Section Six

The Project

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Figure 6-1: Regional location of the Kintyre Project area

6. The Project

6.1 Project Overview

A joint-venture comprising Cameco Australia Pty Ltd (70%) and Mitsubishi Development (30%) proposes to develop an open pit mine and associated processing facilities at Kintyre in the Shire of East Pilbara of Western Australia, approximately 1,200 km north-northeast of Perth (Figure 6-1) on the edge of the Great Sandy Desert.

The proposed Kintyre Uranium Project (the Project) would produce up to approximately 4,400 tonnes of uranium oxide concentrate (UOC) as U_3O_8 per annum (peak annual rate). The single open pit mine encompasses a number of discrete ore zones. The open pit would ultimately extend approximately 1,000 m north-to-south, 1,500 m east-to-west and would be excavated to a depth of around 220 m.

Up to 30 million tonnes (Mt) of overburden and ore would be mined per annum using a combination of selective and bulk open pit mining techniques. Run-of mine (ROM) ore would be stockpiled and subsequently treated in the proposed metallurgical plant, with non-mineralised overburden used as a construction material for the Tailings Management Facility (TMF) embankments, or stored in the permanent above-ground Waste Rock Landform (WRL), or backfilled to the pit. Mineralised but below ore-grade overburden (mineralised overburden) would be stockpiled separately from the non-mineralised overburden and may be blended with high grade ore to ensure a consistent ore grade for processing.

The metallurgical plant would leach uranium from the ore using acid reagents and conventional uranium extraction technologies to produce UOC for containerised export via the Port of Adelaide. All tailings generated during the metallurgical processing of the ore would be directed to an above-ground TMF for storage. The TMF will be constructed adjacent to, and integrated with the WRL, to create an Integrated Waste Landform (IWL).

Additional infrastructure would be required to support the mining and metallurgical operations. The main infrastructure components, as shown on Figure 6-2 would be:

- pit dewatering infrastructure to maintain operable mining conditions and stable pit slopes;
- a flood protection bund around the eastern side of the pit;
- potable and process water supply borefields;
- a lined evaporation pond for the disposal of excess process, mine and tailings water (referred to as the Evaporation Pond);
- a lined evaporation pond for the disposal of storm water and underflow from the TMF;
- on-site diesel power generation and an electricity supply network;
- Class I/II landfill for inert and putrescible waste;
- a Bulk Low Level Radioactive Waste Facility located within the IWL footprint;
- buildings, including offices, workshops and warehouses;
- an Accommodation Village for the fly-in-fly-out (FIFO) workforce to be used during construction and operations;
- associated infrastructure including an airport, haul roads, refuelling facilities, borrow pits, a quarry, waste management facilities, potable water treatment facilities, stormwater management infrastructure, explosives magazine and sewage management facilities; and
- an upgraded site access road from Telfer and the construction of 30 km of road on a new alignment to bypass the Telfer mine site.

A plan view of the conceptual project layout is presented in Figure 6-2. An isometric view of the conceptual project layout is presented in Figure 6-3. The proposed road from Telfer to Kintyre is shown in Figure 6-4.

At the end of mine life the installed infrastructure would be decommissioned, closed and rehabilitated. Specifically the IWL-TMF would be capped so as to remain physically safe and stable in the long term. All infrastructure would be demolished and removed except where specified. All disturbed land would be contoured and revegetated.

The key characteristics of the Project are summarised in Table 6-1.

