Section Two

Description of the Project

This section describes the Proponent's plans to develop and operate the Somersby Fields Project. The extent of the recoverable sand resource is defined and the Proponent's project for sand removal, processing, stockpiling, loading / product transportation, and waste management is presented together with plans for the progressive rehabilitation to create long term conservation fauna / flora corridors within the Project Site. Operational information and details of services and employment are also presented.

A two stage approach to the project has been formulated. Whilst project approval is being sought for both stages, operational approval for the second stage will be sought following the Proponent's satisfactory demonstration of performance during the first stage. To this end, Section 2.13 presents an overview of the possible final landform, land use and rehabilitation strategy in the event operations cease at the end of the first stage.

The project has been designed to ensure that all elements of the sand removal and processing operations minimise, avoid or mitigate adverse impacts upon surrounding residents and land uses and the site's ecology. Details of the Proponent's plans to manage surface water, groundwater, air quality, noise and traffic are presented in Section 4 of this document.

2.1 OUTLINE OF THE PROJECT

2.1.1 Objectives

The Proponent's principal objectives for the Somersby Fields Project ("the project") centre upon:

(i) the development and operation of a new source of high quality fine and fine/medium grained construction sand; and

(ii) progressive rehabilitation of the Project Site to provide for rural / residential development at completion of operations and in a manner consistent with the prevailing Gosford City Council requirements.

The sand produced within the Project Site would contribute significantly towards meeting the predicted shortages of this important construction material for the building and construction industry in the northern half of the Sydney Metropolitan Area and Central Coast. These broad objectives would be achieved by:

(i) planning and removing the sand resource in a manner that maximises the quality and quantity of materials recovered;

(ii) processing of removed raw feed in a state-of-the-art wash plant, designed to maximise product quality and yield;

(iii) adopting a pro-active approach to waste management, particularly dewatered clay fines, to create a useful long term rehabilitated landform;

(iv) undertaking all activities in an environmentally responsible manner that enables compliance with all relevant statutory requirements;

(v) planning and operating all activities in consultation with surrounding residents, Somersby Public School and the wider community; and

(vi) monitoring and reviewing the environmental performance of the Proponent's activities before proceeding with Stage 2 sand removal activities.

2.1.2 The Project Site

For the purposes of this document, the area of land, which is the subject of the application for Project Approval, is referred to as the "Project Site". This area covers Lot 41, DP 1046841 and Lot 1, DP 302768 in the Parish of Narara and County of Northumberland. The Proponent owns both lots.

Figure 2.1 displays the boundary of the Project Site, which covers a total of 42.3ha. Lot 41, DP 1046841 covers 39.1ha and Lot 1, DP 302768 covers 3.2ha.

Access onto the Project Site from the adjoining Peats Ridge Road would cross the Peats Ridge Road reserve, which is currently owned by the NSW Roads and Traffic Authority (RTA) but is under the care and control of Gosford City Council. It is noted that the RTA has provided the Department of Planning its consent for the Proponent's Major Projects Application to be lodged with the Department (see Page A1-4).

2.1.3 Overview of the Project

The Proponent proposes to develop and operate a sand removal operation to produce a range of fine sand products over a period of 15 to 18 years depending on market conditions. The project has been designed to optimise the recovery of sand whilst satisfying both site and surrounding environmental constraints and progressively creating a final landform suited to the proposed end uses.

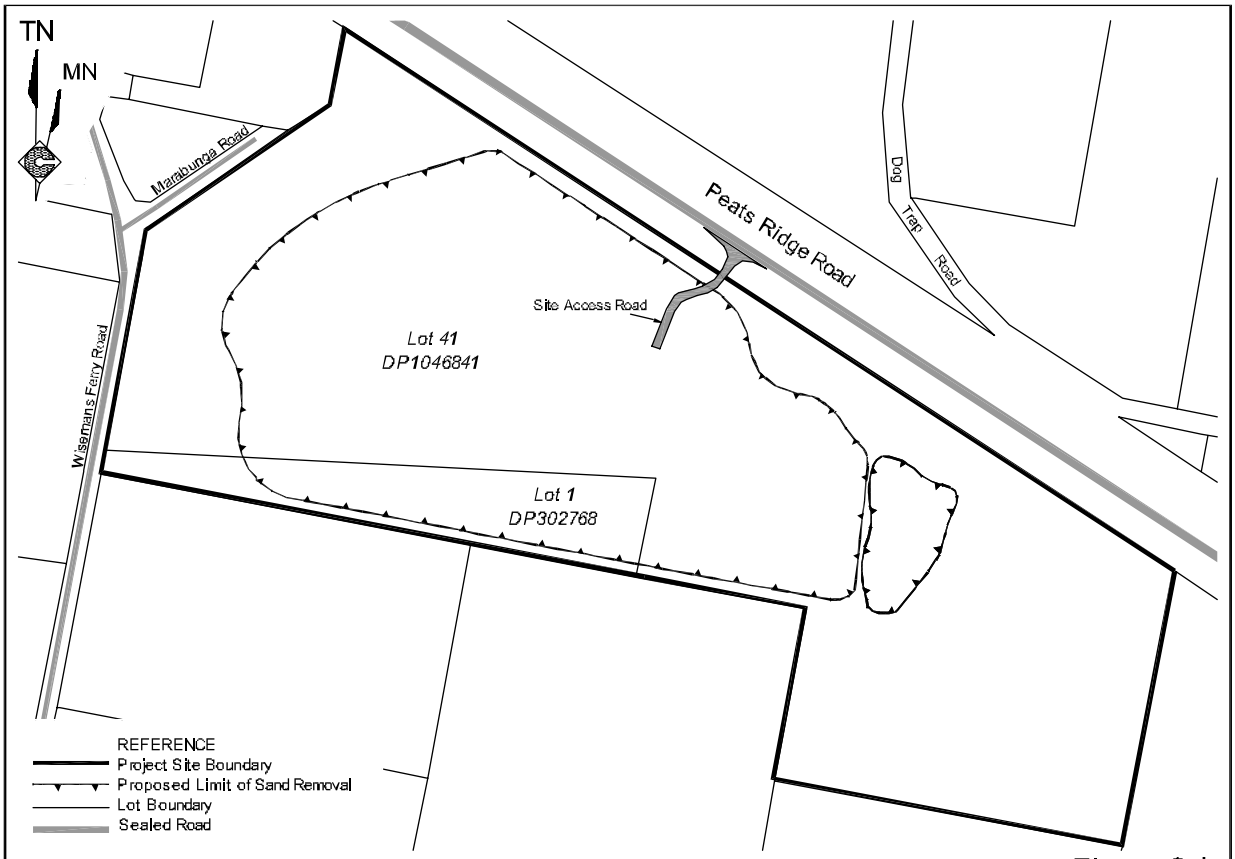


Figure 2.1
PROJECT SITE

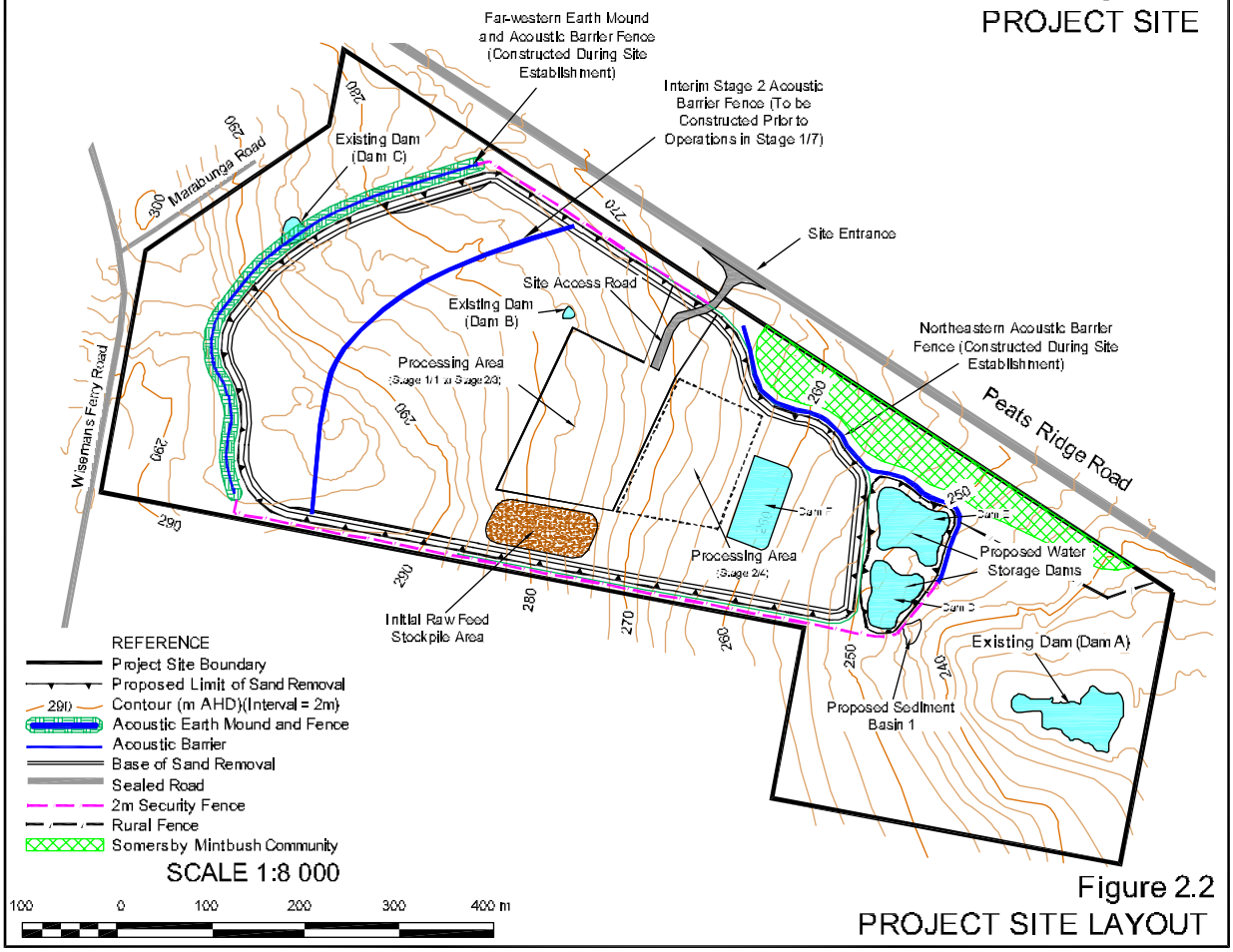


Figure 2.2
PROJECT SITE LAYOUT

Figure 2.2 displays the following principal components of proposed operation.

- A sand removal area covering approximately 22ha.
- The main processing area positioned near the centre of the Project Site (for processing sand removed from Stages 1/1 to 2/3) and a final processing area to be used during the final stage of the project (Stage 2/4).
- Four long term water storage dams (one existing and three proposed).
- A single site entrance onto Peats Ridge Road and associated site access road.

The Proponent would remove the sand on the Project Site that can be easily removed by excavator or bulldozer without any blasting. Sand removal would commence with the excavation of the long term water storage dams (D and E) after which a staged sand removal sequence would follow.

The sand would be processed on site to remove both the oversize and undersize materials not required in the fine sand products. Processing would only involve the use of water collected on site without the use of bore water. Limited amounts of a flocculant (within a closed water circuit) would be used to assist in the collection of the clay particles washed from the sand. The clay fines, recovered after washing, would be dewatered sufficiently allowing them to be placed in worked-out sections of the Project Site thereby assisting in creating the final landform.

All products would be loaded and transported from the Project Site by conventional road truck and trailers. All trucks would travel to and from their market destinations via Peats Ridge Road and the F3 Freeway.

2.1.4 Approvals Required

Three substantive approvals are required from the NSW Government and Gosford City Council for the Somersby Fields Project to proceed.

1. Project Approval (Part 3A of the *Environmental Planning and Assessment Act 1979)*: Approval Authority – Minister for Planning. Project approval is being sought for the two stage project with commencement of the second stage conditional upon the Proponent's satisfactory demonstration of performance during the first stage.
2. Environment Protection Licence (*Protection of the Environment and Operations Act 1997)*: Issuing Authority – Department of Environment and Conservation (Environment Protection Authority) (DEC (EPA)) (relating to air, water, noise).
3. Section 138 Road Permit (*Roads Act 1993*): Issuing Authority – Gosford City Council (relating to the construction of the site entrance from Peats Ridge Road).

Other approvals such as construction certificates and approval for installation and operation of a septic tank would be sought from Gosford City Council prior to the need to install such facilities.

It is noted that the Proponent has already secured a Water Access Licence (No. WAL 11271) for 37ML under the *Water Management Act 2000* to cover the consumptive use of groundwater that is predicted to seep into the sand removal area. The Department of Natural Resources confirmed during the preparation of the *Environmental Assessment* that a 30ML water access licence would be required for the consumptive water use.

The presence of some threatened plant species on the Project Site that are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, require an approval from the Commonwealth Minister for the Environment. It is noted that the assessment process for this legislation is linked to the NSW Government process given a bilateral arrangement between the two governments.

2.2 SAND RESOURCES AND PRODUCTS

2.2.1 Sand Resources

The fine-grained sand resource on the Project Site has been recognised for some time. Initially identified in 1975, the sand resource was the subject of geological surveys in 1976, 1989, 1995 and most recently by the Proponent during the period 1999 to 2005. **Figure 2.3** displays the locations of the drill holes, bulk sample sites and sections through the resource.

The sand resources on the Project Site originate from the underlying Hawkesbury Sandstone.

The Proponent has confirmed the quantity and quality of the sand resource across the Project Site based upon drilling data obtained across the full topographic range on site. A clear understanding has been obtained of the relationship between the depth of sand and Project Site topography, ie. except near the western side of the proposed sand removal area where the sand resource is thicker. For the purposes of the resource assessment, the defined relationship between resource depth and topography has been sufficient to calculate the sand resources across the entire Project Site.

The drill hole data show that the base of the recoverable sand dips gradually to the east near the western boundary, flattens out within the centre of the property (about 260m AHD) and resumes, dipping gradually to the east across the eastern section of the Project Site. The base of the recoverable sand is a comparatively well defined boundary with an underlying high strength, massive sandstone.

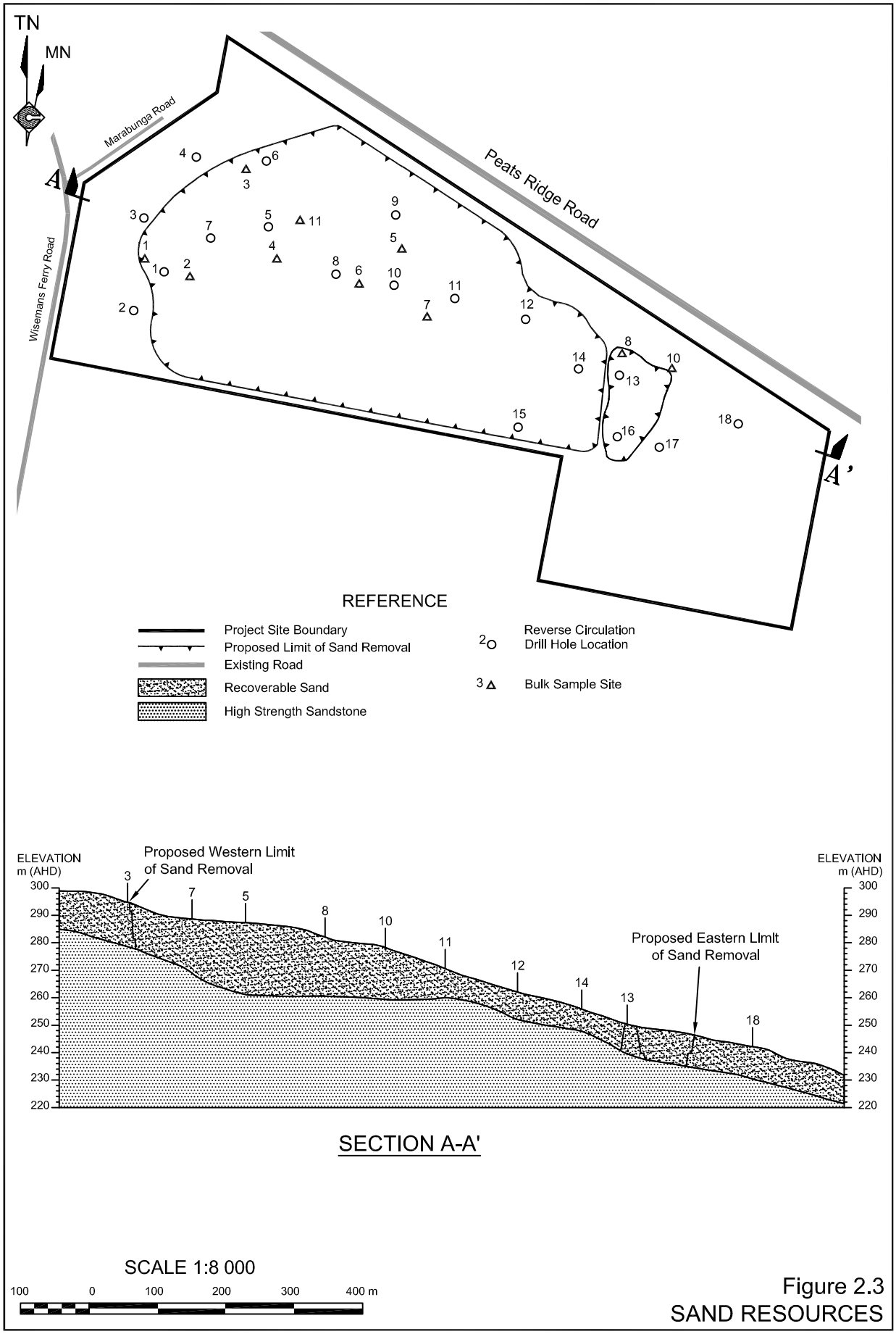


Figure 2.3
SAND RESOURCES

Near the western boundary of the Project Site, recoverable sand thicknesses vary from 12m to 19m. The overall thickness of recoverable sand increases to 23m near the centre of the Project Site and then progressively decreases in thickness across the eastern side of the property. Recoverable sand thicknesses across the eastern side of the property vary from 7m to 11m. The drilling data has conclusively identified the overall extent of the recoverable sand resource.

The recoverable sand resource comprises a soft, loosely bound sandy material in the upper 4m to 8m underlain by a more consolidated sand. Some localised occurrences of harder iron-rich sandstone are present close to the surface. In some areas, lateritic material not removed during the previous road materials quarrying activities, remains on site (see Section 1.4).

The in-situ quantity of sand within the proposed limit of sand removal is approximately 7.4 million tonnes. The quantity of sand within each substage is presented in **Table 2.1**.

Table 2.1
Sand Quantities in Substages

Stage	Quantity (t)	Stage	Quantity (t)	Stage	Quantity (t)
1/1	81 000	1/6	252 000	2/1	566 000
1/2	119 000	1/7	1 192 000	2/2	710 000
1/3	312 000	1/8	957 000	2/3	791 000
1/4	297 000	1/9	790 000	2/4	756 000
1/5	575 000				
Total: Stage 1 = 4 575 000 tonnes Stage 2 = 2 823 000 tonnes Stages 1 and 2 = 7 398 000 tonnes					

For the purposes of planning the sand removal operation and progressive rehabilitation, the average topsoil thickness in undisturbed areas across the Project Site is approximately 150mm and subsoil thickness approximately 0.5m. The subsoil thickness relates to the "overburden" above the recoverable sand. The characteristics of the topsoil and subsoil are provided in Section 4.11.2.2.

2.2.2 Products

The bulk sampling program undertaken by the Proponent enabled more than 100 tonnes of sand to be recovered from eleven sites at depths of down to 15m. The bulk samples were processed through a pilot processing plant to provide an accurate assessment of sand gradings and quality – see **Table 2.2**.

Table 2.2
Average Sand Grading from Test Program

	Percentage Passing Nominated Sieve Sizes							
	4.75mm	**2.36mm**	**1.18mm**	**600µm**	**425µm**	**300µm**	**150µm**	**75µm**
Unwashed Sand	100	100	99	95	87	57	25	18
Washed Sand	100	100	97	91	77	40	9	2.4

Based upon these test results, the Proponent proposes to market the following products.

- Fine-grained concrete sand.
- Fine / medium-grained concrete sand.
- White and yellow mortar sand.
- Fine / very fine-grained sand product.

The principal product marketed from the Project Site would be concrete sand, destined for blending with both coarse sand and manufactured sand products. This product will account for approximately 85% of the total sales.

2.3 SITE ESTABLISHMENT AND CONSTRUCTION

2.3.1 Site Establishment

Following the provision of all specified documentation to enable site establishment, the Proponent would undertake the following activities to establish operations on the site. Each of the activities and their locations are shown on **Figure 2.4**.

Surveying

The locations of the approved components of the operation would be surveyed and pegged to ensure the boundaries of the initial vegetation clearing (where necessary) and the proposed Voluntary Conservation Area (VCA) are clearly defined (see Section 2.12.2). The boundary locations and site access road would be clearly marked at regular intervals to enable operators of earthmoving equipment to contain all disturbances within approved boundaries.

Fencing

Prior to the commencement of site activities and sand removal operations, the following fencing systems would be established, each designed and located to also reduce visual impact of the fencing itself. **Figure 2.4** displays the locations of the proposed fencing.

