3. Description of the Proposed Development

This section of the document describes the proposed extractive industry in sufficient detail to allow for impact assessment. The main activities that could impact on the surrounding environment are described, while additional supporting information required for environmental assessment is provided in subsequent chapters.

3.1 Outline of the Proposal

NKPL propose to develop an open pit operation to extract friable sandstone in EL4192, near Newnes Junction, NSW as shown in **Figure 3.1**. With total estimated reserves of over 23.7 Mt, the pit life is anticipated to exceed 21 years. It is estimated that the extractive operation will have an annual average production in the order of 1.1 Mtpa of raw friable sandstone which will be transported by rail to Sydney for separation into 93,720 t of kaolin (8.52%), 99,550 t of specialty sands (9.05%) and 906,730 t of construction sand (82.43%).

Maximum annual production figures are anticipated to be in the order of 1.4 Mtpa of friable sandstone leaving the site producing 119,000 tpa of kaolin, 127,000 tpa of speciality sands and 1.154 Mtpa of construction sand. The project represents a significant advancement in resource utilisation, product beneficiation and value adding when compared to conventional friable sandstone quarries supplying product into Sydney markets.

In its raw state, the resource would be considered an acceptable friable sandstone deposit similar to that being extracted and processed at a number of quarries in the area. However, by separating kaolin and a portion of the industrial grade silica from the crushed sandstone, three separate product streams will be generated, these being:

- kaolin industrial mineral products;
- industrial grade, silica sand products; and
- premium quality construction sands.

Kaolin in its refined state has a potential value of up to 40 times that of construction sand. Removal of the kaolin from the sand has the additional benefit of optimising the quality of construction sands where an excess of clay minerals are considered as deleterious material.

It is proposed to transport all material to Sydney by train after loading at the existing rail loop servicing Clarence Colliery. A separate processing plant will be established in the Greater Sydney Area (GSA) that will have both rail access for crushed sandstone receival and road access for final product delivery. NKPL is at various stages of negotiation with the owners / lessees of four prospective processing sites in the GSA.

Once the processing site is confirmed, a separate EIS will be prepared for Sydney based operations. The only processing of the friable sandstone undertaken at Newnes Junction will be the primary crushing necessary for materials handling, stockpiling and train loading operations. With no secondary tertiary and/or quaternary processing on-site, there is no need for settlement ponds or other infrastructure normally associated with friable sandstone quarry operations.

The principal features of the project are summarised in the following sections and illustrated in the accompanying figures.

3.1.1 Site Description

The proposed development site is situated north of Newnes Junction, which is a small village located between Lithgow and Bell near the Bells Line of Road. The village contains six houses and a few other blocks of land that may be developed at some point in the future.

The proposed extraction site is bordered on three sides by development, including residential dwellings, roads, active quarrying and coal mining infrastructure. The Clarence Colliery pit top is located immediately to the north of the site, the Clarence Colliery rail loop to the northwest, the Bells Line of Road to the southwest and south and the Rocla sand quarry to the southeast. Newnes Junction residences are located between the proposed site and the road and rail infrastructure to the southwest. Two other sand quarries are located to the northwest of the area, one owned by Boral and the other by Pioneer (Kable Sands).

EL4192 is bordered by the Blue Mountains National Park to the east and this area has recently been included in the Greater Blue Mountains World Heritage Area. Consequently, it is vital that the site be managed in an environmentally sensitive and responsible manner. Detailed environmental investigations have been undertaken as part of this EIS process to ensure that specific environmental issues are adequately addressed.

The elevation of the site ranges from 1,090 to 1,010 m AHD. The site topography is relatively steep and drains eastward into the Blue Mountains National Park. There are no major watercourses through the site, however minor ephemeral creeks exist and the general area of the site drains towards the Wollangambe River and thence into the Colo River before flowing into the Hawkesbury system. The area supports relatively open woodland, with increased tree densities in the gullies.

3.2 Geology and the Resource

The site lies towards the western edge of the sandstone of the Permo-Triassic Sydney Basin. The Triassic Sandstone of the Sydney Basin is deeply dissected by numerous canyons and valleys. The Newnes Plateau rock types consist of non-marine fluviatile sediments, predominantly sandstones, with some claystones and shales. The sequence comprises the Triassic Narrabeen Group that overlies the Permian Illawarra Coal Measures.

A feature of the Newnes Plateau sandstones is that they are friable and therefore readily ripped and processed to yield a range of construction materials and industrial minerals products. Pecover (1986) studied the Newnes Plateau friable sandstones in substantial detail and concluded that their friable nature resulted from a strongly developed joint pattern and weathering. He described the process as *'...fracture assisted deep weathering.'* An added factor may be the presence of feldspar grains deposited with the sediments. Any such feldpars would have weathered to clay under the conditions postulated by Pecover, contributing to sandstone friability and to the clay content of the sandstone.

The friable sandstones of the plateau are mainly developed on the Banks Wall Sandstone, the formation that outcrops on EL4192. The material is predominantly weathered, medium grained sandstone that is generally cream or white in colour. Surface hardening occurs but rarely exceeds a few millimetres and mantles are friable, crumbly sandstone with a clay matrix of kaolin and an overall absence of ironstone crusts.

The sandstone at Newnes is soft and breaks readily with relatively little energy to dis-aggregate into kaolin, silica sand and fine silica. Pecover 1986, describes the Banks Wall Sandstone as gently dipping in an easterly direction and generally comprising:

"...50 to 80% quartz and 5 to 30% clay with a small percentage of lithic fragments" and *"... contains approximately 20% of clay and silt sized* $-75\mu m$ *material which is composed primarily of kaolinitic clays and a small proportion of fine silica, mica, and iron oxide."*

There are claystone horizons within the sandstone that occur as thin discontinuous lenticular bodies. The sandstones are generally massive, display cross bedding and can contain coarse quartz pebbles.

Some areas of the deposit contain prime white kaolin while in other areas the kaolin is slightly off white.

3.3 Geological Exploration

Extensive exploration has been conducted to determine the location and extent of the kaolin reserves. Exploration mine development planning and market research undertaken to date over the tenement area has spanned a 6 year period from 1996 to 2000. As part of the exploration works topographic contour mapping (on a 2 m interval) was produced on an orthophoto base, generated from scanned stereographic pairs of aerial photographs. The topographic database was developed by Geo-Spectrum (Australia) Pty Limited, following an aerial survey carried out for the project.

Reverse circulation drilling in the area comprised 54 drill holes to depths of up to 30 m, spaced over 4.5 km of prepared drill access tracks. The results allowed for the clear delineation of areas of pale coloured kaolinitic sandstone, suitable for the extraction of kaolin. An auger drilling program, using both a four inch and a nine inch diameter drill, was carried out within the area targeted by the previous drilling program in the north western part of the lease.

Bulk samples of the friable kaolinitic sandstone over a range of depths were taken and disaggregated to separate the kaolin from the sand. Bulk separation equipment designed and built at Macquarie University was used to fractionate specific size fractions. The kaolinite fraction (<10 μm) was mineralogically tested by X-ray diffraction techniques and quantitative size analyses using a Sedigraph particle size analyser.

Full interpretation and facies modelling of the drill hole data was carried out and this formed the basis of the mining plan formulated by MineConsult in 1999 and included in this report as **Figures 3.1** to **3.11**.

3.3.1 Product Quality and Reserve Quantities

The sandstone material to be extracted and primary crushed at the site is all of a relatively high quality with commercial value, either as kaolin or as high quality sand. In discussions with major end users, the Company has identified that the 12% silt fraction can be marketed as feedstock for silica flour production and an additive for concrete products. Any remaining unsaleable material can be used as construction fill.

The quality of the friable sandstone can be subdivided into 2 categories, based on the processing required to obtain clean products.

These are:

- ***premium grade friable sandstone*** consisting of light coloured sandstone with very low iron content; and
- ***standard grade friable sandstone*** consisting of coloured sandstone with a small percentage of iron.

Estimates from the geological modelling indicate that the total volume of material proposed for extraction is 23.7 Mt, of which 18 Mt (in situ) is premium grade friable sandstone and 5.7 Mt (in situ) is standard grade material.

The products obtained from the friable sandstone following processing include kaolin and high quality sands. The 'kaolin fraction' is defined for this project as comprising clay admixed with a small proportion of very fine silica minerals, sized at <10 μm. An estimated 2.02 Mt of this product will be extracted over the 21 year life of the project.

The remaining 21.71 Mt comprises high grade construction sands and various speciality sand and gravel products.

Table 3.1 – Estimated Production Figures Over the Life of the Mine (tonnes)

	Total Production *	Average Annual Production	Maximum Annual Production
Kaolin	2,022,432 (8.52%)	96,306	119,000
Construction Sand	19,566,793 (82.43%)	931,752	1,154,000
Specialty Sand	2,148,240 (9.05%	102,297	127,000
Total Production	23,737,466	1,130,356	1,400,000

3.4 Pit Planning

The conceptual designs of the pit, stockpiles and roads are described in the following sections.

3.4.1 Design of the Open Pit

Detail design work is underway for prepared for:

- extraction of the friable sandstone resource;
- internal haul roads and drainage systems;
- primary crushing and materials handling on site; and
- construction and operation of conveyor and rail loading systems to move the material off site to the processing area.

Planning has been computer generated by MineConsult using state-of-the-art Gemcom software. It was based on current aerial survey data obtained by Geospectrum and geological information. Extraction planning and scheduling was reviewed by Don Reed and Associates (DRA) in consultation with the owners of the proposed operation.

Plans have been prepared to show pit development over 21 years and these stages are shown in **Figure 3.2** to **Figure 3.8.** These intervals have been chosen to demonstrate the status and impacts of the development at various stages of extraction and rehabilitation.

The open pit development stages may be summarised as follows and each stage is illustrated in **Figure 3.2** to **Figure 3.7**:

Stage 1: Before any substantial worked faces are established, removal of vegetation, erection of infrastructure, pit depth of RL 1020.

Stage 2: Four (4) benches would be formed with elevations of RL 1053, RL 1044, RL 1035 and RL 1020 respectively.

Stage 3: Further bench established, five (5) benches with elevations of RL 1053, RL 1044, RL 1035, RL 1026, and RL 1020.

Stage 4: Pit widened significantly with three (3) large benches of RL 1008, RL 999 and RL 993; and four small benches of RL 1017, RL 1026, RL 1035, RL 1044 and RL 1053 respectively.

Stage 5: Pit is doubled in size with seven (7) benches of RL 993, RL 999, RL 1008, RL 1017, RL 1026, RL 1035 and RL 1044 respectively.

Stage 6: Pit increased in depth and extended further south, one (1) main bench forming base of pit RL 993.

Principle planning criteria have been adopted to ensure:

- long term viability of the development (ie. planning that allows operational and cost efficient pit operations);
- maximum yield of kaolin from the friable sandstone extracted at any location;
- that environmental planning issues raised by statutory authorities and project consultants are addressed to minimise impacts from the proposed operations; and
- that the post operational landform lends itself to site rehabilitation in a manner that guarantees the long term environmental and aesthetic integrity of the site.

Of particular importance throughout the planning process has been the need to find the most appropriate compromise between:

- accessing high grade friable sandstone early in the extraction process;
- minimising water, noise and visual impacts generated by the project and the potential for negative impacts on the adjacent National Park/World Heritage Area.

Mine planning has made provision for:

- optimising friable sandstone extraction;
- minimising the area of disturbance;
- progressing extraction from the north to the south to mitigate the impacts of the project on Newnes Junction residents to the south;
- constructing a large sump during the pre-extraction phase to capture run-off from disturbed areas and prevent any uncontrolled discharge into the adjacent Blue Mountains National Park;
- providing adequate buffers between the proposed open pit development and the Blue Mountains National Park to the east;
- construction of internal drainage within the pit to ensure zero discharge from the disturbed area runoff catchment in conditions of up to a 1 in 50 year storm event;
- diverting clean water around disturbed areas to ensure that water collected within the pit is minimised;
- designing site batters to minimise erosion;
- progressively rehabilitating disturbed areas.

3.4.2 Site Development

It is proposed that the site will contain a pit from which the friable sandstone will be extracted via ripping and pushing with a dozer. Pushed up material will be front end loaded into trucks prior to being transported to the primary crushing facility, and subsequently conveyed to a covered stockpile. Crushed sandstone will be conveyed to a surge bin adjacent to the railway line and loaded into trains for transportation to an off-site processing facility.

Crushing and materials handling plant and infrastructure, including the grizzly, crusher, covered stockpile and maintenance facilities etc, will be located along the northern portion of the site.

Construction

Prior to the commencement of extractive operations the site will require preparation and installation and erection of operational equipment and infrastructure. Construction operations will be required for the site access road, internal haul and service roads, erection of materials handling, servicing, maintenance and administration facilities, excavation and installation for grizzly and crusher, and erection of conveyor systems.

The construction works will be performed in two (2) stages with total estimated duration of not more than six (6) months (26 weeks). A summary of the construction stages and typical plant and equipment are presented below.

Construction Stage	Description of Activities	Typical Plant & Equipment
Stage 1 (4-13 weeks)	- Access road - Internal roads - Excavation for crushing facility - Preparation for siting of buildings - Compaction of building sites - Preparation of footings for conveyor	- Dozers - Excavator - Front End Loader - Haul Trucks - Tree Mulcher - Truck Mounted Auger - Vibratory Roller - Water Cart
Stage 2 (4–13 weeks)	- Building erection & fitout - Installation of stationary plant & equipment - Erection of conveyor systems - Commissioning of plant & equipment	- Crane - Concrete Trucks - Welders - Compressors - Generators - General Hand Tools

Operation

NKPL has undertaken conceptual designs of the pit, open stockpile areas, covered stockpiles, conveyer routes and internal roads. A key feature of the open pit development will be the requirement for selective extraction of premium grade and standard grade, friable sandstones. For this reason, the pit will be developed with shallow benches typically 3m high. The basic stages are as follows:

Pre Extraction Stage – Stripping and stockpiling of the topsoil overburden by dozer will avoid compaction of the soil and subsequent loss of structure. Topsoil will be stockpiled in low (2m high), but long piles for later rehabilitation works. Stage preparation works will occur prior to the commencement of each extraction stage.

