

Section 2

Description of the Project

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This section presents the Proponent's objectives and plans to develop and operate the Project. Details are presented of the extent of the sand resource, proposed extraction, processing, backfilling, product transportation and waste management. Operational information and details of services and employment are also presented.

Emphasis is placed throughout this section on presenting the Proponent's plans in a conceptual manner. More detailed plans would be formulated throughout the life of the Project to ensure the activities and final landform and landscaping are undertaken in a manner that accurately reflects all relevant constraints and site experience.

A summary of consultation undertaken and a review of the environmental issues identified are provided in Section 3 of this document. Details of the Proponent's plans to manage the various environmental issues identified including proposed safeguards and mitigation measures relating to groundwater, flooding, acid sulfate soils and sediments, and matters relating to ecology, traffic, noise, visibility, soil and air quality are presented in Section 4 of this document.



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2.1 OUTLINE OF THE PROJECT

2.1.1 Objectives

The Proponent's objectives for the development and operation of the Cudgen Lakes Sand Extraction Project ("the Project") are to:

- (a) provide the necessary fill materials (approximately 2 500 000m³) required to complete the Proponent's proposed development strategy for its landholdings within the Kingscliff / Chinderah / Cudgen area;
- (b) recover the remaining high quality fine sand resources to supply the region's construction industry;
- (c) provide a licenced facility capable of accepting and processing both non-acid generating virgin excavated natural materials (VENM(a)) and acid-generating virgin excavated natural material (VENM(b)); and
- (d) create a recreational lake with surrounding parkland, walkways and sporting fields consistent with the recreational and environmental land uses of the Proponent's strategic development plan for its landholdings.

These objectives would be achieved by:

- (i) hydraulic removal and transportation of sand from the southern extraction site to nominated sites (fill sites) to raise the level of the areas approved for backfilling on the subject land;
- (ii) mechanical removal and off-road transportation of sand from the northern extraction site to the processing area;
- (iii) progressive backfilling of the northern extraction site with VENM(a) and VENM(b) followed by sand placement and topsoiling to provide a surface suitable for sporting fields;
- (iv) concurrent production of fine-grained and blended sand products within the processing area at a rate that would meet the construction industry's requirements;
- (v) progressive backfilling of the margins of the southern extraction site with VENM(a), to pre-determined profiles around finalised lake edges, followed by progressive landscaping; and
- (vi) undertaking all activities in a manner that complies with all relevant statutory requirements and accommodates the reasonable expectations of surrounding landowners and residents.

As discussed in Section 1.1, the assessment of the activities involved in raising the elevation of the land within the fill sites external to the Project Site would be covered in the development applications for the activities within each individual fill site.



2.1.2 The Application Areas

For the purposes of describing the Project, reference is made to the “Project Site” and “Pipeline Corridors”. It is noted in the case of the pipeline corridors discussed in this subsection, that alternative corridors have been evaluated, which are addressed in Section 2.15.5.

2.1.2.1 Project Site

Components

The Project Site incorporates the following main components (see **Figure 2.1**).

- An extraction site north of Altona Drive (realigned) covering an area of approximately 9ha, namely the “northern extraction site”.
- An extraction site south of Altona Drive (realigned) covering an area of approximately 37ha, namely the “southern extraction site”.
- A “processing area” north of Altona Drive covering an area of approximately 3.7ha.

The Project Site covers approximately 67ha, approximately 50ha of which would be disturbed during the life of the Project. The remaining 17ha would include areas around the margins of each area of disturbance that would ultimately be included in the Proponent’s long term plan for its landholdings.

Land Description

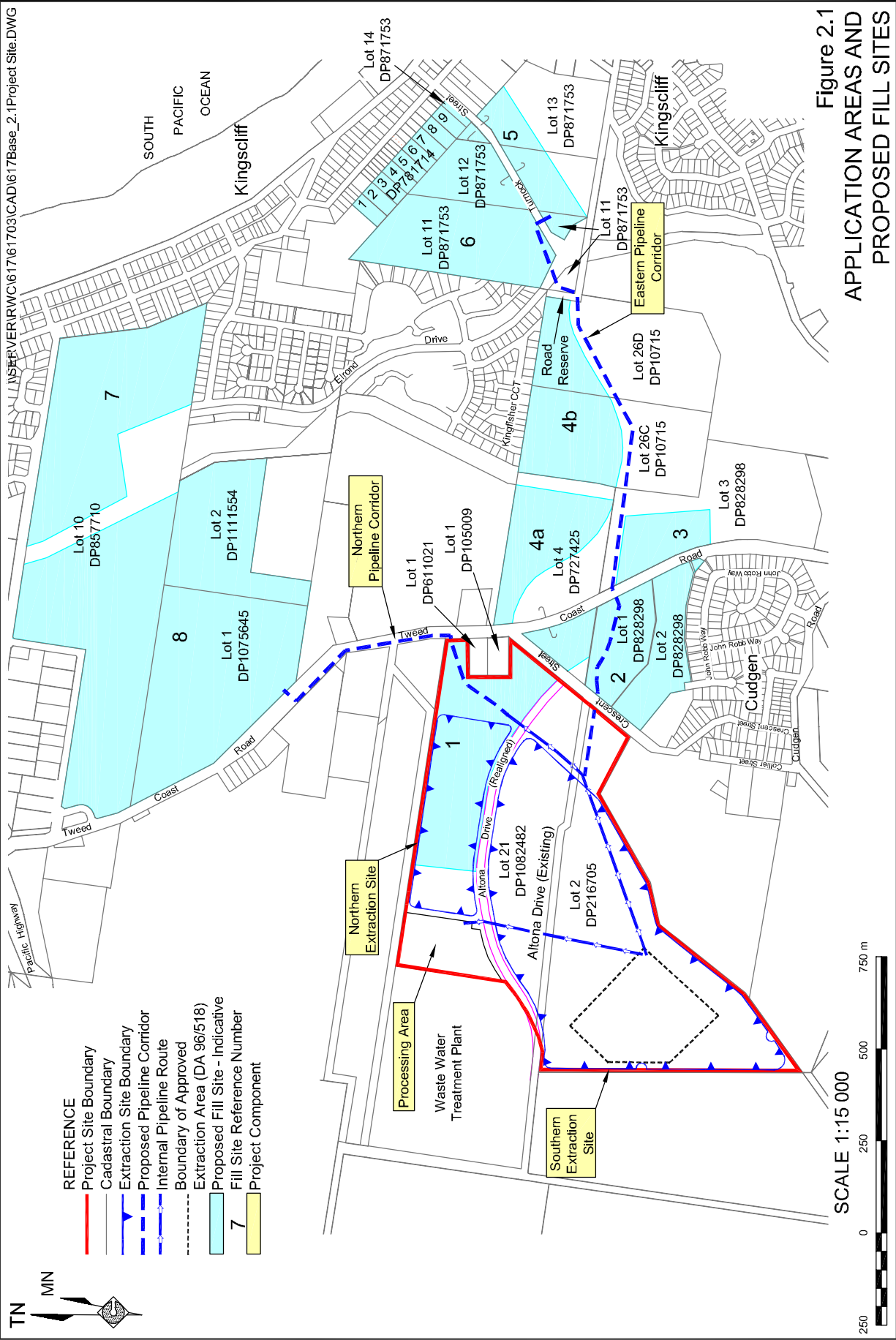
The extraction sites and processing area are located within Lot 21 DP 1082482 and Lot 2 DP 216705 together with the existing road reserve for Altona Drive. Both of these lots are owned by Gales-Kingscliff Pty Ltd. The existing Altona Drive road reserve is owned by Tweed Shire Council. The land within the proposed reserve for the realigned Altona Drive will be transferred into Council’s ownership and the ownership of the existing Altona Drive road reserve transferred to Gales-Kingscliff Pty Ltd following the completion of road construction.

Boundaries

The boundaries of the Project Site and individual component areas shown on **Figure 2.1** have been determined in the following manner.

- The boundaries of the Project Site encompassing the northern and southern extraction areas coincide with the boundaries of Lot 2 DP 216705 and Lot 21 DP 1082482.





- The boundaries of the northern extraction site coincide with the northern boundary of Lot 21, DP 1082482, the eastern boundary of the processing area and a 10m setback from the northern boundary of Altona Drive (realigned).
- The boundaries of the processing area coincide with the northern and western boundaries of Lot 21, DP 1082482 with a 25m setback from the northern boundary of Altona Drive (realigned).
- The northern boundary of the southern extraction site coincides with a 10m setback from the southern boundary of Altona Drive (realigned).
- The southern and western boundaries of the southern extraction site coincide with the boundaries of Lot 2 DP 216705 whilst the eastern boundary of the southern extraction site reflects the location beyond which the sand resource commences to thin noticeably.

2.1.2.2 Pipeline Corridors

Components

Two proposed “pipeline corridors” extend northwards and eastwards from the southern extraction site. These are referred to as the “northern pipeline corridor” (0.8km in length) and “eastern pipeline corridor” (1.5km in length).

The pipeline corridors have been set at 20m wide to provide adequate flexibility to position the sand supply pipeline either on or below the surface and to provide access during installation and for maintenance purposes. The exact location of the pipeline within the various road easements would be discussed with Tweed Shire Council and fully addressed in all relevant permits sought from Council. The pipeline corridors effectively extend from the edge of the Project Site to the boundaries of the land to be filled. The pipeline corridors have been positioned within existing or proposed road alignments / reserves to avoid the need to clear any trees or shrubs. The distribution, levelling etc. of the sand on each fill site would be covered in the development applications for each individual fill site.

Land Description

The proposed northern pipeline corridor:

- commences adjacent to the northeastern boundary of Lot 21 DP 1082482 owned by Gales-Kingscliff Pty Ltd;
- then is aligned for a distance of approximately 450m adjacent to the western side of Tweed Coast Road, and then crosses Tweed Coast Road, a public road controlled by Tweed Shire Council; and
- ends just beyond the boundary of Lot 1 DP 1075645 owned by Gales-Kingscliff Pty Ltd.



The proposed eastern pipeline corridor:

- commences adjacent to the eastern boundary of Lot 2 DP 216705 owned by Gales-Kingscliff Pty Ltd;
- then crosses Tweed Coast Road, a public road controlled by Tweed Shire Council;
- traverses Lot 1 and 3 DP 828298, Lot 26C and 26D DP 10715 owned by Gales Holdings Pty Limited, and an unformed road reserve between the eastern boundary of Lot 26D DP 10715 and Lot 11 DP 871753; and
- then crosses Elrond Drive and Turnock Street (both controlled by Tweed Shire Council) onto Lot 11 DP 871753 owned by Gales Holdings Pty Limited.

All public roads and road reserves are controlled by Tweed Shire Council.

All of the above land titles are shown on **Figure 2.1**. It is noted that the alignment of the proposed eastern pipeline corridor generally coincides with the alignment of the road proposed to be constructed within the Proponent's land between Tweed Coast Road and Turnock Street, however, the precise alignment of the proposed road is subject to approval. Importantly, the pipeline corridor would reflect the location of the approved road reserve.

2.1.3 Overview of the Project

The Proponent plans to recover the sand resource within the two extraction sites over a 15 to 20 year period whilst progressively rehabilitating both sites to provide for the proposed sporting fields north of Altona Drive (realigned) and recreational lake and related parklands and walkways south of Altona Drive (realigned).

The Proponent's Project comprises seven main components.

- (i) Hydraulic sand extraction and transportation to approved fill sites - this is the primary reason for the development of the Project.
- (ii) Hydraulic and mechanical removal, processing and production of sand products for the regional construction industry – this is the secondary reason for the development of the Project – focusing upon the resource remaining on the Project Site not required for (i) above.
- (iii) Receipt and, where possible, processing of VENM(a) to yield additional products for the construction industry.
- (iv) Progressive backfilling of the northern extraction pond and the southern extraction pond edges with VENM(a) unsuitable for processing.
- (v) Receipt and, where possible, processing of VENM(b) to yield additional products for the construction industry.



- (vi) Receival and internment/backfilling of VENM(b) beneath finalised sections of the extraction ponds.
- (vii) Development of a landform consistent with the broad development strategy to be implemented by the Proponent.

It is noted that all references to sand resources or sand pumped hydraulically to fill site are expressed in cubic metres (m³) whereas sand products or incoming VENM are expressed in tonnes (t) given they are despatched or arrive in trucks which are weighed to record tonnage.

All sand within the northern extraction site would be extracted by excavator and transported to the processing area using off-road trucks.

Sand that is hydraulically extracted from the southern extraction site would either be pumped directly to the nominated approved fill sites or alternately, pumped to the processing area. In both cases, a tailwater return pipe would be used to return water and entrained fines to the extraction pond. Sand at each fill site would be levelled and shaped as required in accordance with the conditions provided by separate development consents issued for their development. Some sand above the water table would also be removed using mechanical methods and transported using road trucks to the processing area. These materials would be dry screened and in some cases, blended with washed fine sand.

Within the processing area, sand would be washed to provide a fine-grained construction sand. Clay and silt particles removed during washing would be returned via a tailwater return pipe to the extraction pond.

It is proposed that the Project would also be licensed by the DECC to accept VENM(a) and VENM(b). All VENM would either be stockpiled in the processing area for processing or transported directly to either extraction site. VENM(a) not stockpiled for later processing would either be used as backfill within the northern extraction pond or placed around the finalised edges of the southern extraction pond. VENM(b) would either be placed:

- (e) beneath the northern or southern extraction pond surface in a finalised section of the extraction pond; or
- (f) at or adjacent to the active dredge face in the southern extraction pond. This latter VENM(b), suitable for use as a construction sand product, would then be passed through the dredge and processed. Clay and silt particles and fines separated during washing would be returned via the tailwater return pipe to beneath the extraction pond.

No contaminated materials (ie. materials with hydrocarbons, heavy metals or biological waste) or other wastes would be accepted or stored on the Project Site.

Products from the processing area would be transported to local and regional markets by conventional road truck and trailer.



2.1.4 Approvals Required

It has been established during the preparation of this document that four approvals are required from the NSW Government and Tweed Shire Council for the Project to proceed.

- (a) Project Approval (Part 3A of the *Environmental Planning and Assessment Act 1979*): Approval Authority – Minister for Planning.
- (b) A modification to the Environment Protection Licence 12385 (Section 58 of the *Protection of the Environment Operations Act 1997*): Issuing Authority - Department of Environment and Climate Change (Environment Protection Authority) (DECC(EPA)).
- (c) Road Construction Permit – Section 138 of the *Roads Act 1993* for road intersections (if not already constructed) and pipelines beneath Council roads and with road reserves.
- (d) A licence to pump water from the aquifer beneath the Project Site and to discharge water from the extraction sites in the event it is necessary to pump water following floods – Part 5 of the *Water Management Act 2000*: Approval Authority - Director-General of the Department of Water and Energy.

2.2 GEOLOGY, RESOURCES AND PRODUCTS

2.2.1 Geology

The geology beneath and surrounding the Project Site is presented on **Figure 2.2**. Roy (1973) described the Tweed River floodplain as a drowned river valley formed following sea level rise at the beginning of the Holocene, about 18,000 years ago. The sea level rise resulted in the landward movement of offshore marine sands and clays into the prior valley and the formation of a sand barrier. The basins behind these sand barriers progressively in-filled with estuarine material and today are relative mature floodplains. The depositional environment of the Quaternary sands is described as tidal deltaic, with the presence of shell and organic fragments throughout the sequence indicative of alternating marine and terrestrial influence during deposition (DPI, 2005).

In the area of the Project Site, fine to medium grained sands are underlain by finer grained marine silts and organic clays to about 38m depth. Basement is the Neranleigh-Fernvale Group which outcrops to the north of the Tweed River and to the southwest as shown on **Figure 2.2**. The Neranleigh-Fernvale Group is comprised of greywacke, slate, phyllite and quartzite. Tertiary basalt of the Lamington Volcanics overly the Neranleigh-Fernvale beds immediately to the south of the Project Site and form the Cudgen Plateau. The basalt is fine grained and black as fresh rock, but weathers to form deep red-brown good quality agricultural soils over the Cudgen Plateau. A thin band of beach and dune sands occurs adjacent to the coastline.