- A 2m high security fence would be erected along a 350m section inside the northern boundary of the Project Site behind existing vegetation.
- A 3m to 4m high acoustic earth mound (referred to as the "far-western" earth mound) would be constructed and a 2m fence erected on the top of the earth mound approximately 100m inside the western boundary of the Project Site. The 2m fence would effectively duplicate as a security fence along the western side of the operation. At the base of the far-western earth mound, there would be adequate silt-stop fencing to minimise the risk of sediment movement towards the existing native vegetation. The external slope of the mound would not exceed 1:3 (V:H) and it would be vegetated with local native species.
- A 2m high security fence would be erected along the 600m section of the southern Project Site boundary and around the eastern side of Dams D and E joining up with the eastern end of the northeastern acoustic barrier.
- The existing standard rural fencing would be retained, and if necessary repaired, around the boundaries of the Project Site.
- In order to protect the Somersby Mintbush Voluntary Conservation Area, the southern boundary of the area would be protected either by the 5m high northeastern acoustic barrier or a standard rural fence (see **Figure 2.4**). It is noted the section of the northeastern acoustic barrier would be relocated to the western edge of the Stage 1 sand removal area once it is no longer required in its original location. The acoustic barrier would be replaced by a standard rural fence following its relocation to the western boundary of Stage 1 to continue to provide protection the Somersby Mintbush Voluntary Conservation Area.

Vegetation Clearing

Vegetation in areas required for operations during the first 12 months would be cleared during the site establishment phase. Any threatened species in the areas to be cleared would be translocated prior to the commencement of the main clearing campaign. The area cleared would include the area of Dams D and E, the remnant vegetation remaining in the processing area and nearby initial raw feed stockpile area and internal access and haul roads. Section 4.7.6 lists additional fauna-related safeguards that would be adopted during clearing.

The smaller shrubs and vegetation would be cleared with the topsoil to maximise the retention of the seed stock for this vegetation. Whenever possible, collection of ripe seed for rehabilitation purposes would be undertaken by trained seed collectors prior to and during the initial clearing campaign.

Sufficient area would be cleared within the western fauna / flora corridor (beyond the proposed far-western earth mound) to enable all native vegetation being cleared to be immediately respread across the areas within the corridor to be revegetated.

Soil Removal

Following removal of the larger vegetation, the Proponent would progressively remove the topsoil and subsoil only from those areas required for the first 12 months of operation. Topsoil and subsoil stripped from the initial operational areas would be transferred to proposed revegetation areas within the proposed western fauna / flora corridor or stockpiled on the outer perimeter of the processing area for use in the progressive rehabilitation of the site. Following placement of the topsoil in the western fauna / flora corridor, the larger vegetation would be placed over the respread topsoil.

2.3.2 Construction Activities

Project construction would involve those activities that need to be completed prior to despatch of the first sand products. The locations of each of these construction activities is shown on **Figure 2.4**. These activities would include construction and establishment of the following.

- A network of service tracks to service each construction activity.
- The site entrance and intersection (see Section 2.7.2 for details).
- The site access road (approximately 200m of this road would be sealed, ie. between the wheel wash facility and the site entrance).
- The 3m to 4m high far-western earth mound and 2m high acoustic fence near the western boundary of the Project Site.
- The northeastern acoustic barrier.
- The processing area, including the perimeter bunds.
- Sediment Dam 1 (SD1) near the southern limit of sand removal and Sediment Dam 2 (SD2) near the northeastern corner of the processing area.
- Water storage Dams D and E.
- The internal haul roads between the processing area and water storage dams to the east and far-western earth mound to the west.
- The wash plant.
- The mortar sand plant.
- Power transmission lines and transformer.

Construction of the network of service tracks would be an early activity thus providing a clear definition, to all site personnel and contractors, of the access routes to each construction area.

It is noted that the 3m to 4m high acoustic earth mound and 2m high fence along the western limit of sand removal would be constructed well ahead of its scheduled requirement date. The early construction of the mound is dictated by DEC requirements whereby only one

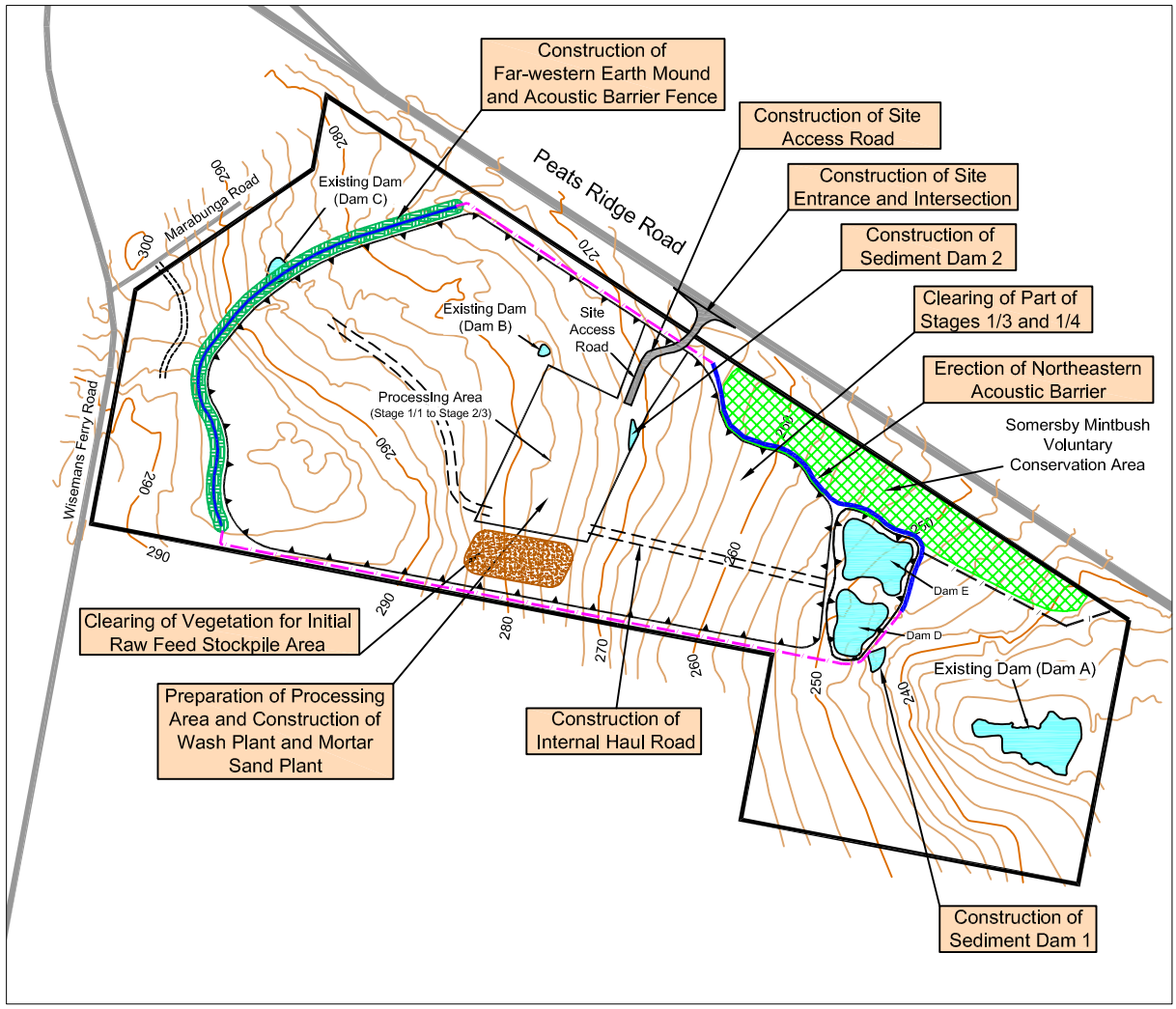


Figure 2.4
SITE ESTABLISHMENT AND CONSTRUCTION ACTIVITIES

construction period is permitted at the commencement of a project, when additional noise can be produced when constructing noise attenuating structures such as earth mounds. In order not to cause any disruption to school learning attributable to noise**,** the construction of this acoustic earth mound and fence would be undertaken during a school holiday period.

2.4 SAND REMOVAL

2.4.1 Design of the Sand Removal Area

2.4.1.1 Setbacks from Boundaries

Figure 2.5 displays the proposed limit of sand removal on the Project Site and the proposed setbacks from the boundary of the Project Site. The sand removal area comprises:

(i) two small areas covering approximately 1ha to be used as water storage dams (Dams D and E) during the life of the operation; and

(ii) the main sand removal area covering approximately 21ha.

The boundaries of the main sand removal area have been determined following a review of all environmental and operational constraints. Details of the setbacks for each section of the proposed limit of sand removal are set out below.

- The northern sand removal boundary has been set back 25m from the property boundary for 350m of its length. This setback, together with the 25m wide section of roadside vegetation within the Peats Ridge Road reserve would create a corridor of existing vegetation approximately 50m wide adjacent to Peats Ridge Road for the maintenance of a fauna /flora corridor along the northern boundary of the Project Site. The 50m wide vegetation buffer would also provide an excellent visual screen to prevent views of the site activities from Peats Ridge Road.
- A 90m to 170m setback near the northwestern boundary of the Project Site has been provided. This setback also incorporates a creek line that ultimately flows into a tributary of Ourimbah Creek.
- The Somersby Mintbush Voluntary Conservation Area varies in width from 40m to 60m along a 460m section adjacent to the northern boundary of the Project Site. In addition, there is a 20m buffer between the nominated edge of the Voluntary Conservation Area, providing an overall width of 60m to 80m.
- The western and northwestern sand removal boundaries have been determined largely by the results of the noise assessment and the need to maintain a vegetated buffer between the sand removal area and the common boundary with the adjoining property to the north. The proposed western limit of sand removal, whilst not visible, is approximately 260m from the closest classrooms within the grounds of the Somersby Public School.
- A 15m wide setback has been provided adjacent to the southern boundary for the retention the existing vegetation. It is noted that there are no residences for in excess of 800m south of the Project Site's southern boundary.

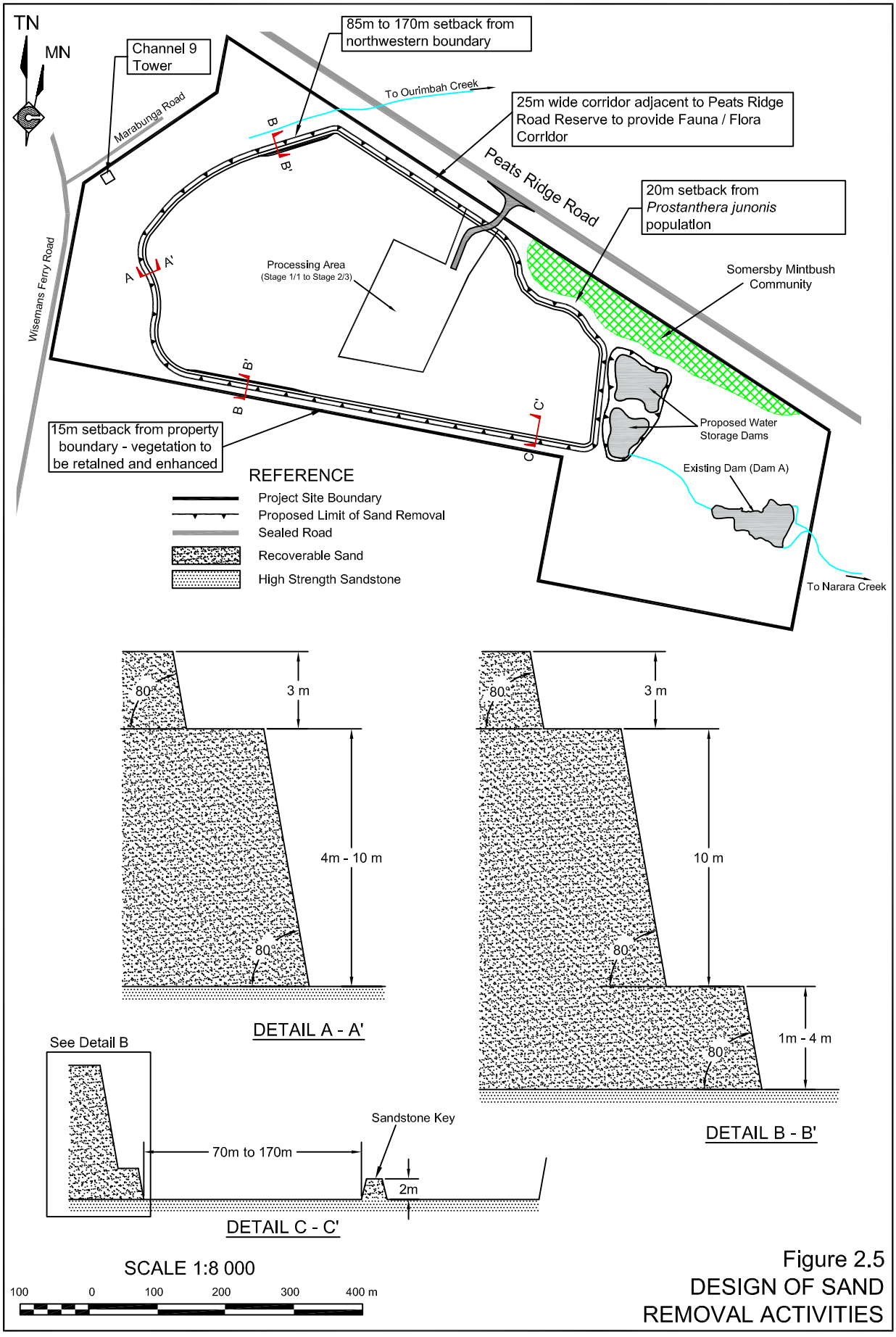


Figure 2.5
DESIGN OF SAND REMOVAL ACTIVITIES

2.4.1.2 Stages of Sand Removal

The removal of sand is planned to progress in two stages. Within each of the two stages, there would be a number of substages that would be operated sequentially. **Figure 2.6** displays the boundaries of the two stages and the substages.

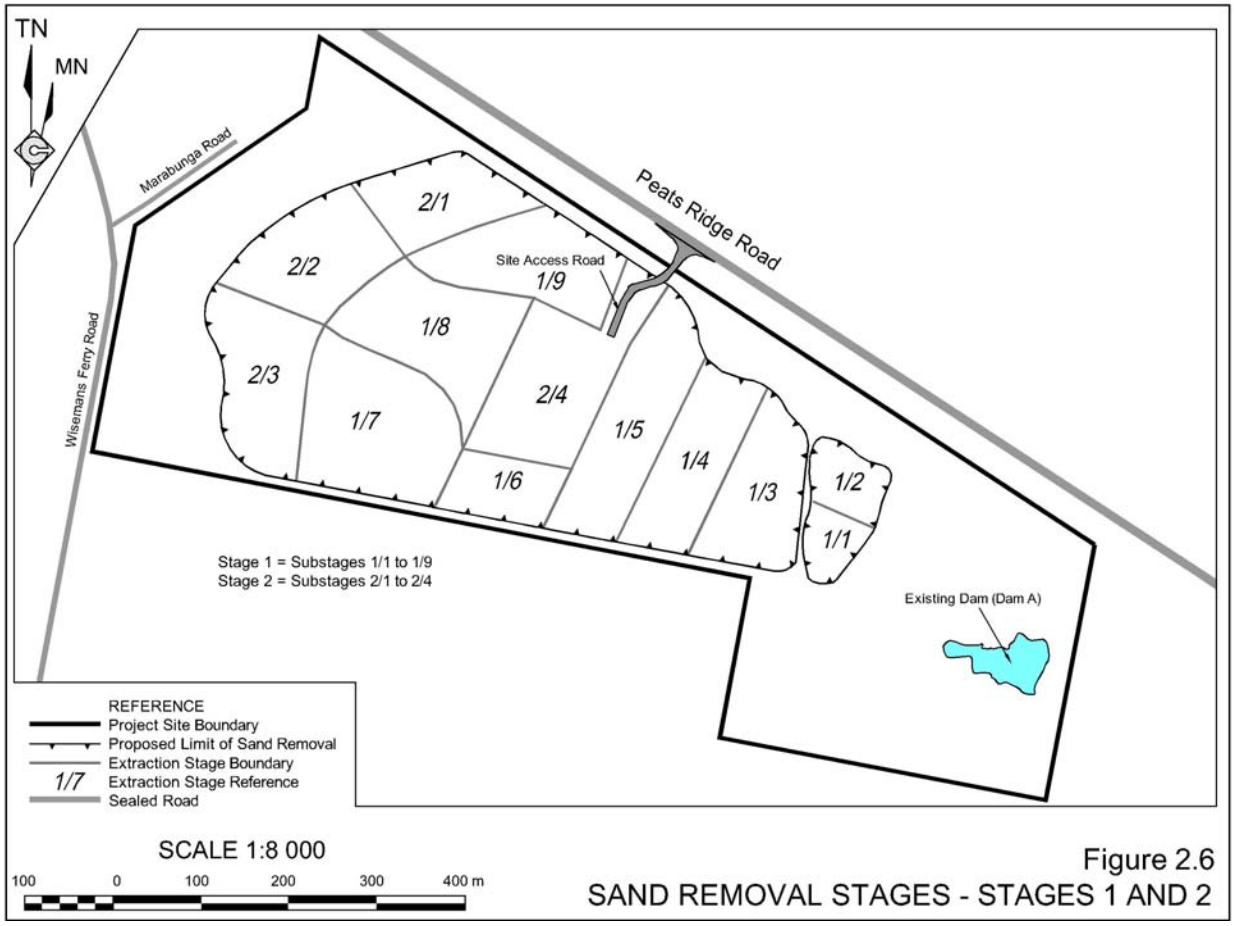


Figure 2.6
SAND REMOVAL STAGES - STAGES 1 AND 2

The two-staged approach to the sand removal operations has been proposed to enable the environmental performance during the first stage to be evaluated prior to the commencement of operations in the second stage. The western boundary of Stage 1 has been positioned along an alignment that would result in noise levels approximately 4dB(A) less than those predicted to occur when operations are underway in Stage 2. Furthermore, noise criteria at all surrounding residences and the Somersby Public School are predicted to be within nominated noise criteria for all Stage 1 operations. The western boundary of Stage 2 has been positioned along an alignment that would achieve compliance with noise criteria at the Somersby Public School.

Stage 1 comprises nine substages (1/1 to 1/9) and Stage 2 comprises four substages (2/1 to 2/4). The reference numbers assigned to each substage reflects the sequence of operations in each stage. This is discussed further in Section 2.4.3.

Section 2.13 of this document reviews the substages in the event the project only proceeds in Stage 1.

2.4.1.3 Design Components

The Proponent has designed the operational components within the sand removal area to meet the following criteria.

1. To maximise the recovery of sand from the Project Site.
2. To provide a satisfactory level of geotechnical stability during the period between sand removal and incorporation into the final landform (see Section 2.6.4.3).
3. To provide a 3m upper bench height as a safety feature around the entire sand removal area (except water storage dams).

Details A-A' and B-B' on **Figure 2.5** show all operational working faces within the sand removal area would be set at approximately 80^{o} (to the horizontal). Approximately 80% of the perimeter of the sand removal area would have maximum face heights of 7m to 13m (Detail A-A') and approximately 20% of the perimeter would have maximum face heights of 14m to 17m (Detail B-B'). It is noted that these face heights would only be temporary as progressive landform reconstruction would result in all faces being reduced in slope through the placement of process fines against the faces and profiled to a slope of 1:4 (V:H) – see Section 2.6.4.3 for details. Detail C-C' on **Figure 2.5** displays the location of the sandstone key to be retained for use as a "support" or toe of the process fines or dewatered clay fines placed against the final working faces.

2.4.2 Sand Removal Procedures

The procedures to be used in removing the recoverable sand within the Project Site have been selected to:

- manage the range of materials on site;
- minimise noise propagation from the Project Site; and
- safely and economically recover the identified recoverable sand on site.

The procedures would involve the following activities.

1. Identification / marking of the nominated sand removal area.
2. Installation of erosion and sediment controls.
3. Vegetation removal.
4. Soil removal.
5. Recoverable sand removal.

In a number of cases, procedures are similar to those adopted for the site establishment phase.

Identification of Stages and Substages

Prior to the commencement of any activities in each substage, the boundaries of each substage would be identified and marked with a series of pegs positioned at regular intervals around the nominated area.

Installation of Erosion and Sediment Controls

Where necessary, surface water and/or sediment and erosion controls would be installed / constructed either prior to or immediately following clearing activities.

Vegetation Removal

Vegetation would be cleared at the commencement of each defined stage. As proposed in the site establishment phase (Section 2.3.1), the larger cleared vegetation, not used for habitat construction but sold off site, would be mulched/chipped or cut into manageable log lengths ie. after seed collection for rehabilitation is completed. Wherever practicable and appropriate, these materials would be managed on site as part of the progressive rehabilitation and vegetation enhancement activities. The Proponent has allocated an area to store surplus logs, mulched and chipped materials within the area adjacent to the processing area until it is required for use or sold off site.

Soil Removal

The soils in each stage would be stripped following removal of the larger vegetation. Small shrubs and groundcovers would be removed with the topsoil. In those areas where natural soils remain on the Project Site, the Proponent would remove approximately 0.15m of topsoil and up to 0.5m of subsoil.

Where practical, the Proponent would remove topsoil and directly transfer it to rehabilitation and revegetation areas. This practice would avoid double handling and maximise natural regeneration. All excess topsoil and subsoil removed during operations would be stockpiled around the processing area for subsequent use in progressive revegetation.

After the topsoil has been respread in the revegetation areas, available biomass and treated seed would be spread, and as required, tubestock propagated from local native seed collected on the Project Site, would be planted.

Sand Removal

Following removal of topsoil and subsoil, the Proponent would adopt either of the following procedures to remove the sand.

Procedure 1: The recoverable soft sand within the top 4m to 8m, would be removed by excavator and loaded into off-road trucks for haulage to the processing area. The excavator would initially be positioned at or just above natural ground level with the off-road trucks located typically 4m lower within the area where sand has previously been removed. The excavator would be progressively positioned lower in the operational area as the sand is removed.

Based on the Proponent's observations to date, it is expected that some 80% of the recoverable sand within the top 8m would be removed by excavator. It is possible that some harder layers, including ironstone, near the surface may need to be removed using ripping, after which sand removal would revert to the use of an excavator.

Procedure 2: The recoverable consolidated sand that requires some form of mechanical breaking to enable it to be removed would be ripped with the tynes or "rippers" behind a bulldozer. Once ripped, it would be pushed into a stockpile within the active sand removal area for loading by excavator into off-road haul trucks for haulage to the processing area. It is envisaged that ripping would be undertaken for the recoverable sand below about 8m, although an excavator would continue to be used if the resource is sufficiently soft to warrant its use.