Friable Sandstone Extraction - The selective winning of friable sandstone will be achieved by ripping and/or excavating the friable sandstone prior to pushing ripped sandstone up for loading. It is proposed to develop the pit in a north to south direction from the top to the bottom of the hillside.

Ripped Sandstone Transportation - The extracted sandstone will be front end loaded into haul trucks and transported to the crusher, from which the crushed sandstone will be conveyed to a covered stockpile.

Train Loading - Stockpiled, crushed sandstone will be fed from the covered stockpile onto the conveyer for transfer to the surge bin located at the train loading facility. The material will then be transported by rail to an off-site processing facility yet to be determined.

Vegetation Management

The proposed open pit development area is covered with eucalyptus woodland vegetation. There are currently exploration tracks crossing the area, some of which will be used for continued site access.

Existing vegetation within the designated pit areas will be progressively removed before extraction starts in specific development areas. The clearing schedule will be roughly in accord with the extraction schedule shown on **Figures 3.2** to **3.8**. Wherever possible, cleared vegetation will be transported directly to rehabilitation areas for respreading.

In the event that there are no rehabilitation areas available at the time, cleared vegetation will be windrowed for future mulching and spreading as part of site rehabilitation activities. If necessary, excess vegetation may be burnt with appropriate approvals from Council.

All clearing and revegetation works will be done in consultation with the relevant authorities and DLWC in particular. Seed collection of species on site will be undertaken as part of the rehabilitation program and the seeds used to propagate plants that will be used in the rehabilitation works.

Topsoil Handling and Storage

The topsoil on site mainly consists of a very shallow (<0.30m) cover of poor quality, sandy loam over most of the proposed kaolin mining area.

Topsoil will be stripped (by bulldozer, hydraulic excavator or FEL) and either used immediately in rehabilitation works or stored for future rehabilitation works. Wherever possible, overburden will be stripped, transported, dumped and respread in one operation. This will be done in accordance with preferred DLWC policy in order to sustain as much of the biological content of the soil as possible.

Topsoil removed from the areas initially disturbed, ie. the infrastructure and stockpile areas, will be stored in topsoil stockpiles located within the final pit limits that will be cleared for this purpose. These areas will have silt fences constructed downslope to contain sediment movement. The topsoil stockpiles will be approximately 2 m high and will have batters no steeper than 1:3 (V:H).

The topsoil stockpiles will be seeded with grasses as soon as construction has been finalised (subject to suitable weather conditions) to stabilise the soil. This topsoil will be used in the initial landscaping works to be carried out on the berms of the pit benches.

Soil and Water Management

An Erosion and Sediment Control Plan will be prepared as part of detailed design for the project. The plan will detail works to be undertaken prior to any surface disturbance such as the clearing of vegetation and subsequent stripping of overburden. Such work will include:

- construction of sedimentation dams on all significant drainage lines exiting the site to ensure that sediment does not leave the site during the early stages of construction;
- use of hay bales or sand bag check dams in roadside drains and minor watercourses to retard runoff flow and trap sediments; and
- erection of silt stop fencing downslope of all disturbed, externally draining areas.

All sediment traps will be regularly maintained to ensure effective control of runoff from disturbed areas.

After initial protection works have been installed a sump will be constructed in the base of the pit to collect stormwater at a low point in the pit, and prevent sediment-laden water from leaving the site. This sump will be constructed to ensure that the 1 in 50 year storm event will be contained within the open pit development area, protecting the waterways of the adjacent Blue Mountains National Park and World Heritage Area. For the remainder of the pit development, all erosion and sediment controls within the mine will discharge into the main open pit sump. Water will not be discharged from the site unless it meets discharge requirements specified by the relevant authorities.

The proposed system will provide significant protection against sediment movement into adjacent watercourses in the Blue Mountains National Park. Further information on erosion control systems is provided in the discussion on water management and erosion control.

3.5 Extraction Method and On Site Handling

Extraction will proceed in a north to south direction from top to bottom to minimise noise and dust impacts on local residents. Additional depth will be obtained as pit development moves southward, helping to shield residences from the development. Extraction of premium and standard grade sandstone will involve the following activities:

- **topsoil removal and storage:** stripping and/or placement of the topsoil using a small dozer. This will avoid compaction of the soil and subsequent loss of structure. If topsoil cannot be used immediately in rehabilitation works, it will be stockpiled in low (approximately 2 m high) piles for later use in progressive rehabilitation;

- **friable sandstone extraction:** extraction will be achieved by dozer ripping and pushing into heaps for front end loading to haul trucks;

- **materials handling:** once ripped, pushed and loaded friable sandstone will be trucked to the crusher station before being conveyed to stockpiles and/or the rail loader.

Due to the fact that downstream processing will be conducted offsite, large stockpiles of the material will not be necessary at Newnes Junction. Temporary stockpiles will be necessary to store crushed sandstone prior to transfer for rail transportation. As far as is practicable, these will be located in-pit, on working benches.

The following details regarding the extraction and handling of the crushed sandstone have been provided by Roger Smith and Associates.

Figure 3.9 and **Figure 3.10** show the conceptual flow and layout of the materials handling, stockpiling and train loading system proposed for the operation.

3.5.1 Extraction

Mine planning is based on a gradual increase over the initial ten years of pit operation until full production is reached in approximately year 11. Friable sandstone will be extracted by ripping with a bulldozer, prior to loading onto haul trucks and transporting it up a ramp to the crusher station (see **Figure 3.10)**.

3.5.2 Crushing

Crushed sandstone will be delivered to the crusher station by 50 t dump trucks and discharged through a grizzly screen to a surge bin below the dump point.

The grizzly will be horizontal and minus 200 mm material will pass through, leaving a small amount of plus 200 mm on the grizzly. The grizzly will be a hydraulically operated, tipping, SimbaGrid type that allows oversize to be tipped off to the side as and when necessary. The small amount of oversize expected would be periodically backloaded onto a returning truck and taken back to the pit to be laid out, run over by the dozer and crushed to below 200 mm. It is anticipated that trucks coming off the dump station would turn left around the end of the Stacking Conveyor, run west along the northern boundary of the lease, then turn left again to pass under the stacking conveyor return down the ramp into the pit.

A light duty Apron Feeder will be located under the Surge Bin to ensure a steady controlled feed to the rest of the system. The Apron Feeder will discharge into a roll type crusher/sizer that performs both the initial crushing operation and also sizes the sandstone for reliable subsequent/ stacker/ reclaimer/ train loading operations. The friable sandstone will crush easily and the crusher/sizer will operate on an open circuit.

3.5.3 Stockpiling Conveyor

Crushed sandstone will fall onto a transfer conveyor and then be transferred to the stockpiling conveyor. The capacity of the stockpiling conveyor system will be 680 t per hr.

Crushed sandstone will include damp clayey material that is difficult to handle if it becomes wet. While the equipment has been carefully selected to take account of the nature of the sandstone and the handling characteristics of the crushed product, it is essential that the raw feed be protected from the rain from this point on. For this reason, the dump point, all conveyors and the product stockpile will be covered. These covers will also reduce the dust generated by the operation.

The stockpiling conveyor will elevate and then run horizontally along a gantry over the top of the stockpile area. A tripper will be incorporated into this system and operate over the full length of the stockpile. The tripper will move automatically when the stockpile reaches the required height and controls will be designed to allow the tripper to operate from either end. By this means, a single stockpile system will stack premium grade sandstone one end and standard grade sandstone the other end, thus avoiding duplication of the facilities.

3.5.4 Main Stockpile

The capacity of the main crushed sandstone stockpile will include 6,000 t of premium grade sandstone and 6,000 t of standard grade sandstone. This will be equivalent to the volume required by two unit trains for each grade of material.

The stockpile area will be excavated out of the slope of the hill and partially concealed from view. The base of the stockpile will be bedrock and no concrete pad will be required. The material excavated during the construction of the stockpile area consists of friable sandstone that will be fed back into the system.

A 45^0 pitched, environmental green, colourbond roof will be erected to cover the entire, main stockpile area. Vertical columns down the length of the stockpile will support the overhead tripper gantry, as well as supporting the A-frame roof support system. This will keep the crushed sandstone dry and reduce the visual impact of the light coloured stockpiled material.

A 3 m deep trench will be excavated down the centre of the stockpile to house the reclaim tunnel under the stockpile. This trench will continue down the length of the stockpile with a slight negative slope so that the whole reclaim tunnel will be self-draining.

3.5.5 Stockpile Reclaim System

The capacity of the reclaim system will be 4,000 t per hour, to match the loading rate of the train loader.

A series of wide throat reclaimers will be located in the roof of the reclaim tunnel under the stockpile. Preliminary estimates suggest that a total of ten units would be required, five for premium grade sandstone and five for standard grade sandstone. Each set of reclaimers will operate independently and interlocks will prevent both sets running at the same time, preventing contamination of the different graded material.

3.5.6 Reclaim Conveyor

As the existing topography on the lease is lower than the rail loop and is sloping away from the rail line, it will be necessary to cut the stockpile area into the hillside and provide a ramp for the conveyor up to the lease boundary. The ramp will involve a 5 m wide bulldozer cut with the surrounding area being left untouched for visual screening. Spoil from the excavation of the reclaim conveyor will consist of friable sandstone and will be fed back into the system.

The reclaim conveyor will run through the reclaim tunnel, up the ramp and then continue on to intersect the rail loop adjacent to the existing Clarence Coal Loading facility. In order to intersect the rail line at the required point, it will be necessary to angle the whole conveyor and stockpile system at about 5^{0} to the line of the northern lease boundary. In consideration of the size and location of this conveyor, it will be designed to drive on the return side of the belt or on the tail pulley.

All conveyor gantry structures will be painted environmental green to reduce their visual impact.

3.6 Transportation

Transportation of crushed sandstone from site is possible either by rail or by road since facilities for both exist in the vicinity of the proposed development. There is an existing rail loop associated with Clarence Colliery, which is used to transport coal to Port Kembla. Currently the facility is under-utilised and can easily accommodate the proposed maximum production rate at the Newnes Junction Pit as well as Clarence Colliery. Road transportation of the material is also a possibility, however, the additional resulting traffic on the Bells Line of Road would be undesirable. It is considered that rail transport of the run-of-mine material to an off site plant located in the outer suburbs of Sydney is the best and most environmentally responsible option.

For these reasons, it is proposed to rail the crushed sandstone to the processing site in Sydney.

In view of the size of the unit trains and the required loading rate it is impractical to provide bins on the rail loop large enough to load a full 3,000 t unit train. Consequently, the reclaim system and conveyor will be designed to match the loading rate and the train loading bin will operate as a small surge bin. The design capacity is 680 t, giving about a 7.5 minutes residence time. This will be adequate to handle any fluctuations in the reclaim system.

Since it is impractical to consider sharing the existing train loader with Clarence Colliery, a separate, purpose designed train loader located adjacent to the existing coal loader will be constructed.

It is intended to use similar rail wagons to those commonly used for coal and it will be necessary to provide a simple, mechanically operated, automatic cover over the loading port to keep the crushed sandstone dry during transit. The loading system is anticipated to be a continuous, automatic, flood loading system similar to that commonly used in the Coal industry throughout Australia. The Clarence Colliery Rail Loop is a Class "A" system and a unit train holds 3,000 t. In order to fit in with the Clarence Colliery operations, it will be necessary to load a unit train in less than 55 minutes to avoid excessive penalty rates. At 4,000 tonnes per hour loading rate, the Newnes Junction Friable Sandstone system will be designed to load a unit train in 45 minutes.

To transport the maximum anticipated production of 1.4 Mtpa on a 50 week/year basis will require 9 unit trains per week. This is similar to the existing number of coal trains per week. Stockpile capacities will allow up to a maximum of 2 trains per day for 2 days. Clarence Colliery will have priority over the use of the loop. They also may, on occasions, load 3 trains in one day however, this is only 3 hours out of a day and still allows adequate time for the proponent to load 2 trains on the same day.

The operation of the reclaim system, the train loading conveyor and the train loader will all be interlocked, automatic and controlled from the train loader control cabin by the operator.

3.7 Processing of Crushed Sandstone

The establishment and operation of the proposed processing plant will be covered under a separate EIS once site selection and negotiations have been finalised. While approval for the processing area is not being sought in connection with this EIS, conceptual information regarding the processing of the primary crushed sandstone is provided in **Appendix C**.

In summary, the downstream processing area will be located close to rail transport to enable the crushed sandstone, raw feed to be brought to site by rail from Newnes Junction. In addition, the processing site will require a reasonable land area, considerable quantities of water, power and proximity to road transport routes.

Given the above criteria, it is considered environmentally responsible and financially more viable to locate the processing plant in an industrial area on the outskirts of Sydney. NKPL is investigating available sites that meet the necessary criteria for secondary, tertiary and quaternary processing, product stockpiling and dispatch. NKPL is at various stages of negotiation with the owners / lessees of each of the sites and a final decision regarding the processing site should be able to be made in the relatively near future.

It is anticipated that a separate development approval will be sought for a processing and distribution site located adjacent to rail facilities in the Greater Sydney Area.

