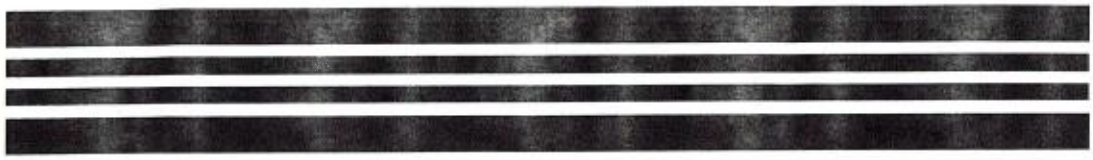

EIS 978

AB019624

Environmental impact statement for supplementary sand and soil extraction from Spring Farm, Macarthur Road, Elderslie, NSW

ENVIRONMENTAL IMPACT STATEMENT

FOR

SUPPLEMENTARY SAND AND SOIL EXTRACTION

AT

SPRING FARM,

ELDERSLIE NSW

OCTOBER 1993

REPORT No JET0160-01.AMA

JOHNSTONE ENVIRONMENTAL TECHNOLOGY
PTY LIMITED A.C.N. 003 146 772

ENVIRONMENTAL IMPACT STATEMENT

FOR

SUPPLEMENTARY SAND AND SOIL EXTRACTION

FROM

SPRING FARM,
MACARTHUR ROAD
ELDERSLIE NSW

PREPARED FOR

M COLLINS & SONS (CONTRACTORS) PTY LIMITED

BY

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED
ACN 003 146 772
54 FRENCHS ROAD, WILLOUGHBY NSW 2068
Tel: (02) 958 2266 Fax: (02) 958 1483

REPORT NO. JET0160-01.AMA October 1993

Environmental Planning and Assessment Act, 1979

(Section 77 (3) (d))

Environmental Impact Statement

This statement has been prepared on behalf of M. Collins & Sons (Contractors) Pty. Limited, being the applicant making this development application for the extraction of sand and soil and construction and operation of a sand washing plant on Spring Farm, Macarthur Road, Elderslie NSW.

This Environmental Impact Statement accompanies the development application, which relates to land described as: Spring Farm, Macarthur Road, Elderslie NSW.

Real Property description: Lot 1, D.P. 587631
Portion 18
Part Portion 19
Parish of Narellan
County of Cumberland

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

This Environmental Impact Statement has been prepared by Edward T.C. Johnstone BA; MA; C.Eng; MIM; M.Aus IMM; MAWWA. of 54 Frenchs Road, Willoughby, NSW, 2068 and others as set out in Section 7.0 of the Environmental Impact Statement.

I, Edward T C Johnstone of 54 Frenchs Road, Willoughby, NSW, 2068 hereby certify that I have prepared the contents of this Statement in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation 1980.

E.T.C. Johnstone

12th October 1993

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1.0 SUMMARY

1.1 Introduction

This Environmental Impact Statement has been prepared following lengthy discussion with Camden Municipal Council regarding a Development Consent issued by Council to M Collins & Sons (Contractors) Pty Ltd in 1982 for the extraction of sand and soil from the Spring Farm property, Macarthur Road, Elderslie in the Municipality of Camden. The location is shown on Figure 1.

Following these discussions, it has now been agreed between Council and M. Collins & Sons that a fresh development application should be lodged with Council for supplementary extraction of sand and soil and for the establishment and operation of a sand washing plant. For clarity and consistency, this Environmental Impact Statement sets out both the proposed supplementary sand and soil extraction and the sand washing plant with associated stockpiles as well as the existing (1982) approved sand and soil extraction areas together.

The deposits of sand and soil on Spring Farm are within the area covered by the Elderslie Sand & Soil Deposits Land Management Study[1], which was prepared for the Macarthur Development Board, then a division of the Department of Planning, in 1977.

1.2 Elderslie Sand and Soil Deposits

The Elderslie sand and soil deposits have been known and worked on an irregular and intermittent basis for many years and the importance of these relatively large sand and soil deposits has been recognised since the early 1970's. The potential for conflict with assuring the resource, with urban development and with the need to protect the fragile and unique environment of the Nepean River valley lead to the preparation of the Elderslie Sand & Soil Deposits Land Management Study[1]. This comprised the management strategy for ordered and sequential extraction of the deposits and the dedication of extracted land near the river into public recreation area on completion of extraction.

The Land Management Study reports, including the Volume VI: Summary Environmental Impact Statement[2], which summarised the proceeding five volumes, examined in detail the characteristics and present state of the area and developed a scheme for the orderly extraction of the deposits. The proposed extraction scheme took into account all factors involved in the development of the deposits

and sought to minimise environmental damage by a series of constraints on extraction, safeguards during extraction and reinstatement requirements following extraction. The Volume VI: Summary Environmental Impact Statement[2] for the Elderslie Sand and Soil Deposits Land Management Study should be read in conjunction with this Environmental Impact Statement for extraction of sand and soil and for the establishment of a sand washing plant on the Spring Farm Property.

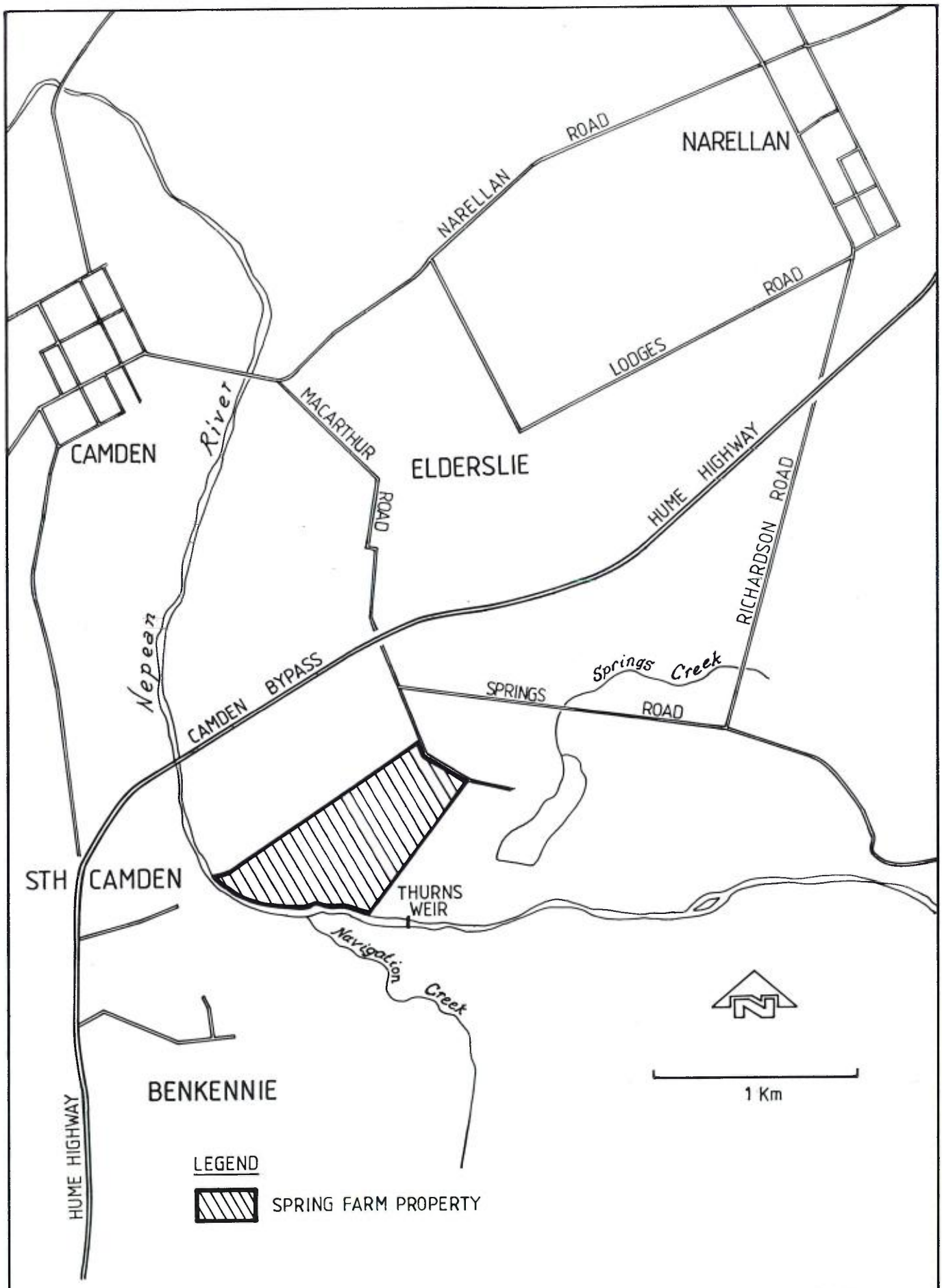
1.3 Development Proposal

The development proposal described in this Environmental Impact Statement is for the extraction of some 665,000m^3 of sand and some 205,000m^3 of soil and the construction and operation of a sand washing plant on the Spring Farm property, which is wholly within the area recommended for extraction in the Elderslie Sand & Soil Deposits Land Management Plan[1]. The proposed developments are wholly in accordance with the Land Management Plan requirements and are shown on Figure 2.

The proposed soil extraction is adjacent to the north bank of the Nepean River, extending from the eastern property boundary of Spring Farm westwards to adjacent to the south-east end of the Anabranch. A part of this area has already been extracted in accordance with the 1982 Development Consent issued by Camden Council. A comprehensive replanting programme over both the soil extraction area and adjacent margins of the Anabranch is also proposed.

The proposed sand extraction extends northwards from the soil extraction area to the 74m contour, near Macarthur Road. A part of the sand extraction area has also already been extracted in accordance with Council's 1982 Development Consent.

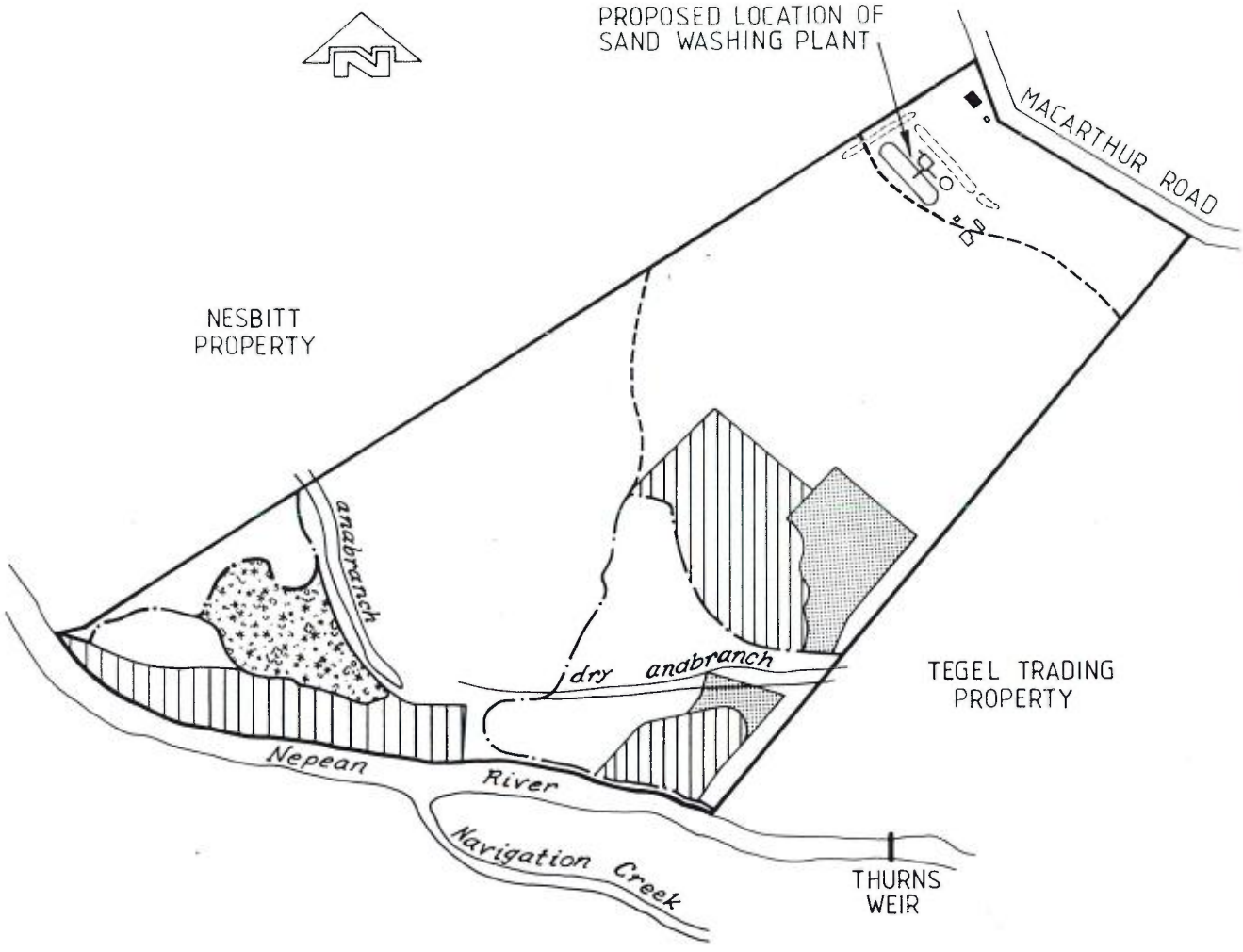
The proposed sand washing plant will be located on land above the 100 year flood level (the 72m contour). Sand will be quarried, screened, trucked to the washing plant area and stockpiled. It will be progressively washed and the washed sand product stockpiled adjacent to the plant. The tailings (clay material washed out to the sand) will be dried to a 'cake' and then used as fill either in the Spring Farm property or in the adjacent Nesbitt property to the north, where M. Collins & Sons are also extracting soil. In the soil extraction areas on both the Spring Farm property and Nesbitt property, dried tailings will be used to reinstate the surface levels, where the valuable soil deposits are extracted below the required final surface levels needed to maintain the river flood plain (3m above normal river level).



LOCALITY MAP

FIGURE 1

JET JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED



LEGEND

- EXTRACTED AREAS
- CURRENT EXTRACTION AREAS
- EXTENT OF SOIL EXTRACTION AREA
- EXTENT OF SAND EXTRACTION AREA
- BOUNDARY OF SPRING FARM
- AREA TO BE BACKFILLED

0 100 200 300 400
METRES

PROPOSED EXTRACTION AREAS
AND SAND WASHING PLANT

FIGURE 2

JET JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

1.4 Assessment of Environmental Impact of Sand and Soil Extraction and Sand Washing Plant

1.4.1 General

The sand and soil extraction plan has been prepared using guidelines established in the Elderslie Sand & Soil Deposits Land Management Plan[1] and the results of a morphological assessment of the Nepean River at Elderslie undertaken by the Water Research Laboratory for this Environmental Impact Statement (see Appendix C). The Volume VI: Summary Environmental Impact Statement[2] of the Elderslie Sand & Soil Deposits Land Management Plan concluded that the major impact of extraction from these deposits would be a transient degradation in the aesthetic value of the area although in the long term, the quality of vegetation and the usefulness of the area as a public utility would be enhanced. This has been confirmed for the Spring Farm deposits by this Environmental Study, which has shown that the impact of the proposed extraction and sand washing will be minimal.

1.4.2 Sand Extraction

The Sand Extraction area is gently sloping grazing land. It has no intrinsic conservation value. Extraction of the sand deposit will cause a transient impact due to disturbance of the land surface and will result in a lower surface suitable for recreational use when the area has been rehabilitated on completion of the extraction activities.

Safeguards incorporated into the proposal will ensure that water or air pollution problems from fugitive dust do not occur.

Noise impact from the sand extraction will raise the ambient noise levels at the nearest houses slightly during the periods when extraction of sand is closest and when minimal shielding is provided. Fitting of special silencers to the mobile equipment and the powerscreen, and the procedure of extracting behind a shielding quarry face will ensure that no disturbance occurs from the sand extraction for most of the time. The noise from semi-continuous site operations will typically be within the range of existing background (L_{90}) levels and predicted maximum intermittent (L_{10}) levels will be less than 45dBA at the nearest houses for most of the time and well within current L_{10} levels. The noise from off-site trucking operations will be similar to that presently occurring and the frequency of such movements is not expected to increase more than marginally, if at all.

The proposed post extraction landform will comply with the requirements of the Elderslie Sand & Soil Deposits Land Management Plan except along the eastern property boundary where it will be necessary to leave a bank up to 6m high to support the adjacent Tegel Trading property. It will also be necessary to leave two mounds in the middle of the extraction area to support the Prospect Electricity power poles.

The proposed sand extraction will not cause environmental disbenefits and will result in the economic production of sand to supply the Macarthur Region.

1.4.3 Soil Extraction

Extraction of the riparian soil deposits can be divided into four separate areas:

- bank of soil along eastern property boundary,
- northern extension of existing soil extraction area,
- extraction of "knoll" between existing soil extraction area and the Anabranch,
- soil to the west of the Anabranch along the northern property boundary.

Additionally it is proposed to reinstate an area to the west of the Anabranch where previously approved extraction of soil has reduced the final level and broken the smooth alignment of the bank along the north side of the river.

The soil bank on the eastern property boundary is a berm, which was left to support the soil on the boundary of the Tegel Trading property. This has now been extracted and the soil bank on the Spring Farm side is no longer required. The Department of Water Resources have directed that this soil bank be extracted. This will enable the objectives of a contiguous and uniform river bank, as set out in the Land Management Plan, to be achieved. Removal of this soil bank will not cause scour or damage to the river bank under flood conditions. There are no disadvantages in extracting this soil.

Extraction of the soil deposit to the north of the existing extraction area will be in accordance with the Elderslie Sand and Soil Deposits Land Management Plan requirements. The post-extractive landform will slope down to a bench some 120m wide beside the river and will be rehabilitated with native grasses, native groundcovers and a mix of Acacias and Casuarinas up to the 61m contour to re-establish the riverside woodland character of the region and provide living area for animals. Above the 61m contour Acacias, Callistemons, Eucalypts and Casuarinas will be planted.

Noise emission from this area will be within the range of background noise levels measured and will not cause disturbance to housing in Benkennie on the opposite side of the river, or to the north, due to distance attenuation and the special silencers fitted to the mobile equipment and powerscreen.

In the "knoll" area to the west of the existing soil extraction area, the existing tree cover will be removed between the bed of the dry anabranch and the river bank. This vegetation has been assessed as regrowth and comprises wattle and eucalypt. It is not considered to have botanical or significant faunal conservation value.

The river bank in this section is high and very steep. It is prone to collapse and slumping and is being eroded away under flood conditions. At present the river bank in the "knoll" area has receded from the correct river channel alignment, both upstream and downstream of the "knoll".

Extraction of the "knoll" area will result in the north bank of the dry anabranch remaining undisturbed and the slope being continued down to a bench beside the river bank some 50m wide. This bench will be continuous with the open areas both upstream and downstream. Extraction of this area of soil is in accordance with the Sydney Regional Environmental Plan No.9, but was excluded from the soil extraction zone in the Volume VI: Summary Environmental Impact Statement[2] of the Elderslie Sand & Soil Deposits Land Management Plan due to concerns about the river breaking through along the Anabranch in times of flood and the need to avoid extracting all the riverside vegetation at the same time.

The morphological assessment has shown that the river shows no tendency to change its course by braiding or changing its meander pattern and should not cut a new channel through the Anabranch in times of flood if the "knoll" is removed. It is also not proposed to remove the riverside vegetation at the same time. The enhanced rehabilitation, including a mix of wattles, casuarinas and eucalypts in the rehabilitation areas upstream and

downstream of the "knoll", will be allowed to mature for at least 5-10 years before the "knoll" is stripped and excavated. This will provide a visual break and also provide protection to this rehabilitation area.

The tree stand on the "knoll" is considered to have value within the existing landscape, which will be altered by the removal of the "knoll" and associated vegetation. In the short term before the existing rehabilitation planting upstream and downstream has grown up, and prior to rehabilitation of the "knoll" area itself, extraction of the "knoll" will have the effect of opening up the view to the north. However as the existing and proposed enhanced riverside plantings mature, the view will once again be enclosed on the northern side of the river, but at a lower level.

The long term botanical and aesthetic (view) effect of removing the knoll will be minimal and the proposed reshaping of the right bank of the river near the Anabranch is expected to direct the main stream flow to continue along the river channel, while allowing flood flow to enter the Anabranch with minimal scour of the bank.

The 'western' soil extraction area along the northern property boundary, in the area to the west of the Anabranch, will be an extension of the soil extraction in the adjacent Nesbitt property, which is also owned by M Collins & Sons. The extraction in this area will be undertaken independently of other soil extraction in the Spring Farm property so that is can be phased in with the Nesbitt property extraction, and so that the total open extraction area in the Nesbitt property and adjacent western soil extraction in Spring Farm does not exceed 2ha, with 2ha being rehabilitated.

Concurrently with the soil extraction, an area near the southern end of the Anabranch, which has previously been extracted will be filled to reinstate the north bank of the river and protect the Anabranch. This will be done progressively working from south to north.

Extraction of soil and filling to reinstate the ground levels will require no removal of mature trees and only a recontouring of the ground in an area which is already affected by soil extraction. It is considered to be a minor addition to the other soil extraction areas with no adverse environmental impact. There will be no disturbance of the vegetation along the margins of the Anabranch.

Control of water quality, silt laden run-off into the river and fugitive dust emission will ensure no problem from these sources. The present soil extraction activities cause no problem and none is expected from the soil extraction proposed.

1.4.4 Sand Washing Plant

The proposed position and configuration of the sand washing plant has been selected to ensure the maintenance of the existing ornamental plantings and to take advantage of the screen planting already established on the north-western and northern (Macarthur Road) boundaries of Spring Farm. These established screen plantings will be augmented by a new 2m high berm and screen planting of wattles along the rest (extending east) of the Macarthur Road boundary and the south-east (Tegel) boundary from the junction with Macarthur Road to the 74m contour line.

The Sand Washing Plant and stockpiles will mostly be effectively screened from the Nesbitt (western) view, from the Camden By-pass bridge and from Macarthur Road, but will be seen from the east until the new screen planting grows up. The upper parts of the Sand Washing Plant cyclone will remain visible above the screen plantings from the west, north and east, but the rest of the Sand Washing Plant, including the stockpiles will only be visible from the north and east.

The dust control measures to be adopted will prevent fugitive dust emission and there will be no escape of silt laden water, which could reach the river.

The Sand Washing tailings will be dried in a filter press and will be used as backfilling to reinstate over-excavated sand extraction areas to the required levels or in the soil extraction areas of the Spring Farm or Nesbitt properties similarly to reinstate the surface to 3m above river level, if additional soil below this level has been extracted. Some sand washing tailings will also be used to reinstate a previously extracted area near the southern end of the Anabranch, where it is necessary to raise the ground level in order to develop a smooth alignment along the north bank of the Nepean River.

The mobile equipment to be used around the Sand Washing Plant (dump truck and front end loader) will have special silencers fitted to reduce noise.

Evaluation of noise emission from the proposed operating sand washing plant itself shows that it will causes noise levels of less than 35dBA at adjacent residences. Intermittent (L_{10}) noise from the mobile equipment will be typically in the range 40 - 44dBA at the 3 or 4 adjacent residences.

Washing of sand from the Spring Farm property was anticipated in the Elderslie Sand & Soil Deposits Land Management Study, however this proposal is superior to the Land Management Study scheme because the tailings produced will be dried and there will be no need for a tailings pond with consequent restriction on land use in the future.

It is considered that establishment of the Sand Washing Plant will enhance the Elderslie resource as it will maximise the amount of sand and soil that can be extracted in an environmentally acceptable manner and provide a supply of quality washed sand for the Macarthur Region.

1.4.5 Planning and Employment

The proposed sand and soil extraction and the Sand Washing Plant will employ 4 people directly at Spring Farm and an additional 12 people indirectly.

The proposed extraction complies with the requirements of the Sydney Regional Environmental Plan No.9 (Extractive Industry), which is the relevant Statutory Planning Instrument. The extraction also complies with the requirements and objectives of the Elderslie Sand & Soil Deposits Land Management Plan but also includes an area of riparian soil in the soil extraction proposal, which is outside the nominated extraction area on the Camden Council master plans, but which was only excluded from concurrent extraction with the other riparian deposits because of unresolved concerns about the stability of the Nepean River channel and possible break through along the Anabranch in times of flood. These concerns are now resolved and it has been shown that the best solution is to include this area (the "knoll") within the soil extraction area. Extraction of the "knoll' complies with the objectives of the Land Management Plan.

When extraction is completed on Spring Farm, the area will be suitable for public open space and recreation usage, as foreshadowed in the Elderslie Sand & Soil Deposits Land Management Plan.

1.5 Conclusions

This Environmental Impact Statement has evaluated the proposal by M. Collins & Sons (Contractors) Pty. Limited to extract sand and soil from the Spring Farm property and to establish a Sand Washing Plant on the property. It is shown that the proposals are in accordance with the requirements of the Sydney Regional Environmental Plan No.9 (Extractive Industry) and the Elderslie Sand & Soil Deposits Land Management Plan.

Evaluation of the proposed riparian soil extraction by the University of New South Wales Water Research Laboratory has been undertaken and the proposed post extraction landform adjusted to leave the optimal configuration along the river bank. The Water Research Laboratory have concluded that the proposed river bank "realignment, reinforced by heavy planting with suitable riverine species will establish a stable, scour resistant bank requiring only minimal maintenance, such as removal of debris after a flood".

The proposed extraction and sand washing can be undertaken in a manner that will not cause long lasting or intrusive environmental consequences. It will create employment, provide a valuable resource for both the Macarthur and Sydney regions in a cost effective manner and will result in riverside land becoming available for public or private recreation or open space use in the rapidly expanding Camden area.

The overall impact on the Elderslie area from sand and soil extraction has been the subject of previous reports, the proposals have been placed on public display and comments or submissions from the public have been sought. As a result of these procedures, the Minister has given his approval to the Elderslie Sand & Soil Deposits Land Management Plan, an integral part of which is the extraction of sand and soil from the Spring Farm property as proposed in this report.

No reason for not proceeding with the proposals has been found and it is recommended that the proposed developments, as set out in this Environmental Impact Statement, be approved.

2.0 OBJECTIVES OF PROPOSED DEVELOPMENT

2.1 Need for Proposed Development

The Elderslie Sand & Soil Deposits Land Management Plan[1], which has been endorsed by the Minister for Planning, sets out a plan for the orderly extraction of the sand and soil deposits at Elderslie so as to ensure that this valuable resource is not sterilised by urban development and so that additional public open space and recreation area is created in the Nepean River flood plain.

The sand and soil deposits in Spring Farm are within the Elderslie Sand & Soil Deposits Land Management Plan area, and consequently it is necessary to undertake the proposed extraction in order to comply with the requirements of the Plan. Failure to undertake the proposed extraction would compromise the implementation of the Plan and could result in a reduction in public open space beside the Nepean River in the future.

The Sydney Regional Environmental Plan No 9 - (Extractive Industry) 1986 [3] has been prepared by the Government to:

> *"a) to facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area and to keep the cost of supplying extractive materials to the community to a minimum -*
>
> *i) by identifying land which contains extractive material of regional significance and ensuring that the land is not developed for purposes which are incompatible with the future extraction of that material; and*
>
> *ii) by ensuring that encroachment by urban development does not prevent existing extractive industries from realising their full potential;*
>
> *b) to permit, with consent of the Council, except as provided by Clause 14, development for the purpose of extractive industries on land described in Schedule 1 or 2;*

c) to prohibit development for the purpose of extractive industries on land described in Schedule 4, being land which is environmentally sensitive; and

d) to ensure that extractive industries are carried out in an environmentally acceptable manner."

The Plan recognises the importance of ensuring an on-going supply of construction materials to the Sydney region and the importance of retaining the availability of sources close to the Sydney Metropolitan area. The Elderslie deposits are recognised as being of regional importance and specifically requires that "Extraction should proceed within the framework of the Land Management Study prepared for the deposit which is shown on the map marked Sheet 6 of the plan" (Figure 3 of this report).

The Elderslie Sand & Soil Deposits Land Management Plan[1], referenced in the Sydney Regional Environmental Plan No 9, noted that:

"There are a number of reasons why the sand and soil deposits at Elderslie are of importance. The most vital are:

M1.2.1 The sand and soil deposits at Elderslie are substantial. It is estimated that there are 14 million tonnes of recoverable and saleable sand and 3 million tonnes of saleable soil.

M1.2.2 The deposits can be extracted simply and economically.

M1.2.3 The available, and extractable, reserves of sand and soil within economic transport distance of the Sydney Metropolitan area are limited, and many are already sterilised by urban development or environmental constraints.

M1.2.4 The Elderslie deposits are central to the Campbelltown/Camden/Appin growth centre and are the major source of both washed and mortar sand for this area.

M1.2.5 *The Elderslie deposits contain a valuable reserve of glass-making quality sand, Sand of this quality is already in short supply close to Sydney, and the deposit is required to fulfil the short term needs of the glass industry.*

M1.2.6 *The soil deposits at Elderslie, either when blended together or mixed with other sands produce a premium quality, top dressing soil that is used for cricket pitches, bowling greens, landscaping, house gardening and similar important community uses throughout the Sydney region.*

M1.2.7 *The deposits are serviced by a major arterial road network, which links the deposits to both the local market and the Sydney market.*

M1.2.8 *The deposits can be worked so that the post-extraction landform blends into the countryside and the land can be used for various purposes which fit the Structure Plan.*

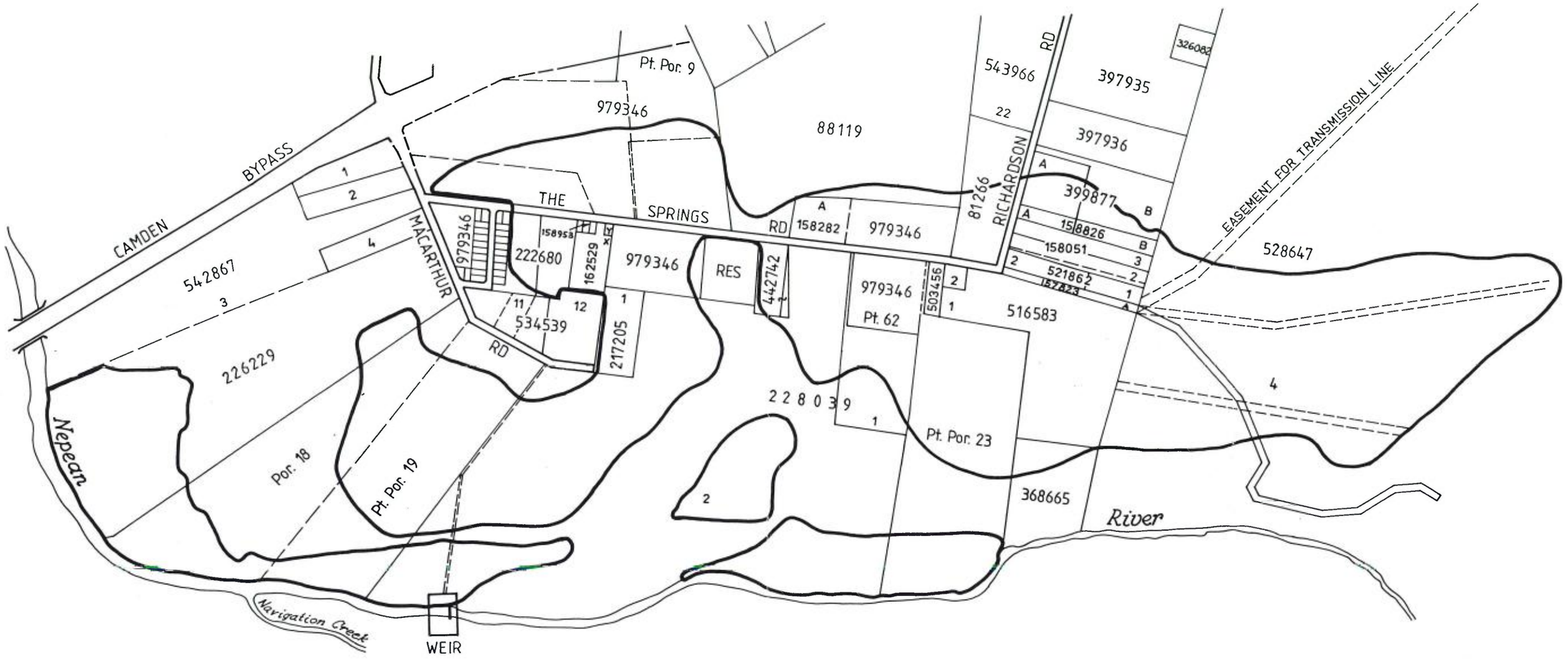
M1.2.9 *Extraction of the sand and soil deposits will be of substantial financial benefit to the landowners."*

These policy documents require that the Elderslie deposits of sand and soil, of which the sand and soil deposits on Spring Farm are a part, be extracted. It is for this reason, and because of the demand for sand and soil in the Sydney region requires to be met, that the Spring Farm deposits need to be extracted.

2.2 Economic Considerations

2.2.1 General

The need for soil, sand,washed sand and blends of soil and sand has been well established by the Department of Mineral Resources, the Elderslie Sand & Soil Deposits Land Management Plan and the Regional Environmental Plan No 9.



LEGEND

SAND AND SOIL EXTRACTION AREAS

0 250 500 750 1000

METRES

SOURCE: DEPARTMENT OF ENVIRONMENT AND PLANNING
SYDNEY REGIONAL ENVIRONMENTAL PLAN Nº 9 - 1986
SHEET 6 OF 11

ELDERSLIE EXTRACTION AREAS - SYDNEY REGIONAL ENVIRONMENTAL PLAN Nº 9

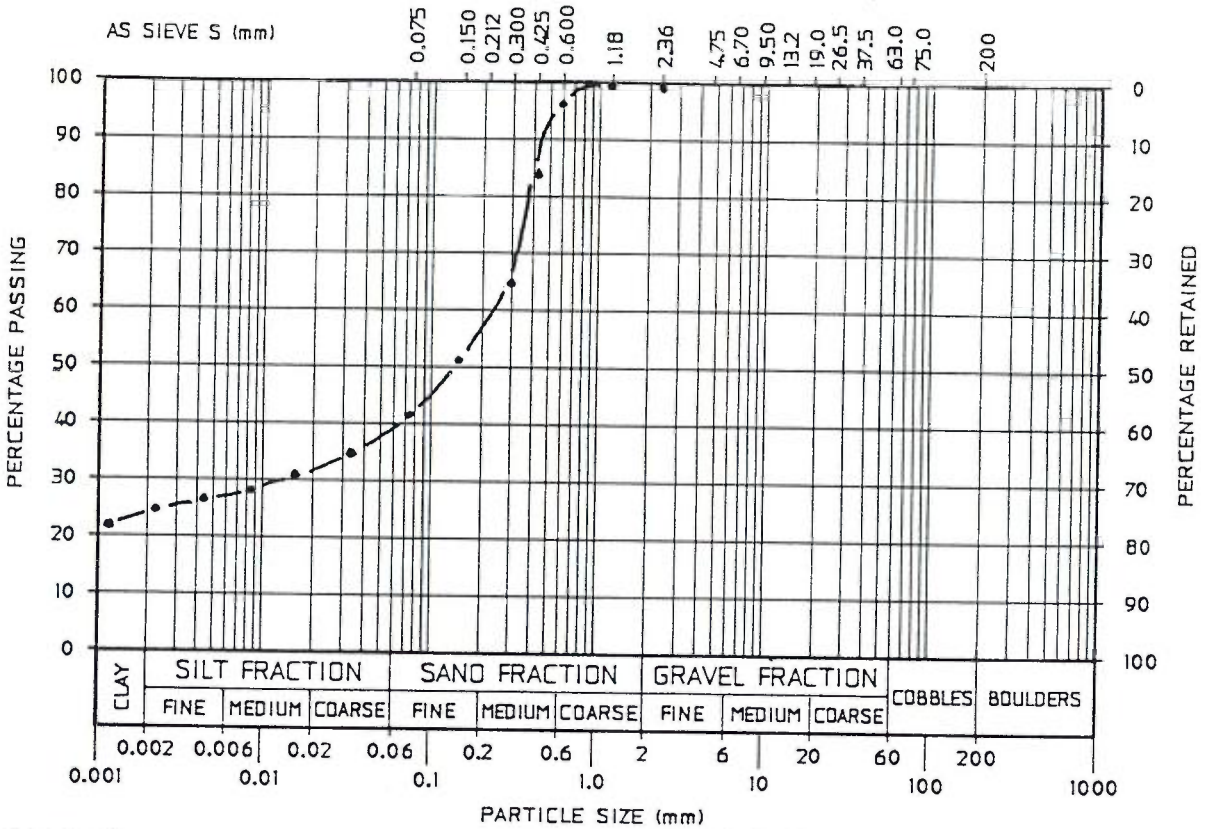
FIGURE 3

JET JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

SOIL CLASSIFICATION REPORT

TESTHOLE :
DEPTH: COLLINS
SAMPLE No. 2536

CLIENT: JOHNSTONE ENVIRONMENTAL TECHNOLOGY
PROJECT: .....
LOCATION: .....