2.4.3 Sand Removal Sequence

Figure 2.7 displays the proposed sequence for the overall sand removal program. As previously explained in Section 2.4.1.2, the sand removal program is planned to be undertaken in two stages. Stage 1 would comprise nine substages (Stages 1/1 to 1/9) while Stage 2 would comprise four substages (Stages 2/1 to 2/4).

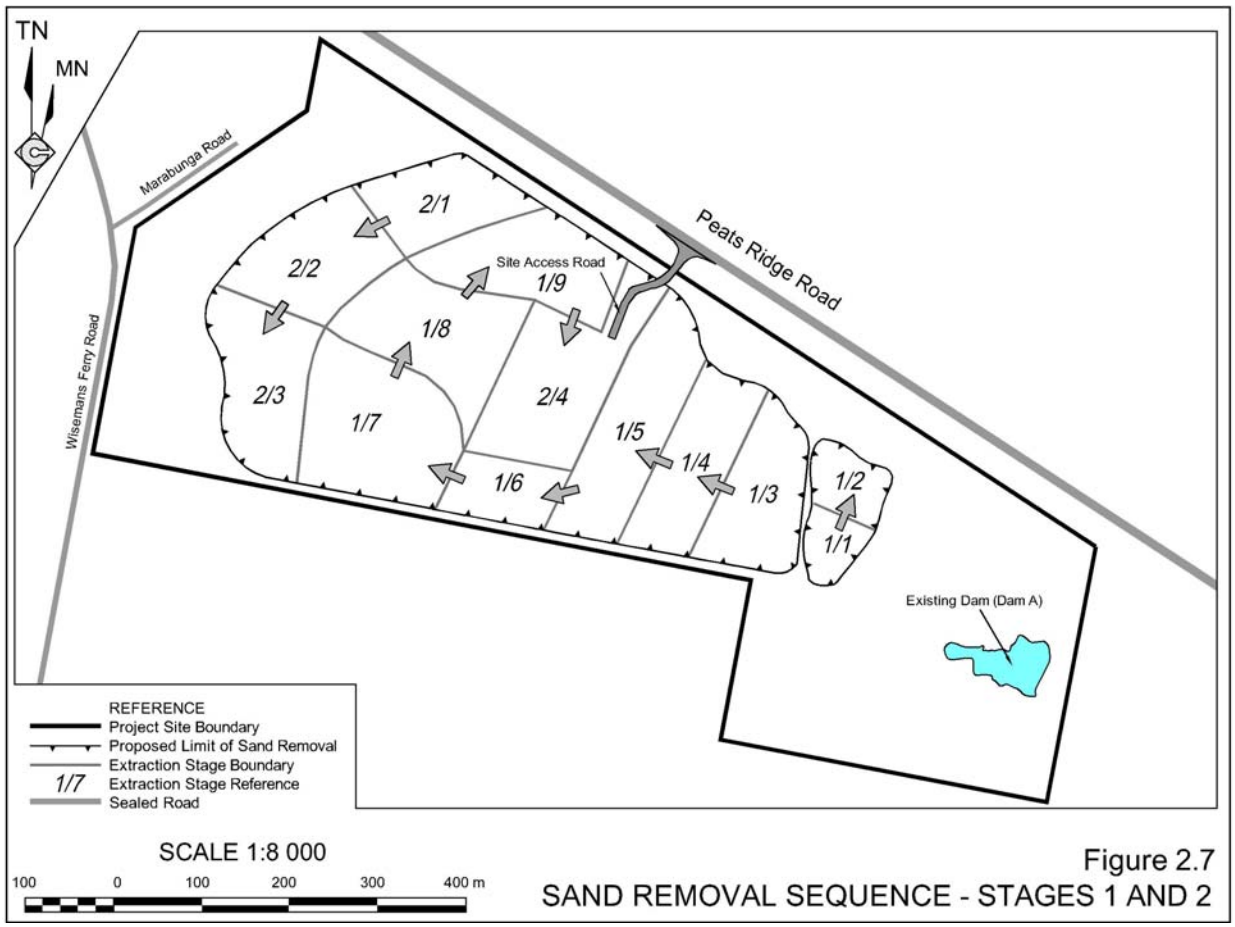


Figure 2.7
SAND REMOVAL SEQUENCE - STAGES 1 AND 2

The general sequence of sand removal reflects the Proponent's general objective to commence operations as far as possible from Somersby Public School. Working towards the school, the Proponent intends to demonstrate, well ahead of time, that compliance with noise and air quality criteria would be satisfied at the school during Stage 2.

Stage 1

Stages 1/1 and 1/2

It is proposed that sand removal would commence in Stage 1/1 (Water Storage Dam D) and then progress to Stage 1/2 (Water Storage Dam E). The recoverable sand excavated from these areas would be hauled along an internal haul road directly to the processing area or the initial raw feed stockpile area.

Stages 1/3 to 1/9

Stage 1/3 would see the commencement of sand removal at the eastern end of the main sand removal area. A 10m strip would remain at natural surface level between the created water storage dams and the eastern boundary of Stage 1/3. Stages 1/4 and 1/5 would involve the gradual advance of the active face from Stage 1/3 in a general westerly direction. Sand removal in Stage 1/6 would also progress in a westerly direction between the southern boundary and the processing area. The sequence of sand removal within Stages 1/7 to 1/9 would be from east to west.

Stage 2

Stages 2/1 to 2/3

Sand removal would only commence in Stages 2/1 to 2/3 following a review of monitoring data for sand removal operations in Stages 1/7 to 1/9. Should the monitoring data support the initial predicted noise and dust levels included in this document, sand removal would proceed in the sequence of Stages 2/1 → 2/2 → 2/3. Again, it is proposed that sand removal would occur from east to west in each substage. The exact Stage 2 sand removal boundaries would be adjusted if necessary in light of the monitoring data collected from Stages 1/7 to 1/9. Similarly, any appropriate modifications to the acoustic barriers would also be undertaken.

Stage 2/4

Stage 2 sand removal would conclude with the decommissioning and removal of the sand washing plant. Processing of the remaining sand in the area defined as Stage 2/4 would be by way of a portable plant, adequately screened by stockpiled materials during its period of operations. Should Stage 2 not proceed, Stage 2/4 would be extracted as the final substage of Stage 1 given it is located wholly within the Stage 1 area.

2.4.4 Production Levels

Whilst the Proponent would remove sand at a level that would sustain prevailing market sales, two levels of production are proposed. Initial annual production would be at a level of up to 250 000 tonnes. This would require the removal of approximately 300 000 tonnes of sand per year prior to processing as approximately 50 000 tonnes of oversize and dewatered clay fines would be removed during processing.

The Proponent intends to increase annual sales to approximately 450 000 tonnes by the end of the third year of production. At that stage, sand removal would be occurring at an annual rate of approximately 540 000 tonnes.

2.4.5 Mobile Equipment

2.4.5.1 Site Establishment and Construction Phase

Table 2.3 lists the mobile equipment to be used during the site establishment and construction phase together with their likely frequency of use. The manufacturer / model number given is provided principally to indicate the site / capacity of the equipment. Alternative equipment of a similar size / capacity may be supplied by another manufacturer. During this phase, site activities would be programmed to maximise the use of each item of equipment for multiple tasks.

Table 2.3
Mobile Equipment used for Site Establishment

Equipment (Manufacturer / Model No.)	No.	Activity / Use	Frequency of Use
Bulldozer (Cat D8)	1	• Clearing of vegetation from area to be used during the first 12 months • Construction of far-western acoustic earth mound	4 weeks 2 weeks
Hydraulic Excavator (Cat 350)	1	• Excavation of Dam D (Stage 1/1) • Construction of acoustic earth mounds • Various drainage works	Continuous As required
Off-Road Haul Truck (Cat 730)	1	• Transfer of excavated material to the initial raw feed stockpile area adjacent to processing area	Continuous
Backhoe	1	• Miscellaneous tasks around site	As required
Grader (Cat 130G)	1	• Road construction	2 week period
Water Truck	1	• Dust suppression	Continuous (2 to 6 passes per day)
Crane	1	• Wash Plant Erection • Acoustic barrier construction.	6 week period
Concrete Agitator	4-12	• Delivering concrete for foundations	6 week period
Chainsaw	1	• Cutting large trees into manageable lengths	Intermittent over 10 weeks
Chipper	1	• Chipping surplus vegetation not required for habitat	Intermittent over 8 weeks
Note: Sound power levels of equipment to be used are presented in Appendix C of Heggies (2006a)			

2.4.5.2 Operational Phase

Table 2.4 lists the mobile equipment to be used throughout the operational phase. This analysis has been provided for the two annual production levels discussed in Section 2.4.4. Distinction is also made in **Table 2.4** between the two procedures to be used to remove the sand, ie. for the soft sand or consolidated sand.

Table 2.4
Mobile Equipment for Sand Removal and Processing Operations

Equipment (Manufacturer / Model No.)	No. and Level of Production*		Activity / Use	Production Level* and Frequency of Use *	
	1	2		1	2
Sand Removal Operations – (Soft Sand)					
Bulldozer (Cat D8)	1	1	• Tree clearing, topsoil / subsoil stripping and removal of soft sand	4 weeks per year	4 weeks per year
Hydraulic Excavator (Cat 365)	1	1	• Sand removal - within 4m to 8m of the surface, and truck loading	Continuous	Continuous
Off-Road Haul Truck (Volvo A30D)	2	3	• Transportation of raw feed from active sand removal area to the processing area	Continuous	Continuous
Grader (Cat 130G)	1	1	• Road maintenance	Four periods (<1 week) per year	Four periods (<1 week) per year
Front-end Loader (Cat 966)	1	2	• Loading product trucks and stockpile management • Loading raw feed from surge stockpile to wash plant hopper	Continuous (10 hours/day) 1 hour/day	Continuous (8 hours/day) 2 hours/day
Water Cart (20kL)	1	1	• Dust Suppression	Intermittent	Intermittent
Sand Removal Operations – (Consolidated Sand)					
Hydraulic Excavator (Cat 365)	1	1	• Sand removal and loading off-road haul trucks with sand (and topsoil / subsoil)	Continuous	Continuous
Bulldozer (Cat D10)	1	1	• Ripping consolidated sand • Tree clearing and topsoil / subsoil stripping.	4 hrs/day 4 weeks per year	6 hrs/day 4 weeks per year
Off-Road Haul Truck (Cat 730)	2	3	• Transportation of raw feed from active sand removal area to the processing area	Continuous	Continuous
Grader (Cat 130G)	1	1	• Internal haul road maintenance	Four periods (<1 week) per year	Four periods (<1 week) per year
Front-end Loader (Cat 980)	1	1	• Loading product trucks and stockpile management • Loading raw feed from surge stockpile to wash plant hopper	Continuous (10 hours/day) 1 hour/day	Continuous (8 hours/day) 2 hours/day
Water Cart (20kL)	1	1	• Dust Suppression	Intermittent	Intermittent
* Level of Production – 1 = 250 000 tonnes per year / 2 = 450 000 tonnes per year					
Note: Sound power levels of equipment to be used are presented in Appendix C of Heggies (2006a)					

2.5 SAND PROCESSING AND STOCKPILING

2.5.1 Introduction

The Proponent would need to process the raw sand to produce those products required by its customers. Processing would involve either washing, to produce concrete sand products, or dry screening to produce mortar sand products. Based upon the various types of sand identified during the resource assessment and a detailed market analysis, approximately 85% of the raw feed would be washed and approximately 15% dry screened.

2.5.2 Processing Area Site Selection

The Proponent proposes to locate the processing area within the centre of the proposed area of disturbance, ie. equidistant from the northern and southern boundaries and marginally closer to the eastern boundary of the sand removal area. This site has been selected based on the following criteria.

- It is distant from surrounding residences and from Somersby Public School (approximately 550m) (to reduce opportunities for noise propagation).
- It provides for a comparatively short distance for trucks travelling from the site entrance to the product stockpiles within the site.

Ultimately, and following the relocation/replacement of the processing plants towards the east (see **Figure 2.2**), the resource beneath the processing area (Stage 2/4), which is approximately 12m to 15m thick, would be removed.

2.5.3 Processing Area Layout and Design

Figure 2.8 presents the general layout of the processing area. The main components within the area comprise the following.

- An enclosed wash plant with a partly enclosed receival hopper and crushing / screening plant and connecting conveyors.
- A raw feed surge stockpile for the wash plant and/or mortar sand plant.
- A horseshoe shaped sand stockpile area around the wash plant.
- A mobile screen for mortar sand production and nearby raw feed and product stockpiles.
- A processing circuit for the clay fines comprising a thickener, feed tank and belt-filter press.
- Water storage tank for the wash plant.
- A workshop for the maintenance of mobile equipment and storage of consumables.
- An office, weighbridge and amenities.
- A bunded fuel tank.

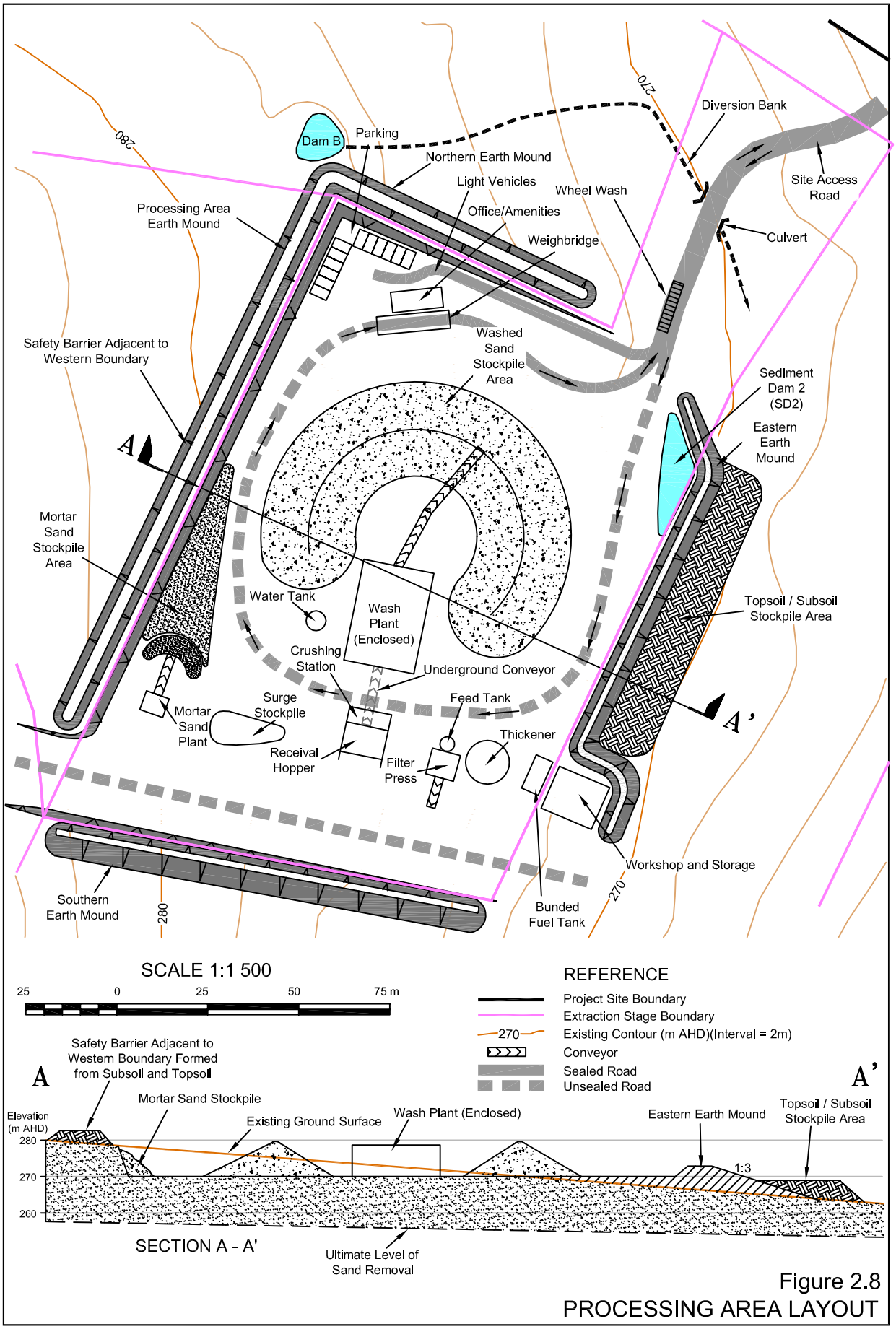


Figure 2.8
PROCESSING AREA LAYOUT

The processing area would cover approximately 2ha and be constructed generally on a single level at approximately 275m AHD. The western side of the processing area would be cut into the natural slope to create a noise barrier.

The processing area would be surrounded with a series of earth mounds, these being created during construction of the area or through placement / stockpiling of topsoil and subsoil from the initial areas of disturbance. Each of these earth mounds would be revegetated (see Section 2.12.2.2). Three openings would be positioned between the earth mounds to provide access to and from the area for haul trucks (near the southern earth mound – eastern and western entrance) and for product trucks and employee vehicles (within the northern earth mound).

The layout and design of the processing area for the sand recovered from within Stage 2/4 would be similar to the main processing area. It is proposed that apart from the clay fines circuit and belt filter press, the equipment used to process the sand from Stage 2/4 would be mobile and shielded by the relocated 5m high acoustic barriers.

2.5.4 Processing Operations

2.5.4.1 Sand Washing

The sand will need to be washed and graded to produce a product suitable for concrete manufacture. The specifications nominated in Australian Standard AS 2758.1 for the use of fine-grained sand in concrete (and other commodities) requires the proportion of <75µm material to be less than 5%. In some cases, customers specify lower proportions than nominated in the Standard.

The washing process removes the bulk of the fine component of the raw feed, ie. the <75µm fraction. The oversize fraction (>4.75mm) is also separated in the initial part of the process.

Figure 2.9 displays the conceptual process flow sheet for the wash plant.

Plate 2.1 displays an artist's impression of an enclosed sand wash plant with components comparable to that proposed for use on the Project Site.

Plate 2.1 Indicative Wash Plant within Enclosed Building

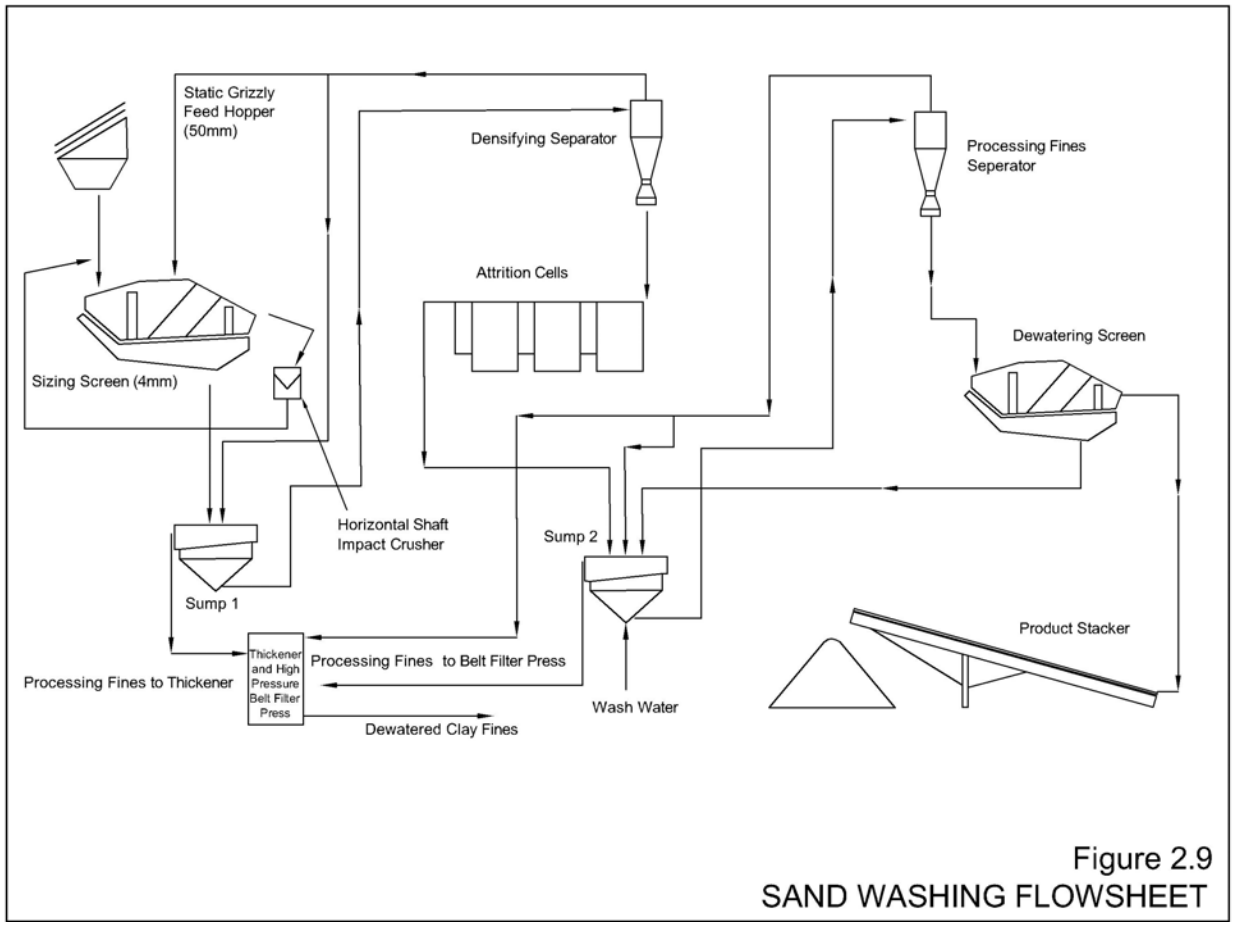


Figure 2.9
SAND WASHING FLOWSHEET

2.5.4.2 Mortar Sand Screening

A single stage screening plant would be used to produce mortar sand from the upper level clayey sands. The raw feed to this plant would be delivered as required, as the capacity of mortar sand product stockpile area would be comparatively small. Whilst this plant does not use water, the inherent moisture content in the raw feed limits dust generation. The mortar sand products produced would be stockpiled radially near the plant and relocated from beneath the stockpile conveyor to the adjoining storage area, as shown on **Figure 2.8**.