Timing of this application will be subject to negotiation of satisfactory commercial terms and any conditions imposed on the Newnes Junction development.

3.8 Plant and Infrastructure

Plant and infrastructure required to support the project will be minimal, given that all the friable sandstone mined at the site will be transported off site for processing. Plant and infrastructural requirements at Newnes Junction will include:

- a 75 tonne feed hopper, scalping grizzly and rolls crusher;
- materials handling equipment (conveyors, drives, feeders, transfers);
- a single train loading bin;
- a small equipment parking area;
- a transportable office block;
- toilet facilities;
- power;
- a potable water supply (to be tanked in as required); and
- an equipment servicing area which will be located within pit limits as far as is practical.

3.8.1 Plant and Equipment

Mobile plant used to win, load and cart friable sandstone from the proposed mine will typically consist of:

- 1 to 2 x Cat D11 bulldozer (or equivalent depending on production);
- 1 x Cat 988 front end loader (or equivalent);
- 3 x Cat 773 dump trucks (or equivalent).

The preferred method of winning and transporting friable sandstone will be using dozers to rip and push the material into piles with a loader feeding dump trucks to transport sandstone from the pit to the crusher plant located at the north-eastern corner of the site. (Alternatively, scrapers could be used to both extract and transport the material while an hydraulic excavator could be used instead of the dozer to directly load dump trucks. The scrapers and hydraulic excavators will be optional and if used would replace the bulldozer, loader and/or dump trucks). Since the extraction of the friable sandstone will likely be undertaken by a contractor, the final equipment list will be subject to competitive tender. For the purposes of this EIS, and in particular the noise impact assessment, the highest noise generating equipment has been assumed. During the early years of the operation, noise data will be collected and if noise exceedences are found to occur, operational alternatives will be considered and implemented.

The major components of the on-site processing facilities will include:

- crusher station/trommel screen;
- stockpile conveyor;
- product stockpiles;
- train loader conveyor; and

- train loading bin.

3.8.2 Road Design

The location of the main haul roads and ramps into the Newnes pit are shown in **Figures 3.2** to **Figure 3.8**. Roads will have a minimum width of 20 m, including the travelling surface and drainage provisions. Ramp gradients will be no greater than 10% that will allow their use during wet weather. Ramps will have a minimum internal radius of 20 m.

3.8.3 Sewage Treatment Facilities

It is proposed to install a package treatment plant that uses biological processes to treat the sewage.

Effluent from such package aerobic treatment plants contains less polluting organic material and significantly less bacteria than septic tank effluent. Effluent quality requirements for such plants are:

- Biochemical oxygen demand (BOD_5) 20 mg/L;
- Suspended solids (SS) 30 mg/L; and
- Faecal coliforms (FC) 30 per 100 ml.

An example of such a unit would be the Envirocycle system. These units are circular with five annular segments in series and two centre compartments. The annular segments comprise two primary sedimentation sections and three aeration sections. The centre compartments comprise one clarifier and one disinfection tank. Sludge from the clarifier is returned to the first primary sedimentation tank. Aeration is achieved by a diffused air system and disinfection by chlorine.

Treated effluent will be used to irrigate landscaped and other revegetated areas. Spray irrigation areas will be licensed by the EPA in accordance with their requirements.

3.8.4 Power

The plant will require in the order of 2.5 megawatts of power, which will be provided from the grid. Diesel generators will be used initially and will then be retained on site as a backup power source for use in emergency. The diesel to run these generators will be sourced from two 10,000 L above ground diesel storage tanks that will be fully bunded. These power sources will provide for all requirements at the Newnes site including domestic needs, extraction requirements and conveyor drive requirements.

3.8.5 Fuels and Lubricants

Fuel will be stored in above ground diesel tanks within a bunded area on an impermeable hardstand. Diesel will be pumped directly from delivery tanks into an above ground storage tank located to the north of the site. The bund will be sufficiently large to contain 110% of the volume of the largest tank within the bund in accordance with AS 1940. Hose couplings will be located within the bund wall and there will be no pipework constructed through the wall. The bund will contain any spillage and prevent associated soil and groundwater contamination. A small mobile tank will be used to refuel the mine equipment.

Lubricants will also be stored in a designated bunded area with a concrete base. Oil will be delivered to the site in drums that will be unloaded and laid on their sides (to prevent the ingress of water) in the bunded area. When required, oil drums will be placed on a lube and workshop truck and oil will be transferred to equipment using portable pumps.

Inspections of the tanks and the bunded areas will be carried out regularly and fuel supplied will be reconciled with fuel stored to ensure that leakage is not occurring.

Waste oil will be stored for periodic collection and recycling by a local waste contractor. In the event of a spillage, the oils will be contained within the bunded area and pumped to drums for recycling. Residual oil will be absorbed using an appropriate material, and disposed of appropriately. Any spills occurring outside the bunded areas will be cleaned up by excavation of the material and appropriate disposal.

3.9 Water Consumption Requirements

The Newnes operation will require water for the following activities:

- domestic water supplies (potable);
- dust suppression within the open pit and hardstand areas (non potable);
- dust suppression on access roads (non potable); and
- fire fighting (non-potable).

No water will be required for processing purposes since ripped and primary crushed rock will be processed off site.

Potable Water

Demand for potable water has been estimated at 20 L/person/day. With an estimated maximum workforce of up to 10 people (including truck delivery fleet), potable water demand will be approximately 200 L per day.

Potable water for drinking and staff amenities will be stored in an above ground tank (up to 5,000 L) located adjacent to the main office and amenities area. Rain water from roofs of on site buildings will be harvested with the shortfall being supplemented as required by water trucked to site by a small tanker.

Non-Potable Water

Raw water will be sourced from the in pit sump and if necessary will be supplemented from tankered supplies.

The vast majority of the site's water demand will be for dust suppression in pit. Stockpiles will be covered to minimise dust since water cannot be sprayed on the ore.

Dust suppression in the mining area and on the access road network will be achieved through the use of a water truck, which will spray water as required to minimise dust generation. The water tanker used will hold approximately 25,000 L of water and will be used as required to suppress dust on the site. During dry weather, it is estimated the tanker may be used for up to 4 hours per day, and will need filling about twice per day.

Water requirements for dust suppression for the site are anticipated to be in the order of 50,000 L/day, depending on weather conditions.

3.10 Project Schedule and Hours of Operation

3.10.1 Project Schedule

It is anticipated that the proposed extractive operation could be in commercial production within 26 weeks of development consent being granted. Exact scheduling of the development will however, depend upon the time of receipt of development approval and necessary licences and permits, availability of suitable equipment and contractors for the initial clearing, construction activities and mine operation.

Another key factor in determining the commencement of the operations will be finalising the approvals for the processing site in the Greater Sydney region.

3.10.2 Construction

Construction activities will commence following development approval and the identification and development of a suitable processing site. Construction activities at the site are expected to last for approximately 26 weeks however will be contingent on circumstances during the construction period. A detailed engineering design will be undertaken once development consent has been granted. This work will take into account any requirements in the conditions of consent applying to the project.

Contractors will be engaged to carry out the majority of construction activities and will be drawn primarily from the local area. The construction workforce will comprise a combination of skilled, semi-skilled and unskilled labour. There will be a small component of specialist contract labour as well as staff from the proponent’s or associated companies who may have to be brought into the area.

Since most of the construction contractors will be locally based, it will not be necessary to establish construction camps on site.

3.10.3 Operation

Production schedules have been calculated on the basis of 10 hours per day, 5½ days per week, 50 weeks per annum, with approximately 400 tonnes per hour being extracted, loaded, transported, crushed, conveyed and stockpiled.

Normal hours of operation for development and operational activities will be as follows:

- ***Pit development*** will occur in daylight hours only, nominally 7.00 am to 6:00 pm Monday to Saturday;

- ***in-pit extraction*** will occur during daylight hours (ie. Monday to Saturday between 7.00 am to 6.00 pm);

- while the majority of ***train loading dispatch*** will occur during daylight hours wherever possible, 6 days per week, the operation will need to be available 24 hours a day, 7 days a week to provide flexibility for transportation requirements. Twenty four hour dispatch is necessary to optimise the available loading times given that the rail loop is owned by Clarence Colliery, which has priority on the loop, and that rail loading times will be determined by the rail authorities. Loading activities would occur on average for 1-2 hours per day but may occur for up to 3 hours a day depending on rail authorities schedules; and

- ***plant maintenance*** - where possible, preventative maintenance will be undertaken during normal pit operational hours. In the event that this is not possible, maintenance will occur after hours with limited overtime. Breakdown maintenance may be required up to 24 hours per day during stoppages, as per normal industry practice.

3.11 Workforce

3.11.1 Construction

During the construction period a significant number of contractors will need to be employed on site. These will include company representatives, project management, supervisors, engineers, surveyors, earthworks and other contractors (electrical, civil, mechanical etc) landscapers and so on.

3.11.2 Operation

The number of people employed at the Newnes Junction operation on a day to day basis is anticipated to fluctuate between 6 and 10, depending on production. The single shift workforce will typically require up to 8 people, including:

- 1 x pit manager;
- 1 to 2 x bulldozer operators;
- 1 x loader operator;
- 3 x dump truck drivers; and
- 1 support staff / train loader.

The proposed development will provide long term job security for the workforce once it becomes established and as production increases, further employment opportunities may become available. Outside contractors may also be employed to assist with clearing and stripping operations, the establishment of site drainage, sediment catchment, water reticulation and rehabilitation systems.

The Newnes Junction operation will also provide direct and/or indirect employment to a number of external suppliers, service providers, contractors and consultants. These may include:

- major consumable suppliers (fuel, wear parts, tyres etc);
- parts suppliers (mobile and fixed plant);
- service contractors (electricians, plumbers, mechanics, fitters etc);
- mining and civil engineers;
- environmental contractors and consultants;
- geologists, surveyors, mine planners; and
- office suppliers, printers etc.

3.12 Rehabilitation

3.12.1 Rehabilitation Objectives

Temporary and permanent rehabilitation strategies have been developed for the site, with the primary aim being to maximise surface stability during the construction phase and to establish the final landform so that impacts on the adjacent National Park and World Heritage are minimal.

A rehabilitation strategy has been developed which incorporates temporary and permanent structures to maximise surface stability during construction works and rapidly establish final batters and benches. The objectives of the rehabilitation strategy are to:

- minimise the environmental impact of the expanding operation during development and operational phases, ensuring that protection of water quality and erosion control works are key priorities, and that progressive rehabilitation is completed as soon as possible;

- ensure that site drainage and sedimentation structures remain stable and functional under extreme rainfall events;

- ensure that vegetative matter and topsoil is made available for site rehabilitation as required;

- guarantee that the resource is extracted and the site rehabilitated in a manner that will ensure the quality of surface runoff and groundwater infiltration at all times; and

- produce a final "walk away" landform which is geotechnically stable and blends aesthetically into the surrounding landforms, yet as far as possible does not limit possible future land uses.

3.12.2 Infrastructure Areas

Rehabilitation works will be conducted on all exposed batters associated with access roads, stockpile areas and water management structures. These works will be conducted as soon as possible after construction, to stabilise surfaces, prevent erosion and protect water quality.

Surface preparation prior to rehabilitation works will generally include:

- dozer ripping of worked out areas in advance of topsoiling, seeding and sowing operations to increase moisture infiltration and improve and prolong the available moisture for establishing vegetation. Ripping will also reduce surface runoff and subsequent erosion hazards whilst promoting tree root penetration. These works will be carried out in consultation with an experienced geotechnical engineer in order to avoid any potential slope instability;

- application of fertilisers and gypsum where required to improve the structure of the material, to avoid surface sealing and to encourage early root development. Any such applications will be done in consultation with DLWC. Fertiliser rates may be reduced in order to avoid nutrient rich runoff leaving the site.

Where applicable and given the small areas to be rehabilitated at any one time, rehabilitation works may include a spray application of straw mulch material to exposed slopes. The mulch would consist of a mixture of straw, bitumen, fertiliser and seed mix. The primary purpose of this application is to provide immediate surface soil stability to minimise erosion potential while at the same time sowing grass seed and fertiliser.

An appropriate grass seed mix will be used, based on recommendations made by the Department of Land and Water Conservation. The mix will consist of a mixture of fast growing, short-lived species; slower growing, hardier grass species; and nitrogen fixing legumes. An example of the type of grass seed mix for different growing seasons is provided in **Table 3.2**.

Table 3.2 - Generalised Seed and Fertiliser Applications

Season	Species	Rate kg/ha	Fertiliser*	Rate kg/ha	Sowing
Autumn sowing/ low bulk pasture	Kangaroo Valley Rye Highlands Bent Rose Clover Red Clover	10 5 5 5	11-34-11 or 15-30-0	400	Early March to early May
Autumn sowing/ high bulk pasture	Cereal Rye Kangaroo Valley Rye Phalaris (Sirosa) Highlands Bent Seaton Park Sub Clover Red Clover Lucerne	10 5 5 5 5 5 5	11-34-11 or 15-30-0	400	Early March to early May
Summer sowing/ low bulk pasture	Couch Haifa White Clover Red Clover	5 5 5	11-34-11	400	Late Dec to late Feb

Table 3.2 - Generalised Seed and Fertiliser Applications

Season	Species	Rate kg/ha	Fertiliser*	Rate kg/ha	Sowing
Summer sowing/ high bulk pasture	Japanese Millet	1			
	Paspalum	3			Late
	Couch	5	11-34-11	400	Dec to late
	Rhodes Grass	15	15-30-0		Feb
	Kikuyu	5			

* The mixtures in the fertiliser column refer to the percentage by weight of P_2O_5;N, and K_2O in the recommended fertiliser types. Commercial fertilisers are available which contain these proportions of major nutrients (Source: Hannon 1984).

