamurra it was felt that both the distance and scale of this view do not markedly detract from its contribution to the local landscape. Maintaining most of the hill face as the outside of the crater will screen all quarrying operations from Shellharbour views. (See Plate 2 and figure 4 in Section 5.4.)

Other areas with significance rating 1 are, the view from the Bass Point Reserve looking towards the Western Hill and from Shellharbour Beach area. It was felt that neither of these areas have the importance associated with Views 1 and 2, because they are uninhabited, and farmers and tourists experience only occasionally views towards the quarry. However, the proposed crater will still greatly protect the view amenity of all these areas with only a slight variation perceived in skyline profile.

Bass Point Reserve, Shellharbour Beach and the road connecting the two have the special problem of bringing the public into close visual contact with the quarry. From the entrace area, the composition of conveyors and stockpile mounds make a dramatic and exciting composition. To minimise any adverse effects at this close range, a planting programme is recommended in two broad locations:-

1. The area from the northern lease boundary to Shellharbour Beach.
2. The area from the western hill face of the proposed quarry to that part of the north-western boundary of the lease, facing Shellharbour.

The first area is at present infested with rank grass and weeds, the ground is pitted, has some old concrete footings and is used periodically as a rubbish dump. Inappropriate planting around the entrance gate as well as the poor condition of the gate all contribute to an unsightly and rundown effect. Regrading, rationalising recent screen planting and undertaking a larger planting programme will give this area a more presentable appearance, and provide a softer foreground to conveyors and stockpiles.

The second of these areas is the important preserved hill face to Shellharbour. Planting in this location will have two functions. It will add to screeningeffects by softening the eventual ridgeline, and will visually tie with planting proposed above and with that existing on Bass Point Reserve.

5.4 RESTORATION

Restoration is proposed for worked sections of the leased area and immediate environs. Both require short and long term implementation programmes to achieve desired softening, screening and erosion control objectives.

Outside the lease boundaries, the area between the fence and the beach has been designated for restoration work. This land is available immediately for attention and it is recommended that the area be regraded, and planting undertaken to achieve a native seaside plant association similar to that existing further east along the peninsula. A plant community association, consisting of dominant Banksia, Casuarina, Leptospermum, Westringias Spp etc., should be established. These plants are native to the area, do well in these severe conditions of wind and salt spray, and blend harmoniously in character with the existing landscape. A list of recommended plant species is contained in Appendix D.

Performing an equivalent function and using similar plant material, the north-western face of the Eastern Hill (within the lease boundary) is recommended to be planted in the short term. This will add a desirable vegetation backdrop to the amenity of Shellharbour and in the longer term, when quarrying operations are extended to the ridgeline, the effect of a change in skyline will be minimal.

Condition 10 of Council's approval set out in Appendix A stipulates planting of Norfolk Island pines at 40 foot centres along boundaries. It is considered that these trees will provide minimal screening effect to the quarry and that their presence will detract from the present close association that this species has with the unique townscape qualities of Shellharbour. Norfolk Island pines are not therefore recommended. However, a planting scheme of low native shrubbery is suggested instead of implementation of Condition 10.

The inside of the crater wall will need to be treated to bring it to an acceptable level of safety and landscape amenity, It is proposed that walls be fractured to produce a stable slope of $1\frac{1}{2}$:1 and this be vegetated by spray techniques to establish a stable cover of grass, shrubs and trees (See figure 3).

The floor of the quarry needs to be graded to facilitate site drainage. It is recommended that this be carried out at a 0.5 percent fall towards the south-east corner. This will enable overland flow to pass to a sedimentation basin, with excess water passing through a rip-rap embankment wall to the sea. Overburden can be used to provide a suitable soil base for establishment of vegetation. Spray techniques are again recommended, mainly for stabilisation.