2.2.2 On-site Resources

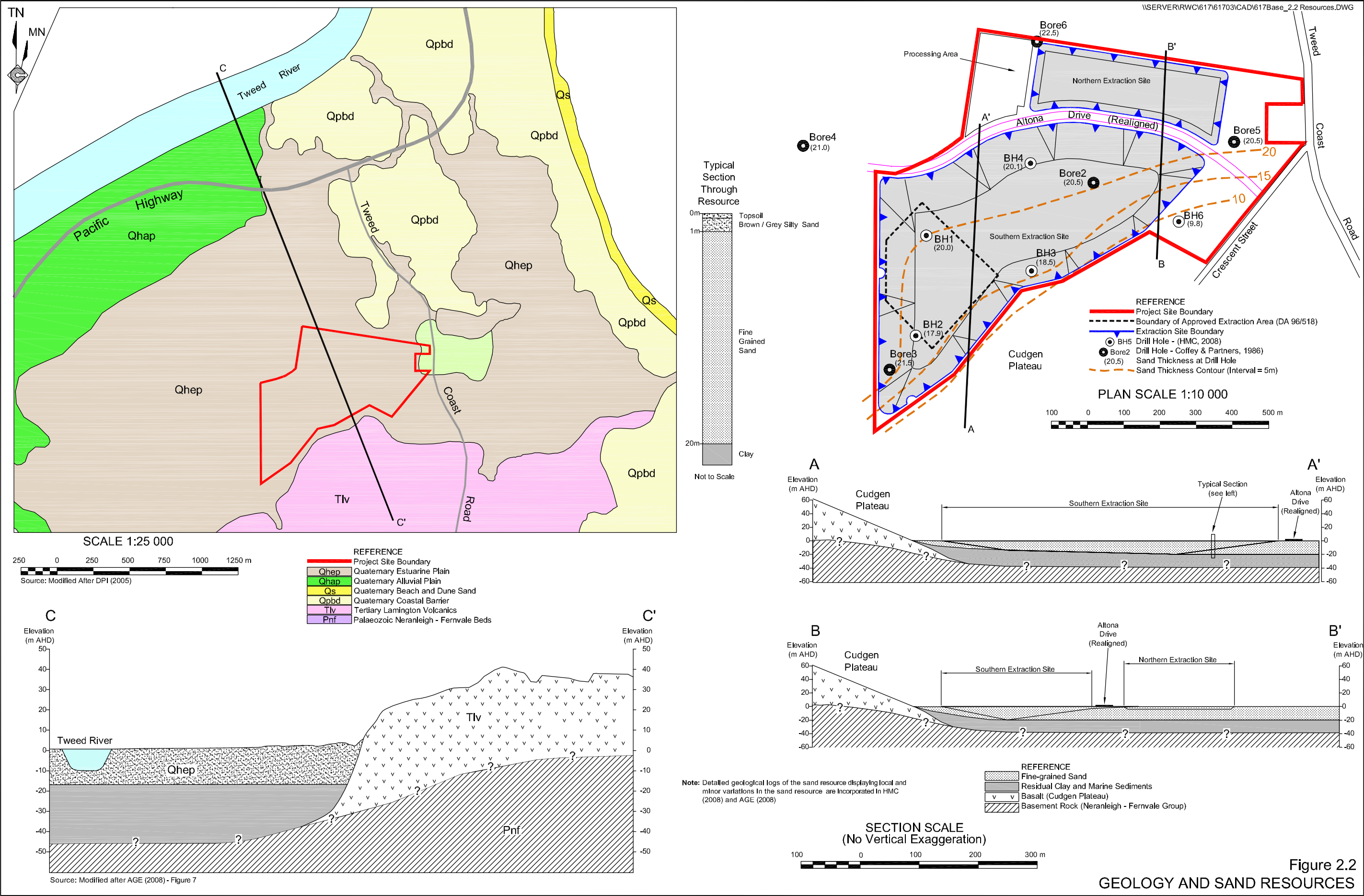
The principal resource within the southern and northern extraction sites is fine-grained sand with an overlying layer of loamy sand. The data relating to the sand resource is drawn from a range of geological investigations that have been undertaken since 1985 for the various proposals discussed in Section 1.4.3 and the current Project proposed by the Proponent. These investigations are as follows.

1. Coffey & Partners (1986) drilled six holes, five of which penetrated the full sand sequence and intersected the underlying clay. These holes established the sand resource over most of the Project Site varied from 20.5m to 22.5m.
2. AGC Woodward-Clyde Pty Limited (1992), drilled two clusters of three monitoring bores consisting of shallow, intermediate and deep bores. One cluster was located closer to the toe of the Cudgen Plateau whilst the other was located in the northwest corner of what is now the new Kingscliff WWTP. The drilled depth of the deep bore near the toe of the Cudgen Plateau reached 23.5m before reaching basal clay, whilst the northern bore reached a depth of 20m before reaching basal clay.
3. P. Guinane Pty Ltd (2005) recorded the thickness of sand on the lot immediately to the west of the Project Site although none of the holes drilled on that site penetrated the full sand sequence. It is noted from two shallow holes drilled near the eastern boundary of the P. Guinane Pty Ltd land that the loamy sand is marginally thicker in that area (2.2m to 3.0m depth).
4. HMC Environmental Consulting Pty Ltd (2008) also drilled six holes that penetrated the full sand sequence. Two of the six holes were located closer to the toe of the Cudgen Plateau and intersected sand thickness shallower than those recorded by Coffey & Partners, namely 17.9m (Hole BH 2), 18.5m (Hole BH 3) and 9.8m (Hole BH 6).
5. Agricola Consulting Services Pty Ltd (2004) and Wallarah Minerals Pty Ltd (2006) presented a range of data relating to size gradings and chemical analyses of the sand. The latter report is duplicated as **Appendix 5** of this document.

Information from each of the above sources is presented in a document compiled by R.W. Corkery & Co Pty Ltd which is available through the Digital Imaging of Geological System on the website of the Department of Primary Industries.

Data from drilling logs and previous resource studies referred to above indicate the base of the sand resource slopes northwards away from its edge on the Cudgen Plateau rapidly increasing to a depth of approximately 20m. The maximum resource depth on the Project Site is 22.5m at the northern side of the northern extraction site. The approximate lateral and depth extent of the sand resource contained within the northern and southern extraction sites is illustrated on **Figure 2.2**, based largely upon the drilling information from 1. to 4. above.





The sequence within the extraction sites comprises a thin, organic rich, sandy topsoil layer within the upper 0.3m which is underlain by between 0.5m and 1.0m of loamy sand except in the northwestern corner of the southern extraction site where it may approach 3m in thickness. The remaining profile consists of fine grained sand with a particle size between 150 and 600 microns. The sand has a 'silica' content (SiO_2) of between 91.7% and 94.8%, a shell content (CaCO_3) of approximately 0.02% to 1.88% and is relatively high in iron oxides (0.67% to 0.95%). The proportion of fine materials ($<75\mu\text{m}$) is comparatively low and typically $<2\%$.

The in situ quantity of sand within the southern extraction site is approximately 4 700 000m³ and 380 000m³ within the northern extraction site. These volumes have been calculated based upon the nominated extraction limits, proposed depths of extraction and a 1:5 (V:H) batter around the perimeter of the extraction area.

2.2.3 Off-site Resources

An important component of the Project would be the acceptance of a range of natural materials from off site that could be processed to produce a range of construction materials suited to the use of the local and regional construction industry.

Based on market research (see Ecoroc, 2007), it is expected that approximately 45 000t of VENM could be attracted annually to the Project Site for placement on site or processing. It is likely that the volume of VENM would increase significantly following commencement of operations, ie. once a licenced facility is made available. The nature of these resources would vary widely and would include both non-acid generating and acid generating fine sands, clay, gravel and rock. Notwithstanding their variability, the Proponent recognises that it is preferable for these materials that might otherwise be treated as waste be effectively "recycled" and used as alternatives to natural products, thereby extending the life of the natural resources throughout the region. It is estimated that approximately 50% of the VENM attracted to the site could be processed.

2.2.4 Processed Products

The Proponent proposes to produce a range of sand products derived from the sand resources within the Project Site and from a variety of VENM delivered to the Project Site. The main products that would be produced from the in situ sand resource include:

- fine-grained concrete/construction sand;
- mortar sand/brickies loam; and
- a fill sand for bedding pipes etc.

The fine-grained concrete / construction sand would have a size grading dominantly <600 microns and would be suitable for a range of concrete and other products. Mortar sand or brickies loam products would be adjusted to customer specifications but would generally contain approximately 10% of material <75 microns in size. Fill sand would essentially be the "raw" resource and consist of the fine sand between 150 and 600 microns together with shell fragments, and some 'oversize' material.



Whenever possible, the Proponent also proposes to produce a suite of graded sands, that is, sands with a range of grain sizes, through blending imported materials with on-site sand products. Where the imported materials have a high sand content, the Proponent would remove as much recoverable sand as possible and blend it with one or more of the site sand products and/or produce a separate product from the imported materials.

2.3 SITE ESTABLISHMENT AND CONSTRUCTION ACTIVITIES

2.3.1 Introduction

Site establishment and construction activities would include preparatory works for the sand processing operations and the dredging operations. For the purposes of the *Environmental Assessment*, it has been assumed that these works would occur concurrently.

The site establishment and construction activities would include:

- (i) boundary definition and fencing;
- (ii) earthworks for the processing area;
- (iii) construction of the processing plant and related infrastructure; and
- (iv) tree screen planting.

The locations of each of the site establishment and construction activities are shown on **Figure 2.3**.

The activities involved in the establishment of the sand extraction operations are discussed in Section 2.4.

2.3.2 Boundary Definition and Fencing

Surveying

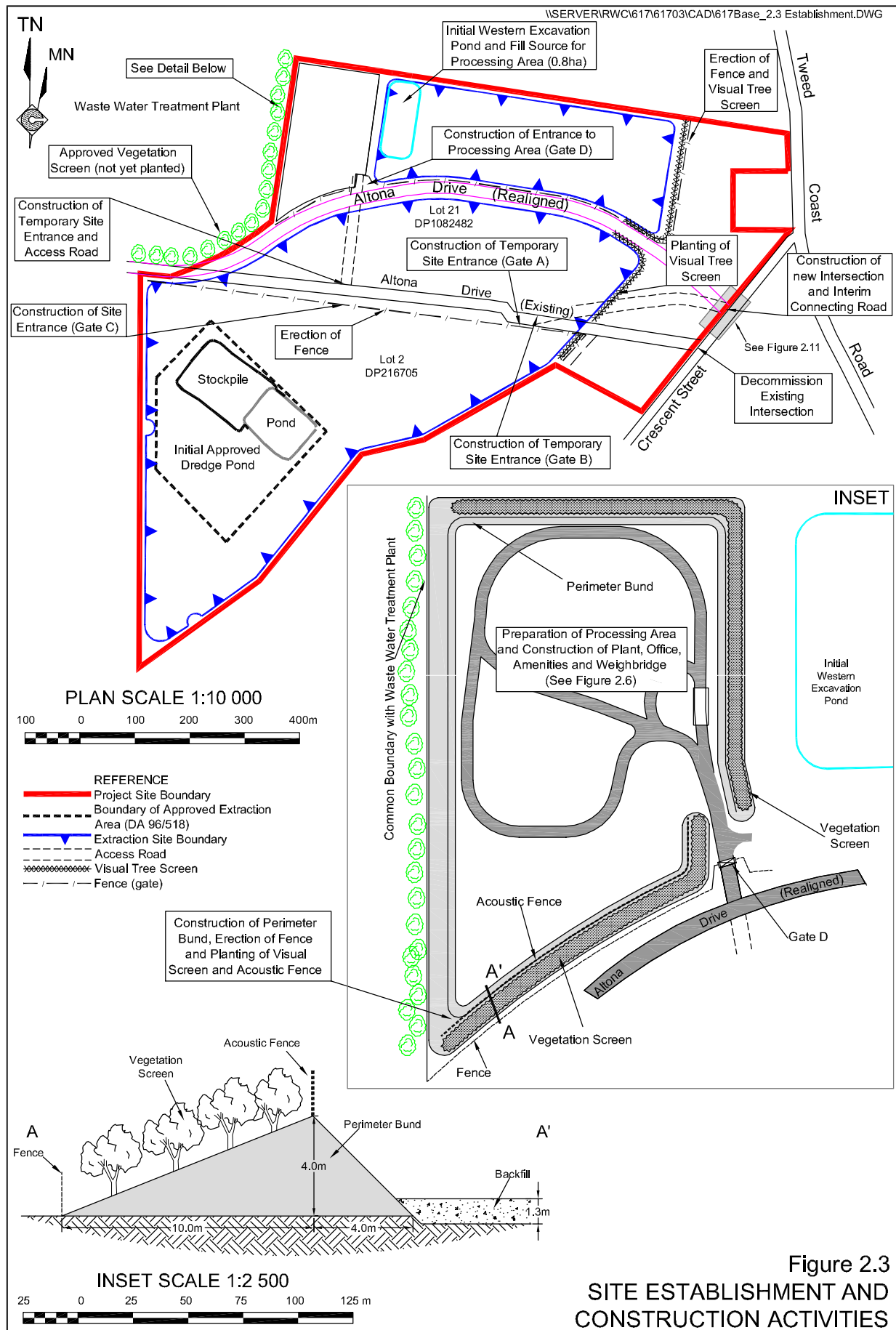
The boundary of each approved Project component would be surveyed to ensure the boundaries of the sand extraction sites, processing area, and site infrastructure, such as the access roads, are clearly marked at regular intervals to enable operators of earthmoving/dredging equipment to contain all disturbances within the approved boundaries.

Fencing

The Proponent would erect fencing adjacent to the southern boundary of the existing Altona Drive, the southern and eastern extents of the northern extraction site, along the eastern boundary of the southern extraction site and surrounding the processing area (**Figure 2.3**). The fencing around the processing area would be erected following the completion of various earthworks. The existing fence would be retained / upgraded along the southern and western boundary of Lot 2 DP 216705 and northern boundary of Lot 21 DP 1082482.

Gates would be erected at each of the entrances A, B, C and D.





2.3.3 Earthworks for the Processing Area

Soil Removal and Bund Wall Construction

Approximately 0.3m of topsoil would be stripped from the processing area and the adjoining initial western excavation pond and pushed up/shaped together with some sand excavated from the initial western excavation pond to form the perimeter bund around the processing area. In the order of 9 000m³ of topsoil and 7 000m³ of sand would be used to construct the perimeter bund around the processing area. The perimeter bund as shown on Section A-A on **Figure 2.3** would be up to 4m high and have a 1:2.5 (V:H) external batter and 1:1(V:H) internal batter.

Initial Extraction Pond

Within the southern extraction site, a substantial water body (the “initial extraction pond”), covering approximately 0.5ha and 5m deep (see Section 1.4.4), is available from the preparatory works (completed under DA 95/518) to position the dredge upon start-up. Given the capacity of the initial pond, the pond may be further enlarged using excavators or the dredge at a reduced pumping rate to allow for the commencement of dredging at the appropriate extraction rate.

Sand Filling

The elevation of the processing area would be raised through the placement of approximately 1.3m of sand over the entire 2.2ha within the perimeter bund. The 28 600m³ of sand would be extracted from the adjoining initial western excavation pond. The sand would be extracted by excavator and loaded into off-road trucks for transfer to the processing area. The sand would be placed against the inside of the perimeter bund (see Section A-A on **Figure 2.3**). Once placed across the processing area, the sand would be levelled by a bulldozer. Raising the height of the processing area would assist to reduce damage to equipment during flood events.

Internal Road Construction

The internal roads within the processing area would be formed with imported road construction materials to provide an all-weather surface for vehicles travelling within the processing area. The section of road between the weighbridge and Altona Drive (realigned) would be sealed to a comparable width to Altona Drive.

2.3.4 Processing Plant Construction

The construction of the processing plant would involve limited earthworks, laying of concrete foundations, delivery and placement of transportable office/amenity buildings, construction of weighbridge and workshop, erection of processing equipment and conveyors, electrical installation and erection of signage etc.



2.3.5 Tree Screen Planting

Following the completion of all other site establishment activities, an initial program of tree planting would be undertaken to establish a visual screen around the areas nominated on **Figure 2.3**. Details of trees and shrubs to be planted are discussed in Section 2.14.2.

2.4 SAND EXTRACTION

2.4.1 Extraction Site Design

The proposed extraction sites have been designed to maximise the recovery of the fine-grained sand resource within the context of the environmental and operational constraints relating to the defined sites. For both extraction sites, a 10m wide setback has been provided from the property boundaries and road reserve for Altona Drive (realigned).

Northern Extraction Site

The proposed northern extraction site covers an area of approximately 9ha and extends to a depth of 5m. Operational batter slopes would be formed at 1:4 (V:H) as the final pond would be progressively backfilled, avoiding potential stability issues on the margins of the pond.