The hay-mulching present in the spray mixture promotes slow runoff velocities, reducing scour potential. However, even with such a surface sealing, runoff from larger storm events will have the potential to erode steeper unconsolidated slopes. The erosion potential will reduce once vegetation is established.

The fertiliser application is likely to be either “Starter 15” or “Grower 11” at a rate of 400 kg/ha. Gypsum may also be applied to improve the soil structure and water infiltration, however this will be determined in consultation with the DLWC prior to revegetation works. Fertiliser rates may be reduced to 125 kg/ha in areas closer to the National Park boundary in order to avoid nutrient release. Once the areas have been sown they will be regularly maintained to maximise germination and sustained growth. Should it be necessary, areas will be reseeded. Once the final revegetation works are complete and self-regenerating native vegetation communities are established, maintenance requirements will be substantially reduced.

The above seed mix will be used in selected areas away from the National Park boundary. Although exposed slopes are not planned between the pit and the National Park, should revegetation works be necessary, only native species will be used. This will also avoid the potential for non-native grasses entering the National Park. The 50 m buffer between the mine pit and the park boundary will not be disturbed.

3.12.3 Open Cut

A unique and critical component of the operation will be the early and progressive rehabilitation of disturbed areas around the open cut. The nature of the friable sandstone requires relatively shallow ripping and selective extraction from horizontal benches to optimise grade separation. Consequently, the pit will be developed with very shallow benches. The general rehabilitation concept for the pit walls is shown in **Figures 3.12** to **3.14**. Rehabilitation of the site will occur progressively around the peripheries of the site, not within the open pit itself, which must be left open for continuing and contamination free extractive operations.

The nominal bench height within the pit will be 3 m high. A 2 m berm will be created on each bench during the extraction of the bench below it. This method of extraction will allow for the 2 m berm to be revegetated as the bench is extracted , enabling progressive rehabilitation of the mine walls. In normal hardrock quarries , the bench heights are usually some 5 times higher, rendering rehabilitation work difficult and impossible to commence until the later stages and/or completion of extraction.

Once the edges of the first bench have been taken, a 2 m wide area around the perimeter of the excavated area can be rehabilitated adjacent to the 3m pit wall, while extraction continues on this and the next bench.

The rehabilitation will occur progressively and will involve:

- surface preparation of the area by ripping;
- placement of at least 10 cm of topsoil on a 2 m wide area of the bench around the edge of the pit; and
- planting of native shrubs and trees on the topsoiled bench. It is proposed to undertake some tree planting in the early stages of the project. These rehabilitated areas will assist in minimising the visual impacts of the mining activities from the adjacent National Park. By the time open pit operations have reached an advanced stage, these rehabilitated areas will be well established and these terraces will form part of the final landform.

The areas to be rehabilitated can be prepared, topsoiled and revegetated using the un-mined working bench for access. Extraction of the next bench will cease at the edge of the rehabilitated berm and then continue down into the next bench. The site topography will allow for continued access to all benches.

The rehabilitation plan results in a large number of small benches being formed, each with a rehabilitated berm. The benches will be formed rapidly, enabling progressive rehabilitation. The final bench will be shaped in the form of a lake, which will be allowed to fill with surface water and pit seepage. This will provide the potential for passive recreational activities at the end of extraction at the site.

3.12.4 Final Land Use

The principal objective of the rehabilitation plan is to form a stable landform that will pose no long-term environmental hazard to the adjacent Blue Mountains National Park and World Heritage Area.

When determining the appropriate final land use for the site, a number of other factors need to be taken in account, namely:

- compatibility with surrounding land uses;
- existing ecological values;
- physical constraints;
- visual implications and landscape compatibility;
- soil availability or suitability of alternative top dressing materials;
- existing land capability for the site and surrounding areas, and
- requirements of state and local authorities and community organisations.

Since the area currently supports open eucalyptus forest, it is appropriate that the final vegetation of the site be similar. The topography of the final land use will consist of a large number of small benches formed in an amphitheatre shape, each with a rehabilitated berm. The final bench will be shaped in the form of a lake that will be allowed to fill with surface water and pit seepage. This will provide for a stable landform that will not have a negative impact on the adjacent National Park.

NKPL are mindful of the importance of keeping final land use options open in light of the significant changes that can occur over a 21 year period. During the course of the mining and rehabilitation works, further opportunities may be identified which could influence the final use of the land. This may result from input from local organisations or government agencies.

The final void will be secured in a manner acceptable to the Department of Mineral Resources. A preliminary final rehabilitation plan is shown on **Figure 3.8**. To achieve this landform, rehabilitation works will occur as soon as practical at the edge of the current working bench.

In order to minimise the visual impacts of the site from views of pit faces from Bald Trig within the Newnes State Forest and elevated vantage points within the Blue Mountains National Park, it is not proposed to leave the excavated pit walls as one face. As outlined above, the resultant pit wall will be progressively rehabilitated to create numerous benches or terraces down the slope, each of which will be vegetated by native species obtained from the area. This revegetation program will limit the visual impact of the project from elevated vantage points during all stages of pit development.

Areas requiring long term stability will be seeded with a mixture of native tree and shrub species in the initial sowing. In addition, seedlings will be planted on the berms in accordance with the requirements of the DLWC. Advice will be sought from the DLWC for an appropriate species list to be included in the sowing mix and seedling planting.

In most areas the final rehabilitation works will be a natural progression and continuation of the initial rehabilitation works. Until such time as extraction has ceased, rehabilitation will occur around the edges of the pit, and will not involve the pit floor. This means that rehabilitation will be limited to bunded berms and vegetation works located around the roadways and infrastructure area.

Following cessation of extraction, it is proposed to permit the floor of the pit to flood, thus creating a water body. The land surrounding the water body at the base of the pit will be revegetated with native species. Once revegetation works are established, the lake could serve as valuable water storage for local wildlife.

Once operations have been completed, all buildings, infrastructure and stockpiles will be removed from the pit and processing areas leaving them to be shaped and ripped where necessary, for topsoiling. It is anticipated that only minor regrading will be required for these areas. It is proposed that the main haul road will remain for use in the ongoing management of the site rehabilitation and for fire fighting purposes.

Revegetation works will be monitored in order to fine tune rehabilitation methodologies and ensure that a suitable vegetation community is established in the open pit area.

3.13 Energy Statement

The principal source of energy to be used in the mine will be electricity. Diesel generators will be used initially and will be retained as a back up system for emergency power only. The company recognises the need to conserve energy in all areas of its operation and is committed to using the most energy efficient processes at its disposal both from environmental and commercial perspectives. At this stage, however, it is not possible to accurately define the total energy use given that at least some of the initial development activities will likely be undertaken on a contract basis.

All mobile plant to be employed at the site (with the possible exception of a petrol powered 4WD vehicle) will operate on diesel. Estimated average annual diesel consumption will be in the order of 511,000 L at peak production, although initially it will be considerably less than this. Two fully bunded 10,000 L above ground diesel storage tanks are proposed for the site. This represents over three weeks usage, but is likely be replenished on a fortnightly basis.

3.14 Sydney Processing Plant (not subject to this application)

A conceptual kaolin separation and beneficiation plant has been designed by Roger Smith and Associates (RSA) for construction in one of several sites under investigation in the Greater Sydney Area. The site will occupy up to 8 ha within in an area serviced by rail.

Crushed friable sandstone from the Newnes Junction Open Pit operation will be transported to the site by rail where it will be fully processed into a range of industrial minerals and construction sand, as shown on **Figure 3.15**. The refined products will be transported to markets by road and or rail from an onsite distribution centre.

The processing plant will consist of a rail unloading facility with a raw product stockpile area attached to a reclaim conveyor.

The plant is designed as a single process, dual strand system catering for both premium and standard grade of friable sandstone and will be capable of processing up to 1.4 Mtpa of raw material.

The washplant through attrition cells and hydrocyclone sizers will recover silica silt and produce a clean washed sand less than 5mm in diameter. Kaolin clay products will pass through thickening tanks, magnetic separators and final dewatering will take place in a continuous dual belt filter press. The plant is current best practice technology and is a controlled process completely enclosed in a building.

Further refinement of the kaolin output from the filter presses will comprise calcination or part calcination, milling and bagging for final distribution. Washwater will be continually recycled through the plant and make up water will be provided from industrial water from local council wastewater treatment plant or alternatively through on site water storage dams depending on the final choice of processing plant sites.

The kaolin separation plant will require 15 full time employees. Rail unloading will proceed 24 hours per day however, the washplant and kaolin beneficiation plant will only operate initially during daylight hours but will progressively build up to a 24 hour operation when production levels are at their peak of 1.4 Mtpa.

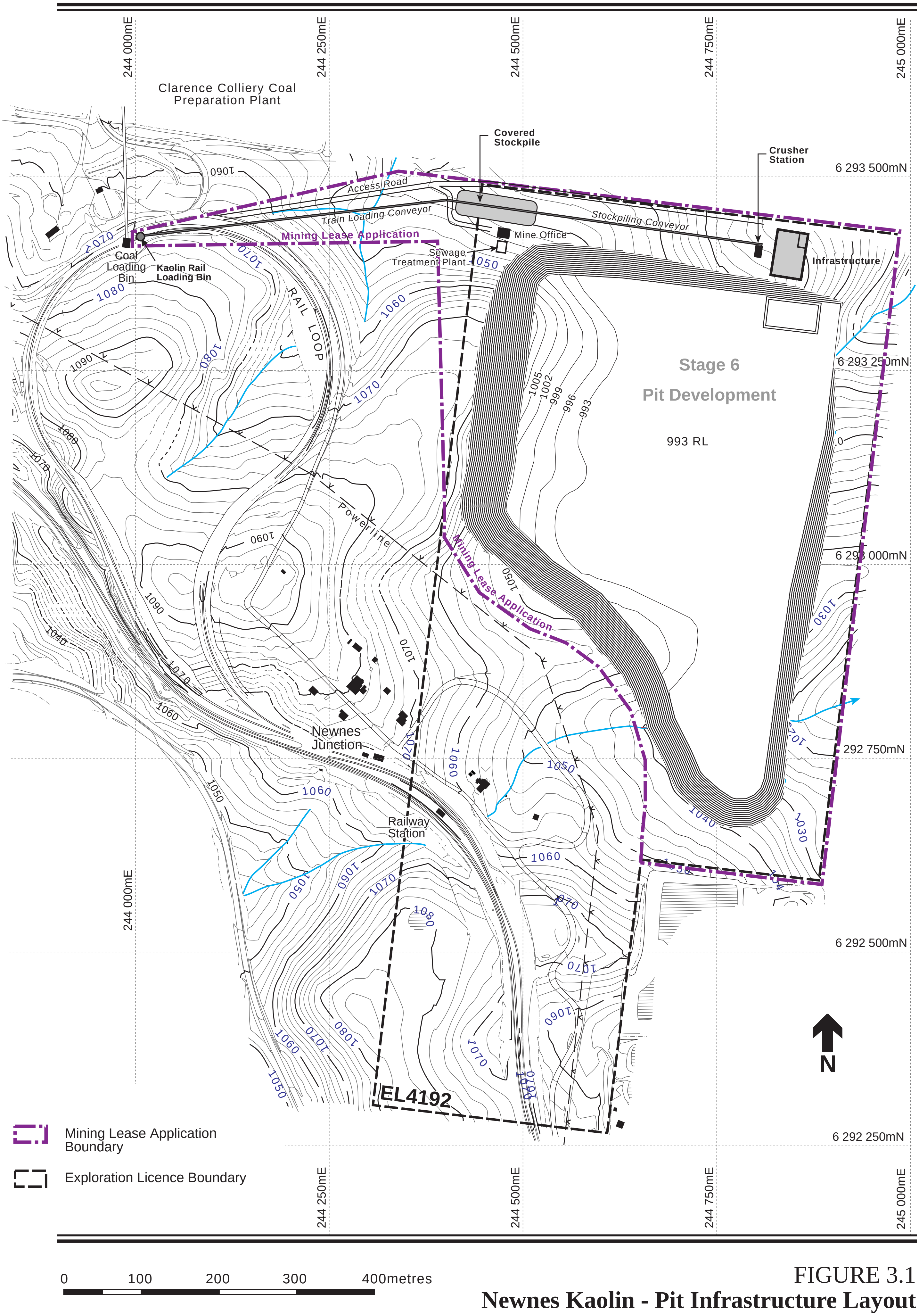
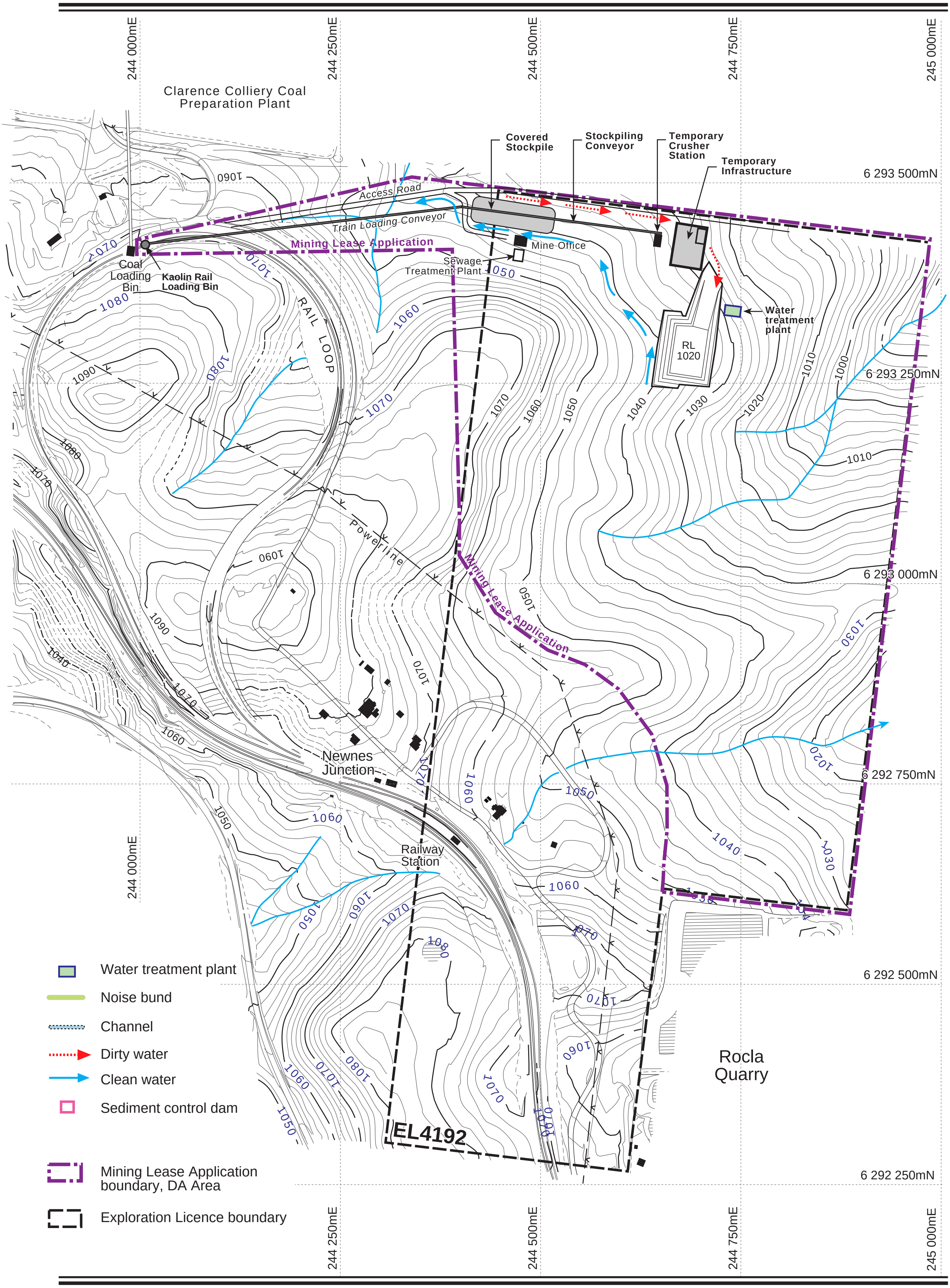


