# ABOUT ILUKA RESOURCES

Iluka Resources Limited (Iluka) is an international mineral sands company with expertise in exploration, project development, mining, processing, marketing and rehabilitation.

The company's objective is to deliver sustainable value.

With over 60 years' industry experience, Iluka is a leading global producer of zircon and the high grade titanium dioxide feedstocks rutile and synthetic rutile. In addition, the company has an emerging position in rare earth elements (rare earths). Iluka's products are used in an increasing array of applications including home, workplace, medical, lifestyle and industrial uses.

With over 3,000 direct employees, the company has operations and projects in Australia and Sierra Leone; and a globally integrated marketing network.

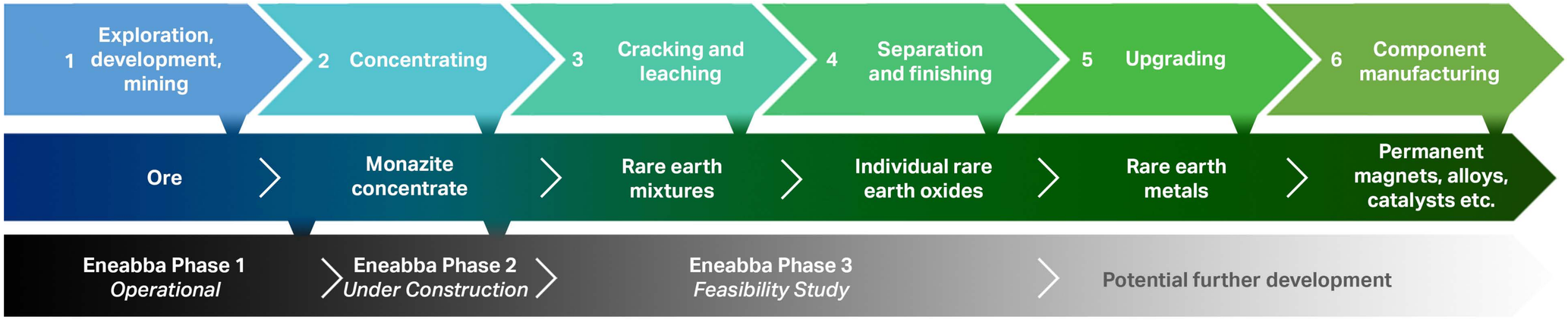
Iluka conducts international exploration activities and is actively engaged in the rehabilitation of previous operations in the United States, Australia and Sierra Leone.

Listed on the Australian Securities Exchange (ASX) and headquartered in Perth. Iluka holds a 20% stake in Deterra Royalties Limited (Deterra), the largest ASX-listed resources focussed royalty company.

## ILUKA IS DIVERSIFYING FROM TRADITIONAL MINERAL SANDS MARKETS INTO THE GROWING MARKET FOR RARE EARTH ELEMENTS, BASED ON WORLD CLASS ASSETS AT ENEABBA AND WIMMERA.

- Phased approach to reduce risk and gain understanding of market
- Eneabba Phase One in operation and Phase Two in construction stage
- Eneabba Phase Three to undertake downstream processing – planning and approvals process underway for a Rare Earths Refinery
- Engagement with potential rare earths customers in progress

