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Detailed Engineering Assessments Confirm Integrity of Main Hoisting Shaft at Prieska Zinc-Copper Project, Northern Cape, South Africa

- **Detailed visual and mechanical inspection of the top 380m of Hutchings Shaft completed.**
- **Condition of shaft concrete lining and steelwork exceeds expectation.**
- **Shaft steelwork mechanical integrity unaffected by having been submerged.**
- **Shaft amenable to refurbishment and re-use.**
- **Further inspections planned to obtain video footage to 200m below shaft water level.**

Orion Minerals NL (**ASX/JSE: ORN**) (**Orion** or the **Company**) is pleased to share the latest results on detailed inspections completed on the main hoisting shaft (**Hutchings Shaft**) at the Prieska Zinc-Copper Project (**Prieska Project**). The Prieska Project is in the Northern Cape province of South Africa approximately 290km south-west of the city of Kimberley (Figure 1). Prieska Copper Mine operated as an underground zinc and copper mine, exploiting the Copperton deposit, between 1971 and 1991. Orion intends to establish new mining operations to continue the extraction of the remaining Copperton deposit, a volcanogenic massive sulphide – style (**VMS**) deposit, with significant residual potential.

Figure 1: Location of Prieska Zinc-Copper Project.

Detailed visual and mechanical inspections of the Hutchings Shaft barrel and steelwork, from the surface down to a depth of 380m, have confirmed that the shaft steelwork and wall integrity have been well preserved. This makes the option of refurbishing the existing shaft for future use a realistic and viable option to be considered in ongoing bankable feasibility studies.

A large volume of engineering data has now been collected for assessment and is being used to formulate and cost the detailed shaft refurbishment plan. This is a significant step towards de-risking the mine re-establishment project.

The shaft inspections are being conducted as part of the ongoing mine feasibility and environmental studies at the Prieska Project. Mine feasibility and environmental studies were commenced in July 2017, with the appointment of lead consultants, DRA Projects SA Pty Ltd for mining studies and ABS Africa Pty Ltd for environmental studies.

The commercial viability of mining operations, planned to be established within the footprint of the historic Prieska Copper Mine, is substantially enhanced by being able to leverage off the substantial suite of pre-existing infrastructure which includes, amongst others:

- an operational water treatment plant and associated 60km long water pipeline, supplying water from the Orange River to the project site;
- the Cuprum Electrical Substation, situated on the project site, already connected to the national grid and owned by the national power utility company, ESKOM;
- a 60km tarred road, which forms part of the regional R357 highway, linking the project site to the nearby town of Prieska;
- the Copperton village, located 4km away from the main hoisting shaft;
- a 1.7km airstrip near the project site;
- the Upington to De Aar railway line that runs past the Groveput siding, 45km away from the project site;
- over 37km of underground excavations including roadways, pump stations, workshops and a crusher chamber;
- a decline roadway and three vertical vent shafts; and
- a concrete-lined, 1km deep, vertical hoisting shaft (Hutchings Shaft).

As such, a detailed assessment of the mechanical and structural condition of the existing Hutchings Shaft has been commissioned to assist with planning and costing of the shaft refurbishment strategy. The Hutchings Shaft is intended to be recommissioned as the main means of rock hoisting, people and materials transportation and as the primary means of ventilation intake.

The Hutchings Shaft serviced historical mining operations until the mine closed in 1991. During that time, the mine produced 430,000 tonnes of copper and 1.01 million tonnes of zinc from 45.6 million tonnes of ore processed, at annual production rates that peaked at 3.0 million tonnes per annum. Almost all production was hoisted through the Hutchings Shaft.[1]

Shaft Configuration
The Hutchings Shaft was established approximately 350m away from the upper part of the orebody. It was originally sunk to a depth of 841m and later deepened to the present 1,024m (Figure 2).

[1] Obtained from mine production records.