GRADING

D_{10} ..... D_{30} ..... D_{60} .....

$C_u = D_{60} / D_{10}$ = ...

$C_c = D_{30}^2 / D_{10} \times D_{60}$ = ...

Particle Density 2.65. ☐ Measured ☑ Assumed

☐ Pretreatment Mass loss ..... %

TEST CONDITION

☑ Wet sieve ☐ Dry sieve ☑ Dispersing agent

INDEX PROPERTIES

Liquid Limit ..... % Plastic Limit ..... %

Plasticity Index = ... %

Linear shrinkage = ... %

UNIFIED SOIL CLASSIFICATION [ ]

TEST METHODS

Particle size AS1289 C6.1
Liquid Limit .....
Plastic Limit .....
Linear shrinkage .....
Classification ASTM02487

SAMPLE HISTORY (ATTERBERG LIMITS)

☐ Natural ☐ Air dried ☐ Oven dried

PREPARATION METHOD (ATTERBERG LIMITS)

☐ Wet ☐ Dry

TYPE OF TEST (LIQUID LIMIT)

☐ Standard ☐ One Point

TYPE OF TEST (LINEAR SHRINKAGE)

Mould size ☐ 250mm ☐ 150mm

CONDITION OF SAMPLE (LINEAR SHRINKAGE)

☐ Curling ☐ Crumbling

DESCRIPTION

.....

.....

TESTED: MJO
DATE: 18.11.91
CHECKED:
CERTIFIED BY:

GEOTECHNICAL TESTING SERVICES
3 EDEN STREET, CROWS NEST, 2065. TELEPHONE 929 0520
LONGMAC ASSOCIATES PTY. LIMITED

JOB No. CLT6008
DWG No.

GRADING CURVE FOR SPRING FARM SAND FIGURE 4

The Spring Farm deposits of soil yield a high quality alluvial soil for use as a growing medium in parks, lawn areas and gardens. The deposit is composed of fine grained sand and silt with rich organic sediment. It is a natural material which requires dry screening to produce a screened topsoil for use by the landscaping, horticultural and construction industries. When dry screened and blended with coarse sand, a specialised sportsturf soil used by golf courses, racetracks, bowling greens and premium sportsturf ovals is produced. The mixture must conform to rigid industry standards of specified particle sizes and drainage characteristics.

The Spring Farm sand deposit has some 25% clay fines in it (Figure 4). This makes it unsuitable for use as a Bricklayers sand or a Concrete sand without being washed. A sand washing plant is proposed as a part of this development so that the following sand products can be produced:

a) Fill Sand. Filling sand does not have to conform to rigid specifications. The sand needs to be reasonably clean which can be produced by dry screening. Filling sand is used predominantly in the construction industry.

b) Bricklayers Sand. Bricklayers sand must conform to industry specifications. The sand must be clean and consist of specified particle sizes. As the Spring Farm sand has a relatively high clay content it will require some washing and blending with dry screened sand to produce an acceptable product. The colour of the sand is another important consideration for bricklaying purposes. Bricklaying sand is used exclusively in the construction industry.

c) Concrete Sand. Concrete sand must pass accredited industry standards. The sand must be clean, free from clay and consist of specified particle sizes. The Spring Farm sand requires washing to remove the clay content to produce concrete sand. Concrete sand is used predominantly in the construction industry.

2.2.2 Market Demand for Sand and Soil

The Elderslie area is situated in the Macarthur Region, which is one of the fastest growing parts of the Sydney Region. In addition, the Department of Planning has released Regional Environmental Studies for the proposed South Creek Valley and Macarthur South urban development areas.

The Draft Regional Environmental Plan for South Creek Valley, released in September 1991, identifies an initial 15,000 potential home sites which are located within fifteen kilometres of the Elderslie area. The Study identified 10,000 hectares of land capable of urban development excluding the Badgerys Creek airport site.

The Macarthur South Regional Environmental Study, also released in 1991, concludes there is up to 12,000 hectares of land in Macarthur South, which can be developed for urban use. The Elderslie area is located within economic reach of the Macarthur South Study area.

The Department projected the total lot production for both proposals over the next twenty years and assessed the total potential as 56,970 lots.

The demand from these developments, together with the rest of the Sydney region, requires to be met. The proximity to the Macarthur Growth area and the proposed South Creek Valley development and the special quality of the soil deposits make the Elderslie resource well suited to meet the demand.

In regard to sand, the Macarthur Region construction industry is a major market for filling sand, bricklayers mortar sand and concrete sand. The Spring Farm extraction proposal has the capacity to produce each of these materials and construction costs dictate that the sand must be supplied from sources within close proximity to the market or transport economics increase costs.

In regard to soil demand, the consumption of soil is closely aligned to urban development. Home lawns, footpath areas and landscaping projects around the home require soil. Soil deposits capable of extraction, which are compatible with the Departments's requirements, are extremely limited. The Spring Farm soil proposal offers the market a local high quality resource.

The demand for specialised sand/ soil mixtures for sportsturf situations is a small, but very significant, factor. It can be demonstrated that the Spring Farm sand and soil resources exhibit properties that cannot be produced elsewhere in the Sydney Region without increasing cost.

2.3 Alternatives

The alternatives to the proposal are to not proceed with the sand and soil extraction and not to establish the sand washing plant.

This would not be in accordance with Government Policy and would preclude the objectives of the Land Management Plan being achieved. Alternative sources of sand and soil are available, but non-extraction of the Elderslie deposits will simply increase demand on deposits elsewhere. This will increase costs in the Sydney Region both immediately because a local resource to the Macarthur area will be closed and because it will be necessary to transport the material further in the future.

The Elderslie area is the major source of sand supply in the Macarthur region. The economic effect of not proceeding with the proposed Spring Farm extraction is to reduce market supply, which would adversely affect construction costs within the region. The use of less viable resources would be undertaken at a significant additional cost incurred through higher transportation costs. Similarly the Elderslie soil deposits are needed to meet both the local landscaping demand in the Macarthur area and the premium quality soil supply needs throughout the Sydney Region, which can not be replicated from other sources.

2.4 Scope of Environmental Impact Statement

This Environmental Impact Statement has been prepared in accordance with the requirements of the NSW Environmental Planning and Assessment Act 1979 and Regulations, under which this development is 'Designated Development' and thus requires an Environmental Impact Statement to accompany the Development Application to Camden Council.

This development is for a continuation of existing sand and soil extraction on Spring Farm, and as such is a **supplementary development** to the existing works. The proposed development comprises:

- extraction of soil along the north bank of the Nepean River generally from the eastern boundary of the Spring Farm property to the Anabranch and between the Anabranch and the river

- dry extraction of sand from the limit of the deposit some 200m from the Nepean River bank extending some 500m northwards towards Macarthur Road to the 74m contour

- establishment of a sand washing plant, with associated stockpiles, tailings filter-cake storage and water supply.

This Environmental Impact Statement assesses the environmental consequences and 'fit' within the Elderslie Sand & Soil Deposits Land Management Plan[1] for extraction of the sand and soil deposits on the Spring Farm property and establishment of a sand washing and blending plant.

3.0 CHARACTERISTICS OF SITE AND EXISTING ENVIRONMENTAL CONDITIONS

3.1 General

The Spring Farm property is wholly within the area included in the Elderslie Sand & Soil Deposits Land Management Plan[1]. That report evaluated the overall environmental quality of the Plan area and evaluated the environmental consequences of extracting the sand and soil deposits in terms of land use planning, landscape quality, ecological impact and potential pollution. These findings are set out in Volume VI of the Land Management Study - the Summary Environmental Impact Statement[2].

For the Elderslie sand and soil deposits, the Summary Environmental Impact Statement covers the general environmental impact and some specific parameters, such as ecological impacts, which cross property boundaries. **This** Environmental Impact Statement for extraction of sand and soil from the Spring Farm property and for the establishment of a sand washing plant, addresses the site specific impacts such as noise and landscaping within the framework of the overall Summary Environmental Impact Statement of the Land Management Plan.

For an understanding and assessment of the environmental impact of the developments proposed on the Spring Farm property, it is necessary to read both the Elderslie Sand & Soil Deposits: Volume VI Summary Environmental Impact Statement[2] **and** this site specific environmental impact statement.

3.2 Location

The "Collins" property, Spring Farm, is located on the north bank of the Nepean River at Elderslie, as shown on Figure 1. The property extends from the river bank at RL 56m and rises to RL 78m at the frontage onto Macarthur Road.

The property has an area of 44.7ha, of which some 37.2ha is within the 100 year flood liable land boundary. The remaining 7.5ha abuts Macarthur Road.

FIGURE 5 - North Bank of Nepean River
Looking Downstream on Spring Farm Property

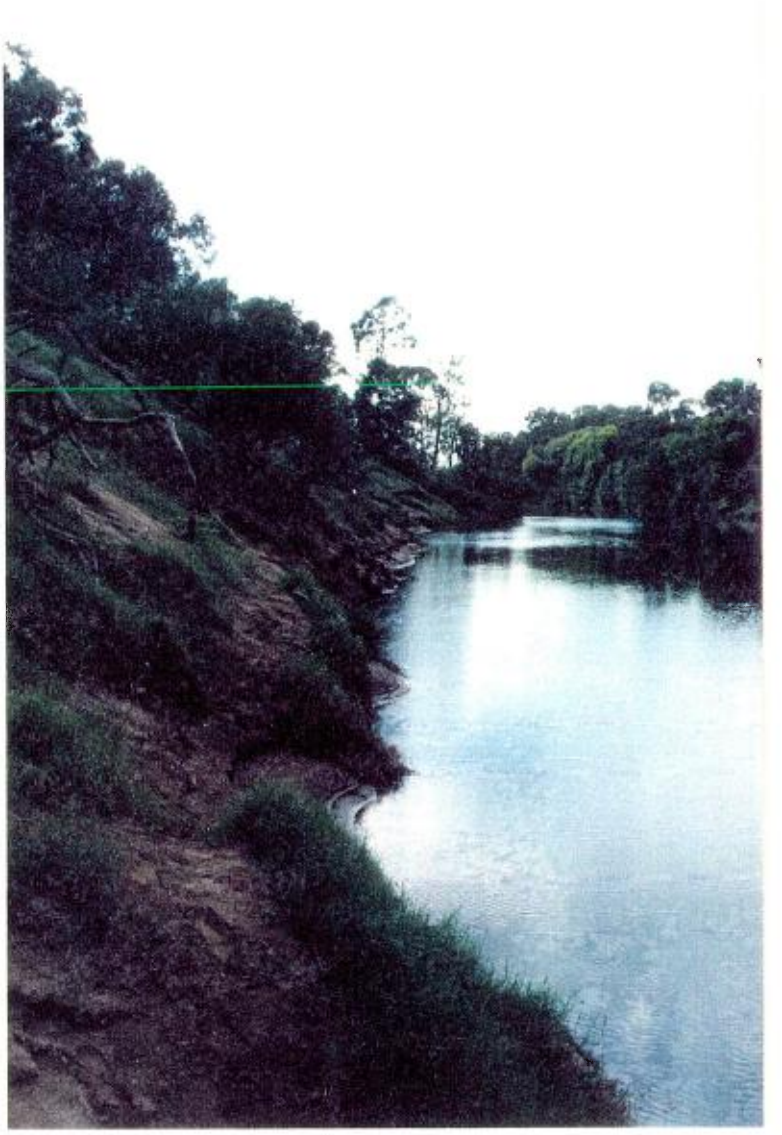
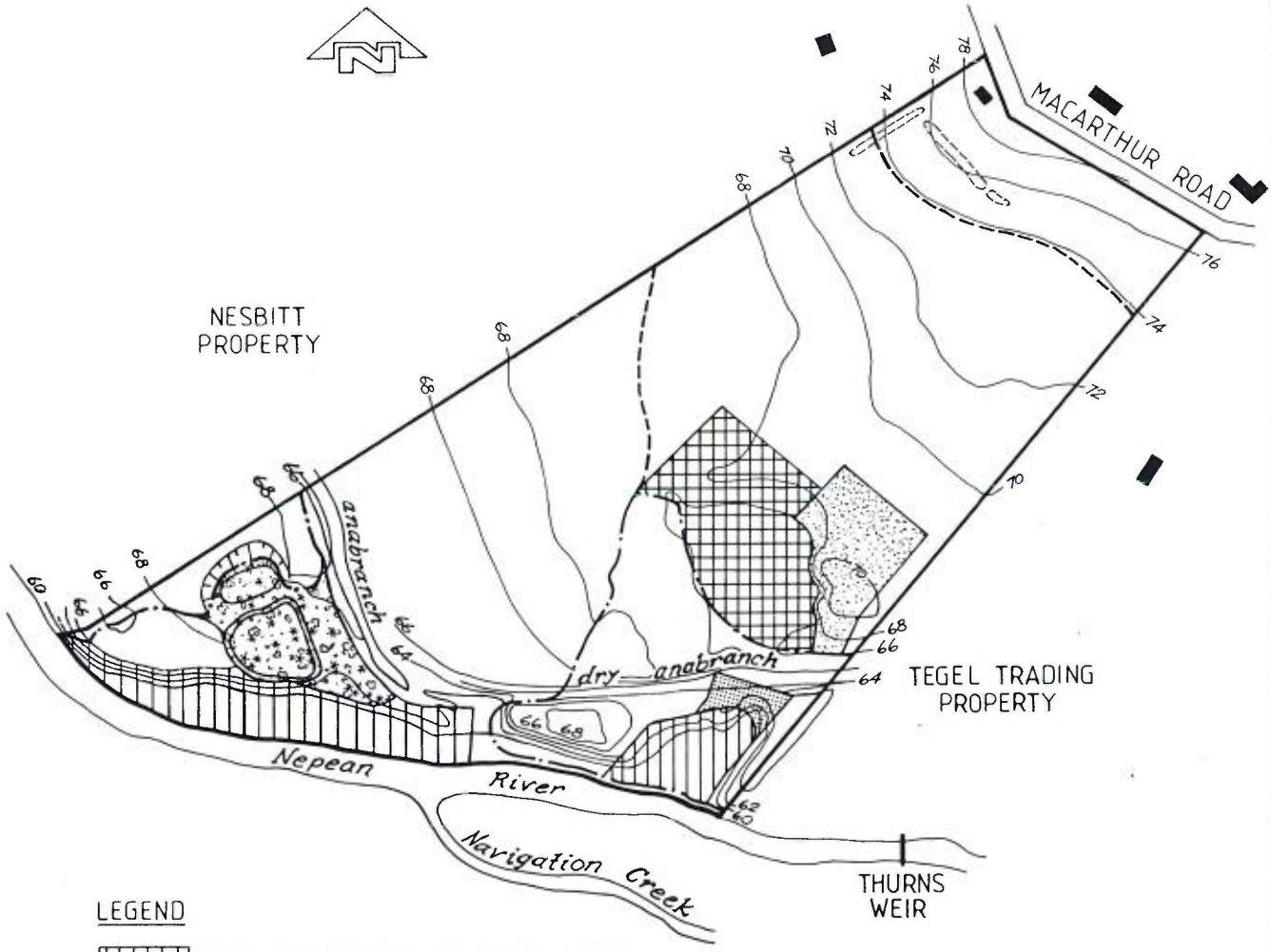


FIGURE 6 - North Bank of Nepean River
Upstream of Anabranch Looking East

FIGURE 7 - Previously Extracted Soil Deposit Beside River in Western Sector of Spring Farm. View Looking West

FIGURE 8 - Previously Extracted Soil Deposit Beside River on Spring Farm. View Upstream



LEGEND

- PREVIOUS SOIL EXTRACTION AREAS
- CURRENT SOIL EXTRACTION AREAS
- PREVIOUS SAND EXTRACTION AREAS
- CURRENT SAND EXTRACTION AREAS
- EXTENT OF SOIL EXTRACTION AREA
- EXTENT OF SAND EXTRACTION AREA
- BOUNDARY OF SPRING FARM
- EXISTING CONTOURS
- AREA PREVIOUSLY EXTRACTED TO BE BACKFILLED

0 100 200 300 400
METRES

SAND AND SOIL EXTRACTION AREAS

FIGURE 9

FIGURE 10 - Upper Part of Site
Looking North

FIGURE 11 - Central Part of Site
(Sand Extraction Area)

FIGURE 12 - Existing Sand Extraction and Stockpiles

FIGURE 13 - Sand Extraction Area and Riverside Soil Processing and Stockpiles on Eastern Side of Property

3.3 Existing Landform and Land Use

The Spring Farm landform slopes gently from Macarthur Road at above 78m to the banks of the Nepean River. The river curves past this portion of land, which also contains the beginning of an Anabranch, which is up to 4m deep and a separate dry anabranch parallel to the river bank. A steeply banked "knoll" occurs on the upstream side of the entry to the "dry" anabranch and separates it from the main stream of the river. These river banks in the vicinity of the "knoll" are over 9m high, are not all stable and in the steep areas have obviously been undercut by the floods in February 1992, which has caused sections of the banks to collapse. Figures 5 and 6 show this. Elsewhere the river banks have mostly been used as a source of sand and soil and are now much lower. The river profile in these previously extracted areas is therefore much more open than in the undisturbed areas surrounding the "dry" anabranch and the "knoll". Figures 7 and 8 show the previously extracted soil deposits beside the river on the western side of the Spring Farm property and the successful revegetation of the area.

Away from the river bank, the land slopes gently up towards Macarthur Road. The area has a steady slope and is used for grazing, cultivation of turf and has been partly extracted for sand under the 1982 approval issued by Camden Council.

Figure 9 shows areas previously extracted for both soil and sand. Figures 10 and 11 show the landform in the upper part of the site containing the sand deposit and Figures 12 and 13 show the existing sand extraction area.

Sand and soil extraction are being (or have been) undertaken in accordance with the Land Management Plan to the east in the Tegel Trading (Woodgrand) property and on the north (north-western) side in the Nesbitt property. Presently these two properties are open land. To the south, the new South Camden suburb of Benkennie extends to approximately 250m across the river. On the north side of Macarthur Road there is a small residential area along Ettlesdale Road and there are individual residences to the east (Tegel), west (Nesbitt) and north (A. Clinton and N. Clinton), as shown on Figure 9.

3.4 Planning

Spring Farm is located within the area covered by the Elderslie Sand & Soil Deposits Land Management Plan, which provides for ordered and sequential extraction of the Elderslie sand and soil deposits. This plan has been approved by the Government and by Camden Council.

The Sydney Regional Environmental Plan No 9 - (Extractive Industry) notes that the Elderslie deposits are of regional significance, makes provision for extraction of the Elderslie deposits and notes that "Extraction should proceed within the framework of the Land Management Study prepared for the deposit, which is shown on the map marked Sheet 6" (Figure 3 of this Environmental Impact Statement).

Spring Farm is also within the area covered by Sydney Regional Environmental Plan No 20 for the Hawkesbury-Nepean River. This Plan addresses the overall management of the Hawkesbury-Nepean River and specifically addresses Extraction in Chapter 5 where it notes:

> *"The Hawkesbury-Nepean Valley is one of the closest sources of materials for Sydney's construction and landscaping industries. These materials include sand, gravel, clay/shale, loam and peat reserves and are described in the Department's report, "Sydney's Extractive Industry Regional Environmental Study (1984)". While most extraction has occurred from the river bed, there are also reserves on the flood plain and in high level deposits."*
>
> and
>
> *"In summary, the Hawkesbury-Nepean plan ensures that regionally significant extractive resources are not sterilised but that significant environmental areas are protected and that extracted areas are rehabilitated in keeping with water quality and environmental objectives. The plan complements and refines the Extractive Industry and Penrith Lakes REP's and identifies a range of matters to be included in guidelines for extractive operations and conditions of development consent, covering all phases of extraction operations."*

Sydney Regional Environmental Plan No.20 also requires that a "specific aim of the plan relating to extraction of materials is to encourage tree planting along the banks of the river to ensure bank stability, but not so as to overshadow the water and prevent or inhibit the growth of aquatic plants in the river."

The Spring Farm property is within the area covered by Camden Local Environmental Plan No 48 and is zoned 1(a) Rural. Extraction is a permissible activity with the consent of Camden Council under this zoning.

3.5 Vegetation

A vegetation analysis for the area covered by the Elderslie Sand & Soil Deposits Land Management Study is presented in Volume VI: The Summary Environmental Impact Statement[2] of the Land Management Study. Spring Farm is in the western sector of this study area. Most of the land on Spring Farm and adjacent properties has been cleared of native vegetation, and has been grazed or cropped for a considerable period. The only stands of native vegetation which remain on the Spring Farm property include a relatively narrow fringe of riparian communities along the Nepean River bank, and the strip of riparian vegetation along the Anabranch, although more extensive native vegetation remains in the vicinity. Sand and soil extraction has been or is currently being undertaken along the Nepean River on the Spring Farm property and on the other properties nearby, generally as indicated in the Volume VI: Summary Environmental Impact Statement [2] of the Elderslie Sand & Soil Deposits Land Management Study. Consequently, most of the bank on the Spring Farm property has been removed (to within 3m above 'normal' water level), along with its riparian vegetation cover, with the exception of plants actually remaining on the bank. In areas from which extraction has been completed, on each side of the "knoll", a revegetation program has been implemented, involving the planting of small trees and shrubs (principally Casuarinas and some Eucalypts).

All areas of the site not currently being extracted have some vegetation cover. In those areas already extracted, the new landform has been stabilised and is covered by pasture grass and planted in some specific areas with native vegetation as described in Section 5.3.

The other undisturbed areas away from the river corridor are presently covered by pasture grass, some ornamental planting of peppercorn trees (Schinus areira) and others in the vicinity of the existing house and small pockets of native vegetation planted to screen views of the extraction works from neighbouring properties. These original ornamental plantings are now approximately 10m in height and the tree screens on the north and western boundaries are now between 6 and 8m in height.

The undisturbed areas within the river corridor in the vicinity of the Anabranch and "knoll" contain stands of native vegetation with a canopy cover of up to 30%. The vegetation surrounding the Anabranch has been documented in the Land Management Study[2] and will remain undisturbed. The vegetation on the "knoll" is dominated by Black wattle Acacia decurrens and Eucalyptus elata both of which are an average of between 6-12m high with a shrubby understorey which includes Acacia floribunda. A single large specimen of Casuarina cunninghamiana remains

on the northern side of this stand. The stand of vegetation on the "knoll" is not representative of mature native vegetation as these trees would normally be expected to reach at least 15m and it is not uncommon for the Eucalyptus to grow to heights of over 30m. This stand of presently low growing open forest is a typical regrowth community, being dominated by the wattle and characterised by a high density of small stems and a moderately dense canopy. Old stumps indicate past logging of the "knoll" and there are no large trees with hollows present in the stand. The lower strata consist of moderate to dense stands of shrubs to about 5m, including young eucalypts and wattles, as well as a range of weed species. The ground is generally covered with a mixture of introduced grasses, weeds (such as blackberry and wandering jew), and small shrubs and bracken, except on the banks of the dry anabranch where cattle have had some impact. The frontage onto the Nepean River comprises a steep bank of 6-8m in height, with a scattered growth of wattles and small She-oaks Casuarina cunninghamiana, and variable grass cover. This bank is characterised by moderate erosion and slumping, with exposed tree roots indicating scouring during major floods. This stand is currently of value within the landscape as it is the only established vegetation along the river banks because the other areas have been extracted and the recently replanted vegetation is mostly only 1-2m high at present. The vegetation on the "knoll" is therefore a major part of the only currently existing canopy cover in the area and it is a source of seed for any natural regeneration that may take place within the extracted areas. Its conservation value is limited due to the fact that the tree heights indicate that the area has been previously disturbed and possibly cleared.

Along the Anabranch in Spring Farm, the riparian vegetation extends from the water's edge, up the banks, and onto the flood plain by varying amounts (from 0-25m). In this area, the vegetation community consists of more scattered trees, including many large specimens supporting tree-hollows, with small stands of tree regeneration and a moderate shrub layer throughout. The upper portion of the Anabranch, above the road causeway and comprising the majority of this feature, currently contains a standing pool of water unconnected to the main River channel. This is filled by direct drainage from the surrounding land surface or during floods when the Nepean River covers the flood plain. Below the road causeway, the anabranch consists of a dry channel dissecting the study site, and is substantially degraded by cattle.

3.6 Landscape and Views

The Spring Farm property landscape is a part of the Elderslie sand and soil deposits. This area was first examined and the findings detailed in the Elderslie Sand & Soil Deposits Land Management Study[1], which was documented in 1977. Since the Land Management Study was undertaken, many of the recommendations for sand and soil extraction, contouring of the final landform and revegetation have been implemented on the properties on both sides of Spring Farm and in some areas planned for extraction within Spring Farm. At the time of this study, the landscape is being altered by the extraction process being undertaken and this has resulted in the appearance of two landscape types occurring within the property. These are the undisturbed landscape and the post-extraction landscape. There is a distinct difference between the undisturbed and post extraction landscapes in the riparian zone, with the undisturbed landscape having a more elevated landform, greater canopy cover by both native and exotic vegetation and views and vistas which are not consistent with the adjacent properties. The post extractive landscape on Spring Farm, which is currently in the process of formation, is in accordance with the recommendations of the Land Management Study, which provides for open space and active and passive recreational facilities.

The views and vistas from adjacent residences and from within Spring Farm are generally limited by the replanted or original vegetation cover on the site. Views from Macarthur Road into the site are restricted by a screen of recently planted native vegetation, as shown on Figure 14, and by the original ornamental plantings of exotic and native vegetation around the homestead as can be seen in Figure 15. These figures show the view into the site from roadway in the vicinity of the neighbouring "Clinton" property. The view from the north-east, as shown on Figure 16, taken from the "Tegel" property driveway is more open and, apart from the planting on the "Tegel" property, the peppercorns seem to provide the only barrier to these views into the site. Views into the site from the adjacent residence on the "Nesbitt" property to the north-west have been obscured by screen planting of native vegetation along the north-western boundary, which is currently up to 8m in height.

Views from the river banks show the river corridor profile to vary in the vicinity of the Anabranch. As can be seen in Figure 17, the river is enclosed by steeply sided and heavily vegetated river banks for approximately 150m where soil extraction has not occurred. Elsewhere the river is open on the northern side with much lower banks and (at present) only scattered juvenile tree plantings.

FIGURE 14 - Screen Planting in Spring Farm Along Macarthur Road Boundary Looking East

FIGURE 15 - Exotic and Natural Vegetation Around Spring Farm Homestead Looking North-West

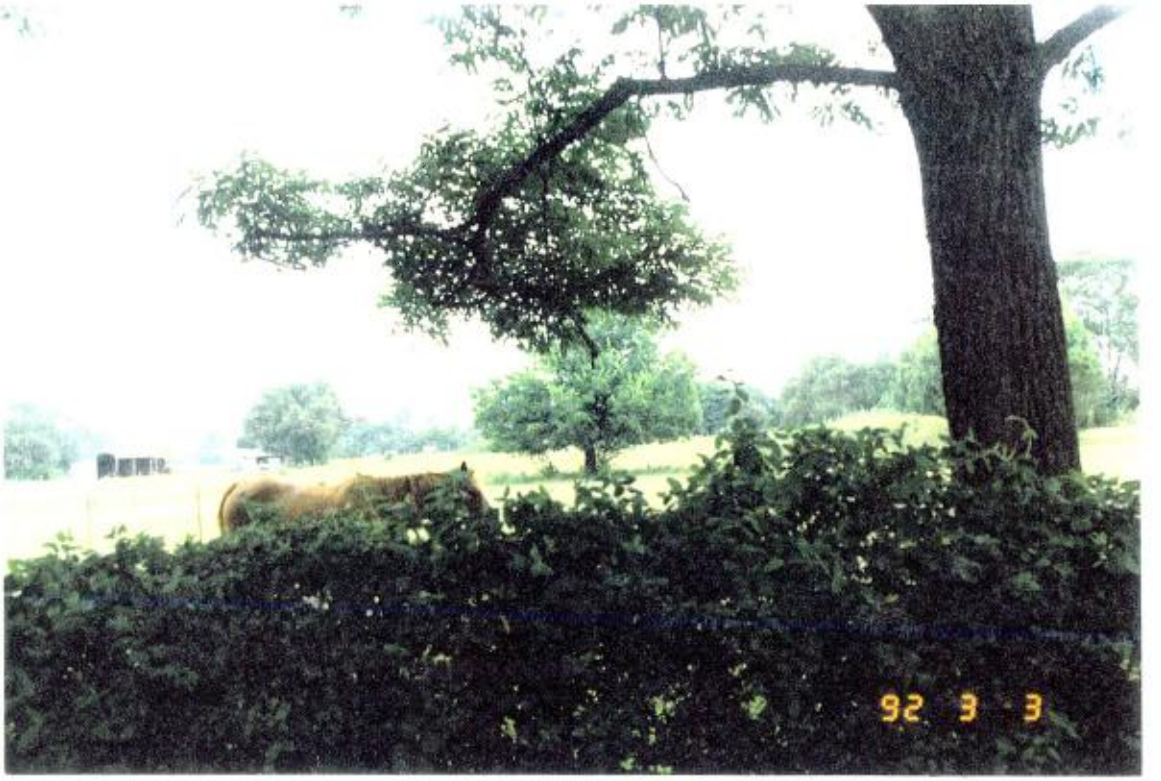


FIGURE 16 - View of Spring Farm and Sand Extraction Area From North-East

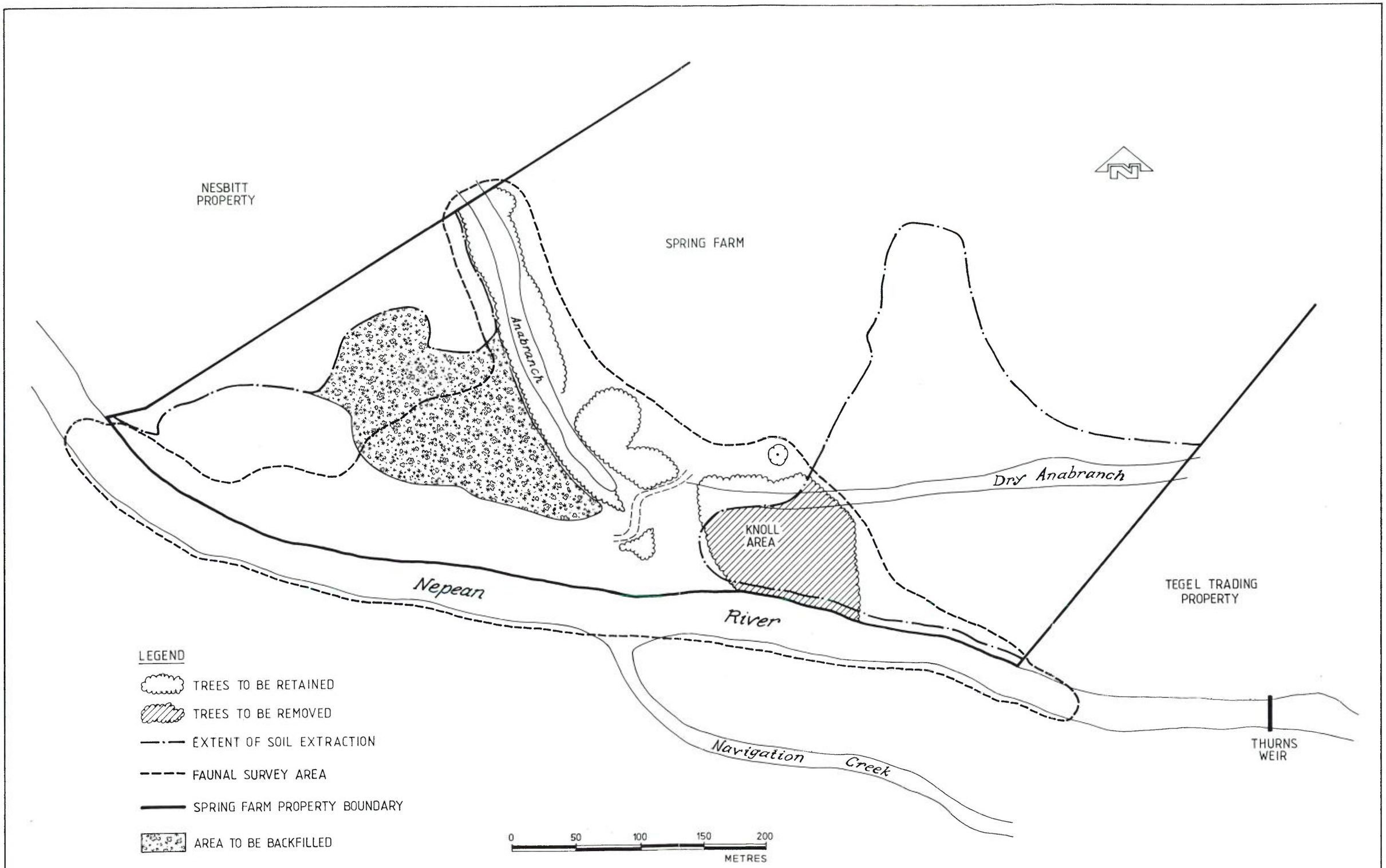
FIGURE 17 - Nepean River Looking Downstream From Spring Farm

3.7 Fauna

As noted in Section 3.5, much of the Nepean River frontage on the Spring Farm property has been disturbed during the removal of soil from the site. The stand of (young) Open Forest on the "knoll" to the east of the Anabranch and riparian vegetation along the Anabranch to the north-west currently exist as isolates, surrounded by either grazing land or the extraction operations. However, a rehabilitation and revegetation program has been implemented on the river banks on either side of the "knoll", which will ultimately restore a continuous belt of riparian vegetation along the river. The properties on each side of Spring Farm continue to support riparian vegetation along the river, and the opposite bank of the Nepean River is densely vegetated. These areas contain considerable numbers of introduced species such as English Elm and Weeping Willow, as well as typical native riparian species, including Casuarinas, wattles and Eucalypts, with a relatively dense shrub layer. The southern shore of the Nepean River, particularly opposite Spring Farm, supports a substantial corridor of vegetation.

The fauna survey conducted for this investigation consisted of daytime searches through the "knoll" area east of the Anabranch, along the Anabranch and along the bank of the Nepean River on the Spring Farm property as shown on Figure 18. Trapping and spotlighting were considered, but deemed unnecessary at this site because of its small size, its isolated location, its disturbed condition, and the existence of recent information from the Volume VI: Summary Environmental Impact Statement[2]. Indirect evidence for the presence of fauna species was noted (scats, tracks, diggings etc), and species present (by call or sighting) were recorded.

No species of native fauna of conservation concern were recorded during this investigation in the area (nor were any located in the previous study by Hodson in the Land Management Study investigations). Species of 'endangered' fauna (as defined by Schedule 12 of the NP & W Act) are not expected to occur in the vicinity, except perhaps as occasional transients or vagrants, principally because of the highly disturbed nature of the general region. In total, 24 species of native birds, 6 mammals (including 4 introduced species) and 3 reptiles were recorded from the Spring Farm property during this survey or had been specifically noted from the site by Hodson (Table 1). Several additional species would be expected in the "knoll" vegetation, including a number of the bird species reported by Hodson in the Land Management Study, but none of conservation significance are expected.



FAUNAL SURVEY AREA

FIGURE 18

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

TABLE 1 Native fauna recorded from the Collins site at Elderslie (including data from Volume VI: Summary Environmental Impact Statement)[2].