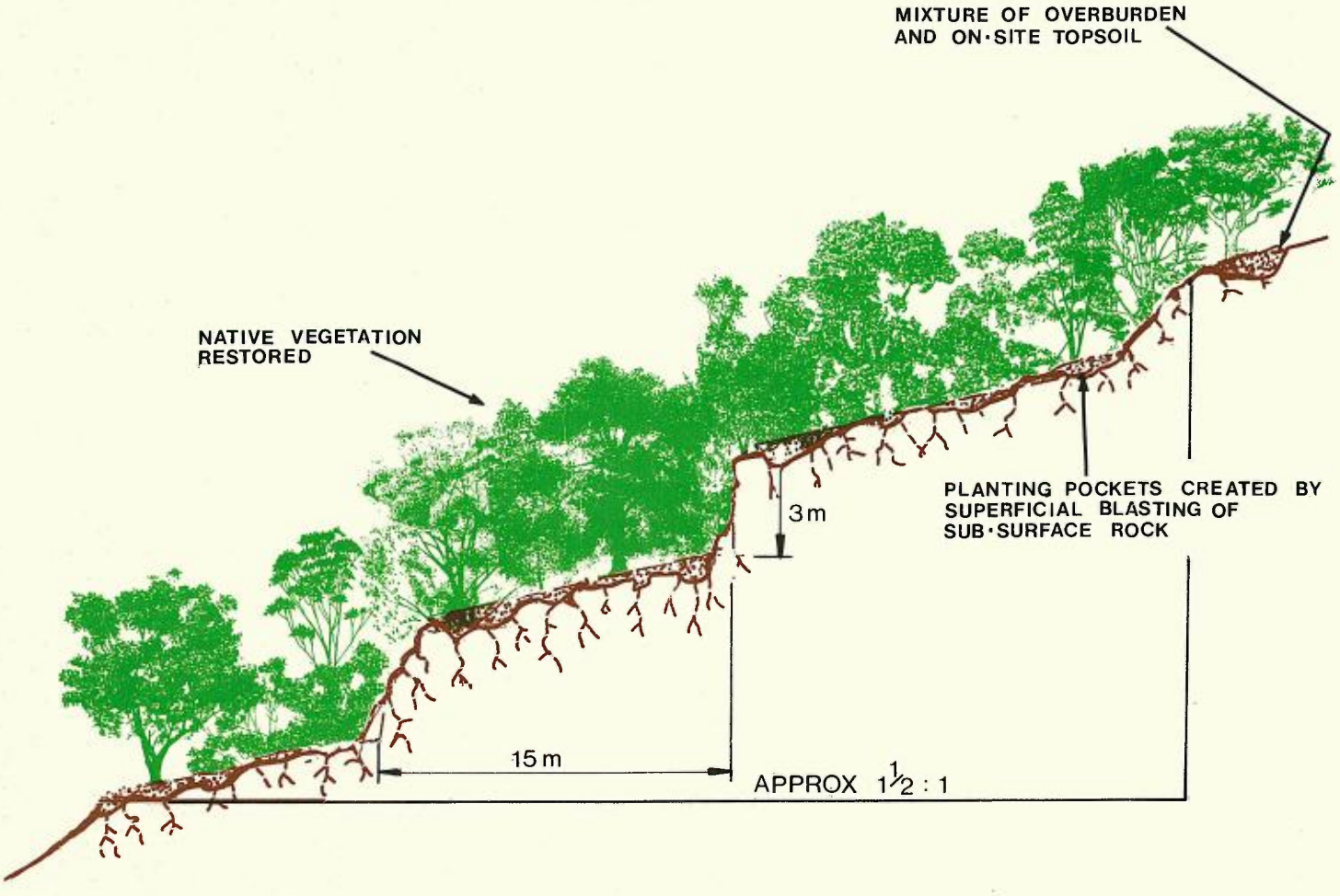


FIGURE 3
SUGGESTED METHOD OF QUARRY FACE RESTORATION

The restored conditions of both quarry wall and floor will allow vegetation of natural species to take place. The crater wall will give some wind protection to provide a more satisfacotry environment for plant growth (See figure 4).

When quarrying operations are completed, minimal evidence of operations will be evident from critical view points surrounding the site. The quarry itself will be vegetated with shrubs and trees of species found at Bass Point Reserve, and any quarry walls observed will have a pleasant weathered appearance similar to that found in other old worked out areas in the Illawarra Region.

5.5 STAGING

The staging of excavations could have significant impact on the visual appearance of the site. The retention of a crater wall around quarrying operation will avoid visual problems of working faces being exposed to view. Therefore, the retention of the crater is desirable to enable staging operations to be independent of visual issues.

The proposed staging is shown on Drawing 6 and is the logical sequence of quarrying the area from the existing face to the recommended limit of operations.

The existing quarry in Stage 1 will be reworked by further excavation to final floor levels and then Stages 2, 3 and 4 will be worked to form a continuous easterly face.