The mortar sand stockpile area shown on **Figure 2.8** has a capacity to store approximately 1 500 tonnes of mortar sand.

Plate 2.2 displays a typical mortar sand plant.

Plate 2.2 Typical Mortar Sand Plant

2.5.5 Product Stockpiling

The Proponent proposes to maintain a stockpile of products representing 5% to 10% of annual sales. All washed sand products would be stockpiled beneath a radial stacker capable of stockpiling sand up to 10m high. The horseshoe stockpile as shown on **Figure 2.8** would have a capacity of approximately 20 000 tonnes of sand.

2.6 WASTE MANAGEMENT

2.6.1 Introduction

The sand removal and processing operations would yield a range of materials that the Proponent proposes to manage as waste materials. These materials are either not saleable or are in excess of the quantity likely to be used on site. In addition, general wastes associated with equipment maintenance, and operating the weighbridge / office, would be generated.

2.6.2 Mulched and Chipped Materials

The Proponent proposes to mulch and/or chip the surplus small seed-bearing tree limbs and trunks removed during clearing. Whilst the Proponent would be able to use some of the mulched and/or chipped materials for rehabilitation, the material produced in excess of site requirements would be stockpiled adjacent to the processing area and sold from site.

2.6.3 Oversize Materials

The raw sand when processed would yield between 2% and 5% of oversize materials. These materials would be hard, often ferruginous sandstone generally >50mm and <150mm. In order to increase sand recovery, the oversize materials not required for rehabilitation purposes would be screened from the raw feed and directed to an impact crusher.

The Proponent proposes to use the recovered oversize materials in rehabilitation (see Section 2.6.5) and as a drainage medium / substrate around the final landform.

2.6.4 Clay Fines

2.6.4.1 Characterisation

Table 2.2 previously identified that the unwashed sand contains clay and fine silt, which needs to be removed by washing. The fine residue from washing comprises material finer than 75µm referred throughout this document as clay fines.

Analytical studies and a pilot plant trial confirmed that the clay fines represent 18% to 20% of the raw feed processed in the wash plant, it is estimated that approximately 1 million m^3 (1 300 000 tonnes) of clay fines and oversize materials would be produced throughout the life of the project.

2.6.4.2 Dewatering Clay Fines

The Proponent has determined that rather than operating with a series of settling dams for precipitating the clay fines in process water, it would be environmentally and operationally better for the clay fines to be dewatered to produce a material with a consistency able to be transported and placed for use in rehabilitation of the Project Site.

Dewatered clay fines would be temporarily stored within Stage 1/4 (**Figure 2.6**) during the first 18 months of processing operations until there is sufficient area within Stage 1/3 to emplace the dewatered clay fines. The residues would be positioned close enough to Stage 1/3 to enable the materials to be pushed into the Stage 1/3 void after it is created.

The clay fines would be collected, thickened and dewatered through a belt filter press yielding a material with a moisture content of approximately 30%. This material would be dewatered sufficiently for it to be removed from the processing area by off-road haul truck.

The use of belt filter press technology is now well proven in both Australia and US sand manufacturing industries. The adoption of this technology eliminates the need for extensive settling dams, many of which remain at the completion of operations and present long term environmental problems.

The technology to be adopted by the Proponent would consist of a closed water circuit for sand washing in which the slurry of sand and clay fines and water collected from sand washing would be initially settled in a large thickening/storage tank and then be metered through a belt press filter which would filter the excess water from fines. The relatively clean water extracted from the fines would be returned to the closed water washing circuit. The dewatered clay fines, which would then be in a form that can be transported by trucks for use in creating the final landform.

Extensive pilot plant trials, undertaken by the Proponent and utilising some 100 tonnes of raw feed, have confirmed the success and suitability of this technology in processing the Project Site's sand, producing a dewatered material suitable for rehabilitation purposes.

In Victoria, the use of this technology is becoming more common with most new sand operations being approved on the basis that this technology will be installed. The use of the technology is favoured on Greenfield sites, and particularly those sites where insufficient land is available for large settling dams and most importantly for those sites where water availability is limited.

2.6.4.3 Clay Fines Emplacement

Figure 2.10 displays the proposed method for the disposal / placement of the dewatered clay fines, principally through its emplacement into Stages 1/3 to 1/5 on the eastern side of the Project Site and around the northern, western and southern sides of the Project Site.

The Proponent proposes to progressively place some 300 000m^3 of dewatered clay fines rehabilitating Stages 1/3 to 1/5 near the eastern boundary of the Project Site and to form a 14.3ML capacity dam within this emplacement (Dam F). The floor of Dam F would comprise the high strength sandstone at the base of sand removal. **Figure 2.10** displays the plan view and cross-sections through the emplacement. In accordance with the necessary structural engineering requirements, the emplacement would be constructed in layers and itself be interlayed with the coarse oversize materials or other materials specified by a structural engineer. The emplacement would effectively bring the landform within the margins of these areas back to levels approaching natural ground level.

Sections A-A', B-B' and C-C' show sections through the perimeter of the Project Site where dewatered clay fines would be emplaced. A total of 700 000m^3 of dewatered clay fines would be emplaced around the perimeter of the sand removal area throughout the life of the project.

It is proposed to emplace the dewatered clay fines in layers behind a sandstone key left in the floor of the sand removal area. The sandstone key (up to 5m wide at its base and 2m high would provide a base upon which to build up the clay fines ultimately to a slope of 1:4 (V: H).

It is proposed that the perimeter emplacements be constructed in sections each approximately 100m in length. At the conclusion of the construction of each 100m section, the surface would be rehabilitated (see Section 2.12.4.2).

2.6.5 General Wastes

All paper and general wastes originating from the office, amenities and weighbridge office, together with routine maintenance consumables from the servicing of the processing plants and mobile equipment, would be disposed of in appropriate containers placed adjacent to each building. The waste containers would be collected by a licensed waste disposal contractor on an as-needs basis.

All routine servicing of earthmoving equipment would be undertaken by contractors with mobile equipment. All used oil and grease would be removed from site by the responsible contractor. No waste oil would be stored on site in substantial quantities.

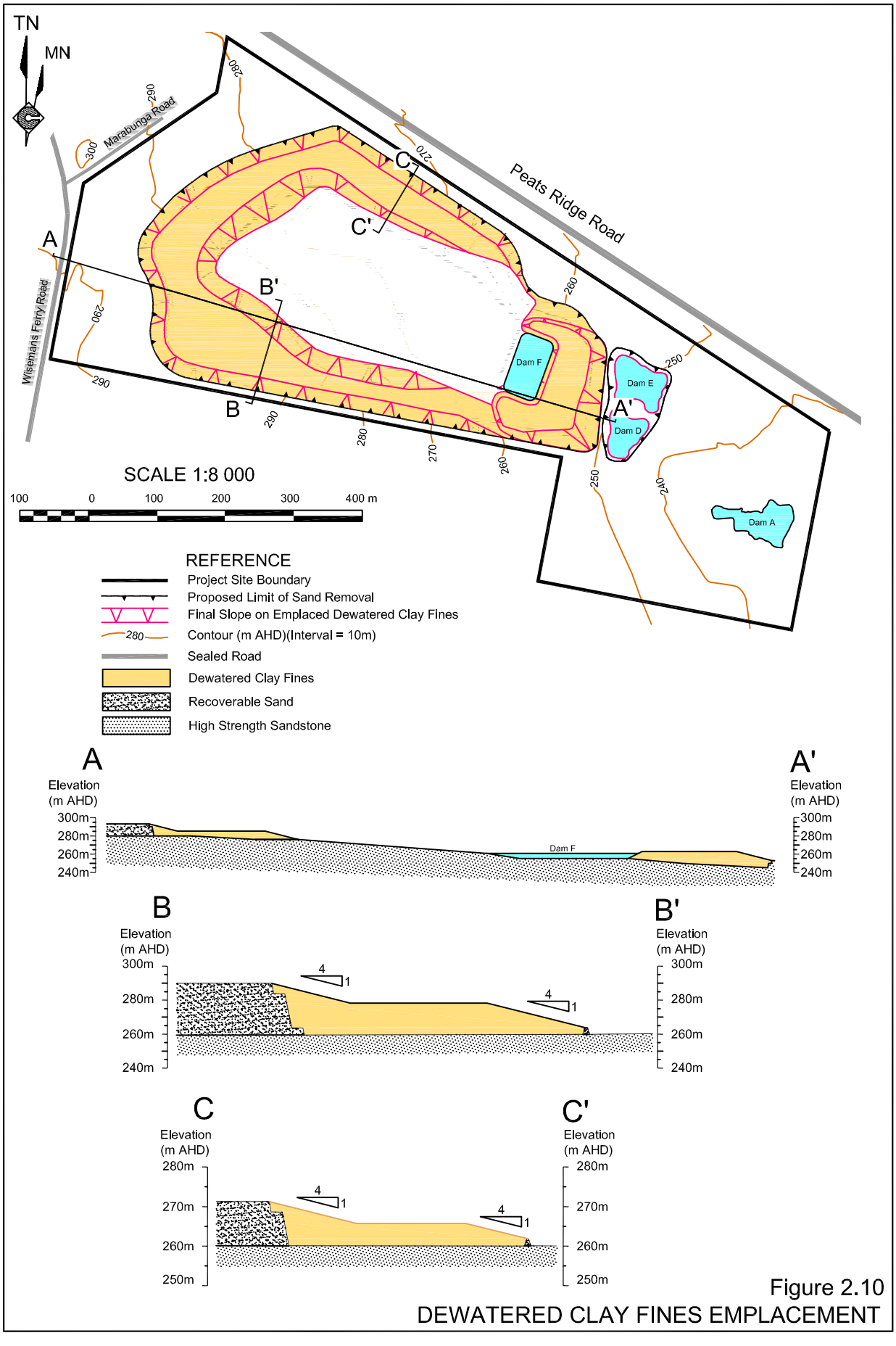


Figure 2.10
DEWATERED CLAY FINES EMPLACEMENT

2.7 TRANSPORTATION

2.7.1 Introduction

An important element in the consideration of the Somersby Fields Project has been the recognition that the proposed site entrance off Peats Ridge Road is only 0.7km from the Somersby Interchange on the F3 Freeway. The Proponent is committed to ensuring that all trucks transporting its products would only approach and leave the Project Site via the F3 Freeway. No products would be despatched to customers using local roads and no un-laden trucks would be permitted to enter the Project Site other than via the F3 Freeway.

This section reviews the design of the site entrance, site access road and the levels of product truck movements and other traffic likely to travel to and from the Project Site. Further discussions about the controls on transportation are presented in Section 4.5.

2.7.2 Proposed Road Construction Activities

Site Entrance

The Proponent proposes to gain access to the Project Site directly off Peats Ridge Road at a location midway along the northern boundary of the Project Site. The selection of the Site entrance has been established following a review of sight distances along Peats Ridge Road and the boundary of the Somersby Mintbush population on and adjacent to the Project Site.

Cardno (NSW) Pty Ltd has assessed the sight distances and proximity to other intersections (particularly the connecting track currently used by local motorists from Dog Trap Road) and identified the section of Peats Ridge Road where the Site entrance could safely be established. The site entrance has been positioned to enable the site access road to be located beyond the western limit of the population of Somersby Mintbush. Hence, none of the identified plants within the Somersby Mintbush population on the Project Site or in the adjoining road reserve would be affected by the site access road.

Figure 2.11 presents the conceptual layout of the site entrance and roadwork improvements necessary to provide safe and convenient access to and from the Project Site. The features of the design of the site entrance are as follows.

1. The entrance provides for a 90^{o} intersection between the site access road and Peats Ridge road with all vehicles entering and leaving in a forward direction.
2. Use is made of the existing wide pavement and sealed shoulder at the location to minimise the amount of road widening / construction work.
3. The intersection would allow a right-turn only for trucks departing the Project Site.

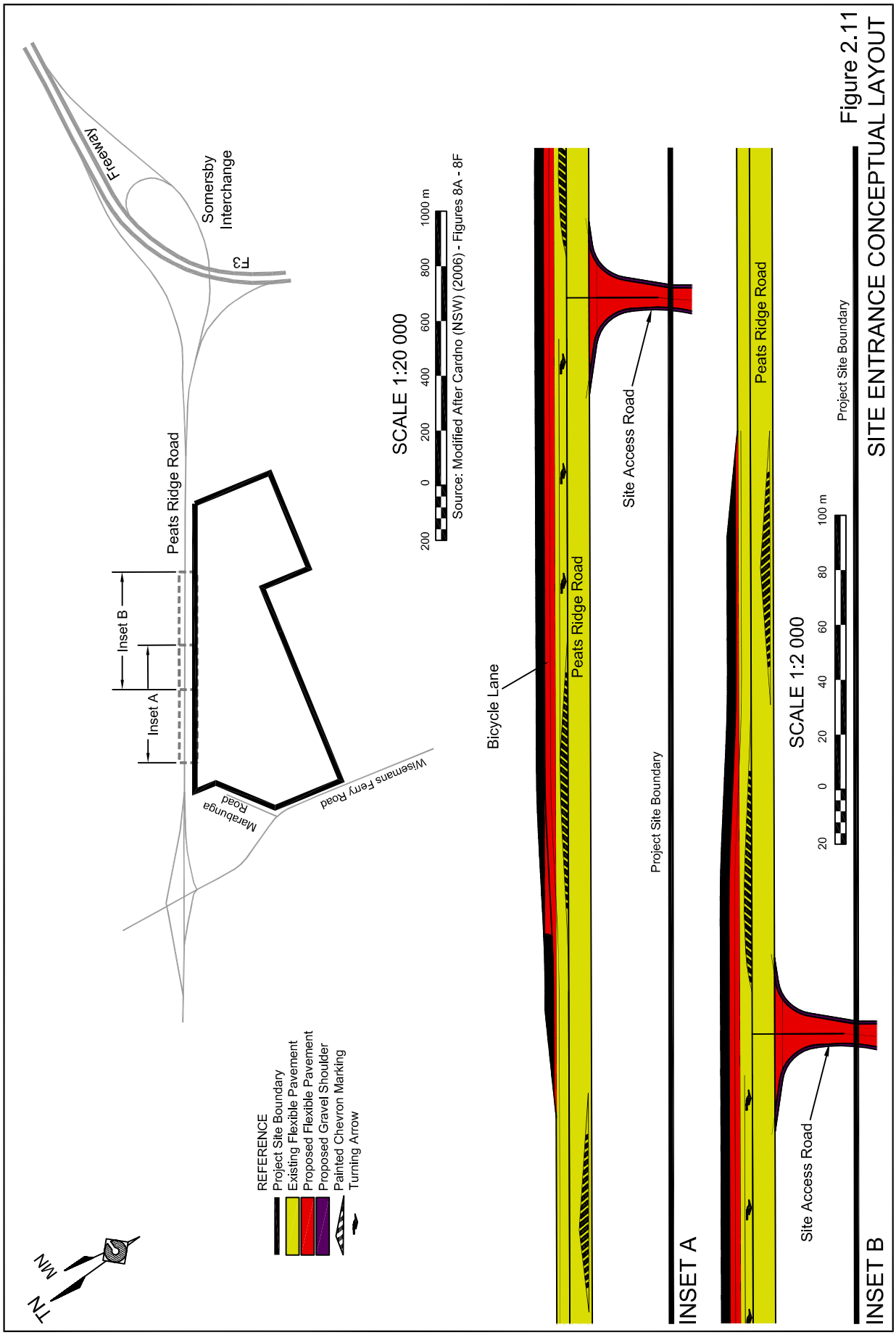


Figure 2.11
SITE ENTRANCE CONCEPTUAL LAYOUT
Freeway
Somersby Interchange
T3
Peats Ridge Road
Inset B
Inset A
Marabunga Road
Wisemans Ferry Road
SCALE 1:20 000
200 0 200 400 600 800 1000 m
Source: Modified After Cardno (NSW) (2006) - Figures 8A - 8F
REFERENCE
Project Site Boundary
Existing Flexible Pavement
Proposed Flexible Pavement
Proposed Gravel Shoulder
Painted Chevron Marking
Turning Arrow
TN
MN
Bicycle Lane
Peats Ridge Road
Site Access Road
Project Site Boundary
INSET A
SCALE 1:2 000
20 0 20 40 60 80 100 m
Peats Ridge Road
Project Site Boundary
Site Access Road
INSET B

4. Peats Ridge Road widening to allow the provision of a deceleration lane for trucks entering the site and right-turn acceleration channelisation on exit.
5. A separated cycle path on the northern side of the intersection.

Site Access Road

The Proponent proposes to construct a site access road from the site entrance for the use of product trucks travelling to and from the product stockpile areas within the processing area. This road would be sealed for a distance of approximately 200m from the Site entrance and would have a sealed width of 7.0m and 1.2m unsealed shoulders. A conceptual design of the site access road from the site entrance through the road reserve and to the processing area is shown on **Figure 2.12**.

The alignment of the site access road through the road reserve and the first 25m of the Project Site has been designed to reduce the direct visual observations of site activities from Peats Ridge Road. A minimum clearing width of approximately 10m would be undertaken through this vegetation. The Proponent proposes to install a wheel-wash facility at a point approximately 120m from the site entrance to assist in removing any sand and clay materials from the tyres of product trucks and other vehicles leaving the Project Site. The road would be sealed from the weighbridge to the site entrance. Beyond the entrance to the processing area, the internal haul roads to the product stockpiles would be unsealed but well defined.

Internal Haul Roads

Internal haul roads would be constructed and/or extended as a new sand removal stage is developed. These internal haul roads would link the sand removal area and the processing area and be positioned wherever possible, either away from the boundaries, particularly during the early stages of development or at the lowest point topographically to achieve the greatest level of noise attenuation. The internal haul roads would be surfaced with ridge gravel or oversize material recovered from the Project Site.

Perimeter Track

The Proponent would progressively construct a 3m wide perimeter track around the approved area of sand removal to provide access for a four wheel drive vehicle to all stages of the sand removal area. The track would extend around the southern side of the far-western earth mound to provide access for ongoing rehabilitation and maintenance work within the western fauna / flora corridor. This track would provide access for operational/safety reasons, during any bushfire events and for use during rehabilitation of the side slopes within the disturbed area. This track would be progressively rehabilitated, as it is no longer required. The standard of track would be comparable to those existing narrow tracks on site.

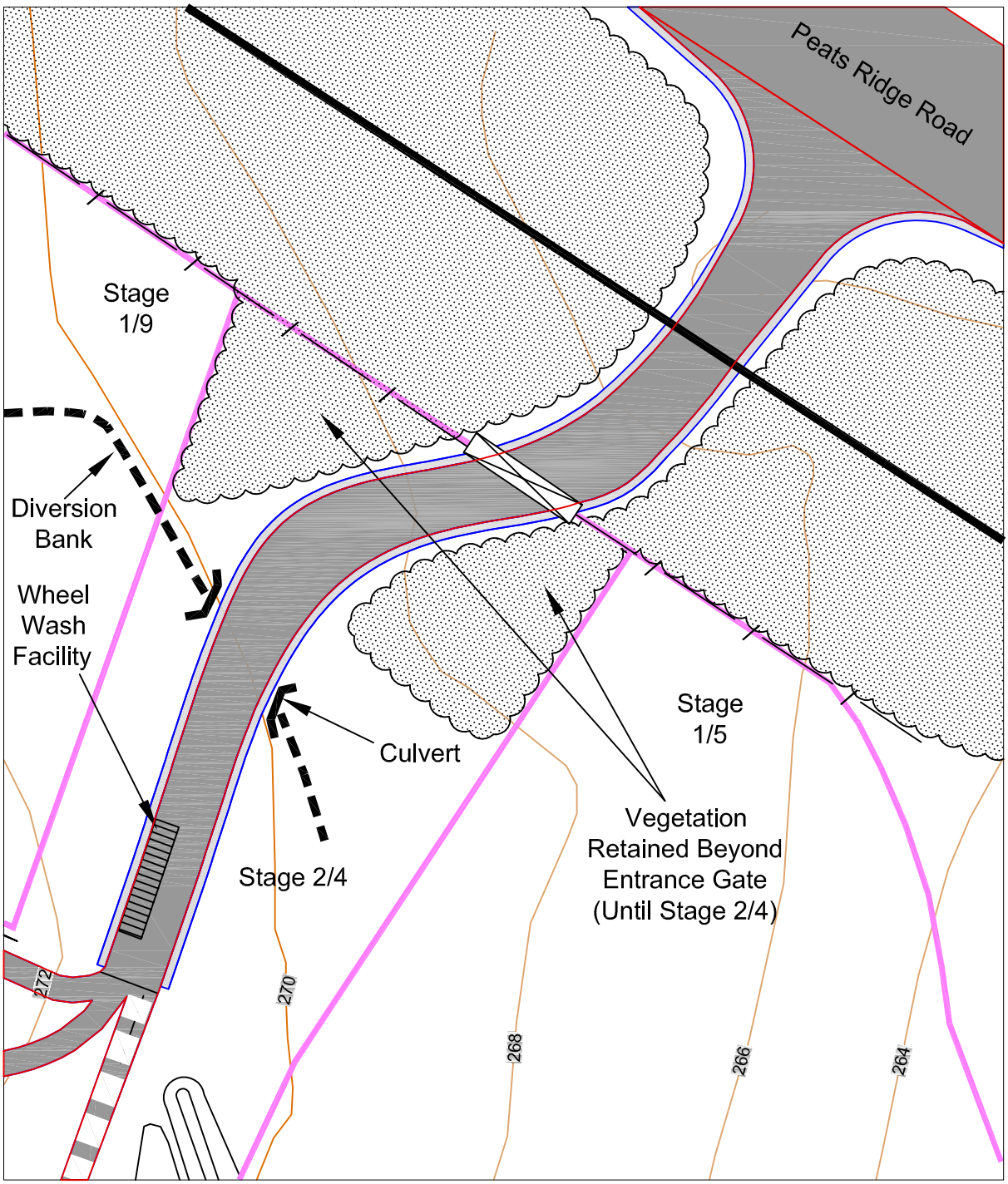


Figure 2.12
SITE ACCESS ROAD
CONCEPTUAL DESIGN

2.7.3 Transport Routes

The majority of products would be transported to the Sydney Metropolitan area with a smaller proportion of product trucks destined to markets throughout the Central Coast. As such, the Proponent proposes that all product trucks would travel to and from the Project Site via the F3 Freeway and Peats Ridge Road (**Figure 2.13**). The Company's commitment to the use of the F3 Freeway and the section of Peats Ridge Road between the site entrance and the F3 Freeway would be reinforced through its contracts with transport companies and/or drivers and would form an important component of the Driver's Code of Conduct (see Section 4.5.4.2).