		Stand	River	AB	Vol.VI EIS
BIRDS					
Restless Flycatcher	*Myiagra inquieta*	X			X
Sulphur-crested Cockatoo	*Cacatua galerita*	X	X	X	X
Eastern Yellow Robin	*Eopsaltria australis*	X			X
Grey Fantail	*Rhipidura fuliginosa*	X	X	X	X
Superb Fairy-wren	*Malurus cyaneus*	X			X
White-browed Scrub-wren	*Sericornis frontalis*	X			X
Brown Thornbill	*Acanthiza pusilla*	X		X	X
Grey Butcher-bird	*Cracticus torquatus*	X	X		X
Spotted Pardalote	*Pardalotus punctatus*	X	X		X
White-throated Tree-creeper	*Climacteris leucophaea*	X	X	X	X
Silvereye	*Zosterops lateralis*	X			X
Kookaburra	*Dacelo novaeguineae*	X	X		X
Australian Raven	*Corvus coronoides*	X	X		X
Darter	*Anhinga melanogaster*		X		
Little Black Cormorant	*Phalacrocorax sulcirostris*		X		X
White-faced Heron	*Ardea novaehollandiae*		X		X
Australian Magpie	*Gymnorhina tibicen*		X	X	X
Azure Kingfisher	*Ceyx azureus*			X	X
Wood Duck	*Chenonetta jubata*				
Pacific Black Duck	*Anas superciliosa*				X
Zebra Finch	*Peophila guttata*				
Australian Pipit	*Anthus australis*				X
Willie Wagtail	*Rhipidura leucophrys*				X
* Indian Mynah	*Acridotheres tristis*				X
MAMMALS					
Brushtail Possum	*Trichosurus vulpecula*				X
Common Ringtail Possum	*Pseudocheirus peregrinus*				X
* Cattle	*Bos taurus*	X		X	X
* European Fox	*Vulpes vulpes*	X	X	X	X
* Rabbit	*Oryctolagus cuniculus*			X	X
* Black Rat	*Rattus rattus*			X	X
REPTILES					
skink	*Ctenotus robustus*	X			
grass skink	*Lampropholis guichenoti*	X			
Eastern Water Dragon	*Physignathus lesueurii*		X		

* Introduced Species
Stand Vegetation Stand on "Knoll"
AB Anabranch

Within the "knoll" area, a total of 15 species of native fauna were located during the survey, all typical of this type of habitat and all common to abundant throughout their distributions (Table 1). Evidence for the presence of cattle and foxes was also obtained, and the lack of Common Ringtail Possum dreys (nests) in the patches of dense shrubs may be accounted for by the apparently large local fox population (foxes are known to be significant predators on the Common Ringtail; Dr M Augee pers comm, Triggs et al 1984). As noted by Hodson, the fox populations are also likely to account for the paucity of small terrestrial mammals, recorded in the region. As there are few tree-hollows in the "knoll" vegetation, arboreal mammals are also likely to be scarce or absent.

As discussed earlier, the banks of the Nepean River bordering Spring Farm have been substantially modified in parts as a result of sand and soil extraction. The remnant bank areas and revegetation sites were surveyed, providing evidence for the presence of water birds (the White-faced Heron, Little Black Cormorant and Darter) and many fox tracks. Despite intensive searching, no Australian Water Rat tracks were noted, although these have been recorded from the vicinity (Hodson[2]). A variety of bird species typical of the habitat were recorded calling from the opposite bank of the river amongst the dense vegetation, and these would be expected to provide a source of recolonising individuals for the forest on the Spring Farm river banks, when rehabilitation has progressed.

There is the potential for Platypus to occur in the Nepean River in the Elderslie region, as they have been recorded both upstream and downstream of the site. There are no records of the species at Elderslie, however, and no evidence for their presence by way of burrows or burrow sites was obtained during detailed searches along the river banks in the immediate vicinity of the proposed extraction works.

Portions of the river bank in the general area would be suitable for the species for nesting, at least in locations where the banks are stable and where groundcover is dense. However, the region generally has long been disturbed (by grazing activities and soil and sand extraction), and does not currently constitute particularly suitable habitat. Disturbance of the river banks especially, by damaging burrows, removing ground cover vegetation and permitting erosion and sediment transport into the waterway, will have severely limited the value of the river in this vicinity for the species. Additionally, the presence of a significant population of foxes in the vicinity also is likely to limit the value of the site for Platypus.

A survey along the Anabranch revealed the presence of several additional fauna species, which favour this habitat (eg the Azure Kingfisher and Easter Water Dragon). The adjacent vegetation, particularly including large trees bearing hollows, and the nature of the Anabranch render it of relatively high value to the local fauna. Sulphur-crested Cockatoos were common, with the hollow-bearing trees providing a valuable nesting resource for them, and the previous study indicated a considerable number of arboreal mammals (Common Ringtail and Common Brushtail Possums). However, the native vegetation comprises only a narrow band and is subject to disturbance. Proposals to enhance its conservation value are given in Section 5.3.

In general terms, the most significant features of the existing environment for native fauna are; the long disturbed nature of the region and consequent depauperate fauna assemblage (relative to the original condition in the area), and the adverse impact of high fox populations on native species, particularly ground-dwellers. The "knoll" forest is characterised by regrowth and appears to support only a limited representation of the fauna species recorded from the area by Hodson in the Elderslie Sand & Soil Deposits Land Management Study [1,2].

3.8 Geology

The high level sand deposits in the study area are composed of Quaternary alluvium, deposited in an eroded basin of Wianamatta Group sedimentary rock of Triassic Age. This deposition is believed to have occurred during Pleistocene times, when the river was flowing at a higher level. The deposits are composed of silica sand and generally have a high clay content, which forms a matrix surrounding the silica grains. Leaching has been a continuing process in the sand. Limonite staining and nodules occur in some locations. The underlying sedimentary Wianamatta Group consists mainly of shales and siltstones, with minor beds or lenses of sandstone. This area of the Sydney basin exhibits the thickest remaining section of this group, and outcropping shales and siltstones are widespread. Basement contours over the site, determined from a drilling program for the Land Management Study[1] indicated that the bedrock is grading gently upwards to the east beneath the sand deposit.

The high level sand deposit is underlain by the Bringelly Shale, which is the uppermost formation of the Wianamatta Group. The predominant lithological types are claystone and siltstone, with some limonite and some sandstone lenses.

3.9 Form of the Sand Deposits on Spring Farm Property

The Spring Farm sand deposit consists of a dark red-brown, fine to medium grained sand with varying amounts of clay and silt fines. The main variation in the material is the amount of fines (material passing a 76μ sieve). The depth of sand in this part of the deposit is typically 4-6m and up to 9m at the existing 74m contour. The base of the deposit is at about RL 65m AHD. The estimated volume of sand to be extracted is 665,000m^3 (1,330,000 tonnes). The sand is suitable for use as a fill sand, or as a mortar sand or concrete sand with beneficiation.

3.10 Form of the Soil Deposits on Spring Farm Property

The soil deposit on Spring Farm is part of a larger deposit stretching along the northern bank of the Nepean River. Drilling investigations undertaken as part of the Land Management Study[1] have shown a large variation in the type of soil in the deposit, but in general it consisted of several metres of sandy silt overlying a fine grained, brown silty sand.

The proponent considers that all of the material in the soil deposit would be useable in one or more of the following categories:

* Top Dressing Soil
* Top Soil
* Garden Soil and Fill Soil

The total quantity of soil present in the deposit is not known precisely as much is below the present river level and is effectively unextractable. The total amount of soil to be extracted, when limiting the depth to 3 metres above low water level, is approximately 205,000m^3 (350,000 tonnes). This will involve a maximum extraction depth of approximately 8 metres.

3.11 Nepean River adjacent to Spring Farm

The Nepean River in the vicinity of Macarthur Bridge flows within a channel approximately 30 metres wide (at bed level) and 10 metres deep. Under dry conditions the river flows in a shallow channel through sand deposits in straight reaches, and through deep water holes at bends in the channel alignment. The normal low water level of the river is approximately R.L. 56 metres.

It mostly has a stable channel alignment with both banks well covered with vegetation. The channel has straight reaches within floodplain deposits with bends in channel alignment at the extremities of the floodplain and where rock outcrops. At these locations, the outside river bank is composed of cohesive soils from sedimentary rocks of the high country bounding the floodplain.

The flood plain is subject to inundation in periods of heavy rainfall, as happened in February 1992. Under these conditions, the river carries a high sediment load, which is deposited in the more quiescent areas over the land.

Figure 19 shows sand deposited on a rehabilitated section of the Spring Farm Soil deposits after the February 1992 flood.

3.12 Climate and Air Quality

Climatic and air quality data were studied for the Elderslie Sand and Soil Deposits Land Management Study Environmental Impact Statement. No further studies have been undertaken for this Environmental Impact Statement.

Climatic data for the area is available from stations at Camden Airport and Camden Bowling Club. Mean daily maximum temperatures vary from 29.4°C in summer to 17.0°C in winter, with minimum temperatures ranging from 16.7° C to 3.1°C respectively. Average annual rainfall is 768 mm with the greater proportion falling during the summer months.

The climate is tempered by winds from a predominantly easterly and southerly direction in summer, and a south-westerly direction in winter. Throughout the whole year, the morning hours are distinctly calmer than the afternoon hours, with the summer months experiencing the least number of calm days. Winds of speeds greater than 30km/hr generally come from the south or south-west.

No regular records for ambient air quality or dust deposition are available for the study area. It is a rural location with adequate cover of vegetation to prevent gross pick up of dust by wind or other natural phenomena.

There is no obvious indication of gross dusting from the existing sand and soil pits and observations of vegetation in areas surrounding the existing extraction operations on numerous occasions during fieldwork for both the Land Management Study and this Environmental Impact Statement, has shown no indication of deposition adjacent to the workings.

FIGURE 19 - Sand Deposition on Spring Farm Rehabilitation Area
Beside Nepean River after Flooding

3.13 Hydrology and Water Quality

The distinct drainage channels on or near Spring Farm are the Anabranch, the Nepean River and the minor riverside anabranches. Normal stormwater run-off drains in a south-westerly direction eventually reaching the river. Little run-off originates off the site except for flood overflows from the river and Anabranch.

The water quality in the Nepean River is variable and alters considerably depending on the flow of water in the river. In periods of flood it is heavily charged with silt and other suspended material, which settles over the flood plain and in the river channel. In periods of low flow the water becomes stagnant and is affected by run-off from the riverside activities.

Riverside activities which cause the low water quality levels in the river include farming, which tends to increase the nutrient level in the water, urban and road stormwater drainage into the river and extraction processes which might tend to raise the non-filterable residue in the water. No measure of water quality in the Nepean River was made during the study as the water quality is completely independent of effects from the study area.

3.14 Acoustic Environment

Ambient noise levels were measured on Spring Farm in 1977 as a part of the field work undertaken for the Land Management Study[1]. Since then, there has been considerable change in traffic density on roads and urban development has been undertaken on the other side of the Nepean River from Spring Farm in Benkennie (South Camden).

To provide reliable noise information to assess the Spring Farm development proposal, a background noise level survey has been undertaken as a part of this study.

This was undertaken over several days in February 1992. A total of six noise sample points were selected in the vicinity of Spring Farm, Macarthur Road and Springs Road, and in the residential areas on the southern side of the Nepean River. The locations are shown on Figure 20 and described in Table II, where the measurement results are given. Measurements taken on a Saturday are given in Table III.

Each sample point was visited on a number of occasions between 6.30 a.m. and 5.30 p.m. on weekdays and also between 6.30 a.m. and 1.00 p.m. on a Saturday.

On each occasion, the following noise levels were measured over a period of approximately 15 minutes:

L_{90} - the level exceeded for 90% of the measurement period (normally taken as the "background" sound level);

L_{10} - the level which is exceeded for 10% of the time and indicative of typically occurring maxima;

L_{max} - the maximum level measured during the period.

The major contributors to background and maximum levels were noted and all readings were taken without the influence of wind, rain or other phenomena. All measurements were taken during good to ideal weather conditions with varying amounts of cloud cover, although it is likely that temperature inversion conditions existed during some early morning measurements.

All readings were obtained by a digital readout using a Bruel & Kjaer Precision Sound Level Meter Type 2231 with a BZ 7101 Statistical Analysis Module. The instrument calibration was checked before and after each set of readings using a Bruel & Kjaer Calibrator Type 4230.

Although the site and study area has a rural character, the acoustic environment is affected by a variety of surrounding land uses and activities which lead to background noise levels not typical of rural land. The major noise sources which contribute to the background acoustic environment are:

- road traffic on the Camden By-pass and on Springs Road (particularly coal trucks);
- activities associated with existing sand and soil extraction on adjacent properties;
- farming and horticultural activities (e.g. tractors, cannon shots to repel birds from the vineyard etc.);
- aircraft;
- domestic sounds;
- birds and insects.

TABLE II ELDERSLIE AREA BACKGROUND NOISE LEVELS (FEBRUARY 1992) - WEEKDAYS

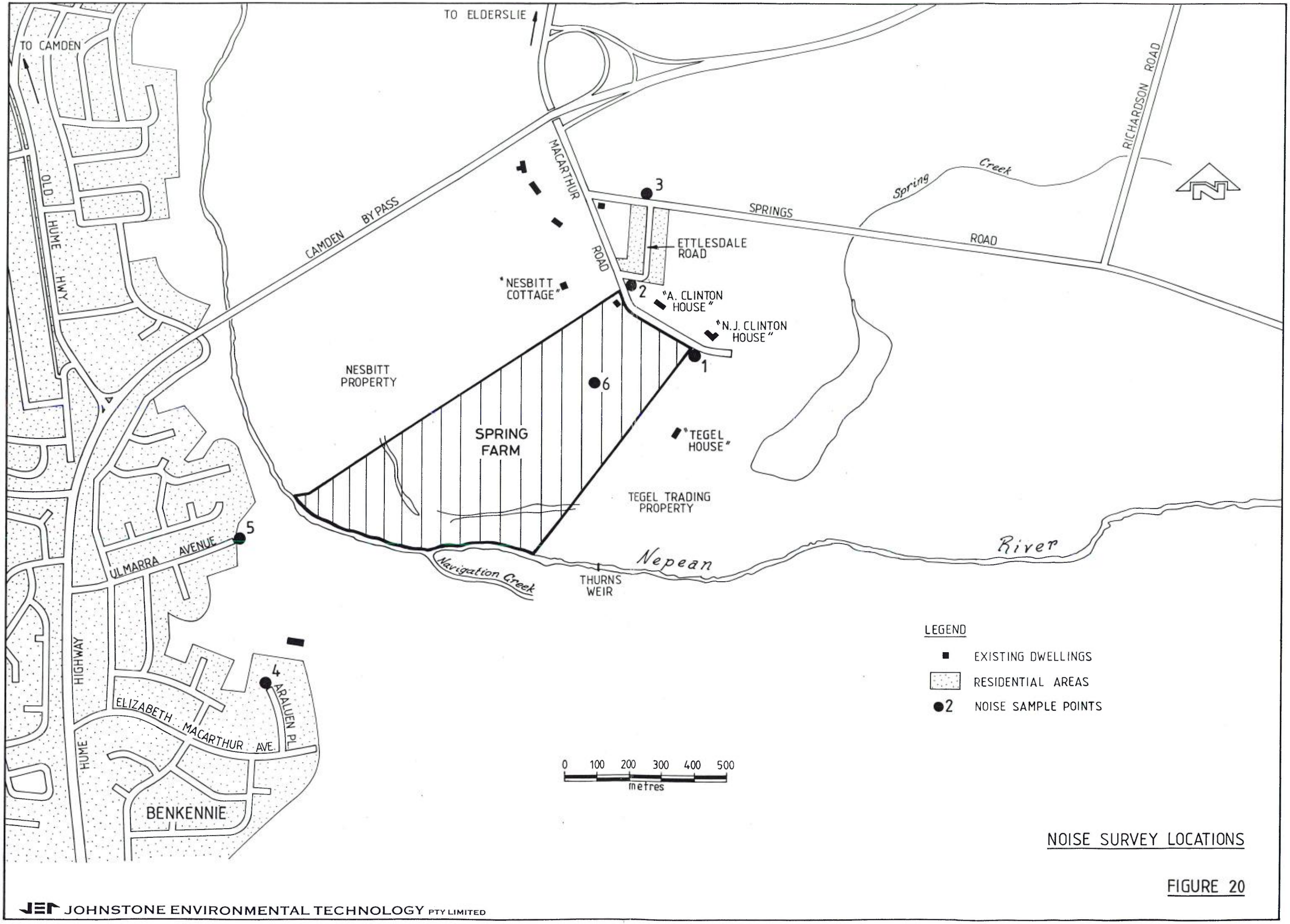
(ALL LEVELS IN DBA)

NOISE SAMPLE POINT		0630-0800 TUES 11/2/92	0630-0800 THUR 20/2/92	0800-0900 TUES 11/2/92	0800-1000 THUR 20/2/92	1000-1140 TUES 11/2/92	1000-1140 THUR 20/2/92	1140-1300 THUR 20/2/92	1300-1420 TUES 11/2/92	1330-1500 MON 10/2/92	1430-1600 THUR 6/2/92	1500-1600 TUES 11/2/92	1615-1700 THUR 6/2/92	1620-1720 TUES 11/2/91
1. MACARTHUR RD AT "THE POPLARS" FRONT GATE	L90	40.7	36.2	36.2	36.7	36.7	35.7	35.2	40.7	33.7	34.7		36.2	33.7
	L10	53.2	43.7	41.7	42.7	48.2	42.2	41.7	49.2	47.7	43.2		45.2	45.7
	Lmax	64.8	63.3	57.0	65.6	68.8	59.1	50.9	71.0	57.5	62.9		60.6	71.1
2. CORNER OF ETTLESDALE RD & MACARTHUR RD	L90	40.2	39.2	41.7	41.2	43.2	39.7	36.7	42.7	38.2	41.7		42.2	39.2
	L10	51.2	45.2	46.7	47.2	52.2	50.2	47.7	53.7	50.2	51.2		51.7	51.2
	Lmax	78.0	64.3	55.8	74.6	73.3	70.1	74.5	77.6	62.9	74.6		76.8	67.0
3. CORNER OF ETTLESDALE RD & SPRINGS RD	L90	47.2	43.2	44.2	43.2	40.7	38.7	39.2	42.7	41.7	48.2	47.2	45.7	44.7
	L10	56.7	58.7	65.2	65.7	61.2	63.7	51.2	65.2	68.7	70.7	72.7	66.2	66.2
	Lmax	78.9	82.1	77.5	84.4	85.3	90.0	78.0	79.6	85.4	86.6	85.8	86.4	78.1
4. No. 24 ARALUEN PLACE (N. END)	L90	40.2	39.7	40.7	32.2	39.7	35.2	36.2	40.2	38.7	38.7			
	L10	48.2	48.7	47.2	42.7	47.2	51.7	53.7	57.2	49.7	46.2			
	Lmax	60.7	68.7	77.8	71.3	61.9	54.9	63.9	64.6	69.8	67.8			
5. No. 37 ULMARRA AVENUE (E. END)	L90	41.2	38.7	41.2	33.7	41.7	35.2	35.2	40.7	40.2	37.2			39.7
	L10	46.7	51.7	51.7	43.7	57.7	50.7	41.7	64.2	54.2	46.7			46.7
	Lmax	55.7	61.8	78.4	60.8	68.0	64.3	61.2	72.0	75.2	64.2			59.7
6. ON COLLINS SITE NEAR FORK IN TRACK	L90	40.2	39.7		39.7	40.2	35.7	37.2	38.7	33.7		39.2		
	L10	45.7	46.2		46.2	45.7	56.2	43.7	47.7	37.7		45.7		
	Lmax	59.1	55.5		59.8	68.6	76.2	63.2	80.5	67.0		71.1		

TABLE III ELDERSLIE AREA BACKGROUND NOISE LEVELS (FEBRUARY 1992) - SATURDAY

(ALL LEVELS IN DBA)

NOISE SAMPLE POINT		0630-0800 SAT 15/2/92	0800-1000 SAT 15/2/92	1100-1200 SAT 15/2/92	1200- SAT 15/2/92
1. MACARTHUR RD AT "THE POPLARS" FRONT GATE	L90	32.7	36.7	36.2	
	L10	44.2	42.2	44.7	
	Lmax	54.9	60.9	56.3	
2. CORNER OF ETTLESDALE RD & MACARTHUR RD	L90	34.7	40.7	38.7	
	L10	47.2	48.2	48.2	
	Lmax	71.0	63.2	61.0	
3. CORNER OF ETTLESDALE RD & SPRINGS RD	L90	38.7	41.7	44.7	45.2
	L10	54.7	64.2	64.7	63.7
	Lmax	78.8	78.5	81.5	80.7
4. No. 24 ARALUEN PLACE (N. END)	L90	38.7	38.2		
	L10	47.2	57.2		
	Lmax	58.7	67.2		
5. No. 37 ULMARRA AVENUE (E. END)	L90	34.2	37.2		
	L10	45.7	48.2		
	Lmax	57.1	68.8		
6. ON COLLINS SITE NEAR FORK IN TRACK	L90	36.7	40.7	41.2	33.7
	L10	64.2	47.7	48.2	50.7
	Lmax	84.1	58.7	70.8	70.3



NOISE SURVEY LOCATIONS

FIGURE 20

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

The results in Table II indicate that typical weekday background (L_{90}) levels on Spring Farm and **in the vicinity of some of the nearest residences** (The Tegel house, "The Poplars" to the east and two the Clinton houses on Macarthur Road) vary from 34 to 41dBA and average 37dBA (refer Noise Sample Points 1 and 6). In many cases the lower levels were found to exist in the middle of the day and not early in the morning. The background levels in this area were most affected by traffic on the Camden By-pass and Springs Road (particularly when coal trucks were operating on Springs Road), the bird cannon shots (on most occasions, but not before 8.00am), aircraft, and natural features such as birds and insects/crickets.

Background levels at the corner of Ettlesdale Road and Macarthur Road (Noise Sample Point 2) are representative of the Nesbitt cottage and were a little higher (average 40dBA) as this point is closer to the Camden By-pass and Springs Road traffic. On Springs Road (Noise Sample Point 3) the typical background levels are higher again (L_{90} range 39-48dBA, average 44dBA) due to the passing traffic (often including coal trucks and other trucks) and proximity to the Camden By-pass road.

At the nearest urban areas to the south-west across the Nepean River, typical background levels range from 32 to 42dBA and average 38/39dBA (Noise Sample Points 4 and 5 are both in residential cul-de-sac locations). These levels are similar to those occurring at the site itself (Noise Sample Points 1 and 6).

The SPCC Environmental Noise Control Manual 4 gives recommended background (L_{90}) noise levels for various types of areas based on their land use and proximity to noise sources. The general area of Macarthur Road near the site would be classed as "(a) Rural" and the appropriate acceptable L_{90} daytime limit is therefore 45dBA. As discussed above, the current background levels measured were less than this.

The urban areas across the Nepean River (Noise Sample Points 4 and 5) would be classed as "(b) Residential", with a similar recommended daytime L_{90} level of 45dBA. Houses on Springs Road (Noise Sample Point 3) would be classed as "(e) Residential Area on a Busy Road" with a recommended daytime L_{90} of 50dBA. The measured background levels, as discussed above, were all less than these recommended acceptable limit criteria as used by the Environment Protection Authority (formerly SPCC).

The readings taken on a Saturday (15 February 1992) are shown in Table III. Most of the readings taken after about 12 noon were affected by wind noise and therefore are not shown. The ranges of L_{90} readings (and the averages) taken on the Saturday are quite similar to those measured on weekdays.

3.15 Traffic Movement

The transport routes used by trucks from the Elderslie area are:

(i) Macarthur Road for traffic from Springs Road to the Camden By-pass/Hume Highway (MR620);
(ii) Richardson Road for traffic from Springs Road to Narellan Road (MR178).

Springs Road is used mainly by coal truck traffic to and from the Clutha Coal Preparation plant and siding at Glenlee. This traffic occurs only during the day, using the Macarthur Road access to the Camden By-pass. Other traffic, including truck traffic from adjacent sand and soil extraction operations, is considered to be minor in comparison with the number of coal trucks using this route.

Richardson Road is the main access route between Springs Road and Narellan. This road is used by trucks transporting waste to Jacks Gully Waste Depot, and also by trucks transporting sand and soil from the Elderslie deposits.

Indicative traffic movement numbers are available from the Roads and Traffic Authority for Camden By-pass and Narellan Road (Table IV) and for the intersection of Richardson Road and Springs Road from Camden Council (Table V). Figure 21 shows the vehicle movement sample locations.

The numbers for local traffic on Springs Road are highly variable depending on whether coal is being trucked to Glen Lee or not. Presently an estimated 340 coal truck movements per day are occurring.

The road network serving the area is good, with sealed two lane roads connecting to the Camden By-pass and Narellan Road, both of which are main roads with typical traffic densities of 11,500 and 16,800 vehicle movements per day.

Both of these roads have ample capacity for the truck movements from Spring Farm and provide an arterial road connection to other parts of the Macarthur Region and to metropolitan Sydney.

TABLE IV **Annual Average Daily Traffic Volumes for Camden By-pass and Narellan Road (1989)**

Location 1 (Camden By-pass)	11,552
Location 2 (Camden By-pass)	12,565
Location 3 (Narellan Road)	16,786
Location 4 (Narellan Road)	15,435

Location of Traffic Counters shown on Figure 22.

Source: Roads and Traffic Authority

TABLE V ROAD COUNTS BY CAMDEN COUNCIL - ENGINEERING DEPARTMENT

Spring Road

	Monday	Tuesday	Wednesday	Thursday	Friday	Average
Coal Trucks	317	289	268	242	380	299
Sand Trucks	67	50	45	46	46	51
Other Trucks	92	89	82	99	98	92
Cars	597	553	582	563	594	578
Totals	1073	981	977	950	1118	

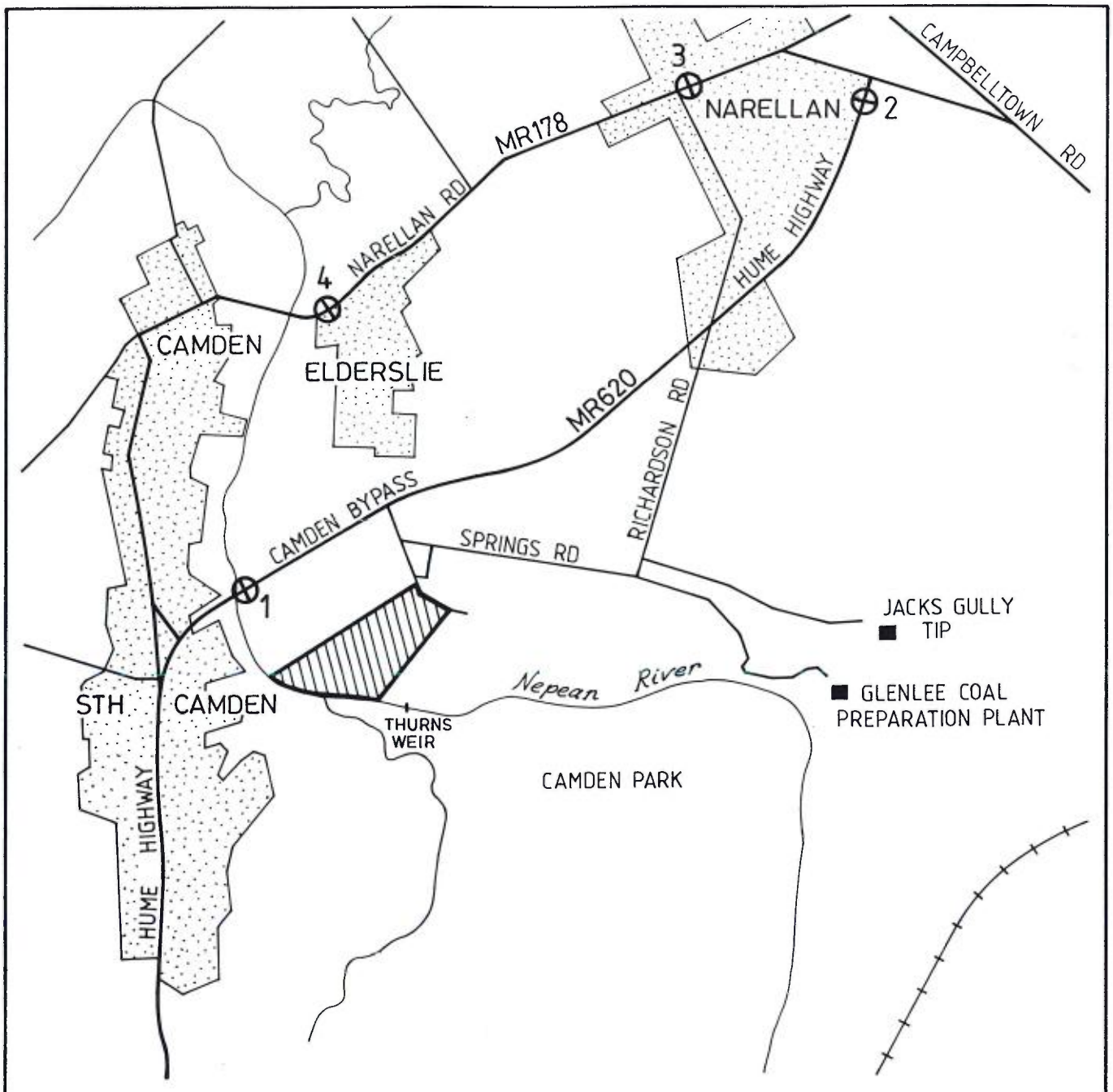
Richardson Road

	Monday	Tuesday	Wednesday	Thursday	Friday	Average
Coal Trucks	28	17	16	8	11	16
Sand Trucks	71	52	50	49	49	54
Other Trucks	101	101	128	159	127	123
Cars	675	595	601	601	639	622
Totals	875	765	795	817	826	

Clutha Coal Road

	Monday	Tuesday	Wednesday	Thursday	Friday	Average
Coal Trucks	345	306	284	250	388	317
Sand Trucks	4	2	5	3	3	3.4
Other Trucks	41	16	54	86	47	49
Cars	184	162	161	152	179	167
Totals	574	486	504	491	617	

Source: Camden Municipal Council, July 1990 (Harvest Scientific Services: 1992)



LEGEND

- MAJOR ROADS
- MINOR ROADS
- RAILWAY LINE
- RESIDENTIAL AREAS
- RIVERS, CREEKS
- LOCATION OF RTA AADT STATION
- SPRING FARM PROPERTY

0 1 2
KILOMETRES

ROAD NETWORK AND TRAFFIC COUNT LOCATIONS

FIGURE 21

3.16 Constraints on Extraction

As Spring Farm is within the area covered by the Elderslie Sand & Soil Deposits Land Management Study[1], constraints applied by the study apply to extraction of sand and soil from Spring Farm.

The criteria which are relevant to the development of the present proposal are:

(a) to plan and undertake the extraction in a similar manner to, and in sequence with, adjoining extraction operations;

(b) to control dust generation within the site;

(c) to maintain a stable extraction area and control erosion from the site by appropriate soil erosion control;

(d) to control silt laden storm run-off and minimise the quantity of such run-off entering the Nepean River;

(e) to maintain the stability of the bank of the Nepean River;

(f) to minimise social disturbance caused by noise and traffic generated by the operation;

(g) to produce a final landform after extraction which is consistent with the landform proposed in the Land Management Study and congruous with the existing remaining landform;

(h) to utilise existing native plant species or plant species ecologically compatible with the indigenous plant material in the rehabilitation programme while being consistent with the recommendations laid down by the Land Management Study;

(i) to develop flood prone land below the 100 year flood level, which will be suitable for recreation and open space usage when extraction is completed.

Additionally the Prospect Electricity power line crossing the sand extraction area constrains extraction near support poles.

4.0 DESCRIPTION OF PROPOSAL

4.1 General

This environmental impact statement assesses a proposal to extract progressively some 665,000m^3 (1,330,000 tonnes) of sand and 205,000m^3 (350,000 tonnes) of soil from Spring Farm over a 15 year period.

Sand and soil extraction on Spring Farm has been undertaken for the last 10 years under a Consent issued by Camden Council in 1982. The proposals set out in this environmental impact statement are **supplementary** to the original Development Consent issued by Camden Council and are for a continuation of the existing extraction and for establishment of a sand washing plant and associated stockpiles.

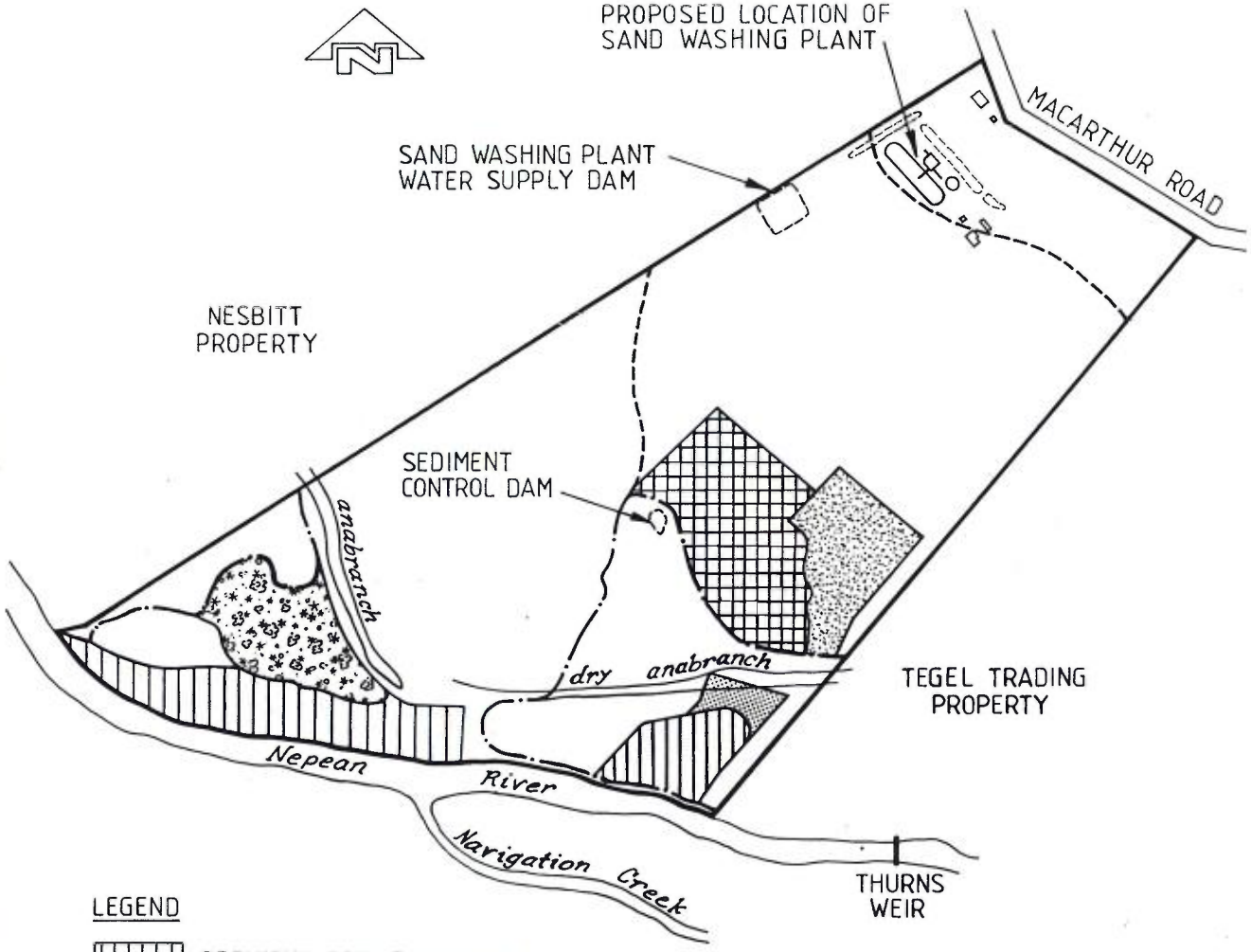
The proponent, M Collins & Sons (Contractors) Pty. Limited, will undertake the extraction as a "dry" operation wholly confined within the Spring Farm property boundaries to achieve a final landform, generally as set out in Figure SE49 of Volume VI: The Summary Environmental Impact Statement of the Land Management Study[2]. Some sand will be washed and the tailings will be dewatered and used as backfill along the eastern property boundary of Spring Farm, in the sand extraction areas where sand is extracted to a lower level than the required final landform level or in the soil extraction zone beside the Nepean River thus allowing additional soil extraction to be undertaken there.

Sand and soil will be extracted from within the area shown on Sheet 6 of the Sydney Regional Environmental Plan No. 9 (Figure 3 of this Environmental Impact Statement).

4.2 Extent of Extraction

The areas proposed for sand and soil extraction in the Spring Farm property are shown on Figure 22. Broadly sand will be extracted from the upper part of the site between land presently with a surface level of 67m and the 74m contour. This area is contiguous with the existing sand extraction area. The base of the extraction will be at RL 65m (AHD).

Soil extraction of the riverine deposits will extend from the eastern property boundary to the Anabranch along the northern river bank, which is contiguous with the existing soil extraction area. Another area to the west of the Anabranch beside the northern property boundary will also be extracted, and will form an extension of the soil extraction on the adjacent Nesbitt property, which is also owned by M Collins & Sons.