FIGURE 3.1

Newnes Kaolin - Pit Infrastructure Layout



0 100 200 300 400metres

N

FIGURE 3.2

Mine Development - Stage 1

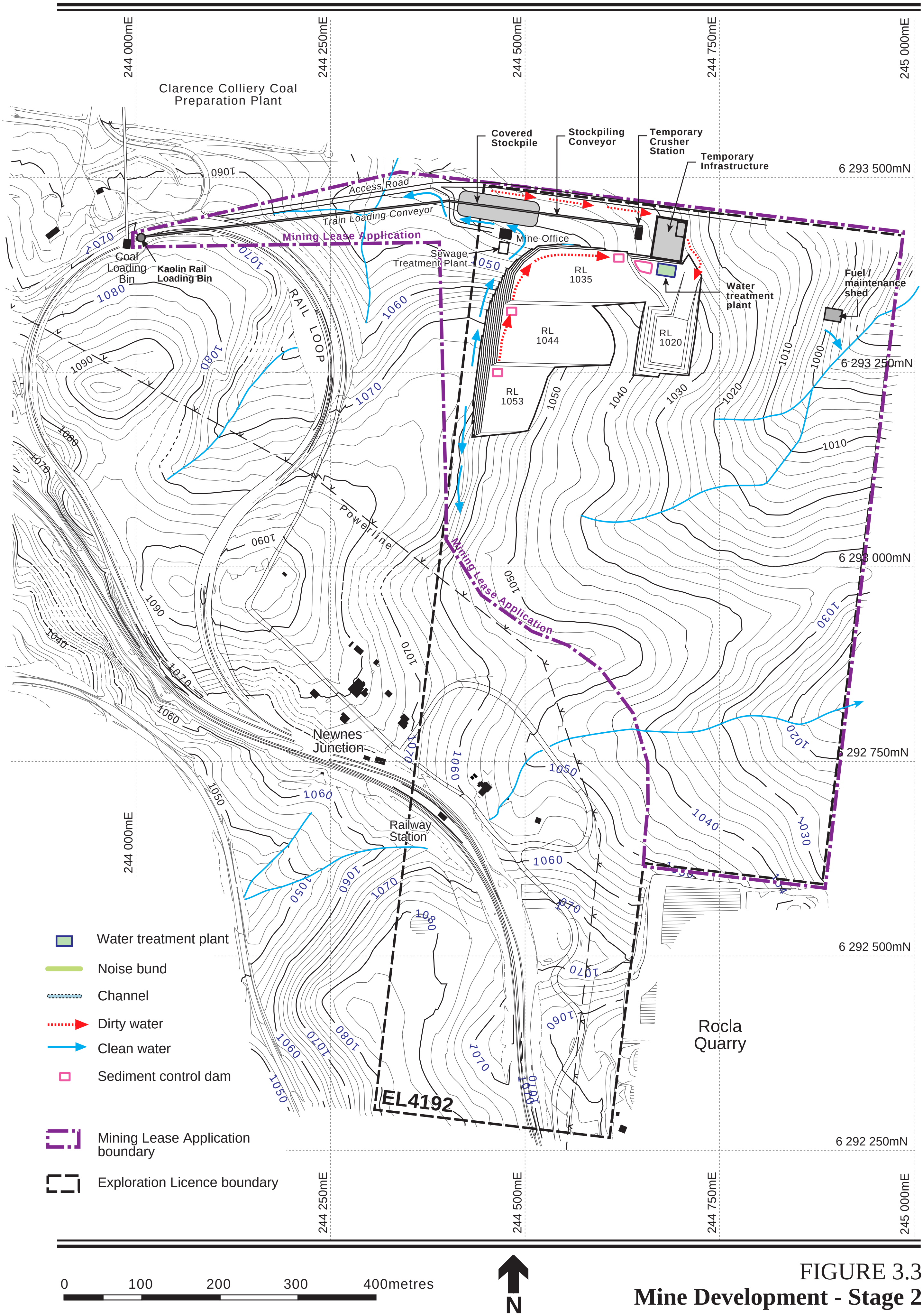


FIGURE 3.3

Mine Development - Stage 2

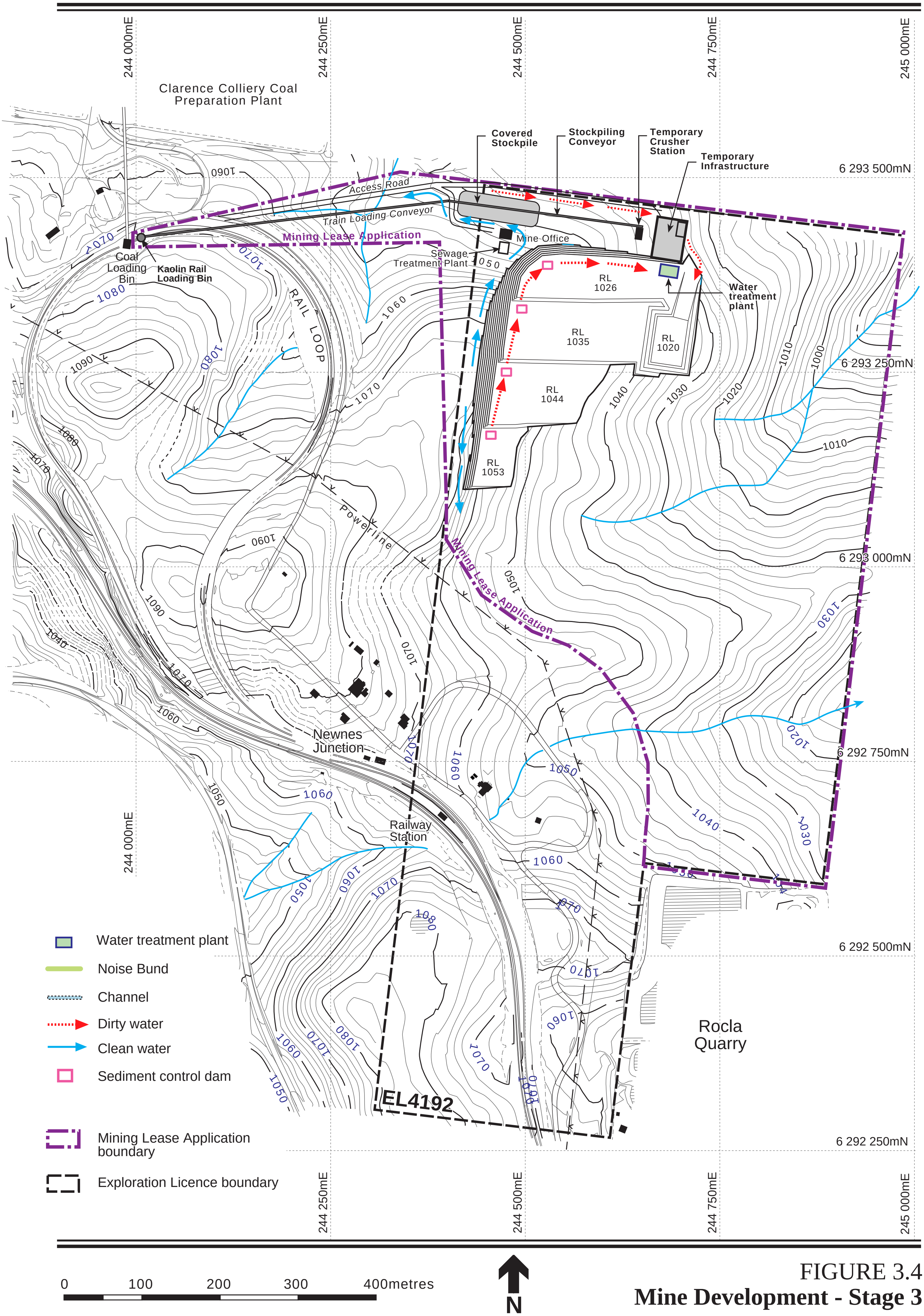


FIGURE 3.4
Mine Development - Stage 3

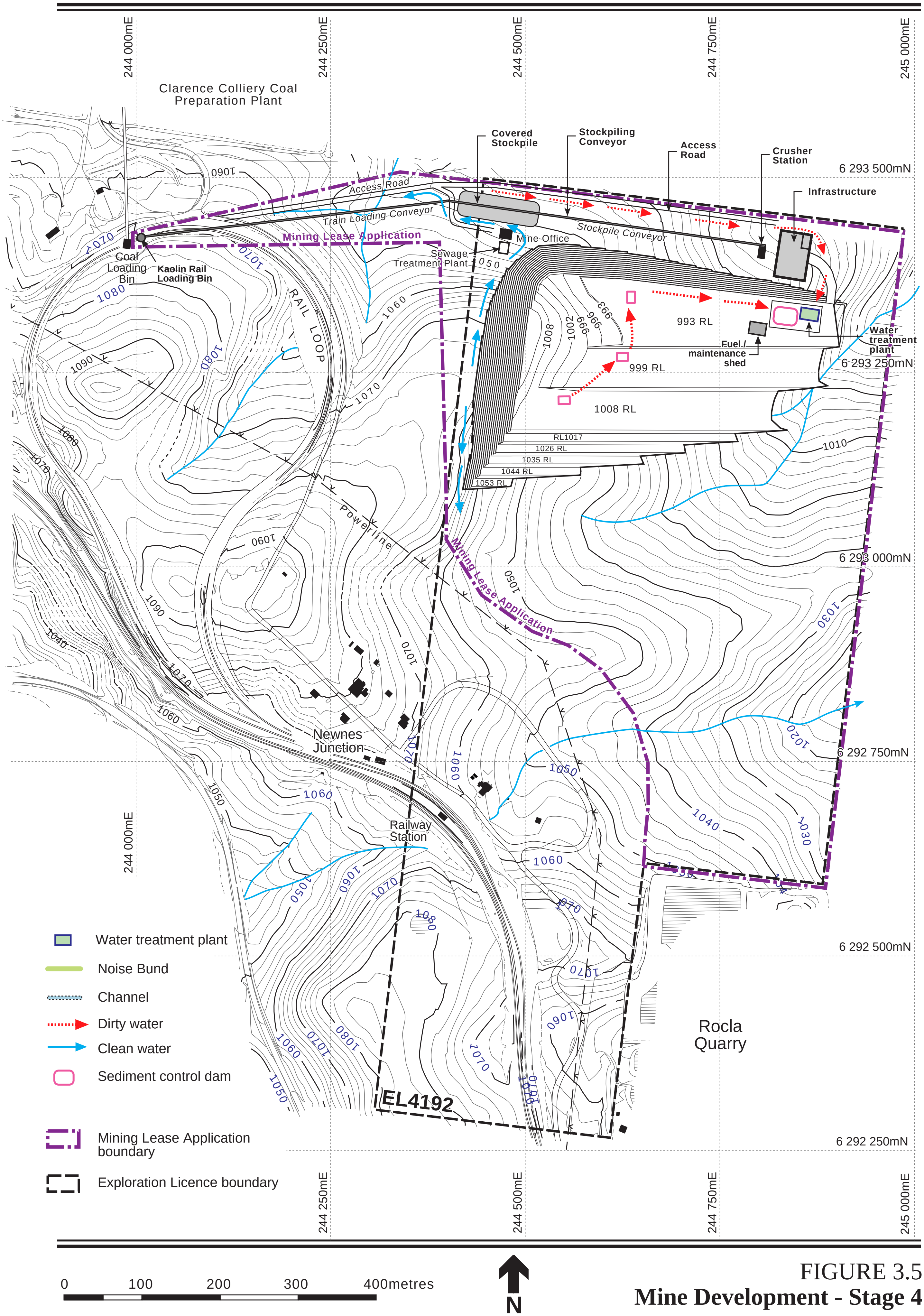


