Extraction of Sand from Port Hacking

March 1984
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SUMMARY

A CONCEPT PLAN

is invited from interested parties for the

EXTRACTION OF SAND FROM NOMINATED LOCATIONS IN PORT HACKING

Authority: This document is issued by the Public Works Department and identifies the requirements of this Department only. The proponent must establish the requirements of all other relevant authorities.

Nominated Locations: • The recognised navigation channels between Lilli Pilli and Hungry Point.

• Areas in the vicinity of Lilli Pilli, Mansion Point, and the Hacking River between Wants Beach and Point Danger.

Sand Quantity: The in-situ volume of sand is not less than two million cubic metres.

Tenure: Final tenure will involve consideration of the proponent's requirements for profitability, and of environmental aspects, requirements in respect of channel maintenance and the extent of any financial commitment of the State Government. A variety of options may be submitted.
Concept Plan: The Concept Plan should provide sufficient information for the Department and other authorities to fully evaluate the plan. The information should include but not necessarily be limited to:

- method of extraction
- stockpiling and treatment provisions
- transport details
- proposed environmental controls
- cost feasibility
- proposed tenure

Additional Information: The information contained herein should be adequate for preparation of a concept plan. More detailed information is available on request from:

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Public Works Department
Shell House
140 Phillip Street
Sydney NSW 2000
Telephone: (02) 231 7356

Closing Date: Concept Plans, endorsed and marked "Confidential - Port Hacking Sand Extraction" will be accepted until 2 pm on Tuesday, 3rd July, 1984

Postal Address: Secretary, Tender Board
Public Works Department
Level 18
State Office Block
Phillip Street
Sydney NSW 2000
INTRODUCTION

Port Hacking is a large, scenic waterway located some 25 kilometres south of Sydney. It is bounded on the south by the Royal National Park and on the north by residential development.

Since early this century, the Public Works Department has maintained navigation channels throughout Port Hacking. This continues today, with the Department maintaining the commuter ferry link between Bundeena and Cronulla and the navigation channels which allow access to the attractive bays and upper reaches of Port Hacking. As a result, sightseeing vessels have operated for many years and the waterway has become an important recreational area for tourists and residents of Sydney.

Tourist activity in Port Hacking is increasing and in recent years, new and larger sightseeing vessels have been introduced. However, realisation of the full potential of the waterway is being hindered by extensive shoaling. This shoaling restricts safe use of the waterway and reduces the area available for boating and other water based activities.

In the past, maintenance of channels has been achieved by intermittent dredging. However, some of the channels are becoming difficult to maintain and a more cost effective approach to channel maintenance is desired.

The material dredged from navigation channels was relocated in adjacent areas determined by consideration of natural hydraulic factors, environmental issues and practical limitations of dredge equipment. This practice has become less desirable as dredging costs have increased and acceptable sites for disposal have become more difficult to find. It is now proposed that sand dredged from the navigation channels be removed from Port Hacking, rather than merely being relocated. It is further proposed that the cost of dredging be offset by sale of the sand.

It is recognised that a sand extraction operation may not be economical
based on the quantities of sand available from channel maintenance alone. Therefore, to permit economy of scale as well as to provide a continuous base load for an extraction operation, locations have been identified where larger quantities of sand may be removed without adversely affecting the natural hydraulic and sedimentary processes of the waterway.

The Department is working toward long term solutions to the problem of channel maintenance and options for development of the full recreational and commercial potential of the waterway. The introduction of a limited scale sand extraction operation as described in this document, would provide an interim solution to the problem of channel maintenance prior to the achievement of longer term solutions.
2.0 EXTRACTION FROM RECOGNISED NAVIGATION CHANNELS

The navigation channels are to be maintained for the tenure of the extraction operation within the limits of the design cross-sections shown on Figure 1.

2.1 Brief History and Location of Channels

The Public Works Department has long been involved in maintenance dredging of navigation channels in Port Hacking. The total cost of the dredging since 1940 is more than $2.5 million (present value).

Since the early 1970's, maintenance dredging has been undertaken by the Sutherland Shire Council under an agreement with the Department. Photo 1 shows the location of the channels, the occasions over the last ten years when dredging has been carried out, and disposal areas. The recognised navigation channels are:

Area A : channel across the mouth of Gunnamatta Bay
Area B : channel into Gunnamatta Bay
Area C : channel at Burraneer Point
Area D : channel across the mouth of Burraneer Bay
Area E : channel at Gogerleys Point
Dredging Areas
Disposal Areas

Dredging
B: 1974
C: 1974, 1979, 1981
D: 1981
E: 1979

Scale: 1 to 16000

PORT HACKING - DOWNSTREAM (1982) PHOTO 1
2.2 Performance of Dredged Channels

The sandy bed sediments in the vicinity of the navigation channels move under the action of waves and tidal currents. The interaction of waves and tidal currents varies with location throughout the waterway and with time. Hence channel infilling rates are variable.