LEGEND

- PREVIOUS SOIL EXTRACTION AREAS
- CURRENT SOIL EXTRACTION AREAS
- PREVIOUS SAND EXTRACTION AREAS
- CURRENT SAND EXTRACTION AREAS
- EXTENT OF SOIL EXTRACTION AREA
- EXTENT OF SAND EXTRACTION AREA
- BOUNDARY OF SPRING FARM
- REP Nº 9 EXTENT OF EXTRACTION
- VOL VI SUMMARY EIS EXTENT OF EXTRACTION
- AREA TO BE BACKFILLED

0 100 200 300 400
METRES

PROPOSED EXTRACTION AREAS

FIGURE 22

Filling to reinstate the area to the south-west of the Anabranch will also be undertaken concurrently with extraction of soil to the west of the Anabranch so as to develop a smooth bank along the north side of the Nepean River.

4.3 Sand Extraction

The sand extraction area is about 17ha and is estimated to contain some 665,000m^3 (1,330,000 tonnes) of sand. The sand deposit varies in depth between about 1-2m at the southern edge at the 67m contour to a maximum of about 9m.

The sand will be extracted dry using a Caterpillar CAT966F front end loader to dig out the sand from the face of the extraction area, as shown on Figure 12. The first step in sand extraction will be to cut down and remove any trees, shrubs etc. These will either be chipped and reused in the rehabilitation or will be removed from the site to landfill disposal. There will be no burial of trees, shrubs etc. within the property. The next step will be to strip the top 300mm of grass, topsoil and some sand. This will be stockpiled for use in the rehabilitation. The sand will then be dug out of the face of the sand pit and screened in the Powerscreen (Mark 2 or "Commander"). The screened product is fill sand, which will continue to be stockpiled in the active area of the pit and will be loaded direct in the pit by the front-end loader. Fill sand for sale will be transported to market direct from the in-pit stockpiles. Other sand will be progressively loaded into a dump truck and transported to the raw sand stockpile at the sand washing plant (see Section 4.4).

In-pit equipment will be:

- Front-end loader (CAT966F)
- Powerscreen (Mark 2 or Commander)
- Bulldozer (D7 or equivalent)
- Excavator (1m^3 capacity)
- Water Cart
- Dump Truck

The procedure for extraction will be to progressively strip the surface top soil ahead of the working face, extract the sand and as the area is extracted to progressively rehabilitate the extracted area. The progression of extraction is shown on Figure 23.

Extraction of sand will proceed from the existing sand pit (Section 1) at the south end of the sand deposit and work up through Sections 2, 3 and 4 to the 74m contour line at the limit of the extraction area. Sand will be dug out right up to the

eastern boundary, adjoining the Tegel Property and this zone will be backfilled with dewatered tailings to support the boundary (see Section 4.6). Extraction will then be undertaken in Sections 5, 6, 7, 8, 9 and 10 to complete the sand extraction. The water supply dam for the sand washing plant in Section 9 will be relocated as necessary to enable the sand to be extracted.

The open area being worked at any time for sand extraction will be limited to 2 ha, with an adjoining 2 ha being rehabilitated. Because of the progressive nature of the extraction and rehabilitation this will not necessarily correspond to a numbered area on Figure 23, but will straddle area boundaries as the stripping, extraction and rehabilitation progresses over the sand deposit.

Contours of the existing ground levels and post-extraction levels are shown on Figure 35.

4.4 Sand Washing Plant

It is proposed to construct a nominal 30 tonnes/hour sand washing plant in the north-west corner of the site above the 100 year flood level, as shown on Figure 22. Figure 24 shows a diagrammatic flow sheet for the plant and Figure 25 shows the layout of the plant.

Sand will be transported from the in-pit screened sand stockpiles by truck and will be dumped onto the raw sand stockpile. This will have a nominal capacity of 1000 tonnes. From there, raw sand will be loaded into the Receiving Hopper of the plant by front end loader (CAT950E), from where it will be carried by a 30 tonne/hour conveyor to the mixing tank where water will be added to form a slurry.

The sand/water slurry will then be pumped by a nominal 181m^3/hr slurry pump up to a single 375 mm diameter cyclone, which will separate the material greater than 100µm from the clay and fine sand. The greater than 100µm material will be the washed sand which will be discharged from the base of the cyclone onto the washed sand stockpile, of nominal capacity 10,000 tonnes. The washed sand stockpile will be up to 10m high, 20m wide and 100m long.

The fine fraction (less than 100µm) will pass to a 6m diameter clarifier after addition of a flocculant to aid in removal of the fine clay particles from the water. Clarified water will be recycled from the clarifier via a storage tank and back to the initial mixing tank to be reused.

Underflow from the clarifier containing the sand washing tailings will pass to a 1.2m wide belt filter to remove water and produce a filter cake. This process will be continuous, similarly to the rest of the washing plant. Dewatered filter cake will be discharged onto a conveyor belt and will be placed on the filter cake stockpile, as shown on Figure 25. Water from the belt filter will be recycled to the clarifier and reused.

The clarifier, surge tank, belt filter and flocculant system will be built on a concrete slab, with kerb to contain spillage. Beside this a sink hole sump will be provided to hold the contents of the clarifier in the event of it being necessary to empty it due to malfunction or blockage.

Water for the sand washing plant at the consumption rate of 21m^3/hour will be pumped from the Nepean River. A water supply dam, as shown on Figure 22, will act as an intermediate storage, from where the water will be pumped to the sand washing plant supply tank beside the plant, as shown on Figure 25.

M Collins & Sons (Contractors) Pty. Ltd. already hold a licence from the Department of Water Resources to abstract water from the river. This will be used to provide the supply to the sand washing plant.

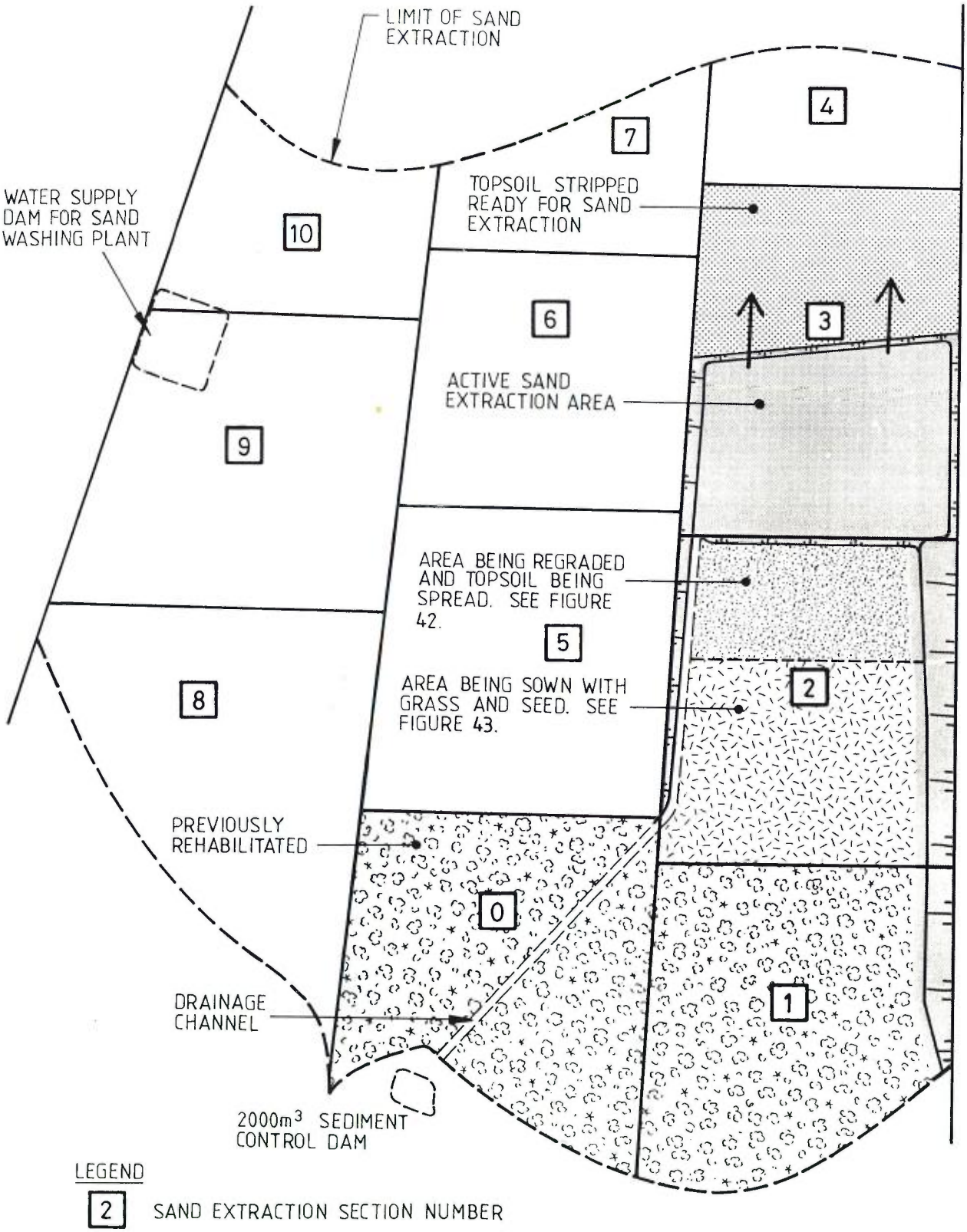
The anticipated capacity of the sand washing plant will be 50,000 tonnes/annum of washed product sand (equivalent to some 65,000 tonnes/annum of raw sand).

4.5 Sand Products

Filling sand will be produced in the pit and will be loaded out direct from the in-pit stockpiles after preliminary screening in the "Powerscreen". Annual production is estimated to be 25,000 tonnes.

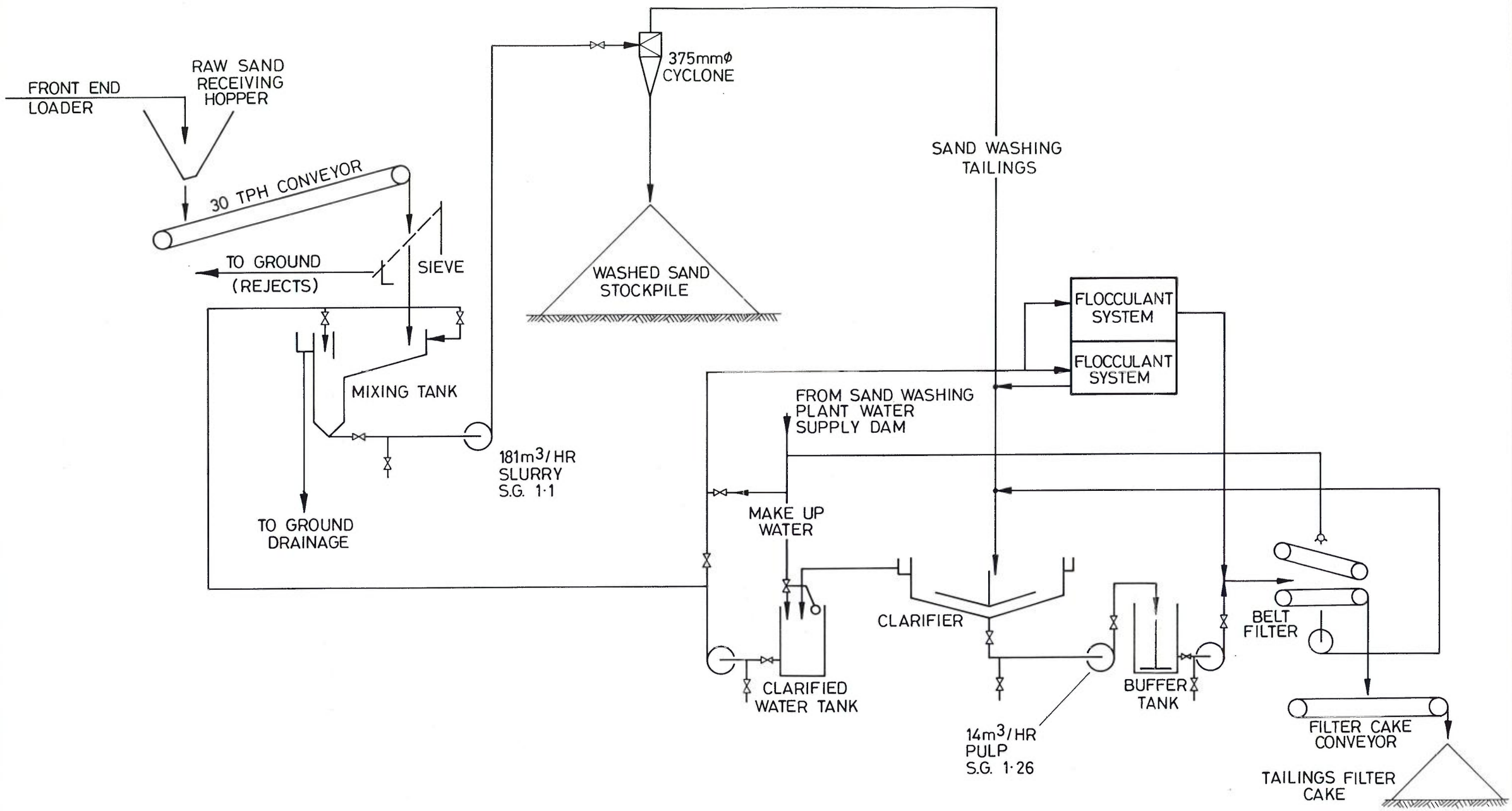
Concrete sand will be supplied direct from the washed sand stockpile. It will be loaded by front-end loader into trucks and transported to market. Annual production is estimated to be 50,000 tonnes.

Mortar sand will also be produced at Spring Farm. This will be done by blending some of the concrete sand and filling sand together. The blending will be done in the stockpile area of the sand washing plant by front-end loader. Annual production is estimated to be 15,000 tonnes.



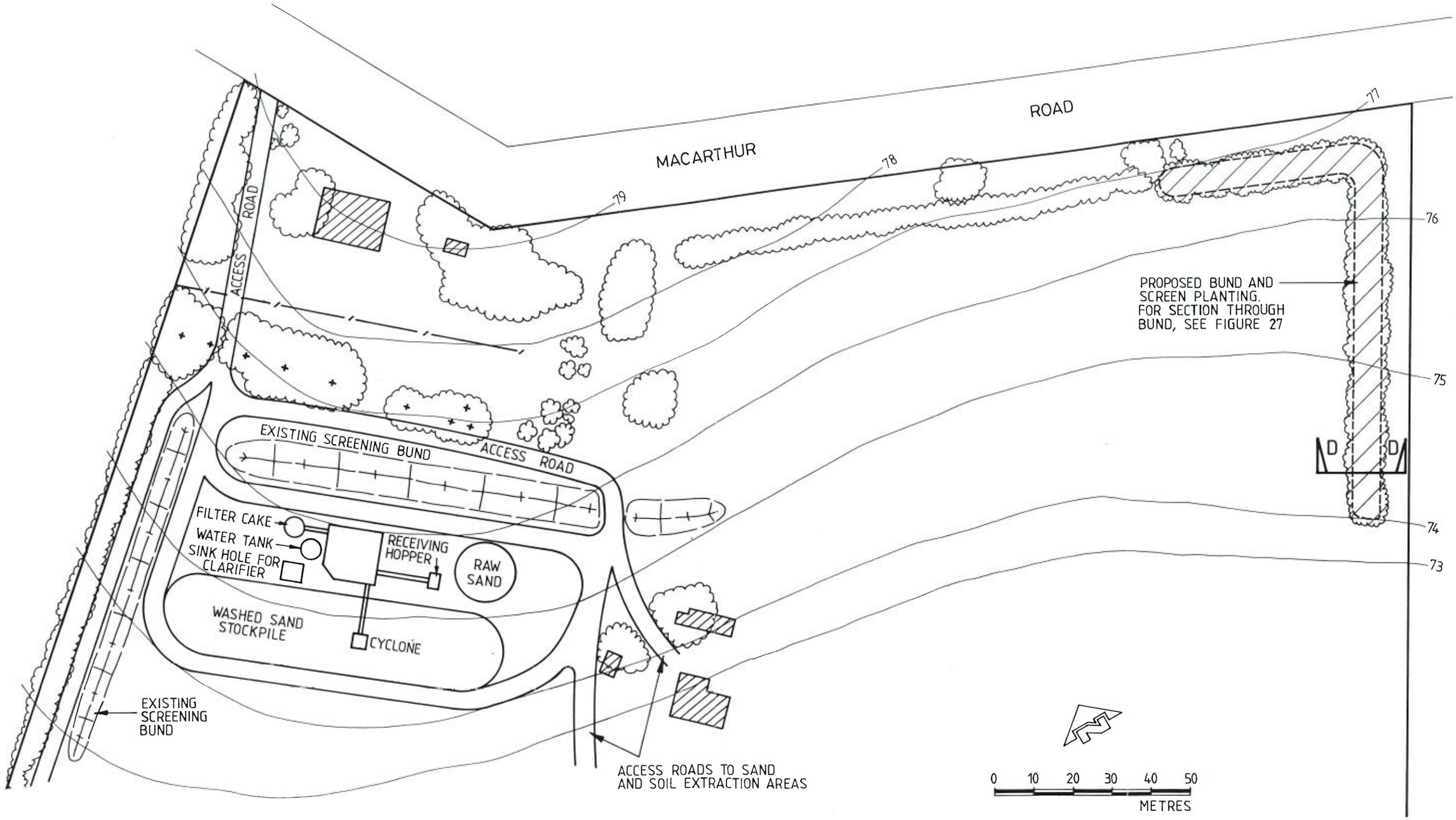
PROGRESSIVE SAND EXTRACTION AREAS

FIGURE 23



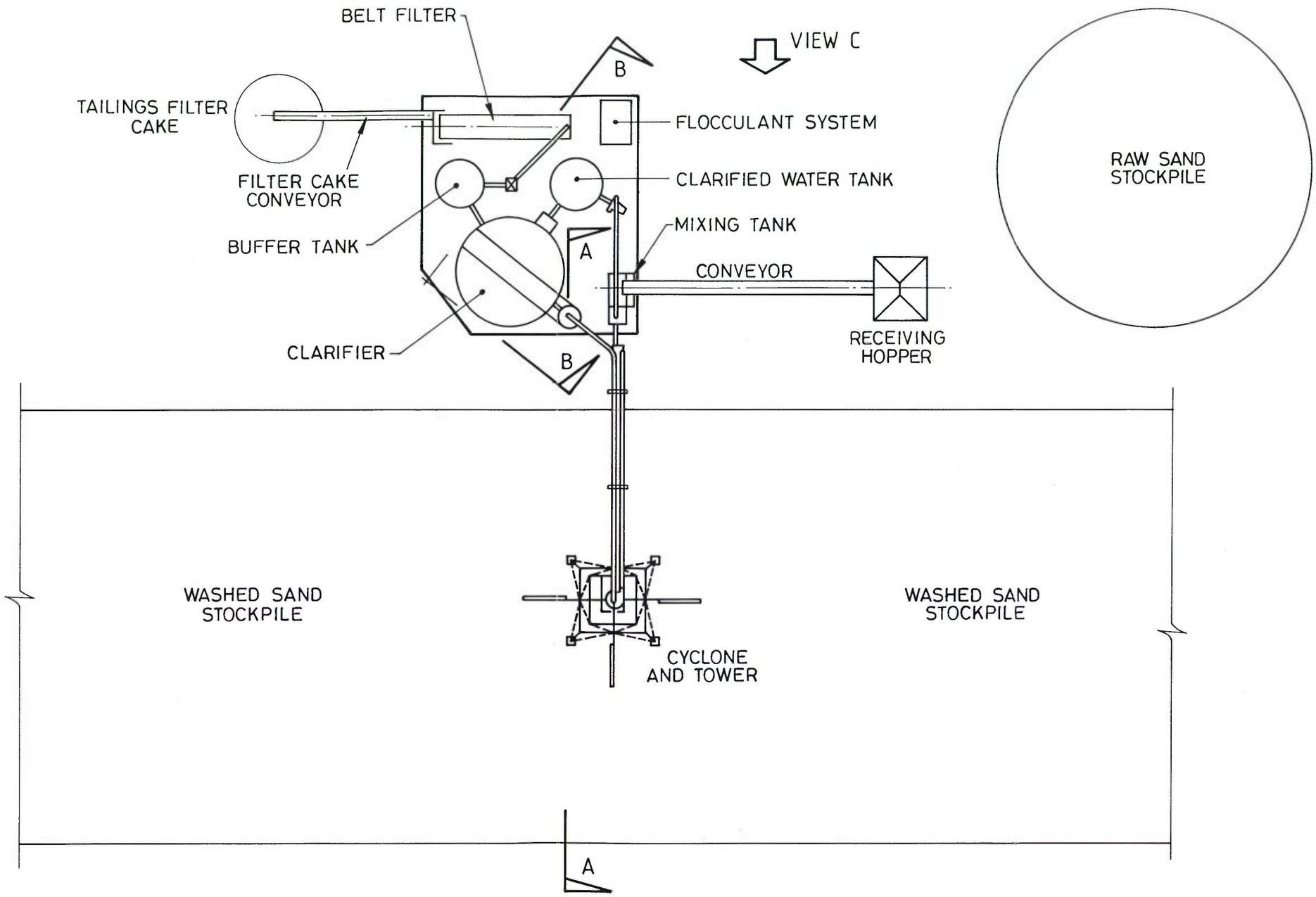
FLOWSHEET FOR PROPOSED SAND WASHING PLANT

FIGURE 24



LAYOUT OF SAND WASHING PLANT

FIGURE 25



PLAN OF SAND WASHING PLANT

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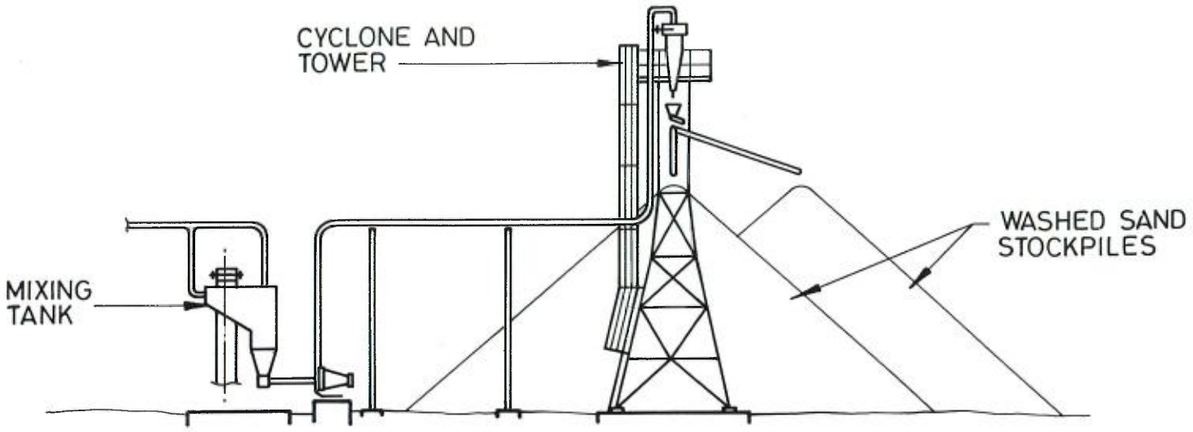
SECTIONS AND VIEW ARE SHOWN ON FIGURE 27

DETAILED LAYOUT OF SAND WASHING PLANT

FIGURE 26



SECTION A-A
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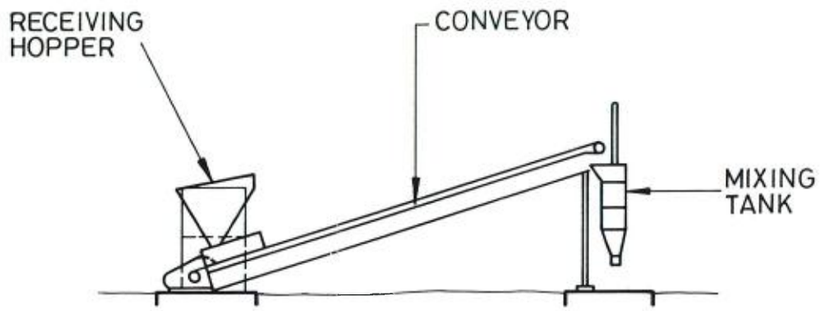

VIEW C
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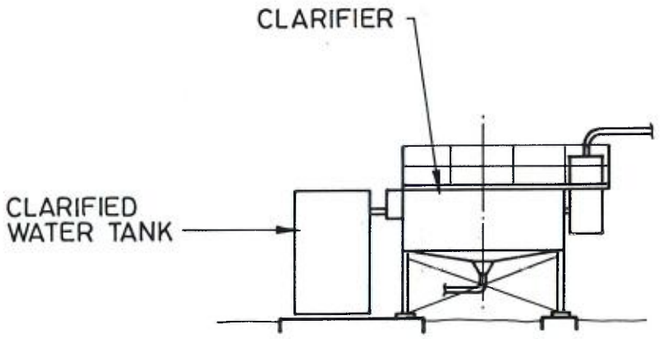

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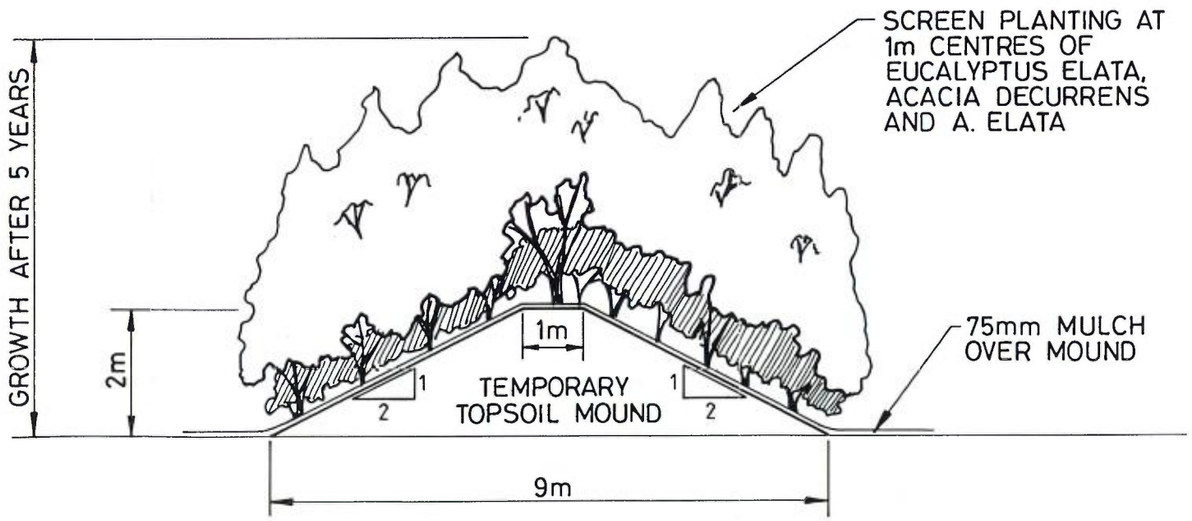


SECTION D-D THROUGH PROPOSED BUND AND SCREEN PLANTING ON EASTERN BOUNDARY OF PROPERTY (SEE FIGURE 25)
1:100

ELEVATIONS OF SAND WASHING PLANT

FIGURE 27

4.6 Sand Tailings Filter Cake Disposal

The filter cake from the sand washing plant will be a solid material that does not require further drying prior to disposal. It will be handled as a normal solid material and will be disposed of as backfill either within the Spring Farm property or as off-site landfill.

The proposed extraction levels in the sand area will require a lot of the available filter cake, however if selected clean, hard fill is available it may be used to replace the dried filter cake to reinstate the final levels. This will release the dried filter cake for other uses.

Fill, including the dried filter cake, will be placed along the eastern boundary of the sand extraction area to match the levels on the other side of the boundary. It will be compacted when placed and the revegetation will be established over the compacted fill and filter cake.

Other fill, including the filter cake, will be used to adjust the levels of the final surface of the sand extraction area, where sand has been extracted below the final profile required as envisaged for this area in the Volume VI: Summary Environmental Impact Statement[2] of the Land Management Study (page 112). Extraction to the base of the deposit will be undertaken and the area will then be backfilled with the dried filter cake (and fill), particularly for the areas near the north-western and northern boundaries of the extraction area, in order to leave a final landform that complies with the Land Management Study requirements. The dried filter cake and other fill will be compacted as placed.

Dried filter cake, or other selected clean fill, will also be used to raise the ground level and reinstate the area to the west of the south end of the Anabranch where previous soil extraction has lowered the surface and where it is necessary to develop a smooth alignment of the northern bank of the Nepean River to minimise the risk of flood overflow into the Anabranch and erosion of the bank under flood conditions. The dried filter cake or selected clean fill will be compacted as placed.

Any surplus filter cake will be used to backfill the soil extraction areas beside the north bank of the Nepean River in both the Spring Farm property and the adjacent Nesbitt property, which is also being extracted by M Collins & Sons (Contractors) Pty Ltd under a Development Consent issued by Camden Council. The filter cake would be used to reinstate the surface of the extraction area to RL 59m, where extraction of the soil below this level has been undertaken in order to maximise recovery of this valuable and scarce resource. As for the sand extraction areas and area beside the Anabranch, the dried filter cake will be compacted as placed.

4.7 Soil Extraction

The soil extraction areas beside the north bank of the Nepean River are about 7.0ha in area and are estimated to contain some 350,000 tonnes (205,000m^3) of extractable soil. A part of this area has already been extracted, as shown on Figure 22, and it is now proposed to extend the extraction area to the east, north and west. An area of about 2ha on the western side of the south end of the Anabranch will also be filled with dried sand washing tailings filter cake to reinstate the ground surface.

The extraction area proposed is within the area shown in Volume II of the Elderslie Sand & Soil Deposits Land Management Plan and complies with Sheet 6 of the Sydney Regional Environmental Plan No.9. It includes an area of soil ("the knoll"), which was excluded from the areas to be extracted shown in Volume VI: The Summary Environmental Impact Statement [2] of the Elderslie Sand & Soil Deposits Land Management Study,(superseded by Sydney Regional Environmental Plan No 9), but which is proving to be unstable in flood conditions. As may be seen on Figure 30, the river bank in this area is receding and is collapsing due to the bank geometry in this area between two low extracted areas and the steep, high bank which has not been extracted.

Other changes to the Land Management Study which have been found to be necessary have included reshaping the north bank of the Nepean River to maintain a smooth alignment of the river bank so as to channel flood flows to the bend in the river and not constructing the Anabranch Island animal refuge. The Morphological Assessment of the Nepean River at Elderslie (see Appendix C) notes:

> *"To further minimise the risk of the flood overflow into the Anabranch causing bank erosion it is proposed to reshape the right bank to maintain as smooth an alignment of the bank as possible at the mouth of the Anabranch taking into account the presence of any mature vegetation. The proposed reshaping is shown on Drawing No JET0160/53 Issue 1 and consists of establishing two well aligned banks, one at RL 59 and the other at RL 66. It is expected that such realignment, reinforced by heavy planting with suitable riverine species will establish a stable, scour resistant bank requiring only minimal maintenance, such as removal of debris after a flood".*
>
> and concludes
>
> *"The proposed reshaping of the right bank at the Anabranch is expected to direct the main stream flow to continue along the river channel while allowing flood overflow to enter the Anabranch with minimal scour of the bank"*

In regard to the Anabranch Island, the Morphological Assessment notes:

> *"One proposed option for site rehabilitation after extraction is to construct an island refuge for wild life by removing part of the left (western) bank of the Anabranch. This bank is a well treed, stable bank and given the scale of the planned extraction it is felt that it would be preferable to preserve any stable, well vegetated landforms that are not required for the extraction operation. Removing the bank of the Anabranch will probably destroy its clay lining allowing the water in the Anabranch to drain rapidly into the permeable soils surrounding the Anabranch."*
>
> and concludes
>
> *"Construction of the refuge island in the Anabranch is considered an unnecessary disturbance of a stable, well treed landform and is not recommended."*

Accordingly an amended post extractive landform omitting the Anabranch Island, as shown on Drawing No JET0160/53 Issue 1, is proposed for the Spring Farm and Nesbitt properties. The soil extraction proposed for Spring Farm, as shown on Figures 2, 22, 29, 35, 36 and 49, is in accordance with this amended design.

On the eastern side of the area already extracted, it is proposed to extract the remaining soil up to the property boundary. Woodgrand (Tegel Trading) have already extracted soil up to **their** western boundary (the Spring Farm eastern boundary) in this area under a Development Consent issued by Camden Council thus forming a thin wedge of soil which is both unstable and which will be washed away in a flood. This soil batter along the eastern boundary of the Spring Farm property is now being extracted in accordance with a directive from the Department of Water Resources to match the levels on the Tegel Trading property and the Spring Farm property.

On the northern side of the area already extracted, it is proposed to extend the soil extraction area to the edge of the soil deposit adjacent to the southern boundary of the sand extraction area.

On the western side of the existing soil extraction area, it is proposed to extend the soil extraction along the river bank through the soil "knoll" to the eastern side of the Anabranch drainage channel. The extraction will be bounded by the bed of the dry (eastern) anabranch and match into the main (western) Anabranch drainage channel bank so as to preserve all the tree cover along the Anabranch and the stand of trees and wattles on the northern side of the dry anabranch. The large Casuarina in this area will remain.

In the area of the "knoll", the river bank is high and very steep as shown on figures 30 and 31. There are trees in the bank in a state of incipient instability and the February 1992 flood eroded and damaged the soil bank which is showing signs of slippage (see Figures 32, 33 and 34).

Along the northern boundary of the property to the west of the Anabranch, soil extraction will extend from the property boundary towards the line of the Prospect Electricity powerlines. This area has already been partly extracted and there is a large soil pit still there, as shown on Figure 35. The whole area will be extracted down to the contours shown on Figure 35 and concurrently dried sand washing tailings filter cake or other selected clean fill will be placed in the area to the west and south-west of the southern end of the Anabranch to create a smooth alignment of the bank for 'training' the river under flood conditions. This area has previously been extracted but the Morphological Study (Appendix C) has shown that the area should be reinstated to minimise erosion and scour by the river in flood conditions.

The soil extraction procedure will be similar to the sand extraction. Firstly the trees will be cut down and removed or chipped. No trees or shrubs will be buried within the Spring Farm property. Then the topsoil, grass, tree stumps etc. will be stripped and stockpiled ready for subsequent use in the rehabilitation. If an area is ready to be rehabilitated, the stripped surface material will be replaced on the rehabilitation area immediately after being stripped. The soil will then be extracted dry, using a Caterpillar CAT966F front-end loader, trucked to a powerscreen and stockpiled.

Equipment to be used for the soil extraction will be:

- Front-end loader (CAT966F);
- Powerscreen (Mark 2 or Commander);
- Bulldozer (D7 or equivalent);
- Excavator ($1m^3$ capacity)
- Water cart
- Dump truck

The screened soil from the in-pit stockpiles is usually then loaded into trucks and transported to market. However for some special soil products, and due to increased market specialisation which has caused rigid industry standards to be created, some blending is required in spite of the very high quality of the Spring Farm soil deposits. For these products, Spring Farm soil will be blended with both washed sand and with imported materials as required. Whilst this blending is only a small scale operation, it is an extremely important factor in the overall project. The Spring Farm resource enjoys an economic advantage due to the location of sand and soil on the one site. Blending imported material with the "on site" resources increases the viability of the proposal.

The blending operation would be carried out adjacent to the washed sand stockpile area shown on Figure 25, with equipment which is used for extraction or other sand blending for mortar sand production.

Figure 35 shows the present landform and proposed final surface contours of the soil extraction areas, which will be no lower than RL 59m so that the final levels will be approximately 3m above the normal river level. Some soil extraction below this level may occur, but the levels will be reinstated by placement of dried sand washing tailings filter cake as described in Section 4.6.

Areas reinstated by placement of dried sand washing tailings or clean fill both adjacent to the south end of the Anabranch and elsewhere in the soil extraction areas will be rehabilitated as the final levels are reached in the same way as other parts of the soil extraction areas.

The order of soil extraction in the area to the east of the Anabranch is shown on Figure 28. Figure 29 shows the progressive extraction along the northern property boundary to the west of the Anabranch and the staged filling to reinstate areas to the west of the Anabranch, which have been extracted previously.

Soil will be extracted in an area no more than 2ha in extent, with a maximum area of 2ha being rehabilitated at any one time for all soil extraction areas in Spring Farm. These areas will move progressively over the soil extraction area so that the areas being extracted and the areas being rehabilitated will not necessarily correspond to a soil extraction area shown on Figure 28 and Figure 29, but will straddle boundaries as the extraction and rehabilitation progress over the soil extraction area.