Southern Extraction Site

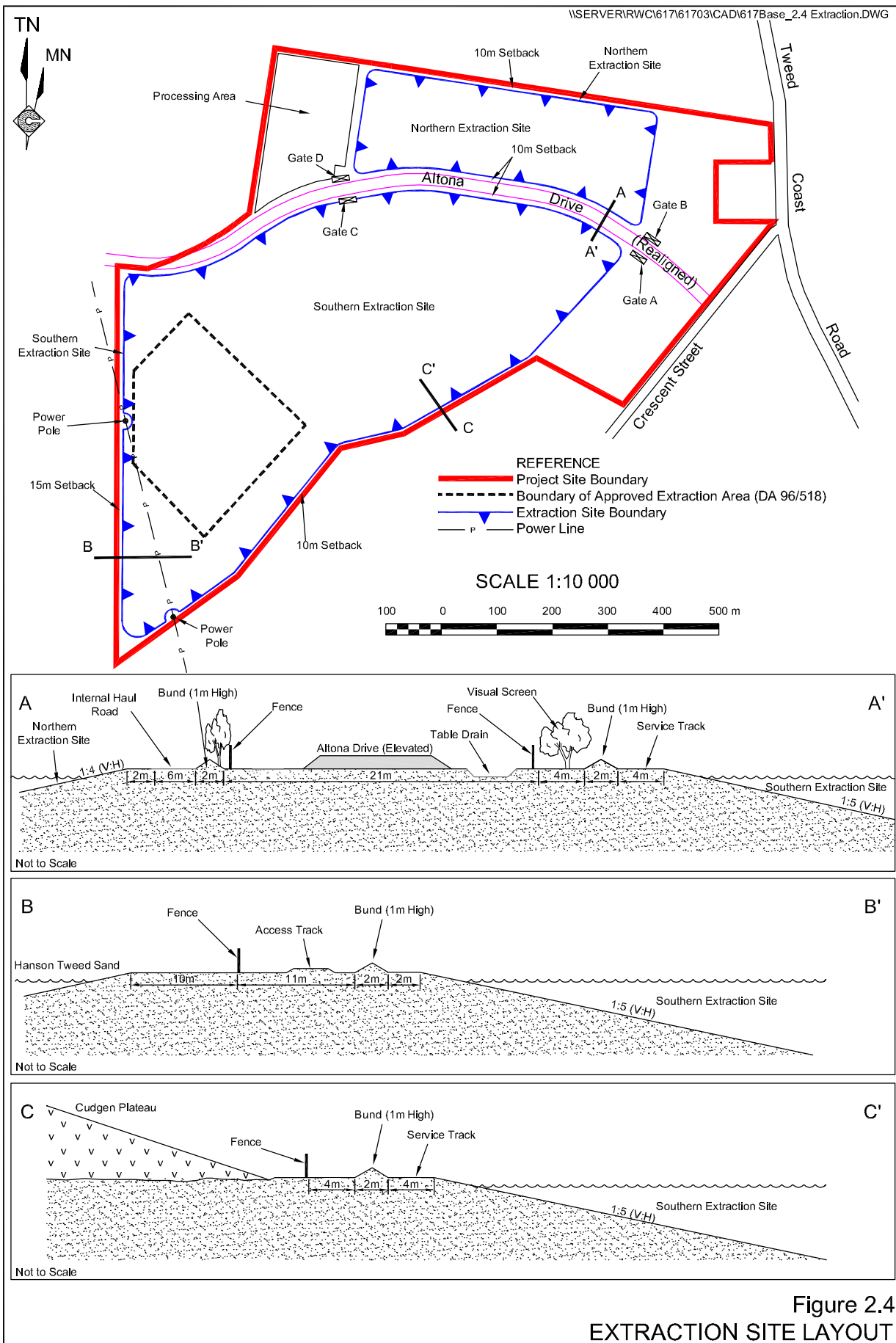
The proposed southern extraction site covers an area of approximately 37ha and would extend to a depth of approximately 20m or to the base of the sand resource. Operational and final batter slopes would be formed at the preferred long-term slope of 1:5 (V:H) to avoid potential instability on the edge of the extraction pond. Following consultation with Country Energy, a 15m setback would also be provided along the western property boundary and around the power poles located on the property boundaries in the southwestern section of the southern extraction site (see **Figure 2.4**). In consultation with Country Energy, the two power poles within the proposed limit of extraction would be removed and the poles on either side raised at the appropriate time in order to maintain the required clearance of the power lines.

2.4.2 Extraction Procedures and Methods

The procedures to extract the recoverable sand within the extraction sites would involve the following component activities.

1. Identification / marking of each nominated sand removal stage.
2. Soil removal and installation of surface water controls.
3. Extraction of recoverable sand by excavation and/or dredging.





Identification / Marking of the Nominated Sand Removal Area

Each active extraction stage would be clearly marked using a series of pegs positioned at regular intervals around the boundary of that stage. Slashing of the grass within the active extraction stage may also be used to more clearly define the boundary of each stage.

Vegetation Removal

The northern extraction site consists solely of grassland with no woody vegetation. Hence, no vegetation clearing would be necessary. No substantial vegetation exists within most of the southern extraction site, however, approximately 25 *Casuarina glauca* trees are present along the alignment of the existing Altona Drive. These would be cut down and removed ahead of the planned soil removal in that stage. Any groundcover present within the extraction sites would be removed during stripping of the topsoil.

Soil Removal and Installation of Surface Water Controls

Following the delineation of the next active extraction stage, topsoil would firstly be stripped to expose sufficient sand to be extracted for a period of up to 12 months. It is also noted that during the preparatory works in the southern extraction site, a suitable area for stockpiling of VENM(b) would also be formed. The topsoil would be stripped to a depth of approximately 0.3m and pushed up to form 1m high bunds with 1:3 (V:H) batters surrounding the area which has been stripped. Excess topsoil not required for creation of bunds or for rehabilitation would either be used for topsoil on other land owned by the Proponent, incorporated into sand products or sold without processing.

Defined sections of the 1m high bund (up to 50m wide) would be reduced to a height of 0.5m in order to provide a grassed spillway during flood events. A spillway would be installed within both the eastern-most and western-most bunds surrounding both the northern and southern extraction sites.

All topsoil bunds would be seeded with fast-growing grass species to stabilise the outer surface and would form part of the surface water control measures to prevent off-site runoff from disturbed areas entering the extraction sites. The bunding would not, however, prevent the extraction areas from being inundated during a major flood event. In the event of a major flood, the spillways would allow the flood waters to drain naturally from the extraction sites.

Extraction of Recoverable Sand

Northern Extraction Site

Following the removal of topsoil, the sand profile would be extracted to a depth of approximately 5m using a 30t or similar excavator. The upper 0.5m to 1.0m of loamy sand would be removed first after which the remaining sand profile would be excavated. Sand would be loaded directly into off-road trucks which would transport the sand via the internal road directly to the processing area for washing.



Southern Extraction Site

Following the removal of topsoil, the upper 0.5m to 1.0m of loamy sand would be extracted using a 30t excavator and/or swamp dozer. The loamy sand would be extracted starting at the point furthest within each stage from the extraction pond and moving back to within approximately 5m of the pond. A thin layer of the loamy sand would be left at the base of the excavation to minimise inflow of water from the water table.

The remaining sand profile would then be extracted using a 300mm cutter-suction dredge. The dredge would float on the pond and move backward and forward across the pond extracting from the underwater face of sand. Any parts of the sand resource above the water table would slowly slide into the extraction pond as the dredging operation advances across the pond. The sand/water slurry would be pumped directly from the dredge via a pipeline to the approved fill sites. The position of the dredge would be stabilised once or twice each day by the use of tie ropes connected to anchors on the banks of the extraction pond.

Following completion of the extraction within northern extraction site, a T-piece and manual valves would be installed within the pipeline from the dredge in order to control the destination of the sand dredged from the southern extraction pond (ie. to the nominated fill sites or the processing area). A campaign such as a one-week-on, two-weeks-off, or similar, campaign of pumping to nominated fill sites is likely to be used during periods when fill sand is required at the approved fill sites. During the 'off' week(s) of such campaigns, sand would be pumped to the processing area and sufficient stockpiles of processed products would be maintained within the processing area to meet the projected market demands during those weeks when sand is being pumped to the nominated fill sites.

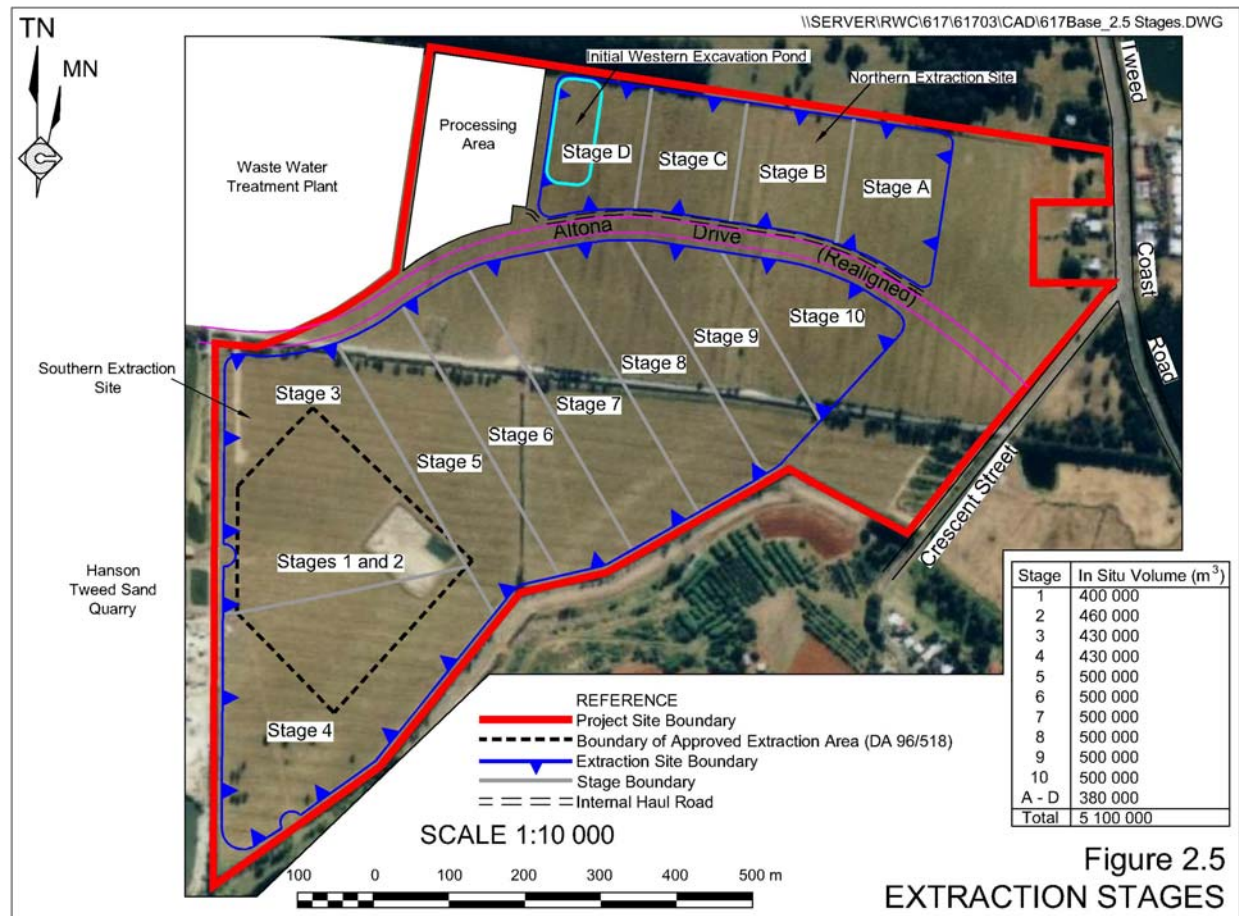
2.4.3 Extraction Sequence

Figure 2.5 displays the proposed sequence for the overall sand extraction program for both the northern and southern extraction sites.

Northern Extraction Site

Within the northern extraction site, extraction would be undertaken in four stages (Stages A to D). As previously discussed in Section 2.3.3, sand extraction is proposed within the initial western excavation pond to supply the sand needed for the processing area and as the initial VENM(b) receival area (see Section 2.6). Sand extraction for production purposes would commence at the eastern end of Stage A and progress to the west, recovering approximately 100 000m³ of sand in each stage. Extraction would be undertaken to a depth of approximately 5m.





Southern Extraction Site

Within the southern extraction site, dredging would commence within the 0.5ha initial extraction pond created within the approved extraction area under DA 95/518 expanding the pond to the full extent of the currently approved extraction area, recovering approximately 400 000m³ of sand (Stage 1). Stage 2 would involve the continuation of Stage 1 extending the depth of the pond from 8m to the full extent of the resource and involve the recovery of a further 460 000m³ of sand. The remaining sand extraction stages across the southern extraction site would each enable the recovery of between approximately 430 000m³ and 500 000m³ of sand ie. by extracting the sand resource to its maximum depth. Once the sand is recovered within and around the approved extraction area, the general sequence of extraction would be in an easterly direction.

Subject to the requirements for pumping fill sand to the fill site and the operation of the processing area, it is possible extraction within Stage A and Stages 1 and/or 2 would occur concurrently.

2.4.4 Extraction Rates

The maximum annual extraction rate would be in the order of 650 000m³. This would comprise a regular component of up to 200 000m³ of various grades of sand for supply to the construction industry with the remaining 450 000m³ of fill sand being intermittently extracted for hydraulic transportation to approved fill sites.



Up to 200 000m³ of sand would be extracted each year from the northern extraction site to supply a range of construction materials, although production is likely to commence at a level approaching 100 000m³ per annum and progressively ramp up to levels of approximately 200 000m³ per annum. The extraction rate would fluctuate according to the market requirements for the various sand products produced. It is noted that 200 000m³ of extracted sand would yield approximately 300 000t of products.

Up to 450 000m³ of sand would be extracted annually from the southern extraction site for the supply of fill sand, ie. during the period whilst sand is being extracted from the northern extraction site. Following the completion of sand extraction from the northern extraction site, the full 650 000m³ of sand for supply of both construction and fill materials would be sourced annually from the southern extraction site. In the event that extraction within the northern and southern extraction sites does not occur concurrently, the maximum annual extraction rate within the southern extraction site would be 450 000m³ at least for the first two years of extraction. Should monitoring of groundwater levels indicate that extraction activities are not adversely affecting groundwater levels, the extraction rate from the southern extraction area may be increased up to 650 000m³. In the event that less than 200 000m³ of sand is extracted to supply construction materials in any one year, the difference may be extracted for filling purposes, provided the maximum total extraction does not exceed 650 000m³. The volume of sand extracted in any one year for the Proponent's filling projects would depend upon several factors including timing for approvals for development of the nominated fill sites.

2.4.5 Mobile Equipment

Table 2.1 lists the mobile equipment proposed for use during site establishment and operation together with their frequency of use. Any decommissioned equipment would be replaced with equipment of similar capacity. The number of items of mobile equipment would vary depending upon the extent of sand production and the prevailing market requirements.

2.5 PROCESSING AND BLENDING OPERATIONS

2.5.1 Introduction

Sand suitable for use as construction materials would need to be processed to produce the sand products meeting specifications required by customers. Washing of the extracted sand is required to remove a range of impurities naturally present within the sand e.g. shell, mud, vegetation etc whilst screening and blending would be undertaken to remove oversize or add particular size fractions. The extent and type of processing would be dependent upon the specifications of the products required.



Table 2.1
Operational Mobile Equipment

Equipment*	Number	Use	Duration/Frequency
300mm Cutter – Suction Dredge	1	<ul style="list-style-type: none"> Sand extraction (southern extraction site only). 	<ul style="list-style-type: none"> up to 11 hours/day continuous (for fill sand). up to 15 hours/day continuous (for construction sand).
D6 Swamp Dozer (or equivalent)	1	<ul style="list-style-type: none"> Topsoil removal and shaping of bunds. Pushing up loamy sand. Pushing and shaping VENM. 	<ul style="list-style-type: none"> 4-6 times per year for 5 days per campaign.
950 Front-end Loader (or equivalent)	2	<ul style="list-style-type: none"> Stockpile management and loading product. Adjustment of dredge anchor points and pipeline. Loading of treated loamy sand and VENM. 	<ul style="list-style-type: none"> Continuous during operational hours.
10 000L Fuel tanker	1	<ul style="list-style-type: none"> Re-fuelling of static equipment (pumps & dredge) 	<ul style="list-style-type: none"> Once daily, as required.
30t Excavator	2	<ul style="list-style-type: none"> Construction of water management structures and site maintenance. Extraction of loamy sand from extraction sites. Extraction of fine sand from northern extraction site (1 excavator only). Management of VENM placement. 	<ul style="list-style-type: none"> 4-6 times per year for 5 days per campaign. 11 hours/day continuous (maximum during extraction of fine sand).
15 000L Water truck	1	<ul style="list-style-type: none"> Dust suppression. 	<ul style="list-style-type: none"> Operational hours.
Crane	1	<ul style="list-style-type: none"> Plant erection and initial dredge placement. 	<ul style="list-style-type: none"> When required.
Road Truck	1 to 3	<ul style="list-style-type: none"> Transportation of loamy sand (extracted using excavator) adjacent to the active extraction pond (southern extraction site only). Transportation of treated loamy sand and VENM from southern extraction site to processing area. 	<ul style="list-style-type: none"> 4-6 times per year for 5 days per campaign. 2-3 hours per day or 1 day per week
Off-road Truck	1 to 2	<ul style="list-style-type: none"> Transportation of sand from northern extraction site to processing area. 	<ul style="list-style-type: none"> 11 hours/day (maximum)
Street Sweeper	1	<ul style="list-style-type: none"> Removal of sand/mud from Altona Drive. 	<ul style="list-style-type: none"> Once daily, as required.

*Does not include equipment use to develop fill sites.



The Proponent also intends to process a range of virgin excavated natural materials (VENM) imported to the Project Site that would otherwise be destined as fill materials. The opportunity exists to either produce blended products with on-site sand resources or specific products reflecting the characteristics of the VENM.

None of the sand extracted for filling purposes on the various fill sites would need to be processed.