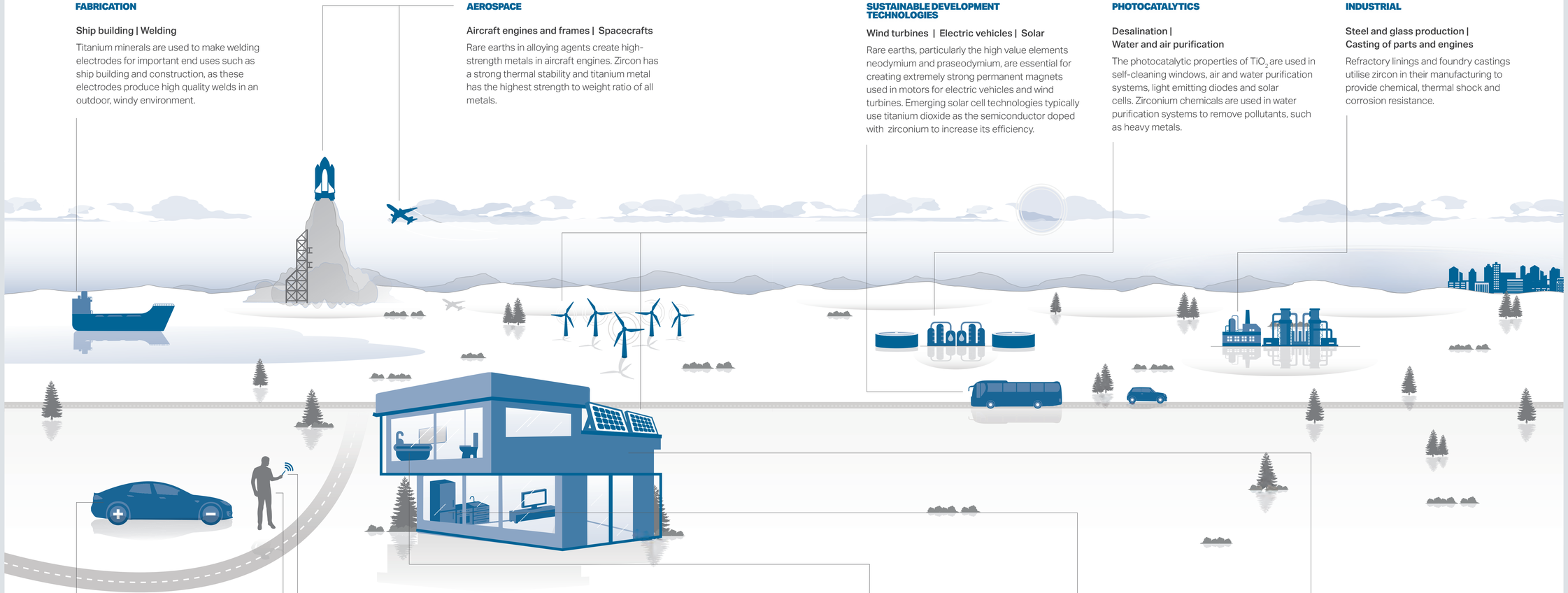
### RARE EARTH VALUE CHAIN



# MINERAL SANDS & RARE EARTHS

## PART OF EVERYDAY LIFE

**ILUKA'S PRODUCTS ARE CRITICAL INPUTS TO THE MODERN ECONOMY. FROM PAINT AND TILES TO MEDICAL, LIFE-STYLE, INDUSTRIAL AND RENEWABLE ENERGY TECHNOLOGIES, THE UNIQUE PROPERTIES OF TITANIUM DIOXIDE, ZIRCON AND RARE EARTHS ARE ESSENTIAL TO A WIDE VARIETY OF APPLICATIONS, PART OF EVERYDAY LIFE.**



### FABRICATION

**Ship building | Welding**

Titanium minerals are used to make welding electrodes for important end uses such as ship building and construction, as these electrodes produce high quality welds in an outdoor, windy environment.

### AEROSPACE

**Aircraft engines and frames | Spacecrafts**

Rare earths in alloying agents create high-strength metals in aircraft engines. Zircon has a strong thermal stability and titanium metal has the highest strength to weight ratio of all metals.

### SUSTAINABLE DEVELOPMENT TECHNOLOGIES

**Wind turbines | Electric vehicles | Solar**

Rare earths, particularly the high value elements neodymium and praseodymium, are essential for creating extremely strong permanent magnets used in motors for electric vehicles and wind turbines. Emerging solar cell technologies typically use titanium dioxide as the semiconductor doped with zirconium to increase its efficiency.

### PHOTOCATALYTICS

**Desalination | Water and air purification**

The photocatalytic properties of $TiO_2$ are used in self-cleaning windows, air and water purification systems, light emitting diodes and solar cells. Zirconium chemicals are used in water purification systems to remove pollutants, such as heavy metals.