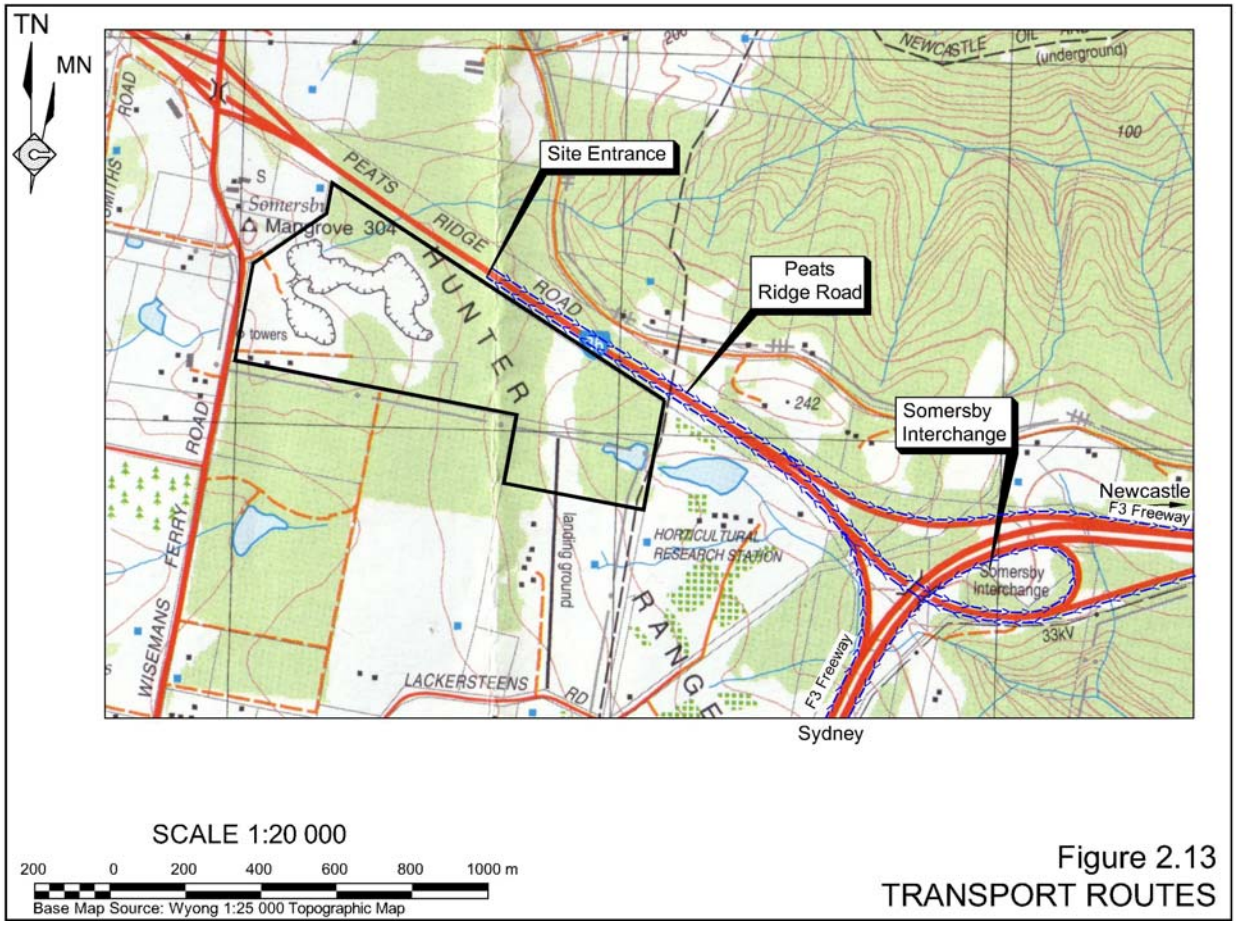


Figure 2.13
TRANSPORT ROUTES

2.7.4 Traffic Types and Levels

The Proponent envisages that the majority of sand products transported from the Project Site would be in 30t to 33t capacity truck and trailers. Some sand sales would be despatched within 25t capacity semi-trailers and occasionally 38t capacity B-Double trucks. A small proportion of product would be despatched in 13t and 17t capacity rigid trucks largely for Central Coast deliveries only. Notwithstanding the likely predominance of deliveries by trucks with trailers, the site entrance and the internal network has been designed to cater for use by B-double trucks able to carry approximately 38t of sand, given these trucks are permitted to travel on Peats Ridge Road. The extent of use of B-doubles in the future would be dependent upon access for these vehicles at the market destinations. The Proponent intends that its products are only to be delivered by contractors who have negotiated contracts with the Somersby Fields Partnership.

For the purposes of establishing average traffic levels, the average truck capacity (without B-doubles) would be approximately 30t. Daily and hourly levels of truck movements would vary noticeably in response to fluctuations in market requirements, rain days, industry picnics, rostered days off etc. **Table 2.5** presents the estimate of traffic levels during the initial years of operations and later once the maximum production of 450 000tpa is achieved. **Table 2.5** indicates that the number of loads of sand despatched on a daily basis would average between 30 and 54. Given the likely variability in daily traffic levels, **Table 2.5** also presents the 85th percentile number of loads despatched daily, ie. on a busy day. It is noted that each load of sand would generate two truck movements, one laden and one unladen.

Table 2.5
Proposed Daily and Hourly Loads Despatched *

Truck Loads	Annual Production Level	
	250 000t	450 000t
Minimum Daily	10	10
Average Daily	30	54
85th Percentile Daily	40	72
Minimum Hourly	1	1
Average Hourly	3	5
85th Percentile Hourly	8	10

* Assumptions:
1. Average load = 30t
2. Operational Days/Year equivalent to 280 days
3. 85th Percentile Daily No of Loads = One third above the average level
4. One load would generate two truck movements – one inwards onto the Project Site and one outwards from the Project Site

The maximum hourly levels of truck movements into and out of the Project Site would vary throughout the day. These maximum levels have been established to ensure compliance with relevant noise criteria (see Section 4.3.4.5) and also reflect requests from the local community to reduce truck movements after 6.00pm. Maximum loads and truck movements would be as follows.

	Loads	Trucks Movements
5:00am to 6:00am	6	12
6:00am to 7:00am	11	22
7:00am to 6:00pm	15	30
6:00pm to 10:00pm	12	24

It is acknowledged that there would be a number of days per year when the number of loads despatched would be above the 85th percentile level. However, reference to the 85th percentile level is typically used by traffic professionals in the design and impact assessment of new proposals.

2.8 DEVELOPMENT TIMETABLE, HOURS OF OPERATION AND PROJECT LIFE

2.8.1 Development Timetable

The site establishment and construction activities, outlined in Section 2.3, would be undertaken over a 6 month period, ie. following surveying, marking out and fencing activities. Time estimates for the major construction activities are as follows.

- Site entrance and intersection construction – 12 weeks.
- Site access road / wheel-wash facility construction – 6 weeks.
- Construction of the far-western earth mound – 2 weeks.
- Vegetation clearing for water storage dams, initial raw material stockpile area and processing area – 10 weeks.
- Soil removal – 4 weeks.
- Excavation of Water Storage Dams D and E – 12 weeks.
- Construction / assembly of processing plant – 26 weeks.

A number of these activities would be undertaken concurrently.

2.8.2 Hours of Operation

Table 2.6 lists the proposed hours of operation for both the establishment/construction phase and operational stages of the Somersby Fields Project. The proposed hours of operation are consistent with those normally adopted by the extractive industry for operations on the Somersby Plateau and servicing the Sydney metropolitan area, particularly those operating in close proximity to the major arterial road network. Such hours of operation are important for extractive industries servicing the Sydney metropolitan area enabling delivery of the first load of each day to occur prior to the morning peak period.

Table 2.6
Proposed Hours of Operation

Activity	Monday to Friday*	Saturday*
Site Establishment and Construction Activities		
Earthmoving Activities	7:00am to 6:00pm	7:00am to 6:00pm
Non-audible Maintenance and Equipment Installation	6:00am to 10:00pm	6:00am to 10:00pm
Operations		
Sand Removal and Processing	7:00am to 6:00pm	7:00am to 6:00pm
Product Loading and Transportation**	5:00am to 10:00pm	5:00am to 4:00pm
Non-audible Maintenance	5:00am to 10:00pm	5:00am to 10:00pm
* Public Holidays excluded		
** Project-related truck movements would be restricted during the 5:00am to 7:00am period and 6:00pm to 10:00pm period		

It is noted that non-audible maintenance activities may need to be carried out outside the above hours, 7 days per week. None of the activities listed in **Table 2.6** would be carried out on Sundays or public holidays.

2.8.3 Project Life

The Proponent envisages that approximately 7.4 million tonnes of sand would be removed and processed within the Project Site over a period of approximately 15 to 18 years. The 15 years would be achieved if the maximum production level is achieved during each year, however, given likely fluctuating market requirements, an additional 3 years has been allowed to recover the entire defined resource. Rehabilitation of the residual area not yet rehabilitated during the operation period would be completed within a further 2 years.

2.9 INFRASTRUCTURE AND SERVICES

2.9.1 Infrastructure

The Proponent proposes to establish a range of infrastructure on site necessary for site operations, management and security. The Proponent proposes to erect and/or construct an appropriate lightweight building for use as an office, lunch room and amenities. These buildings would be located adjacent to the weighbridge (**Figure 2.14**). All buildings would be surrounded by landscaped gardens.

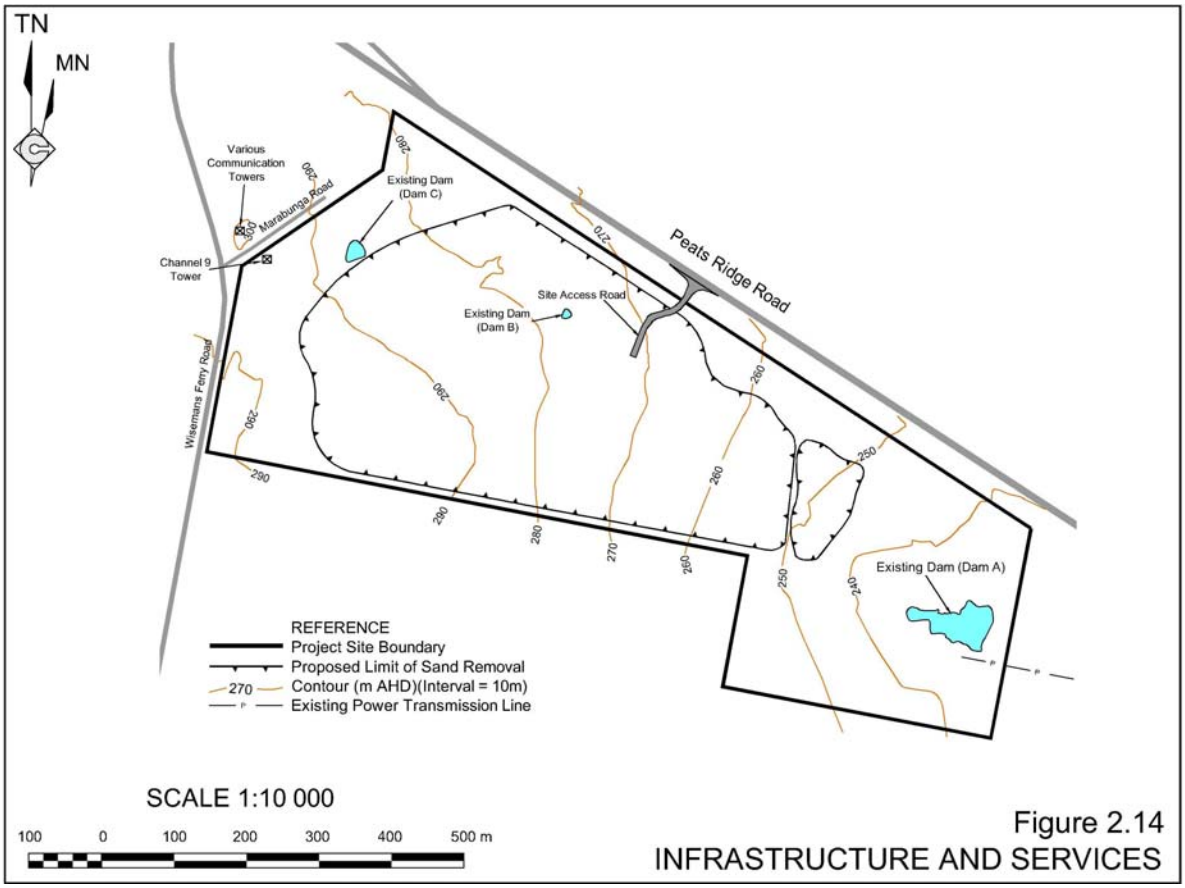


Figure 2.14
INFRASTRUCTURE AND SERVICES

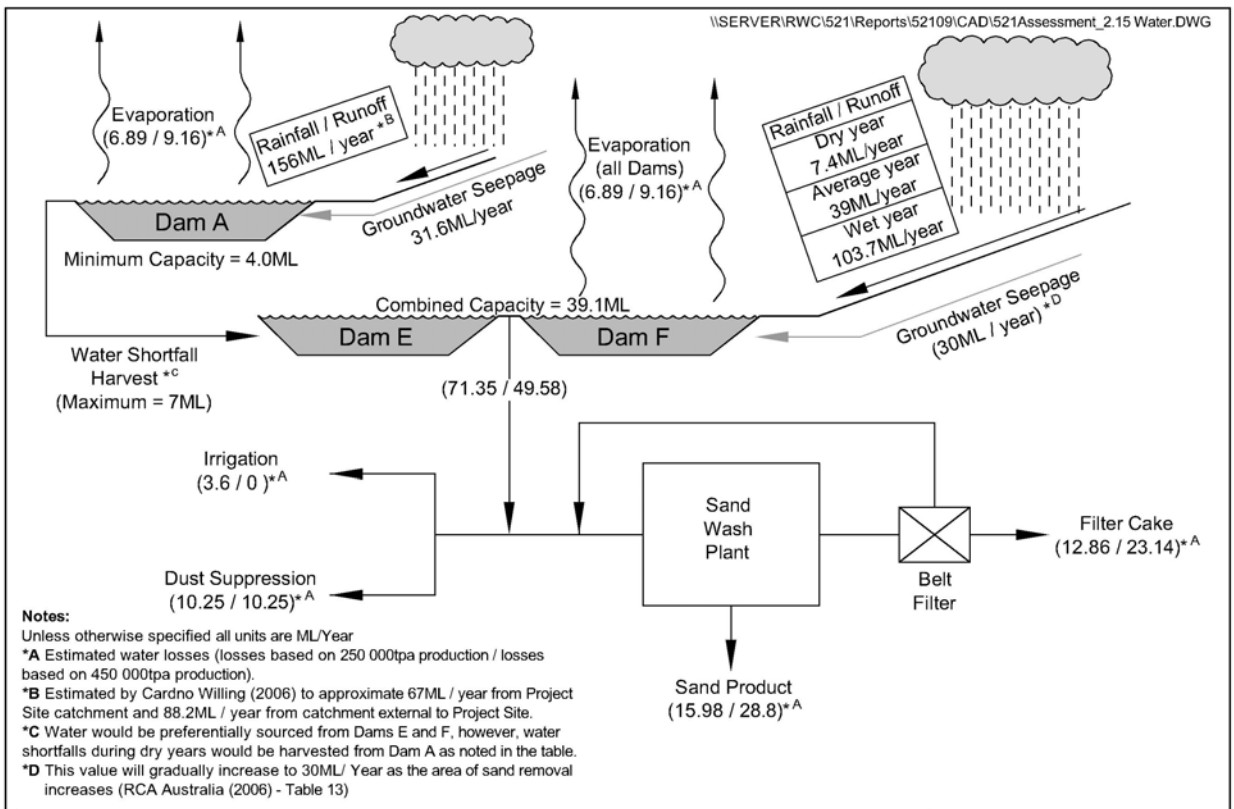
2.9.2 Services

Power

The Proponent proposes to establish three phase 415V power on the Project Site. The Proponent estimates its electricity consumption would be in the order of 550kW/hr, ie. when operating at 450 000tpa. This service would be drawn from existing power lines on the site boundary brought into the site via overhead power lines. Localised clearing / trimming of vegetation may be required, subject to the final location of the power line. A power transformer would be positioned adjacent to the wash plant. It will be a requirement of the Proponent that all power is reticulated underground within the processing area.

Water

The bulk of processing water requirements would be drawn directly from runoff collected within Dams D and E and recirculated from the wash plant. When necessary, small quantities of water would also be drawn from the existing dam (Dam A). **Figure 2.15** presents the water balance for the Project Site. This identifies the quantity of water likely to be collected during dry, average and wet years, the annual water requirements and the average annual volume of water lost to evaporation, retained in the sand products, retained in the dewatered clay fines, used for dust suppression or irrigation and recycled through the wash plant. Where applicable, water use estimates are provided for both a production rate of 250 000tpa (initial production rate) and also 450 000tpa (final production rate).



Dry Year Water Requirements From Dam A * C

Year	1 - 3	4 - 6	7 - 9	10 - 12	13 - 15
Yearly Requirement	Harvest of additional water from Dam A not required	7% possibilty of up to 3ML requirement	20% possibility of up to 7ML requirement	4% possibility of up to 3ML requirement	Harvest of additional water from Dam A not required

Source: Cardno Willing (2006) - Figure 12

Figure 2.15
SITE WATER BALANCE

From **Figure 2.15** it can be calculated that the annual water consumption would be in the order of 49.58ML/yr (production of 250 000tpa) to 71.35ML/yr (production of 450 000tpa).

Of the total project water usage, distinction is made between water used for operational (or consumptive) purposes, ie. the sole use or loss is a consequence of the project, and water used for environmental purposes, ie. controlling dust. Therefore, water used for dust suppression (9.16ML/yr) and retained in the sand products (28.8ML/yr) is considered to be used for environmental purposes. The remaining 32.3ML/yr (sand production of 450 000tpa) is considered the consumptive use of the project. This is relevant when considering the water harvest licensing requirements for the project which is discussed in further detail in Sections 4.2.6 and 4.2.9.2.

All ablution water would be drawn from Dams D and E and stored in a separate tank adjacent to the amenities building.

All potable water requirements would be drawn from tank water collected from the roofs of all site buildings. If necessary, potable water supplies would be supplemented by water purchased in 20L containers.

Communications

The Proponent would seek the installation of up to four telephone lines for the provision of telephone, computer links and facsimile services on site. Mobile services and two-way radio would be used for on-site communications. External telephone speakers would be avoided.

Fuel

The Proponent would install a double lined 15 000 litre diesel tank close to the site workshop (**Figure 2.8**). This fuel storage would supplement the daily / weekly delivery of fuel by a fuel contractor directly to the mobile earthmoving equipment used for the sand removal operation. It is not intended that any product trucks be fuelled at the Project Site. The Proponent estimates the annual on-site fuel usage would be in the order of 580 000 litres when producing 450 000tpa.

Annual fuel usage for the delivery of the sand products is estimated to be approximately 540 000 litres to 975 000 litres, ie. based on an average return trip of 130km for 8 350 loads per year (250 000tpa) and 15 000 loads per year (450 000tpa). It is noted that all product trucks would be fuelled off site.

Sewage / Ablutions

The Proponent proposes that Port-a-Loos are used during the site establishment phase. A Council-approved septic tank system would be installed adjacent to the amenities building for use by all site personnel and truck drivers. The septic system would be pumped out utilising a service truck, as required.

2.10 EMPLOYMENT

2.10.1 Site Establishment and Construction

The Proponent estimates that approximately 30 persons would be involved in the site establishment and construction phase. This estimate is based upon the following.

- Site management – 3 persons.
- Earthmoving contractor / road construction crew – 8 persons.
- Wash plant construction and erection – 8 persons.
- Other – 11 persons.

The Proponent expects to draw the personnel for the site establishment and construction phase principally from the Central Coast and Sydney metropolitan area.

Based on the above estimated employment levels and the duration of the various activities listed in Section 2.8.1, the site establishment and construction stage would generate an equivalent 20 full-time jobs over the 6 month construction period. Off-site activities involved in the manufacture of wash plant components would also generate a number of indirect jobs should the project proceed.

2.10.2 Operations

The Proponent estimates that with the attainment of the 450 000tpa production level, it would maintain a constant workforce of up to 33 people. This estimate is based upon the following.

- Quarry Manager – 1 person.
- Environmental / Community Liaison Coordinator – 1 person.
- Earthmoving equipment operators – 6 to 8 persons.
- Processing area operators – 2 persons.
- Maintenance/Other – 3 persons
- Administration / Other – 2 persons.
- Truck drivers – up to 18

As with the site establishment and production phase, there would be a range of indirect jobs generated by the operation.

