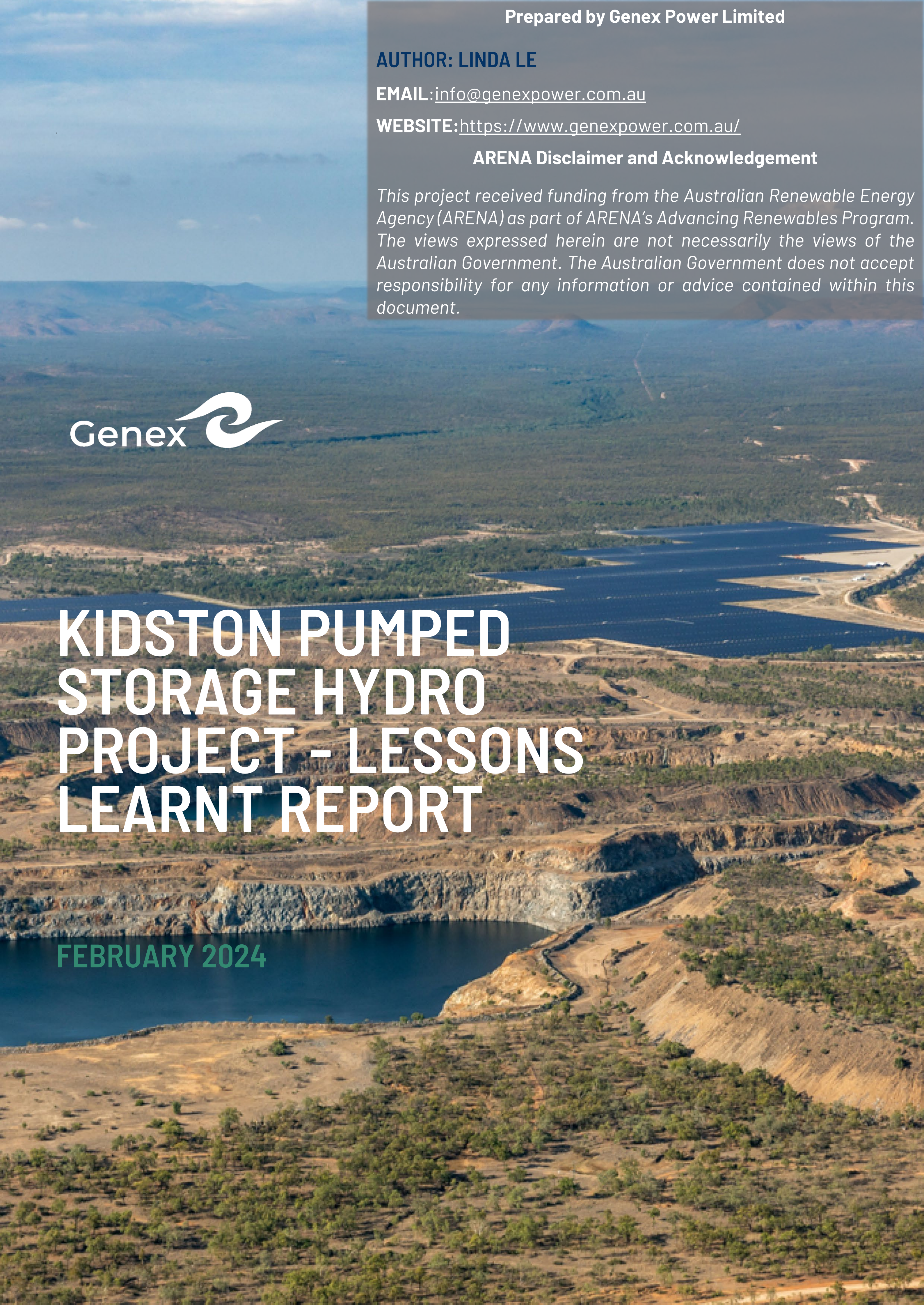

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ARENA Disclaimer and Acknowledgement

This project received funding from the Australian Renewable Energy Agency (ARENA) as part of ARENA's Advancing Renewables Program. The views expressed herein are not necessarily the views of the Australian Government. The Australian Government does not accept responsibility for any information or advice contained within this document.

Genex

KIDSTON PUMPED STORAGE HYDRO PROJECT - LESSONS LEARNT REPORT

FEBRUARY 2024

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1. EXECUTIVE SUMMARY

Genex Power Limited (**Genex**, **Company** or **Owner**) is the 100% owner of the Kidston Clean Energy Hub, located in North Queensland (the **Kidston Hub**). Stage 1 of the Kidston Hub was completed in the form of the 50MW Stage 1 Kidston Solar Project, which was energised in November 2017. Stage 2 of the Kidston Hub is the 250MW Pumped Storage Hydro Project (**K2-Hydro** or **Project**) which is currently under construction, having reached financial close in May 2021. A further Stage 3 of the Kidston Hub, being a wind project of approximately 258MW which Genex is developing in a 50:50 partnership with Electric Power Development Co. Ltd (trading as **J-POWER**), is currently in the development stage.