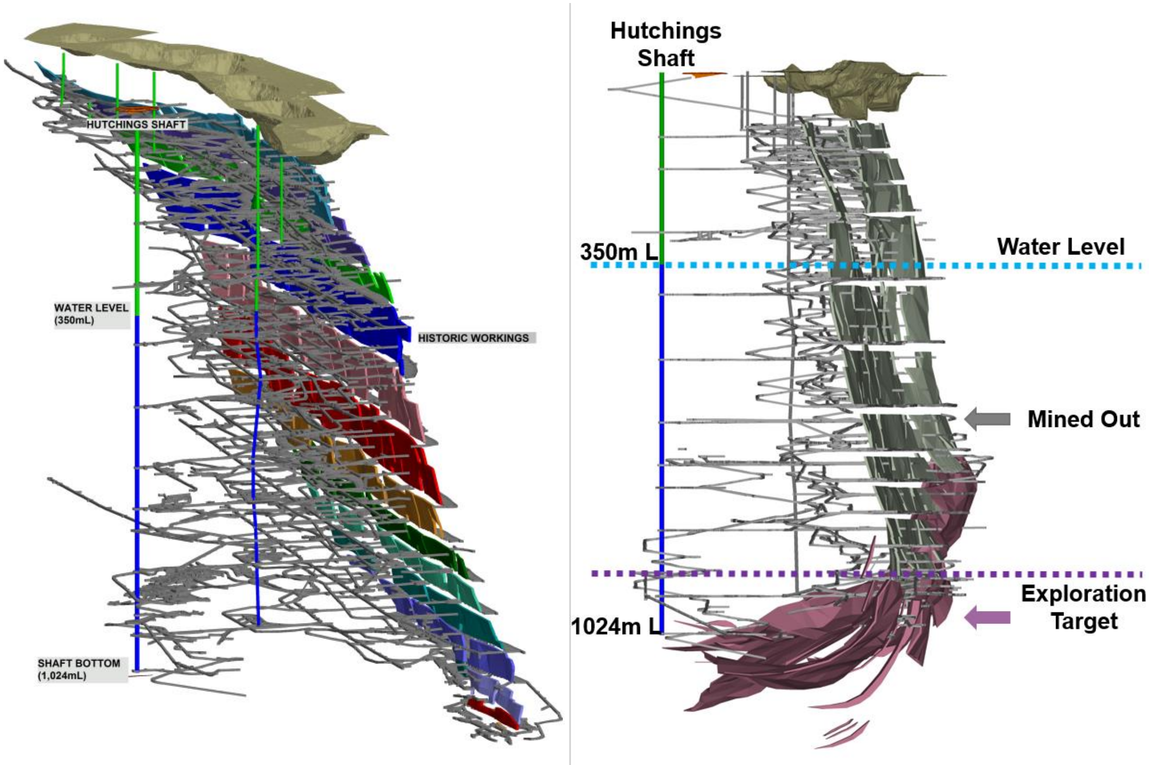


Figure 2: Isometric views of Hutchings Shaft and existing excavations.

The shaft is concrete-lined with an inside diameter of 8.84m. The shaft steelwork consists of a lattice of buntons and dividers that are configured to provide two compartments to house rock hoisting skips and a central compartment to house a square cage to transport men and materials (Figure 3).

The shaft barrel is topped by a rectangular concrete headframe which is 68.6m high (Figures 4 and 5). The shaft operated with a Koepe-type winder mounted on top of the headframe to hoist the rock skips and a separate, ground-based, double-winder to lift the people and materials cage.

The shaft was designed with the capacity to hoist 330,000 tonnes of rock per month.