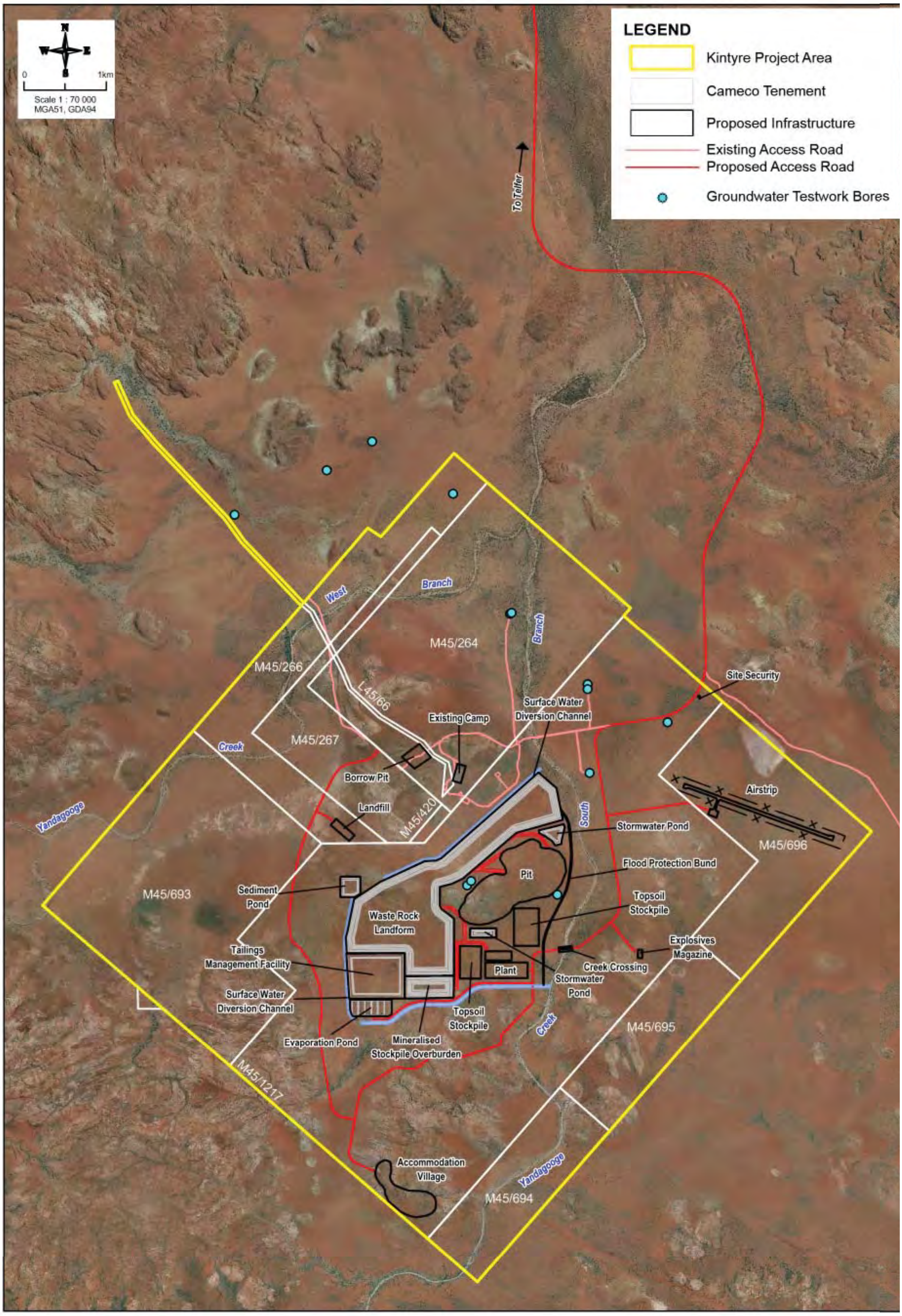


Figure 6-2: Conceptual Project layout

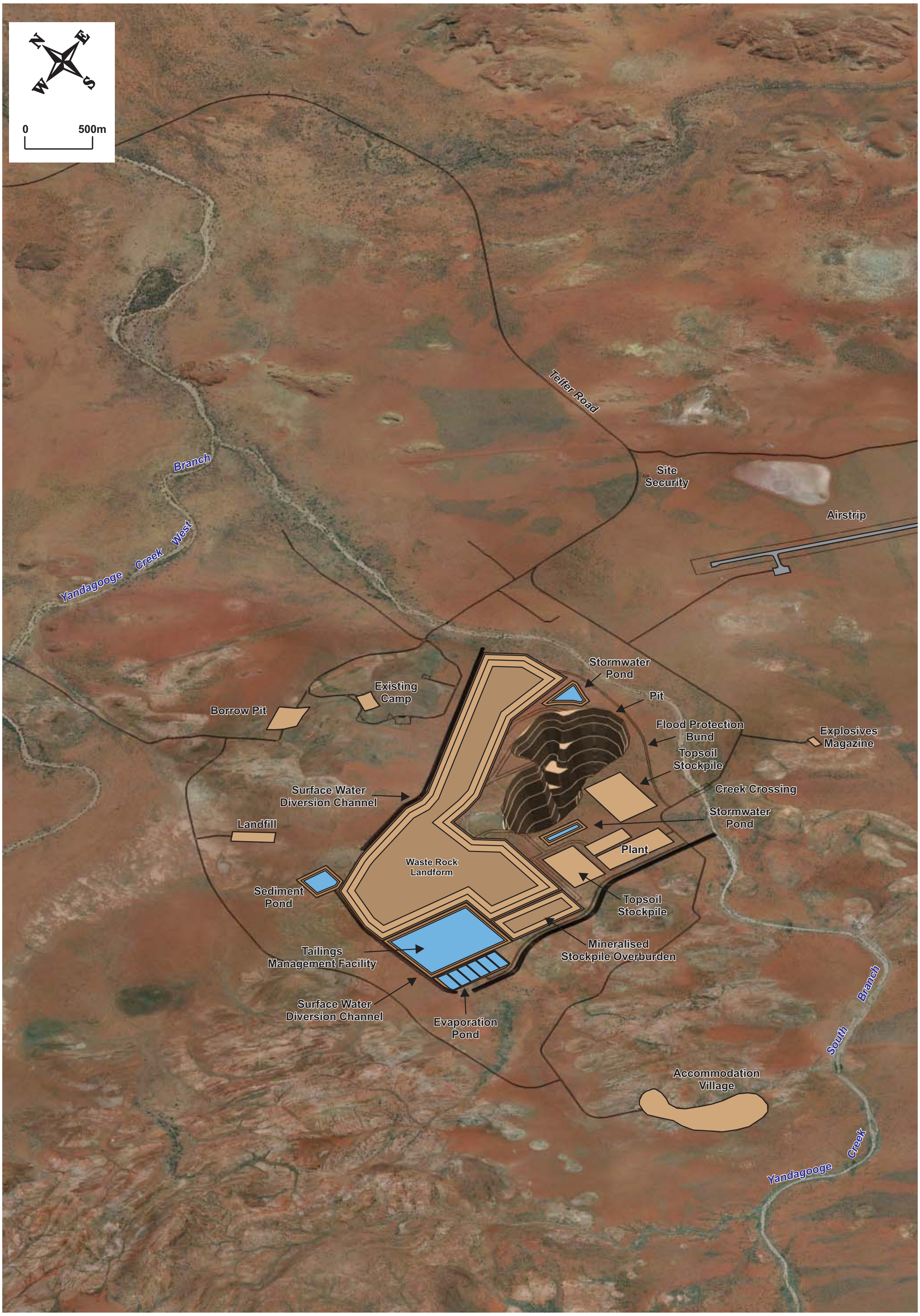


Figure 6-3: Isometric view of the conceptual Project layout

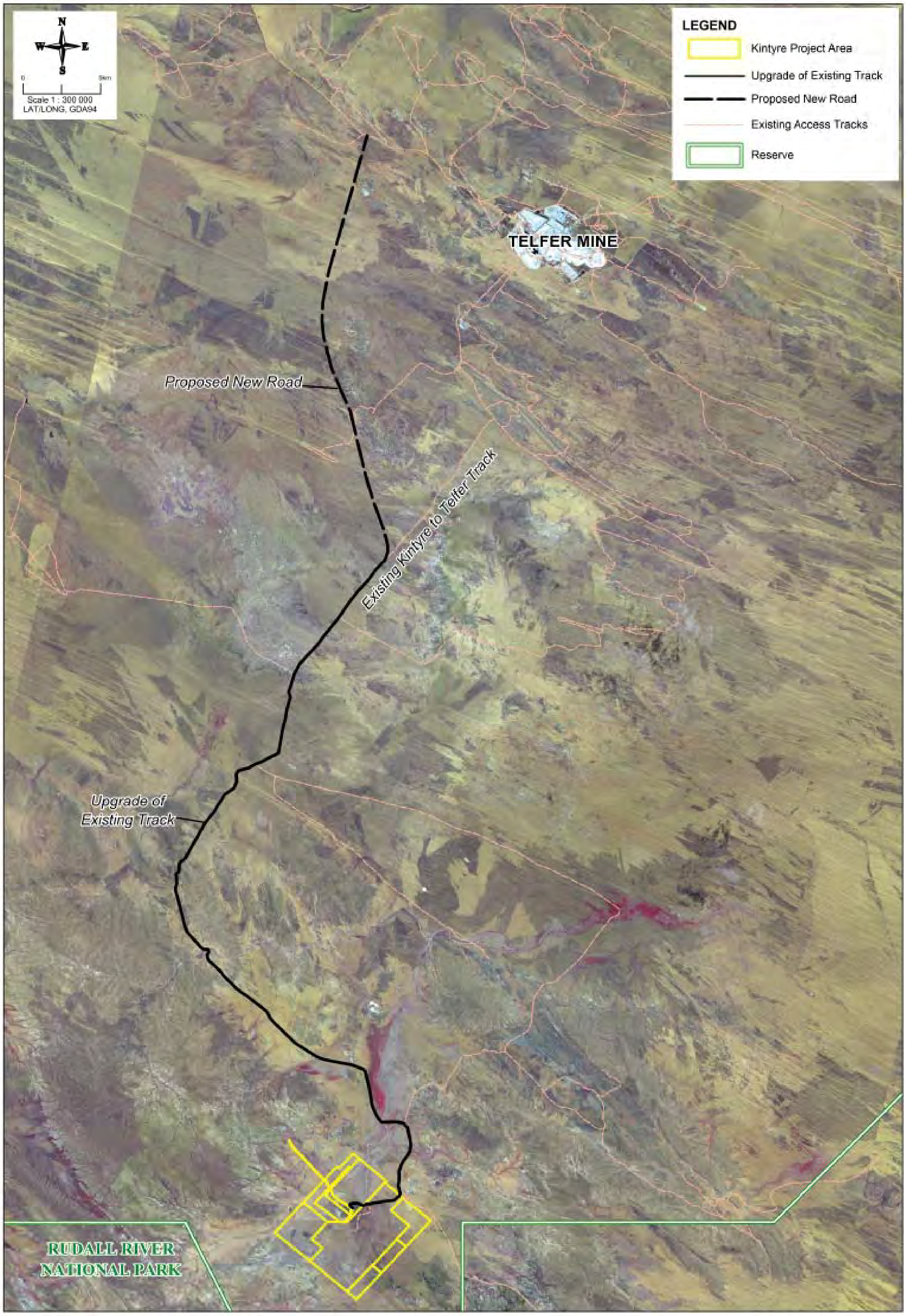


Figure 6-4: Access Road Telfer to Kintyre

Table 6-1: Key characteristics of the proposed development

Summary of the Proposal

Proposal Title:	Kintyre Uranium Project
Proponent Name:	Cameco Australia Ltd
Short Description:	The proposal is to mine ore from the Kintyre uranium deposit, located approximately 260 kms north east of the town of Newman WA. The proposal includes the construction of associated mine infrastructure, including mineral processing facilities, offices, accommodation and the discharge of waste to a Tailings Management Facility. The proposal also includes the upgrade and construction of 90 kms of access road and the transport of uranium oxide concentrate to the Western Australian/South Australian border on route to the Port of Adelaide.

Physical Elements

Element	Location	Proposed Extent Authorised
Open Pit Mine	Figure 6-5	Clearing no more than 75 ha within a 1981 ha development envelope; pit to be mined below the water table
Integrated waste management facility, including, waste rock landform, mineralised overburden stockpile and tailings management facility	Figure 6-5	Clearing no more than 259 ha within a 1981 ha development envelope
Processing plant and mine infrastructure	Figure 6-5	Clearing no more than 176 ha within a 1981 ha development envelope
Access Road and Borrow Pits	Figure 6-6	Clearing no more than 280 ha within a 1180 ha development envelope

Operational Elements

Element	Location	Proposed Extent Authorised
Tailings	Integrated waste management facility	7 Mt over the life of mine
Groundwater Extraction	Dewatering and production bores	3.1 MLpd

6.2 The Resource

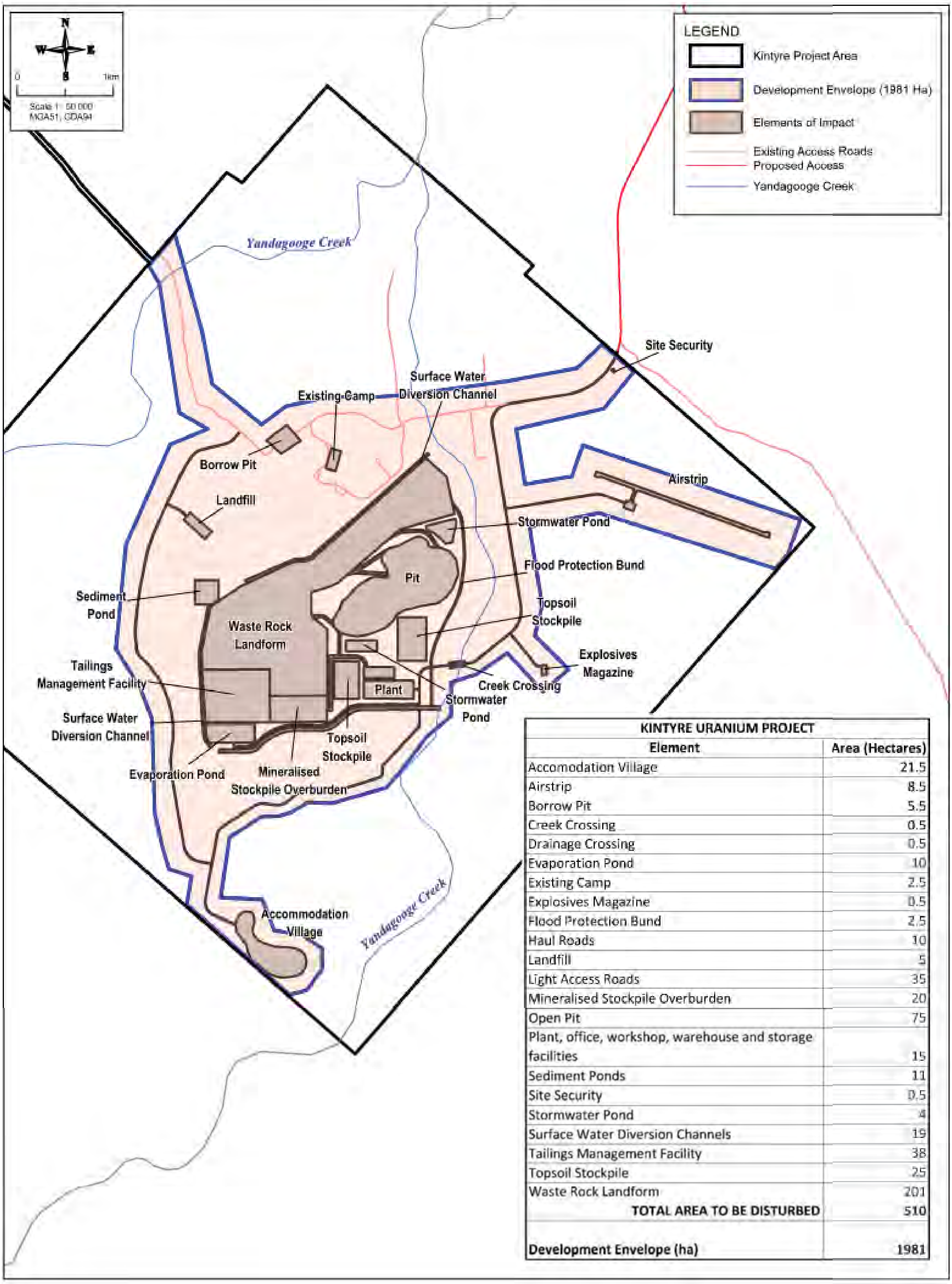
Kintyre is one of the largest known uranium occurrences in Western Australia. The JORC and NI 43-101 compliant Mineral Resource estimate for Kintyre is 5.26 Mt of indicated resources at an average grade of 0.49% U_3O_8 and 505,000 t of inferred resources at an average grade of 0.47% U_3O_8.