This report will serve as a Lessons Learnt Report, discussing issues and learning with respect to the excavation of the shafts at the project.

2. DESCRIPTION OF SHAFTS

The project requires the following four shafts to be excavated:

- Ventilation Shaft – 4.1m diameter (excavated), 243m deep
- Cable Shaft – 4.1m diameter (excavated); 252m deep
- Intake Shafts x 2 – 5m diameter (excavated); 244m deep

The location of the shafts is illustrated in Figure 1 below

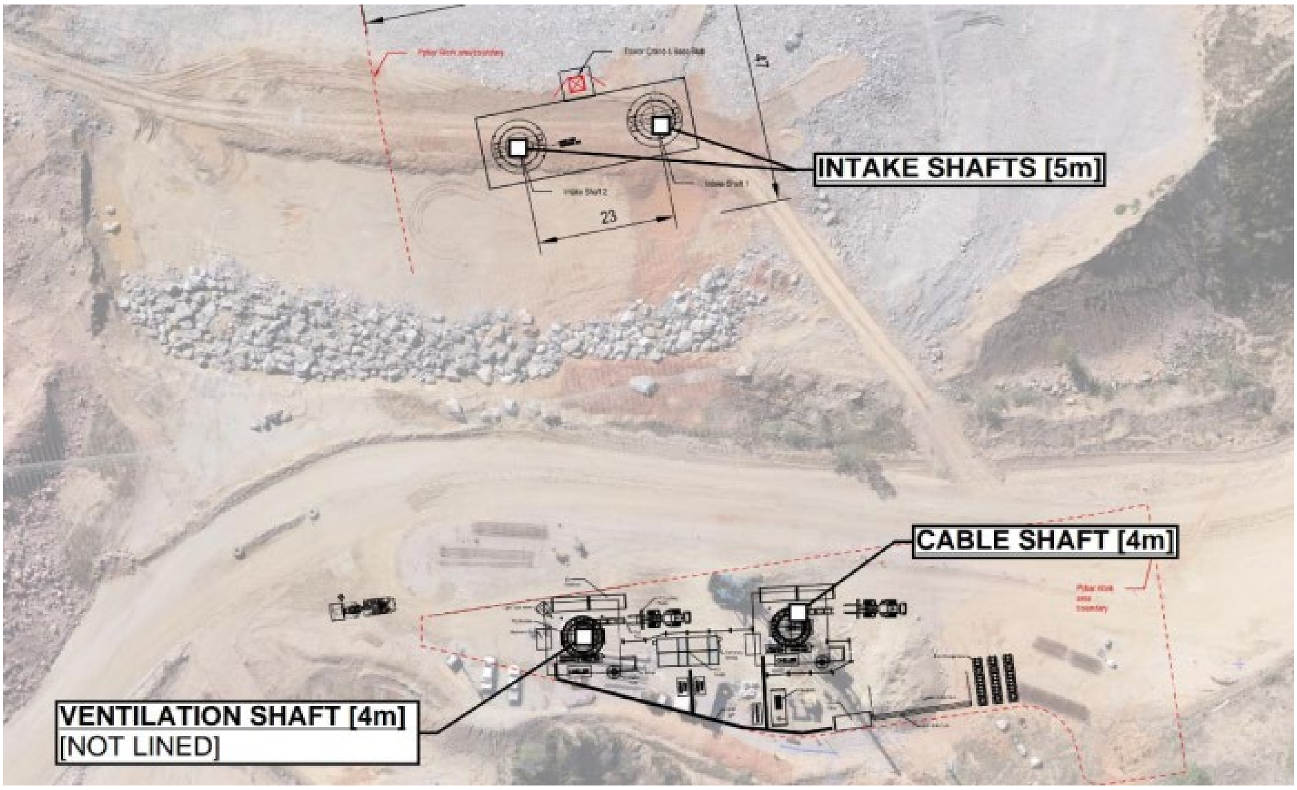

Figure 1: Shaft Locations

The sinking of the shafts was undertaken using raisebore techniques where the shaft is excavated from the bottom up. This was made possible due to the availability of underground caverns prior to the shaft excavation commencing. The general methodology is as follows (and illustrated in Figure 2):

1. Establishment and survey
2. Installation of pilot hole
3. Attachment of cutterhead and ream the shaft towards the surface
4. Removal of cutterhead and dis-establishment.