FIGURE 3.5
Mine Development - Stage 4

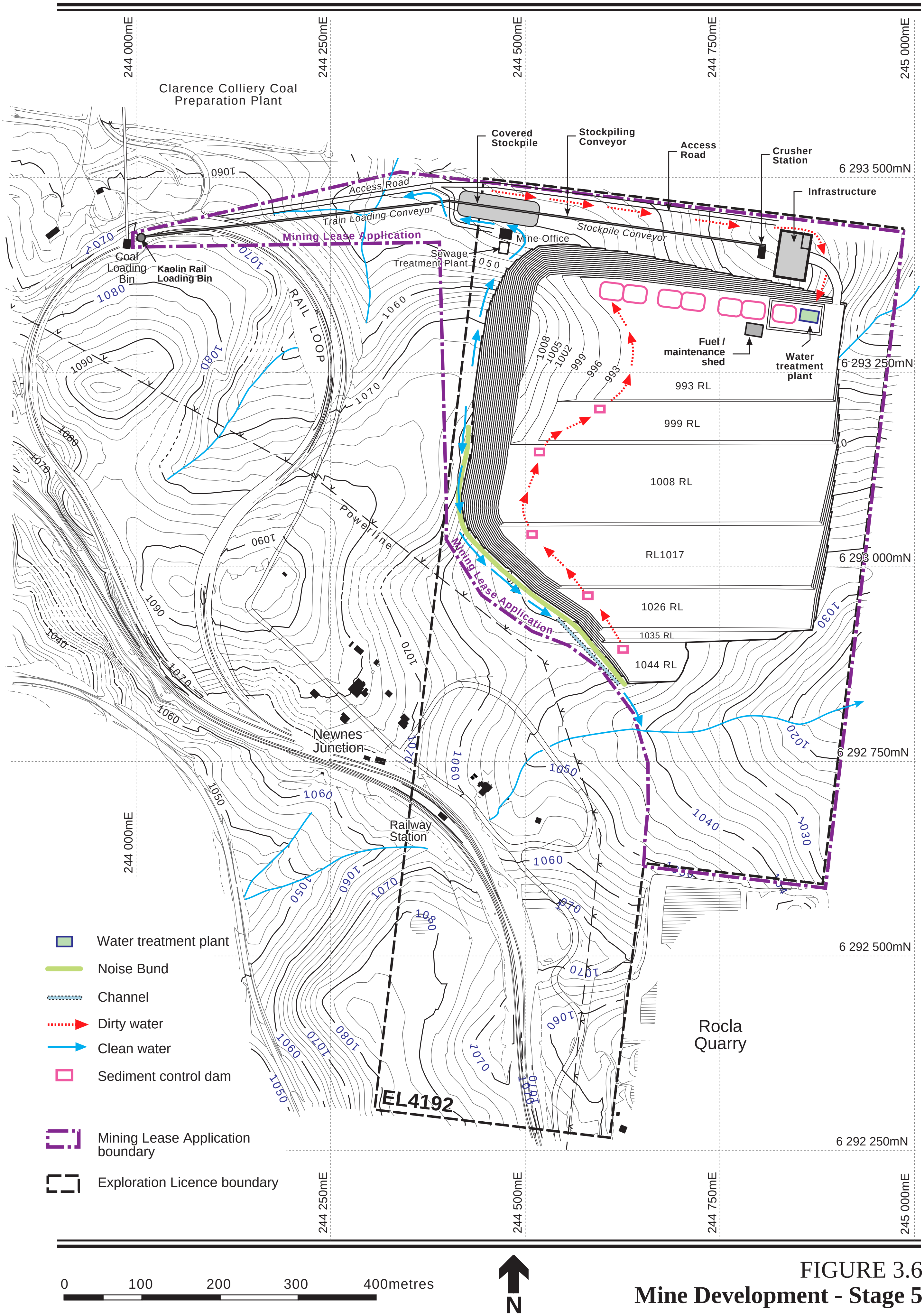


FIGURE 3.6
Mine Development - Stage 5

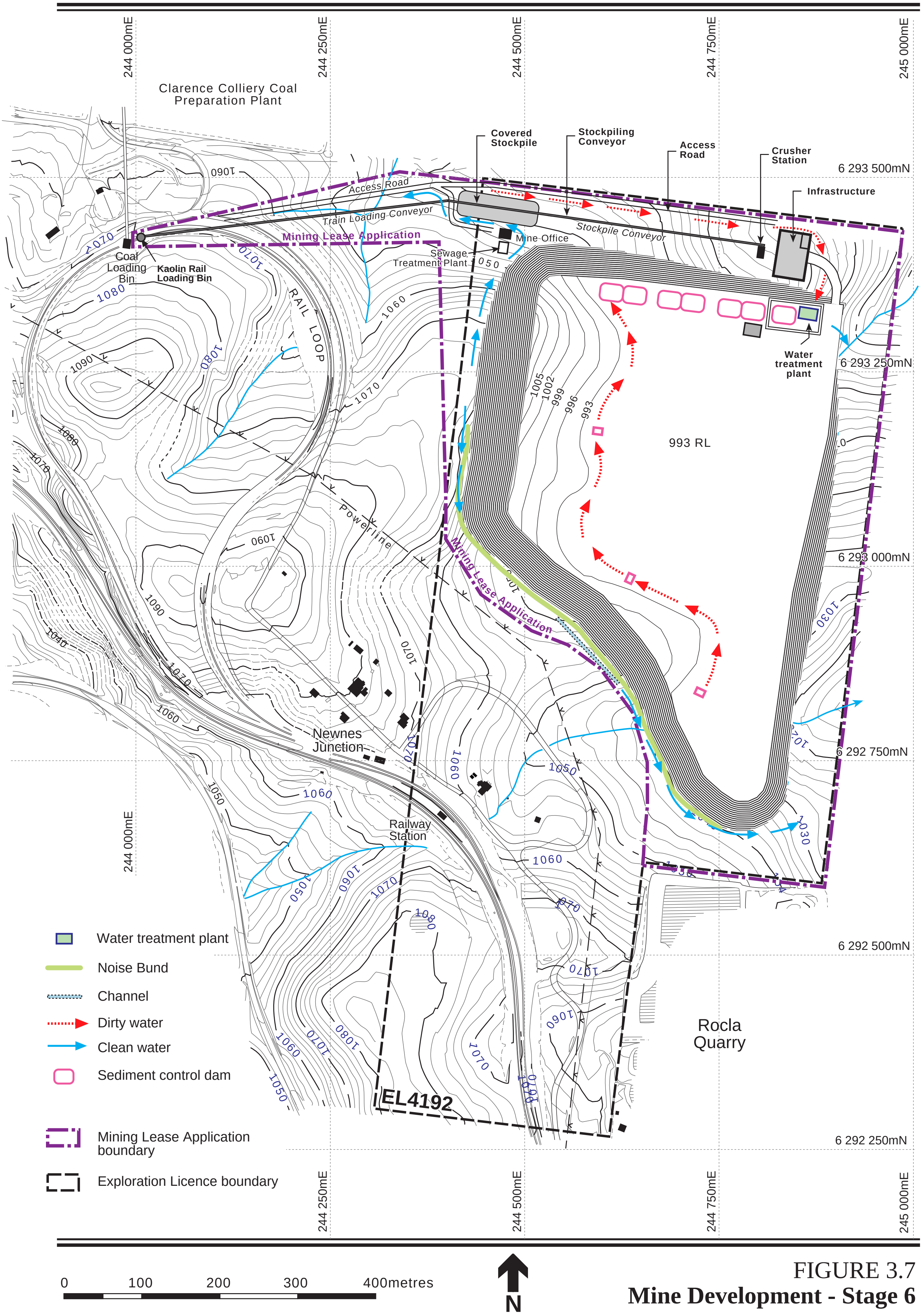


FIGURE 3.7
Mine Development - Stage 6

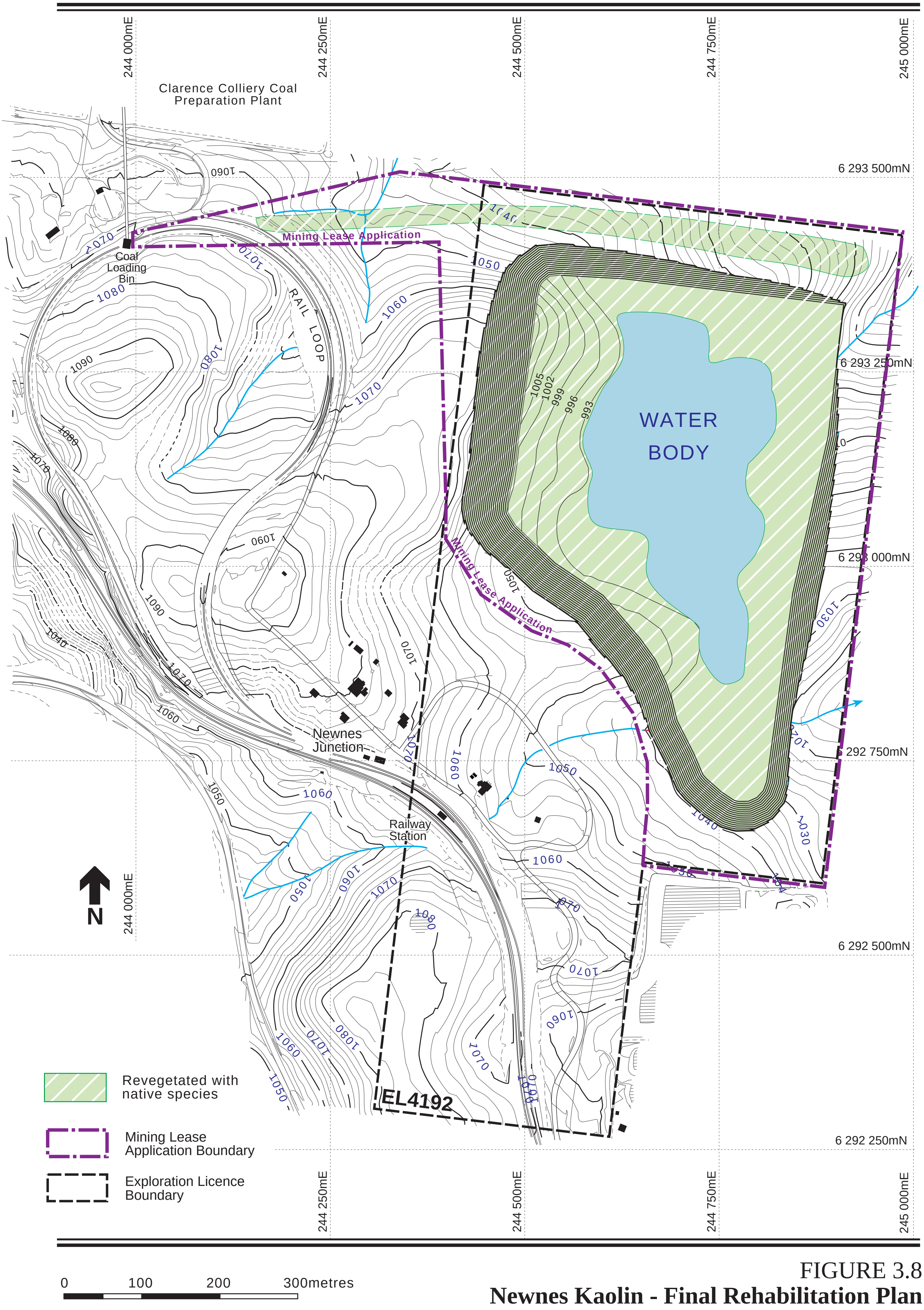
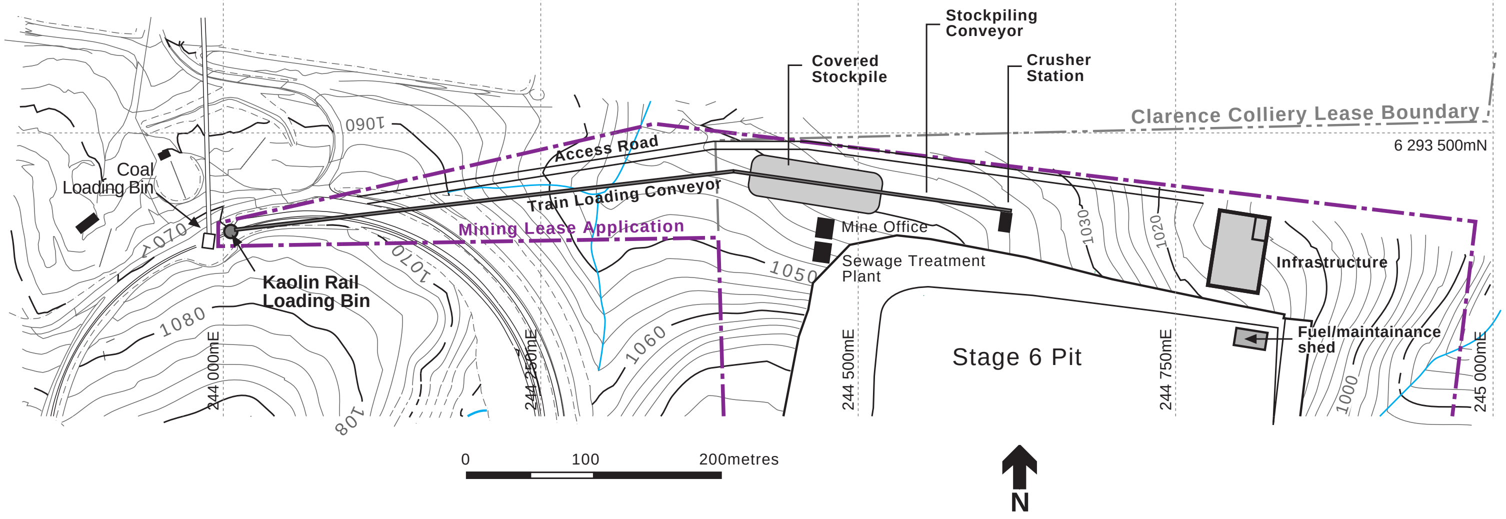
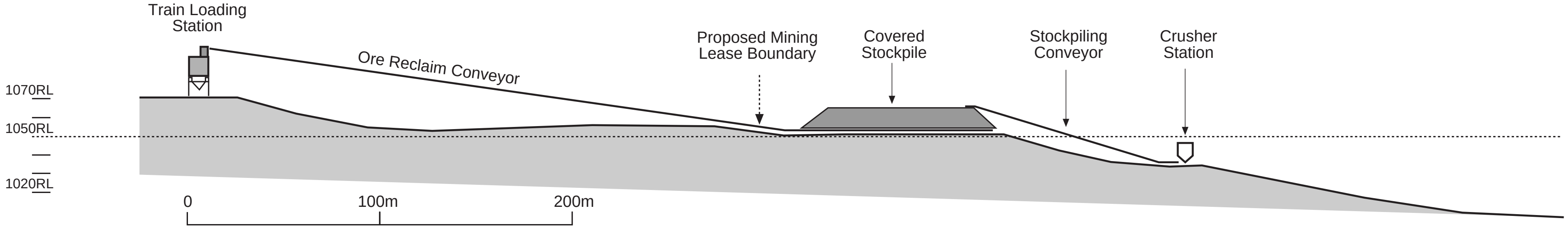