### INDUSTRIAL

**Steel and glass production | Casting of parts and engines**

Refractory linings and foundry castings utilise zircon in their manufacturing to provide chemical, thermal shock and corrosion resistance.

### AUTOMOTIVE

**Engines | Paint | Electronics**

Titanium, zircon and rare earths are required for vehicles in the brake linings/ pads, parking sensors, oxygen sensors, engine management systems, paint, catalytic converters, electrics and rubber products. Rare earths are used in catalytic converters and electric vehicles, enabling lighter and more efficient motors.

### HEALTHCARE

**Medical equipment**

The anti-corrosive nature and biocompatibility of titanium makes it ideal for prosthetics, orthopaedic implants and medical instruments. Zirconia materials are highly desired for medical implants, and zirconium chemicals provide filtering function to home dialysis systems.

### TECHNOLOGY

**Electronics | Batteries**

Rare earths are used in a range of modern technologies including smartphones, televisions, lasers, rechargeable batteries and computer hard drives. Zirconia materials are applied in various electronics, such as piezoelectric components which make smart phones "smart" through sensors, ultra-tough structural casings for mobile phones and watches, and new-generation of higher-capacity and safer solid-state batteries.

### CERAMICS

**Tiles | Sanitary ware**

Zircon is hard wearing and water, heat, chemical and wear resistant making it ideal for use in ceramics and sanitary ware.

### HOME APPLICATIONS

**Cosmetics | Pharmaceuticals | Home appliances**

Iluka products are used in light bulbs, dishes, glasses, clock parts, food colouring, ceramic knives, pans, toothpaste, antiperspirants and sunscreens, glass and faucets for taps.

### PIGMENTS & CONSTRUCTION

**Paint | Plastic | Ceramics**

Titanium dioxide provides UV and chemical resistance, preventing fading, peeling and cracking when used in paint coatings, inks and plastics. Zircon provides corrosion resistance to glassfibres applied to high-performance concrete for building construction, including 3D-printed concrete structures.

# ENEABBA PHASE 2 PROGRESS

- Phase 1 currently produces a concentrate (20% monazite), transported from Eneabba to Narngulu for export via Geraldton port.
- Phase 2 project proposes to upgrade this material from 20% to 90% monazite.

Phase 2 will create:

- $40 million project Capex
- +200 jobs during construction
- +30 jobs during operation (mining, operations, admin, transport)
- Ministerial approval received in April 2021

## Major engineering packages

**Awarded to Midwest businesses**

✓ Civil construction and concreting
✓ HV electrical installation

**Currently being tendered**

- Structural, Mechanical, Piping
- LV electrical, Instrumentation installation

## Minor Packages

**Awarded to Midwest businesses**

✓ Surveying
✓ Geotechnical (soil testing)
✓ Repair and upgrade of existing roads
✓ Communication infrastructure
✓ Installation of offices and buildings
✓ Supply and installation of furniture
✓ Truck wash installation work

## PHASE 2 TIMELINE

Executive approval
July 2020

Board approval
Aug 2020

Regulatory approvals
Q1 2021

Construction begins
Q2 2021

Commissioning
Q1 2022

First shipment
Q2 2022

*June 2021 construction progress on schedule*

*Final construction plan*

# ENEABBA RARE EARTHS REFINERY

## PROJECT OVERVIEW

- Construction and operation of a rare earths refinery, producing separated, high purity rare earth products.
- Located at the current Eneabba Mineral Sands Mine site.
- The plant will use the rare earth mineral product (mainly monazite) as feedstock from Eneabba Phase 2, along with other sources of rare earth concentrate as feed material.
- Packaged products will be transported by road for export through Fremantle Port.

**Project Status:** Feasibility Study Phase

**Production capacity:** 17,000tpa of rare earth elements

**Indicative operational life:** >20 years

**Project footprint:** ~600 hectares within existing Eneabba mine footprint

**Project workforce:** ~300 construction jobs, ~250 operational jobs

*The high value rare earth elements contained in Iluka's mineral products are used to create powerful permanent magnets. Permanent magnets are used in clean energy and high-end technology solutions including wind turbines and electric vehicles.*

## PHASE 3 TIMELINE

Board approvals sought
2022 H1

Feasibility study and investigations
2021

Regulatory approvals
2022 H2

Construction begins
2023 H1

Commission
2024 H2

# ENEABBA RARE EARTHS REFINERY CONCEPT

## PROCESS OVERVIEW

### Roasting and Leaching

- Acid is added to the heavy mineral concentrate, which is then heated to around 300°C to convert the rare earth minerals into a soluble form. The product from the kiln is dissolved in water and recycled acid.