Based solely on the Department's experience to date, maintenance dredging of the navigation channels could be required at the approximate intervals set out in the table below and involve, on average, a total of 30,000 cubic metres per annum. However, the intervals and quantities could vary to a significant degree and the proponent should allow for potential variations in his costing structure.

<table>
<thead>
<tr>
<th>Navigation Channel (see Photo 1)</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3 years</td>
</tr>
<tr>
<td>B</td>
<td>7-10 years</td>
</tr>
<tr>
<td>C</td>
<td>6 months</td>
</tr>
<tr>
<td>D</td>
<td>2-3 years</td>
</tr>
<tr>
<td>E</td>
<td>5 years</td>
</tr>
</tbody>
</table>

2.3 Design Cross-Sections

The minimum and maximum limits of the design cross-section for navigation channels A, B, C, D & E are set out on Figure 1.
All dimensions in metres
Datum:
ISLW = Indian Spring Low Water
Scale: 1 to 500
3.0 EXTRACTION FROM LOCATIONS OTHER THAN RECOGNISED NAVIGATION CHANNELS

3.1 Nominated Locations and Estimated Quantities

The locations nominated for extraction are shown on Figure 2. The quantities of sand available are conservatively estimated as follows:

- The general vicinity of Lilli Pilli Point between Gogerleys Point and Little Turriell Bay. : 1,000,000 cubic metres
- Between Lightning Point & Mansion Point. : 500,000 cubic metres
- Hacking River between Wants Beach and Point Danger. : 500,000 cubic metres
- Other areas: In addition to the above, consideration would be given to extraction of material from the heads of bays within the estuary.

3.2 Design Cross-Sections

The limits of extraction in the above locations are shown on Figure 3. It should be noted that a buffer zone in the form of an undredged bench is to be maintained between all dredged areas and foreshores as measured from Mean High Water Level (MHW). Where there are mangroves growing, this bench is to be measured from the edge of the mangroves.
EXTRACTION LOCATIONS
DATUM OF SOUNDINGS: ISLW (FORT DENISON)

EXTRACTION LOCATIONS OTHER THAN RECOGNISED NAVIGATION CHANNELS Fig 2
Maintain bench if adjacent to foreshore or seagrass beds

SECTION 1

Mangroves

SECTION 2

SECTION 3

MHW = Mean high water
ISLW = Indian spring low water

SECTION 4

All dimensions in metres
Datum: ISLW

Scale: 1 to 500

DESIGN CROSS SECTIONS
LOCATIONS OTHER THAN RECOGNIZED NAVIGATION CHANNELS
4.0 WAVE AND CURRENT CONDITIONS

4.1 General

The proponent should take into account the mixed wave and tidal current conditions within Port Hacking which at times, can be severe.

Areas east of Burraneer Point are subject to ocean swell of variable height with period ranging from 8 to 12 seconds. All sites are subject to shorter period wind waves with period ranging from 3 to 5 seconds.

4.2 Conditions at Nominated Extraction Locations

Wave and tidal current conditions at the nominated extraction locations throughout the estuary (refer Photo 1, Photo 2 and Figure 2) are as follows:

Area A

- Average spring tidal velocities up to 0.6 m/s.
- Ocean swell up to 3 m high is possible during severe storms. Swell up to 0.5 m high is very common.
- Wind waves up to 0.5 m are possible.

Area B

- Average spring tidal velocities up to 0.5 m/s.
- Ocean swell is negligible at the northern end and approaches the conditions of Area A at southern end.
- Wind waves as for Area A.
Area C

- Average spring tidal velocities up to 1 m/s.
- Ocean swell up to 2 m high is possible during severe storms.
- Wind waves as for Area A.

Area D

- Average spring tidal velocities up to 0.8 m/s.
- Ocean swell up to 0.5 m high is possible on a flood tide during severe storms.
- Wind waves as for Area A.

Area E

- Average spring tidal velocities up to 0.8 m/s.
- No ocean swell.
- Wind waves up to 1 m are possible.

Hacking River

- Average spring tidal velocities up to 0.3 m/s.
- Minor wind waves up to 0.2 m are possible.
5.0 DESCRIPTION OF SAND BODY

5.1 General

Two distinct sand deposits exist in Port Hacking (Figure 4):

The Riverine Delta: where river sand derived from the catchment area by weathering of rocks is carried downstream by floods and settles to form shoals. These shoals are gradually moving downstream.