The Kintyre deposits are located in the Paterson Province which also hosts the Telfer Gold Mine and the Nifty Copper Mine. The uranium mineralisation is hosted within the Yandagooge Formation which occurs between the basement gneisses and the overlying Coolbro Sandstone (see Figure 6-7).

The Yandagooge Formation comprises a sequence of folded biotite graphite schist, chert banded chlorite garnet magnetite schist, dolomitic carbonates and quartz muscovite schist. This sequence generally dips to the north at about 50 degrees in a series of recumbent folds with east-northeast trending axial planes and axial planar cleavage. The uranium mineralisation occurs as pitchblende veins in the chert banded chlorite garnet magnetite schist.

Glaciers of Permian age incised the Proterozoic metamorphics, and glacial sediments of the Paterson Formation were deposited in U-shaped valleys. The thickness of the Permian sediments is quite variable in the area, the thickest section being 70 m over the Whale deposit. The Permian sediments are typically silts and clays with a basal layer of coarse sand and gravel.

Most of the bedrock exposed in the hills around Kintyre comprises the Yandagooge formation. The flat areas between the hills are largely underlain by a few metres of red sand and then Paterson Formation sediments.



KINTYRE URANIUM PROJECT	
Element	**Area (Hectares)**
Accomodation Village	21.5
Airstrip	8.5
Borrow Pit	5.5
Creek Crossing	0.5
Drainage Crossing	0.5
Evaporation Pond	10
Existing Camp	2.5
Explosives Magazine	0.5
Flood Protection Bund	2.5
Haul Roads	10
Landfill	5
Light Access Roads	35
Mineralised Stockpile Overburden	20
Open Pit	75
Plant, office, workshop, warehouse and storage facilities	15
Sediment Ponds	11
Site Security	0.5
Stormwater Pond	4
Surface Water Diversion Channels	19
Tailings Management Facility	38
Topsoil Stockpile	25
Waste Rock Landform	201
TOTAL AREA TO BE DISTURBED	510
Development Envelope (ha)	1981

Figure 6-5: Development envelope of the Kintyre Project area

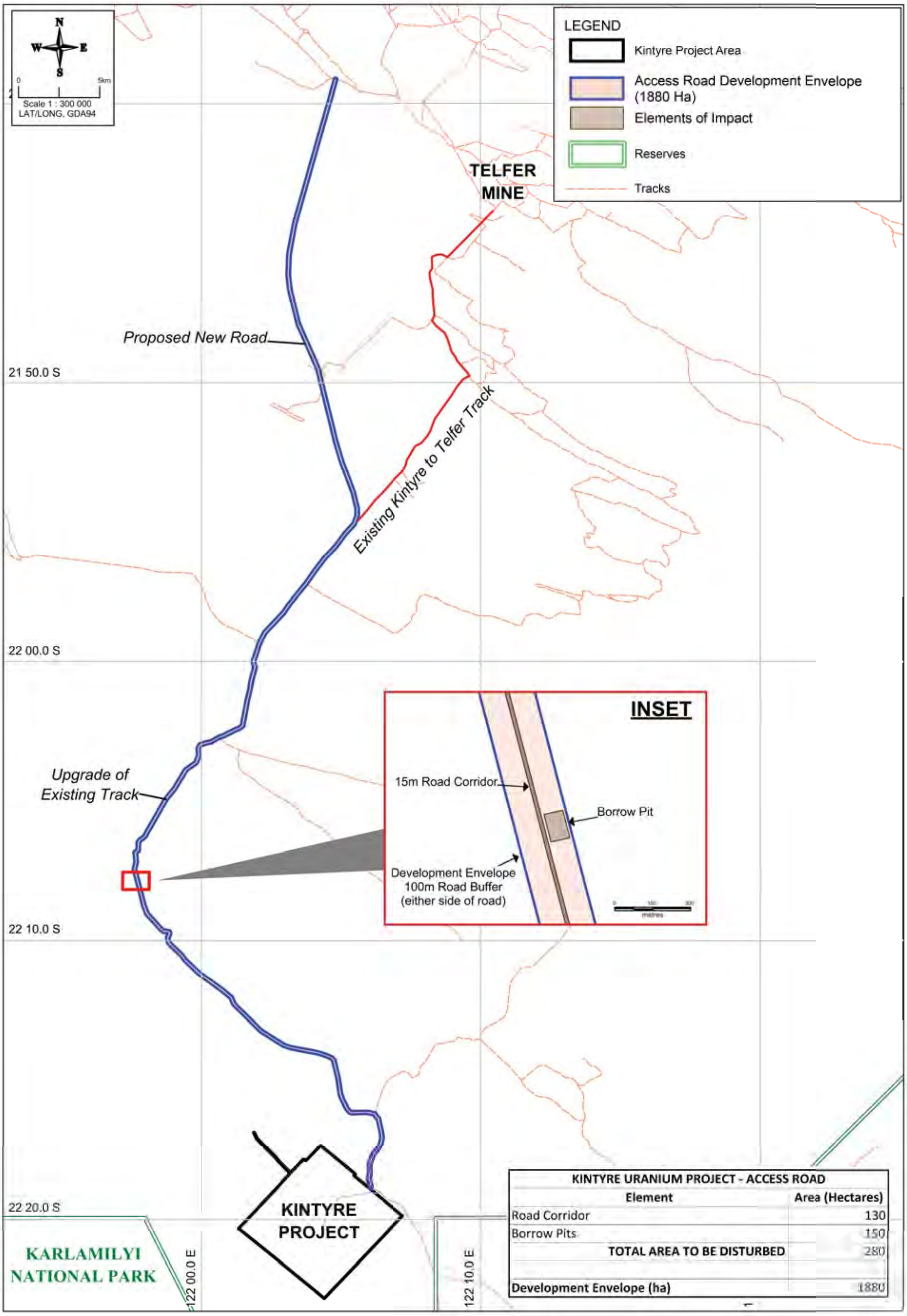


Figure 6-6: Development envelope of the Kintyre access road

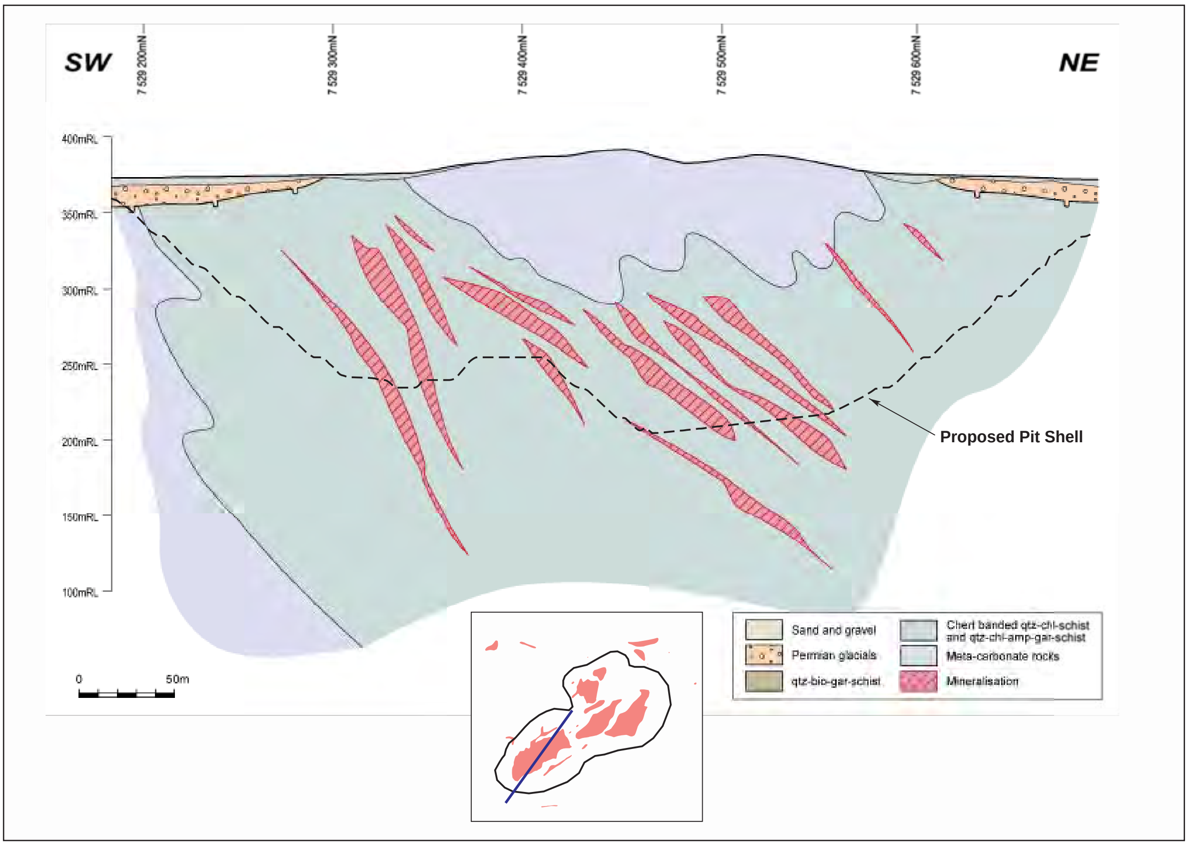


Figure 6-7: Geology of the Kintyre deposits

6.3 Mining

The Kintyre ore would be mined via a single open pit mine that would encompass the ore zones. The mine would use a combination of selective and bulk open pit mining techniques and a conventional excavator and truck fleet. A mining rate of up to 30 Mtpa would result in approximately 152 Mt total material movements, including 148 Mt of overburden and up to 4 Mt of ore being mined over the life of the mine. A summary of the mining process is shown in Figure 6-8.

All material generated from the open pit would be classified into one of three categories (ore, mineralised overburden or non-mineralised overburden) depending on the U_3O_8 content.

- Ore includes material above an economic cut-off grade which is approximately 1,500 ppm of U_3O_8.
- Mineralised overburden (low grade ore) defined as material containing less than the economic cut off grade but above 200 ppm U_3O_8„ and on average containing approximately 500 ppm U_3O_8.
- Non-mineralised overburden (waste rock) defined as material containing less than 200 ppm and on average containing approximately 10 ppm U_3O_8.