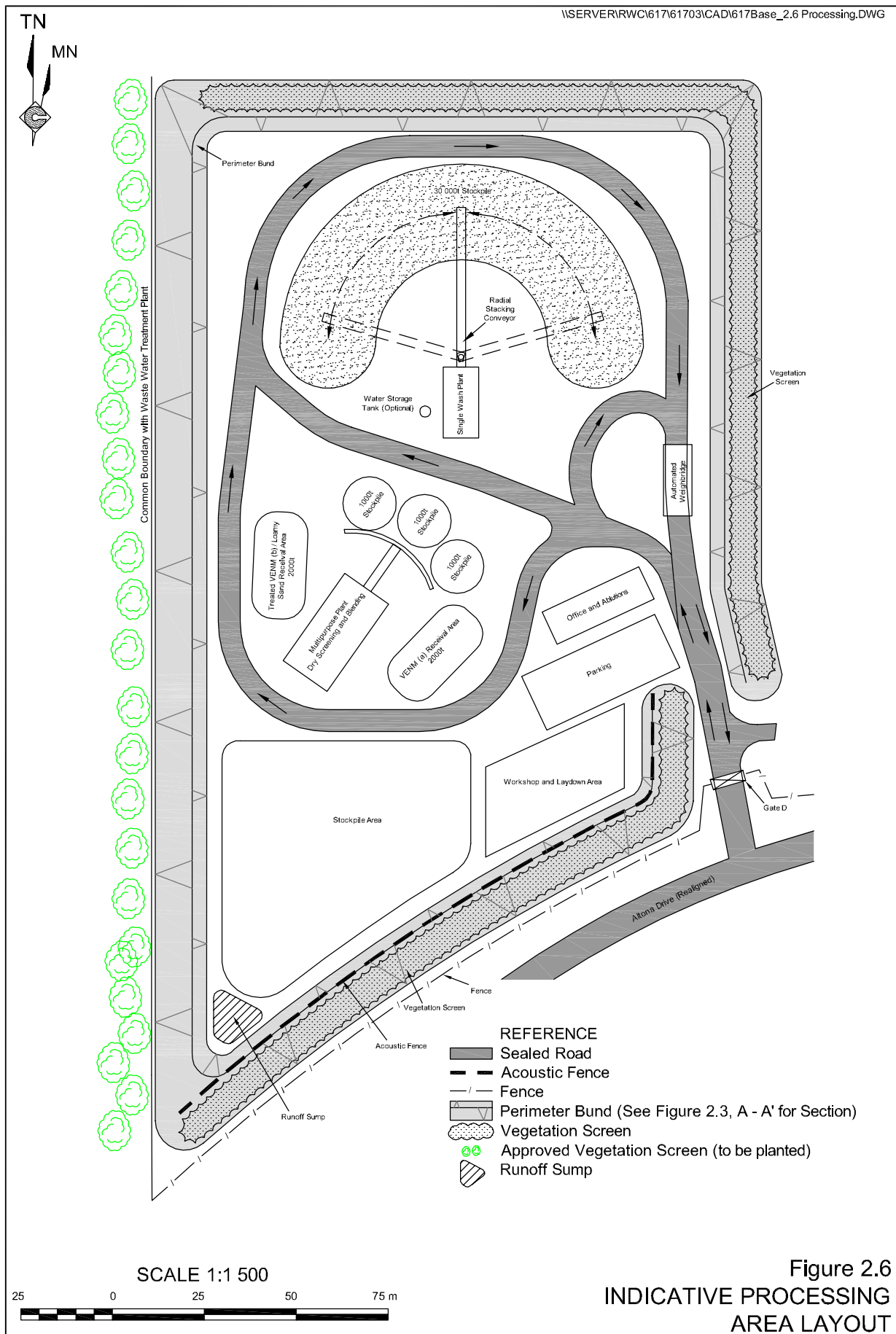
2.5.2 Processing Area Layout and Design

Figure 2.6 displays an indicative layout of the processing area. The main components within the area comprise the following.

- A single wash plant.
- Multipurpose plant with dry screening and blending capabilities.
- VENM(a) receival area (2 000t capacity).
- Two circular, one-way, access roads.
- Bunded area for storage of treated VENM(b) and loamy sand (2 000t capacity).
- General storage area.
- Water storage tank for the wash plant (optional).
- Workshop for maintenance of mobile equipment.
- Office and ablutions block.
- Automated weighbridge.
- Parking area.
- Runoff sump.
- A perimeter bund, vegetation screen and security fence.

The internal area of the processing area would cover approximately 2.2ha (and a total area of 3.7ha) and be surrounded on all sides (except for a gap for access) with a 3m high continuous perimeter bund and vegetation screen. An acoustic fence at least 1.8m high would be constructed on part of the southern bund to reduce operational noise levels to the south. The outer surface of the perimeter bund would be established with fast growing grass species. A vegetation screen would subsequently be planted on the outer northern, eastern and southern slopes of the bund to provide enhanced visual screening.





A runoff sump would be constructed in the southwestern corner of the processing area and all runoff within the processing area would be directed to the sump. Any overflow from the sump would drain through piping to the southern extraction pond.

Access to the processing area would be provided through a gap within the southeastern corner of the perimeter bund with two roughly circular, one-way, access roads facilitating simple truck movements and providing access to the processing plants and product stockpiles with sufficient area for several product trucks to be loaded at any one time. All employee and visitor vehicles would be parked within the defined parking area adjacent to the site entrance. All product trucks would exit over the automated weighbridge.

2.5.3 Sand Washing Operations

Washing through the single wash plant would be the main processing undertaken for the recovered sand to be sold for construction materials. The wash plant would have a production capacity of approximately 250 tonnes per hour (tph). Raw sand would either be loaded into the wash plant hopper by off-road trucks from the northern extraction site or pumped directly from the dredge within the southern extraction site. The wash plant would remove any impurities (eg. vegetation), fine particles (ie. silts and clays) and oversize materials eg. shells or clay balls. All fines separated during the process would be returned via the tailwater return pipe near the base of one of the extraction ponds. The washed sand would be stockpiled using a radial stacker positioned centrally above the 30 000t capacity stockpile area on the northern side of the processing area. The stockpile would have a maximum height of approximately 8m to 10m. From time to time, washed sand would be relocated by a front-end loader and stockpiled within a nearby area.

2.5.4 Screening, Blending and Processing Other Products

The processing of the loamy sand and other sand products and the recycling of suitable VENM would be undertaken using the multipurpose plant. The multipurpose plant would have the ability to simply screen the loamy sand or screen and blend dredged sand with either loamy sand extracted on site or VENM delivered to the processing area. The plant would operate with a throughput of between 50tph and 200tph depending on product type with a daily average of up to 100tph. Loamy sand and/or VENM may be screened and blended with dredged sand to provide various other products including mortar sand / brickies loam and mixed graded sands. Additionally, some of the sandier VENM(a) could be screened and either blended with sands produced on site or sold without further blending.

Screening of loamy sand (and blending with washed sand) would commence early in the life of the Project. Processing of other products and blending would commence when appropriate material becomes available.



The multipurpose plant would have a radial stacking conveyor with the ability to place individual products on separate stockpiles. Individual stockpiles would typically be approximately 1 000t.

Any VENM not suitable for processing and any unsaleable material would be placed in defined backfilled areas around the margins or base of the extraction ponds.

2.6 VENM RECEIVAL, TREATMENT AND BACKFILLING OPERATIONS

2.6.1 Introduction

The Proponent proposes to receive a range of virgin excavated natural materials (VENM) at the Project Site for processing and/or use as backfill. VENM(a), ie. materials that don't generate acid, would either be used to:

- (a) progressively backfill the northern extraction pond and cap the VENM(b) materials placed towards the base of the pond; or
- (b) create a final landform suitable for wetlands and surrounding parkland around the southern extraction pond in accordance with the planned recreational and environmental land uses of the area.

Additionally, VENM(b) not suitable for processing would either be used to backfill the northern extraction pond from below approximately -1m AHD or be interned beneath the finalised lake sections of the southern extraction pond. **Figure 2.7** presents a flow chart for the receipt and handling of VENM. The following subsection details the management of VENM receipt, treatment prior to processing and backfilling sequencing and procedures.

2.6.2 VENM Receipt Procedures

The procedures adopted to receive VENM would reflect the DECC's conditional requirements on the Environment Protection Licence for the site.

These requirements are likely to relate to:

- 1. a pre-acceptance validation of the VENM;
- 2. verification at the time of delivery; and
- 3. an inspection and audit program.



The pre-acceptance validation would often involve a site inspection by the Proponent's representative or agent to inspect the location and setting of the origin of the VENM and to confirm the validation testing intended.

The general procedure for verification at the time of delivery would involve the driver of the vehicle delivering the VENM firstly reporting to the office within the processing area. Validation papers would be reviewed and verified, after which the truck would be directed to pass over the weighbridge and then to the appropriate receival area. VENM(a) would either be delivered to:

- (a) the VENM(a) receival area within the processing area; or
- (b) the nominated delivery area adjacent to the northern or southern extraction pond for use as backfill.

VENM(b) suitable for processing would either be:

- (a) stockpiled within the bunded area surrounding the active extraction pond within the southern extraction site for treatment; or
- (b) placed within the extraction pond at the active face.

This material would ultimately be recovered by the dredge and pumped with the in situ sand to the processing area. VENM(b) recognised to be unsuitable for processing would be placed into a finalised section of either the northern or southern extraction ponds on the day of its delivery to the Project Site. This is a standard practice adopted elsewhere in NSW for the placement of VENM(b) materials, eg. materials excavated from the M5 East Tunnel and delivered to the Dunmore Sand Quarry.

No VENM or other wastes which are contaminated would be accepted or stored on the Project Site.

Following the delivery / unloading of VENM, the Proponent's representative would undertake regular inspections to ensure the material delivered is consistent with the material approved.

Every quarter, coinciding with the end of the period for submitting an Environment Protection Licence return, the Proponent would randomly sample the delivered VENM to confirm the quality of the materials being delivered. The proposed monitoring of the water in the respective ponds would also be used to verify that no inappropriate VENM has been placed into the pond.

2.6.3 VENM(b) Treatment

VENM(b) delivered to the southern extraction site and loamy sand extracted on site (likely to contain potential acid-forming materials) would be stockpiled within a suitable area near the active extraction pond. The base of the stockpile areas would be treated with an alkaline amendment such as lime prior to the laying down of the material. The materials themselves would also be treated using an alkaline amendment. It is expected that between 1 and 3 months would be allowed for treatment of these materials prior to their use in production of mortar sand or other construction materials. Regular tests would be undertaken of materials prior to and following treatment to ensure sufficient alkaline amendments have been added.



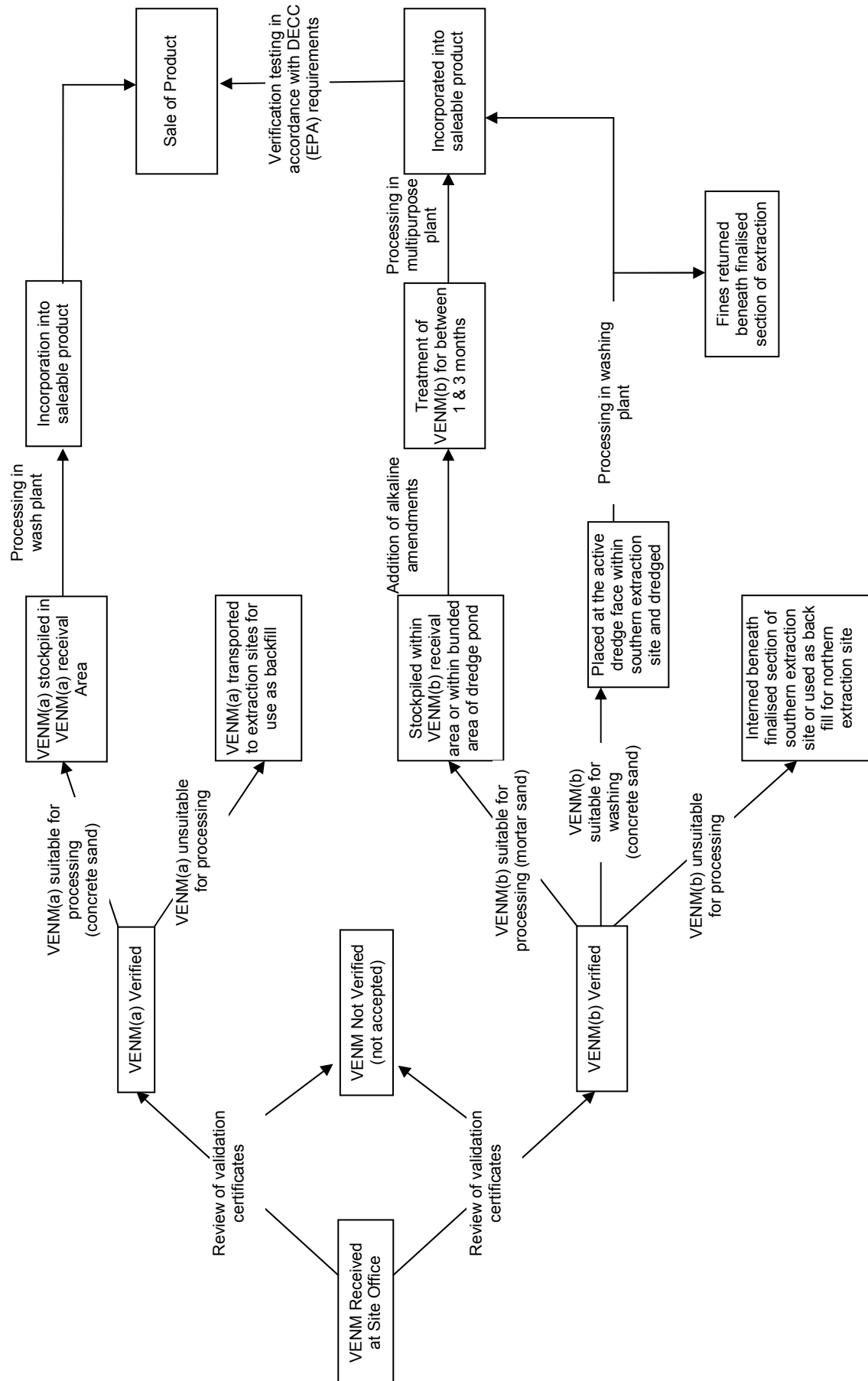


Figure 2.7
VENM MANAGEMENT FLOW CHART



Additional regular testing of products produced using the treated VENM(b) and/or loamy sand would also be undertaken to ensure that relevant DECC(EPA) criteria are complied with.

No untreated VENM(b) would be stockpiled within the northern extraction site or processing area.

2.6.4 Backfilling Sequence and Procedures

VENM(a) not used in production of saleable products would either be used to backfill the upper sections of the northern extraction pond or deposited along the edges of finalised sections of the southern extraction pond.

Within the southern extraction site, the swamp dozer and/or 30t excavator would then be used to push/move VENM suitable for creating a slope of 1:10 (V:H) for approximately 10m from the shoreline forming an area suitable for wetland establishment. It is expected that backfilled material further than 10m from the edge of the extraction pond would settle underwater at an angle of between approximately 1:3 and 1:6 (V:H) depending on the nature of the VENM (see **Figure 2.8**). In order to create these wetland areas, between approximately 9m³ and 15m³ of VENM(a) would be required as backfill for each lateral metre of shoreline of the final lake. Additional backfilling would also be undertaken to reclaim portions of the shoreline, providing flat areas surrounding the final lake. The length of the shoreline backfilled to create wetlands and reclaim lake edges would be dependent on the volume of suitable VENM(a) received. In the event that limited volumes of suitable VENM(a) are received, focus would be placed upon the formation of a consolidated wetland area, preferentially across the southern boundary of the Project Site adjacent the Cudgen Plateau.

During the early stages of extraction within the northern extraction area, whilst sufficient volume is being created for the receipt of VENM(a) and/or VENM(b), all VENM received that cannot be processed would be placed into the initial western excavation pond.

