The Mandena sands contain multiple minerals: quartz, ilmenite, zircon, sillimanite (the zirsill is a mix of zircon and sillimanite), monazite, hercynite, spinel. For separating ilmenite and zirsill (minerals of interest) from the other, the different extraction steps will use their physical properties.

**Mandena Site Infrastructures**

1. Dredge
2. Floating concentrator
3. Heavy Mineral Concentrate (HMC) deposit
4. Wet Concentrator
5. Processed HMC drainage bay
6. Ilmenite drier
7. Dry Concentrator
8. Ilmenite Storage Shed
9. Zirsill Drainage Bay
10. Zirsill Drier
11. Bagging of Zirsill
12. Tailing Sands Deposit
13. Laboratory
14. Warehouse
15. Administrative Offices
16. Cafeteria
17. Change Room
18. Gate house - Medical Clinics
19. Mechanic Workshop
The dredger constitutes the first step in the production. It is connected to the wet plant. The wet plant moves together on the deposit according to a specified mining plan.

During this first phase, the dredge pumps sand using a rotating cutter head. The sand is conveyed towards the wet plant to the rear of the dredge.

Dry extraction process comes in addition to the dredge to feed the wet plant continuously and so allow us to reach our production objectives.

In the wet plant, the sand is mixed with water. It then goes through the 2160 spirals which will use the difference of minerals density to separate them.

Heavy minerals (such as ilmenite, sillimanite and zircon) are concentrated near the central column while lighter minerals (such as quartz and silica) are pushed near the outer edge of the spirals. At the exit of this first circuit we get a concentrate at 90% of heavy minerals. This concentrate is pumped to the preparation circuit.

The mineral concentrate is dried in fluidized bed dryers at a temperature of 130 °C. They are now ready for the final circuit which is the dry circuit.

The Preparation Circuit
This concentrate then passes through the preparation circuit (3-4). Attritioners will clean and remove particles stuck to their surface and that may affect the separation process.

Then the minerals will pass through floatex and spirals which will separate quartz from heavy minerals. The minerals remain then for 36 to 48 hours in the Drainage bay (5) to let flow a maximum of water.

If the concentrate was at 90% on leaving the wet plant, it is at 95% on leaving the preparation circuit.

The Dry Circuit: extraction of ilmenite
The heavy mineral concentrate is routed to the dry concentrator (7) where the minerals undergo electrostatic separation. 4 HTR (High tension rollers) separate conductive minerals from non-conductive minerals. Ilmenite which is the only conductive mineral, is separated from the heavy minerals. The ilmenite is stored on site in two tanks (8) before being hauled out to the port for export.

The Dry Circuit: extraction of zirsill
The non-conductive minerals pass again through a series of spirals to remove magnetic minerals such as monazite and spirel.

They pass again through series of spirals in the Wet Concentrator (4) to remove quartz.

They are then stored in the Zirsill Drainage bay (9), and then dried in the Zirsill Drier (10).

They pass through HTR separators and magnetic separators to remove the residual conductive and magnetic minerals. Zirsill is obtained, that is non-conductive and non-magnetic and consists of zircon and sillimanite.

The quality of our products is checked at every stage of the process in our laboratories in order to satisfy our customers.

Ilmenite is shipped to the Rio Tinto Iron and Titanium plant in Canada to be transformed into slags containing more than 90% TiO2. Zirsill is for its part directly shipped to customers.