Around 148 Mt of overburden would be mined over the life of the Project, and would consist of both mineralised and non-mineralised overburden. Approximately 142 Mt of non-mineralised overburden would be generated. Approximately 113 Mt would be transported to the WRL, around 23 Mt backfilled into the western side of the pit following the completion of mining activities in this area (Figure 6-9) and about 6 Mt used in the construction of TMF embankments.

Backfilling of the western side of the open pit would be undertaken following the completion of mining activities in this area (around year 3-4) and would be limited to around 23 Mt over the life of the operation in order to avoid sterilisation of the remaining ore deposit.

Approximately 6 Mt of mineralised overburden would be stored as a discrete stockpile (Mineralised Overburden Storage Area) within the WRL.

Mineralised overburden may be used to blend with high grade ore or processed during periods of production shortfall. If not processed, the mineralised overburden would be covered with non-mineralised overburden to minimise radon emanation and mitigate the potential for hazardous stormwater run off at mine closure.

The key features of the proposed mining operation are provided in Table 6-2.

Table 6-2: Indicative features of the proposed mining operation

Element	Description
Mining method	Open pit
Maximum mining rate (Mtpa)	30
Length of pit (m)	1,500
Width of pit (m)	1,000
Pit depth (m)	220
Number of drill rigs	6
Number of excavators	4
Number of haul trucks	15

6.3.1 Site Infrastructure

Site infrastructure would be established during the initial mining and processing phases of the Project. Infrastructure required for the mining operations includes:

- mine maintenance facilities;
- explosives magazine;
- mining fleet refuelling facilities;
- mining administration, laundry and change room facilities;
- mine pit dewatering facilities;
- pit flood protection bund; and
- dust suppression equipment.

These would be located as necessary to optimise the mining operations.

6.3.2 Pit Dewatering

The groundwater level in the vicinity of the proposed open pit is approximately 12-15 m below surface. Production bores around the pit would be used to dewater the pit area prior to, and during mining. In-pit sumps and horizontal drains would be established as the mine develops to capture any remaining groundwater in-flows and stormwater.

6.3.3 Mining Operation

The mine would be developed in stages. The initial mining stage would be used to test the design assumptions, such as in-situ ore continuity and actual ore dilution during mining and metal recovery. In the subsequent mining stages there are likely to be several areas of the pit being mined simultaneously. This practice would:

- enable the effective management of in-pit safety;
- provide initial access to non-mineralised overburden for IWL-TMF construction;
- provide an optimised supply of ore and minimise ore sterilisation;
- provide dry areas of the pit should stormwater limit access to the pit bottom; and
- progressively establish the final pit walls over life-of-project thus minimising in-pit work at closure.

As a first step in the mining process, drill rigs would be used to collect both grade control samples (i.e. to identify the ore) and geotechnical information for ongoing pit design. Drill rigs would also be used to prepare for the placement of mining explosives. A combination of ammonium nitrate fuel oil (ANFO) and emulsion-based explosives would be used for the blasting.

As the ratio of overburden to ore is approximately 37:1, two types of mining would be used; selective mining and bulk mining. Selective mining involves the use of relatively small trucks and excavators to selectively extract ore. Selective mining has the key benefit of maximising the recovery of ore whilst minimising the risk of its dilution with overburden. In contrast, bulk mining involves the use of relatively larger trucks and excavators to remove the proportionately much greater mass of overburden. The larger equipment used in bulk mining provides efficiencies in both speed and cost. This mining process is illustrated conceptually in Figure 6-8.

Blasting and hence excavation would proceed along pre-defined benches within the pit. In general, benches consisting primarily of overburden would be thicker (~10 m or more), whilst benches containing ore would be thinner (~2.5 m). Once the rock is blasted it would be recovered with a 'top loading' excavator.

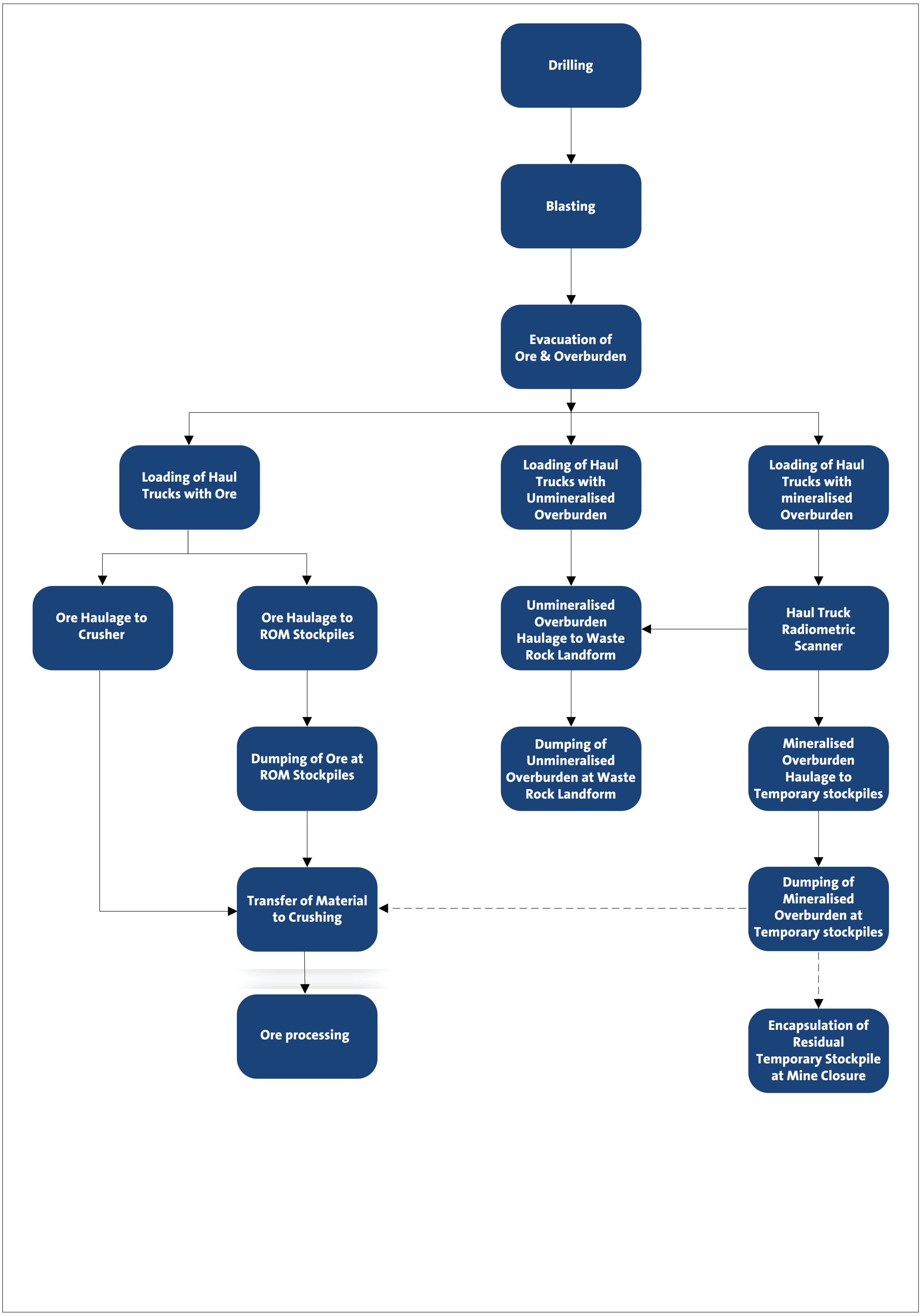


Figure 6-8: Outline of proposed mining process

The overburden would be classified into one of two types whilst in the pit; either mineralised or non-mineralised overburden. Once placed in trucks, the material classified as mineralised overburden would be subject to radiometric scanning which will measure the radioactivity of the load. In the event of a low measurement (less than 200 ppm), the material would be reclassified as non-mineralised overburden.

Ore delivered to the ROM stockpile would be subject to further grade control prior to the commencement of processing. Mineralised overburden may be moved to the ROM stockpile and used to dilute high grade ore, or processed as ore.

To support the mining operations, additional mobile equipment would be required for tasks such as ROM stockpile re-handling, drill pattern preparation, road maintenance, haul road watering and general clean-up. This equipment would include:

- small excavators;
- front-end loaders;
- wheel dozers;
- bulldozers;
- graders; and
- water carts.

6.3.4 Waste Rock Landform

The WRL would be constructed to contain a total of approximately 119 Mt of non-mineralised waste. The WRL would be integrated with the TMF to form the IWL-TMP. A smaller stockpile of approximately 6 Mt of mineralised waste would also be constructed on the southern side of the WRL and will form part of the IWL. The WRL would be located as shown in Figure 6-2.

Overburden would be end-dumped from haul trucks onto the footprint of the WRL in a series of lifts, each of around 10 m, with a final 4.5 m lift prior to closure. Each lift would be battered down from the natural angle of repose (around 37 degrees) to around 18 degrees to ensure slope stability. During operations, benches would be maintained between lifts for the management of stormwater run off and to enhance stability. A number of tipping points would be operated simultaneously, each with a windrow designed as a safety barrier for reversing haul trucks. Overburden would be directed to a specific WRL based on the location of extraction of the material from the pit in order to minimise haul distances, thus reducing the required fleet size and minimising diesel consumption.