The soil depths being extracted will be up to 8m. Extraction to the east of the Anabranch will proceed from the present soil extraction area in a generally northerly direction to Sections B, C, D, E, F and then to Section G. Extraction of Section G will be delayed until the rehabilitation of other riverside sections of the Spring Farm soil extraction area both west of the Anabranch and east of the "knoll" have had time to allow the trees to grow up (5 years). Extraction of the Spring Farm soil deposits and the Nesbitt soil deposits will be alternated to allow this to happen. Extraction of the area to the west of the Anabranch will proceed east along the Nesbitt property boundary and will be undertaken as an extension of extraction on the Nesbitt property. As the whole of this extraction area is less than 2ha, it will be extracted together to fit in with extraction on the north side of the property boundary and rehabilitation requirements on Spring Farm, particularly the need to allow plantings on previously extracted sections to grow up prior to extraction of the "knoll".

Filling to reinstate surface levels to the west of the Anabranch will similarly be undertaken to fit in with the soil extraction and will be undertaken progressively working in a northerly direction.

4.8 Site Equipment and Workforce

Equipment to be used for the sand and soil extraction is set out in Sections 4.3 and 4.7. Equipment will alternate between the sand washing plant, the sand extraction, the soil extraction and blending of sand and soil for market. The aggregate equipment used for sand and soil extraction on Spring Farm will be:

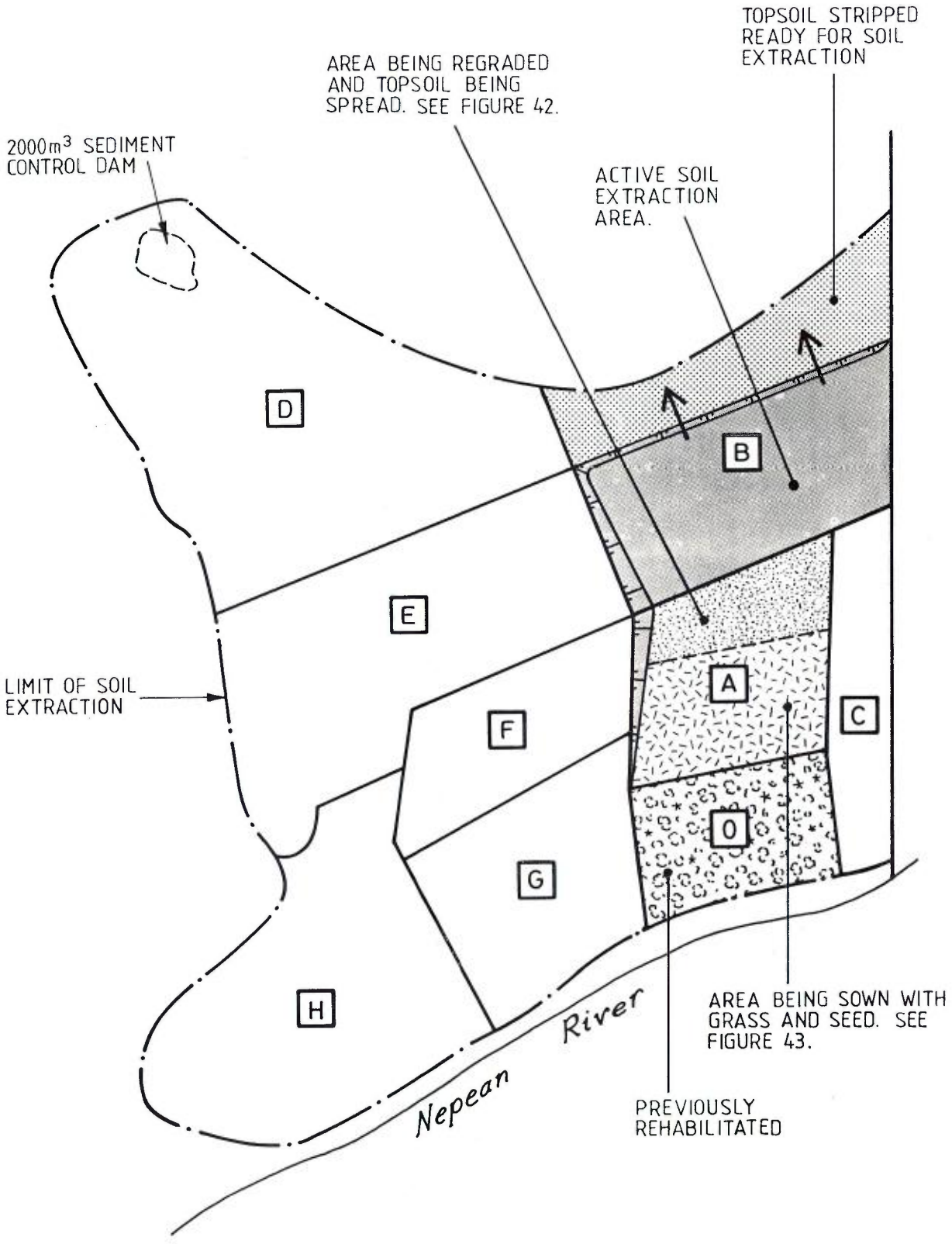
Number	Description	Detail
2	Front end loader *	CAT950E and CAT966F
2	Powerscreens *	Mark 2 or Commander
1	Bulldozer *	D7 or equivalent
1	Excavator	20 tonne or equivalent ($1m^3$)
1	Water Cart *	15,000 litre or equivalent
1	Farm Tractor *	60 hp
2	Dump Trucks	20 tonne or equivalent (rigid body)

* on site at present

Four (4) people will be employed in the extraction and sand processing at Spring Farm. One person will be required to operate the Sand washing plant and three people will be required to operate the extraction equipment, powerscreens, dump trucks and other equipment.

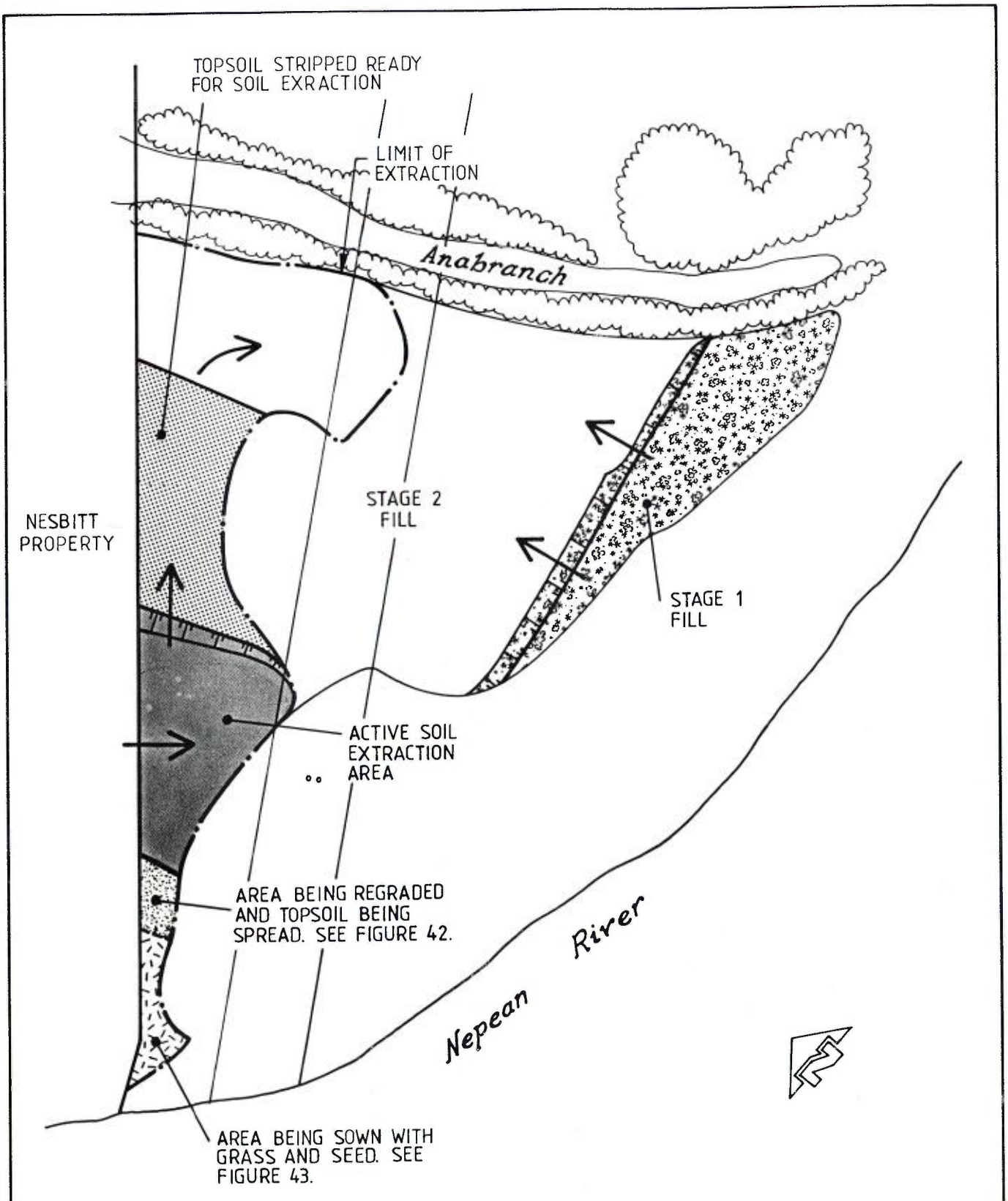
4.9 Hours of Operation

The hours of operation will be from 7.00am to 5.30pm on weekdays and 7.00am to 1.00pm on Saturdays.



PROGRESSIVE SOIL EXTRACTION (EASTERN ZONE)

FIGURE 28



PROGRESSIVE SOIL EXTRACTION (WESTERN ZONE)

FIGURE 29

FIGURE 30 - Area of Northern Bank of Nepean River at "Knoll"
Showing Spring Farm River Bank Instability and Recession

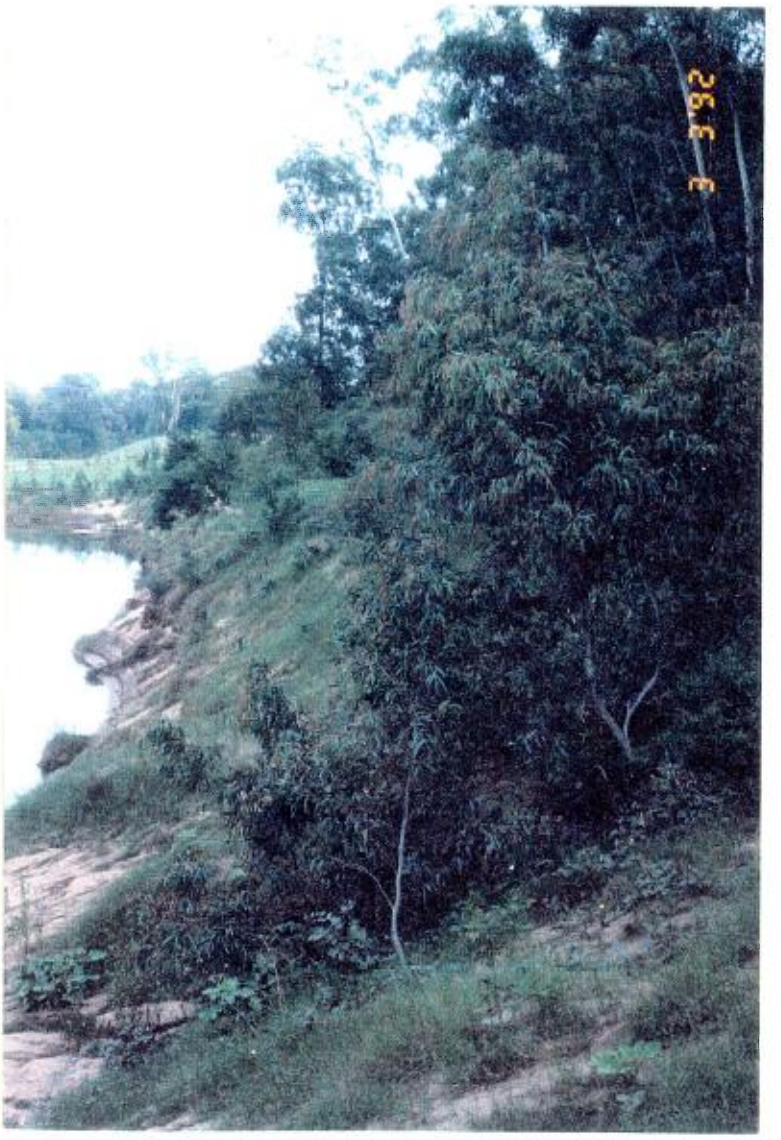


FIGURE 31 - North Bank of Nepean River
in proposed "Knoll" Extraction Area

FIGURE 32 - Eastern End of Soil "Knoll" on North Bank of Nepean River in Spring Farm Property

FIGURE 33 - Scouring and Tension Cracks in River Bank of Spring Farm at Eastern End of "Knoll" area

FIGURE 34 - Tension Cracks and Slumping in North Bank of Nepean River in Area with High Soil Bank

4.10 Production Rates and Duration of Project

Projected production rates are:

Soil	24,000	tonnes/annum
Filling sand	25,000	tonnes/annum
Concrete sand	50,000	tonnes/annum (including washed sand used for mortar sand production)
Mortar sand	15,000	tonnes/annum (made out of blending washed concrete sand and filling sand)

The estimated life of the resource is:

Soil	15 years
Sand	15 years

4.11 Transport

All product sand and soil will leave Spring Farm in trucks through the existing access onto Macarthur Road, as shown on Figure 25.

Truck size will vary from small single loads to multiaxle rigid body and articulated trucks of 25 tonne capacity. Most trucks transporting sand and soil from Spring Farm will be Highway vehicles of 15 tonne and 25 tonne capacity.

The trucking route will be down Macarthur Road to the intersection with Springs Road. At this intersection trucks will either:

a) travel along Macarthur Road and onto the Camden By-pass; or

b) travel up Springs Road to Richardson Road and onto Narellan Road; or

c) travel along Macarthur Road past the Camden By-pass when vehicles are making local deliveries.

The number of vehicle movements will vary with output and truck type used but is expected to be a maximum of 50 vehicle movements per day (25 loads per day). Peak truck trips leaving the site will be 10 loads/hour (20 vehicle movements/hour).

Trucks will operate between 7.00am and 5.30pm Monday to Friday and 7.00am - 1.00pm on Saturday. There will be no transport of product sand or soil on Sundays and public holidays.

4.12 Final Landform and Land Use

Figure 35 shows the existing landform and proposed landform and levels after completion of the sand and soil extraction. Figure 36 shows the Land Management Study "Master drawings" landform and the landform proposed.

Sections A-A' to V-V' inclusive through the extraction areas (computer drawn) at 20m centres are included in Appendix A.

The proposed final landform complies with the requirements of Elderslie Sand & Soil Deposits Land Management Plan except that the Anabranch Island 'ecological refuge' has been abandoned as a result of the Morphological Assessment (Appendix C), which recommends against disturbing the western bank of the Anabranch. The proposed extraction will result in a low terrace beside the Nepean River and a large, substantially flat area with surrounding banks in the sand extraction area.

There will be a bank, up to 6m high along the eastern boundary of Spring Farm caused by the previous extraction and backfilling on the Tegel Trading property and by backfilling on the Spring Farm property to support this bank. This will not be in accordance with the requirements of the Land Management Plan.

The ultimate use of the Spring Farm land below the RL 72m contour (the 1 in 100 year flood level) is planned as public open space and recreation in the Elderslie Sand & Soil Deposits Land Management Plan (Figure SE 30). Until acquired into public ownership, the sand extraction area will continue to be used for grazing and turf cultivation both before extraction and after rehabilitation. Similarly for the soil extraction areas, the tree cover planted as a part of the rehabilitation will be allowed to mature and a stand of riverine tree cover allowed to develop.

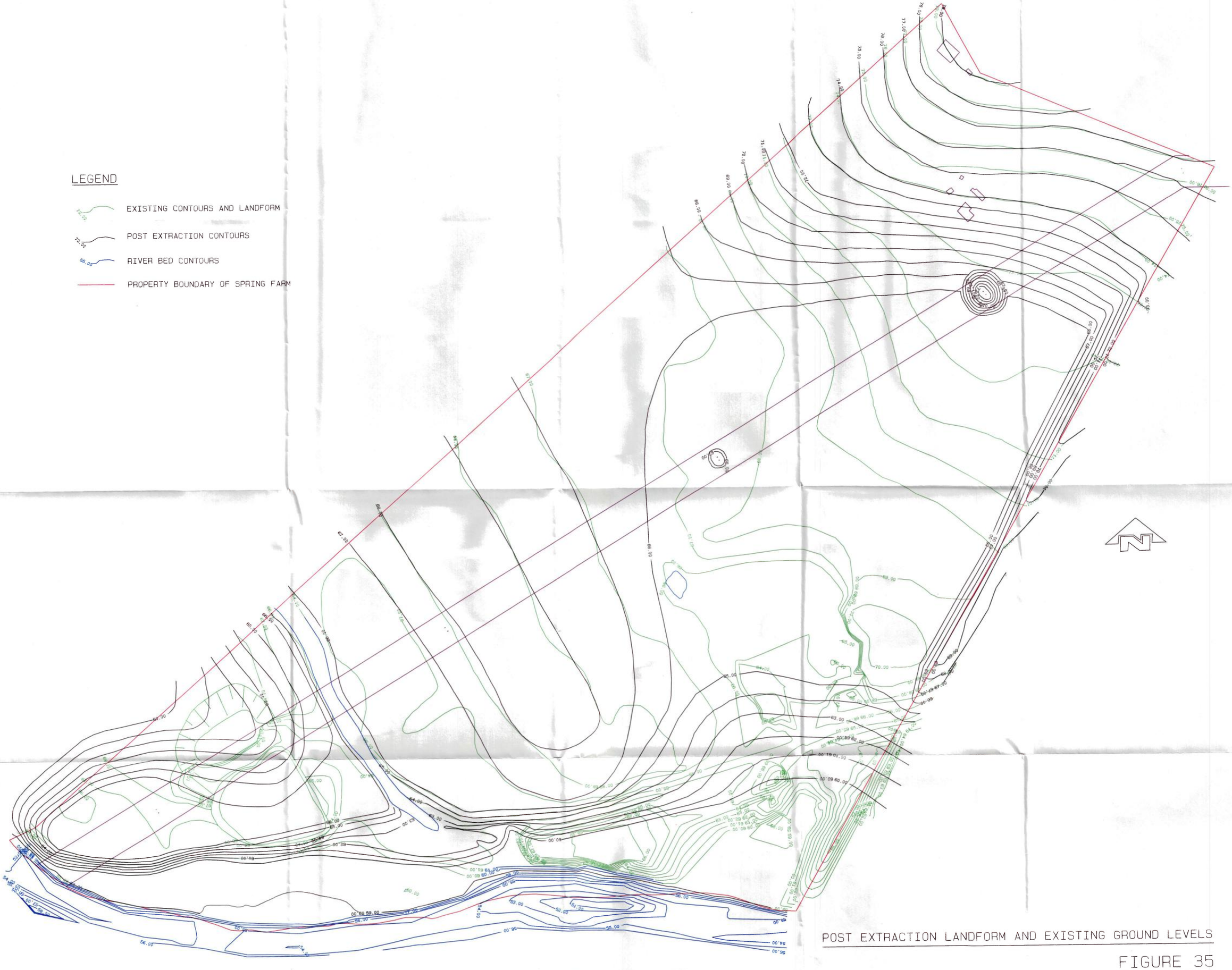
LEGEND

EXISTING CONTOURS AND LANDFORM

POST EXTRACTION CONTOURS

RIVER BED CONTOURS

PROPERTY BOUNDARY OF SPRING FARM



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METRES

POST EXTRACTION LANDFORM AND EXISTING GROUND LEVELS

FIGURE 35

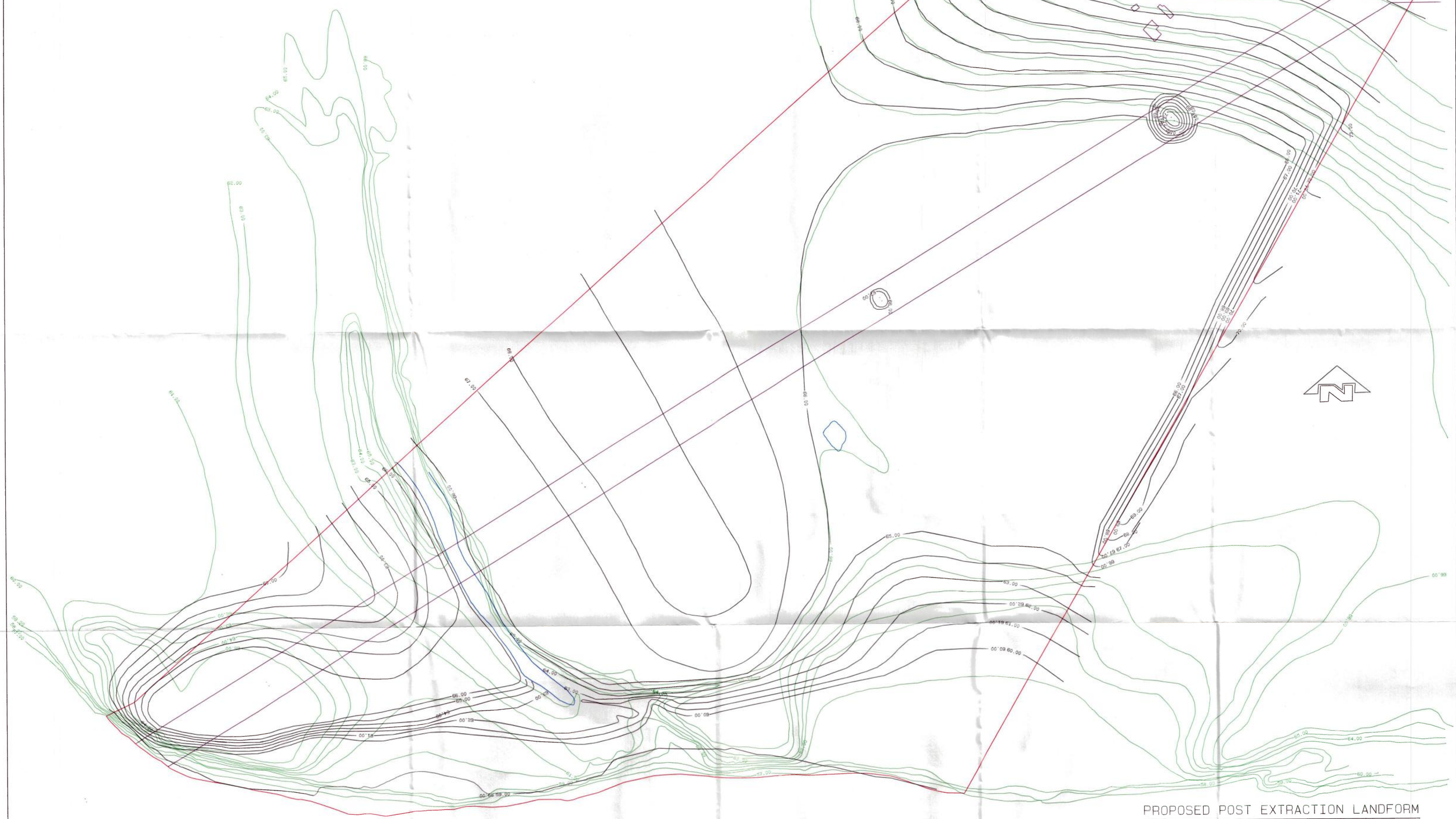
JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

LEGEND

LAND MANAGEMENT PLAN CONTOURS

POST EXTRACTION CONTOURS

PROPERTY BOUNDARY OF SPRING FARM



0 50 100 150 200

METRES

PROPOSED POST EXTRACTION LANDFORM

AND LAND MANANGEMENT PLAN LANDFORM

FIGURE 36

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

5.0 ENVIRONMENTAL SAFEGUARDS

5.1 Dust Control and Air Pollution

Spring Farm is an active farm and, as such, occasional fugitive dust emission may occur from normal agricultural tillage in dry and windy weather. In regard to the sand and soil extraction, no greater dust generation will occur outside active extraction areas than from the present farming activities as the areas are vegetated.

The active extraction areas are limited to 2ha for the soil pit and 2ha for the sand pit. In these areas and on the haul roads, a water cart (see section 4.8) will be used to keep the surfaces damp, as necessary, to avoid fugitive dust emissions occurring. This is the present practice, which has proven effective in preventing a dust nuisance occurring.

At the sand washing plant, sprays will be used to keep the raw sand stockpile and adjacent working area damp. This area could become a source of dust due to the dry and clayey sand on the ground being run-over by the front-end loader feeding the plant if dust minimisation procedures are not adopted.

It is not expected that the washed sand area would become a source of dust.

The special soil mixing area and the mortar sand mixing area adjacent to the sand washing plant will be treated in the same manner as the raw sand area.

Sand leaving the site will be damp and all loads will be covered. Trucks carrying loads of soil from the site will also have cloth covers over their loads at all times to reduce dust generation both within and outside the Spring Farm property.

All trees, scrub, shrubs etc stripped from extraction areas will be chipped and reused in the extraction area rehabilitation or will be removed from the Spring Farm Property. None will be burnt on site.

5.2 Water Quality Control

Sediment laden run-off from within the excavation areas can be expected during heavy rainfall periods, especially when the ground is already saturated. Control procedures will be different for the soil extraction areas and the sand extraction area.

In the soil extraction areas, the surface of the extraction pit near the river will be graded back from the bank so as to form a settling pond and filter bed of nominal 400 m^3 capacity, which will trap silt laden run-off from extended rainfall. This settling pond will hold run-off from a 1 in 3 year storm of 30 minutes duration.

Water trapped in the settling pond will either seep away through the sandy substrate or be pumped back for use in dust suppression activities or irrigation over the rehabilitation areas.

In the sand extraction area, a silt trap and Sediment Control Dam of 2000m^3 capacity will be constructed in Extraction Area 0 (see Figures 22 and 23). As required, berms and diversion drains will be constructed to trap run-off from active extraction areas and direct them to the dam, which will have the capacity to contain a 20 minute 1 in 10 year storm. Water collecting in this dam will be used for dust suppression and irrigation.

The sand washing plant is upslope of the sand extraction area. Any run-off from the stockpiles or spillage from the clarifier will be contained within the Spring Farm property and will pass over/through the sand extraction area and into the 2000m^3 Sediment Control Dam.

In periods of extreme rainfall, the Nepean River floods and both the soil and sand extraction areas may be inundated (see Figures 37, 38, 39 and 40). In this situation the river deposits silt onto Spring Farm (see Figure 19).

5.3 Rehabilitation Scheme

The rehabilitation scheme follows the recommendations of the Elderslie Sand & Soil Deposits Land Management Study. This involves:-

- A continuous program of weed control and removal;
- Grading of the post-extraction areas;
- Seeding works;
- Tree planting program
- and Maintenance of these works.

Moreover, M Collins & Sons is not only involved in the extractive industry, but also enjoys considerable experience in the lawn turf industry. In addition, the Company conducts operations as extractor/landowner. As a result of this background, a high priority is attached to ensuring successful rehabilitation.

FIGURE 37 - Nepean River in Flood at Spring Farm

FIGURE 38 - Nepean River Flood Inundating Sand Extraction Area on Spring Farm

FIGURE 39 - Flooded Sand Pit in February 1992

FIGURE 40 - Nepean River in Flood and Covering Soil Extraction Areas in February 1992

5.3.1 Weed control

An integral part of the management of the property includes a continuous weed eradication and removal program. The program utilises both mechanical and chemical methods for eradication and any occurrences of weeds in the rehabilitation areas are promptly removed from the site. This procedure will continue with the proposal set out in this Environmental Impact Statement.

5.3.2 Grading of Post Extraction Areas

As set out in Sections 4.3 and 4.7, the active extraction area for both the sand and soil is limited to 2ha for each material and as the extraction moves into new areas, the rehabilitation follows behind to limit the "open" area. Thus there is a progressive activity of clearing/stripping, extraction and rehabilitation.

At Spring Farm, the normal procedure is to commence rehabilitation when a (nominal) 4000m^2 area is no longer required for extraction. The extracted areas are backfilled to accord with the approved final landform contours. The ground, where necessary, is consolidated to ensure settlement is minimised and careful attention is given to providing a smooth landform free of depressions. Levels are checked at this stage to confirm compliance with the final landform plan and any discrepancies are rectified. A minimum 100mm topsoil is then spread over the area. The topsoil must be ploughed, harrowed and worked into a fine tilth to create a suitable seed bed. The moisture level within the soil needs to be controlled with the aid of irrigation as it is important that the topsoil does not dry out excessively or turn to powder.

In certain locations where stock graze on the rehabilitated area, it is necessary to construct temporary stockproof fencing. This is required prior to planting and grassing works being carried out.

5.3.3 Seeding Works

The appropriate seed mix for the season and location is then sown. In the Riparian zone, from the river to the anabranch, locally gathered seeds of native grasses and groundcovers will be sown with native couch (25kg/ha) in the warm seasons and clover (2kg/ha) in the cooler seasons. The native

grasses and groundcovers will be selected from the following list of plants from the Riverine Forest, Camden Park as recommended by the Royal Botanic Gardens at Mt Annan:-

Commelina cyanea;
Dichondra repens;
Entolasia stricta;
Hardenbergia violacea*;
Kennedia rubicunda*;
Lomandra longifolia*;
Microlaena stipoides;
Oplismenus aemulus;
Pellaea falcata var. falcata;
Pratia purpurascens;
Scaevola albida;
Stipa verticellata;
Stypandra glauca;
Themeda australis* .

* These plants are widely available through nurseries as potted stock and, if it is difficult to get seeds of these plants, they could easily be inserted into the planting scheme as tubestock plants.

In areas other than the riparian zone (generally above the 61m contour) the recontoured and topsoiled surface will be sown with the following species:

Cynodon dactylon (native couch) at 25kg/ha;
Rye grass at 15kg/ha;
Clover at 2kg/ha.

The seed mix for both areas will be prepared well in advance of the time required for sowing in consultation with contract nurseries and local community groups. Following seeding and planting, the rehabilitation area will be irrigated as necessary to ensure the grass cover is established successfully.

5.3.4 Tree Planting Programme

Once the grass and groundcover growth is proceeding satisfactorily, and any failed areas have been resown or planted, the tree planting programme will be commenced. Tree holes are excavated deeper and wider than the plant containers as it is important to break up the base of the hole to allow easier

penetration of the tree roots. The root ball of the trees is teased before positioning in the hole, which is then backfilled with topsoil. It may be necessary to stake and tie certain trees. Watering of the trees is carried out to ensure proper establishment.

The sand extraction area, outside from the riparian zone, will be rehabilitated principally with grass cover only, but with stands of shade trees as shown on Figure 41, which shows the general landscaping proposals for Spring Farm. The riverine soil extraction area will be rehabilitated with grass, groundcovers and indigenous Acacia and Casuarina trees extending from the river bank through to approximately the 61m contour. These coloniser trees have been chosen because of their ability to rapidly stabilise flood prone areas. From the 61m contour to the edge of the Anabranch in the western sector and up to the crest of the dry anabranch bank in the eastern sector, the seeding of grasses and groundcovers will be supplemented with plantings of Acacias, Casuarinas, Callistemons and Eucalypts. These tree species for planting have been compiled from the list supplied by the Royal Botanic Gardens at Mount Annan referred to above. Figures 42, 43, 44 and 45 show photographs of the rehabilitation procedures at Spring Farm.

Current tree planting practices at Spring Farm are based on the broad recommendations of the Land Management Plan, which specifies tree planting at a density of 3 trees / $10m^2$. In the riparian zone it is proposed to upgrade the planting density to 1 tree / m^2 (see Figure 41). This regime will provide a more rapid vegetative cover for native vertebrates than the use of limited plantings and natural regeneration (see section 6.3).

As the stand of vegetation in the "knoll" area will remain for some 5-10 years before it is extracted, a programme of seed collection and seedling generation will be implemented in the "knoll" area and the Anabranch margins so that the local genetic stock and local species mix can be retained. This will provide a substantial stock of young plants for the rehabilitation program being conducted along the river bank. If the seeds of Eucalyptus elata, Acacia decurrens, A. floribunda, Casuarina cunninghamiana and the native grasses and groundcovers are gathered and germinated as soon as approval is issued by Camden Council, then they can be grown onto an advanced stage for at least 5 years before extraction and planting, thereby reducing the time required to restore a tree canopy to the area. It is also proposed that the planting density at the 1 metre centres described above be arranged in rows set out along the contours, with a 50m wide cover along the river and Anabranch margins.

5.3.5 Maintenance of the Works

The maintenance practice followed in the first two years following rehabilitation is critical to ensure rehabilitation is successful. Maintenance of the works will include regular watering, weeding and possible slashing of grassed areas. In addition any failed areas of grassing or planting will be replaced.

5.4 River Bank Stability and Extraction

Extraction of soil along the river banks will be carried out in such a way that the 3m height of existing bank above the normal water level is not disturbed. The proposed method is shown in Figure 46.

The vegetation on the bank top will be cut in such a way that it does not fall down the river bank. A strip about 20m wide will then be extracted along the bank, down to the permitted level, taking care that a minimum of loose material is knocked down the bank. A strip having a minimum width of 5m will then be revegetated, and will be fenced to prevent damage by animals or vehicles and equipment which may be working on the remainder of the deposit. Extraction will proceed inwards (towards the dry anabranch) from the initial strip extracted.

These procedures are designed to protect the steep river bank, particularly in the "knoll" area, and prevent soil falling down into the river channel.

Protection of the river bank stability is important and will be assisted by protecting the existing channel alignment. An integral part of this is the reshaping of the north bank to maintain as smooth an alignment as possible, particularly near the mouth of the Anabranch. This will be reinforced by the proposed heavy planting of the riverine zone, which will establish a stable scour resistant bank and enhance bank strength. It is considered that these safeguards will ensure that river flow remains within the present channel. Excavations have been limited to 3 metres above normal flow level in the Nepean River to prevent gross siltation over the future open space (public amenity area).