The Marine Delta: where marine sand introduced into Port Hacking from offshore during the last sea level rise has formed extensive shoals. The marine delta is gradually moving upstream under wave and tidal action.

Hydrographic survey details of both sand bodies are presented in Figure 4. These depths are based on the most recent comprehensive hydrosurvey of the waterway which was completed by the Department in 1979. Figure 4, however, is only a summary plan and more detailed survey information, which covers many plans, is available.

5.2 Sediment Characteristics

5.2.1 Riverine Delta (refer Photo 2)

Analysis of a limited number of surface sediment samples indicates a predominantly medium sized sand with variable mud and silt content. The sand grains are quartzose, mainly angular with a significant lithic component. Sorting is variable and pockets of high mud and organic matter occur. Shell content is very low.
No detailed borelogs are available. However, it is known that in the early 1960's over 200,000 cubic metres of material was extracted to depths of approximately ten metres. Few details of the operation are available but the fact that it did take place may provide some insight into the depth and potential value of the sediment contained within the riverine delta.

5.5.2 Marine Delta (refer Photo 1)

Numerous surface sediment samples have been collected throughout the marine delta. In addition, in 1979, drilling and coring was carried out for purposes of establishing, in broad view, the stratigraphy and age structure of the entire deposit (see Figure 5).

The marine delta is comprised primarily of quartz grains and shell particles. The shell is mainly of sand size, with some larger fragments and whole shells. Minor components are wood fragments, clay and silt size particles and some lithic fragments. The quartz fraction is fine to medium grained, subangular to rounded, moderate to well sorted, and partially iron stained.

Sediment classification within the marine delta has been determined on the basis of shell content, as this is one of the main sedimentological characteristics of the deposit and because shell is detrimental to the commercial potential of the sand. The sands of the marine delta have been classified therefore, as having either a low shell content (less than 10%), a moderate shell content (10-20%) or a high shell content (greater than 20%).

Figure 6 shows the stratigraphy of the marine delta deposit along each of the drill hole cross-sections identified in Figure 5. The high shell sand forms a thin layer over much of the delta surface and comprises the bulk of the sand body upstream of Deeban Spit. Near surface deposits of the low shell sand are restricted to the seaward portion of the delta.
5.3 Commercial Quality of the Sand Body

The Department of Mineral and Resources has carried out a preliminary investigation into the commercial potential of the marine delta deposit based on the 1979 drilling data. The details of this investigation are set out in Geological Survey of N.S.W. Report No. 1981/530 dated August 1981. This report suggested that the potential commercial uses for the sand are:

- fill

- general purpose concrete, if no alternative competitive source is available and if its high shell content can be accepted by industry

- high strength concrete, if blended with coarser clean sand

The commercial potential of the riverine delta deposit has not been examined.
PORT HACKING TIDAL DELTA STRATIGRAPHY

DEPTH
BELOW
STANDARD
datum

VERTICAL SCALE

HORIZONTAL SCALE

1:25,000 metres

GUNNAMATTA BAY

DELTA CROSS SECTIONS

FIG. 6
6.0 ENVIRONMENTAL CONSIDERATIONS

Whilst the Department has nominated locations within which extraction will not adversely affect the natural hydraulic and sedimentary processes of the waterway, it is the responsibility of the proponent to establish the requirements of the other relevant authorities. These authorities may impose additional limitations and constraints on the extraction operation. The proponent's Concept Plan should indicate the manner in which the requirements of these authorities, including at least those listed below, are proposed to be satisfied.

Any extraction would be undertaken strictly in accordance with the requirements of the Environmental Planning and Assessment Act 1979.

- Crown Lands Office (Department of Local Government & Lands)
- Department of Environment & Planning
- Department of Mineral Resources
- State Pollution Control Commission
- Maritime Services Board
- Department of Agriculture (Fisheries Division)
- National Parks & Wildlife Service
- Sutherland Shire Council
7.0 CONTENT OF CONCEPT PLAN

The concept plan should provide full details of at least the following:

(a) Proposed method of extraction including:
   • water based activities - equipment specifications, operating procedures and any special or unusual features
   • land based activities - stockpiling and loading points, sand treatment methods and location, transport methods and waste disposal methods

(b) Proposed environmental controls.

(c) The manner in which the requirements of all other relevant authorities are proposed to be satisfied.

(d) Copies of company annual reports for at least the last two years.

(e) A summary of the proponent's experience with extraction and dredging projects of a similar nature.

(f) The economic and financial basis of the proposed Concept Plan.

(g) An extraction programme showing the sequence in which nominated extraction locations are proposed to be worked.

(h) Tenure proposal.

Although the Department will consider every Concept Plan on its merits, the Department gives no undertaking that any Concept Plan will be proceeded with.