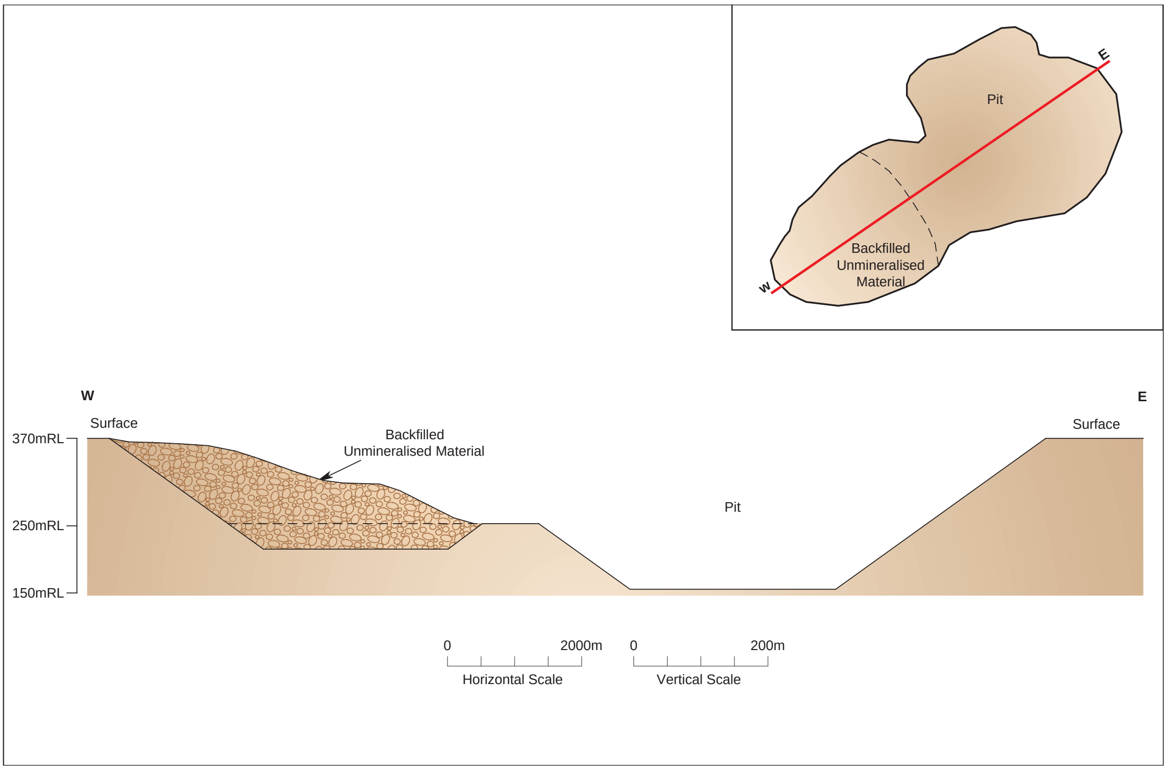


Figure 6-9: Indicative pit backfill

The total footprint for the WRL would be expected to be approximately 200 ha, with a maximum height of 45 m. Sufficient separation would be maintained between the open pit and the WRL such that each facility did not influence the stability of the other.

The proposed geometry of the WRL has been designed to reflect the local natural topography within the constraints of the land available. Placement of overburden on the WRL would be controlled to conform to the WRL design plan and minimise the amount of earthworks required at closure. Investigations undertaken during the course of project studies have indicated that the WRL would be constructed of largely competent rock, and that the proposed design (as described above) would be stable in the long-term.

Progressive rehabilitation of the WRL would be completed as final external slopes are established. Rehabilitation would include the placement of topsoil, drainage structures and establishing vegetation in line with leading industry practice and statutory requirements.

Development of the IWL-TMF allows for optimisation of capital cost for earthworks and liners and optimisation of closure costs. The concept of a tailings storage partially surrounded by the waste dump to form an IWL has significant economic and environmental benefits for the project from the perspectives of construction, operation and closure.

During the detailed design phase, Cameco will design fit-for-purpose drainage controls in the design for the integration of the TMF and WRL and submit the plans for approval as part of the Mining Proposal.

6.4 Ore Processing

A metallurgical plant suitable for the production of up to 4,400 tpa of UOC as U_3O_8 would be established to treat ore extracted from the open pit using a conventional acid leaching process followed by conventional uranium extraction processes to produce a final UOC product for export.

The key features of the proposed metallurgical plant are detailed in Table 6-3.

The proposed metallurgical process is illustrated in Figure 6-10, and described in greater detail in the following sections.

The Project process diagram, containing averaged mass balance information on inputs, outputs and waste streams is described in Figure 6-11.

Table 6-3: Indicative characteristics of proposed metallurgical operation

Element	Description
Processing method	Acid leaching followed by solid-liquid separation, solvent extraction, precipitation and calcination
ROM ore to crusher / radiometric sorter (tpa)	Up to 1,300,000
Radiometric sorter rejects (tpa)	Up to 700,000
Ore to metallurgical plant (tpa)	Up to 600,000

6.4.1 Ore Preparation

ROM ore from the open pit mine would be delivered to the plant feed bin or to the ROM stockpile by haul trucks. The ROM stockpile would have a capacity of around 600,000 t and would be constructed using a clay liner and waste rock foundation. Within the footprint of the ROM stockpile there would be a ROM pad with an access road for use by haul trucks. Directly tipped ore along with ore reclaimed from the ROM stockpile by front end loader would be fed into a primary feed bin ahead of the Primary Crusher. Ore would be withdrawn from the bottom of the feed hopper by means of a vibrating grizzly which would separate smaller material not requiring crushing from larger rocks which would be fed to a primary jaw crusher.

Material from the jaw crusher and the grizzly underflow would then be screened to prepare the feed to the radiometric sorters into two coarse fractions. The fines (the screen underflow) would bypass the sorters and be routed to the milling circuit. The coarse material would pass through the radiometric sorter to sort low grade materials from waste rock at a defined uranium cut-off grade (nominally 200 ppm of uranium). Material below the defined uranium cut-off grade would be rejected and transported to the WRL. Material above the defined uranium cut-off grade would be conveyed either to the mineralised overburden stockpile or to the secondary crusher feed bin.

In order to achieve a consistent 600,000 tpa through the milling circuit and metallurgical plant, the feed

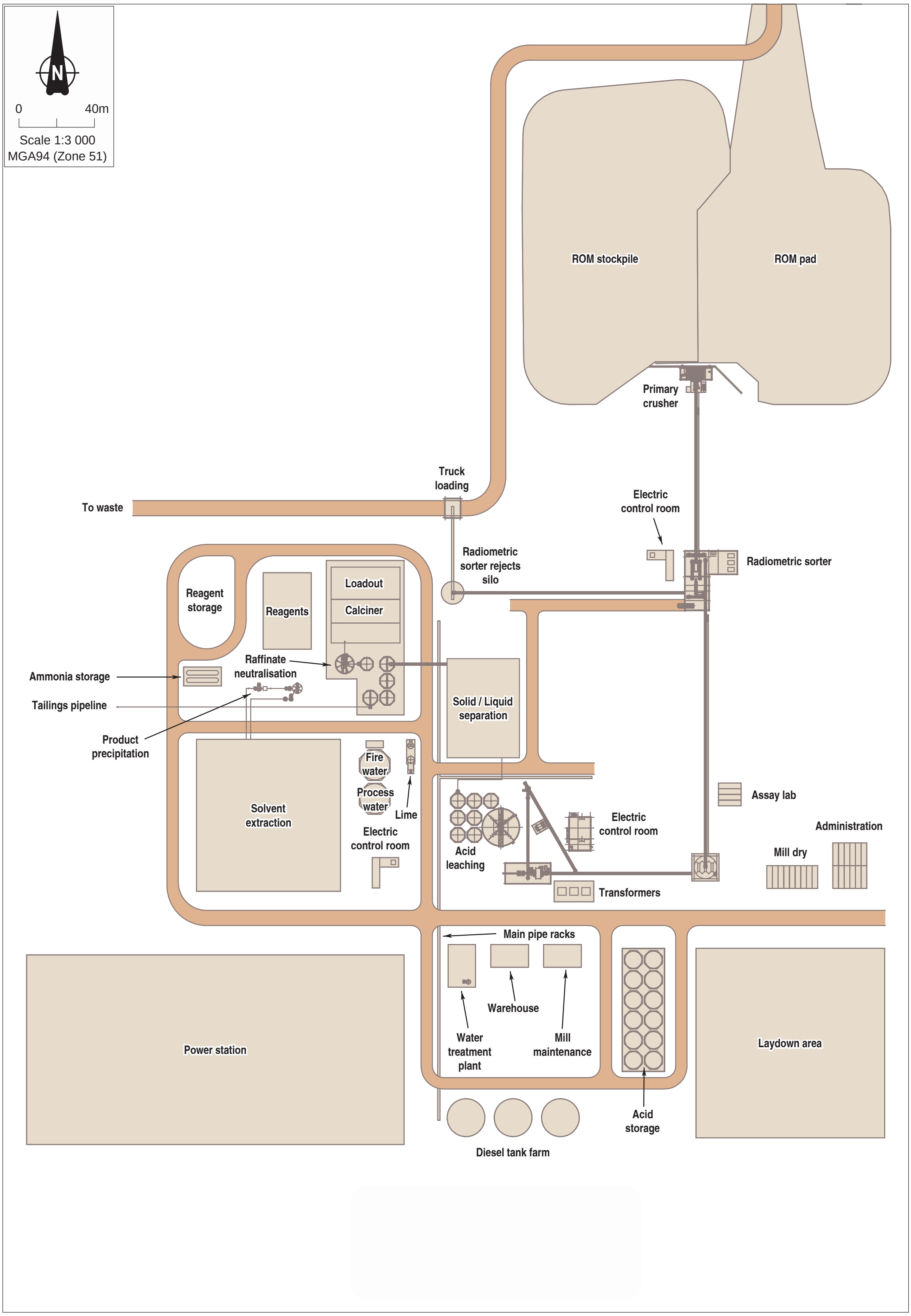
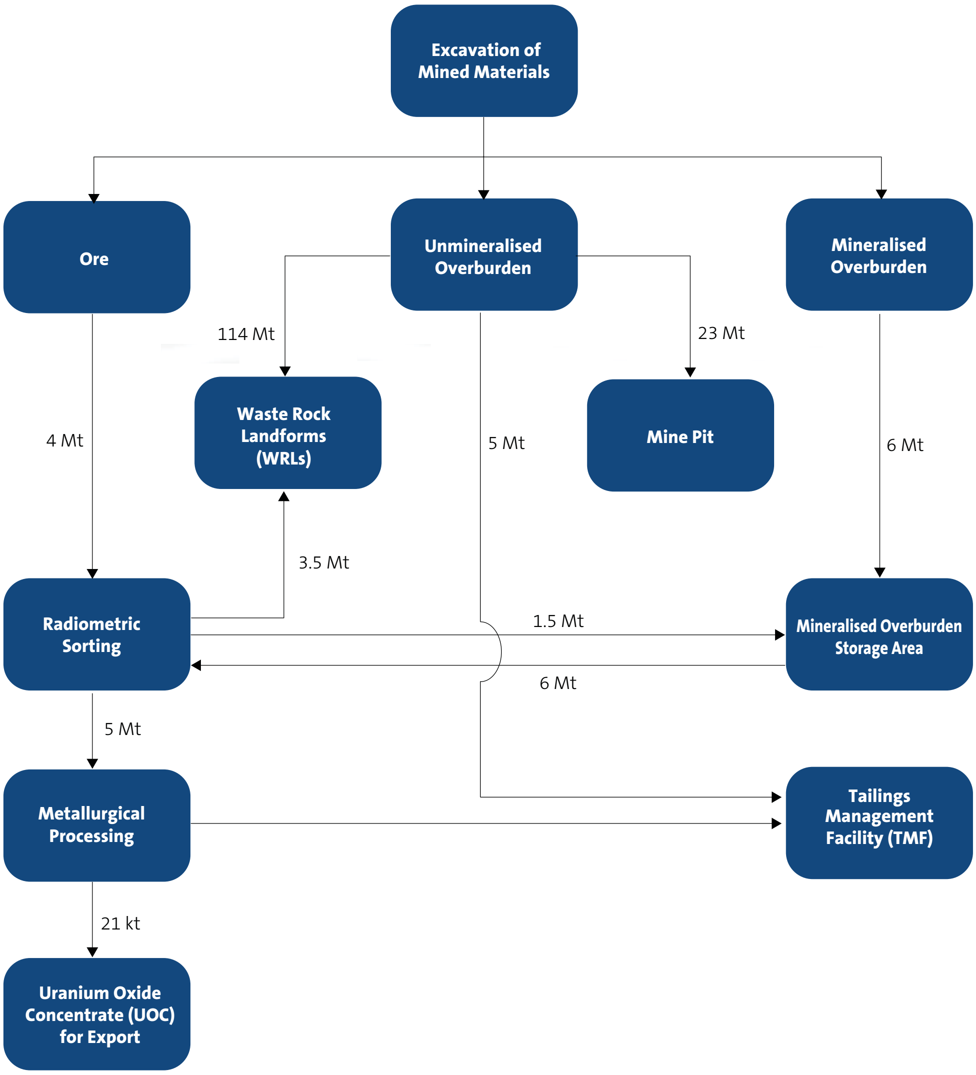