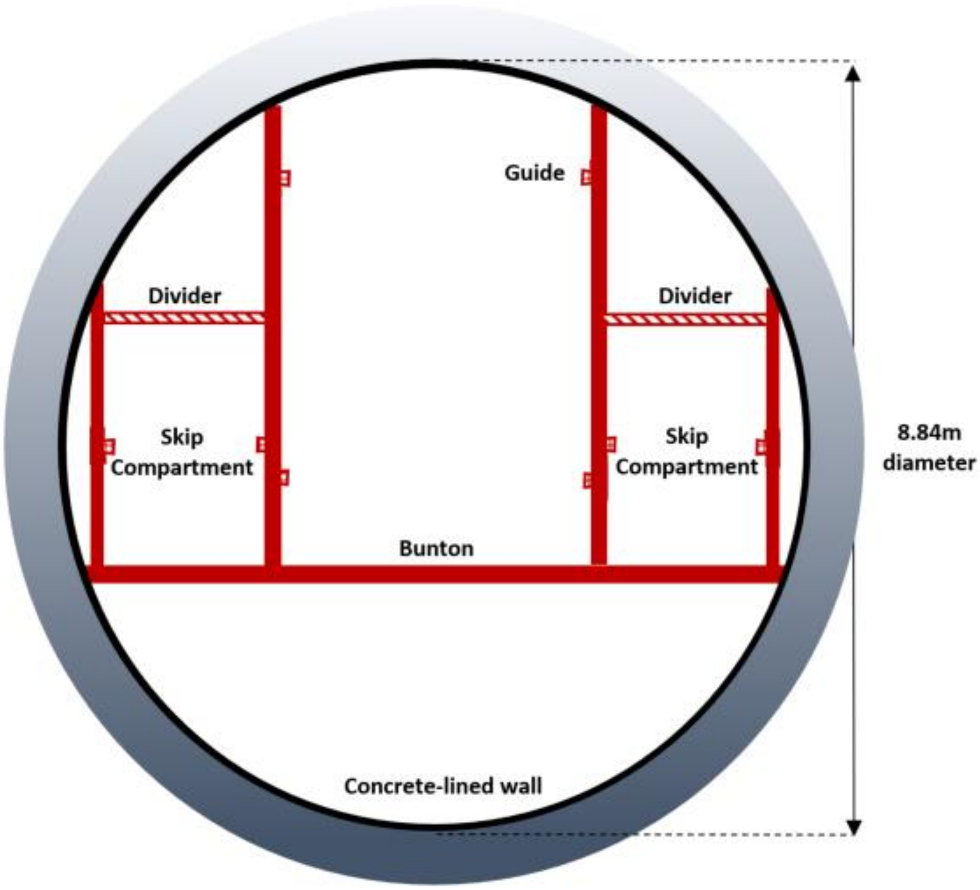


Figure 3: (Top) Plan-view schematic showing the configuration of the Hutchings Shaft and (Bottom) photograph of the Hutchings Shaft taken in January 2018 showing a similar plan-view perspective, with the accumulated water at the 350m Level.

Shaft Decommissioning and Closure

The Hutchings Shaft was decommissioned when mining operations ceased in 1991 and has not been in use since then. The shaft barrel was sealed by a concrete plug and the headframe bricked-in to prevent inadvertent and unauthorised access and use of the facilities. It is suspected that a corrosion inhibitor may also have been applied to the shaft steelwork prior to decommissioning.

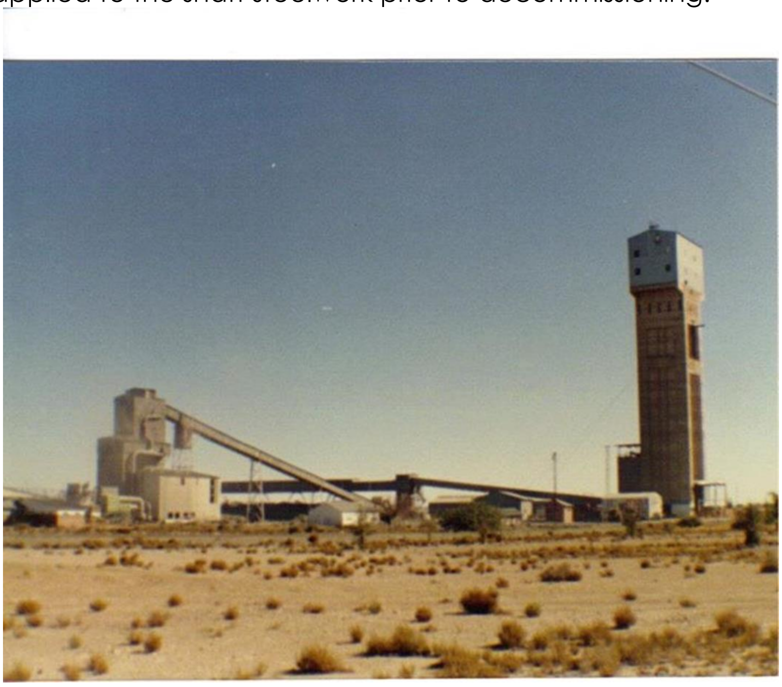


Figure 4: Hutchings Shaft and winder room during historic mining operations (1971 to 1991).

Figure 5: The Hutchings Shaft headframe, standing 68.6m high (2017).

The winder room on top of the concrete tower was removed and most of the shaft equipment dismantled and sold. The original winder is still in use at a mining operation in South Africa (Figure 6)

Figure 6: The original Hutchings Shaft rock winder in use currently at a South African mining operation.

Since mine closure, groundwater has slowly accumulated in the mine workings, submerging a portion of the shaft. The water level has risen to within 350m of the surface, thus submerging 670m of the lower portion of the shaft.