REHABILITATION PLANTING SCHEME

M A SCHELL & ASSOCIATES FOR

JET JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

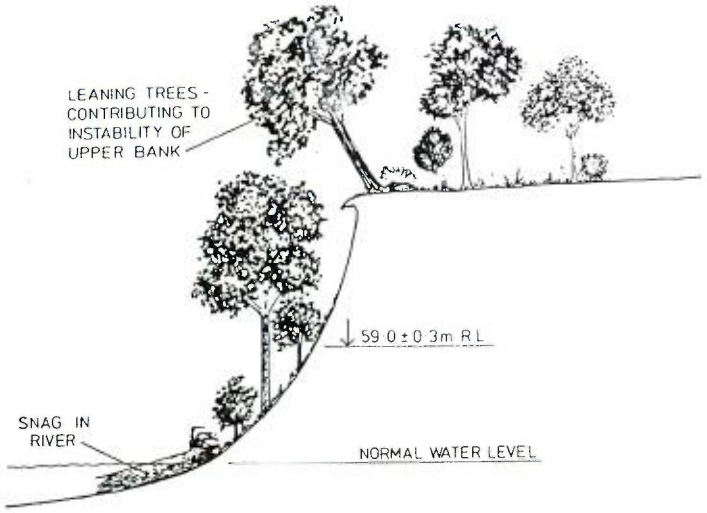
FIGURE 41

FIGURE 42 - Backfilling and Recontouring Extraction Area
Ready for Rehabilitation

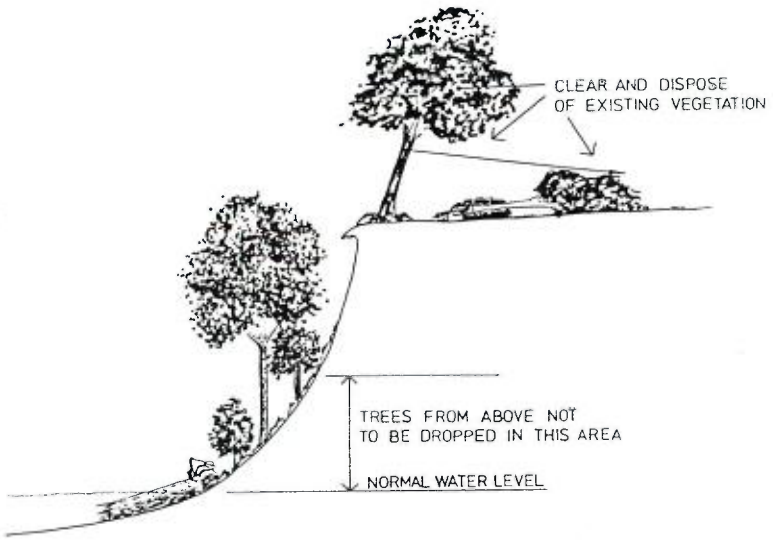
FIGURE 43 - Seeding Areas as part of Rehabilitation

FIGURE 44 - Irrigation and Tree Planting

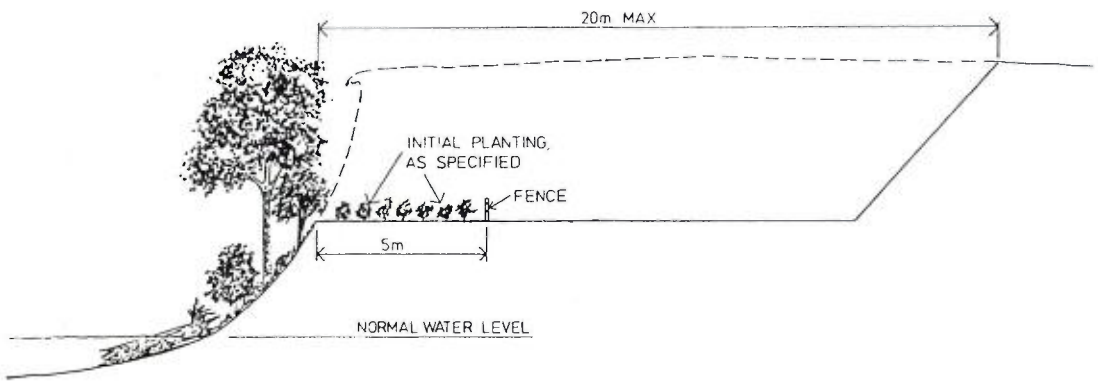
FIGURE 45 - Rehabilitation Area with Early Stages of Grass Growth and Young Trees Planted



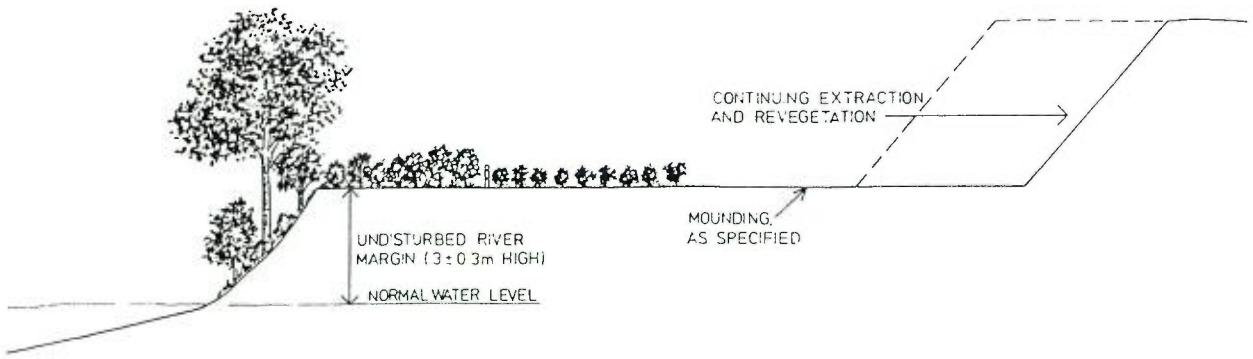
1. EXISTING RIVER BANK



2 CLEARING OF UPPER BANK



3 INITIAL EXTRACTION AND REVEGETATION



4 END STAGES

SOIL EXTRACTION PROCEDURE ALONG RIVER BANK

FIGURE 46

5.5 Noise Control

The mobile equipment to be used for the sand and soil extraction (CAT966F) and at the sand washing plant (CAT950E) have been fitted with special (residential) silencers to reduce noise emission. The silenced noise emission level at 7.5m for the CAT966F is 79dBA and for the CAT950E is 72dBA. In addition, special silencing equipment will be fitted to the on-site dump truck (75dBA at 7.5m) and also to the powerscreen (78dBA at 7.5m). These noise emission levels have been used to calculate the noise impact (see Section 6.7 and Table VII).

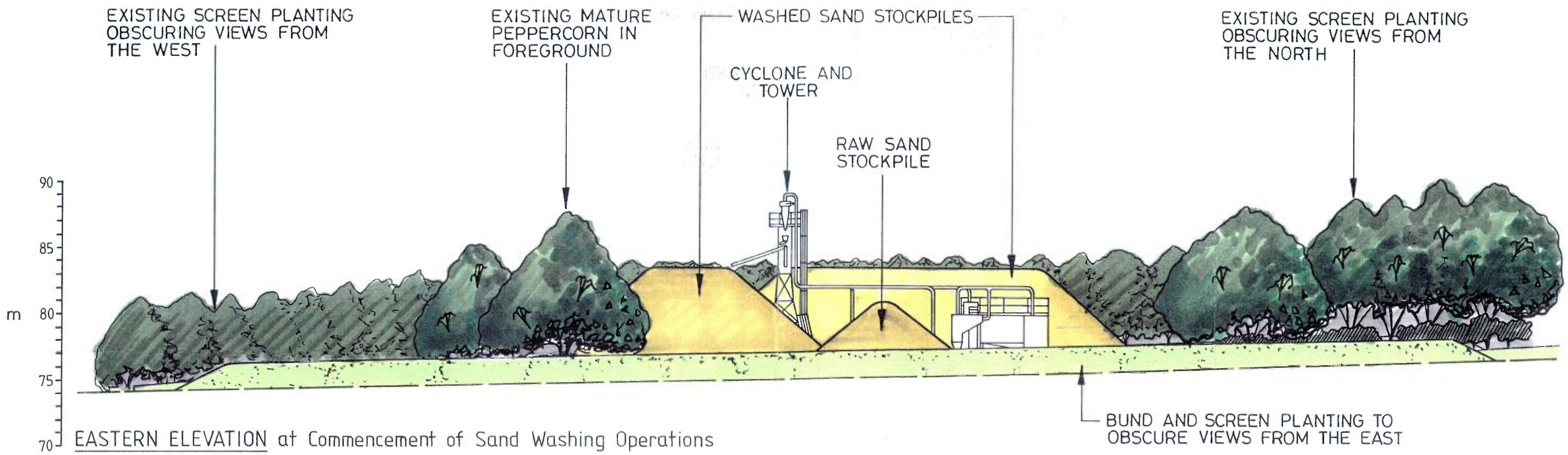
In addition, the method of working the sand deposit will reduce noise impact. The order of extraction shown on Figure 23 will form a shielding bank up to 9m high along the eastern boundary and place the operating equipment in a cutting which will shield it from housing to the north and east. This will reduce noise emission in these directions.

5.6 Visual Barriers

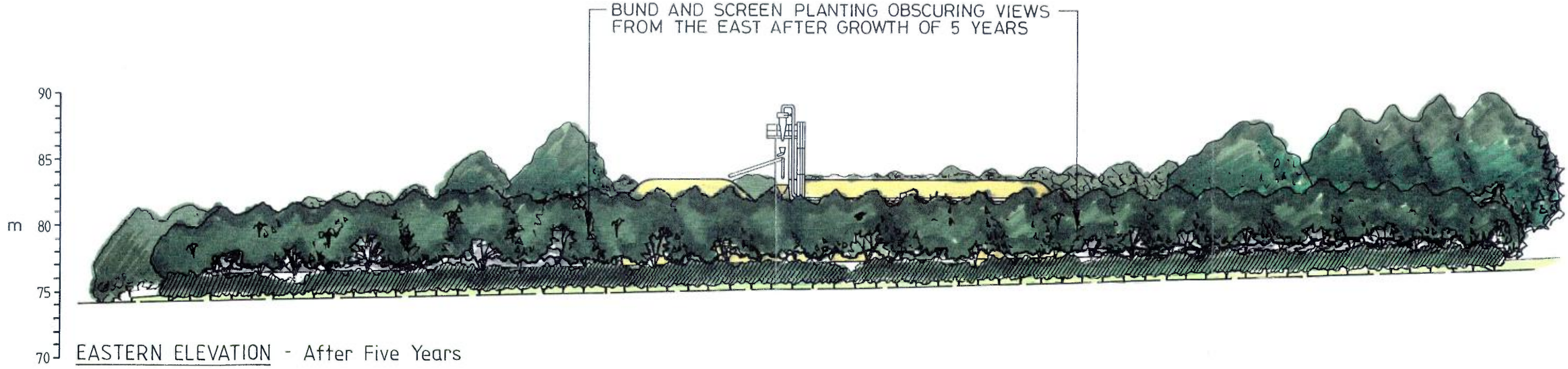
The proposed sand washing plant will not adversely affect the views and vistas to the north and west due to the effective tree screens currently established along the north-west and northern boundaries of the site. Unfortunately, as can be seen in the eastern elevation of the sand washing plant (Figure 47), the existing trees provide only a minor screen to the plant in this view from the east. In order to reduce the adverse effect from this direction, a screen of quick growing Acacias and Casuarinas is being planted on a bund of about 2 metres height located along the eastern sector of the Macarthur Road frontage and then south-west along the south-east (Tegel) boundary of the property as far as the RL 74m contour, which is the proposed limit of extraction. The position of the tree screen and bund is shown on Figure 25.

As the objective of these plantings is to achieve a rapid cover, plantings will be at 1m centres and will be irrigated for at least six months to ensure rapid establishment and growth.

When the sand deposit is worked out and the area redeveloped for residential use, these screen bunds and plantings can be removed in accordance with the guidelines set out in the Elderslie Sand & Soil Deposits Land Management Study.



EASTERN ELEVATION at Commencement of Sand Washing Operations



EASTERN ELEVATION - After Five Years

0 5 10 15 20
APPROX. METRES

ELEVATIONS OF SAND WASHING PLANT FROM THE EAST

FIGURE 47

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

6.0 ASSESSMENT OF ENVIRONMENTAL IMPACT

6.1 Landscape and Landform

6.1.1 General

The proposed post-extractive landform has been designed to comply with the Elderslie Sand & Soil Deposits Land Management Plan[1], which has been incorporated into the Sydney Regional Environmental Plan No 9. Figure M33 of the Land Management Plan shows the planned post-extractive landform including development of a playing field area and extraction of the riparian soil deposits in Spring Farm.

The Volume VI: Summary Environmental Impact Statement[2] of the Elderslie Sand & Soil Deposits Land Management Plan, which post-dates the Land Management Plan, but predates the Sydney Regional Environmental Plan No.9, shows amended contours around the playing field area and the retention of a "knoll" of riparian soil near the entrance to the Anabranch on Spring Farm.

The proposed extent and post- extractive landform for the sand and soil extraction on Spring Farm is shown on Figures 35 and 36. Figure 36 also shows the proposed landform taken from Camden Council's master plans. Figure 22 shows the extent of the sand and soil extraction proposed and also the extraction boundaries given in Regional Environmental Plan No.9 and Volume VI: the Summary Environmental Impact Statement[2] of the Elderslie Sand & Soil Deposits Land Management Study.

The sand extraction landform complies with the Council plans but the soil extraction differs slightly. A Morphological Assessment undertaken by the Water Research Laboratory of the University of NSW (Appendix C) has recommended both that a smooth bank be created along the northern side of the Nepean River and that the Anabranch Island 'ecological refuge' not be constructed. Both of these recommendations have been adopted which means both that the "knoll" area between the existing soil extraction and the Anabranch will be extracted and that the bank will be continued from the Anabranch to the raised ground on the inside of the bend in the river in the south-west corner of the property. Thus the proposed landform will not comply with the Land Management Plan landform in three places:

(i) the "knoll" will be extracted. The "knoll" area is, however, within the area designated for extraction on Sheet 6 of the Sydney Regional Environmental Plan No 9, which is the current statutory planning instrument.

(ii) a raised bank will be left between the south end of the Anabranch and the mound on the inside of the bend of the river to the west instead of extracting this area.

(iii) the western bank of the Anabranch will not be extracted and so the Anabranch Island will not be formed.

In all other respects the final post extractive landform complies with the requirements of the Elderslie Sand & Soil Deposits Land Management Plan. It will retain the extensive flat nature of the original surface, but with banks and batters as necessary to join into existing boundary surfaces.

Land use in the extraction areas is presently restricted by being flood prone. On completion of extraction, the levels will be lower and, particularly in the soil extraction areas, will consequently be more prone to flooding.

6.1.2 Soil Bank on Eastern Boundary

The soil bank on the eastern (Tegel Trading) boundary was left to support the soil deposit on the Woodgrand (Tegel Trading) property. As this soil has now been extracted, the soil on the Spring Farm side is also being extracted in accordance with a directive from the Department of Water Resources. Extraction of this soil will enhance the visual quality by removing a strip of soil, which divides the flat riverside bench on both sides of the property boundary, and enable the objective of the Elderslie Sand & Soil Deposits Land Management Plan to create a coherent and consistent post-extractive landform along the river bank, that will be suitable for passive recreation, to be achieved.

6.1.3 Riparian "Knoll" and North Bank of River

As can be seen in Section X-X' (Figure 49) the landform in the vicinity of the knoll is more elevated and with steeper sides than the surrounding (previously extracted) areas, generally as shown in Section Z-Z' (Figure 50).

At this section of the river the extraction is proposed to commence at the base of the northern side of the dry anabranch and as can be seen in the Section X-X', the profile of the landform will then change to eliminate the southern enclosing side of the dry anabranch and replace it with an open landform, which slopes gently down to a 50m wide bench on the river bank.

A similar landform will be created to the west of the Anabranch (Figure 51), which will be a continuation of the landform to the east when the "knoll" is extracted.

The extraction of the "knoll" and the southern side of the dry anabranch will mean the removal of the existing cover of low open forest as shown on Figure 48. As discussed in Section 3.5, this community is of value within the existing landscape and the effect of the removal of this stand will depend upon the height and density of the surrounding stands of vegetation at the time of removal, the program for rehabilitation and the type and density of the replanting of trees. The vegetation has no intrinsic botanical value, is regrowth and is relevant only for its riparian landscape value.

The view along the river, as shown in Figure 17, will be altered by the removal of the "knoll" and its vegetation cover. In the short term, before the existing and proposed rehabilitation planting has reached maturity, this will have the effect of opening up the view to the north. However as the existing and proposed additional riverside plantings mature along the north bank of the river, the view will once again be enclosed on the northern side, but at a lower level. The long term effect of removing the "knoll" on the view along the river will therefore be minimal.

6.1.4 Sand Extraction Area

The sand extraction area is presently cleared grazing land. The sand extraction will cause a temporary scar from removal of the grass and extraction of the sand. This will be transient only and will disappear as the rehabilitation re-establishes the grass cover over the area and the shade trees are planted and mature.

NESBITT
PROPERTY

SPRING FARM

Anabranch

Dry Anabranch

Nepean River

Navigation Creek

TEGEL TRADING
PROPERTY

THURNS
WEIR

SECTION Y-Y
FIGURE 51

SECTION X-X
FIGURE 49

SECTION Z-Z
FIGURE 50

LEGEND

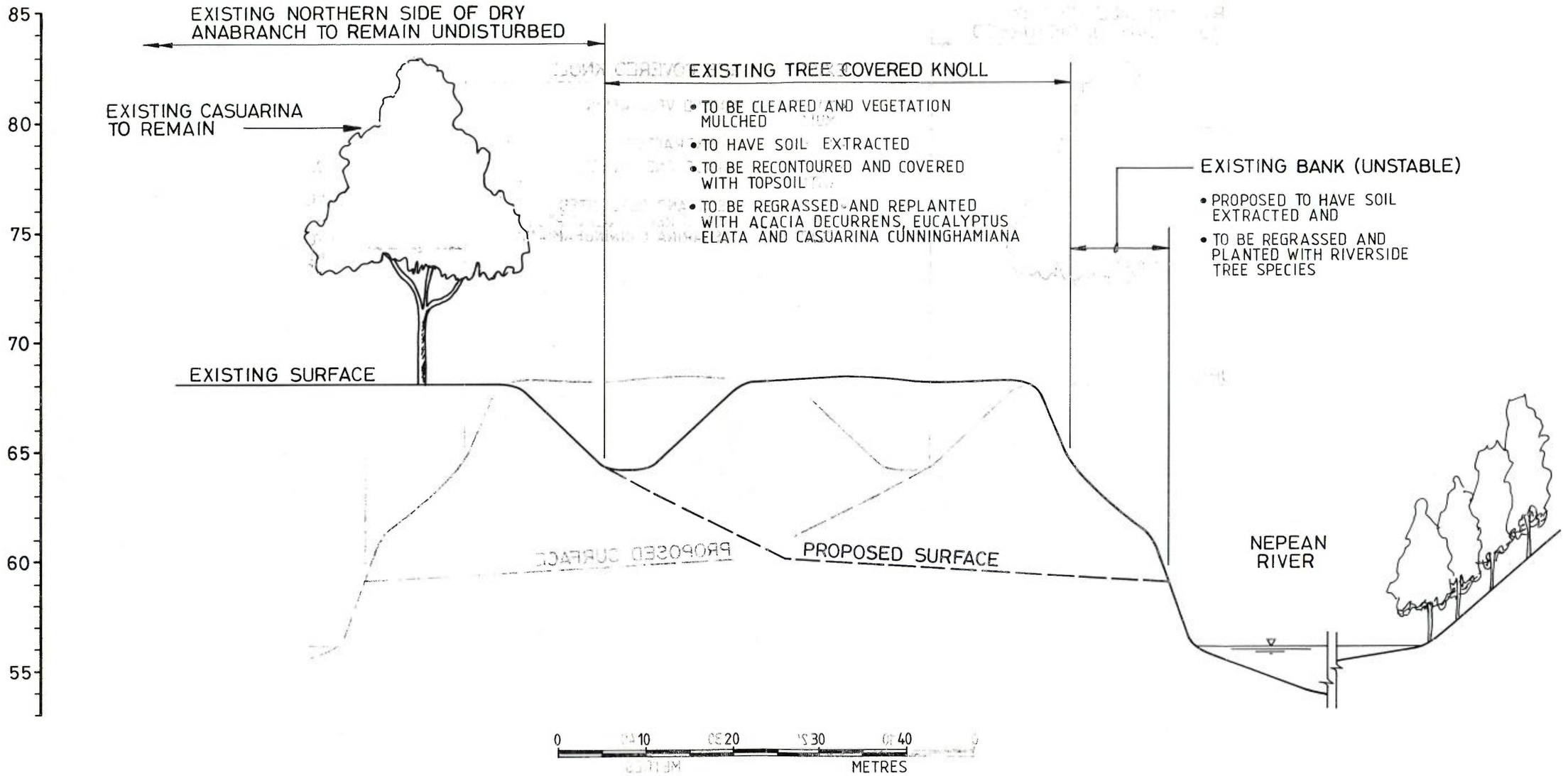
- TREES TO BE RETAINED
- TREES TO BE REMOVED
- EXTENT OF SOIL EXTRACTION
- SPRING FARM PROPERTY BOUNDARY
- AREA TO BE BACKFILLED

0 50 100 150 200
METRES

AREA OF RIPARIAN LOW OPEN FOREST TO BE REMOVED

FIGURE 48

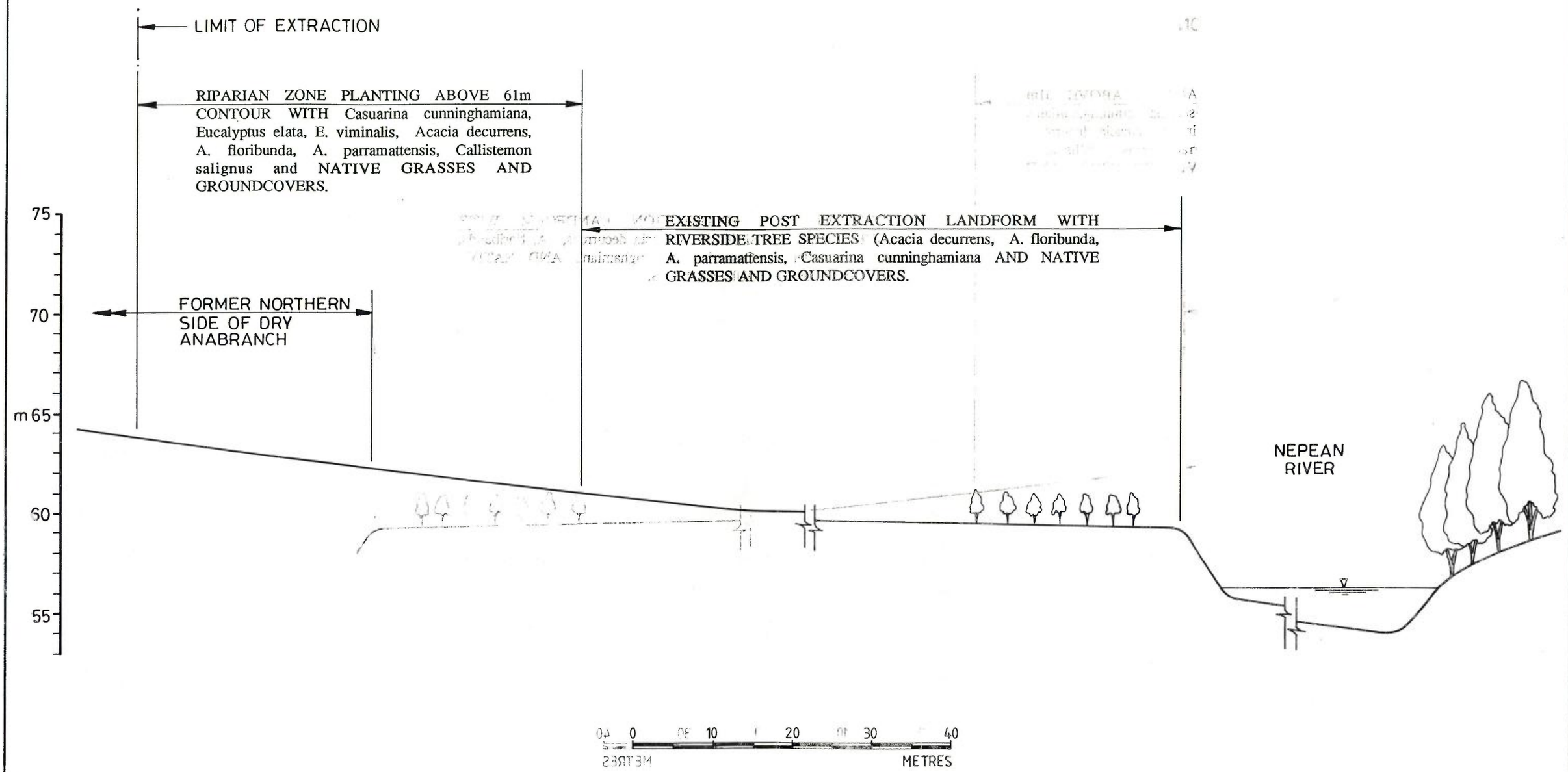
JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED



SECTION LOCATION IS SHOWN ON FIGURE 48

SECTION X-X' THROUGH KNOLL ON SPRING FARM RIVER BANK

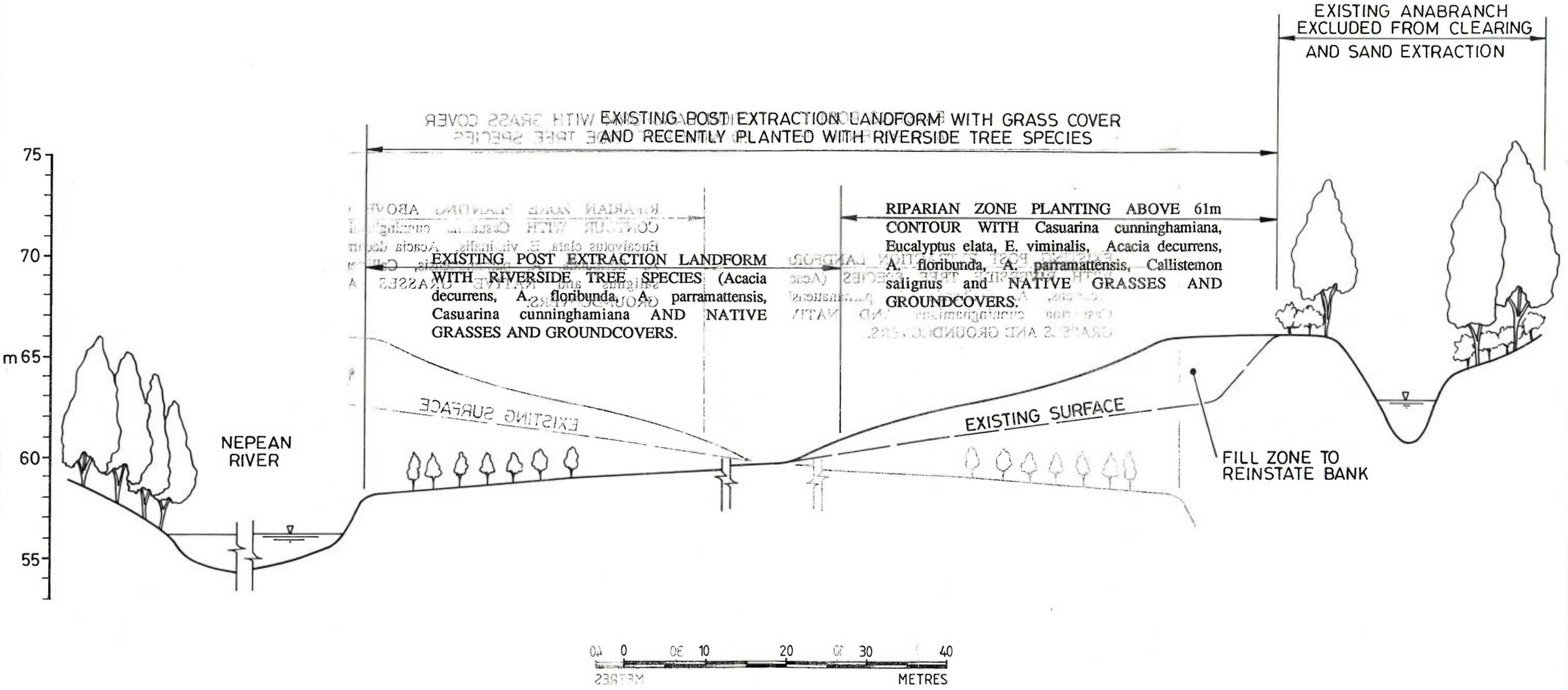
FIGURE 49



SECTION LOCATION IS SHOWN ON FIGURE 48

SECTION Z - Z' THROUGH AREA OF PREVIOUSLY EXTRACTED SPRING FARM RIVER BANK

FIGURE 50



8A SECTION LOCATION IS SHOWN ON FIGURE 48

SECTION Y-Y' THROUGH PREVIOUSLY EXTRACTED AREA OF SPRING FARM RIVER BANK TO BE REINSTATED

FIGURE 51

On the eastern boundary of the property there will be a bank of variable height but up to 6m above the surrounding land. This will not be in accordance with the requirements of the Elderslie Sand & Soil Deposits Land Management Plan to develop a level area for future recreational use but is necessary to support the bank left on the Tegel Trading side of the property boundary.

Two mounds will also be left around the two Prospect Electricity power poles located within the sand extraction area. When the land is taken into public ownership for use as recreation/open space, it will then be appropriate for the power lines to be relocated and the residual supporting mounds removed.

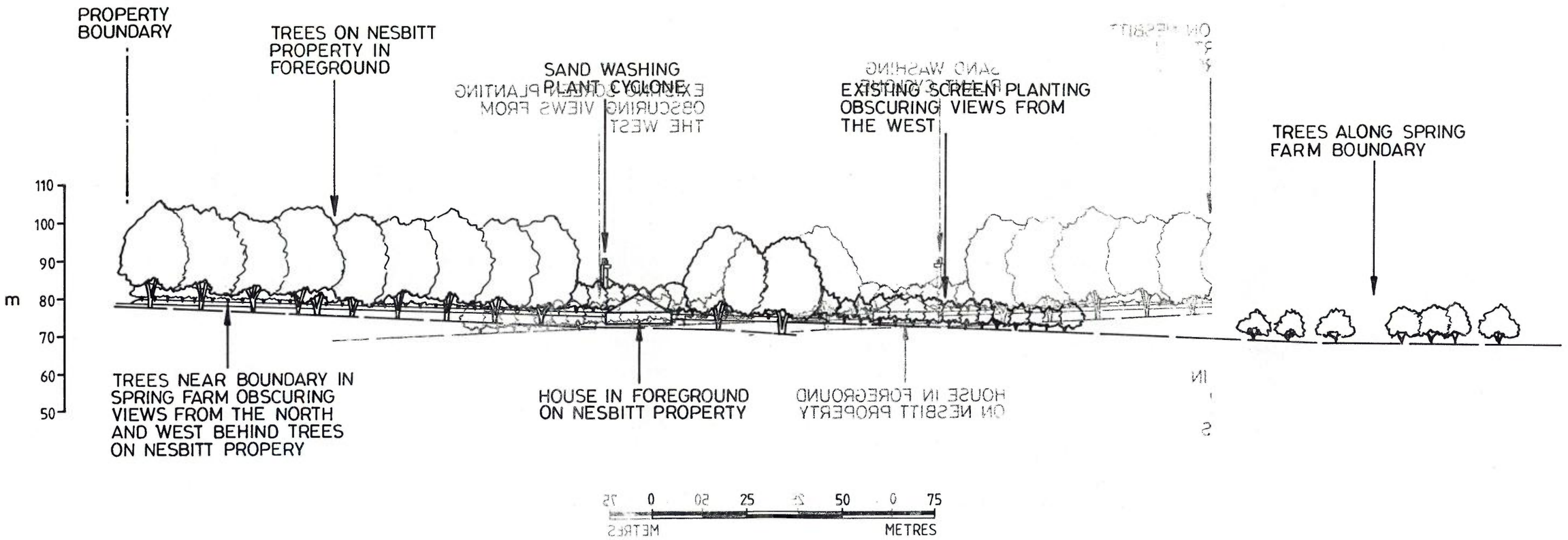
6.1.5 Sand Washing Plant

The proposed location of the sand washing plant has been developed to ensure the maintenance of the existing ornamental plantings which were to remain in accordance with the Land Management Study. The only alteration to the existing vegetation in this upper portion of the site will be as a result of additional screen planting that will be established to screen views of the plant from adjacent properties.

As can be seen in the elevation of the proposed sand washing plant when viewed from the east (Figure 47), the stockpiles and upper part of the cyclone separator will be higher than the surrounding vegetation levels. This will mean that the views from the Nesbitt property and from the Tegel property will contain portions of the higher parts of the plant in the view. From the Nesbitt property all of the stockpiles, conveyors, clarifier and mobile equipment working in the sand washing plant will be hidden by the established 8-10m high screen planting along the Spring Farm property boundary.

From further west on the Camden By-pass, which is elevated above the ground, the view will be similar, as shown on Figure 52. Only the top of the cyclone will be visible as a fleeting view among the trees when crossing the bridge. This part of the plant will be painted a dark colour so that it blends into the landscape.

The views of the sand washing plant from Macarthur Road and from the Clinton properties to the north will similarly be screened by the established screen and ornamental plantings on that side of the Spring Farm property. These plantings will ensure that only the top of the cyclone will be visible above the trees.



NOTE: VIEWING POINT ON CAMDEN BY-PASS BRIDGE

WESTERN VIEW OF SAND WASHING PLANT FROM CAMDEN BY-PASS

FIGURE 52

LEGEND

EXISTING CONTOURS AND LANDFORM

POST EXTRACTION CONTOURS

RIVER BED CONTOURS

PROPERTY BOUNDARY

NESBITT
PROPERTY

SPRING
FARM

N

0 50 100 150 200
METRES

ISSUE	DATE	DESCRIPTION
1	15/9/93	POST EXTRACTION CONTOURS AMENDED

DRAWN: SA
DESIGNED:
CHECKED:
APPROVED FOR CONSTRUCTION:
SCALE: 1:2000
DATE: SEPTEMBER 1993

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED
54 FRENCHS ROAD, WILLOUGHBY, 2068 PHONE (02) 958 2866 A.C.N.003 146 778
ENVIRONMENTAL, HAZARDOUS WASTE, POLLUTION CONTROL CONSULTANTS AND ENGINEERS

POST EXTRACTION LANDFORM
NESBITT AND SPRING FARM PROPERTIES
M COLLINS & SONS (CONTRACTORS) PTY LTD

JET

JOB NO: JET0160

DRAWING NO: 53 ISSUE: 1

The view from the Tegel property will, to a degree, be protected by the existing peppercorn trees, which will be retained in the foreground of their view. However the majority of the plant will be visible and the degree to which it is visible will be determined by the height of the additional screen planting proposed along the south-eastern boundary. The effect of this screen planting is shown on Figure 47.

6.2 Vegetation

The sand extraction area contains only a few single trees and grass cover and has no biological significance.

Along the river bank, the "knoll" area has a stand of trees and shrubs dominated by Black Wattle (Acacia floribunda) and Eucalyptus elata, which is not considered to have high conservation value due to previous logging, the relatively young age of most trees, and weed invasion.

The type of vegetative cover present on the "knoll" will be replaced and improved by the proposed intensive planting and it is considered that there are no conservation reasons to retain the "knoll" area. Further the additional planting proposed along the Anabranch margins will strengthen this environmentally important area.

6.3 Fauna

Fauna surveys undertaken for the Elderslie Sand & Soil Deposits Land Management Study [2] indicate that no rare or endangered terrestrial species are present on Spring Farm.

The stand of native vegetation on the Spring Farm riparian "knoll" is regarded as of relatively low value to the native fauna in either local or regional terms. This feature is located at one end of the Anabranch, and has been isolated from other areas of native vegetation by the extraction of soil and sand along the Nepean River bank on each side. Furthermore, the stand is of small size, has been substantially disturbed by cattle and past logging and clearing activities, and the presence of a substantial population of foxes in the area appears to have been detrimental to the native terrestrial fauna. Additionally, there are areas of native vegetation nearby which are of greater value to the native fauna, particularly along the Anabranch, which is to be retained, along the southern bank of the Nepean River opposite the site, and further upstream.

No native fauna of conservation significance were recorded during this survey, nor are any anticipated in the "knoll" stand of vegetation (See Figure 18). All species recorded or anticipated within this site are common to abundant and widespread. It is considered that no species will be adversely affected by the proposed soil extraction, although some individuals of some species will be forced to move from the "knoll". It is regarded as unlikely that any significant small animal populations remain at this site.

It has been suggested that the Anabranch may contain Platypus[1]. Although this species may be present, the existing water body is not large and is not connected to the main River. During drought conditions the waterway is likely to dry up (or nearly so), and under these circumstances it would not provide suitable habitat for Platypus. Additionally, the high fox population is likely to have an adverse impact on any existing Platypus population.

The proposed extraction of the soil and sand resource on Spring Farm will not adversely affect Platypus, even if they do occur in the vicinity. The river bank which forms one side of the "knoll" is currently unstable, and is being eroded during high flow conditions in the river. It consequently does not constitute suitable habitat for the species, and may be considered in its current condition to be contributing to conditions adverse to survival of the Platypus in the vicinity. By removal of the "knoll" and stabilisation of the river banks, as proposed in Section 5.3, the potential for Platypus to inhabit the area may well be enhanced. Additionally, control measures for water quality and for silt and sediment erosion are to be implemented (see Section 5.2), thus limiting the potential for degradation of the river, in terms of water conditions and the nature of the stream substrate.

The habitat value which the "knoll" stand does possess in the immediate vicinity will be compensated for by the existence of the Anabranch and its associated native vegetation, by the regeneration of native vegetation on the adjacent banks and extracted areas, and by the ultimate rehabilitation of the "knoll" area itself. The current rehabilitation program appears to require upgrading however (as is proposed and set out in Section 5.3), to provide a satisfactory replacement environment and to adequately protect the banks of the River.

Of most significance for the local or immediate vicinity in conservation terms is the retention of the Anabranch and its associated vegetation. This area contains a range of fauna habitat resources, most notably the large trees with their hollows and a variety of microhabitats along the waterway, and is consequently of particular value. However, the remnant native vegetation consists of a rather narrow band along the Anabranch, and its conservation value is consequently somewhat limited. The proposed rehabilitation of the general area will include a substantial increase in the area of forest and shrub communities to about 50 metres beyond the edge of the Anabranch on each side.

A detailed consideration of the most appropriate management of the Anabranch (involving revegetation, cattle and human exclusion and fox control) is recommended, to enhance its conservation value for the local area.

Appendix D assesses the significance of potential impacts on native fauna in more detail and in terms, impact on endangered fauna as required by the National Parks and Wildlife Act and the Environmental Planning and Assessment Act.