### Purification

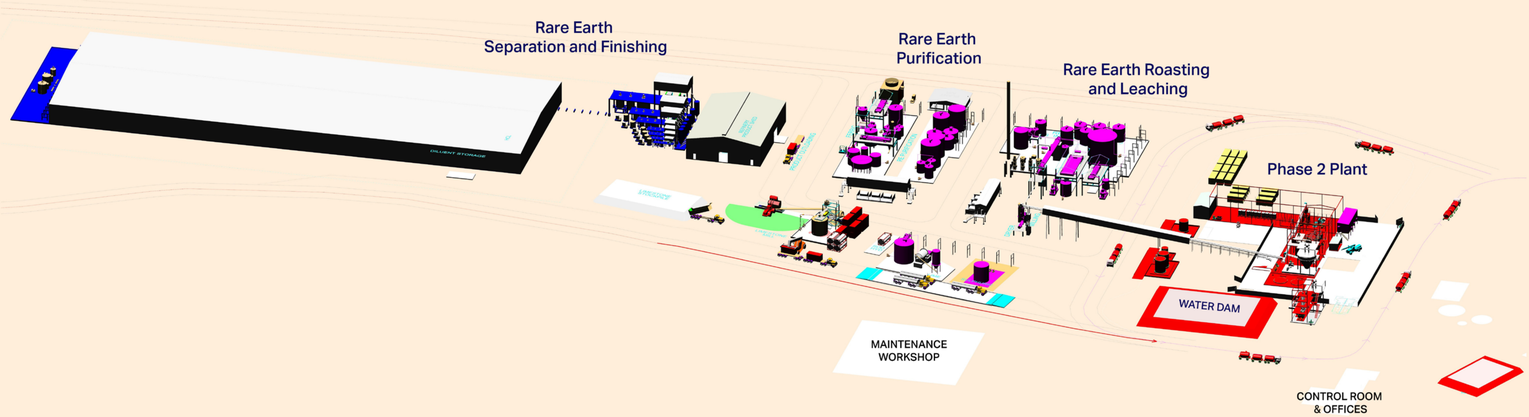
- Impurities are precipitated and removed from the solution by neutralisation. The precipitate is the main waste stream, consisting of sulfates (mainly calcium) and phosphates (mainly iron). The majority of the radioactive components are captured in this stream.