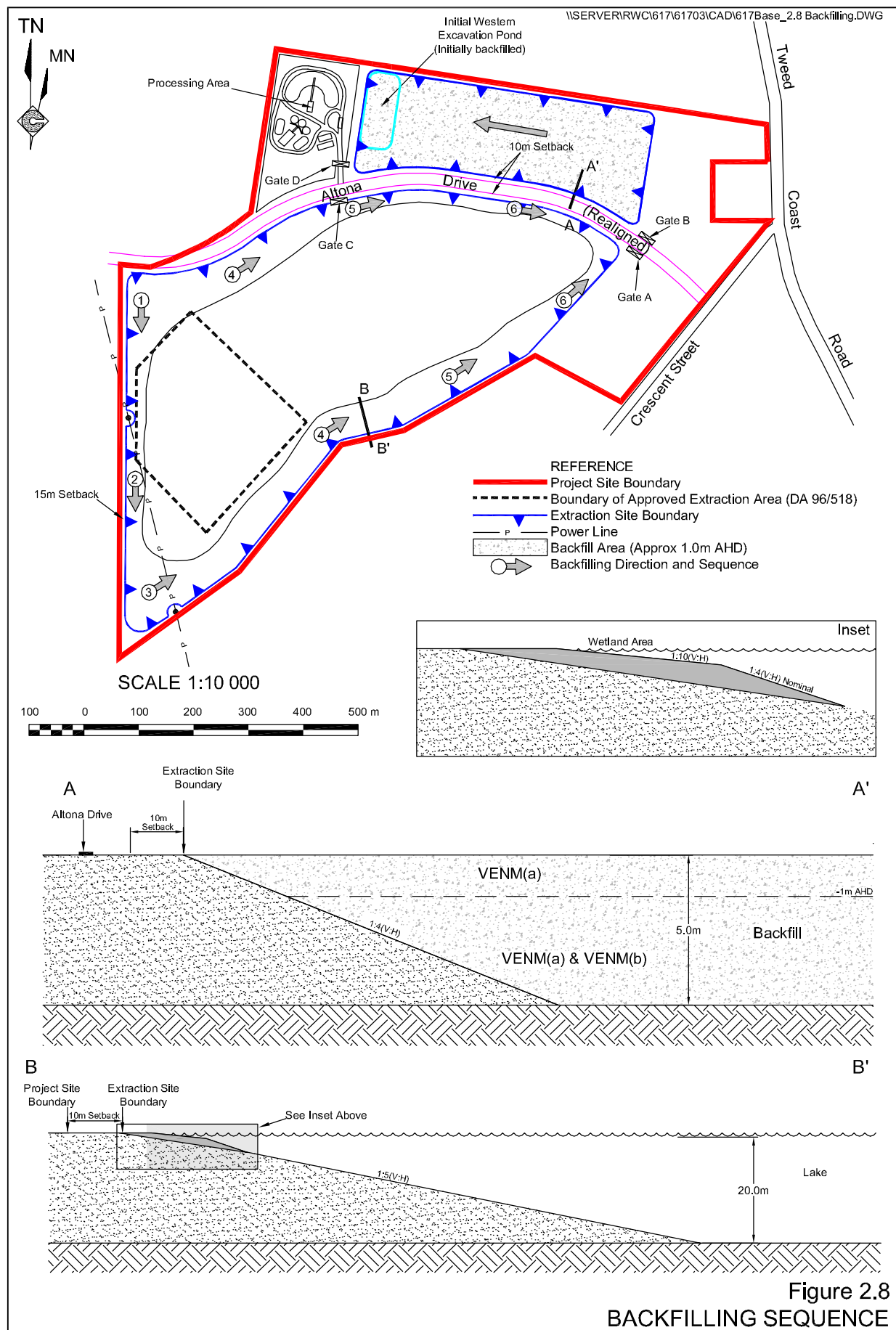
Backfilling of the remainder of the northern extraction pond would occur progressively from east to west following the recovery of the sand resource. VENM(b) would always be placed within the pond and pushed by the excavator bucket below -1m AHD. VENM(a) would preferentially be used to backfill sections of the extraction pond between -1m AHD to ground level (approximately 1.0m AHD). Approximately 380 000m³ of VENM would be required to backfill the northern extraction pond to existing ground level. Separate approval would be sought for any additional filling of land to raise the level of the land above the existing ground level within Lot 21 DP 1082482.

2.7 WASTE MANAGEMENT

2.7.1 Introduction

Waste generated by the Project would be either related to extraction and processing operations or involve the production of general wastes.





The extraction and processing operations would result in the mobilisation and separation of potentially acid generating pyritic fines and sediments while the extraction of the loamy sand would also expose potentially acid materials. Furthermore, a range of acid producing materials would be received on site (ie. VENM(b)). A small amount of oversize material may also be produced during the processing operations though it is unlikely to be acid generating.

General wastes associated with equipment maintenance, and operating the weighbridge / office would also be generated.

The following subsections describe the nature of these waste materials and their management.

2.7.2 Acid Generating Materials

Acid generating pyritic fines mobilised as a result of extraction would be largely removed from the product sands during the washing process. The process water that passes through the washing plant would remove the bulk of pyritic fines and sediments. During deposition of sand at each fill site, the fines would remain within the tailwater and return to an on-site tailwater pond. In both cases, the process water or pond water would be returned via a tailwater return pipe and, using a snorkel, the fines would be deposited above a section of the extraction pond floor that has been fully extracted. In the event that a finalised section of the southern extraction pond is not available, a separate temporary return pond would be created to temporarily store and contain the fines. As the operation proceeds, the fines would be re-pumped directly to a finalised section of the southern extraction pond.

Additionally, as discussed in Section 2.6.2, VENM(b) materials would also be deposited within the extraction ponds. VENM(b) suitable for passing through the dredge would be deposited within the path of the active dredging area in the southern extraction site whilst VENM(b) not suitable for any form of processing would be deposited beneath the pond surface of a completed section of the pond. Furthermore, any excess VENM(b) which cannot be processed would also be deposited beneath the pond surface. All fines, sediments and VENM(b) interned beneath the surface of the southern extraction pond would be covered by a minimum of 2m of water to avoid potential remobilisation through wind or wave action on the dredge pond surface. This depth of water has been demonstrated at Dunmore Sand Quarry (south of Wollongong) to be adequate for the fines not to oxidise and adversely affect the acidity of the pond water. Within the northern extraction site, all VENM(b) and fines placed within the extraction pond would be covered by at least 2m of VENM(a) and hence would not be subject to remobilisation.

Regular testing of the water within the extraction ponds would also be undertaken to ensure that the water quality meets relevant guidelines and standards. Section 4.2.11 further describes the proposed water quality monitoring and management.



2.7.3 Oversize Materials

Small amounts of oversize materials would be generated during screening operations (approximately 1% to 5% of screened materials). Oversize is likely to comprise large shell fragments, oversize rock fragments and clay balls dredged from the base of the extraction area. Screened oversize would be placed within the VENM(a) receival area and placed in the same manner as VENM(a). In the event that any oversize is suspected to be potentially acid producing, it would be interned beneath at least 2m of water.

2.7.4 General Waste

All routine servicing of earthmoving and dredging 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 storage would occur on site.

All paper and general wastes originating from the office, ablutions, 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 licenced waste disposal contractor on an as-needs basis. All wastes capable of being recycled would be separately stored and removed by a licenced contractor.

2.8 HYDRAULIC TRANSPORTATION TO FILL SITES

2.8.1 Introduction

An estimated 2 500 000m³ of sand would be required to raise the level of approximately 125ha of land owned by the Proponent and associated companies. Details of the areas to be filled have previously been described in Section 1.4.6. The sand would be best transported from the southern extraction site to each fill site by hydraulic means, ie. pumped as a sand / water slurry through a pipeline. The sand would be separated from the water on the fill site and the water (including the separated fine silt component) pumped back to the fines placement area within the southern extraction pond.

This section provides an overview of the proposed pipeline corridors, the activities involved in establishing the required pipelines and the operational issues relating to the pumping of the sand slurry from the southern extraction site to the boundaries of the eastern and northern fill sites. Details of the activities on each of the fill sites would be the subject of separate development applications for each site. The Project which is the subject of this assessment is confined to delivery of the sand slurry to the boundary of the northern and eastern fill sites and the return of the separated tailwater (and the fine silt component).



2.8.2 Pipeline Corridors

Figure 2.9 displays the proposed pipeline corridors to hydraulically transport or pump the sand slurry to both the northern and eastern fill sites. Beyond the Project Site, the northern pipeline corridor follows a route identified to have no substantial trees or shrubs that need to be cleared to enable the pipeline to be positioned. For the eastern pipeline corridor, it is intended to locate the pipeline adjacent to the proposed road between Tweed Coast Road and Turnock Street to serve the development of the land east of Tweed Coast Road. Within the Project Site itself, the internal pipelines would be periodically relocated to accommodate site activities. The Proponent recognises the need to retain a degree of flexibility when locating the pipeline within its land holdings. For example, prior to the completion of the northern extraction site, the pipelines within the Proponent's land would most likely be laid in the most direct route for the fill sites. Following completion of the northern extraction site it is likely the initial section of the pipeline route would be located in a direct line to the processing area beyond which the pipelines to and from the fill sites would be laid.

Pipelines within the northern pipeline corridor would be buried approximately 1m beneath the ground surface within the road reserve on the western side of Tweed Coast Road (see **Figure 2.9**). No clearing would be required within the northern pipeline corridor as the pipelines would simply be buried within the existing cleared road easement (see Section 2.8.3 for details). Placement of the pipelines within the northern pipeline corridor would involve underbored crossings of up to four driveways and Tweed Coast Road approximately 600m north of the Tweed Coast Road / Crescent Street intersection.

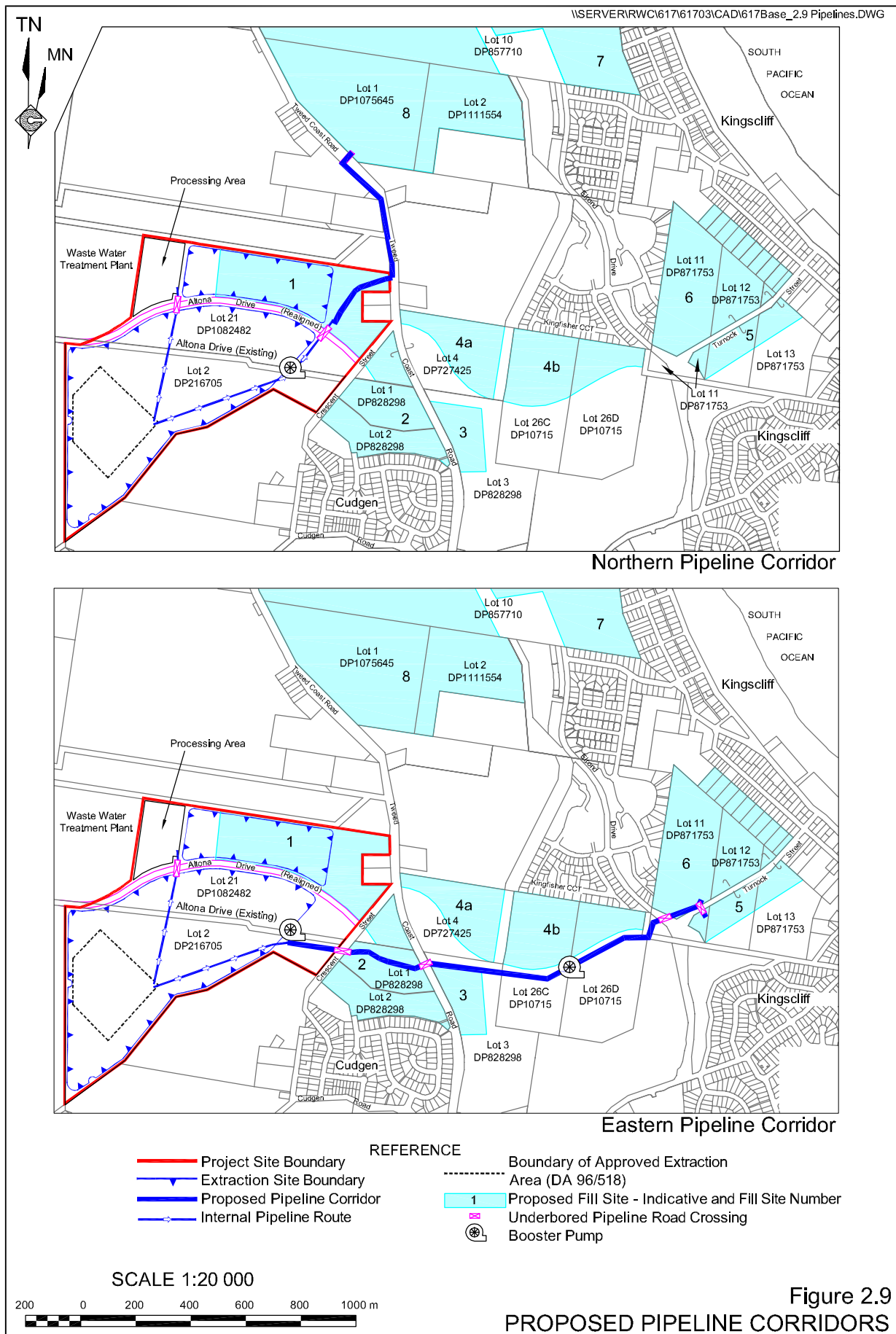
Details of alternative pipeline corridors considered during the project design and the reasons for selecting the preferred corridors are presented in Section 2.15.5. It is noted that, prior to placement of any pipelines external to the Project Site on land owned by the Proponent and associated companies, Tweed Shire Council would be consulted to ensure that the precise placement of pipelines within the corridors does not adversely affect any existing services or services planned to be installed during the period that the pipelines would be required.

2.8.3 Design Features

The hydraulic transportation of the sand slurry would involve the following components.

1. The pumps on the dredge within the extraction pond would provide the energy to extract and pump the sand slurry for up to 500m from the dredge.
2. A 300mm diameter HDPE pipeline for sand slurry delivery and 500mm diameter HDPE pipeline for tailwater return to be supplied in 10m to 12m sections for joining with standard couplings and flanges.
3. A number of 300mm and 500mm diameter steel pipes would be incorporated along the sand slurry delivery and tailwater return pipelines respectively where additional strength is required, eg. below roads and across drainage lines.





4. An enclosed booster pump would be located on the Proponent's land near the eastern side of the Project Site to provide the necessary energy to pump the sand slurry to the fill sites. A further booster pump would be located near the boundary of Lots 26C and 26D DP 10715 to provide the energy to pump the sand slurry to the eastern-most sites. The booster pumps would be placed within acoustically treated and enclosed storage units (approximately the size of a small sea container) and would be positioned using a small truck-mounted crane).
5. A series of underbored crossings would be incorporated along the length of the pipelines to be positioned safely beneath roads, driveways, other services and infrastructure.
6. A narrow service road would be constructed adjacent to the pipeline route to enable a 4WD light vehicle to undertake the necessary daily inspections and maintenance where necessary.

The use of a 500mm diameter return pipeline would reduce the friction of the tailwater and hence reduce the horse power required from the tailwater return pump located within the fill site.

Figure 2.10 displays a number of schematic sections of the pipelines illustrating the above design features. It is noted that all pipelines positioned within the easement for Tweed Coast Road would be buried to a depth of approximately 1m below natural ground level.

2.8.4 Pipeline Installation

Installation of pipelines of the nature proposed is a standard practice adopted by numerous companies, construction contractors and local and State Government Agencies. All pipes would be delivered along the respective corridors using a road truck and laid either in a prepared trench or on the cleared ground using a front-end loader at a rate of approximately 180m of pipeline per day. Due to the weight of the steel pipes, no specific anchoring of the pipelines would be required. All driveways and roads which are crossed by the pipelines would be underbored to allow the pipeline to pass underneath without disrupting or damaging the driveway or road surface. Standard procedures for the underboring of public roads and driveways within the road reserve would be adopted and outlined within the application for the Road Construction Permit (see Section 2.1.4).

2.8.5 Operations

The operation of the pipelines between the southern extraction site and either the processing plant or fill sites would require the adoption of a range of standard operations procedures.

During the first half hour of each day (ie. 6:30am to 7:00am), all equipment and pipelines would be visually checked for leaks and integrity after which the pipelines would be filled with water. Once prepared, the dredge would commence to pump the sand slurry continuously from approximately 7:00am to 6:00pm. The return water would also be back pumped continuously to the operational extraction pond. During the last half hour of each day's operation (6:00pm to 6:30pm) the delivery pipeline would then be progressively flushed of sand.





As discussed in Section 2.4.2, following completion of the northern extraction site, it is proposed to pump the sand to the respective fill sites on a campaign basis, such as alternating on a two-weeks-on, one-week-off, or similar basis. The duration of the campaign period to pump sand to the processing plant is likely to vary depending upon sales for construction sand etc. Campaigns to pump sand to fill sites would typically last about two weeks at a time, with the rate of pumping typically about 9 000m³ of sand per week. In the event that the maximum annual quantity of sand allocated for construction sand is not required in any one year, the surplus sand (up to a total of 650 000m³ per year) would be pumped to the active fill site, if the additional quantity of sand could be managed on that fill site.

Table 2.2 lists each of the fill sites, their fill sand requirements and the likely duration of the overall campaigns for each site.

Table 2.2
Fill Sand Requirements and Duration of Pumping of Fill Sites

Fill Site [#]	Area (ha)	Approximate Fill Sand Requirement (m ³)	Duration of Filling Campaign*
1. Part Lot 21 DP 1082482	11.7	230 000	6 months
2. Lots 1 and 2 DP 828298	10.5	300 000	8 months
3. Part Lot 3 DP 828298	3.2	80 000	2 months
4a. Part Lot 4 DP 727425 and Lot 26C DP 10715	5.8	130 000	3.5 months
4b. Part Lot 26D DP 10715 and Lot 11 DP 871753	9.1	160 000	4 months
5. Lots 11, 12 and 13 DP 871753	4.0	100 000	2.5 months
6. Part Lots 11, 12 13 and 14 DP 871753, Lots 1 to 9 DP 781714	6.5	500 000	13 months
7. Part Lot 10 DP 857710	16.9	350 000	9 months
8. Part Lot 10 DP 857710	46.8	650 000	17 months
Total	124.5	2 500 000	5 years 6 months
[#] See Figure 2.1			
* Based on an annual pumping rate of 450 000m ³ per year.			