6.4 Air Quality

The measures described in Section 5.1 to minimise dust generation during extraction operations are considered adequate to ensure that fugitive dust emission will not be a problem from the proposed extraction and sand processing.

6.5 Water Quality

As a result of the safeguards proposed in Section 5.2, no sediment laden run-off originating from the open area of the site will reach the Nepean River, except under extreme flood conditions.

In the soil extraction area, the settling pond and filter bed will effectively trap silt laden run-off from heavy storms of short duration, which do not cause flooding but might transport silt into the river.

In the sand extraction area, the 2000m^3 Sediment Control Dam will contain silt laden run-off from the sand pit or Sand Washing plant and prevent transport of silt into the river channel.

Flood flows are expected in the Nepean River within the life of the proposed extraction operations, which will cause erosion, deposit silt on the extraction (and rehabilitation) areas and erode some sediment off the site into the river.

Such extreme events will involve flooding of the whole flood plain. The progressive revegetation of the extraction area will reduce the water velocity in the zone beside the river and hence the amount of erosion of soil from the site. During these floods, the Nepean River will be carrying a large amount of sediment from upstream and the effect of soil pick up from the site on the river sediment levels will be minimal.

6.6 Flood Levels and River Bank Protection

The plan form of the Nepean River between Menangle and Camden is essentially straight with right angle bends where the river is deflected by outcropping bedrock. The Elderslie data place the river in the transition region between meandering and straight. To induce meandering would require a substantial increase in the width-depth ratio or a reduction in Froude number. With the channel slope fixed by bedrock and weirs, Froude number can be reduced only by a reduction in discharge, ie a climatic change to a drought dominated period such as the early part of this century from 1901 to 1948. This is unlikely as the consensus on the greenhouse effect is an increase in rainfall in southern Australia. It is considered that the river shows no tendency to change its course by braiding or changing its meander pattern.

As noted in Section 4.7, to minimise the risk of flood overflow into the Anabranch causing bank erosion, it is proposed to reshape the right bank to maintain as smooth an alignment of the bank as possible at the mouth of the Anabranch taking into account the presence of any mature vegetation. The proposed reshaping is shown on Drawing No JET0160/53 Issue 1 and consists of establishing two well aligned banks, one at RL 59 and the other at RL 66. It is expected that such realignment, reinforced by heavy planting with suitable riverine species will establish a stable, scour resistant bank requiring only minimal maintenance, such as removal of debris after a flood.

Thus the channel width will be increased at levels 3 metres above normal flow level, however, flow above this level outside the channel will be retarded by increased resistance to flow from the riverside plantings and consequently the main flow will remain along the original channel alignment.

The soil extraction operation will not affect flooding of adjacent properties.

6.7 Noise Impact

The items of equipment to be used on Spring Farm and their expected maximum operational sound levels are listed in Table VI. These levels have been obtained from manufacturers specifications or from actual measurements taken. The two front-end loaders the dump truck and the powerscreen will also incorporate special silencing equipment. As shown in Table VI, most of the equipment is mobile and will operate on an intermittent or occasional basis. Only the sand washing plant and powerscreen will be continuous or semi-continuous in operation.

TABLE VI

EQUIPMENT SOUND LEVELS

Equipment Item	Max Sound Level at 7m (dBA)	Type	Source Area
Front-end loader (no. 1) * (CAT950E)	74	Mobile/intermittent	Sand wash plant
Sand washing plant (total)	58 (all motors)	Stationary/continuous	Sand wash plant
Dump truck *	75	Mobile/intermittent	Sand extraction + washing plant
Powerscreen *	78	Stationary/semi-continuous	Sand extraction **or** soil extraction
Excavator	84	Mobile/occasional	Sand extraction
Front-end loader (No. 2) * (CAT966F)	80	Mobile/intermittent	Sand extraction **or** soil extraction
Bulldozer, D7	86	Mobile/occasional	Sand/soil extraction & rehab.
Watercart	75	Mobile/intermittent	All extraction areas
Tractor	80	Mobile/occasional	All extraction areas
Truck Movements (to and from site)	85	Mobile/intermittent	Entry roads and wash plant

* Includes special treatment for silencing/noise reduction.

These maximum operational sound levels have been obtained from manufacturers specifications or from actual measurements undertaken.

Reductions in normal sound levels have been achieved by the installation of special silencers on the two front-end loaders and the levels quoted have been measured. Special silencing and noise reduction is proposed for the dump truck and powerscreen and the quoted levels reflect this.

TABLE VII

PREDICTED NOISE LEVELS AT NEARBY RESIDENCES

		Nesbitt Cottage	Tegel Residence	A. Clinton Residence	Araluen Place
Maximum semi-continuous noise level (dBA)	Worst Case	44	44	40	38
	Typical	39	39	38	34
Maximum intermittent (L_{10}) noise levels from on-site activities (dBA)	Worst Case	46	46	44	41
	Typical	44	42	44	36
Maximum intermittent levels expected from trucking movements to and from site (dBA)	Worst Case	60	52	60	40
	Typical	60	51	60	38

Note: *Worst case estimates refer to the maximum levels expected for periods of up to a few months, when site operations are closest to the respective residences, and when little or no shielding is provided by the landform (see Section 5.5).*

Calculations of predicted total noise levels at nearby residential locations have been carried out and the results are presented in Table VII for three neighbouring houses and for the nearest residence across the Nepean River, in Araluen Place. The projected noise levels are given as maximum semi-continuous levels and intermittent (L_{10}) levels from site activities and also as maximum levels occurring from trucking movements to and from the site (of which there are expected to be a maximum of 50 movements per day). Because of the nature of the extraction operation, which will occur over different parts of the site at various stages in time (see Sections 4.3, 4.4 and 4.7), each of the receivers can expect different levels of noise impact during different stages of the extraction operation. The level of noise impact at any stage, will depend on distance to active work areas, degree of shielding present and use of mobile equipment. In Table VII, estimated noise levels (semi-continuous, intermittent L_{10} and trucking noise) have been presented as both "Worst Case" and "Typical". The "Worst Case" maximum levels would apply when extraction is in closest proximity to the receiving residences and/or when shielding is not present and generally would refer to a period of a few months only within the overall life of the proposal (about 15 years). "Typical" maximum levels are those which would apply for probably 2 to 5 years duration, or in some cases for the life of the operation.

In assessing noise impact, reference is made to the Environmental Noise Control Manual[4] produced by the SPCC (now EPA). For a residential location in a rural area, the acceptable limit for daytime L_{90} background noise level is 45dBA and the extreme limit 50dBA. The levels given are the same for receivers in residential areas such as Araluen Place.

The SPCC manual also gives recommended noise levels for planning purposes, according to existing or current background levels. Existing average background (L_{90})levels at the residential locations close to the site are between 37 and 40dBA. (See Section 3.14). From Table 20-1 in the SPCC Manual[4], the recommended maximum noise level, for planning approval purposes at these locations would be 2dBA below the acceptable level or 43dBA ideally.

From Table VII, it can be seen that the maximum semi-continuous noise levels reaching the two closest residences are estimated to be about 1dBA above this figure during "worst-case" situations or for short-term durations, but will be less that 40dBA for most of the time. The intermittent or L_{10} levels predicted at the closest residential locations are expected to be up to 44dBA for typical operational periods and up to 46dBA for "worst case" periods.

The predicted noise levels at the residential areas on the southern side of the Nepean River are considered acceptable, and no noise impact is expected in these areas other than some minor short-term intermittent levels of up to 41dBA during "worst case" conditions. The houses which will be most affected are those four which are closest to the northern part of the site near Macarthur Road, the "Nesbitt", "Tegel", "A. Clinton" residences and, to a lesser extent, the "N. Clinton" residence to the east.

The houses on Ettlesdale Road and Macarthur Road (north of the Nesbitt property) will not be significantly affected because of their higher current background levels, which result principally from road traffic on Macarthur Road, Springs Road and the Camden By-pass.

Noise from trucking to and from the site (up to 50 truck movements per day) is likely to cause maximum or peak noise levels at the "Nesbitt" and "A. Clinton" residences of up to 60dBA. The noise from each of these truck movements would be similar to that which **already occurs** but the frequency will be increased. Other houses in Macarthur Road would be similarly affected, though as stated above, they have higher existing background levels.

6.8 Traffic

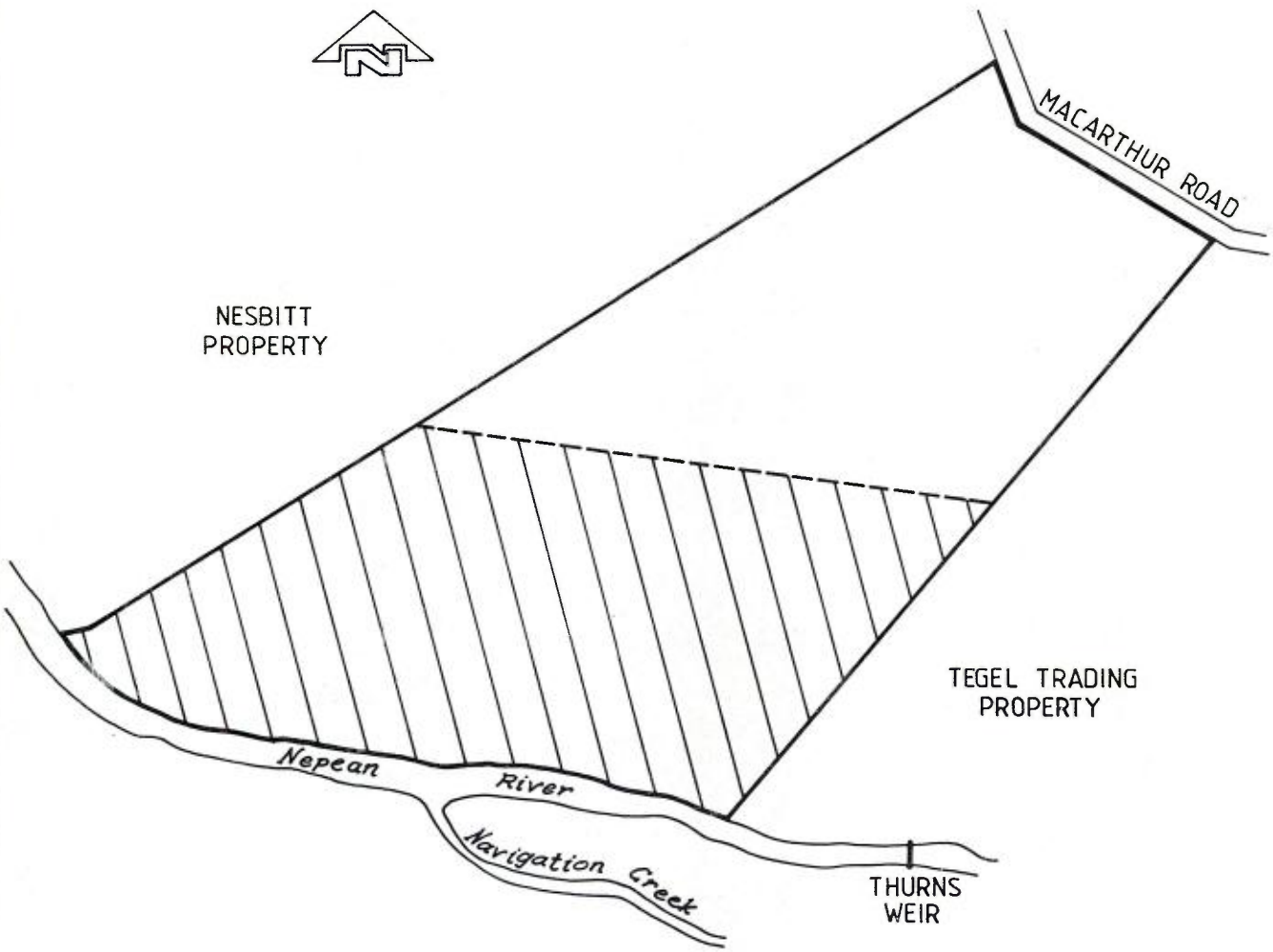
Macarthur Road is a rural two lane road servicing one end of Ettlesdale Road, the A A Tegel farm and 5 residences (including Spring Farm). Traffic movements on Macarthur Road are minimal.

The estimated 50 vehicle movements per day from Spring Farm are well within the capacity of Macarthur Road and will have no traffic impact. The vehicles leaving Macarthur Road enter Springs Road (AADT 1019) or the Camden By-pass (AADT 11,552), where they will be of no consequence within the existing road capacity and traffic volumes.

The proposed Spring Farm extraction will cause no adverse traffic impact.

6.9 Interaction with Mining Induced Subsidence

The Spring Farm property is wholly within the South Campbelltown Mine Subsidence District, but is not affected by any coal or mining leases[10].



LEGEND

AREA AFFECTED BY
EXPLORATION LICENCE 4470

0 100 200 300 400
METRES

AREA AFFECTED BY
EXPLORATION LICENCE 4470

FIGURE 54

The lower part of the property is affected by Exploration Licence 4470 as shown on Figure 54 and the whole Spring Farm property is within Petroleum Exploration Licence Application No 6 (Amoco Australia Petroleum Company).

Any mining induced subsidence from Coal Mining, if it should occur in the future, would not affect the proposal. All land proposed for extraction is already below the 100 year flood level and thus subsidence would not matter. There are no structures or similar which would be affected by coal mining induced subsidence.

6.10 Hawkesbury Nepean Catchment Management Council

The Hawkesbury Nepean Catchment Management Council have been approached for comment on the proposed sand and soil extraction on Spring Farm. Officers of this organisation are familiar with the Spring Farm property and have requested that they be kept informed about the proposal.

The have made no other comment.

6.11 Prospect Electricity

Prospect Electricity have been approached for comment and have advised that:

> "Approval is granted to extract sand within the easement area subject to the following conditions:
>
> 1. Structure 10 will need to be replaced with a new structure once the first stage of the sand mining has been completed. This first stage of mining should not come within five (5) metres of the existing structure.
>
> 2. Structure 11 can remain in its existing location provided that the sand extraction does not come within five (5) metres from the structure in any direction. Unobstructed vehicular access will have to be available to the structure at all times. A suitable grade to provide access to the structure is 1:3."

The complete response from Prospect Electricity is given in Appendix E.

6.12 Environment Protection Authority

A copy of this Environmental Impact Statement has been submitted to the Environment Protection Authority who have responded that "the environmental controls for the mitigation of air, water and noise pollution from this proposed development have been adequately addressed" (Appendix F).

6.13 Social Impact and Land Use Planning

There is a large demand for sand and soil in both the Macarthur Region and the Greater Sydney Region, which requires to be met. This is recognised in the Sydney Regional Environmental Plan No.9- (Extractive Industry) which aims:

> *"(a) to facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area and to keep the cost of supplying extractive materials to the community to a minimum-*
>
> *(i) by identifying land which contains extractive material of regional significance and ensuring that the land is not developed for purposes which are incompatible with the future extraction of that material;*
>
> *(ii) by ensuring that encroachment by urban development does not prevent existing extractive industries from realising their full potential;"*

The Elderslie deposits are an important resource recognised by the Sydney Regional Environmental Plan No.9 and are to be extracted. The Spring Farm deposits are within the area nominated for extraction and consequently must be considered an important resource for the region. Extraction of the Spring Farm deposits, as proposed, is therefore clearly of benefit to the community.

The Spring Farm Property is zoned 1a: Rural.

The proposed extraction will employ 4 people directly at Spring Farm and support another 12 employees (both transport operators and direct employees of M. Collins & Sons).

There are no known social disbenefits from the proposal.

6.14 Cumulative Effect of Extraction of "Western" Elderslie Sand and Soil Deposits.

The proposed extraction of the Spring Farm sand and soil deposits, the soil extraction on the adjoining Tegel Trading property (to the east) and the Nesbitt property (to the west) and the previous sand extraction on the Tegel Trading property are (or have been) undertaken in accordance with the requirements of the Elderslie Sand & Soil Deposits Land Management Plan.

The objective of this plan is to ensure the ordered extraction of this important resource and the development of public open space. The extraction of the Western Elderslie sand and soil deposits, including the proposed Spring Farm extraction, is achieving this objective.

The cumulative impact of extraction of the Western Elderslie deposit is to reduce the overall level of the land, which is already flood prone and will continue to be so. The extraction will result in a landform more suitable for recreational and passive open space use in the future. This would allow public access to the river and provide riverine recreation area for the rapidly growing Camden district.

This is considered to be a major benefit.

6.15 Consultation with Government Departments

During the course of preparation of this Environmental Impact Statement, the following Government entities have been consulted:

Camden Municipal Council
Department of Mineral Resources
Department of Planning
Department of Water Resources
Environment Protection Authority

7.0 ACKNOWLEDGMENTS

This Environmental Impact Statement has been prepared by a team from Johnstone Environmental Technology Pty. Limited and their associated specialist consultants.

The principal members of the study team were:

E.T.C. Johnstone	B.A.; M.A.; C.Eng; M.Aus.I.M.M.; M.A.W.W.A.
D.O. Johnson	B.Sc., M.App.Sc.
H.B. Wismer	B.S. (Civ.Eng.)
M.A. Schell (M.A. Schell & Associates)	B.L.Arch., Dip. Env.Stud., A.A.I.L.A.
F. Dominic Fanning (Gunninah Consultants)	B.Sc (Hons.1); MAI Biol; MEIA; MESA.

8.0 REFERENCES

1. Elderslie Sand & Soil Deposits Land Management Study: Volume II Land Management Report, October 1977: Longworth and McKenzie Pty. Ltd.

2. Elderslie Sand and Soil Deposits Land Management Study: Volume VI: Summary Environmental Impact Statement, December 1981: Longworth and McKenzie Pty. Ltd.

3. Sydney Regional Environmental Plan No. 9 - (Extractive Industry) and Planning Report (1986).

4. State Pollution Control Commission "Noise Control Manual".

5. Cogger H G. 1983. Reptiles and Amphibians of Australia. AH & AW Reed, Sydney

6. Slater P, Slater P and Slater R. 1989. The Slater Field Guide to Australian Birds. Weldon Publishing Sydney.

7. Strahan R ed. 1983. The Australian Museum Complete Book of Australian Mammals. Angus & Robertson Publishers, Sydney.

8. Triggs B. 1984. Mammal Tracks and Signs. Oxford University Press, Oxford.

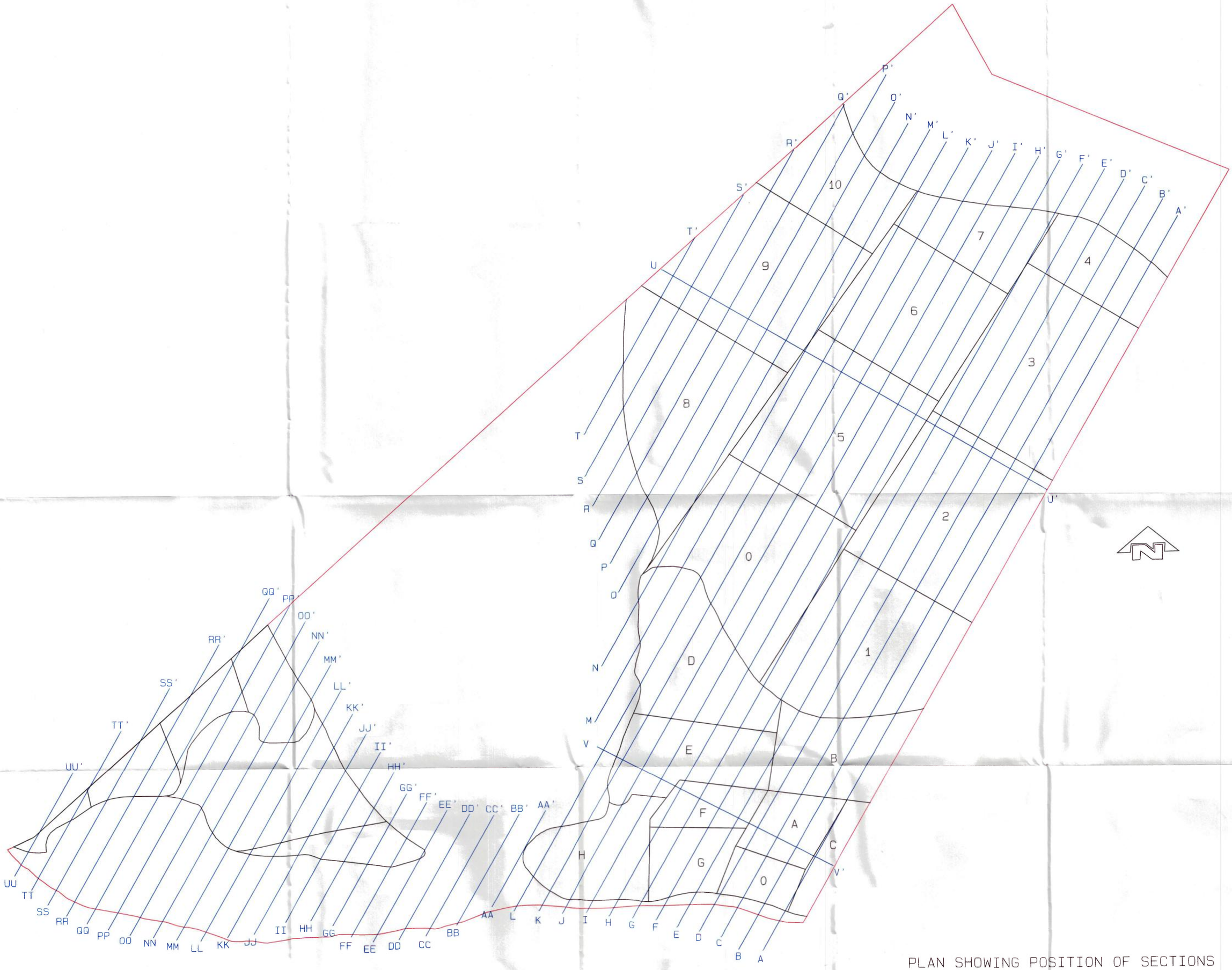
9. Triggs B, Brunner H and Cullen J M. 1984. The food of fox, dog and cat in Croajingalong National Park, south-eastern Victoria. Aust Wildl Res **II**: 491-500.

10. Letter from Department of Mineral Resources: 2 April 1993

APPENDIX A

SECTIONS THROUGH PROPOSED EXTRACTION AREAS

PLAN SHOWING POSITION OF
SECTIONS A - A' TO V - V' (22 Sections) AND
SECTIONS AA - AA' TO UU - UU' (21 Sections)



PLAN SHOWING POSITION OF SECTIONS

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY LIMITED

APPENDIX B

LETTER AND ATTACHMENTS FROM DEPARTMENT OF PLANNING ADVISING DIRECTOR'S REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENT

New South Wales Government

Department of Planning

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

Telephone : (02) 391 2000 Ext: 2077
Fax No : (02) 391 2111

Johnson Environmental Technology
54 Frenchs Road
WILLOUGHBY NSW 2068

Contact : V Thomson

Our reference : W92/01135/001

Your reference :

Dear Sir

RE PROPOSED SAND AND SOIL EXTRACTION, SPRING FARM, ELDERSLIE

Thank you for your letter of 6 December, 1992 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

2. As development consent is required for the proposal and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, as amended, an EIS must accompany the development application to the Camden Municipal Council. The EIS shall be prepared in accordance with clause 34 of the Regulation and shall bear a certificate required by clause 26(1)(b) of the Regulation (see Attachment No. 1).

3. In addition, pursuant to clause 35 of the Regulation, the Director requires that the following matters be specifically addressed in the EIS:

- Interaction with Nepean River, flooding, remanent vegetation and water quality;
- Assessment of impact noise from excavation and transport of sand and soil;
- Proposals for rehabilitation of the site and final topography shown on a contour plan;
- Assessment of road haulage regional and off-site impacts, especially at Elderslie;
- Relation of proposal to concepts for end use of the extraction area set out in the Longworth and McKenzie Sand and Soil Deposits Land Management Study;
- Possible interaction with mining induced subsidence due to underground coal mining.
- Results of consultation with Nepean Hawkesbury Catchment Management Council.

4. Attachment No. 2 is a guide to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guide is not exhaustive.

5. In preparing your EIS you should approach the Camden Municipal Council and take into account any comments Council considers may apply to its determination of the proposal.

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

Yours faithfully,

7/1/93

M. Smith
Acting Manager
Assessments and Major Hazards Branch
As Delegate for the Director

DEPARTMENT OF PLANNING
ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS

In accordance with Part IV of the Environmental Planning and Assessment Act, 1979, an environmental impact statement (EIS) must meet the following requirements.

Pursuant to clause 34 of the Environmental Planning and Assessment Regulation, 1980, as amended, the contents of an EIS shall include the following matters:

(a) full description of the designated development proposed by the development application;

(b) a statement of the objectives of the proposed designated development;

(c) a full description of the existing environment likely to be affected by the proposed designated development, if carried out;

(d) identification and analysis of the likely environmental interactions between the proposed designated development and the environment;

(e) analysis of the likely environmental impacts or consequences of carrying out the proposed designated development (including implications for use and conservation of energy);

(f) justification of the proposed designated development in terms of environmental, economic and social considerations;

(g) measures to be taken in conjunction with the proposed designated development to protect the environment and an assessment of the likely effectiveness of those measures;

(g1) details of energy requirements of the proposed development and measures to be taken to conserve energy;

(h) any feasible alternatives to the carrying out of the proposed designated development and reasons for choosing the latter; and

(i) consequences of not carrying out the proposed development.

The EIS must also take into account any matters required by the Director of Planning pursuant to clause 35 of the Regulation, which may be included in the attached letter.

The EIS must bear a certificate as required by clause 26(1)(b) of the Regulation.

DEPARTMENT OF PLANNING
ATTACHMENT NO 2

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR AN EXTRACTIVE INDUSTRY

A definition of extractive industry may be found in paragraph (n) to Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, (as amended). Extractive industries may take the form of dredging operations, quarrying operations, turf farms or various forms of land excavation etc. Processing of extracted material on the same site as the winning of the material may also constitute an extractive industry.

Extractive industries have prompted considerable public controversy in the past since, among other things, they affect visual amenity, generate heavy vehicle movements, raise dust and cause disturbance through noise and blasting. This is the prime reason for designation of extractive industries under the Environmental Planning and Assessment Act, 1979.

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for extractive industries. It is intended to assist the preparation of the EIS. However, it is the applicant's responsibility to identify and address as fully as possible the matters relevant to the specific development proposal in complying with the requirements for EIS preparation (see Attachment No 1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of an extractive industry. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and where appropriate be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the consent authority (usually the Council) and the Department of Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

The description of the proposal should provide general background information on the location and extent of the works proposed, an indication of adjacent developments, and details of the site, land tenure, zonings and relevant forward planning proposals and any other land use constraints.

2/...

The EIS should address the compatibility of the proposal with any regional strategy for extractive industries in the area and with the provisions of the Local Environmental Plans for existing and proposed development.

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved (highlighting any proposed crushing or blasting), disposal of wastes, landscaping and site rehabilitation. A description should also be provided of associated operations such as the transport of materials and use of the end product if likely to have environmental implications.

Particular details that may be relevant include:

. Characteristics and economic significance of the resource.
. Possible availability of alternative resources.
. Quantity of materials to be extracted.
. Details of any blasting and/or crushing.
. Effects of vibrations.
. Type of machinery and equipment to be used for dredging and stockpiling operations and for any processing plant.
. Expected life of the operation.
. Hours of operation.
. Details of necessary stockpiling.
. Access arrangements - truck routes, truck numbers etc.
. Site drainage and erosion controls.
. Proposals for rehabilitation.

2. Description of the Environment.

This should provide details of the environment in the vicinity of the development site and also of aspects of the environment likely to be affected by any facet of the proposal. In this regard, physical, natural, social, archaeological and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development.

3. Analysis of Environmental Impacts.

Environmental impacts usually associated with extractive industries are listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them.

. The flow of any affected rivers or watercourses.
. The effect of the extraction on the sediment transport rate of any affected rivers or watercourses.
. The bed and bank stability of any affected rivers during and after completion of the operations and any need for recurrent maintenance dredging.
. Any possible siltation, sedimentation or downstream effects of the operation.
. Any likely cumulative effects of the proposed operation when considered together with other operations in the vicinity.

3/...

- Details of floods and any likely effects of the operation on flood liability of surrounding lands.
- The possible effects of flooding on the operation.
- Effects on flora and fauna.
- The agricultural viability of the landholding.
- Likely noise/vibration disturbance caused by the operations, including transport operations, on nearby residences.
- Other impacts of trucking movements, including access over railways and onto highways.
- Dust nuisance likely to be caused.
- Effects on water quality of nearby watercourses.
- Disposal of waste material.
- Effects on the visual environment.
- Any likely affectation of sites of Aboriginal archaeological or European heritage value if located in the vicinity of operations.
- Impact of the operations on navigation aspects for all types of shipping (commercial, recreational, etc).

In addition, any potential for hazard or risks to public safety and any proposals to monitor and reduce environmental impacts should be included.

4. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

- The Environment Protection Authority in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- The Department of Mineral Resources concerning its responsibilities under Sydney REP No 9 Extractive Industry;
- The Department of Water Resources concerning the implications of the proposal on their jurisdiction;
- The Department of Conservation and Land Management regarding appropriate erosion control and rehabilitation procedures;
- The Department of Agriculture if prime agricultural land may be affected by the proposal;
- New South Wales Fisheries if the proposal is for extraction of resources in or adjacent to a waterway;
- The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State; the National Parks and Wildlife Service if aboriginal places or relics are likely to be affected.
- The Maritime Services Board in relation to navigational aspects of shipping; and
- The Public Works Department in relation to hydrological impacts and relevant legislative requirements.

It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.

APPENDIX C

MORPHOLOGICAL ASSESSMENT OF THE NEPEAN RIVER AT ELDERSLIE: SAND AND SOIL EXTRACTION BY M COLLINS & SONS (CONTRACTORS) PTY LTD

THE UNIVERSITY OF NEW SOUTH WALES

WATER RESEARCH LABORATORY

MORPHOLOGICAL ASSESSMENT OF THE NEPEAN RIVER AT ELDERSLIE

SAND AND SOIL EXTRACTION BY M COLLINS & SONS PTY LTD

by

R Nittim
and
R J Cox

Technical Report No. 93/06

September 1993

PREFACE

The work reported herein was carried out and is published under the direction of the Director of the Water Research Laboratory, acting on behalf of the client, Johnstone Environmental Technology Pty Ltd for M Collins and Sons Pty Ltd.

Information published in technical reports is available for general release only by permission of the client and the Director.

CONTENTS

1. INTRODUCTION

M Collins & Sons Pty Ltd propose to extract a high area of bank known as the "knoll" at the mouth of the Anabranch as shown on Johnstone Environmental Technology drawing JET0160/50. Concerns were expressed by the Department of Water Resources (DWR) that removal of the knoll "may well compromise the stability of the Anabranch and adjacent bank" allowing the river to change its course into the Anabranch. Water Research Laboratory (WRL) was engaged to assess the likely effects on river stablity of extracting the knoll and other earthworks including the construction of an island in the Anabranch.

This report examines the present condition of the river, reviews published data on the Nepean River and compares the fluvial parameters of the river at Elderslie with published geomorphological relationships of river stability. The locality and the various local place names are shown on Figure 1.

2. PRESENT CONDITION OF THE RIVER CHANNEL

2.1 Cross-Section Surveys

Three surveys of the river channel at Collins' property have been carried out for the purpose of sand/soil extraction – September 1980, October 1990 and December 1991. The 1980 and 1991 surveys are compared in Figure 2 where the surveyed cross-sections have been averaged by eye. Location of the cross-sections is shown on Figure 1. Also shown are the two, three and five year flood levels, derived from the Camden Flood Study Report (WRC 1986). The 1991 cross-section 9 illustrates the lowering of the right bank that has taken place with soil extraction.

Figure 3 shows the long section of the river above Cowpastures Bridge with the location of the surveyed cross-sections on Collins' property and flood level profiles from the Flood Study Report. Also shown are the 1980 and 1991 bed and bank levels and a bed level survey by the Water Board in 1985 (MWS&DB 1985).

2.2 Discussion

As can be seen from Figures 2 and 3 the undisturbed banks are at a height of between the two and five year flood levels.

There has been a change in the average cross-section between 1980 and 1991 – an increase in width and depth. The increase in depth is directly caused by dredging the river bed while the increase in width is a complex inter-action between regime increase in discharge and a reduction in bed load due to dredging and bank lowering, which will be discussed later.

2.3 Sediment Size

Representative sieve analyses for bed and bank material were supplied by M Collins & Sons Pty Ltd. Results are summarised below.

Sample	D_{50} mm	% Silt/Clay <0.075 mm
Bed	0.40	6
Bank (floodplain)	0.16	23

2.4 Site Inspection

A site inspection was carried out on 27 May 1993 in the company of Mr Matt Collins. Two processes relevant to this study were noted.

(i) erosion of high banks;
(ii) deposition of sand on the bank lowered by soil extraction.

Erosion of the high banks is evident on both right (Collins' property) and left banks but is most severe near the Anabranch. The mechanism seems to be over-steepening of the bank by toe cutting followed by slumping and possibly also seepage failure.

By contrast the bank area that had been lowered by soil extraction to about 3 m above low water level showed deposition on top of the bank and no bank erosion.

2.5 Study of the Nepean River by R F Warner

Warner (1983) studied the changes in channel morphology over the period 1911 to 1982. He concluded that, with the bed slope fixed by bedrock bars and riparian weirs, the river has responded to the dredging and increased discharge since 1949 by increasing channel width and some reduction in depth. No changes were found in the meander wave lengths and sinuosities.

2.6 Borehole Data

There are no bore hole data on Collins' property. The Mines Department sank auger holes to investigate a high level sand deposit at Elderslie (Gobert 1976). Bedrock levels from these holes cannot be extrapolated to Collins property.

Borehole data for the construction of the Macarthur Bridge are given on DMR (now RTA) bridge plans (DMR 1970). These are shown on Figure 4. At the present river course the hard blue shale bedrock is at about RL45.2. At the Anabranch the bedrock of blue shale is at RL45.5. The lowest occurrence of blue shale is in borehole No 8, 366 m east of the Anabranch, at RL43.7. Generally the shale bedrock is at RL44 to 45 m indicating the river has planed down

the bedrock over a valley width of more than 900 m. The present location of the river is controlled by the outcropping bedrock on the left bank at Camden.

2.7 Air Photographs

Air photos dated 28.6.69, 10.6.72, 30.11.75 and 5.10.90 were examined. Although at least four overbank floods (> 10 m on Cowpastures Bridge gauge) were recorded in that period, visual examination of the air photos shows no evidence of any tendency for the river to change its course. The Anabranch has the appearance of an abandoned river course rather than a flood way.

3. COMPARISON WITH WORLD WIDE MORPHOLOGICAL DATA

3.1 Width-depth ratio (W/D) and percentage silt/clay in bed and banks (M), Schumm (1960)

Using the two year flood level the parameters are as follows.

Year of Survey	W/D	M%
1980	8.2	8.8
1991	7.8	8.9

The changes between the two surveys are small and probably not significant. Comparison with Schumm's US data shows that for the low silt/clay content (~9%) the width–depth ratio is very low (expected ratio ~23).

Possibly the floodplain sample does not represent the banks but very high silt/clay content in the original intact banks is unlikely.

Another possibility is that rivers on purely sandstone catchments do not follow Schumm's correlation. Here, the grain size of the bed material is determined by the grain size of the bed rock (sandstone) and not by attrition in the downstream direction since sandstone breaks down to boulders and sand but not to gravel.

3.2 Correlation Between Bankfull Discharge, Channel Slope, Plan Form and Bed Sediment Size, Leopold and Wolman (in Richards 1982)

The Nepean data plot near the threshold between meandering and braiding but the Nepean grain size of 0.4 mm is very much finer than expected grain size of 25 mm (Figure 5a).

3.3 Correlation Between Channel Slope, Froude Number and Width-Depth Ratio, Parker (in Richards 1982)

The Nepean data plot in the transition region between meandering and straight, well away from the transition to braiding (Figure 5b).

3.4 Equilibrium Geometry, Chang (1986)

The regime plot given in the paper by Chang (1986) classifies the Nepean at Elderslie as a region 4 stream – "a highly braided but fairly straight channel pattern". Since the method was developed using data on sand and gravel bed rivers it may not be applicable to rivers on sandstone catchments which do not produce any gravel size sediments.