2.11 SAFETY AND SECURITY

The Proponent has designed the proposed sand removal area with the full knowledge of the proximity of Somersby Public School and surrounding land uses. As previously outlined in Section 2.4.1.3, the Proponent propose to adopt a consistent 3m high top bench for the entire sand removal area to limit the potential for injury to any person who advertently / inadvertently enters the Project Site and falls over the edge of the sand removal area. The Proponent would erect either a 2m high perimeter security fence or a 2m high fence on the top of the far-western earth mound that would duplicate as a security fence.

The gate at the site entrance from Peats Ridge Road would be locked outside approved operating hours. The gate at the existing access to the telecommunications tower from Marabunga Road would remain locked at all times other than when infrequent access is required.

2.12 SITE REHABILITATION AND BIODIVERSITY OFFSET STRATEGY

2.12.1 Introduction

It is a requirement of the NSW Government that project managers plan their projects to:

(i) minimise the extent of native vegetation cleared;

(ii) progressively rehabilitate areas disturbed throughout the life of the project; and

(iii) put in place a series of offsets that in effect compensate for the unavoidable removal of native vegetation from the land to be cleared.

Each of these requirements has been incorporated into the design of the Somersby Fields Project to ensure that the recovery of the important sand resources on the Project Site also provides for long term conservation benefits for the Somersby area.

This section commences with a broad overview of the Proponent's biodiversity offset strategy which in turn introduces the various component areas that would be rehabilitated throughout the life of the project. The approach adopted to planning the rehabilitation activities is outlined.

Important elements in managing the conservation values of the 42.3 ha Project Site would be:

- the retention, protection and management of 12.7ha of the 25.5ha existing native vegetation beyond the planned areas of disturbance;
- the progressive re-establishment of local native vegetation; and
- the enhancement of the native vegetation in the existing fauna / flora corridors on the Project Site.

The retention, protection and management of the native vegetation beyond the planned areas of disturbance and program to revegetate existing disturbed areas are an integral part of the Proponent's overall biodiversity offset strategy.

The planned rehabilitation activities are presented for the site establishment phase, operational areas and all component areas of the designated long-term conservation fauna / flora corridors. This section also identifies the components involved in site decommissioning.

The section concludes with the approach to ongoing monitoring and maintenance and an overview of the long term land use following project completion.

The proposed rehabilitation plan and procedures have been developed in conjunction with Anne Clements & Associates Pty Ltd. Anne Clements & Associates is a group of botanists, ecologists and restoration ecologists who specialise in botanical conservation assessment and developing and implementing optimal conservation strategies. The company has more than 25 years of experience. Four of the company's environmental managed sites have won excellence awards for their quality and innovations, including "Excellence of Excellence" in 2000. Gold and Silver in NSW Rivercare 2000, Silver and Excellence in NSW Mineral Resources Excellence Awards and Excellence in Earthmovers Awards, 2006 Environment Award for Australian Property Industry.

It is noted that this section focuses upon the rehabilitation of both Stages 1 and 2. Section 2.13 addresses the rehabilitation of Stage 1 only.

2.12.2 Biodiversity Offset Strategy

The Proponent's biodiversity offset strategy focuses upon providing long term security for all mature native vegetation outside areas of proposed disturbance, particularly for the area of threatened *Prostanthera junonis*, and the progressive revegetation of areas either to be disturbed or that lie outside the planned area of disturbance and are currently cleared or support exotic vegetation.

Figure 2.16 displays four distinct areas within the Project Site relating principally to the planned long term land uses following project completion.

(i) A Voluntary Conservation Area (3.2ha).

(ii) A Section 88B protected area (21.0ha).

(iii) Four dams also providing aquatic habitat (1.5ha).

(iv) An area without protection (16.6ha).

Components (i) to (iii) above are the principal components of the Proponent's biodiversity offset strategy whereas the area without protection is largely the area of proposed sand removal although some area disturbed would be revegetated to a high standard for inclusion in the Section 88B protected area.

The planned revegetation strategy to achieve the biodiversity offset strategy is presented schematically in **Figure 2.17**.

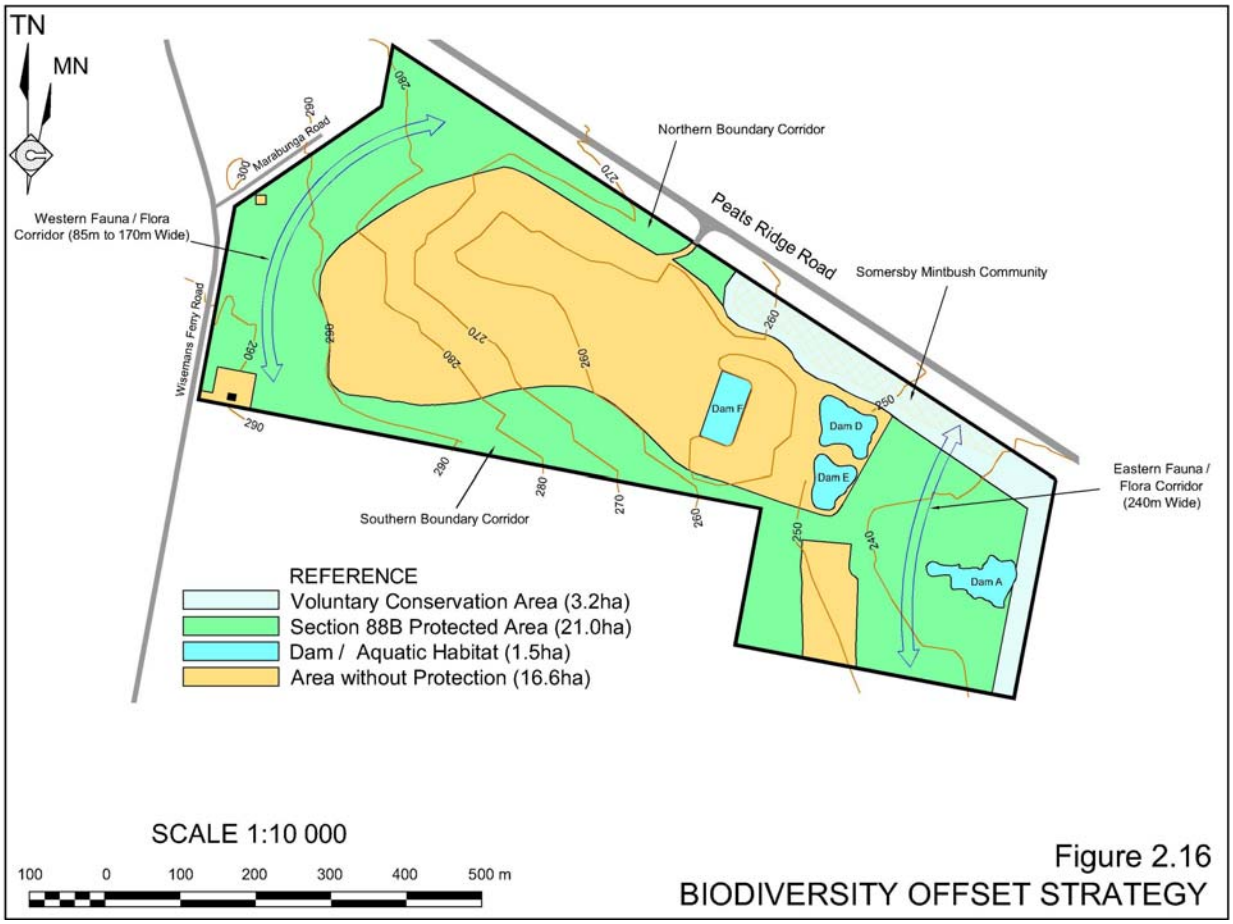


Figure 2.16
BIODIVERSITY OFFSET STRATEGY

An overview of each of the biodiversity offset strategy components is provided as follows.

1. Voluntary Conservation Area (VCA)

   It is proposed to set aside under an area of 3.2 ha to protect the main *Prostanthera junonis* population on the Project Site and also to implement the recommendation for land protection as outlined in the Aboriginal Heritage Assessment Report (AS&R, 2006). The terms of the VCA have yet to be finalised but will include appropriate fencing, limited managed access and management including weed control. Additionally, the Proponent recognizes there are a number of *Prostanthera junonis* plants adjacent to Peats Ridge Road within the road reserve under the control of Gosford City Council. The Proponent is prepared, if Gosford City Council decide, to include this area in an extended VCA, to manage the additional area in an integrated manner within its own VCA.

   Some areas of previous disturbance (tracks etc) remain within the area proposed for the VCA. The rehabilitation activities planned for this area are outlined in Section 2.12.5.

2. Protected Area under a Section 88B of the *Conveyancing Act 1919*

   It is proposed that 21ha of the Project Site be set aside for nature conservation through the use of a Section 88B addendum on the land titles. The area covered by the instrument would include the areas referred to as the eastern and western fauna / flora corridors and northern and southern boundary corridors.

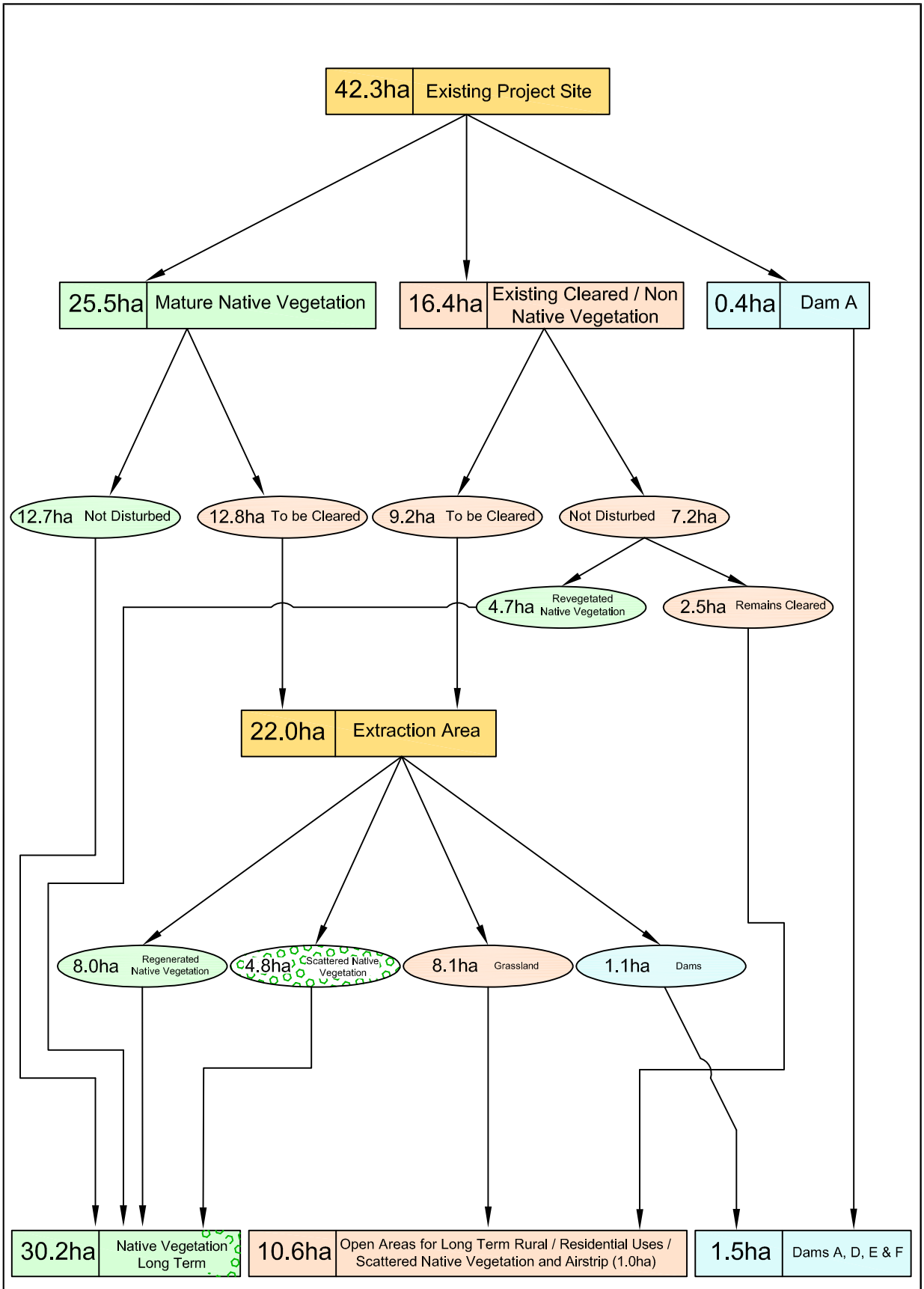


Figure 2.17
REVEGETATION STRATEGY

The eastern fauna / flora corridor is already well vegetated with only a few areas requiring rehabilitation. Limited access would be required across the corridor during the life of the project to gain access to Dam A for occasional water supplies and for monitoring purposes. This fauna / flora corridor would be approximately 240m wide.

The western fauna / flora corridor comprises a range of vegetation types including mature Somersby Plateau Forest vegetation, exotic grasses and pines. The Proponent intends to progressively enhance the conservation values of this corridor to improve the connectivity between the native vegetation stands both south and north of the Project Site. This corridor would vary in width from 85m to 170m.

The northern boundary corridor would comprise the remnant vegetation retained along the northern boundary and a strip of revegetated land along the northern boundary of the area of sand removal. These two areas, combined with the vegetation adjacent to the southern side of Peats Ridge Road, would provide a corridor with a width of approximately 80m.

The southern boundary corridor would comprise the remnant vegetation retained along the southern boundary and a strip of revegetated land along the southern boundary of the area of sand removal. This corridor would be approximately 50m wide.

The rehabilitation activities planned for these corridor areas are outlined in Section 2.12.6.

3. Dams / Aquatic Habitats

The existing Dam A and the proposed Dams D, E and F would serve a range of uses following project completion including nature conservation. Other potential uses would be a water source for fire fighting, agriculture and recreational uses for the land owners.

It is noted that the area designated on **Figure 2.16** as "without protection" would also incorporate an area of scattered revegetation designed to stabilise slopes as well as complement the surrounding denser areas of native vegetation and improve the amenity of the area intended for rural / residential land use.

The short term protection / management and long term net gain in native vegetation above existing levels is considered an appropriate offset for the vegetation clearance required for the Somersby Fields Project to proceed.

2.12.3 Rehabilitation Planning

In order to achieve the high standard of rehabilitation required for the Somersby Fields Project, comprehensive planning has been undertaken. The Proponent recognises the need for a high standard of rehabilitation given the presence of three threatened plant species on site and the commitment to a proactive biodiversity offset strategy. The rehabilitation plan has been prepared drawing upon relevant elements of the documents entitled "*How to Prepare a Vegetation Management Plan*" – Version 4 (DIPNR, undated) and "*General Guidelines for Environmental Management Plans*" (NSW NPWS, 1999).

At the outset, it is essential that a viable long term land use is identified which reflects the capabilities of the land itself and is compatible with surrounding land uses. Rehabilitation planning for the Somersby Fields Project has been undertaken following a review of the information sources set out below.

(i) The proposed final landform and materials available for use as a substrate from final landform planning (see Section 2.12.5.2) and the materials available (see Section 2.6).

(ii) The various land uses that are present on and around the Project Site – drawn from the aerial photographs recorded on **Figure 4.5b** and the Proponent's investigations.

(iii) Current adjoining land uses – drawn from discussions with surrounding land owners and a review of recent aerial photography.

(iv) The existing vegetation on site and its clearing history. Particular emphasis is placed upon known locations of three threatened plant species – drawn from Robert Payne – Ecological Surveys & Management (2006) and implications of and the effects of previous land uses as compiled by Anne Clements and Associates and recorded on aerial photographs of the Project Site and its surrounds since 1954 (**Figure 4.5a**).

(v) Substrates and soil rehabilitation materials on the Project Site – drawn from published literature and GCNRC (2006).

(vi) The existing faunal use of the Project Site and its surrounds, particularly fauna corridors – drawn from Countrywide Ecological Service (2006).

(vii) An appreciation of the existing threats to existing and rehabilitated native vegetation – provided by Anne Clements & Associates.

Table 2.7 lists information drawn from each of the above sources and their implications for rehabilitation planning on the Project Site.

Table 2.7
Factors Influencing Rehabilitation Planning

Factor	Relevant Information	Implications for Rehabilitation
Final Landform	An amphitheatre landform would be created with slopes varying from <1° to 14° (see Section 2.12.4.2).	Slopes are consistent with similar natural slopes of the Somersby soil landscape and in Hawkesbury Sandstone terrain and are suitable for rehabilitation.
Substrates and Soil Rehabilitation Materials	A combination of sandstone (ripped) on the shallow slopes and clay fines (<75μm), oversize material (10mm to 100mm) on the perimeter slopes together with subsoil / biologically active topsoil and biomass. Approximately 1 million m^3 of dewatered clay fines would be produced and up to 360 000m^3 of oversize remaining for use in rehabilitation activities.	Ripped sandstone may need to be covered with subsoil and native topsoil to support growth of local native plants. Clay fines have limited wet-bearing capacity and preferably need to be contained. Oversize material is suited as a drainage medium. The topsoils contain a diverse array of seed from native plant species.
Historic Land Uses	**Figure 4.5a** records the various land uses at decade intervals since the 1950s. Considerable areas both north and south of the Project Site have remained native vegetation (with records of some bushfires) whereas land both east and west of the Project Site is largely cleared with scattered native vegetation.	It would be preferable for rehabilitation activities to focus on maintaining / re-establishing fauna / flora corridors networks on both the eastern and western sides of the Project Site to provide connectivity between the tracts of native vegetation north and south of the Project Site.
Current Land Uses	**Figure 4.5b** records the various current land uses surrounding the Project Site. Limited visual access is available from adjoining properties although improved screening is required along the southern boundary of the Project Site.	The presence of rural / residential properties and motorists' use of Peats Ridge Road requires a high standard of visual screening. The rehabilitation of the Project Site to enable its proposed future use for rural / residential would be appropriate so that it is comparable with surrounding land uses.
Existing Vegetation Communities	Two mature vegetation communities (covering 25.5ha) are present on site, namely the Somersby Plateau Forest and Hawkesbury Banksia Scrub-Woodland. The remaining area is predominantly exotic grassland with some areas of Radiata Pine.	Species from the two native vegetation communities need to be used in revegetation of both existing and future disturbed areas, preferably with a diversity similar to that recorded on site. Areas of exotic grassland could be reduced to increase the natural habitat value of the Project Site. All pines are to be progressively removed.

Table 2.7 (Cont'd)
Factors Influencing Rehabilitation Planning

Factor	Relevant Information	Implications for Rehabilitation
Threatened Species	Three threatened plant species have been recorded on the Project Site, namely *Prostanthera junonis* (220 plants), *Tetratheca glandulosa* (2 plants) and *Hibbertia procumbens* (40 plants). The bulk of the plants of these species are located within the proposed Voluntary Conservation Area. Approximately 16% of the *P. junonis* plants occur around the base of trees in the highly modified area of the Project Site within the area to be disturbed by the project. Anne Clements & Associates established when reviewing the historic photographic record that *P. junonis* has been recorded in previously cleared areas (around the base of trees remaining on soil / laterite pedestals) and other areas on site either not previously cleared or previously cleared but without gravel extraction. Clements concluded that *P. junonis* appears to be absent from areas on the Project Site where ironstone gravels have been extracted. This species appears to have more restorative habitat requirements than *T. glandulosa* or *H. procumbens.*	Areas of known threatened species need to be protected and managed. The opportunity exists to carefully translocate a number of the *P. junonis* and *H. procumbens* plants in accordance with the "*Guidelines for the Translocation of Threatened Plants in Australia*" (Australian Network for Plant Conservation, 1997). Given the apparent requirement for iron in the soil profile to sustain *P. junonis*, it would be appropriate for the reconstruction of the substrate for revegetation on site to incorporate some additional iron. This could potentially be in the form of scrap steel which could duplicate as a membrane to support the substrate created for plant growth, particularly *P. junonis*.
Soil Resources	Topsoils are typically approximately 15cm thick and subsoils up to 50cm thick. Subsoils generally display low dispersibility. Soil pH levels of the Project Site are typically 4.5 to 6.0 with low salinity.	Topsoils and subsoils on site are suitable for revegetation purposes. Replace subsoils at a depth of at least 20cm and topsoils at a depth of at least 10cm. Preference needs to be placed upon direct transfer of subsoils and topsoils and then with preference placed on the use of soil from either the Somersby Plateau Forest or the Hawkesbury Banksia Scrub-Woodland.
Fauna Habitats	A range of fauna habitats are present on site, particularly in areas of native vegetation and dams. Fauna habitats are present in native vegetation north and south of the Project Site.	The existing fauna / flora corridors especially on the western side of the Project Site need to be enhanced to encourage north-south fauna movement. Felled or fallen native timber need to be used to create ground cover habitats and refuges for native fauna. All existing and proposed water storages should include some shallow edges as part of the long term aquatic and native bird environment.

Table 2.7 (Cont'd)
Factors Influencing Rehabilitation Planning

Factor	Relevant Information	Implications for Rehabilitation
Existing Threats to Native Vegetation	The principal threats are as follows. • Fallow Deer. • *Pinus radiata*. (Radiata Pine) • Pastures and Fertiliser. • Fragmentation by Tracks.	Any Fallow Deer need to be carefully trapped and relocated to a deer farm. All *Pinus radiata* need to be progressively cleared off site and the cleared areas revegetated with native vegetation. Any pasture seed mixes used on site need to be sterile. Use of fertiliser needs to be avoided to promote native revegetation. All existing tracks outside the planned area of disturbance need to be rehabilitated.

The overall objectives of the project rehabilitation plan are as follows.