Stages 5 and 6 will be excavated towards the west and north with working faces towards the ocean.

The final Stage 7 would be the removal of plant and machinery and the regrading of this area.

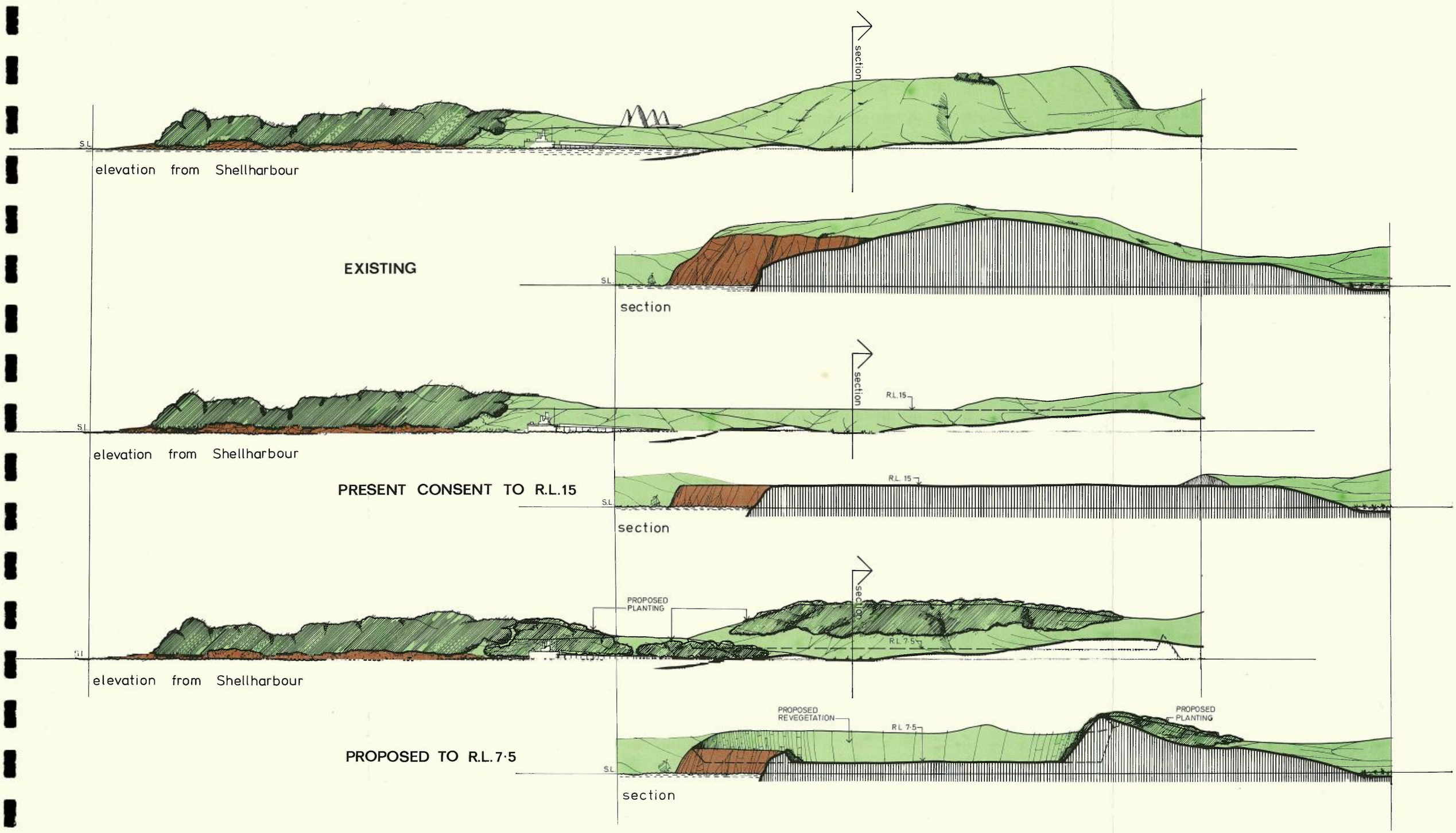


FIGURE 4
QUARRYING ALTERNATIVES

0 20 40 60 80 100 120 m VERTICAL
0 100 200 300 400 500m HORIZONTAL

5.6 FUTURE USE AFTER QUARRYING

Various Governmental reports discussed earlier in Section 1 draw attention to the importance given to Bass Point Quarry within a regional context. This viewpoint arises particularly from the desire to conserve the Illawarra Coastline and take account of local growth pressures for additional Public Open Space. This will soon become evident with the development of the Housing Commission's large project at Shellharbour. In the N.S.W. Planning and Environment Commission's "Shellharbour Structure Plan", a large area, encompassing the quarry site is designated "Special Environmental Area".