3.5 Comment

The plan form of the Nepean River between Menangle and Camden is essentially straight with right angle bends where the river is deflected by outcropping bedrock. The Elderslie data fit the Parker correlation best (Figure 5b), placing the river in the transition region between meandering and straight. To induce meandering would require a substantial increase in the width–depth ratio or a reduction in Froude number. With the channel slope fixed by bed rock and weirs, Froude number can be reduced only by a reduction in discharge, *ie* a climatic change to a drought dominated period such as the early part of this century from 1901 to 1948 (Warner 1987). This is unlikely as the consensus on the greenhouse effect is an increase in rainfall in southern Australia (Henderson-Sellers and Blong 1989). Transition to a meandering regime is highly unlikely.

4. SUMMARY OF PREVIOUS STUDIES AND MORPHOLOGICAL COMPARISONS

The perceived trend (Warner 1983) for the river is to widen and to shoal in response to longterm increase in rainfall (1949 to present) and reduction in bed load due to construction of dams early this century and dredging of the river bed for sand extraction up to the present. No change in sinuosity or wavelength is expected.

The hypothetical diversion of the river into the Anabranch would in effect reduce the length of the river channel thereby increasing the channel slope. An increase in channel slope requires an increase in bed load. As already described the Nepean is short of bed load and therefore an increase in bed slope is unlikely as is the possible diversion into the Anabranch.

Correlation of the Nepean River morphological parameters with published overseas data is poor except for Parker's study. This places the Nepean River in the transition region between straight and meandering where transition to meandering is highly unlikely.

Another indicator against plan form change is the fact that the river is generally incised into bed rock – gorges in the sandstone reaches and incised into shale or older sediments (Warner 1983,

Erskine 1993). No borehole data are, however, available at the site.

Air photographs over the period 1969 to 1990 show no tendency for the river to change course.

5. RESHAPING THE RIGHT BANK

To further minimise the risk of the flood overflow into the Anabranch causing bank erosion it is proposed to reshape the right bank to maintain as smooth an alignment of the bank as possible at the mouth of the Anabranch taking into account the presence of any mature vegetation. The proposed reshaping is shown in Johnstone Environmental Technology Drawing JET0160/53 (Issue 1) in the main report and consists of establishing two well aligned banks, one at RL 59 and the other at RL 66. It is expected that such realignment, reinforced by heavy planting with suitable riverine species will establish a stable, scour resistant bank requiring only minimal maintenance, such as removal of debris after a flood.

6. THE OPTIONAL ISLAND IN THE ANABRANCH

One proposed option for site rehabilitation after extraction is to construct an island refuge for wild life by removing part of the left (western) bank of the Anabranch. This bank is a well treed, stable bank and given the scale of the planned extraction it is felt that it would be preferable to preserve any stable, well vegetated land forms that are not required for the extraction operation. Removing the bank of the Anabranch will probably destroy its clay lining allowing the water in the Anabranch to drain rapidly into the permeable soils surrounding the Anabranch.

7. CONCLUSION

It is considered that the river shows no tendency to change its course by braiding or changing its meander pattern.

The proposed reshaping of the right bank at the Anabranch is expected to direct the main stream flow to continue along the river channel while allowing flood overflow to enter the Anabranch with minimal scour of the bank.

Construction of the refuge island in the Anabranch is considered an unnecessary disturbance of a stable, well treed landform and is not recommended.

8. REFERENCES

Chang, H H (1986), "River Channel Changes: Adjustments of Equilibrium", *ASCE Jnl Hydr Eng*, Vol 112 No 1, pp43-55.

Department of Main Roads (1970), Bridge over Nepean River at Camden, Bridge Drawings 0620 075BC2712, Sheet 2.

Erskine, W D (1993), Pers comm.

Gobert, V (1976), "Geological Investigation of a High Level Sand Deposit", *Department of Mines Report* GS 1976/181.

Henderson-Sellers, A and Blong R (1989), "The Greenhouse Effect, Living in a Warmer Australia" NSWUP Sydney.

MWS&DB (1985), "Upper Nepean Profile Survey", Cat No WP 6876.

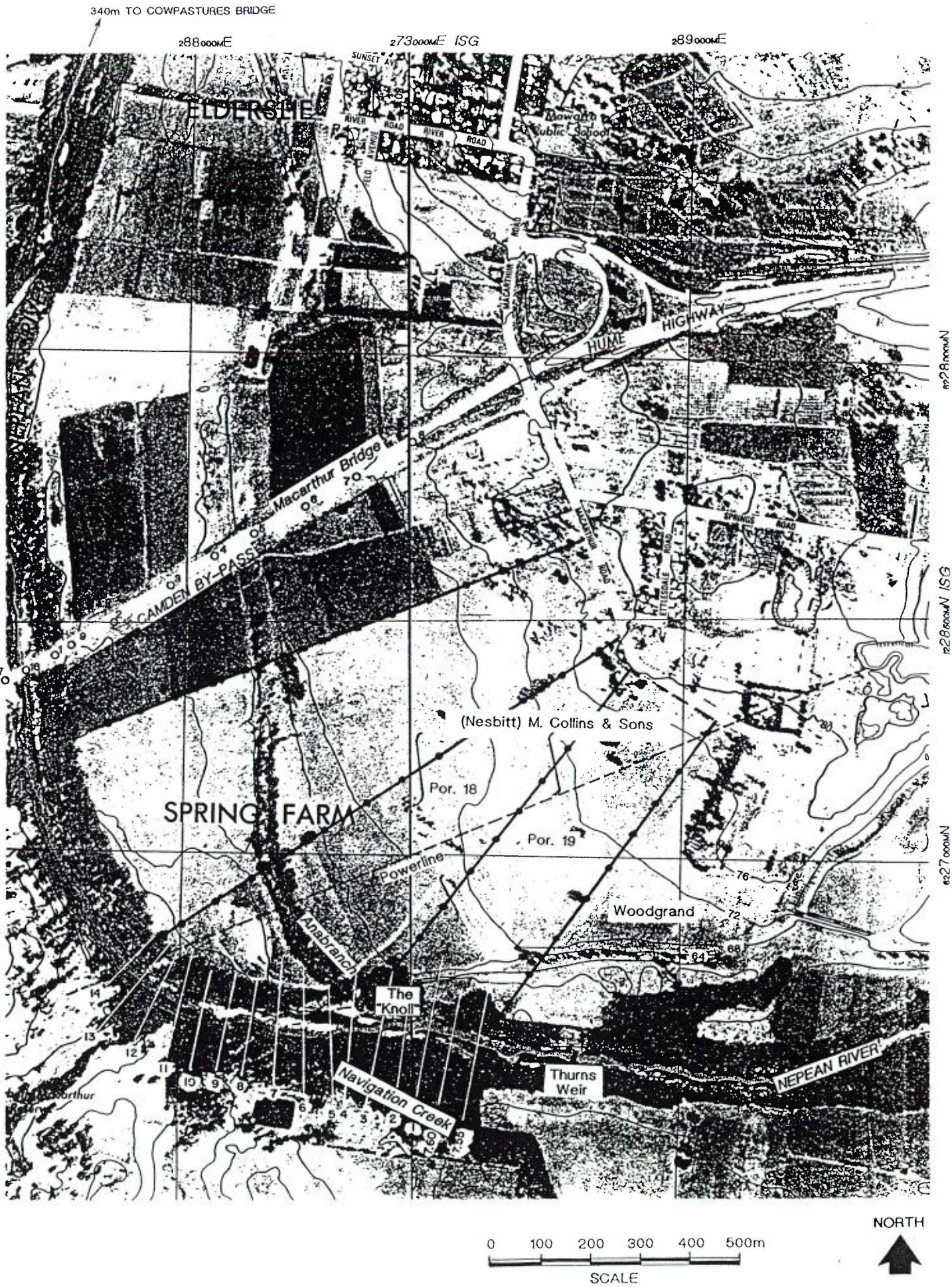
Richards, K (1982), *Rivers, Form and Process in Alluvial Channels*, Methuen, London.

Schumm, S A (1960), "The Shape of Alluvial Channels in Relation to Sediment Type", *US Geological Survey Professional Paper* 325-B.

Warner, R F (1983), "Channel Changes in the Sandstone and Shale Reaches of the Nepean River" in Young R W and Nanson G C "Aspects of Australian Sandstone Landscapes", *ANZ Geomorphology Group Special Publication* No 1.

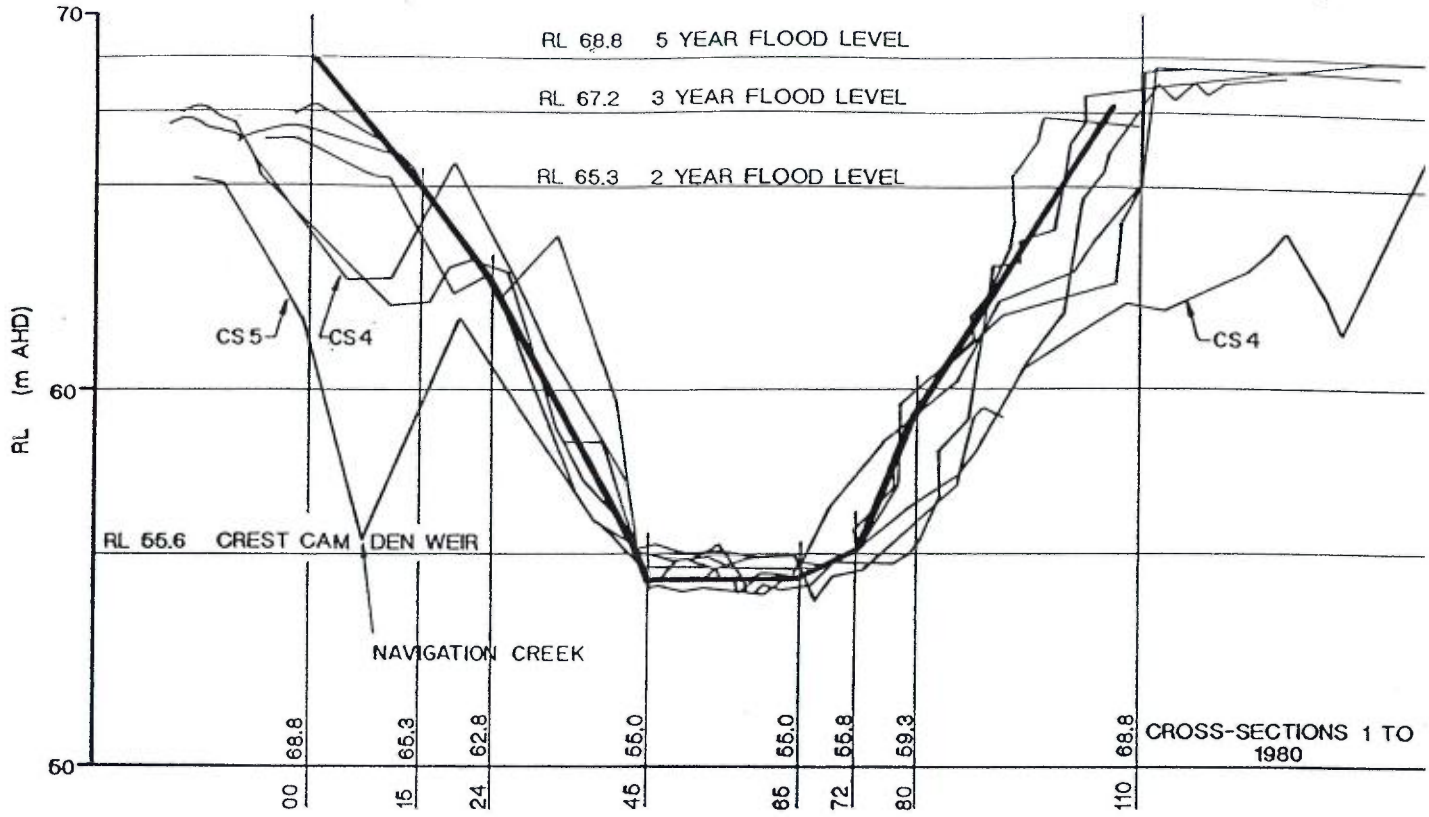
Warner, R F (1987), "The Impacts of Alternating Flood- and Drought-Dominated Regimes on Channel Morphology at Penrith, New South Wales, Australia", *Proc Symp The Influence of Climate Change and Climatic Variability on the Hydrologic Regime and Water Resources*, Vancouver, IAHS Publication No 168.

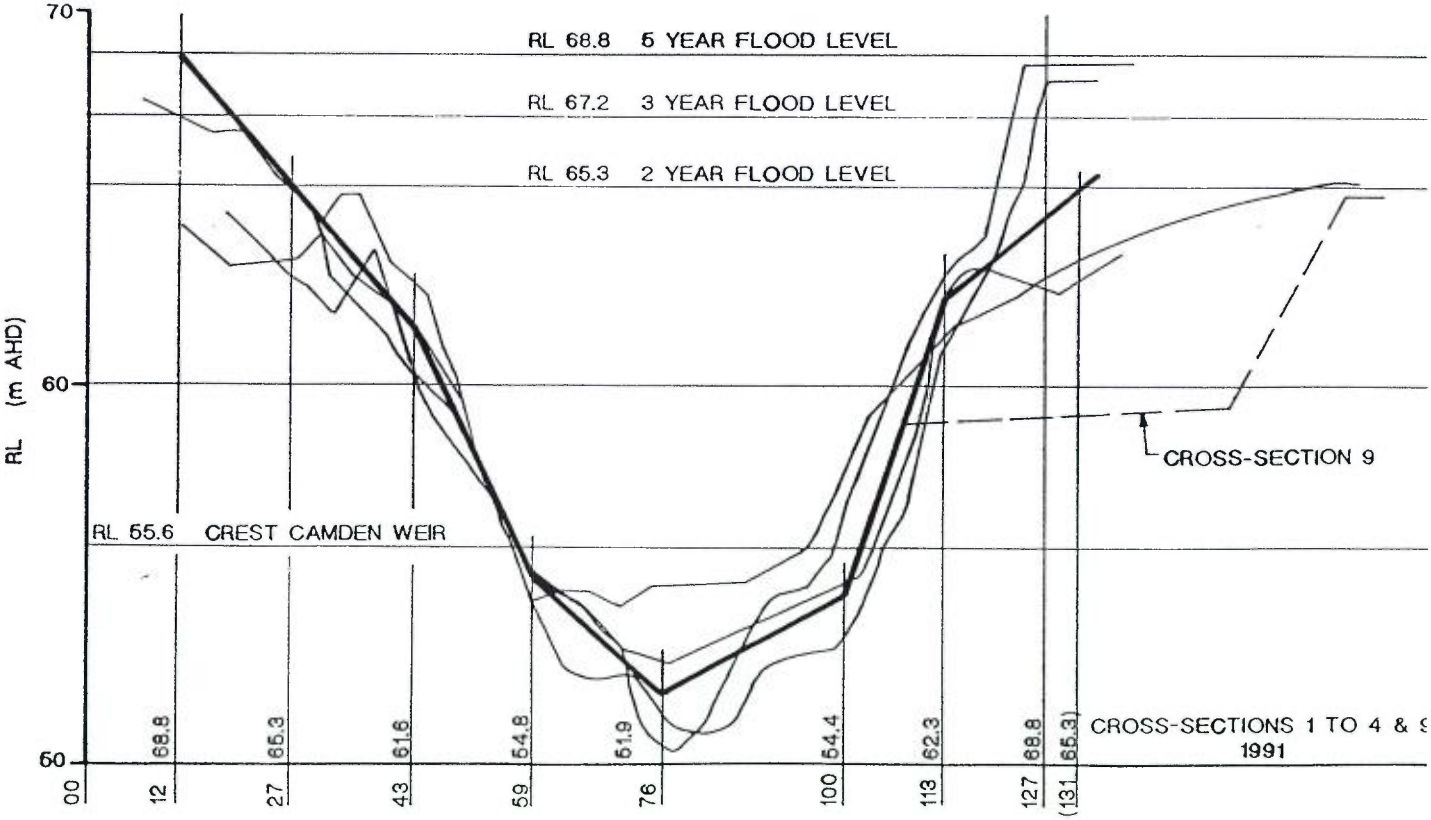
WRC (1986), "Camden Flood Study Report", *Water Resources Commission of NSW.*



LOCALITY MAP

FIGURE 1





AVERAGE RIVER CROSS-SECTIONS 1980 AND 1991 FIGURE 2

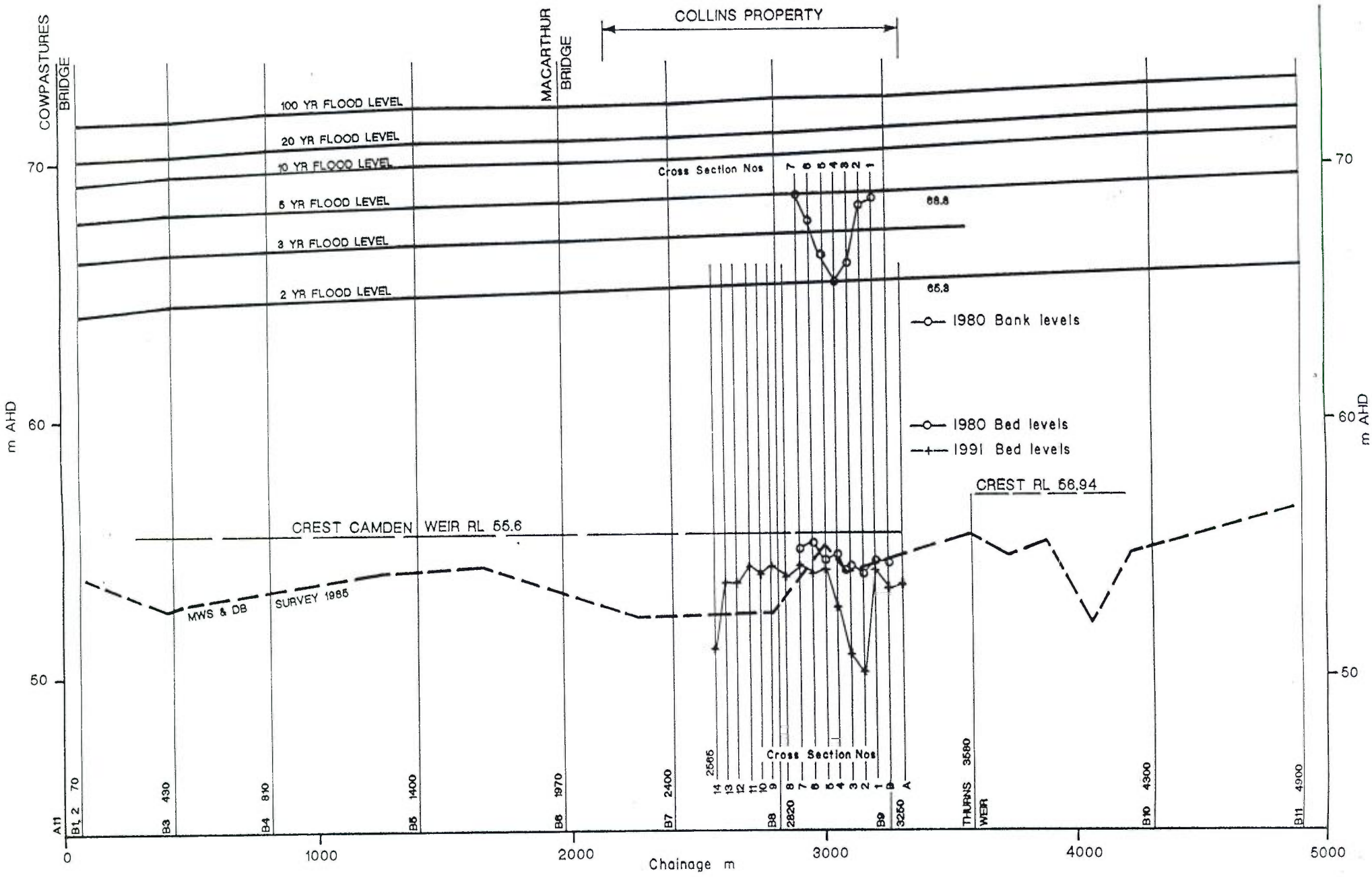


FIGURE 3

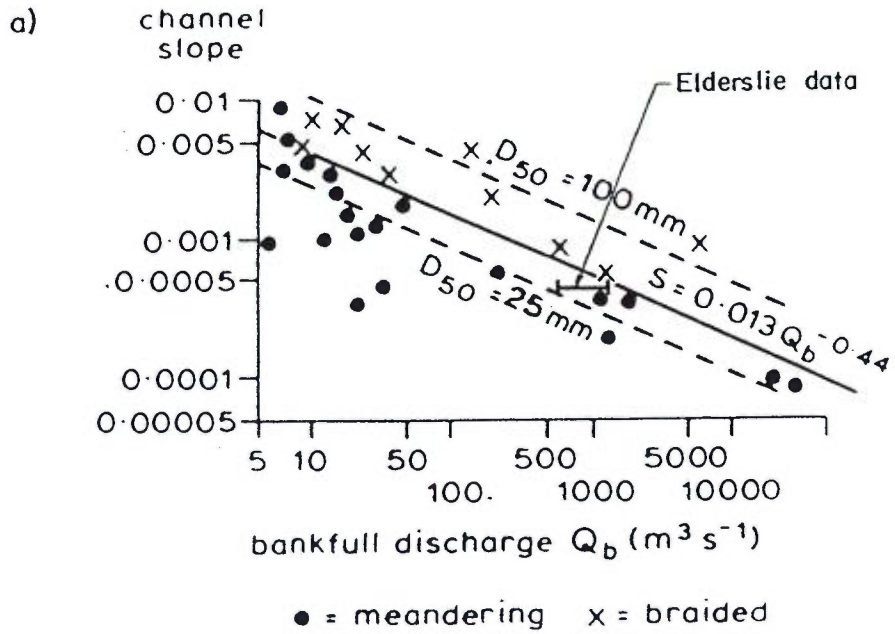
NEPEAN RIVER LONG SECTION U/S OF COWPASTURES BRIDGE

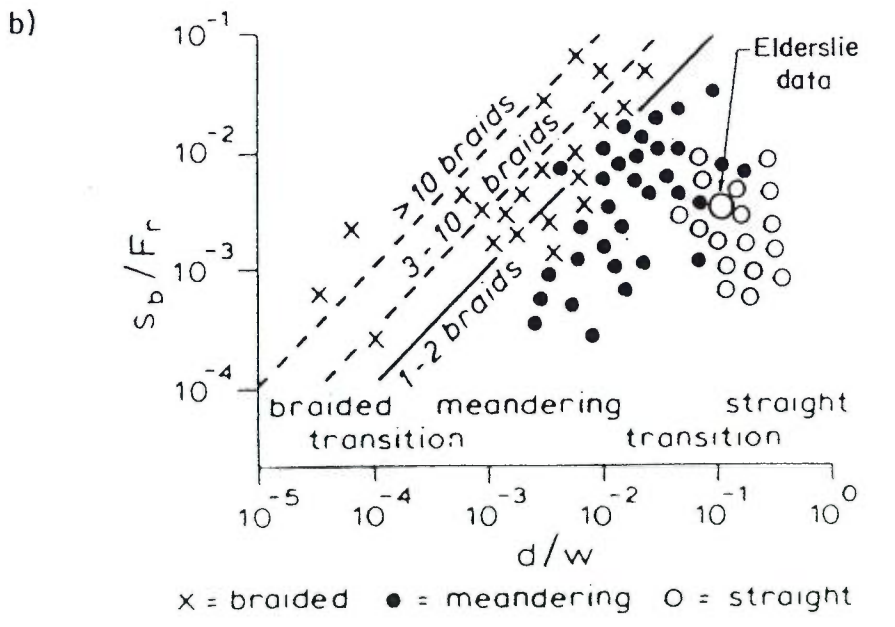
(FROM CAMDEN FLOOD STUDY REPORT)

BORE HOLES AT MACARTHUR BRIDGE

HORIZONTAL SCALE 1:5000
VERTICAL SCALE 1:500

FIGURE 4





FROM RICHARDS (1982)

CORRELATION OF MORPHOLOGICAL PARAMETERS FIGURE 5

APPENDIX D

ASSESSMENT OF THE SIGNIFICANCE OF POTENTIAL IMPACTS ON NATIVE FAUNA

SAND and SOIL EXTRACTION at ELDERSLIE
COLLINS PROPERTY

ASSESSMENT
of the SIGNIFICANCE of POTENTIAL IMPACTS
on NATIVE FAUNA

F Dominic Fanning

The potential impacts of the proposed sand and soil extraction operations at Elderslie (as described in this EIS) on the native fauna of the vicinity are considered using the criteria established under Section 4A of the Environmental Planning & Assessment Act, as amended by the Endangered Fauna (Interim Protection) Act 1991 and the Timber Industry (Interim Protection) Act 1992. These criteria are designed to determine "whether there is likely to be a significant effect on the environment of protected fauna", and consequently whether there will be a significant impact on the native animals. If endangered fauna or their habitats are to be significantly affected, a licence is required under Section 120 of the EF(IP) Act 1991 to "take or kill" endangered species.

The National Parks & Wildlife Service' "General Guidelines for Fauna Impact Statements" state:

> "Under the provisions of the Endangered Fauna (Interim Protection) Act, 1991, as amended by the Timber Industry (Interim Protection) Act, 1992, there are two scenarios which require the preparation of Fauna Impact Statements:
>
> NATIONAL PARKS AND WILDLIFE ACT, 1974
>
> The National Parks and Wildlife Act, 1974, (NP & W Act) requires a Fauna Impact Statement to be prepared where an action is likely to take or kill **endangered** fauna.
>
> **Endangered fauna** are those species named in the revised (interim) Schedule 12 as Threatened or Vulnerable and Rare, published on 28 February 1992 [and subsequently revised].
>
> A Fauna Impact Statement is a requirement for obtaining a general licence from the National Parks and Wildlife Service to take or kill endangered fauna after 27 February, 1992.
>
> ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979
>
> The Environmental Planning and Assessment Act, 1979 requires a Fauna Impact Statement to be prepared where a development or activity is likely to significantly affect the environment of endangered fauna."

Whilst a range of protected fauna (including native birds, reptiles, amphibians and mammals) will use the vegetation communities and habitats on the property and in the immediate vicinity (including those to be removed during extraction activities), the majority of species expected or observed are widespread, and common to abundant throughout their respective ranges. Few endangered fauna species are regarded as likely to occur in the vicinity (due primarily to the highly disturbed and modified nature of the environment), and these only an occasional or limited basis (if at all).

As noted in the main report, the relevant property has long been substantially cleared, and little 'natural' or native vegetation remains. Of the two areas which support some native vegetation on the property, the open forest on the 'knoll' adjacent to the Nepean River substantially consists of regrowth, with few large trees present. This area has obviously been previously cleared (during prior agricultural pursuits on the property) and is significantly degraded in its current state. The remnant vegetation along the Anabranch includes substantial trees, which support hollows suitable for arboreal mammals, bats and hollow-nesting birds. Whilst the understorey has been lost in parts of this area, the elements of this site provide the potential for a significant conservation resource in the vicinity.

(a) the extent of modification or removal of habitat, in relation to the same habitat type in the locality

The area to be cleared or modified for the sand and soil extraction at Elderslie is for the most part cleared for agriculture, and consequently possesses little habitat value for native fauna. The Dry Open Forest community on the 'knoll' adjacent to the Nepean River is also disturbed, comprising young trees characteristic of regrowth from previous clearing. Large trees are few, and tree-hollows (essential for many species of native forest fauna) are lacking. This vegetation community is dominated by eucalypt saplings and tall acacias, the latter being characteristic of disturbed sites.

With respect to protected or endangered native fauna, the communities and habitats present on the Elderslie site which are to be disturbed for the extraction operations are of little consequence. The cleared areas do not provide any resources of significance, and their modification is of no relevance in terms of fauna conservation.

The regrowth forest on the 'knoll' does provide limited resources for native fauna, although no endangered species have been recorded from it and none are expected (except perhaps as occasional visitors). This area of habitat is isolated from other significant tracts of native vegetation, and given the levels of disturbance through the area generally is not able to provide resources to other than highly mobile species (such as the birds). It should be noted that approximately 40% of this stand of 'forest' is to be retained throughout the extraction operations and will remain after the project has been completed. Additionally, removal and extraction in this locality is not planned until the adjacent plantings (along areas of the bank already extracted) have been growing for 5 years, thus providing alternative habitat for many of the animals currently present within the 'knoll' vegetation.

There is a substantial band of forested land on the opposite side of the Nepean River, which doubtless does provide appropriate resources for native fauna. Additionally, although currently somewhat degraded, the stand of large trees and native vegetation along the Anabranch is regarded as of potentially high conservation value, and is to be enhanced by protection and nurturing.

(b) the sensitivity of the species of fauna to removal or modification of its habitat

Virtually all species of fauna are "sensitive to removal or modification" of their habitat, with relatively few native species being advantaged by alterations to natural habitats or ecosystems. The appropriate concept in this regard is the 'significance' of the habitat removal or modification for the conservation of species and populations (particularly endangered species) in the vicinity of the proposed activities, and in regional conservation terms.

Extraction activities through the cleared agricultural land at Elderslie will not significantly affect any native fauna species. Whilst the removal of a portion of the forest on the 'knoll' will affect animals residing on it or which may use the resources present, this habitat is of poor quality, comprising regrowth from previous clearing, and no endangered fauna species are considered likely to be significantly affected by the proposal.

Although some individuals of some common fauna species may perish during the vegetation removal and extraction operation, no populations of any native species are expected to

disappear from the general area as a result of the proposed activity, given the extent of habitat nearby and the previous disturbance on the site.

(c) the time required to regenerate critical habitat, namely, the whole or any part of the habitat which is essential for the survival of that species of fauna

The areas proposed for extraction at Elderslie is in a generally disturbed condition and does not support "critical habitat" for endangered fauna. No species of endangered native fauna are regarded as dependent on the vegetation present on the study site (ie the communities present are not considered "essential for the survival" of any species in even a local sense). Indeed, none are expected to utilise the habitats present on other than an occasional basis.

With respect to other protected (non-endangered) species of native fauna present in the vicinity, although the habitats present may be considered important or 'critical' for individual organisms of some species, they are not considered 'critical' in the sense of "essential for the survival of that species". No native fauna species are likely to be rendered even locally extinct as a result of the proposed extraction operations, as the site does not support unique habitats or resources.

(d) the effect on the ability of the fauna population to recover

No native fauna species are considered likely to become even locally extinct as a result of the proposed deviation, although some individuals of a few species may perish. No endangered species are considered likely to be adversely affected (see items 'b' and 'c' above), and consequently the 'recovery' of populations of native fauna does not appear to be of concern.

The retention of 'forest' vegetation on the 'knoll' and on the opposite bank of the Nepean River, the retention and enhancement of habitat along the Anabranch, and the detailed and intensive revegetation program on the property are considered as providing suitable and adequate resources for the native fauna of the region.

It is considered that the proposed extraction operations at Elderslie will impose no adverse "effect on the ability of the fauna population[s] to recover".

(e) any proposal to ameliorate the impact

Impact amelioration on and adjacent to the proposed extraction operation primarily involves revegetation of the site and enhancement of the habitats along the Anabranch.

The areas along the Nepean River banks which have previously been extracted have already been replanted, and an increased density of planting has been implemented (to approximately 1 metre centres). This approach will provide a substantial and diverse riparian habitat for native fauna. Additionally, it is proposed to fence the Anabranch with a barrier of approximately 50 metres on each side, to protect the vegetation from stock grazing and to promote enhancement and native vegetation regrowth.

The use of plant material removed from the 'knoll' as a source of seeds and mulch to rehabilitate extracted areas and exposed banks is recommended. Plant material removed from this area should be shredded and stockpiled for use as a mulch on exposed soil surfaces, reducing the potential for erosion, minimising weed infestation and providing plant propagules to revegetate areas with local native plant species.

(f) whether the land is currently being assessed for wilderness by the Director of National Parks and Wildlife under the Wilderness Act 1987

The subject land is generally highly disturbed, and does not conform to the parameters required of 'wilderness' (Section 6 of the Wilderness Act 1987). It therefore cannot be considered for this purpose by the Director of the National Parks & Wildlife Service.

(g) any adverse effect on the survival of that species of protected fauna or of populations of that fauna

Whilst the proposed extraction operations at Elderslie will doubtless affect some individuals of some common native fauna species in the immediate vicinity, it is considered that the proposal is not likely to have "any adverse effect on the survival of ..... species of protected fauna". Nor is it anticipated that there will be "any adverse effect on the survival of ..... populations of that fauna" (ie no populations of native fauna are considered likely to become non-viable in the vicinity because of possible impacts from the proposed extraction operations). No species of native fauna will be threatened in local, regional or national conservation terms, because of the minimal area of native 'habitat' involved, the retention of habitat in the locality, the already highly disturbed nature of the local environment and the extent of rehabilitation proposed on the site.

No Schedule 12 (endangered) fauna species have been recorded from the site, and none are expected to occur in the vegetation on the 'knoll'. The area of greatest potential significance for native fauna in the locality are the vegetation and features along the Anabranch, and these are to be retained and enhanced.

Consequent upon the foregoing discussion, the proposed extraction operations will not impose any significant impact on any native protected or endangered fauna. Consequently, a Fauna Impact Statement, as detailed under the Endangered Fauna (Interim Protection) Act 1991, is deemed not relevant for this development, and a Section 120 Licence will not be required.

APPENDIX E

RESPONSE FROM PROSPECT ELECTRICITY

PROSPECT ELECTRICITY

11 June 1993

The Manager
M Collins and Sons Pty Ltd
PO Box 55
MILPERRA NSW 2214

Attention: Mr M J Collins

Dear Sir

33KV FEEDER 303 NEPEAN TRANSMISSION SUBSTATION TO OAKDALE ZONE SUBSTATION - PROPOSED SAND EXTRACTION WITHIN LOT 1 DP 587631 MACARTHUR ROAD, ELDERSLIE

Further to a site meeting between yourself and Prospect's Mr Steven Baker and Mr Des Brigden on 19 May, 1993 to discuss the above proposal I advise the following;

Approval is granted to extract sand within the easement area subject to the following conditions:

1. Structure 10 will need to be replaced with a new structure once the first stage of the sand mining has been completed. This first stage of mining should not come within five (5) metres of the existing structure.

2. Structure 11 can remain in its existing location provided that the sand extraction does no come within five (5) metres from the structure in any direction. Unobstructed vehicular access will have to be available to the structure at all times. A suitable grade to provide access to the structure is 1:3.

In addition to the above conditions the following restrictions apply;

1. Unobstructed access to the line structures shall be available at all times for Prospect plant and personnel.

2. Obstructions of any type shall not be placed within five (5) metres of any part of a line structure or guy.

3. Vehicles, plant or equipment having a height exceeding four (4) metres when fully extended shall not be brought onto or used within the easement area without prior approval of Prospect.

.../2

In reply quote: 91/12114 SB:JZ Your contact: Mr D Brigden Ext: 85681

10 Smith Street Parramatta NSW 2150 ☎ 131 003 Fax: 02 635 2511
Postal Addresses: PO Box 389 Parramatta NSW 2124 or DX 28443 Parramatta

4. The parking of vehicles within the easement area shall be limited to types whose height when fully extended does not exceed four (4) metres. Adequate precautions shall be taken to protect the structure from accidental damage in areas subject to vehicular access.

5. Flammable liquid carriers, caravans and other camping vehicles shall not be parked within the easement area.

6. Garbage, refuse or fallen timber shall not be placed within the easement area.

7. Flammable material or explosives shall not be stored within the easement area.

8. Explosives shall not be used within the easement area without the prior written approval of Prospect.

9. Trees and shrubs may be planted within the easement area provided that they are species whose mature height is less than 3.5 metres and do not interfere with access to any line structure.

All cost associated with replacing or relocating the affected structures shall be met by your company with no cost to Prospect.

For any further assistance please contact Prospect's Engineering Officer, Mr Des Brigden on telephone 131003 extension 85681.

Yours faithfully

S Baker
ACTING TRANSMISSION ENGINEER
SOUTHERN AREA

APPENDIX F

RESPONSE FROM ENVIRONMENT PROTECTION AUTHORITY

EPA

Environment
Protection
Authority
New South Wales

PO Box 1135 Chatswood NSW 2057
Tel .02. 795 5000 Fax .02. 325 5678

The Manager
Johnstone Environmental Technology Pty Ltd
54 Frenchs Road
Willoughby NSW 2068

Our Reference: BA358

Your Reference:

Contact: Mr R Aubrey

Attention: Mr David Johnson

Dear Sir

Draft EIS for Supplementary Sand and Soil Extraction Spring Farm, Elderslie

I refer to your request for the EPA to comment on the above draft EIS.

The Environmental controls for the mitigation of Air, Water and Noise pollution from this proposed development have been adequately addressed.

For further information please contact Rod Aubrey on 02 325 5648.

Yours faithfully

Alan Dyer 22/6/93.

Alan Dyer
Acting Regional Manager Outer Sydney
for Director General