Figure 6-10: Conceptual layout of the metallurgical plant



*Note: Numbers are approximate

Figure 6-11: Process diagram

rate to the primary crushing circuit would be up to 1.3 Mtpa, with about 50% being reject material.

Material from the mill feed bin would be mixed with water and ground in a semi-autogenous grinding (SAG) milling circuit, with oversized material passed to a pebble crusher prior to recirculating to the SAG mill. The resultant slurry would be pumped to a neutral thickener, with neutral water returned to the milling circuit and the thickened slurry passing to the acid leach circuit.

6.4.2 Processing Circuit

The leaching of uranium would be carried out in a series of cascade overflow leach tanks, allowing one tank to be off-line at any time for maintenance. Manganese dioxide and sulphuric acid would be added to the tanks to facilitate leaching. The leached pulp (containing uranium in solution and gangue materials as a slurry) would pass from the last leaching tank to the solid liquid separation circuit, where the solids would be separated from the uranium-bearing solution (termed pregnant liquor solution, PLS). The dewatered solids would pass to a neutralisation tank. The PLS would be filtered using ultrafiltration membranes to remove any remaining solids and pumped to the PLS storage tank.

A conventional solvent extraction system would be used to recover uranium from the PLS to an organic phase (termed 'loaded organic') with the addition of extractant, modifier and diluent reagents, leaving a raffinate solution containing the majority of the iron, silica and sulphate impurities. The loaded organic solution would be scrubbed to remove any entrained raffinate and any silica, and the scrubbed solution would subsequently pass to a stripping circuit where the uranium would be extracted using a stripping agent to form a uranium-bearing loaded strip solution. The barren organic solution, stripped of its uranium, would be regenerated using sodium carbonate and recycled.

The loaded strip solution would be treated with either ammonium or hydrogen peroxide to produce a uranium precipitate. The uranium precipitate would be calcined in a rotary calciner, producing a 99% U_3O_8 uranium oxide concentrate (UOC). This would be discharged to a UOC product bin, before being loaded into 205 L steel drums, each of which would be sampled, sealed, washed, weighed and labelled in preparation for dispatch. Off-gas from the calciner would be scrubbed prior to discharge to the atmosphere. The captured material would be pumped back to the uranium precipitation circuit. A separate baghouse system would be installed to provide scrubbing of the calcining and packaging building ventilation gases.

6.4.3 Tailings Management

The process waste that remains following the extraction of uranium from the mined ore is referred to as tailings. The tailings consist of the neutralised filter cake, post acid leaching. The filter cake is neutralised in the neutralisation circuit and then thickened and deposited in an above-ground TMF at a rate of around 600,000 tpa. The TMF would have a total footprint of approximately 38 ha and be integrated into the WRL.

The TMF would have a nominal final height of around 20.5 m, and would be designed to store approximately 7 Mt of tailings material over the life of the operation. This includes capacity to store tailings from the processing of the mineralised overburden. The facility would have a minimum 1 m of freeboard for the management of stormwater at the conclusion of tailings deposition. The TMF would include a double liner with leak detection and seepage collection system. The TMF embankments would be constructed of non-mineralised material from a combination of mine overburden and material extracted during pond construction and land clearing.

A plan view of the indicative TMF layout and associated Evaporation Pond is presented in Figure 6-12.

6.4.3.1 Layout and Design

The design of tailings dams in Western Australia follows the requirements of the WA Department of Mines and Petroleum (DMP) guidelines on the Safe Design and Operating Standards for Tailings Storage (Department of Minerals and Energy [DME], 1999). That document provides the requirements and guidelines for the design, construction, management and decommissioning of tailings facilities in Western Australia. Other relevant guidelines are provided by the Australian National Committee on Large Dams (ANCOLD) and International Committee on Large Dams (ICOLD).

For all mining projects in Western Australia, a TMF design report is to be produced in accordance with the DMP requirements (DME, 1999). In the event that the Project obtains the requisite environmental approval (i.e. project approval via the ERMP process)

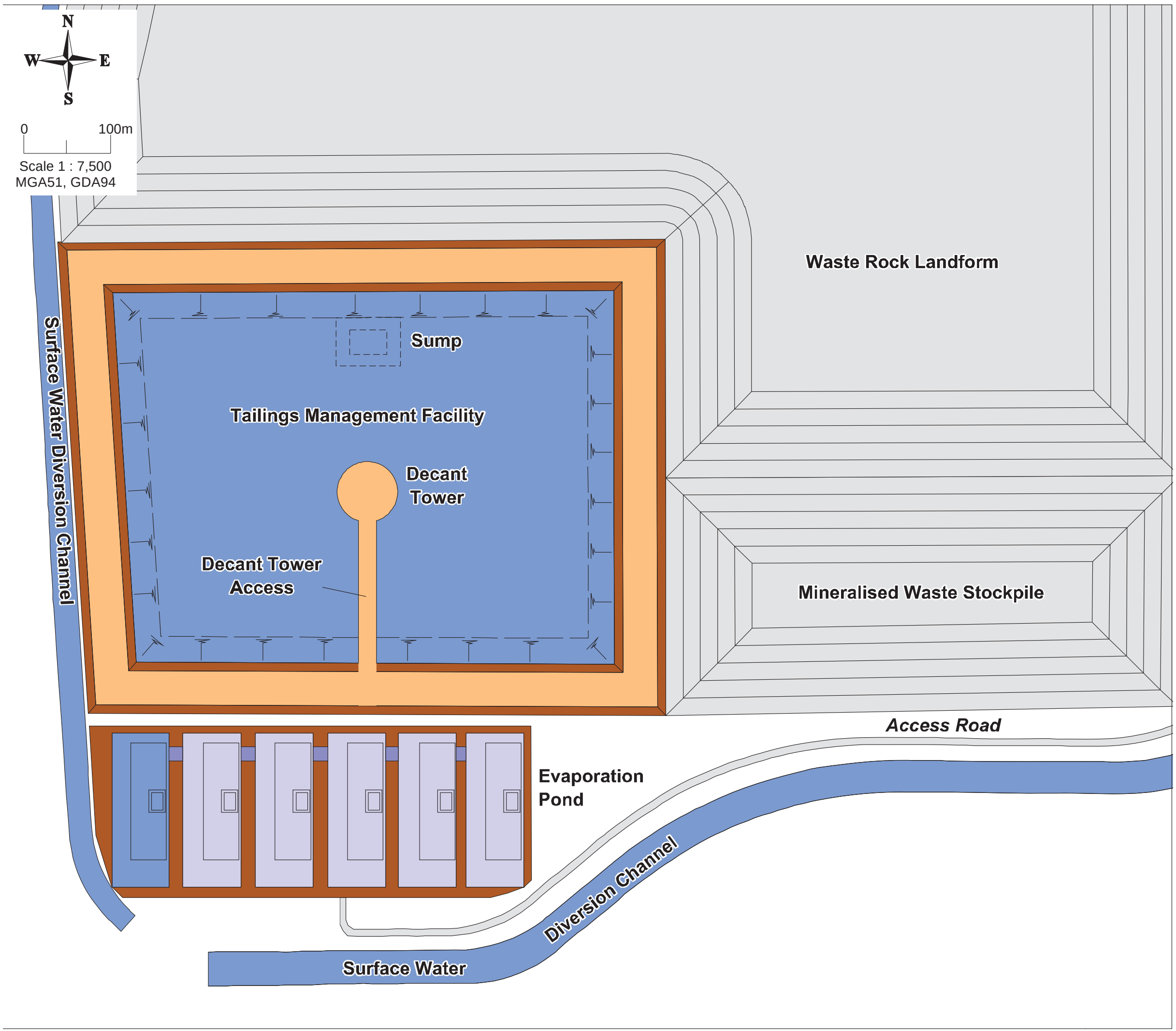


Figure 6-12: Indicative TMF layout

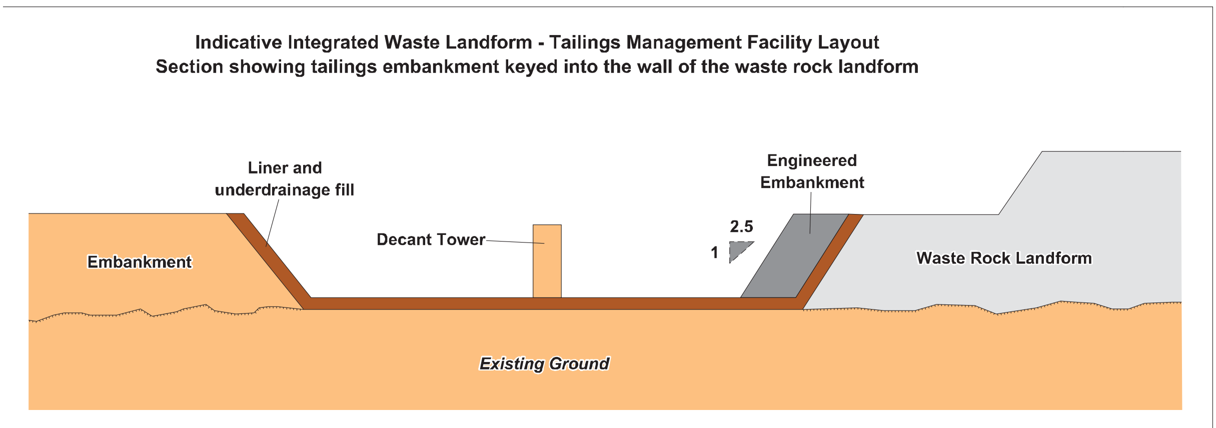


Figure 6-13: Indicative TMF cross section

a TMF design report will be submitted to the DMP as part of the subsequent and various other approval processes. The design report is subject to approval by the DMP, and thereafter the TMF is to be constructed in accordance with the approved design.