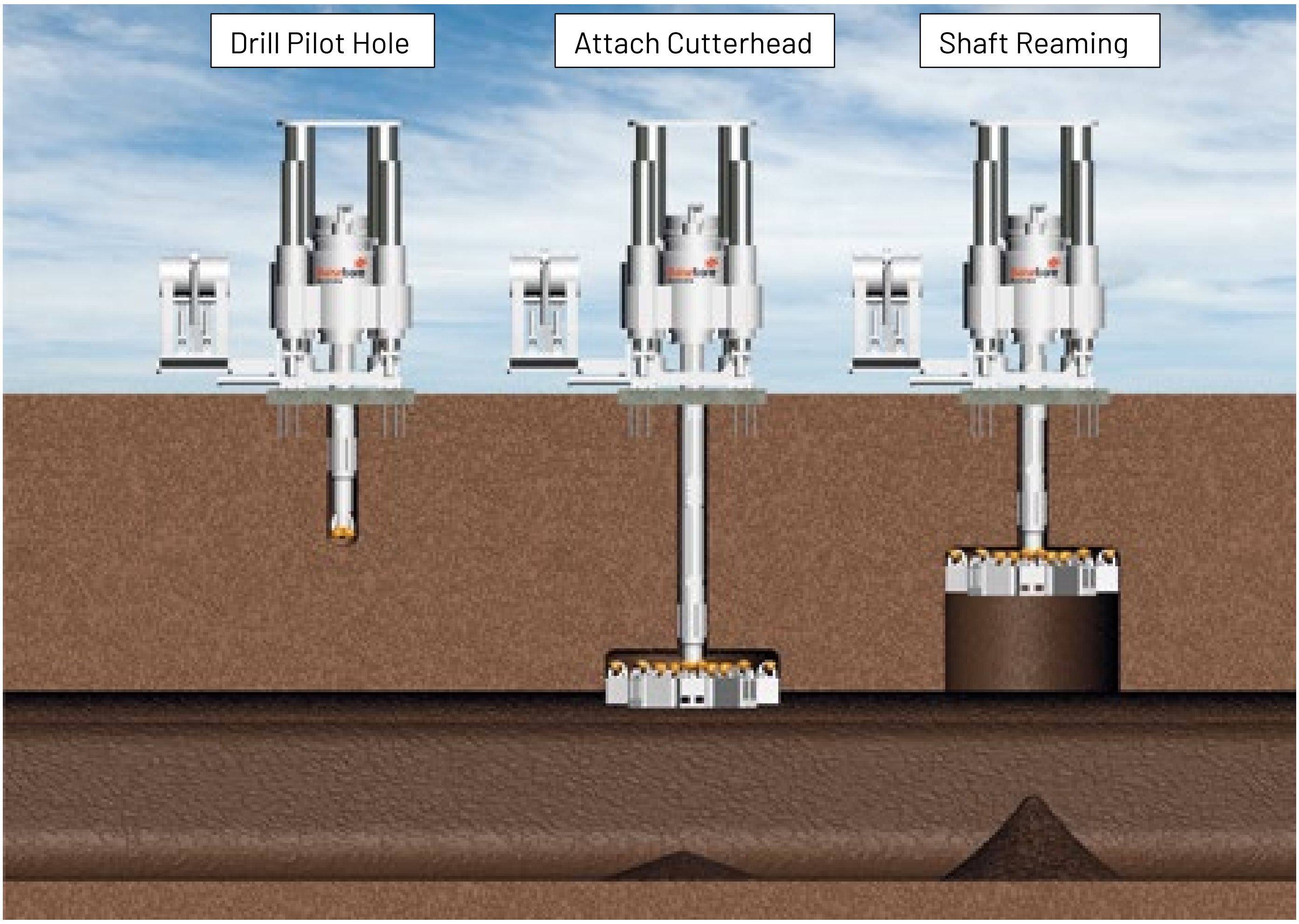

Figure 2: Raisebore Methodology

Each stage is critical to the success of the overall operation.

3. KEY CHALLENGES AND LESSONS LEARNED

The following key challenges and lessons learned relating to the raisebore operations are as follows.

3.1 Ground Conditions

During raisebore operations, the excavated shaft is an unsupported circular profile. Support to the shaft surface can only occur once the reaming operations are complete. Raisebore shaft construction techniques are normally adopted where ground conditions are favourable, access is provided to the shaft bottom, and the project shaft diameter and length are assessed as suitable for the equipment available. Where the ground conditions are less stable and at risk of collapse/ravelling, then structural ground support treatment is required.