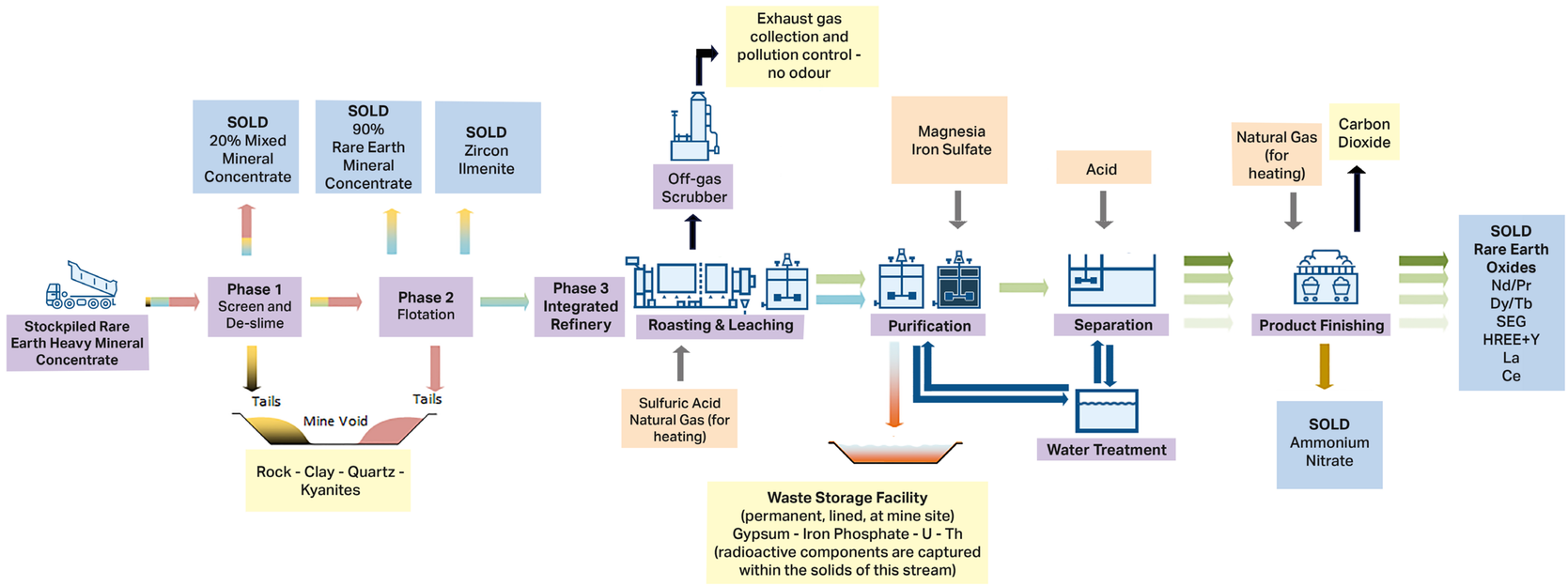
### Separation

- Rare earth elements are separated using solvent extraction technology.

### Product Finishing

- Separated rare earth products are precipitated from each stream. High value products are heated and converted into oxides.



# RADIATION CONTROLS IN WASTE MANAGEMENT

## Disposal on site

- Iluka will dispose of solid waste material produced by the refinery to engineered waste disposal facilities. These facilities will utilise existing or previous mine voids within the Mining Lease to avoid land disturbance.

## Very Low Level Waste

- The radiation content of the waste products is expected to be Very Low Level Waste (VLLW) as classified by authorities*, and suitable for disposal in near surface, industrial or commercial landfills.
- ARPANSA requires a moderate level of containment and isolation for VLLW. Once a waste facility is full, it will be capped and closed and prepared for its final land use.

## IAEA & ARPANSA waste classification scheme and disposal controls

| WASTE CLASSIFICATION | VSLW<br>Very Short Lived Waste<br><100 Days Half Life | EW<br>Exempt Waste<br><1 Bq/g | VLLW<br>Very Low Level Waste<br>1 to 100 Bq/g | LLW<br>Low Level Waste<br>100 to 400 Bq/g | ILW<br>Intermediate Level Waste<br>400 to $10^8$ Bq/g | HLW<br>High Level Waste<br>$10^8$ - $10^9$ Bq/g |
|---|---|---|---|---|---|---|
| EXAMPLES | • Nuclear Medicine | • Petrolium Sludge<br>• Petrolium Hard Scale | ENEABBA RARE EARTHS REFINERY - SOLID WASTE DISPOSAL<br>Solid wastes from Iluka's proposed Eneabba Rare Earths Refinery would meet this classification.<br>• Industry Rare Earth Waste<br>• Petrolium Sludge<br>• Petrolium Hard Scale<br>• Uranium Mine Tails | • Commonwealth LLW Waste Facility (SA)<br>• Mount Walton LLW Waste Facility (WA)<br>• Tellus LLW Waste Facility (WA)<br>• Petrolium Sludge<br>• Petrolium Hard Scale<br>• Uranium Mine Tails | • Nuclear Fuel (Uranium Rods)<br>• Petrolium Sludge<br>• Petrolium Hard Scale<br>• Uranium Spent Nuclear Fuel<br>• Uranium Mine Tails | • Nuclear Fuel (Uranium Rods)<br>• Uranium Spent Nuclear Fuel<br>• ANSTO Opal Reactor Spent Fuel HLW treated off-shore to reduce waste to ILW, therefore no HLW in Australia |
| WASTE DISPOSAL CONTROLS | Decay storage until levels are Exempt Waste. | Disposed of in conventional landfill facilites or discharged as liquid or gaseous waste, in some cases after decay (e.g. VSLW). Exempt from regulatory control. | Disposal in near surface, industrial or commercial, landfill type facilities. Needs a moderate level of containment and isolation. | Disposal in engineered near surface facilities. Limited amounts of long-lived radionuclides but requiring robust isolation and containment for up to a few hundred years.<br>Iluka proposes to engineer the waste disposal facility for the Eneabba Rare Earths Refinery at this level - above the prescribed regulatory standard. | Disposal at depths of tens to a few hundred metres. Contains long-lived radionuclides and requires a greater degree of containment and isolation than that offered by near surface disposal but no or little provision for heat dissipation. | Disposal in stable geological formations at depths of several hundred metres. Waste with large amounts of long-lived radionuclides and an activity concentration high enough to generate significant quantities of heat by radioactive decay process. |