The program for pumping sand to the fill sites would depend upon the timing and conditional requirements for each of the developments at each of the fill sites. It is therefore possible that the pumping operations may be intermittent with a period of no pumping to fill sites.

2.9 ROAD TRANSPORTATION

2.9.1 Introduction

An important component of the Project would be the despatch and distribution by road of the range of construction sand products produced within the processing area and the receipt of VENM. This section reviews the design of the approved upgraded Altona Drive/Crescent Street intersection, Project Site entrances, site access roads and the levels of product truck movements and other traffic likely to travel to and from the Project Site. Further discussions regarding controls relating to road transportation are presented in Section 4.7.



2.9.2 Altona Drive Realignment and Crescent Street Intersection

As discussed in Section 1.4.5.4, it is the Proponent's intention to realign Altona Drive in accordance with the conditional requirements of Development Consent DA05/1450. Altona Drive together with the Western Drain would be realigned prior to sand extraction within the southern extraction site reaching the existing alignment of Altona Drive. However, prior to despatch of products from the processing area or receipt of VENM, the intersection of the realigned Altona Drive with Crescent Street would be constructed together with a short section of road to link with the existing Altona Drive (see **Figure 2.3**). This would ensure that the Project utilises the improved intersection from the commencement of product despatch.

When Altona Drive is ultimately realigned, it would be linked with the improved intersection providing a curved access road and minimising sterilisation of the sand resource south of the road.

Figure 2.11 shows the location and layout of the approved intersection of the realigned Altona Drive and Crescent Street. The approved intersection includes:

- a 40m long right turn in deceleration lane into Altona Drive;
- a concrete splitter and pedestrian refuge on both Altona Drive and Crescent Street; and
- 32m and 42m long painted chevrons on Crescent Street and a 32m long painted chevron on Altona Drive.

The remainder of this document has assessed the Project based on the use of the improved intersection and ultimate realignment of Altona Drive.

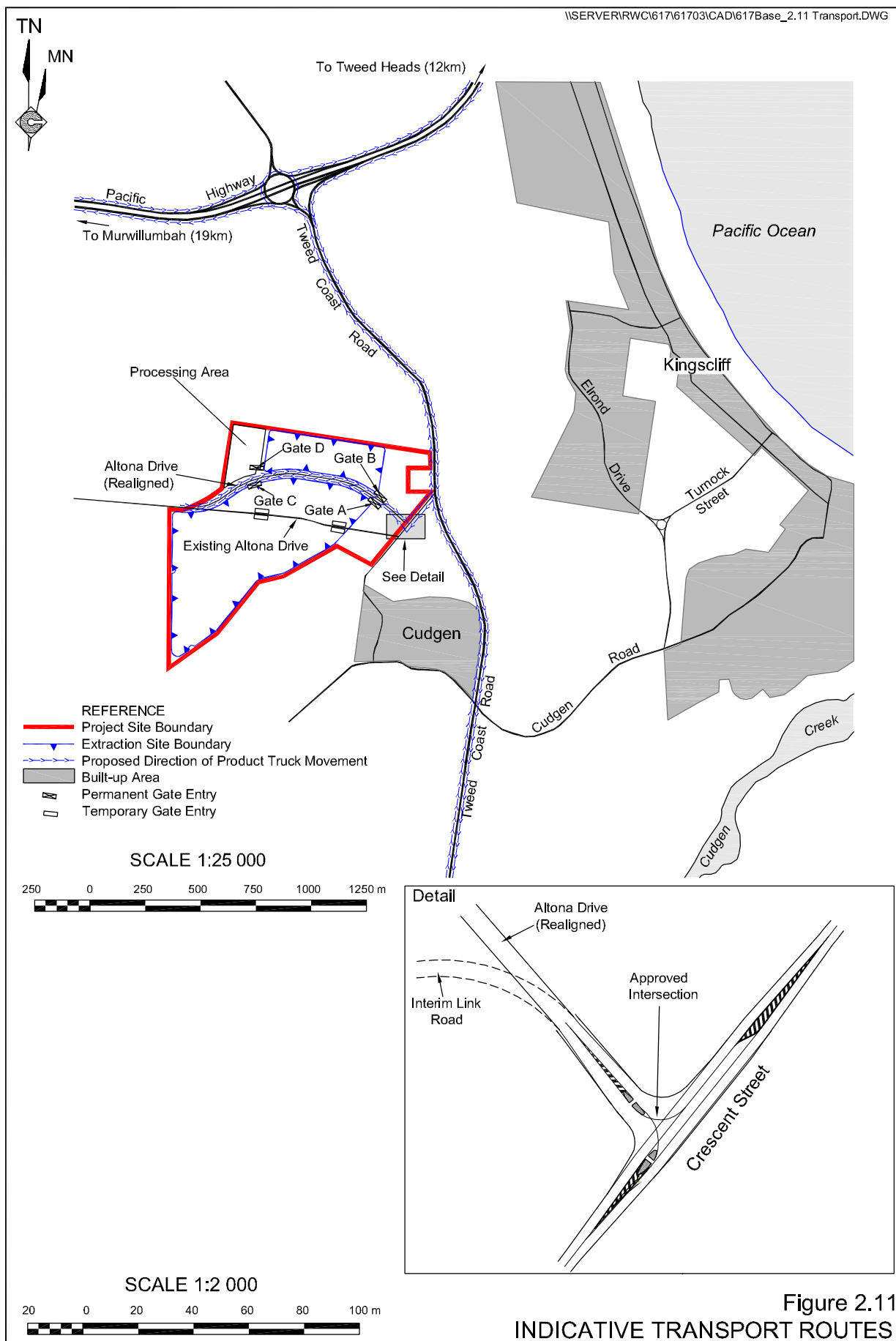
2.9.3 Project Site Entrances and Access Roads

The Project would involve the use of four entrances directly off Altona Drive to access the Project Site. The southern extraction site would be accessed via an entrance on the eastern end (Gate A) and an entrance on the western end (Gate C) (see **Figure 2.11**). The processing area and northern extraction site would similarly be accessed via an entrance on the eastern end (Gate B) and an entrance adjacent the processing area (Gate D).

Access to each entrance would be provided by a concrete culvert positioned within the table drains either side of Altona Drive. Temporary intersections for each site entrance would be provided prior to the realignment of Altona Drive (**Figure 2.11**) and relocated as part of the realignment process. Further details relating to the construction of the Project Site entrances and access roads is presented in Section 4.7.4.

The gate for each entrance would be sign-posted and Gate D would be setback approximately 20m from the sealed section of Altona Drive to enable vehicles to safely park off Altona Drive whilst the gates are being opened, if necessary. Gates A / B and C / D would also be positioned directly opposite each other (see **Figure 2.11**) allowing traffic movements between the processing area / northern extraction site and southern extraction site to occur simply by crossing Altona Drive without the need to turn and travel along Altona Drive.





Veitch Lister (2007) has assessed the sight distances and proximity to other intersections and identified the intersections with Altona Drive could be safely constructed. All required line markings and signs would be installed in accordance with relevant standards.

2.9.4 Transport Routes

Figure 2.11 depicts the road network in the vicinity of the Project Site. All product trucks departing from the processing area would travel eastwards along the eastern section of Altona Drive towards Crescent Street and then northwards along Crescent Street towards Tweed Coast Road. The bulk of the trucks would continue to travel northwards towards the Pacific Highway whilst a small proportion would travel southwards to deliver products to local construction projects.

No project-related trucks would travel on Altona Drive west of the Project Site, south of Altona Drive on Crescent Street or on any other local roads except for the purpose of a local delivery.

Transport routes for trucks delivering VENM to the Project Site cannot be accurately specified, however, the Proponent would nominate a preferred route for trucks as part of the preparatory procedures required for the delivery of the VENM. The preferred route would nominate the avoidance of the sections of roads referred to above.

2.9.5 Traffic Types and Levels

During the site establishment and construction phase, estimated to occur during a 3 month period, the maximum daily traffic activity would be approximately 130 vehicle movements (65 return trips). Of this, approximately 14 movements (7 return trips) would involve trucks / heavy vehicles with the remainder being light vehicles. Additionally, the laying of pipelines external to the Project Site would generate approximately 30 vehicle movements (15 return trips) per day of which approximately 6 movements (3 return trips) would be trucks / heavy vehicles. It is estimated that the laying of pipelines external to the Project Site would be completed in each corridor within a period of approximately two weeks. Both corridors are unlikely to be constructed concurrently.

The Proponent has identified both average and maximum traffic levels likely to be associated with the Project based on maximum sales of construction sand products of 300 000tpa and receipt of up to 45 000tpa of VENM. It is conservatively estimated that the average number of product truck movements on any weekday or Saturday would be approximately 100 and 60 respectively, ie. 50 and 30 loads (based on an average of 20t truck loads and transportation 5.5 days per week, 50 weeks per year). As sales would vary from day to day, the 85th percentile number of truck movements on the local roads on any weekday or Saturday would be 130 and 80 respectively or 65 and 40 loads.

It is noted that, in reality, most products would likely be distributed using truck and dog trailer rigs with capacities of 30t to 33t resulting in average load sizes of closer to 30t. Therefore, the average number of truck movements associated with product despatch would be reduced to approximately 74 movements per day. However, for impact assessment purposes, the number of truck movements calculated using the more conservative load size of 20t has been used.



Based on the importation of 30 000m³ of VENM to the Project Site on an annual basis, it is estimated the incoming VENM would generate an average of approximately 24 truck movements (12 loads) per day (based on average 15t truck loads and receipt 5.5 days per week, 50 weeks per year). The 85th percentile volume would generate an estimated 40 truck movements (20 loads) per day relating to VENM importation. Other vehicles travelling to and from the Project Site would be delivery trucks (e.g. fuel and supplies) estimated at 2 truck movements per day and employee's light vehicles estimated to amount to 8 to 16 light vehicle movements per day.

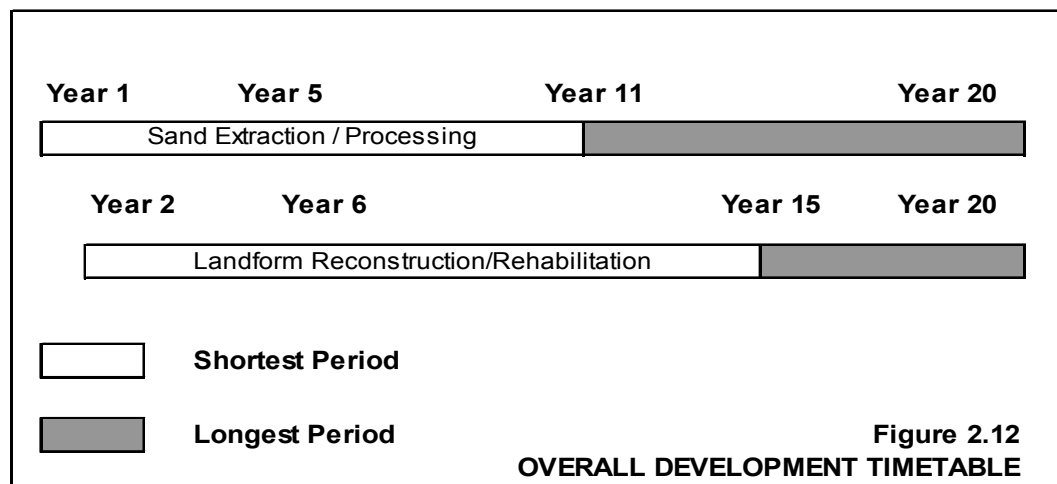
In total, it is assumed that once the Project is fully operational, the despatch of products and importation of VENM would generate up to 124 truck movements (62 loads) per day on an average day. It would be rare that a busy day for despatch of products and importation of VENM would coincide. It is also noted that opportunities exist for trucks delivering VENM to backload with a load of sand from the processing area. Hence, the estimated traffic levels are conservative.

In addition to product despatch and VENM importation, treated loamy sand and VENM(b) would be transported from the southern extraction site across Altona Drive to the processing area using road trucks. It is estimated that up to 12 loads or 24 truck movements per day would occur across Altona Drive between the southern extraction site and processing area, ie. during the campaigns to remove loamy sand. These campaigns would typically occur up to six times per year, with each campaign typically of approximately 5 days duration.

2.10 DEVELOPMENT TIMETABLE, HOURS OF OPERATION & PROJECT LIFE

2.10.1 Development Timetable

The indicative development timetable for the Project from commencement of sand extraction to the completion of the final lake is set out in **Figure 2.12**.



Establishment of the site for sand extraction and processing activities would require approximately 3 months. This would include construction of the weighbridge, ablutions and office building, extension of the required services and erection of the processing plants.

Once operational, the sand extraction and processing operations for production of construction materials would continue for a period of between 11 and 15 years and perhaps longer. However, the rate at which fill sand is extracted is likely to vary and may extend beyond 11 years depending on the staging of approvals for the development of the various fill sites.

Following the initial removal of the sand resource from the northern extraction site and once terminal faces within the southern extraction site have been reached (commencing within approximately 2 years), subsequent activities involving progressive backfilling and landform creation would commence and continue concurrently with the sand extraction activities.

2.10.2 Hours of Operation

Table 2.3 records the proposed hours of operation for all activities planned for the Project Site.

Table 2.3
Proposed Hours of Operation

Activity	Monday to Friday	Saturday	Sunday
Site Establishment	7.00am to 6.00pm	7.00am to 1.00pm	-
Sand Extraction (dredging to processing area) and Processing	6.30am to 10.00pm	7.00am to 4.00pm	-
Sand Extraction (dredging to fill sites)*	6.30am to 6.30pm	7.00am to 1.00pm	-
Soil Removal and Sand Extraction (excavation)	7.00am to 6.00pm	7.00am to 1.00pm	-
Product Distribution	7.00am to 6.00pm	7.00am to 1.00pm	-
VENM Receipts	7.00am to 6.00pm	7.00am to 1.00pm	-
Site Maintenance	6.30am to 7.00pm	6.30am to 4.00pm	9.00am to 4.00pm
*Note: the first and last 30 minutes of each day would involve filling or draining water from the pipelines.			

During the first half hour of each day, all equipment and pipelines would be visually checked for leaks and integrity and the pipelines filled with water. The dredge would typically operate for approximately 10 hours per day, however, provision has been made for the occasional periods when it is necessary to operate up to 15 hours per day when pumping sand to the processing area. Pumping of sand to nominated fill sites would occur on a campaign basis for approximately 11 hours per day on weekdays. During the last half hour of each day's operation, the supply pipeline would be progressively flushed of sand.



2.10.3 Project Life

The complete extraction of the sand resource within the extraction sites would occur over a minimum of 11 years. As discussed, the completion of extraction of the fill sand component would be dependent on the issuing of the required development consents for development of the fill sites and may extend the operation over a more extended period. As backfilling and rehabilitation of the final sections of the lake would be undertaken progressively, the finalisation of the Project is expected to be within 12 months from the completion of sand extraction.

In order to account for any delays in the issuing of development approvals for the development of the fill sites, planning approval is being sought for an operational period of 20 years.

2.11 INFRASTRUCTURE AND SERVICES

2.11.1 Buildings

The Proponent proposes to construct / erect a range of buildings on site to assist with site operations, management and security including the following.

- Offices.
- Maintenance workshop.
- Automated weighbridge.
- Amenity / ablutions facilities.

All of these buildings would be located on a raised area within the processing area. Separate construction certificate applications would be submitted to Tweed Shire Council following the grant of Project Approval.

2.11.2 Services

2.11.2.1 Power

The Proponent proposes to commission a local energy provider to provide three phase 415V power to the processing area. The Proponent estimates its electricity requirement would be approximately 400kW/hr when operating at 300 000tpa. This service would most likely be drawn from Country Energy with overhead poles brought into the site via the existing power lines located within the extraction site. A power transformer would be positioned adjacent to the workshop within the processing area. Maximum use would be made of underground power cables.

The power requirements for booster pumps and tailwater return pumps would be supplied using diesel generators.



2.11.2.2 Water

Approximately 200kL of mains water would be required annually for use in the offices and amenities. This requirement would be obtained from the mains that are located within an easement to the north of the Project Site. Most water required for processing would be drawn from the southern extraction pond either in the form of a slurry with the sand being dredged or through water pumped from the southern extraction pond. The pumping rate for the dredge would be approximately 300litres/sec or 17.3ML per day (based upon a maximum 16 hour day).

During processing, almost 99 per cent of the process water would be returned to the southern extraction pond with the process fines. The remaining 1 per cent of water would be incorporated with the various products produced equating to a moisture content of approximately 5%.

Approximately 30ML to 35ML of water per year would be used for dust suppression on site roads, and around the processing plants and hardstand areas. This water would be pumped directly from the southern extraction pond to an overhead stand pipe for the water truck to be filled.

In summary, the net annual water usage from the southern extraction pond would be in the order of 45ML to 55ML, based upon the following components.

- 30ML to 35ML – Dust suppression (roads and equipment)
- 15ML to 20ML – Incorporated in products

2.11.2.3 Sewage

The on-site ablutions would be connected directly to the sewer mains located within the easement directed to the adjoining waste water treatment plant.

2.11.2.4 Communications

Underground cables for telephone, facsimile and internet services would be required for both the weighbridge office and site office. A total of four lines would be sought.