1. To conserve, enhance and / or re-establish an area of native vegetation greater than that removed to gain access to the sand resource beneath the Project Site.
2. To conserve, enhance and / or re-establish habitat for three threatened species, *Prostanthera junonis*, *Tetratheca glandulosa* and *Hibbertia procumbens*, recorded on the Project Site within long-term viable conservation corridors. It should be noted that *Prostanthera junonis* appears to have more restrictive habitat requirements than *Tetratheca glandulosa* or *Hibbertia procumbens*.
3. To conserve, enhance and re-establish the habitat of the native fauna by conserving, enhancing and re-establishing the local native vegetation (Clements 1997b), particularly in the fauna / flora corridors across the eastern and western sides of the Project Site.
4. To maintain and enhance the native vegetation within the Voluntary Conservation Area and eastern and western fauna / flora corridors.
5. To protect the amenity of existing and proposed other land uses such as:
    - ongoing vegetation trimming on the Project Site within the northern approach to the airstrip;
    - setbacks from rural / residential dwellings on the Project Site for fire protection; and
    - if practicable, provide dam water for a fire-fighting helicopter.
6. To provide sufficient areas of land for the subsequent land uses across the Project Site.
7. To monitor the rehabilitation and implement corrective actions to ensure the conservation objectives are met.

The development of a rehabilitation plan needs to consider a range of factors and variables including the following.

1. Protection of in-situ conservation areas, reducing fragmentation and formalising tracks.
2. Re-construction of landforms.
3. Maintaining and re-constructing soils as a growth medium for native vegetation.
4. Creating biological active soil on constructed landforms.
5. Re-constructing potential soil habitat for *Prostanthera junonis.*
6. Water management.
7. Utilising plant material.
8. Conservation and enhancement of the habitat of the threatened plant species recorded.
9. Maintaining and enhancing the conservation values through careful bush regeneration.
10. Monitoring and maintenance.

Each of these factors and variable were considered during the preparation of the overall plan and the design of the proposed rehabilitation procedures.

2.12.4 Site Establishment

2.12.4.1 Rehabilitation Objectives

A number of areas on the Project Site disturbed during the 6 month site establishment period would need to be rehabilitated during this period. The objectives relevant to these activities are as follows.

(i) To stabilise all disturbed areas to limit erosion and dust lift-off.

(ii) To create a visually attractive site.

(iii) To close off and stabilise all tracks no longer required by encouraging natural regeneration, particularly within the Voluntary Conservation Area.

During the site establishment period, the rehabilitation program to improve the coverage of native vegetation on areas beyond the area to be disturbed would be commenced. This program, which would be ongoing for a number of years, is discussed in Section 2.12.6.

2.12.4.2 Rehabilitation Procedures

The rehabilitation procedures to be adopted would be consistent with best practice in the extractive and mining industries. The procedures are presented for water management structures, acoustic earth mounds, roadside verges and drainage, and landscape areas.

Water Management Structures

All structures to divert water away from operational areas (discussed in Section 4.2.5) would be stabilised either with gabion size rock or by encouraging recolonisation of local native sedges, ferns and grasses. The outlet points from all diversion banks would incorporate a level sill which would be stabilised through the placement of oversize rock, as required.

Acoustic Earth Mounds

The outer surfaces of the far-western acoustic earth mound would be covered with topsoil transferred directly from an operational area, seeded and spread with biomass, as required to encourage natural regeneration of the local native species.

Roadside Verges and Drainage

All areas adjacent to the site access road outside the footprint of the road and its shoulders would be revegetated principally with the local native species. The roadside drains would be stabilised with a bitumen-based binder and straw to minimise the extent of sediment-laden runoff from the drains themselves. Silt-stop fencing may be required.

Landscape Areas

Towards the end of the site establishment period, the Proponent would establish a range of landscape areas in the vicinity of the site office/amenities and car park. The Proponent intends to create an attractive work environment with an emphasis upon positive environmental attributes. These areas are to be planted using local native species.

Track Rehabilitation

All tracks no longer required to be used, especially those within the Voluntary Conservation Area, would be ripped and spread with topsoil and biomass recovered from areas cleared during the site establishment phase, as required.

Plant Translocation

Both during and following the site establishment phase, the Proponent would undertake a program of translocation focussing upon the *Prostanthera junonis* and *Hibbertia procumbens* plants within the proposed area of sand removal. It is proposed that the translocated *Prostanthera junonis* and *Hibbertia procumbens* would be planted either within the Voluntary Conservation Area or the western fauna / flora corridor. All plant translocations would be undertaken in accordance with the Translocation Guidelines prepared by the Australian Network for Plant Conservation, Canberra (1997). The principal features of the planned translocation program on the Project Site are as follows.

1. The area around the plant would be carefully weeded prior to translocation under the supervision of a qualified bush regenerator / plant ecologist.
2. Pyramidal plugs using a truck-mounted tree spade or similar equipment would be carefully excavated retaining the plant and the surrounding topsoil and biomass intact.
3. The pyramidal plugs would be carefully placed into pre-dug pyramidal plug holes in the western fauna / flora corridor.
4. Brush matting would be placed around the translocated plants.
5. All translocated plants would be tagged and recorded to assist in subsequent monitoring.

It is noted that the above method was successfully used at a site in Strathfield in 1998 (Moore and Clements, 1998).

Protection and Sediment Control

All areas rehabilitated during the site establishment phase would be protected, where necessary, with silt-stop fencing or clearly defined with coloured tagging or fencing to prevent accidental vehicle movement across the rehabilitated area. All persons working on site would be made aware of the conservation significance of local native vegetation on the Project Site as part of the site induction procedure.

2.12.5 Operational Areas

2.12.5.1 Rehabilitation Objectives

The Proponent's objectives for the operational areas within the Project Site are as follows.

(i) To provide a low maintenance, geotechnically stable and safe landform which would support the intended long term combined land use that being nature conservation and rural / residential activities consistent with the prevailing Gosford City Council zoning.

(ii) To revegetate areas designated for long term nature conservation with native tree, shrub and grass species comparable with the surrounding woodland vegetation and consistent with the Proponent's biodiversity offset strategy.

2.12.5.2 Final Landform

An important component in rehabilitating areas disturbed by extractive industries is the reconstruction of a landform that can support the proposed vegetation and subsequent land uses. **Figure 2.18** presents the final landform after all site activities in Stages 1 and 2 are concluded and all equipment is removed. It is proposed that the earth mounds constructed during the site establishment period would be removed as part of the final rehabilitation unless they are required for any subsequent land use. The features of the final landform would be as follows.

(i) Overall, the final landform within the sand removal area would appear as an amphitheatre with perimeter slopes on three sides and free draining via a series of water quality dams to the east.

(ii) All perimeter slopes on the northern, western and southern sides of the sand removal area would be re-formed slopes with a maximum grade of 14^{o} or 1:4 (V:H). The perimeter slopes would be constructed using the dewatered clay fines from the sand washing process (see Section 2.6.4.3). Localised changes in slope would be introduced to allow diversity in the final landform and to provide niches for various plants. The eastern slope would be comparable with the existing natural land surface, although a new water storage dam (Dam F) would be formed within this area.

(iii) A central comparatively flat area would be created within the final landform, ie. on the sections within the Project Site where the sandstone forms the base of sand removal and is not covered by any clay fines.

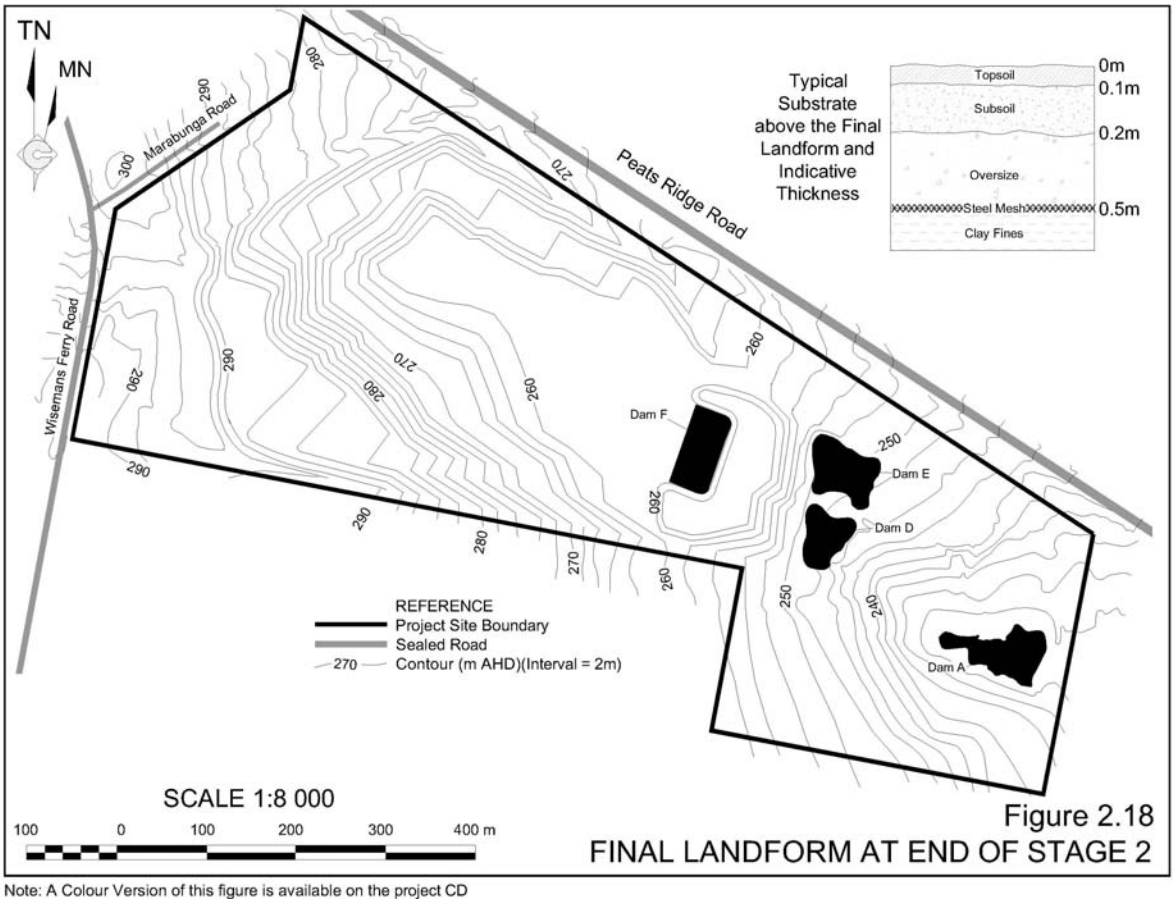


Figure 2.18
FINAL LANDFORM AT END OF STAGE 2

Note: A Colour Version of this figure is available on the project CD

2.12.5.3 Substrate Reconstruction

Perimeter Slopes

The perimeter slopes would be constructed in comparatively short sections with dewatered clay fines placed in layers against the final sand faces. As the final landform in each section approaches completion, the following procedures would be followed to create the substrate required for subsequent revegetation.

1. The upper surface of the clay fines would be covered with steel mesh (with openings of at least 5mm) such as rusty re-enforcement steel mesh to allow root penetration and limit the movement of oversize material downwards into the clay fines. The presence of the steel mesh in the substrate would also re-introduce a source of iron that was present as the laterite in the natural pre-sand removal profile.
2. The steel mesh would be covered with up to 300mm of oversize rocky material to from the drainage component of the substrate.
3. Up to 200mm of subsoil would be placed above the oversize rocky material to re-create the subsoil from the natural profile.
4. At least 100mm of topsoil would be placed above the subsoil to provide the substrate for revegetation.
5. At the completion of each section of the perimeter slope in the manner described above, the completed area would be isolated through the use of localised diversion banks and provided with silt-stop fencing appropriately placed to control sediment-laden runoff from the surface prior to being fully stabilised.

The sequence of materials referred to above are shown schematically on **Figure 2.18**.

This approach to reconstructing a vegetation substrate has been used at a range of mines and quarries when rehabilitating process tailings (Clements et al, in press). Box trials can be used early in the project life to assist in optimizing the relative thickness and chararacteristics of each of the materials used in substrate reconstruction and determine the optimal growth medium for the threatened species *Prostanthera junonis*.

An important component of the rehabilitation of the perimeter slopes would be the monitoring of progress of the revegetation and assessment of the suitability of the substrate. Minor variations would be implemented where it is established that improvements could be achieved. This practice is common in rehabilitation of mines and quarries (Clements et al, in press).

Gentle Floor

The proposed final land use of this area is rural / residential and grazing. The substrate for rehabilitation of the sandstone floor not covered by dewatered clay fines would be ripped to a depth of approximately 0.3m after which both subsoil (200mm) and topsoil (100mm) from the current agricultural land would be placed.

2.12.5.4 Revegetation Activities

The revegetation activities would be undertaken progressively throughout the life of the Somersby Fields Project. Four principal forms of revegetation on the final landform would be undertaken.

(i) A mixed open eucalypt woodland comparable to the surrounding Somersby Plateau Forest where the emphasis would be placed upon achieving a species diversity comparable to the surrounding vegetation.

(ii) A Banksia Scrub Woodland principally in those areas where long term seepage could be expected in the final landform. Again, the species diversity in these areas would be comparable to that present in the Hawkesbury Banksia Scrub-Woodland on the Project Site.

(iii) Scattered native vegetation planted in areas supplementary to the areas used for rural / residential land uses.

(iv) Open grassland comparable to the areas of the existing cleared and rehabilitated areas on the Project Site.

Figure 2.19 displays the areas of planned revegetation for each of the operational areas.

Procedures to revegetate the areas intended for (i) and (ii) above would be as follows.

The final surface would be revegetated through a combination of natural regeneration (from the placed topsoil), direct seeding (including placement of seed-bearing branches) and tubestock planting using seed collected on site, wherever possible. Plantings, direct seeding and retention of the shrubs and trees would be undertaken in such a manner to achieve a structure similar to that of the existing native vegetation on the Project Site.

Many of the local native understorey species are likely to be re-established through transfer of topsoil and biomass and natural re-establishment following weeding and bush regeneration. Additional planting may be required to reduce risk of weed invasion and to establish species diversity similar to the more intact areas.

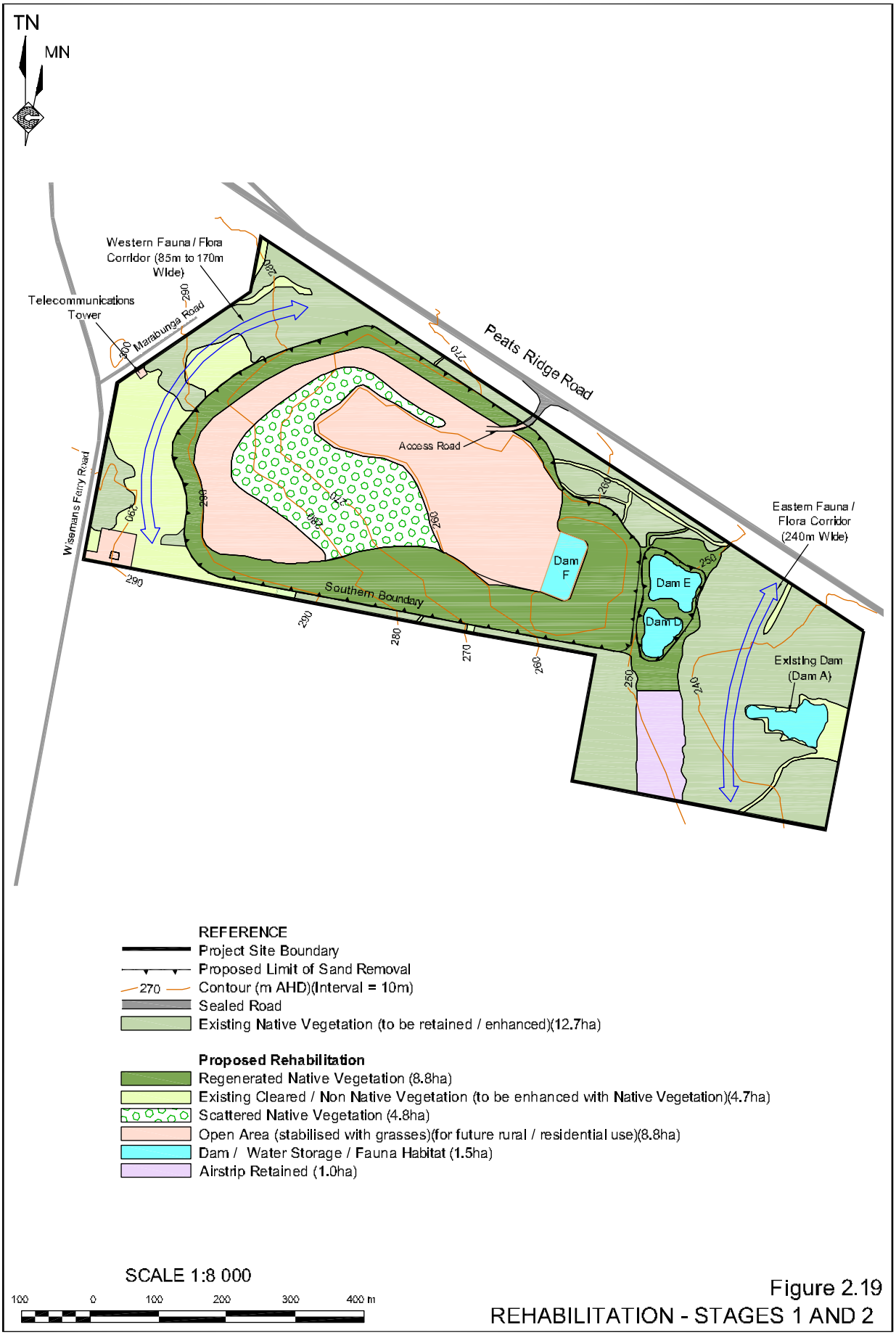


Figure 2.19
REHABILITATION - STAGES 1 AND 2

Planting would occur in the autumn / winter / early spring period when rainfall is more likely and there are lower transpiration rates. Limited watering of tubestock may be necessary after planting. Mulching also may be required to be spread around any planting to reduce weed growth and reduce water loss from the soil surface.

Following, and/or immediately before seeding, the Proponent would position a range of tree and shrub debris, including logs and branches, to assist in microclimate creation and fauna habitat.

The revegetation procedures for those open areas to be used for rural / residential and grazing activities would involve seeding with the pasture mixes. These areas are to be vegetated to achieve a satisfactory level of cover until subsequent land uses are developed on the land.

The above procedures adopted would be regularly reviewed throughout the life of the project and modified, if required, to reflect the results of monitoring and the operational experience gained.

2.12.6 Long Term Conservation Corridors

Western Fauna / Flora Corridor

The corridor between the western boundary of the Project Site and the far-western earth mound currently comprises cleared grassland and substantial areas of exotic pines etc. It is intended to progressively remove the exotic vegetation and gradually replace it with native vegetation and improve its values as a fauna / flora corridor. Following the progressive removal of all exotic grasses, shrubs and trees, the landform in areas previously disturbed by former extraction activities would be reshaped and appropriate drainage controls installed. Revegetation would be undertaken in a manner similar to that previously described in Section 2.12.5.4.

Eastern Fauna / Flora Corridor

Small areas have previously been cleared within the area east of the airstrip on the Project Site principally to form access tracks. It is intended that the access tracks in this area are rationalised and those not required (and any other areas) would be revegetated principally through ripping and placement, if necessary, of topsoil, biomass, logs and branches.

Southern Boundary

The vegetation within the 15m setback between the southern boundary of the Project Site and the proposed area of sand removal is variable in density. It is intended to increase the density of the vegetation in this area to further limit visual access of site activities from residences to the south of the Project Site. This revegetation may include tubestock grown from seed sourced on site.

Northern Boundary

The vegetation within the area adjacent to the northern boundary is comparatively dense, however, any areas where vegetation is sparse additional seed bearing spread and tubestock planting, grown from seed sourced on site may be required.

2.12.7 Site Decommissioning

The Proponent intends to remove all buildings and structures off site at the end of the project life. All concrete footings would be ripped up and removed from the site for recycling.

All internal roads not required for the subsequent land use(s) would be cross-ripped, topsoiled and seeded. It is envisaged that the site entrance would be retained for the intended rural / residential land uses.

Any areas where there have been fuel spillages etc would be remediated either on site or the affected material removed from site.

2.12.8 Monitoring and Maintenance

An important component of the rehabilitation strategy for the Project Site would involve a program of monitoring and maintenance. It is proposed that monitoring is undertaken at regular intervals in a series of fixed quadrats and transects positioned on or across representative rehabilitation areas. Increases in native species diversity and decreases in exotic species diversity would be assessed over time and used as indicators of the success of the rehabilitation works. Monitoring may define particular species that may need to be specifically introduced to achieve the required species diversity. Fixed photographic monitoring locations and monitoring quadrats and transects would include areas where:

- tracks have been closed;
- topsoil has been respread;
- biomass transfer has occurred;
- tubestock has been planted;
- vegetation is regenerating naturally; and
- existing stands of native vegetation remain.

Maintenance is likely to be required for a period of at least 2 years after initial rehabilitation works in each respective area. Maintenance would also include erosion and sediment control, weed control, tubestock, replacement of planting losses and any other requirements for achieving successful vegetation establishment.

During the early stages of the project, erosion and sediment controls would be inspected fortnightly and following any substantial rainfall events. Regular programs of primary and secondary weeding would also be undertaken. Primary weeding would involve hand weeding and secondary weeding would involve careful spot spraying with diluted *Roundup Bioactive*.

The extent of maintenance undertaken and the results of all monitoring would be summarised and included in each AEMR.

2.12.9 Long Term Land Uses

The Somersby Fields Partnership was originally of the view that the most effective way it could contribute to the local community was through granting some of the site during and/or following the completion of sand removal / rehabilitation, to the community for use either as:

(a) a regional sporting and recreational facility; or

(b) a small Somersby "village green".

Hence, the Proponent's name "Somersby Fields" was created. The Proponent originally envisaged that the transfer of land ownership of the various areas of land could occur progressively as sand was removed and sections of the site were progressively rehabilitated.

The Proponent now acknowledges that it has been unable to obtain the necessary support for the above concepts and accordingly now proposes that the land would be used for rural / residential activities consistent with Gosford City Council requirements. **Figure 2.20** displays the proposed long term land uses following the completion of rehabilitation activities on site. The principal land uses would be as follows.

- Nature Conservation – 27.7ha.
- Rural / Residential – 13.6ha.
- Airstrip Retained – 1.0ha.