The TMF is designed as a permanent, single-use facility and would be constructed with a double layer liner system with an intervening leak collection and recovery system to contain process solutions, enhance solution collection, and protect the groundwater.

The perimeter embankment design provides for a nominal crest width of 14 m, comprising a 10 m width of waste rock and 4 m width of transition and seal zones. The design includes an access causeway that extends to the central decant tower. A cross-section of the TMF is illustrated in Figure 6-13, and the indicative features of the proposed TMF are provided in Table 6-4.

The TMF has been designed to be positioned immediately adjacent to the WRL effectively forming an integrated waste landform (IWL). This design provides for a range of benefits, including increased structural integrity on the sides of the facility adjoining the WRL, where factors of safety for embankment stability are nominally higher, simply due to the mass of waste in place surrounding the TMF when compared with conventional TMF construction. The design also allows for more optimum use of mine waste and topsoil to construct the tailings storage.

A more detailed discussion of the TMF and tailings properties is presented in Section 8.12 and Appendix E.

Table 6-4: Indicative features of the proposed TMF

Element	Description
Storage method	Two above-ground downstream-raised tailings cells
Total tailings deposited (Mt)	7
Annual rate of deposition (tpa)	Up to 600,000
Number of TMF cells	2
Area of proposed TMF cells (ha)	35 (tailings surface area)

6.4.3.2 Operation

The IWL-TMF would be constructed during the mining pre-strip phase using pre-strip material to form the embankments. The construction phase would involve:

- construction of the embankments;
- installation of liner systems, including the leak detection system (LDS) and leachate collection system (LCS);
- construction of the initial central decant structures and access causeway; and
- construction of pipeline corridors for tailings delivery and reclaim systems and installing pipework and pumps.

The TMF would be provided with 1 m of freeboard and the impoundment floor will have a minimum grade of 1% to facilitate leachate drainage toward the decant tower. An earthen berm (causeway) would be constructed to the decant structure for access and to provide a reclaim pipeline corridor. The causeway and reclaim pipeline will be raised in lifts to maintain at least 1 m of freeboard above the tailings surface. A decant tower would be constructed at the centre of the facility and would comprise a reinforced concrete (or other suitable material) base cast above the liner system and a superimposed tower constructed of slotted reinforced concrete sections. The tower would be surrounded by an annulus of selected coarse and competent waste rock to retard the inflow of tailings fines into the tower. The tower would be equipped with a submersible pump, power, and lighting equipment. A reclaim water pipeline would be constructed from the return water pump, along the pipeline corridor to the evaporation pond.

A pipeline/utility corridor would be constructed to provide secondary containment for the slurry delivery and reclaim pipelines. A tailings distribution system would be installed around the embankment crest to provide for rotational spigoting of tailings into the TMF from the embankment crest. The tailings delivery pipelines would have isolation valves to allow rotating tailings deposition. Ramps would also be required to provide access to the top of the embankments.

The inactive portion of the cell will be kept moist to minimise dust generation and keep radon emanation to as low as reasonably achievable.

Stormwater collected on the TMF surfaces would be either allowed to collect on the tailings surface within certain operational parameters, or would be collected via the central decant system and directed to the evaporation pond for evaporation or if suitable reclaimed to the metallurgical plant.

6.4.4 Evaporation Pond

A large proportion of the process water used in the process plant would be recovered and recycled. However, the water associated with the tailings discharge would be recovered by the decant system and directed to the evaporation pond for disposal.

The Evaporation Pond would be double lined with a leak detection system. As the tailings water evaporates a salt residue would accumulate in the base of the pond. The Evaporation Pond would be designed such that the accumulated salts can be periodically removed so as to avoid loss of capacity. The removed salts would be placed in the TMF for permanent disposal.

The total area of the Evaporation Pond would be approximately 9 ha.

6.5 Water Demand

Water of different qualities would be required for the proposed development, consisting of low quality water for dust suppression during mining operations, process water for use in the metallurgical plant and potable water for use in the fire water systems, the safety shower systems, and the administration and accommodation facilities.

Water supply would be prioritised such that the process water demand would be met in the following order:

- mine dewatering from bores and sumps;
- opportunistic capture of stormwater run off; and
- make-up water from the process water supply borefield.

A total of 3.1 MLpd would be required for the Project, including an estimated 1.4 MLpd for dust suppression, 1.5 MLpd in the process plant and 0.2 MLpd potable water for the accommodation village and safety systems.

The estimated water demand would be met through the delivery of water from the pit dewatering operations and from a local production borefield. Test work and modelling conducted to date indicates that the Project's water demand can be met. A number of groundwater bores have been established and tested. The locations of the wells are illustrated in Figure 6-2. Details of the borefield supply based on the testwork undertaken to date are presented in Section 8.4 and Appendix K.

In the event that supply of water from dewatering exceeds demand, excess water would be disposed of to either the site stormwater ponds, the evaporation pond or the TMF, depending on water quality.

6.5.1 Process Water

An extensive system of water recycling has been engineered into the metallurgical plant design, allowing the reclamation of reagents from used process water and the recovery and reuse of process water throughout the plant.

6.5.2 Potable Water

Potable water supply for the current exploration project is supplied from North Bore. When establishing the bore, Cameco analysed water samples for radionuclide concentrations including gross alpha, gross beta, Ra-226, Ra-228 and Pb-210. The measured concentrations were converted into a dose with consideration of who might drink the water and how much might be consumed and the water was determined to be safe to drink from a radiation perspective (Kellogg Brown Root, 2010).

In order to meet the additional requirements of increased manning levels for a mining operation, additional water supplies may need to be developed. These supplies will be tested and both during development and while in operation to confirm that drinking water meets the required standards.

A small potable water treatment plant would take water from the fresh water borefield to produce potable water. Impurities extracted from the fresh water would be pumped to a process water storage facility where it would be combined with other process water streams and used in the metallurgical plant. The potable water would be used in the administration and accommodation facilities and the site safety shower systems.

6.6 Site Infrastructure

Infrastructure required to be constructed prior to the operation of the metallurgical plant would include:

- access roads including a crossing over the Yandagooge Creek;
- warehouse and reagent storage facilities;
- maintenance workshops;
- sand-blasting and painting facilities for the removal of surface contamination prior to the removal of plant and equipment from site;
- emergency response facilities;
- a vehicle wash down facility;
- metallurgical administration, change room and laundry facilities;
- diesel power plant and distribution network;
- water treatment plant;
- borefield and water distribution network; and
- waste management facilities.

6.7 Site Security

Security on site will be managed in accordance with Western Australian Mines Safety and Inspection Regulations and will include measures such as a security gate on the main entry road into the site and security fences to restrict access to the mine site.

Other areas within the mine such as product packing and solvent extraction, will have higher level security features in accordance with Australian Safeguards and Non-Proliferation Office requirements.

Areas within the mine and processing plant that need delineation to establish “controlled and supervised areas”, with respect to the radiation management system, will be controlled through administrative processes such as access control, signage and procedures.

6.8 Energy Supply

The power supply to the entire site would be provided by an on-site power station. The power station would be either an owner-operated diesel or diesel/gas hybrid power station or a contract power supply through a Build Own and Operate agreement.

The indicative annual electricity demands are summarised in Table 6-5.

Table 6-5: Indicative electricity demand

Demand source	Demand (MW)	Consumption (MWh/a)
Infrastructure and support services	2	17,000
Processing	4	35,000
Total	**6**	**52,000**

The primary sources of diesel demand would be associated with the operation of the mining fleet and the generation of electricity to support the proposed operation, and thus varies by year. Diesel would be supplied via road transport, and stored on site in appropriately bunded tanks sized to provide approximately six weeks supply. A summary of the proposed diesel consumption for the year of greatest diesel demand is presented in Table 6-6.

Table 6-6: Indicative annual diesel demand

Demand source	Consumption (ML/a)
Mining fleet	15.3
Electricity generation	12.3
Total	**27.6**

6.9 Chemical Storage and Use

A number of reagents would be used throughout the metallurgical process. Table 6-7 details the reagent types, their form and indicative annual consumption.

6.10 General Waste Management

Construction and operational activities of the Project would generate a number of different types of wastes including:

- inert waste such as excess fill and building rubble;
- organic debris;
- general refuse including scrap metal, cardboard and plastics;
- sewage; and
- waste oil.