2.11.2.5 Fuel

It is estimated that 900 000L of diesel fuel would be required annually to operate all on-site mobile equipment, pumping stations and the dredge. The fuel for the mobile equipment would be stored within a self bunded mobile fuel tank (capacity 10 000L). It is proposed that a fuel tanker would service the mobile equipment and pumping stations on a daily basis. Whilst not in use, the fuel tanker would be parked adjacent the workshop.

Management of fuel to avoid contamination of surface water and groundwater is addressed in Section 4.2.6.



2.11.2.6 Consumables

A number of maintenance products, such as air and oil filters, would be stored in the workshop for servicing mobile equipment and plant.

Additionally, agricultural lime or similar would also be stored in the workshop to neutralise any minor spills/exposure of acid generating material.

2.12 EMPLOYMENT

Once fully operational, the operation would employ approximately five full time equivalent persons (see **Table 2.4**). A range of other contractors would also be engaged from time to time.

Table 2.4
Indicative Direct Employment

Position/Function	Status	
	Full-Time	Campaign*
Site Manager	1	-
Clerical Officer/ Weighbridge attendant	1	-
Excavator Operator	-	2 to 3
Dredge Operator	1	
Truck Driver	-	1 to 3
Swamp dozer Operator	-	1
Grader Driver	-	1
Loader Operator	1	-
Processing Plant Operator	1	-
Total	5	5 to 8
* This incorporates the extraction activities within the northern extraction site		

Additionally, the Project would provide employment for approximately 14 truck drivers for delivering sand products and VENM deliveries.

2.13 SAFETY AND SECURITY

The Proponent would continue to adopt all the required safety measures for all on-site activities as required by DPI (MR) and the WorkCover Authority of NSW. All safety measures would be incorporated in a Work Safety Management Plan which would be implemented by the site manager. The main features of the plan would be to provide:

- safe access and egress to site by employees, contractors and visitors;
- a safe environment for work;
- safe premises for employment, contractors and visitors; and
- necessary training and equipment to maintain a safe site.



As discussed in Section 2.3.1, fencing would be maintained around the processing plant and the northern and eastern boundaries of the southern extraction site and southern and eastern boundaries of the northern extraction site. The existing fences would be maintained/upgraded on the southern and western boundaries of the southern extraction site and northern boundary of the northern extraction site. Signs exhibiting “Warning – Deep Water” would be positioned at appropriate locations on the fencing surrounding the extraction sites and the Site Manager would undertake regular inspections of the boundary fences to ensure they are in good condition.

All entrance gates would also be locked outside the hours when trucks are travelling to and from the processing area and extraction sites.

Security lighting would also be provided around the weighbridge office and workshop compound but directed downwards and not towards local nearby residences.

2.14 LANDSCAPING AND REHABILITATION

2.14.1 Introduction

The Proponent would adopt a progressive approach to site landscaping and rehabilitation to ensure that, wherever possible, disturbed areas are either temporarily or permanently stabilised to limit erosion and adverse visual impacts. The following subsections describe:

- the Proponent’s rehabilitation objectives for each phase of rehabilitation including site establishment;
- the rehabilitation procedures to be adopted throughout the life of the Project;
- the components involved in site decommissioning;
- the final landform that would be progressively formed throughout the life of the Project; and
- the planned long term uses of the rehabilitated landform.

An important component of the Proponent’s plans for development at Kingscliff, Chinderah and Cudgen is the rehabilitation of the Project Site, with the progressive backfilling of the northern extraction site and selected finalised sections of the southern extraction site and introduction of native vegetation to create wetland areas and landscaped parklands. The construction of recreational facilities such as sporting fields, walking and equestrian tracks would occur following completion of sand extraction activities within the respective extraction site.

The proposed rehabilitation procedures have been developed with the assistance of HMC Environmental Consulting (for soil resources), Idyll Spaces (for flora species and community construction) and Kendall and Kendall (for preferred fauna habitats). The procedures adopted would be regularly reviewed throughout the life of the Project and modified if appropriate, to reflect the operational experience gained.



2.14.2 Site Establishment and Construction Phase

2.14.2.1 Rehabilitation Objectives

The site establishment and construction phase would result in the disturbance of a number of areas on the Project Site, many of which would need to be rehabilitated during the phase itself. The objectives relevant to this phase are as follows.

- To stabilise all disturbed areas to limit erosion and dust lift-off.
- To create a visually attractive site.

2.14.2.2 Rehabilitation Procedures

The rehabilitation procedures to be adopted would be consistent with best practice in the extractive industry. The procedures are presented for surface water management structures, amenity bund walls, visual screening and landscaping.

Water Management Structures

Bunding used to retain dirty water within, and divert clean water away, from operational areas would be stabilised either through placement of chipped vegetation/mulched shrubs or vegetated with a pasture seed mix similar to that listed in **Table 2.5**.

Table 2.5
Pasture Species Seed Mix

Season	Common name	Rate (kg/ha)
Autumn and Winter	Perennial Ryegrass	10
Spring and Summer	Japanese Millet	20

Source: Idyll Spaces (2008) – Section 4

Bund Walls

The perimeter bund wall (surrounding the processing area) would be constructed during the site establishment and construction phase. The outer surfaces of the amenity bund would be covered with topsoil, initially stabilised with a pasture seed mix similar to that listed in **Table 2.5** with the addition of a range of shrub species listed in **Table 2.6**. It is intended that the bund wall would be maintained and incorporated into the long term land use for that area.

Table 2.6
Typical Shrub and Small Tree Species for Revegetation

Scientific name	Common name	Final height (m)
<i>Acacia sophorae</i>	Coast wattle	3
<i>Allocasuarina littoralis</i>	Black oak	10
<i>Austromyrtis dulcis</i>	Midyim	1
<i>Banksia integrifolia</i>	Coast banksia	10
<i>Banksia robur</i>	Swamp banksia	3
<i>Callistemon pachyphyllus</i>	Thick-leaved bottlebrush	1

Source: Idyll Spaces (2008) – Section 4



Visual Screening

A range of tree and shrub species would also be planted on the outer side of the bund walls, on the eastern boundaries of the extraction sites and adjacent to the eastern section of Altona Drive (realigned). Species likely to be used are listed in **Table 2.7**.

Table 2.7
Typical Tree Species for Visual Screening

Scientific name	Common name	Final height (m)
<i>Archontophoenix cunninghamiana</i>	Bangalow palm	13
<i>Callistemon salignus</i>	Willow bottlebrush	10
<i>Casuarina glauca</i>	Swamp oak	30
<i>Glochidion sumatranum</i>	Umbrella cheese tree	20
<i>Melaleuca quinquenervia</i>	Broadleaved paperbark	25

Source: Idyll Spaces (2008) – Section 4

Landscape Areas

By the completion of the site establishment and construction phase, the Proponent would establish a range of landscape areas adjacent to the access road and entry points. It is proposed that part of the landscaping would include the planting of selected tree species from **Table 2.6** and **2.7**. The Proponent intends to create an attractive work environment with an emphasis placed upon positive environmental attributes.

2.14.3 Extraction Sites

2.14.3.1 Rehabilitation Objectives

The Proponent's objectives for the extraction sites are as follows.

- To provide a low maintenance, geotechnically stable and safe landform that would provide for planned recreational uses including sporting fields.
- To backfill finalised edges of the finalised southern extraction pond and revegetate to provide wetlands, surrounding parklands and facilities that would compliment the Proponent's broader development plan (see Section 2.14.5).

2.14.3.2 Rehabilitation Activities

Northern Extraction Site

As the northern extraction pond is progressively backfilled, reclaimed sections would be seeded with a suitable pasture mix such as outlined in **Table 2.5**, essentially recreating the existing landform and use. It is noted that, pending separate approval, the elevation of much of the northern extraction site would be further raised and landscaped to provide for sporting fields and recreational activities.



Southern Extraction Site

As described in Section 2.6, some finalised sections of the southern extraction pond would incorporate both an extended flat area and an adjoining 10m wide wetland area. Topsoil would be placed along the edges of the pond and, where possible, directly transferred to maintain the soil structure and organic content. The soil surface would be left roughened so as to reduce erosion and promote establishment of vegetation.

The final surface on the pond edges would be revegetated through use of seed and planting of tubestock. Similar species to those specified in **Table 2.7**, would be used. Additionally, the wetland area would be planted with appropriate wetland species as outlined in **Table 2.8**.

Table 2.8
Typical Wetland Species for Site Revegetation

Scientific Name	Common Name	Max Water Depth(m)
<i>Bacopa monniera</i>	Bacopa	0.1
<i>Baumea spp</i>	-	0.3
<i>Carex appressa</i>	-	0.1
<i>Eleocharis sphacelata</i>	Tall Spike-rush	2.0
<i>Leersia hexandra</i>	Swamp Rice-grass	0.1
<i>Lepironia articulata</i>	-	1.5
<i>Phragmites australis</i>	Common Reed	0.5
<i>Schoenus validus</i>	-	0.3

Source: Idyll Spaces (2008) – Section 4

An important component of revegetation would be the maintenance program to ensure the soil substrate and range of plants are maintained and any weed infestations are controlled. A vegetation monitoring program would be undertaken annually to record the progress of revegetation and the establishment success.

In the event of any ongoing erosion problems that can not be successfully stabilised through the use of vegetation, ‘hard’ erosion control measures, such as rock armouring, would be investigated and implemented where required.

Pipeline Corridors

Within the northern pipeline corridor, following installation of the underground pipelines, all soil material would be replaced and, if required, sown with a suitable grass seed mix for stabilisation. Similarly, upon removal of the underground pipelines, the void would be backfilled with sand from the Project Site and the soil material replaced and a grass seed mix applied, as required. The sections of the pipeline beneath the respective roads would be retained and capped off for the future use by Council, RTA or any authority to convey utilities under the road(s) at any future date. As the pipeline within the eastern corridor would be above ground, it is envisaged that, following removal of the pipeline, no specific rehabilitation measures would be required. As outlined within Section 2.8, no trees would be required to be removed for the installation of the pipelines, hence, no trees would need to be planted within the pipeline corridors following the removal of the pipelines.

2.14.4 Site Decommissioning and Final Landform

The Proponent intends to remove all buildings and structures off site at the end of the Project life. Any concrete footings would be ripped up and removed.

All unsealed internal roads not required for the subsequent land use(s) would be cross-ripped, topsoiled and seeded. It is envisaged that the site entrances would be retained for the intended recreational uses. Additionally, the perimeter bund wall and vegetation screen surrounding the processing area could be retained and utilised in the final land use, potentially as a separate sporting arena.

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

The margins of the final lake formed by the southern extraction pond would contain a flat area of land up to 40m wide and a number of shallow wetland areas extending from the shore for a distance of up to 10m. The exact width of the flat area would depend on the availability of VENM(a) throughout the life of the Project. Any areas where backfilling has not occurred around the lake edges would dip into the lake at a slope of 1:5 (V:H). The total depth of the lake would vary depending on the depth of the sand resource and volume of VENM interned within the pond though the maximum depth would be approximately 20m.

The final landform would be consistent with the intended final uses described in Section 2.14.5.

2.14.5 Long Term Land Uses

The long term land uses on the Project Site would be consistent with the overall master development plan for the development of the Proponent's landholdings within Kingscliff, Chinderah and Cudgen. In accordance with the master development plan and dependent on the relevant approvals, the extraction site and processing area at the end of the Project life and beyond (see **Figure 2.13**) could comprise the following.

- Multipurpose sports fields.
- Recreation pond with parkland, walking tracks and picnic facilities.
- Equestrian club.
- Boat house.
- Tennis club.
- Athletics tracks.
- Bowling club.
- Indoor pool.



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Community and local government support for this range of facilities has been established through various consultation undertaken with Council, surrounding residents, community groups and the wider community (see Section 4.11). It is noted that the formation of a recreational pond and parkland would be consistent with the proposed final land use for the Hanson Tweed Sand Quarry.

2.15 PROJECT ALTERNATIVES

2.15.1 Introduction

An analysis of any feasible alternatives to carrying out the Project as proposed has been undertaken as part of the Project design and assessment process. The consideration of feasible alternatives to the activities proposed on the Project Site relate principally to:

- (i) alternative sources of fill sand;
- (ii) the location of the processing area;
- (iii) design of extraction sites; and
- (iv) alternative pipeline corridors.

2.15.2 Alternative Sources of Filling Materials

There are a number of alternative sources of fill sand including the quarries operated by Hanson Construction Materials and Action Sands (see Section 1.4.5.1), however, neither hold approval to supply fill sand at the required rates and / or the quality of the water transported with the sand would not be suitable to use for filling large areas. Other alternative sources of fill sand are geographically removed from the fill sites and/or would not prove an economic alternative.

The importation of weathered bedrock as a source of filling materials has been considered and rejected by the Proponent both from a cost-perspective and environmentally. The importation of 2.5 million m³ of weathered bedrock would cause substantial impacts on local roads and its compaction close to some surrounding land uses would cause considerable noise impacts.

2.15.3 Location of the Processing Area

Four alternative sites for the processing area were examined (see **Figure 2.14**), namely:

- Option 1: northwestern corner of the Project Site (proposed);
- Option 2: within the northwestern side of the southern extraction site;
- Option 3: on the eastern side of the southern extraction site; and
- Option 4: within the southwestern side of the southern extraction site.



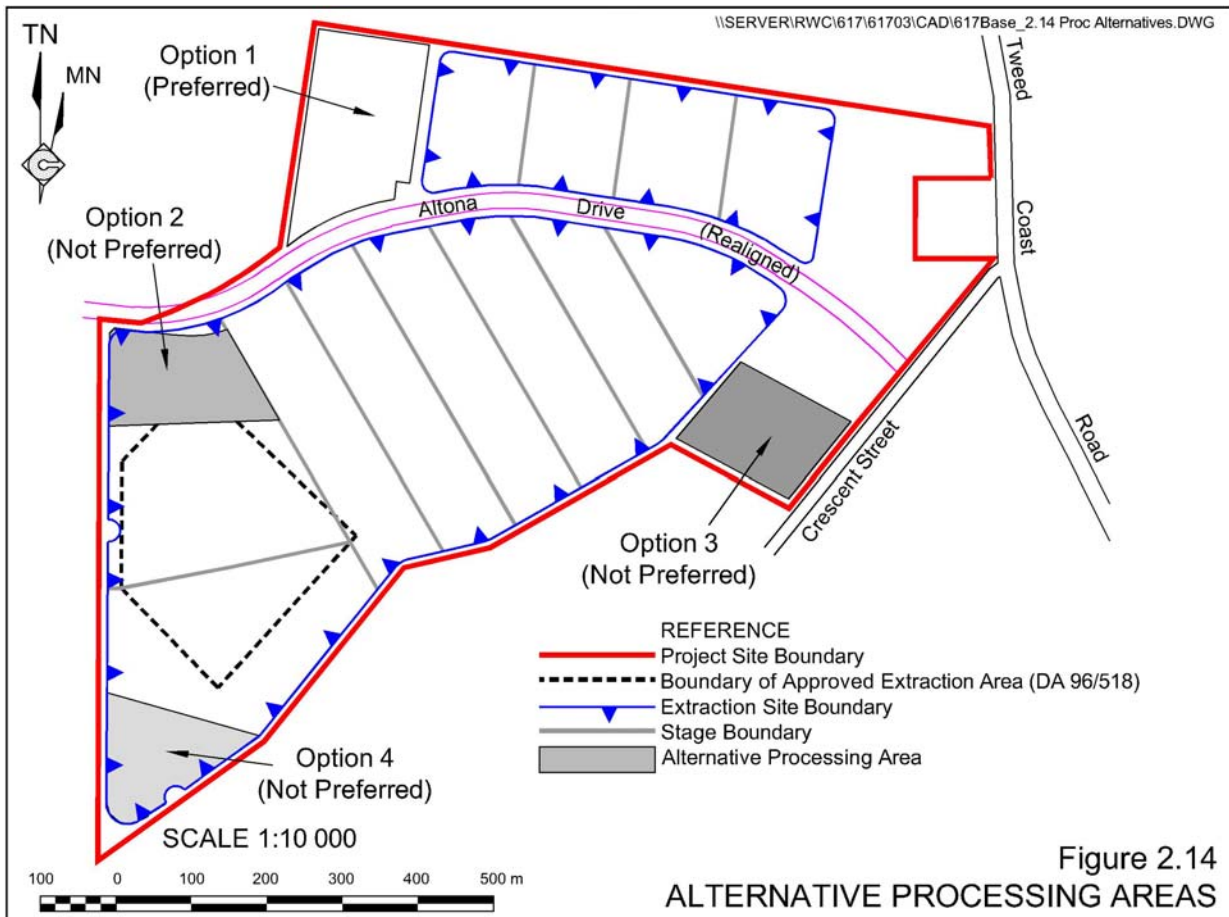


Figure 2.14
ALTERNATIVE PROCESSING AREAS

Option 1 is the preferred option and is the design used within this Project description. Option 1 is located immediately adjacent to the new WWTP and would provide the least impact upon noise and visual amenity and is the most practical from an operational perspective. Locating the processing area on the eastern side of the southern extraction site (Option 3) would likely result in greater noise impacts on surrounding residents. Additionally, the processing area would be located further away from other developments (ie. waste water treatment plant and existing Hanson Tweed Sand Quarry) hence resulting in greater visual intrusion created by its isolation.