FIGURE 3.8

Newnes Kaolin - Final Rehabilitation Plan

Plan showing stockpile, conveyor and infrustructure





Detail schematic showing typical rail bin loading arrangement

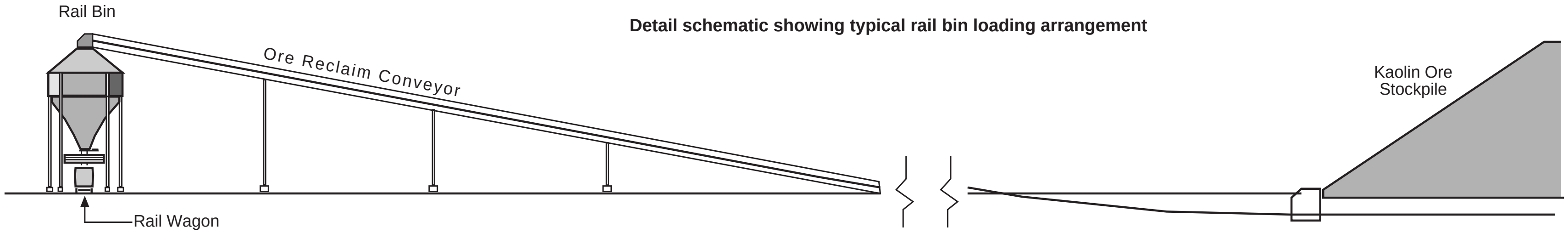


FIGURE 3.9
Newnes Kaolin
Stockpiling and Trainloding System

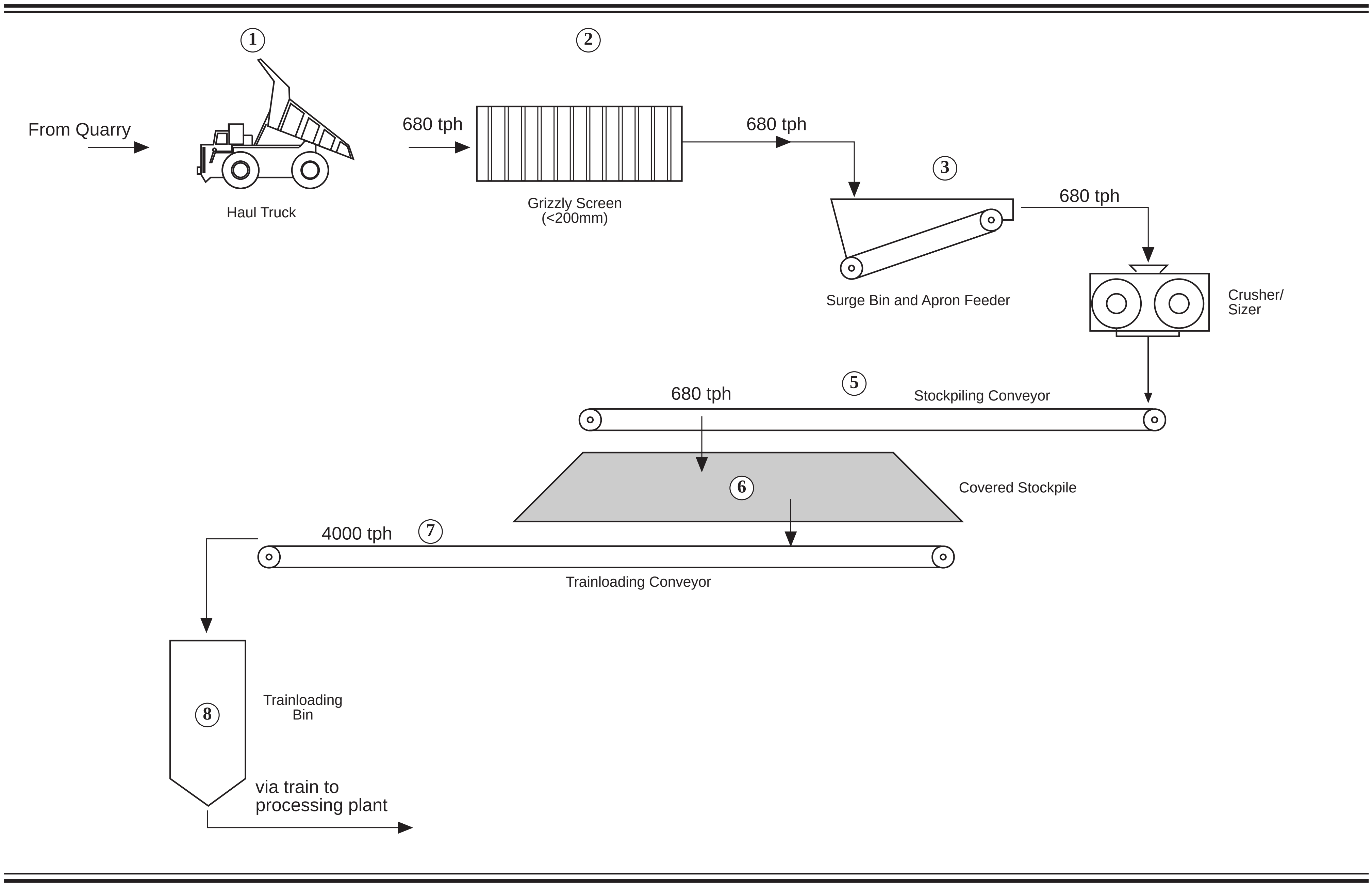


FIGURE 3.10
Materials Handling - Conceptual Flowsheet

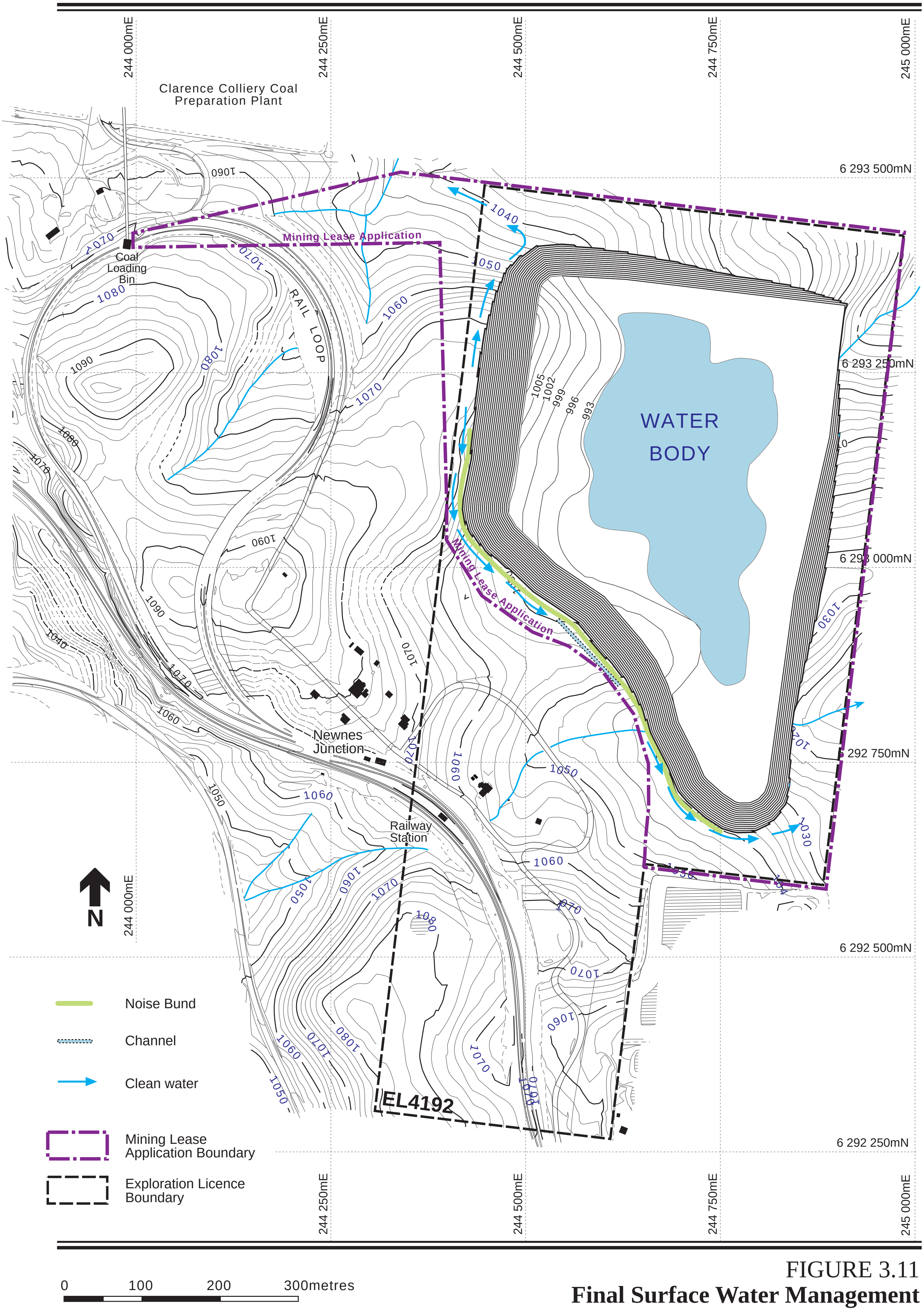


FIGURE 3.11

Final Surface Water Management