EXEMPTION LEVEL FROM REGULATORY CONTROL

Increased activity content and half-life/increased requirements for containment and isolation

** IAEA - International Atomic Energy Agency*

*ARPANSA - Australian Radiation Protection and Nucelar Safety Authority*

*ANSTO - The Australian Nuclear Science and Technology Organisation*

# REGULATORY FRAMEWORK

## ENVIRONMENTAL APPROVALS

- Eneabba is an existing mine site, with ongoing environmental monitoring and management plans in place to support operating licences.
- The rare earths refinery has been designed within the existing Eneabba mining footprint, to avoid clearing of any remnant native vegetation.
- Q3 2021 – the project will be referred to the WA Environmental Protection Authority (EPA) and Commonwealth Department of Agricultural, Water and Environmental (DAWE)

Iluka is conducting a range of studies to address potential impacts including:

- flora and vegetation assessment;
- fauna and habitat assessment;
- targeted threatened species assessment;
- groundwater and surface water modelling;
- noise assessment;
- air and dust assessment; and
- soil and landform assessment.


## REGULATORY FRAMEWORK

The rare earths refinery will require several approvals and ongoing regulation under a number of different laws. These include:

- Mineral Sands (Eneabba) Agreement Act 1975 (DJTSI);
- Environmental Protection Act 1986 (DWER);
- Environmental Protection and Biodiversity Conservation Act 1999 (DAWE, Cth);
- The Aboriginal Heritage Act 1972;
- Radiation Safety Act 1975 (RCWA);
- Mines Safety and Inspection Act 1994 (DMIRS).

# ENEABBA'S REHABILITATION PROGRAM

Rehabilitation of previously mined areas is another big part of Iluka's activities around Eneabba, and an example of innovation driving outcomes.

For the third year running, in 2021 Iluka's rehabilitation team had a successful season rehabilitating 53 hectares of native vegetation using their ground-breaking invention, the Flora Restorer.

Also completed was 136 hectares of agricultural pasture establishment at Eneabba.

The machine designed by the Eneabba rehabilitation team, combines several land management techniques into a single piece of equipment to address wind erosion, water run-off, evaporation and other barriers to revegetation in the Mid-West region. More recently there were upgrades to complete the design and function of Flora Restorer, improving on last year's performance.

More than 46,000 thousand native seedlings were sowed during the 2021 planting season, alongside the seed distributed by the Flora Restorer. This equates to a revegetated area of approximately 53 hectares.

Native seeds and cuttings were collected locally from 140 species and processed on site at Eneabba, so that the biodiversity of the region is reflected in the revegetation. Advanced techniques were used such as tissue culture to grow species that are very difficult to cultivate using conventional methods.

In 2021, the team at Eneabba will move 300,000 thousand tonnes of top soil and 1.6 million tonnes of overburden. This is in preparation for a total of 56 hectares being returned to native vegetation in 2022.

*Completed native vegetation seeding of an old mining area and haul road*

*Preparing for tubestock planting*

*Flora Restorer at work*