The importance of basalt to the Sydney market is outlined in the 1971 and 1977 Geological Survey Reports and, if present trends continue, the quarry would have an expected life of 50 years. After quarrying however, possible long-term uses suitable for the site are industry, commerce, housing and recreation or various combinations.

The lease arrangement between I.C.I. Australia Ltd. and South Coast Basalt Pty. Ltd. have foreshadowed a desire by the owner to use the site for industrial purposes. This approach does not now seem likely having regard to problems of traffic, noise, air pollution and the views of Council, N.S.W. Planning and Environment Commission and the National Trust of Australia (N.S.W.).

Use of the site for commercial or residential purposes is, however, a possibility. Exceptional views from the site and the shortage of land for private urban development in the locality could justify the conversion of the quarry to sites suitable for urban purposes. A similar scheme has been applied to the site of a limestone quarry at Edgewater, one of Perth's northern suburbs, where roads have been designed around the quarry faces to enable home owners to enjoy fine water views.

The most likely activity possible for the site is recreation. Rehabilitation of the site during mining would enable it to be used in the future for major playing fields, a car racing circuit and

similar active recreational pursuits. A further proposal to develop the site with a small boat marina would be possible, however this could only take place if certain sections of the quarry were mined to 10 metres below sea level during the later stages of quarrying.

Extension of Bass Point Reserve to include the quarry is advocated by the National Trust of Australia (N.S.W.). However, a disused quarry, rehabilitated with limited vegetation may not prove as useful as a well-frequented recreation area within the Region.

The quarrying and restoration programmes proposed in this study have considered the long-term future of the site. These programmes must allow for removal of visually obtrusive site equipment after quarrying has ceased. Landscape restoration of quarry faces and the floor will provide an area suitable for future use.

5.7 CONCLUSIONS AND RECOMMENDATIONS

Bass Point has a history of quarrying extending from 1880. However it was not until 1970 that operations commenced by South Coast Basalt Pty Ltd under a 50 year lease from the owner, I.C.I. Australia Limited. Quarrying at Bass Point is now firmly established and the extraction of basalt is considered necessary to serve the needs of the Sydney and Illawarra Regions.

However, activities associated with quarrying are noisy and can cause problems of air and water pollution and visual impact. At Bass Point these environmental problems have been investigated and it has been concluded that if quarrying proceeds in terms of the present conditions of approval, there is likely to be significant visual impact, particularly on the towns of Minnamurra and Shellharbour. This impact can be minimised and proposals are put forward in Section 5.3. A number of proposals for restoration of the quarry now and into the future are suggested in Section 5.4.

To implement these proposals, amendments to the Condition of Consent set out in Appendix A and Appendix C will be required. It is therefore recommended that the Company take action to amend the following conditions:-

(1) Condition 10 set out in Appendix A regarding the planting of Norfolk Island Pines.

(2) Condition 4 set out in Appendix C regarding backfilling to R.L. 15 metres (50 feet).

The recommended new conditions are:-

(1) Planting areas outlined in Drawing 6 to be implemented by the Company in conjunction with Shellharbour Municipal Council with the use of plant species listed in Appendix D.

(2) Quarry operations to be restricted to the area outlined in Drawing 6, with quarry floor finished surface levels not less than R.L. 7.5 m as shown diagrammatically in figure 4. Restoration to be generally in accordance with the profile shown in Figure 3.

APPENDICES

APPENDIX A

CONDITIONS OF APPROVAL FOR BASALT QUARRY

The Development Application granted by Shellharbour Municipal Council in August, 1968 to Imperial Chemical Industries of Australia and New Zealand Ltd. for permission to operate a basalt quarry and ancillary and other purposes at Bass Point is subject ot the following conditions:-

1. SEPARATE BUILDING APPROVAL

That it is acknowledged that the permission of Council as above recited is not a permission under Part XI of the Local Government Act and that no structure within the meaning of the said Part XI shall be placed upon the land or any part thereof unless and until the approval of the Council has been obtained thereto beforehand in accordance with the usual requirements of the said Part XI.