Preliminary Shaft Condition Inspection

Determining the condition of the shaft for costing and planning purposes has required formulating inspection programs that account for a large part of the shaft barrel being under water.

Orion obtained permission and re-established access into the underground mine and the shaft barrel from March 2017. During that time, Orion completed a preliminary assessment of the shaft integrity by commissioning an expert team to undertake:

- visual inspections of the shaft barrel down to the water level;
- an engineering assessment of select steelwork in the headframe and shaft barrel;
- water quality testing at various depths down to 900m below surface; and
- probing of the shaft barrel to confirm the shaft is clear of large obstructions and excessive debris.

These preliminary inspections concluded that:

- no substantial obstructions were in the shaft barrel;
- the water quality was unlikely to accelerate corrosion;
- the main steel members, bolts and welding in the headframe and shaft barrel had been preserved; and that
- shaft refurbishment and re-use was a realistic option to be considered for further assessment.

Detailed Shaft Inspection Method Statement

As a follow-on from the preliminary shaft inspections conducted in 2017, a detailed inspection program has been under way since the start of 2018. The initial stage of this inspection program aimed to accurately determine the mechanical and structural integrity of the shaft steel work down to a depth of 380m.

The second stage of inspection will involve obtaining video footage of the shaft steelwork and walls to a depth of at least 200m below the accumulated water level.

Various characteristics of the shaft steelwork and infrastructure were assessed as part of the first stage. Table 1 summarises characteristics assessed, and methodologies employed.

Characteristic	Assessment Methodology
Buntons, dividers and guides identification	Aerosol paint markers
Buntons, dividers and guides condition	Visual assessment / detailed photography
Buntons, dividers and guides connections condition	Visual assessment / detailed photography
Shaft barrel connection condition	Visual assessment / detailed photography
Shaft services and piping condition	Thickness testing instrument
Bunton, divider and guide thickness testing	Thickness testing instrument
Piping thickness testing	Thickness testing instrument
Shaft wall / concrete lining condition	Visual / mechanical assessment / detailed photography
Shaft dimensions assessment	Laser distance measuring instrument
Bunton, dividers and guide positioning	Laser distance measuring instrument
Steelwork weld integrity	Magnetic particle inspection instrument (NDT)

Table 1: Shaft steelwork and infrastructure characteristics inspected during campaign.

The first stage of inspections has been undertaken in three phases: *Phase one* involved labelling steel members, visual inspections and photography.

Phase two of inspections involved thickness testing of steelwork, followed by non-destructive testing of connections and welds using magnetic particle inspection (MPI).

The *final phase* of inspection involved a diving expedition to obtain a sample of steelwork from 30m below the water level, as well as retrieving comparison samples from above the waterline. These samples will assist with determining the comparative condition of submerged shaft steel work.