Cameco will operate the Project along the principles of the following waste management hierarchy:

1. avoid;
2. reduce;
3. reuse;
4. recycle;

Table 6-7: Indicative metallurgical reagent consumption, handling and storage methods

Reagent	Annual consumption (t)	Handling and storage
Sulphuric acid	111,000	98% sulphuric acid solution will be delivered by road tanker and stored in a sulphuric acid tank farm for distribution to the leach and solvent extraction areas.
Leach circuit oxidant - manganese dioxide (pyrolusite) or equivalent	15,000	Pyrolusite will be sourced from the nearby Woodie Woodie mine (or alternative source) as crushed manganese ore at 62% manganese dioxide. Road trucks will deliver ore to a receiving bin. Ore will be conveyed to a manganese ball mill. Manganese slurry will be thickened to 50% solids in a conventional thickener and stored in a storage and distribution tank from where it will be pumped to the leach section.
Lime	12,000	Quicklime (85% CaO) will be delivered by pressurised tanker and transferred to storage silos. Lime will be slaked with process water to produce milk of lime for distribution to the raffinate treatment tank and tailings neutralisation tanks.
Ammonia*	1,500	Anhydrous ammonia (liquid ammonia stored and transported under pressure) will be delivered by road tanker and stored in two anhydrous ammonia bullets. Ammonia gas will be distributed to the product precipitation tanks. Ammonium hydroxide solution will also be prepared by reacting ammonia with water and used for in the solvent extraction process.
Hydrogen peroxide	500	The peroxide system consists of unloading pumps from a peroxide isotanker, storage tank and peroxide dosing pumps to the Fluid Bed precipitation vessel.
Sodium carbonate	1,000	Sodium carbonate may be delivered either by pressurised tanker and transferred to a storage silo or in one tonne bulk bags which will be added to a solution make up tank as required. Sodium carbonate solution will be pumped from a storage tank to the regeneration mixer settler.
Shellsol D70 (kerosene)	800	Kerosene will be delivered by road tanker and off-loaded to a storage tank from where it will be pumped to the barren organic tank.
Alamine 336	100	Alamine will be delivered in intermediate bulk containers (IBCs) and pumped to user points.
Isodecanol	10	Isodecanol will be delivered in intermediate bulk containers (IBCs) and pumped to user points.
Flocculant	200	Flocculant will be delivered in powder form to site. The flocculant will be stored in a hopper/silo prior to preparation and distribution to the user points.

* Ammonia or hydrogen peroxide would be used depending on the selected stripping agent.

5. recover;
6. treat; and
7. dispose.

Waste management will be taken into consideration at all stages of the Project, including requiring contracts to supply recyclable containers where practical.

Further discussion of the different waste streams is provided in the following sections.

6.10.1 Non Process Solid Wastes

Inert waste such as excess fill and building rubble and general refuse excluding recyclable materials would be directed to an on-site landfill (Figure 6-2). Cardboard, plastics and scrap metals would be collected for transport off-site to an approved recycling depot.

6.10.2 Non Process Liquid Wastes

Non-process liquid wastes including stormwater, potable water treatment plant brine and vehicle wash-down water would be directed to the evaporation pond. Sewage wastes generated in

Figure 6-14: Proposed transport route

the administration and accommodation facilities would be treated in a modular sewage treatment plant, with the treated effluent being used for dust suppression or landscaping irrigation.

6.10.3 Controlled Wastes

All controlled wastes, as defined in Schedule 1 of the Environmental Protection (Controlled Waste) Regulations 2004, would be collected and removed for recycling or disposal at a licensed off-site facility. Should there be any hazardous waste on site, this would be segregated from non-hazardous waste and managed in accordance with the relevant licence conditions issued under the *Environmental Protection Act 1986*, or appropriate Australian or international standards. Cameco would work with its suppliers to maximise container recycling options.

6.10.4 Radioactive Contaminated Wastes

Miscellaneous wastes that may have become contaminated through contact with ores and process residues (referred to as contaminated waste), including discarded conveyor belts, rubber lining material, pipes, filter media and used protective equipment will be managed according to the Radiation Management Plan.

A system of separate collection of potentially contaminated wastes from operational areas will be instituted. Where practical, potentially contaminated waste will be decontaminated and disposed of with normal waste streams. Contaminated waste will be collected and initially held in a secure, bunded area. Depending on the nature of the waste several disposal options will be available. These include:

- disposal into the tailings management facility;
- disposal within the waste rock landform in a similar manner to mineralised overburden;
- disposal into the mine pit at the end of operations; or
- disposal into purpose dug trenches in approved locations.

In all cases records of the disposal, including type of material, quantities and locations will be kept.

6.11 Transport

6.11.1 Site Access

The primary road access to and from the Project would be via the Telfer road between Marble Bar and Telfer, and onto the Kintyre Road (see Figure 6-14). This road, which is currently a track, would be upgraded to enable transport of construction machinery and plant during Project development, and the transport of raw materials, supplies and UOC product during operations.

The existing track from Telfer to Kintyre is approximately 84 km long and 7 m wide. It is an un-gazetted road on vacant crown land and has been in existence for at least 20 years.

The existing track has been constructed on country rock with no reinforcing fill. In places the surface of the road is up to a metre below the ground surface, as sand and clay has been eroded or graded away. In other places where the road is prone to flooding it has become considerably wider than normal as users of the road have sought firm ground off to the side of the track.

At the northern end, the track joins access roads associated with the operation of the Telfer mine before intersecting the Marble Bar to Telfer Road approximately 1 km west of Telfer Mine. At the southern end, the track continues past the turnoff into the Project area through the Karlamilyi National Park and then intersects with the Talawana Track (Figure 2-1). Even in its undeveloped state, the track is an important north-south link in the region for local Aboriginal people, mineral exploration and tourism.

Cameco would upgrade and realign the road to avoid the Telfer mine site and environmentally or culturally sensitive areas. The proposed road will be 13 m wide including a running surface of about seven metres, shoulders of two metres and drains one metre wide. It is anticipated the new road would largely follow the alignment of the existing track (see Figure 6-7) except where it is necessary to straighten curves and align approaches to creek crossings to meet engineering design criteria. The new section of track designed to bypass the Telfer mining area will be constructed in a previously undisturbed area.

Within the Project area, a road would be constructed from the access point to the plant and to the accommodation village. The construction of this road would include the construction of a drainage crossing on the Yandagooge creek (see Figure 6-2).

It is proposed that a new airport would be constructed within the Project area for transport of construction and operation personnel and supplies (see Figure 6-2).

6.11.2 Transport of Materials to Site

Materials, mining fleet and associated equipment for the construction and operation of the proposed development would be sourced from within Australia and overseas, and would be delivered via road from Kalgoorlie in the case of items originating from the east coast, via Newman and/or Port Hedland in the case of items originating from Perth, and the port of Port Hedland for imported materials and pre-assembled components.

The Project would result in approximately an additional 7,500 t of material being transported to site, most through Port Hedland. Irrespective of the source, all materials would be required to be transported along the Telfer Road between Marble Bar and Telfer. Estimated traffic volumes associated with the movement of materials and mining fleet via this roadway during the construction phase of about 24 months would be around 10.5 average annual daily traffic (AADT) movements.

Reagents and diesel required for the operation of the Project (refer Section 6.8 and Section 6.7 respectively) would be transported to site from various sources within Australia (east and west coast suppliers) and imported from overseas. The exact route of all reagents would be determined during the detailed design phase and may change subject to commercial arrangements. As with the construction-phase traffic, irrespective of the source, all materials would be required to be transported along the Telfer Road between Marble Bar and Telfer, and it's estimated that peak operation-related traffic movements would be around 9.9 AADT, of which 9.0 would be associated with reagent imports to site, with the remaining 0.9 AADT movements being for product transport from site.

6.11.3 Transport of Product from Site

This proposal includes the transport of the UOC within Western Australia via Kalgoorlie to the Western Australian border and then to the Port of Adelaide via road. The proposed transport route is to the Western Australian border via Telfer, Marble Bar, Port Hedland, Newman, Meekatharra, Mount Magnet, Leinster, Leonora, Menzies, and Kalgoorlie (Figure 6-14). The environmental assessment relating to the transport of the UOC beyond Western Australian borders would require approval by South Australian and Federal regulatory agencies and the proposal is currently being discussed with the relevant State and Federal regulators.

The total distance of the preferred road route from Kintyre Mine Site to the Port of Adelaide is approximately 4,600 km. It is proposed that an average of two road trains per week will operate along the route. Up to five road trains associated with the Project may travel the route during a single week but on average about 100 movements will occur in a single year.

Further information regarding transport volumes and routes is presented in Section 9.5 and Appendix U.

6.12 Workforce and Accommodation

It is anticipated that the Project would require a construction workforce of up to 400 employees and an operational workforce of up to 450 employees, around 200 of whom would be on site at any one time. Around 30 employees would be based in Perth. Employees and contractors would be sourced from regional centres and Perth. An airstrip would be used for air transport of personnel from these locations. Personnel would also be driven or flown in from local communities including, for example, Newman, Marble Bar, Nullagine, Port Hedland, Punmu and Parnngurr. Cameco is proposing to develop an Indigenous training and employment programme to provide opportunities for members of the local Indigenous communities to become involved in the Project.

An accommodation village of around 250 rooms would be constructed for the workforce to be used during construction and operations. The accommodation village would have the following facilities:

- a kitchen and cafeteria;
- laundry modules;
- exercise facilities;
- media (theatre) facilities;
- recreation facilities;
- a swimming pool; and

- domestic water, sewage and fire protection systems.

The existing exploration camp would remain in serviceable condition for use as overflow accommodation during periods of high on site workforce demand such as plant maintenance shutdowns.

6.13 Rehabilitation and Closure

A Mine Closure Plan (MCP) has been prepared to provide information to key stakeholders on Cameco's post-mining land use aspirations, proposed closure and rehabilitation measures and planned outcomes. A Mine Closure and Rehabilitation Plan will also be required as part of Mining Proposal approval under the WA Mining Act 1978. The MCP has been prepared in accordance with the DMP 'Guidelines for Preparing Mine Closure Plans, June 2011' and is provided in Appendix D17. The DMP recognises that closure planning is a progressive process and that mine closure plans are living documents which are reviewed on a regular basis throughout the life of a mine. The MCP is based on the current available information and project design, and will be reviewed as the Project progresses.

The concave face of the waste dump upstream of the TMF will be the source of waste rock for the cover for the TMF. The TMF cover closure concept is based on a minimum of 1.0 m waste rock, 2.0 m silty sand, with a GCL (Geosynthetic Clay Liner) placed in the middle of the silty sand layer and 0.1 m rock mulch.

Following closure, the site objective for the Project area is to be 'rehabilitated with the goal of achieving a safe, stable property that allows future use of the area for traditional purposes or occasional access that is similar to the existing (pre-mining) land use'.