2. AMENITY OF THE AREA

That the Company will not at any time conduct its operations on the said land or any part thereof in such a manner as to injure or to interfere with the amenity of the neighbourhood.

3. AIR POLLUTION CONTROL

That the Company will not carry out any work in connection with the development until approval from the Under Secretary of the Department of Public Health is obtained in accordance with Section 16 of the Clean Air Act.

4. LICENCE UNDER THE CLEAN AIR ACT

The the premises will be licensed as required under Part III of the Clean Air Act,

5. COMPLIANCE WITH REQUIREMENTS

That the Company shall not carry out the development except in accordance with:-

(a) Any approval conditions imposed by the Under Secretary of the Department of Public Health pursuant to Section 16 of the Clean Air Act.

(b) Any approval conditions imposed by Council under Part XI of the Local Government Act.

(c) Any approval and conditions of approval of any Licence granted under Part XII of the Clean Air Act.

(d) The conformity with the requirements of all Acts, Regulations, By-Laws and Ordinances and other Statutes relating to the Development and in particular the Local Government Act and Ordinances thereunder.

(c) In such a manner as not to create nuisance by vibrations, noise or omission of air impurities,

6. WASTE MATERIAL

That the Company will not conduct the development in such a way as to pollute any water, watercourse or stream. All wastes from the development will not be disposed of in any way likely to create a nuisance or danger to health or in any manner other than that approved by Council.

7. THAT all machinery installed and/or operated by the Company on the said land shall be so designed and constructed as to create a minimum of noise arising therefrom.

8. THAT the Company will not conduct blasting operations on the said lands or any part thereof in such a manner as to cause damage to houses or other improvements on adjoining or adjacent lands.

9. BLASTING

That the Company will not conduct blasting operations except in accordance with the requirements of the Mines Department and in such a manner as not to create any nuisance by way of noise, vibration or dust.

10. SCAR

That the Company will take reasonable steps to minimise the effect of any scar which may be created on the said lands or any part thereof and in particular that the Company will plant and grow and maintain and from time to time when necessary replant three rows, each row 40 feet apart, of trees Araucariaexcolsa (Norfold Island Pine), each tree 40 feet apart. Such rows of trees to extend along the boundaries of the area to be quarried.

11. CEASING CONDITIONS

That if the Company shall cease operations upon the said lands and shall leave therein machinery, plant and/or equipment and material, which is or may be a hazard or eyesore and the Company shall fail to remove all or any such machinery, plant and/or equipment and material within a period of six months from the date of cossation of the Company's operations on the said lands and if at the time of ceasing operations the levelling of the site as described in the Interim Development Application has not been completed and the rock faces benched and covered with creepers, the Council shall be at liberty and is expressly empowered and authorised (but only after the expiration of three months notice in writing to the Company of its intention so to do, and subject to all rights of the Company to sell, remove or otherwise dispose of all or any of such machinery, plant and/or equipment and material within such period of three months) to enter upon the said lands and to remove and/or destroy any such machinery, plant and/or equipment and to convert the same to its own use and/or to dispose of same and to carry out any work to remove any material necessary to minimise any unsightly scar and to restore the area as far as is possible to its natural state and to recover as a liquidated debt any not expense to which the Council may be put in/or about the carrying out of its powers hereunder. In this clause the Company shall not be deemed to have ceased operations if it can be shown that operations have been suspended for a reasonable time for any purpose of the Company and the Company is able to supply reasonable evidence to recommence operations within a reasonable time under the circumstances.

12. JETTY

The Company will submit full details and obtain the approval of Council of the jetty and overhead conveyor before construction commences.

13. THAT it is agreed and acknowledged that the permission granted by the Council as above recited and set forth relation to the use of the said lands for the purpose of a basalt quarry as hereinbefore set forth and that the use of the said lands or any part thereof for any other purpose including any ancillary purpose (excepting always any one or more of the "associated activities" hereinbefore mentioned) shall be subject to the consent of the Council under Part XIIA of the Act as well as under Part XII of the Act.

14. LEVELLING

All land used for the development will be levelled according to Council's reasonable requirements in the manner proposed in the Annexure "A"* to the Company's development application.