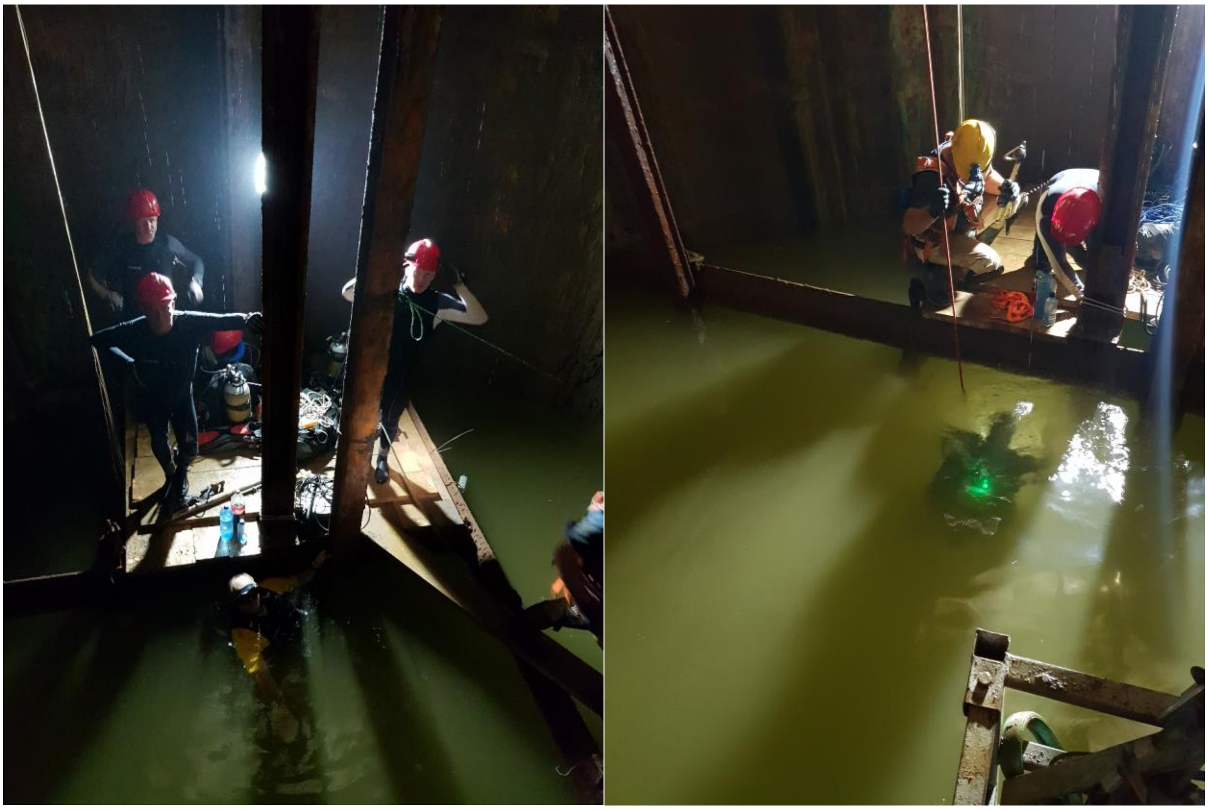


Figure 7: (LHS) Diving platform at the 350m Level below surface. (RHS) The divers retrieved a section of steelwork from 30m below the water surface to allow assessment of corrosion/preservation of submerged shaft steelwork.

Figure 8: (LHS) Divider from submerged Bunton Set number 81 tested steel thickness to 5.0mm; (Middle) section through retrieved Bunton (RHS) location where bunton section was removed.

Assessment of Inspection data

Based on collected information the following preliminary conclusions have been made:

- The primary steelwork, connections and shaft walls presents well and better than was expected by the shaft inspection team.
- Significant corrosion is limited to the top 45m of primary steelwork in the shaft. Structural integrity of the steelwork below this level is amenable to re-use following selective replacement and repairs.

- Shaft steelwork recovered from underwater has been unaffected by being submerged and shows no signs of added deterioration compared to similar steelwork from above the waterline.

- As expected, secondary light steelwork and pipework is compromised by corrosion and will be replaced.

Preliminary indications are that shaft refurbishment is the optimal route of re-establishing hoisting capabilities of the Hutchings Shaft. The steelwork is repairable, though a portion of the steelwork will require replacement, generally in line with assumptions that were made as part of formulating conceptual planning.

Dewatering Assessment
Investigations into the most practical manner to dewater the mine are well advanced. The favoured dewatering approach is the use of a large submersible pump, lowered to the bottom of the shaft on its pipe column and capable of pumping the water from the bottom of the shaft in a single lift. Available models of such pumps can operate at pumping rates of up to 1,300 m^3/hour, which could completely dewater the mine within nine months, (see Figure 9 for example). The pump and rising main could be placed in the shaft such that the assembly does not interfere with concurrent shaft refurbishment works.

Figure 9: A Ritz pump recently used for mine dewatering at an operation in the Democratic Republic of Congo.

Further Work

A large volume of useful data has been collected on the condition of the shaft and headframe above the water level and 30m below the water level.

This information will be used to formulate and cost a shaft refurbishment plan for the mine feasibility study.

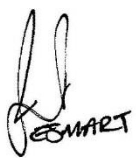
A remote-operated vehicle will be used to obtain additional video footage of the shaft steelwork and walls to a depth of at least 200m below the water level.

Detailed civil and structural assessment of the concrete headframe will be conducted once winder selection and proposed placement is completed.

Work on optimising the management of the water pumped from the mine during dewatering is in progress.

Orion's Managing Director and CEO, Errol Smart, commented:

"it is encouraging that the Hutchings Shaft steel work is in such good condition after 26 years of being inoperable and submerged. The shaft refurbishment plan forms a significant part of our strategy to take advantage of existing infrastructure which will reduce the Capex burden on the Prieska Project build. The existing shaft infrastructure is sufficiently-sized so that we are free to optimise mine production rates to the JORC compliant Mineral Resource estimates we end up delineating. This gives us great design latitude to make the most of what remains at Prieska".



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