Alternatively, the processing area could be located within the northwestern or southwestern side of the southern extraction site (Options 2 and 4). This would involve the temporary sterilisation of the sand resource. In the event that a sufficient area could be backfilled with VENM, the processing area could be relocated to the backfilled area and the sand extracted beneath the original location. In the event that sufficient quantities of suitable VENM could not be attracted to the site, the processing area would not be able to be relocated and the sand beneath would be effectively sterilised until the completion of the processing operations.

2.15.4 Design of Sand Extraction Area

Figure 2.15 identifies the three options considered for the extraction of sand from the southern extraction site subject to the removal / retention of the power poles and lines in the southwestern corner of the Project Site.

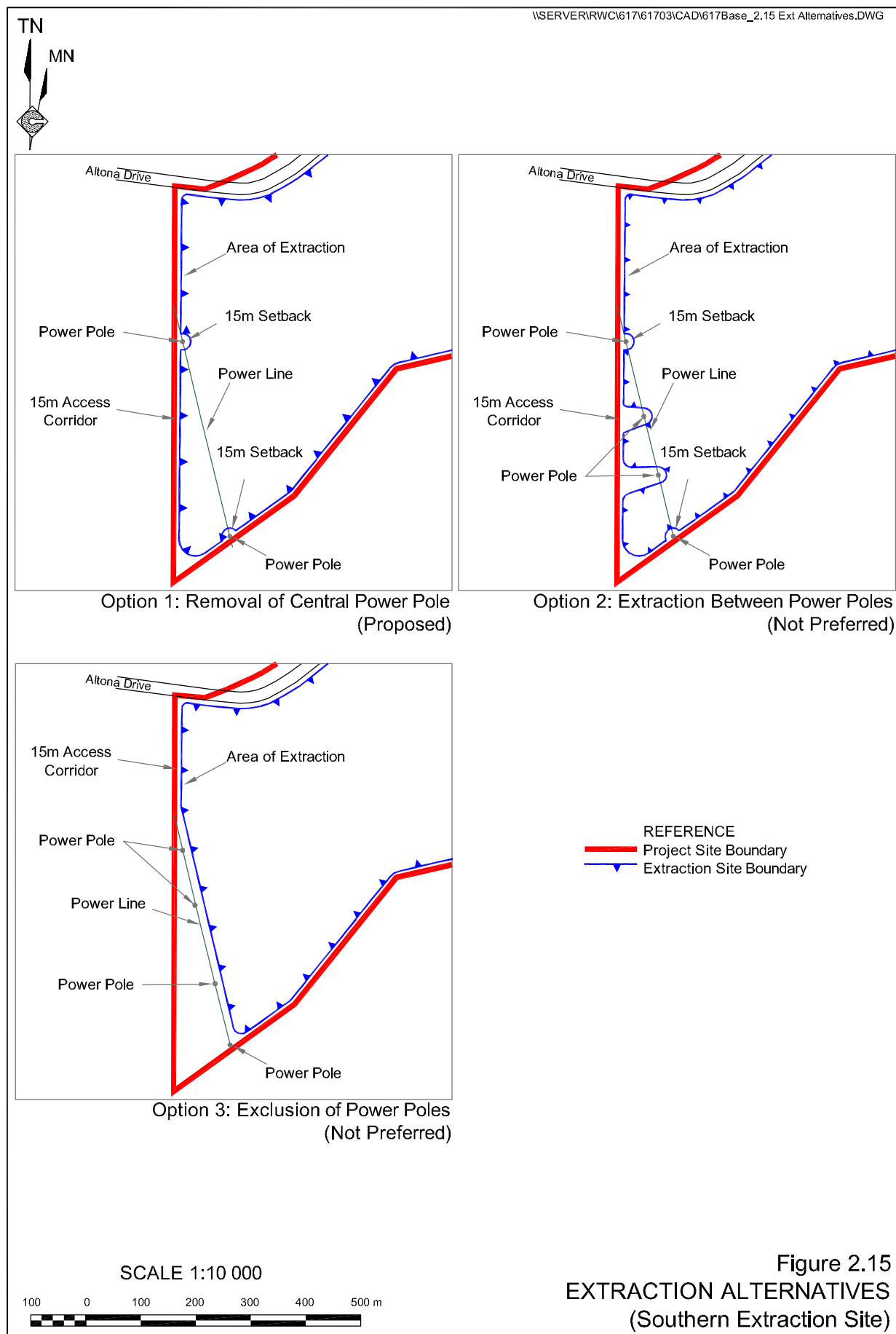
- Option 1 is the preferred option and is the design used within this Project description. This option involves the removal of the central power poles and raising the height of the adjacent poles so as to allow full extraction of the sand resource.
- Option 2 involves the extraction of the sand resource around the power poles, leaving a suitable buffer around each pole. Approximately 180 000m³ of sand would be sterilised should this option be used.
- Option 3 involves the exclusion of the power poles from the extraction area and a 15m buffer from both the power poles and lines. Approximately 200 000m³ of sand would be sterilised should this option be used.

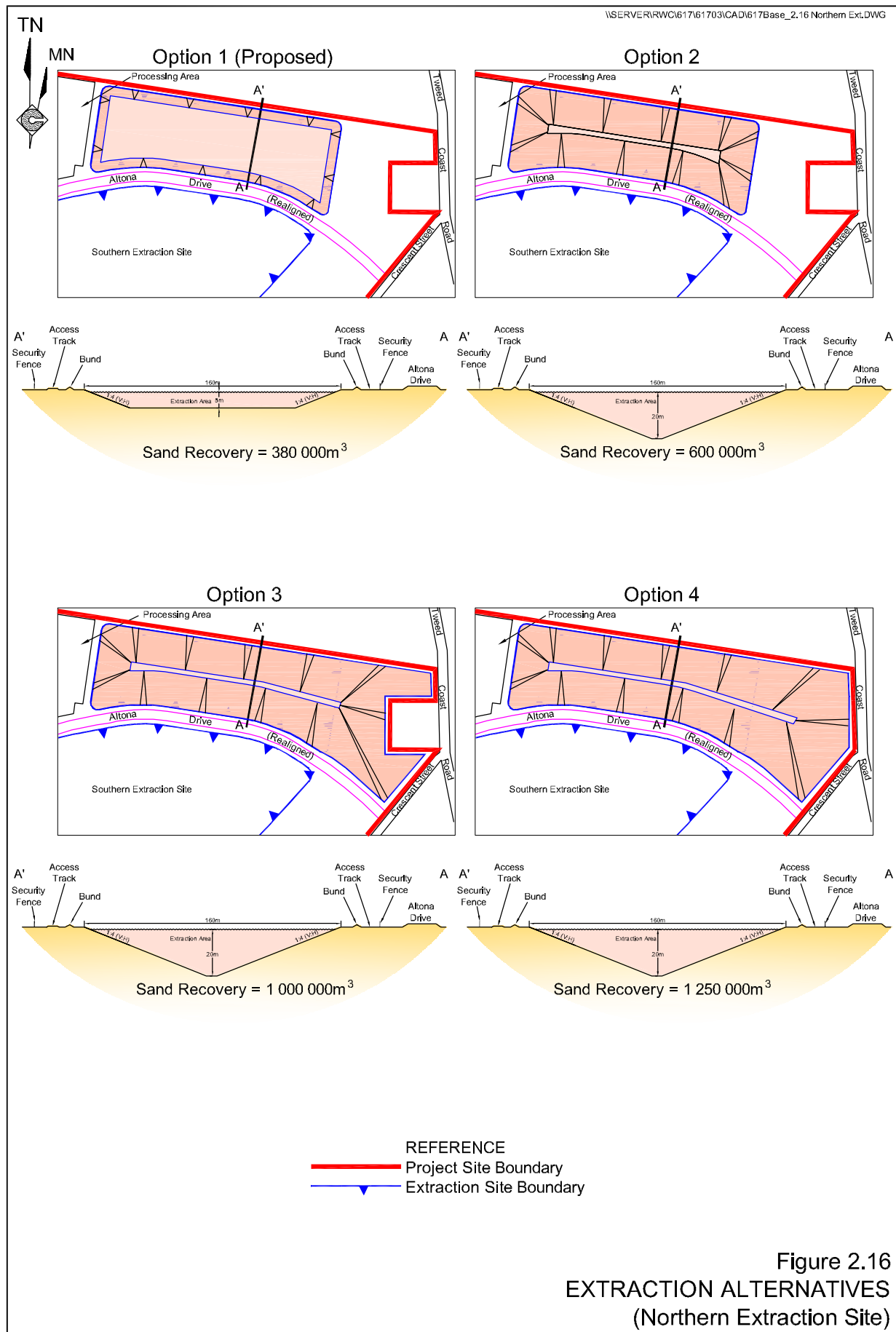
Consideration may also be given at a future date to the joint extraction of sand within the setback areas between the Hanson Tweed Sand Quarry and Project Site boundaries should this be feasible and agreeable to both Hanson Construction Materials and the Proponent. All necessary consultation would be undertaken and approvals would be sought at that time. It is noted that the joint extraction of the common boundary would provide access to additional sand resource and additional potential cases of the final lake (eg. use in rowing events and training).

Figure 2.16 identifies four options considered for the extraction of sand from the northern extraction site pending the availability of backfill and agreements with neighbouring landholders.

- Option 1 is the design used for this assessment and involves the extraction of sand to a 5m depth over the area between the northern boundary and Altona Drive (realigned) and from the processing area to an area aligned with the eastern extent of the southern extraction site. Option 1 would result in the recovery of 380 000m³ of sand.
- Option 2 would involve the extraction of the resource to the maximum recoverable depth and would result in the recovery of approximately 600 000m³ of sand. Sand would be extracted using a medium size dredge rather than excavators and trucks. Option 2 would be used in the event that it can be shown that sufficient VENM would be available to backfill the extraction pond. The potential impacts on groundwater would need to be reassessed prior to proceeding with this option.







- Option 3 would involve the extension of the northern extraction site further east increasing the area of extraction and volume of sand recovered to approximately 1 000 000m³. This option would be used in the event that agreements are made with relevant adjoining landholders and sufficient VENM is available to backfill the extraction pond. The timeframe in which the backfilling of the extraction pond is required would be determined by the required timeframe for supply of the sporting fields and recreational facilities proposed as the final land use for this section of the Proponent's landholdings.
- Option 4 would involve the extension of the northern extraction site to the western boundary of Tweed Coast Road. This option would be used in the event that Lot 1 DP 611021 and Lot 1 DP 105009 bounded by the Project Site and Tweed Coast Road are purchased by the Proponent and would allow the potential recovery of 1 250 000m³ of sand.

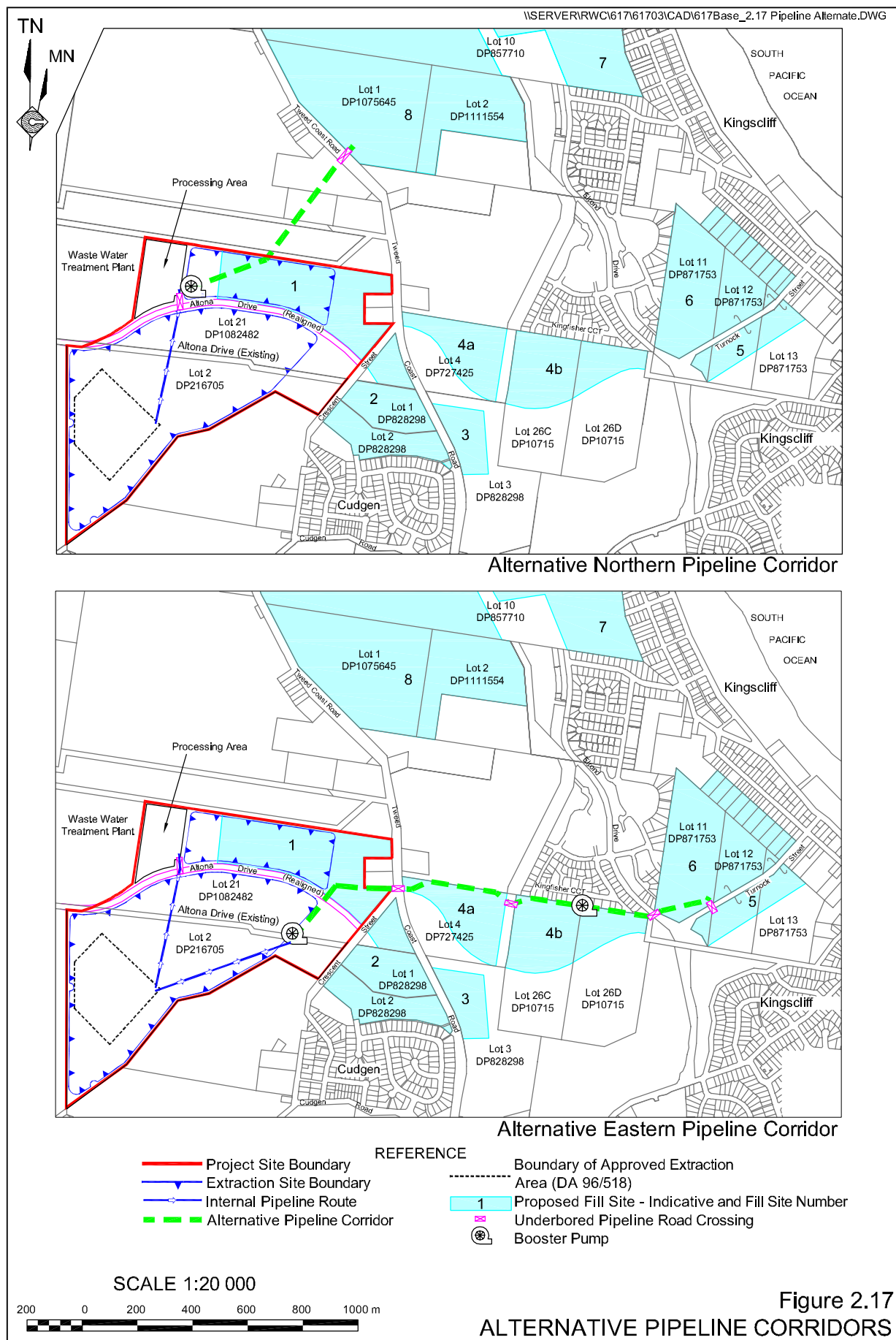
In the event that sufficient backfill becomes or is likely to be available to completely backfill the northern extraction area under Options 2 to 4, consideration may also be given to extraction of the sand resource beneath the intended alignment of Altona Drive (realigned). The feasibility of this would be further investigated in the event that sufficient VENM is available for backfill, Altona Drive is not required to be realigned prior to this time and the available backfill material would provide a suitable substrate upon which the realigned road could be constructed.

2.15.5 Alternative Pipeline Corridors

Figure 2.17 displays the locations of an alternative pipeline corridor to both the northern and eastern fill sites. Details of each of these are provided below together with information on the reasons why they are not preferred, however, information is also provided on the circumstances under which the corridors would be used.

The alternative northern corridor would be aligned from the southern extraction pond to a point on the northern boundary of the Project Site. The pipeline would then cross Lot 33 DP 7482 owned by Mrs C. Cooper, and Lot C DP 33290 and Lot 1 DP 781709, both owned by the Proponent, before passing underneath Tweed Coast Road. The use of the corridor would again necessitate the underboring of Tweed Coast Road. An access ramp over the pipeline or similar would be provided within Lot 33 DP 7482 in accordance with any agreement made with the landholder. It is further noted that this corridor relies upon crossing the northern extraction area before extraction occurs or after the area is backfilled. Hence, there is an uncertainty regarding this corridor and at the time of publication an agreement had still not been reached with Mrs Cooper. It is noted that the alternative northern corridor could be used in the event that a suitable agreement is reached with Mrs Cooper and it is practical to cross the northern extraction area.





The alternative eastern pipeline corridor would be positioned primarily within the Proponent's landholdings, generally along the northern boundaries of Lot 4 DP 727425 and Lots 26C and 26D, DP 10715. The corridor would require underbored crossings of Tweed Coast Road, Elrond Drive and Turnock Street (see **Figure 2.17**). No driveways would be crossed by the alternative eastern pipeline corridor and no clearing would be required as the pipeline would be laid on open ground. The alternative eastern pipeline corridor would be used in the event that the proposed road for development of Lots 26C and 26D, DP 10715 is not approved. The proposed eastern pipeline corridor, however, provides superior access to the pipeline and is further removed from surrounding residences and would therefore be preferentially used.

The eastern pipeline corridor would traverse the eastern section of the southern extraction site and require underbored crossings of both Crescent Street and Tweed Coast Road. It is proposed that the alignment east of Tweed Coast Road would be within the road reserve for the proposed road planned for construction to develop parts of Lots 26C and 26D, DP 10715 and nearby land. No driveways would be crossed by the pipeline and the proposed road would provide access to the pipeline for inspection and maintenance purposes. It is acknowledged that the proposed development of these lots, and the associated road, are not yet approved. It is expected that the development will be approved prior to the need to pump sand to the eastern fill sites.