* Annexure A refers the reasons in support of the development application by I.C.E. of A & NZ dated 3rd November, 1967.

APPENDIX B

CONDITIONS OF APPROVAL FOR SHIPLOADING FACILITIES

The Development Application granted by Shellharbour Municipal Council in December, 1971 to South Coast Basalt Ltd for permission to develop ship loading facilities at Bass Point is subject to the following conditions:-

1. The conditions outlined in the agreement between the Company and the Council dated 21st August, 1968 shall be complied with.

2. Three rows of Araucariaexcelsa (Norfolk Island Pines) shall be planted on the land to screen the stockpiles from the road.

3. All requirements of the Clean Air Act shall be complied with, and adequate measures shall be taken to prevent dust becoming windborne from the conveyors and at the transfer points.

4. The loading terminal to be constructed, used and maintained to the requirements of-

   a) The Maritime Services Board

   b) The requirements of the Department of Health.

5. A building application in respect of the motor control room to be submitted and approved by Council.

6. Details of the closet location and waste disposal to be submitted and approved by Council.

7. The conveyor tunnel beneath the roadway and across the Council reserve to be constructed to details approved by Council's Engineer.

8. The proposed use of land as a contractors work yard to be the subject of a separate application setting out full details of the proposed use, building, manufacturing processes, alteration to existing site, fencing and time of use.

APPENDIX C

CONDITIONS OF APPROVAL FOR EXTENSIONS TO QUARRYING

The Development Application granted by Shellharbour Municipal Council in August, 1973 to South Coast Basalt Ltd. for extension of quarrying operations below 50 feet (15 metres) level within the bounds of the existing quarry at Bass Point is subject to the following conditions:-

1. All conditions of previous development consents shall be complied with.

2. Groundwater catch drains shall be constructed to the satisfaction of Council so as to prevent surface water from areas outside the bounds of the quarry finding its way into the excavation.

3. Water ponded in the quarry shall be used in connection with operations conducted on the land so as to prevent a build-up of water in the base of the excavation.

4. Backfilling of the quarried areas shall be undertaken progressively to the satisfaction of Council. Such backfilling shall be effected so that the land is completely restored to the 50 feet contour, by the time quarrying operations are completed, and the extent of backfilling shall be reviewed by Council at six-monthly periods during the currency of the quarrying operations to determine whether the extent of backfilling is adequate.

5. Council reserves the right to require additional drainage works to be carried out should it consider such works are necessary.

6. The backfilling material to be described to Council and approved, together with the method of backfilling.

APPENDIX D

RECOMMENDED PLANT SPECIES

Vegetation will be used to reinstate the landscape around the quarry and to provide screening on the eastern hill. There are two categories:

1. FRONT LINE, i.e. at the ocean edge, where there is no protection from wind and salt spray.

2. SECOND LINE, i.e. in locations protected by the front line of vegetation or sheltered positions.

All material recommended is Australian native, and is either growing on the site at present, or is similar in character to that growing on the site.

RECOMMENDED TREES AND SHRUBS FOR "FRONT LINE" CONDITIONS

Small Trees and Shrubs:

Acacia saligna, (Cypress Wattle) 3 m.
Acacia longifolia var. sophorae, (Coast Wattle) 1 m.
Leptospermum laevigatum, (Coast Tea Tree) 3 m.
Westringia fruticosa, (Coast Rosemary) 1 m.

RECOMMENDED TREES AND SHRUBS FOR "SECOND LINE", PROTECTED SITUATIONS

(a) Small Trees and Shrubs

Acacia longifolia, (Sydney Golden Wattle) 5 m.
Agonis flexuosa, (Willow Myrtle) 10 m.
Callistemon salignus, (Pink Tip) 5 m.
Leptospermum flavescens, (Tea Tree) 5 m.
Melaleuca armillaris, (Bracelet Honey Myrtle) 5 m.

(b) Medium and Large Trees

Banksia integrifolia, (Honeysuckle) 10 m.
Casuarina stricta, (Drooping She-Oak) 5 m.
Eucalyptus botryoides, (Bangalay) 20 m.
Eucalyptus gummifera, (Red Bloodwood) 10 m.
Pittosporum undulatum, (Pittosporum) 8 m.

APPENDIX E

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APPENDIX F

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