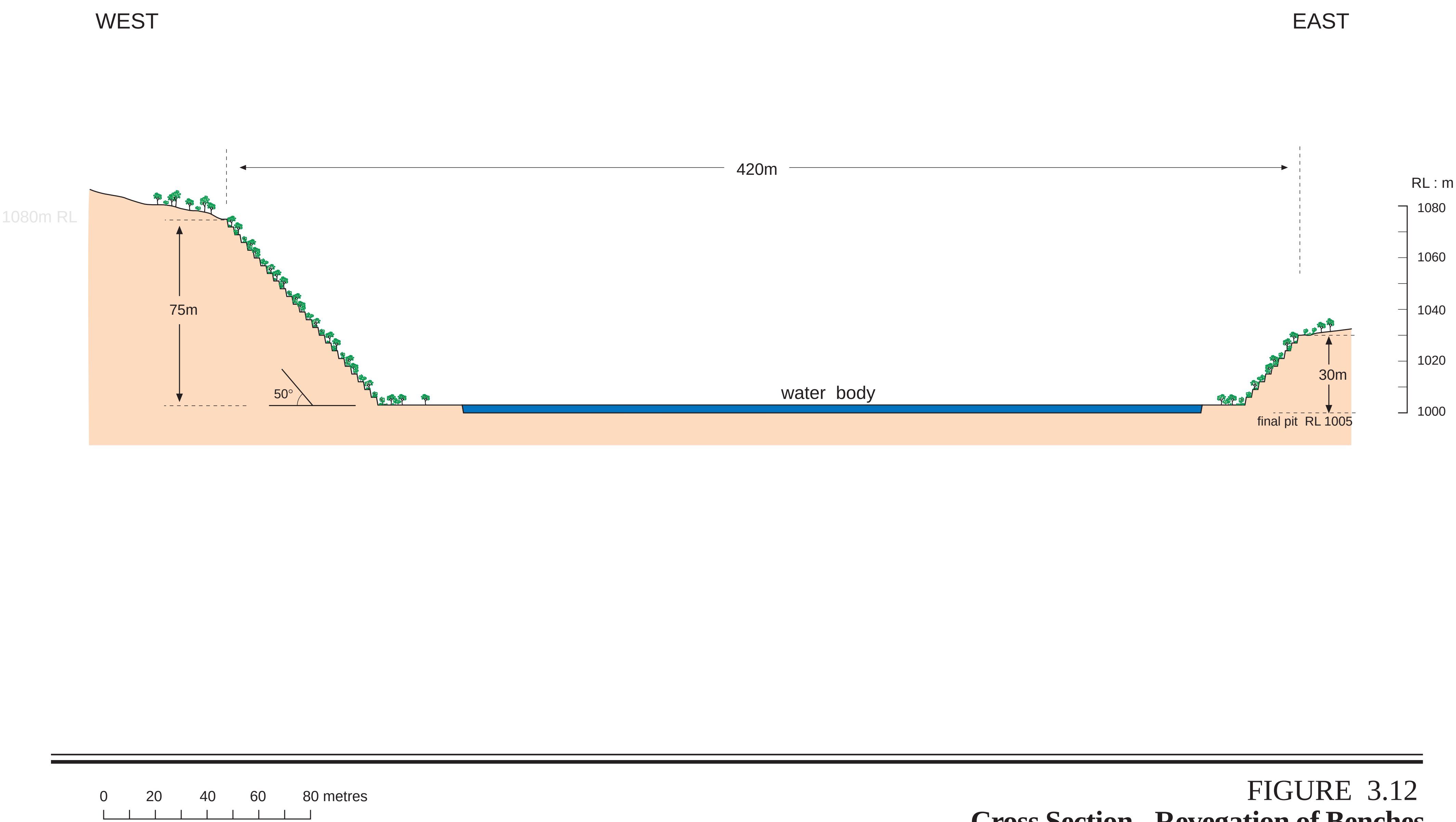


FIGURE 3.12
Cross Section - Revegation of Benches

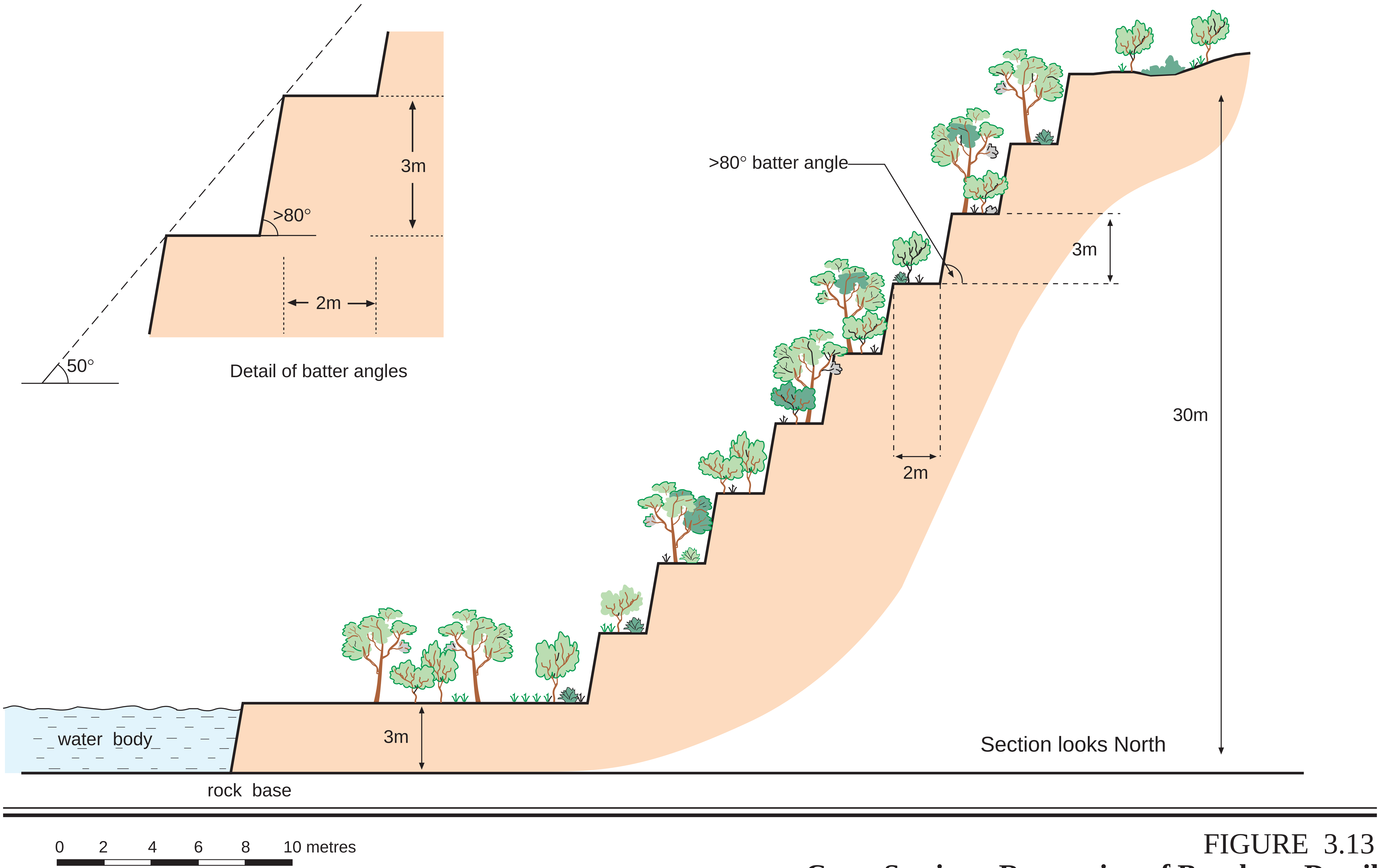
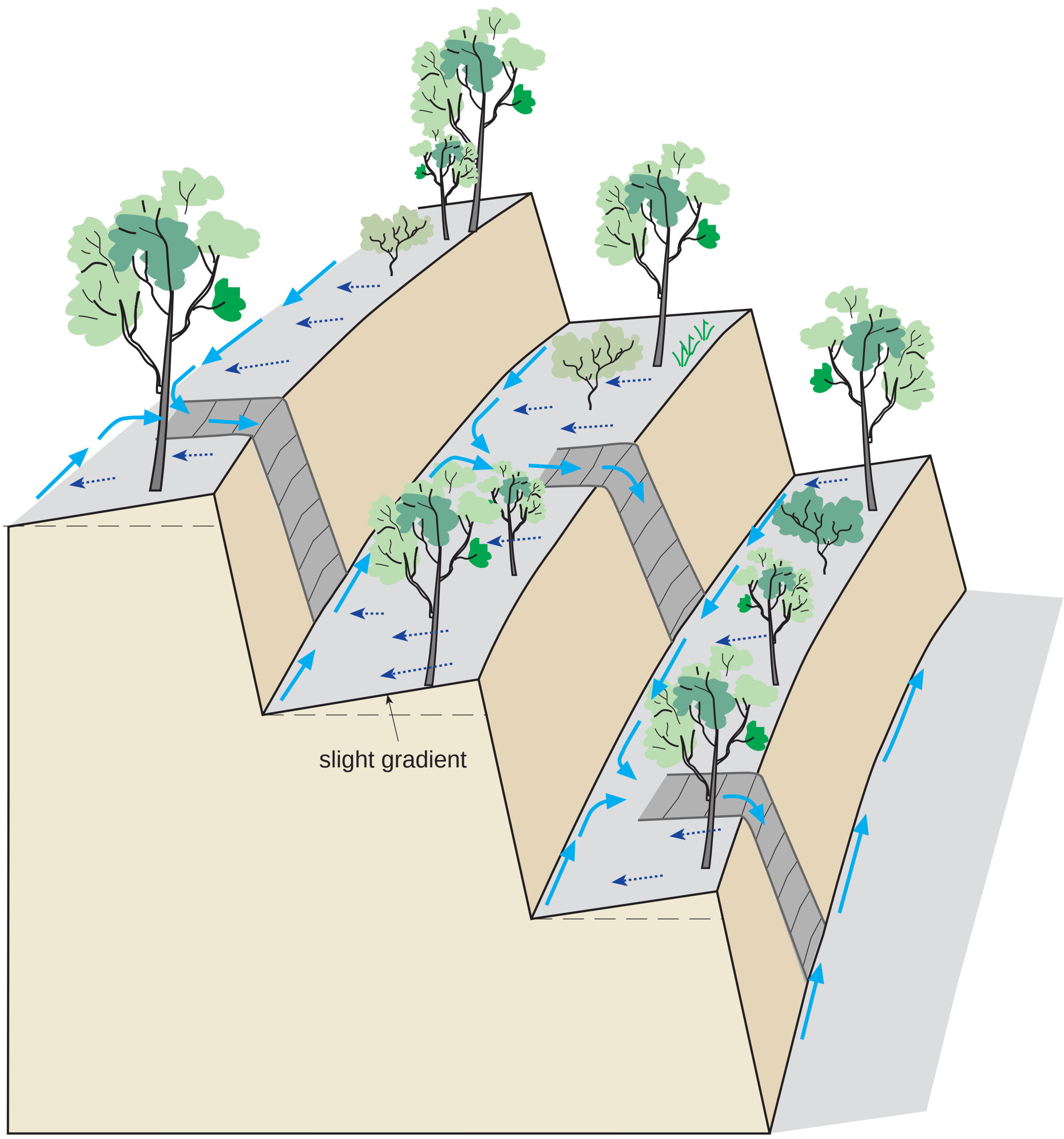


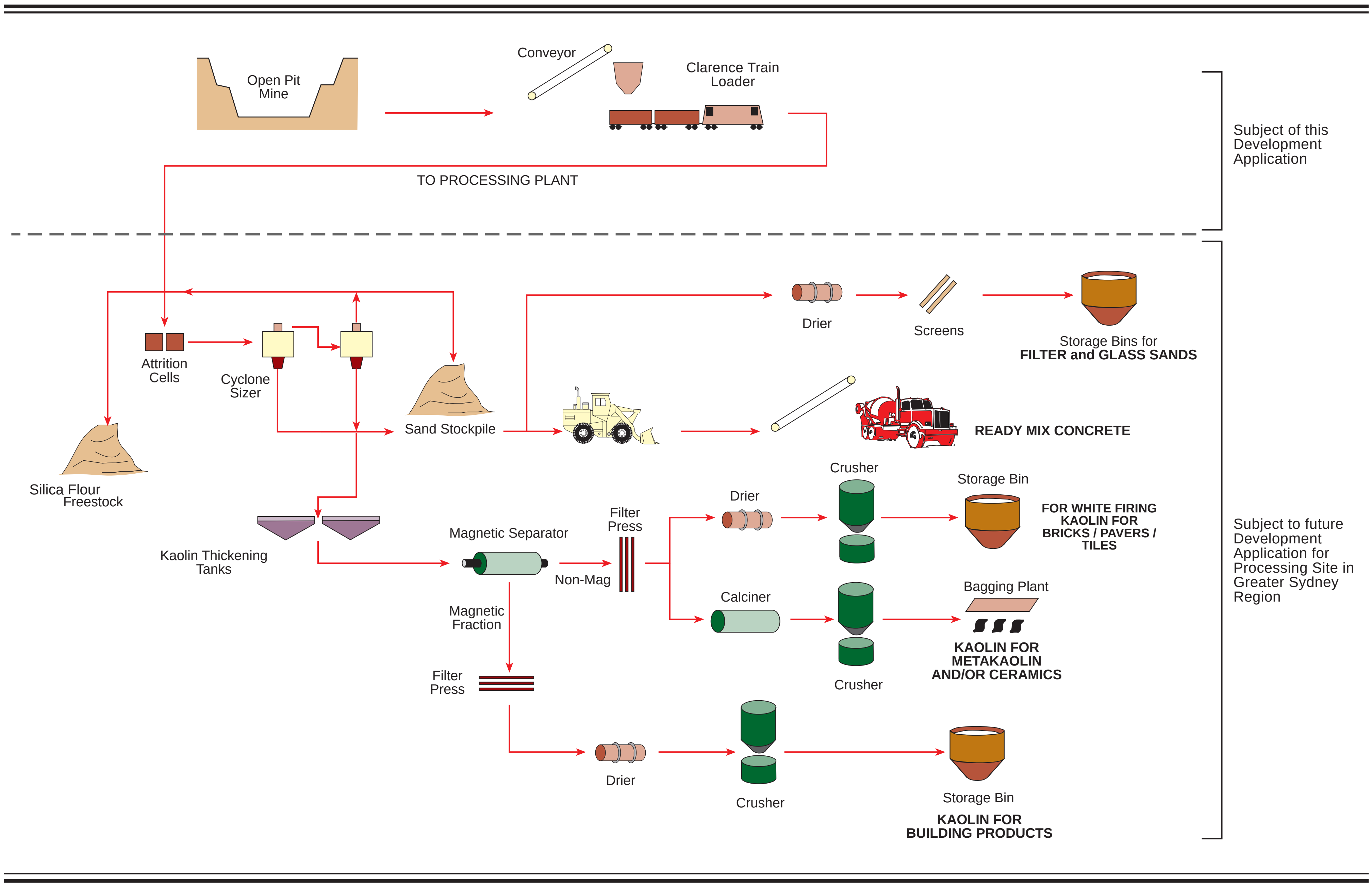
FIGURE 3.13

Cross Section - Revegation of Benches - Detail



Schematic - Not to Scale

FIGURE 3.14
Water Management on Rehabilitating Benches



Source : Newnes Kaolin Pty Ltd, March 2002

FIGURE 3.15

Sand and Kaolin Processing Flow Chart