The nature conservation component of the Project Site would include four water storage / aquatic bird habitats that could also be used as a source of water for fire-fighting purposes.

The Proponent intends to realign the boundary between Lot 41 DP 1046841 and Lot 1 DP 302768 (**Figure 2.1**) to create two similarly sized allotments (approximately 21.15ha) for each rural / residential lot.

It is noted that the telecommunications tower on the western side of the Project Site would not be affected by any project-related activity nor rehabilitation activities.

The indicative mechanisms to provide long term protection to both the retained native vegetation and native revegetation have previously been outlined in the Proponent's biodiversity offset strategy presented in Section 2.12.2.

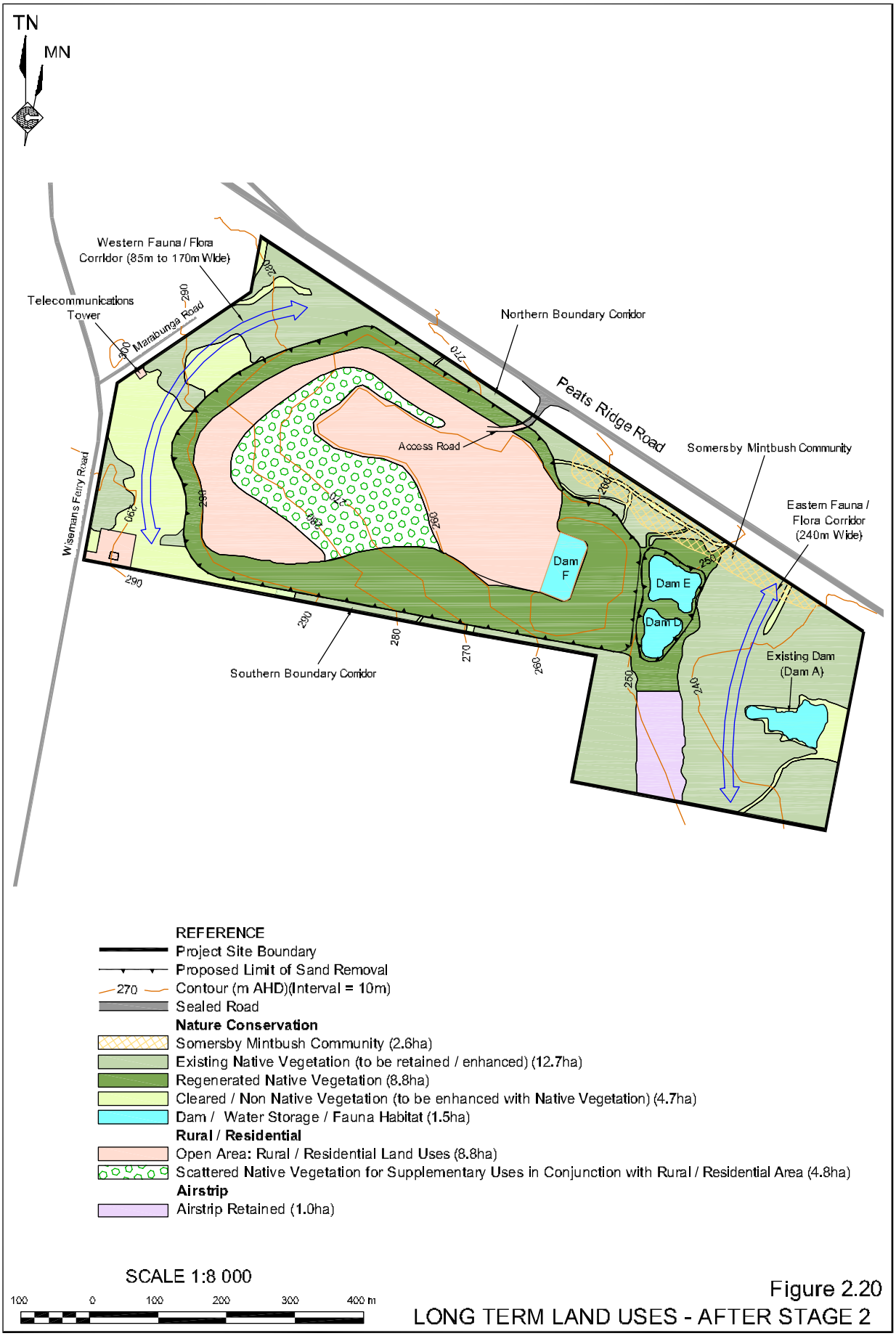


Figure 2.20
LONG TERM LAND USES - AFTER STAGE 2

2.13 STAGE 1 OPERATIONS

2.13.1 Introduction

The Proponent has committed to a staged approach to the development and operation of the Somersby Fields Project. This approach is predicated upon demonstrating during Stage 1 of the project that all environmental issues can be appropriately managed and compliance with all relevant criteria / goals etc. can be achieved. The two stages of sand removal were introduced in Section 2.4.1.2 principally to give the Somersby Public School and wider community and the various relevant government agencies a level of confidence that sand removal would only proceed in Stage 2 once the Proponent has satisfactorily operated in Stage 1.

Not withstanding the assessments of impacts and provision of a range of design and operational safeguards for Stage 2 (covered in Section 4 of this document), the Department of Planning has requested that the *Environmental Assessment* present an overview of the final landform, land use and rehabilitation strategy for Stage 1 only in the event that Stage 2 operations do not proceed.

It is noted at the outset that all operational aspects of Stage 1 would be identical to that proposed in Sections 2.1 to 2.12. In the event sand removal ceases at the end of Stage 1/9, the Proponent would complete operations by removing the sand in Stage 2/4, to be reconfigured as Stage 1/10. **Figure 2.21** displays the proposed re-numbered sand removal sequence for Stage 1 with the exclusion of Stages 2/1, 2/2 and 2/3. It is noted that the area of sand removal defined on **Figure 2.21** covers approximately 15.8ha.

2.13.2 Final Landform

Figure 2.22 displays the proposed final landform for Stage 1 in the event that Stage 2 does not proceed. The bulk of the landform is comparable to the final landform at the end of Stage 2 – only the western boundary would be located approximately 130m further to the east. Similar final slopes ($\leq$1:4 (V:H)) would be created around the edge of the sand removal area.

2.13.3 Rehabilitation

Figure 2.23 displays the proposed rehabilitated landform for Stage 1 in the event that Stage 2 does not proceed. The principal components are similar to those for the rehabilitated landform at the end of Stage 2. The same rehabilitation principles for the entire site discussed in Section 2.12 would equally apply for Stage 1. It would be the Proponent's intention to confine the revegetation / habitat enhancement in the western fauna / flora corridor to the area depicted on **Figure 2.19**. The area between the corridor and western boundary of Stage 1 would be allowed to naturally regenerate until it was confirmed whether Stage 2 would proceed.

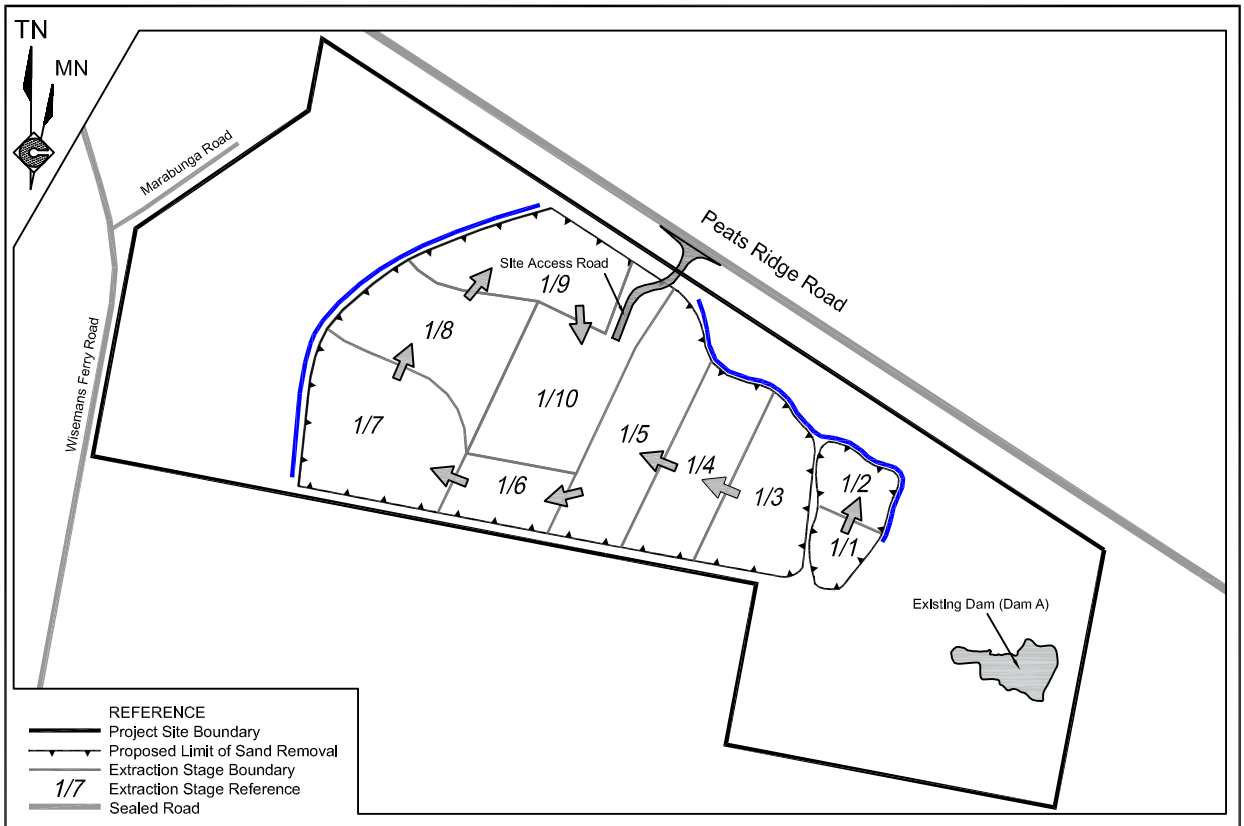


Figure 2.21
SAND REMOVAL SEQUENCE - STAGE 1

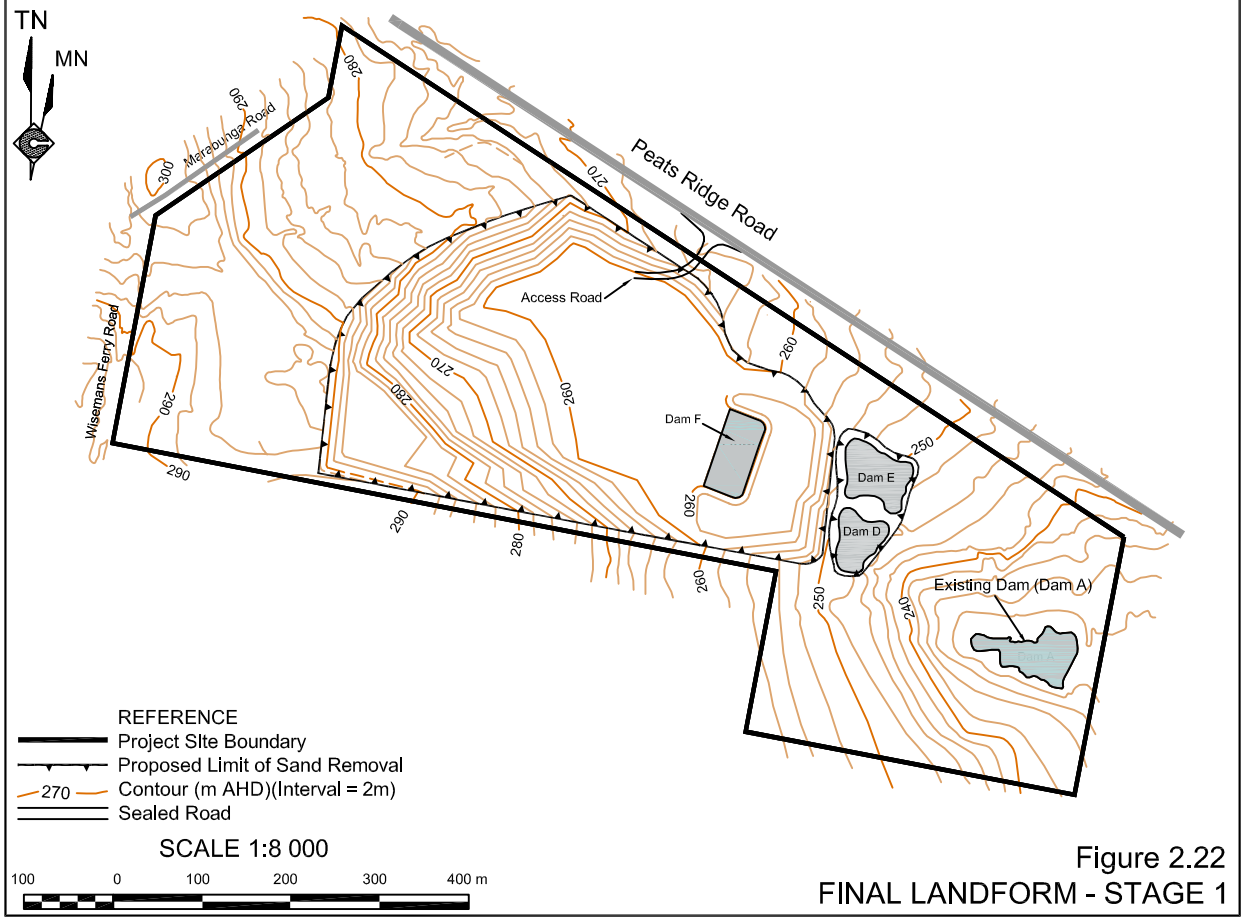


Figure 2.22
FINAL LANDFORM - STAGE 1

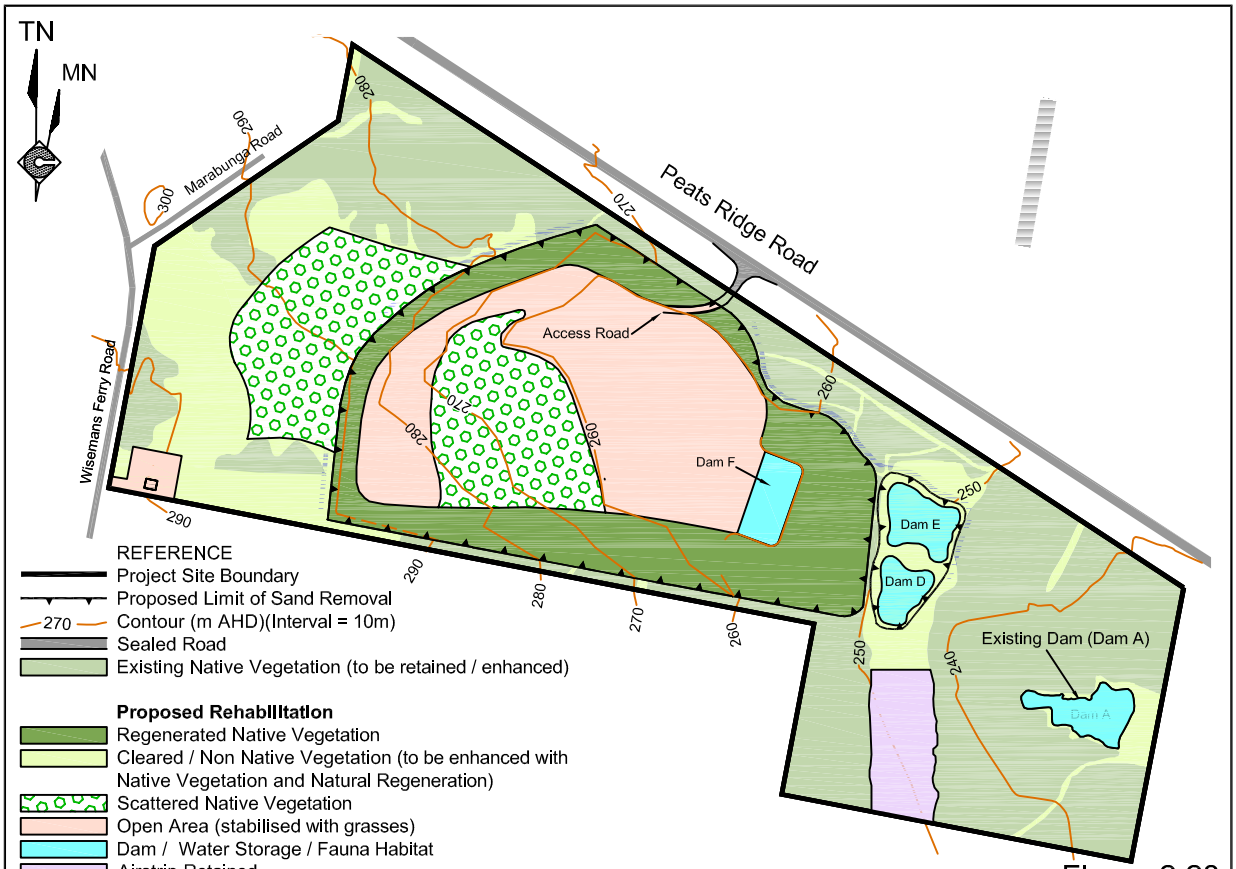


Figure 2.23
REHABILITATION - STAGE 1

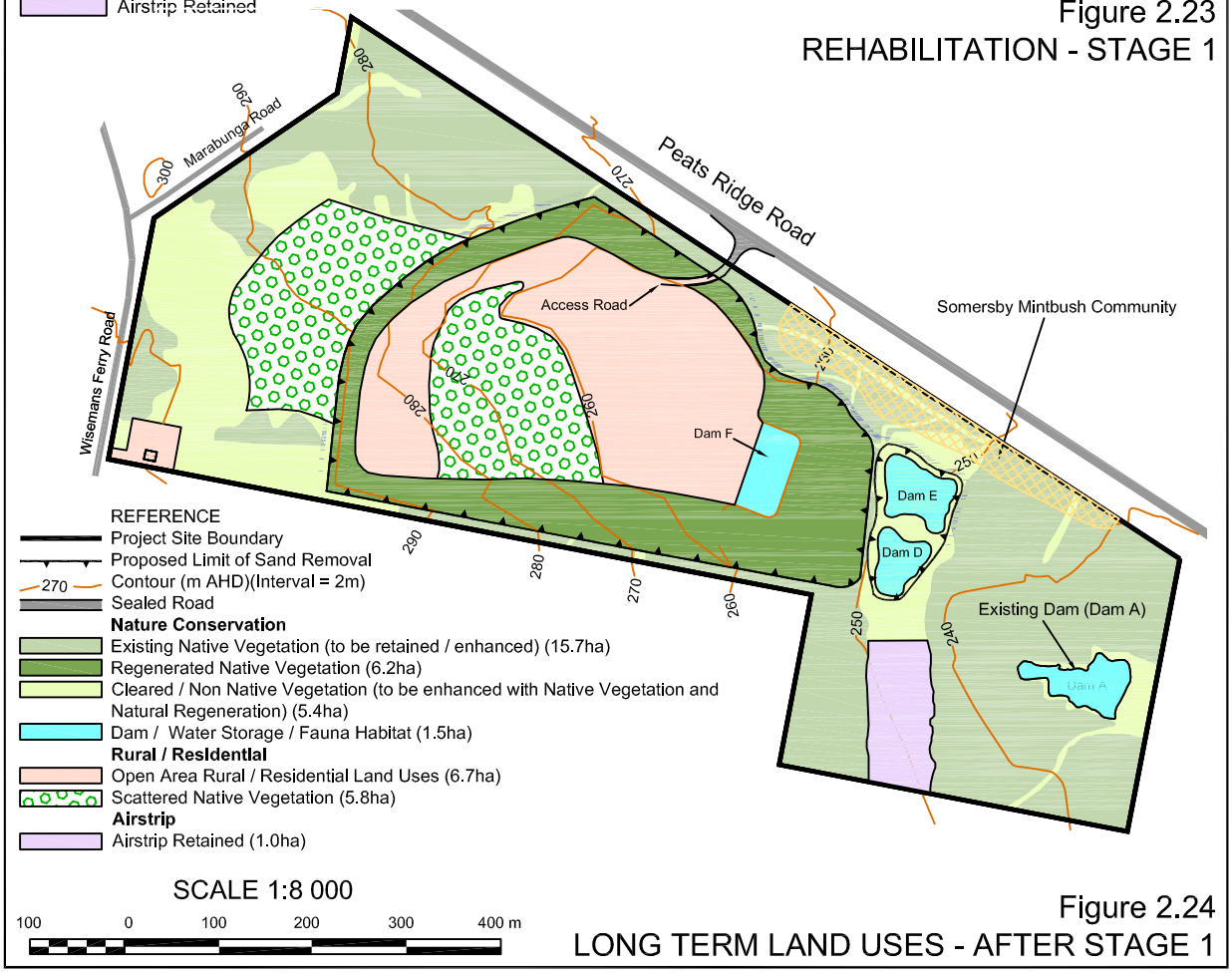


Figure 2.24
LONG TERM LAND USES - AFTER STAGE 1

2.13.4 Long Term Land Use

The long term land use following the completion of Stage 1 operations would generally be the same as that proposed at the end of Stage 2 and previously discussed in Section 2.12.7. **Figure 2.24** displays the distribution of the possible various land uses. It is envisaged the same (or similar) land title boundary re-adjustment would occur which would provide for the two rural / residential style dwellings consistent with the prevailing planning requirements at the time. **Figure 2.24** also identifies a 3ha area immediately west of the Stage 1 area that could be used in conjunction with the rural / residential land uses. The area available for rural / residential land uses on **Figure 2.24** would be comparable to that previously indicated on **Figure 2.20**.

If sand removal operations are only confined to Stage 1, the long term land uses on the Project Site would be comparable to those listed in Section 2.12.9.

Similar protective mechanisms would be put in place for the retained native vegetation and native revegetation as shown on **Figure 2.16**.

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