Following a comprehensive geotechnical investigation, it was identified that all four shafts were to encounter competent rock with the exception of the top 20m of ground for the ventilation and cable shaft locations where extremely weathered rock was found to exist, resulting in potential ground squeeze, ravelling and stability issues if left unsupported.

As such, the project commenced the installation of a secant piled ring in the upper zone of both the ventilation and cable shafts as an advanced presink activity to the raisebore operations. Secant piling comprises overlapping piles to ensure a continuous ring is formed and allowed the raisebore machine to be supported on the piled ring ensuring negligible differential movement during reaming operations, allowing the reamer head to be pulled up through the zone created by the presink piles without risk of upper shaft instability. This activity was not allowed for as part of the original scope of works, as the geotechnical information needed to be confirmed before committing to the need of a presink. Further geotechnical information obtained during detailed design confirmed the need for presink piles.

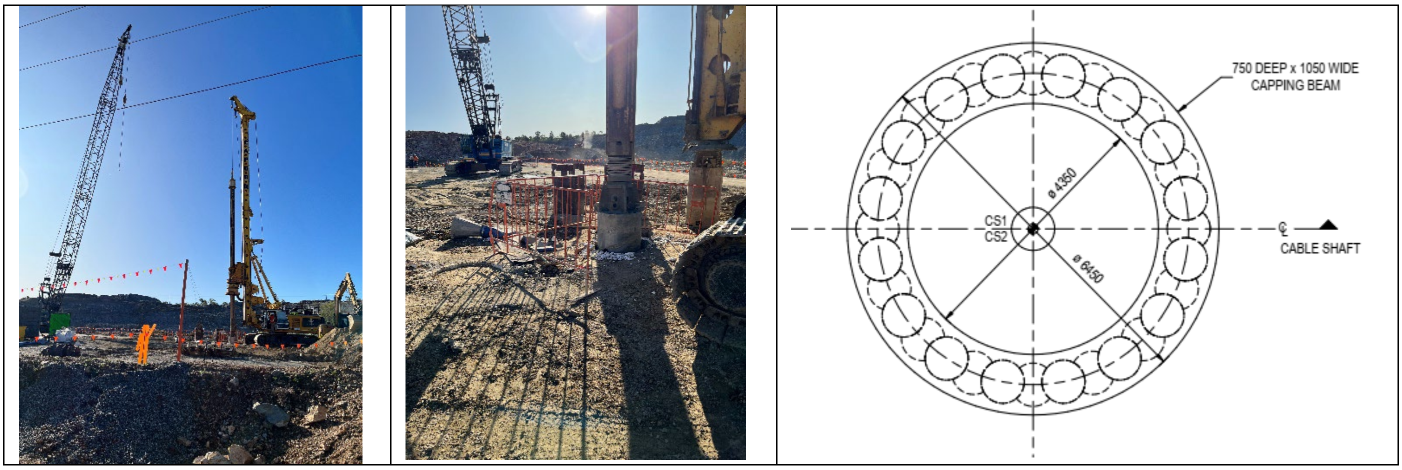

Figure 3: Typical Presink Operations (Photos left to right: Drilling Rig with service crane; drill cutter head for the piling; design arrangement of the secant piles)

The lesson learned relates to the need for good geotechnical investigation and analysis to make informed decisions on ground treatments and supports. For the Kidston Project, this was a known risk which was confirmed and addressed prior to raisebore operations commencing.

3.2 Pilot Hole

The pilot hole links the top and bottom of the shaft and ultimately sets the shaft alignment. Ensuring verticality when drilling the pilot hole is of utmost importance. At Kidston, the pilot hole for each shaft was drilled using the rotary vertical drilling system (RVDS) which is located on the drill rods that self-corrects in real time providing a hole positional accuracy of up to 0.1% (ie 250mm over 250m). At Kidston, the pilot hole within the cable shaft encountered a rogue geotechnical monitoring instrument at depth which twisted around the drill head and affected the verticality of the hole and in turn the shaft. this was remedied by removing the Pilot hole drill rods clearing the Drill bit and recommencing pilot hole drilling.

> The lesson learned relates to ensuring that the utilisation of state-of-the-art positioning and drilling equipment will provide the greatest chance of shaft verticality. Other methods are available, though, for the Kidston Project, verticality was paramount and would not have been achieved without the use of RVDS.

3.3 Reaming Operations

Once the pilot hole has broken through into the underground receival chamber, the cutter head can be attached to the drill string by mechanical connection between the centre of the cutter head and the lowest drill rod. The cutter head is then carefully rotated to engage with the underground chamber roof to provide a collar and flat surface between the cutter head and ground, in a process known is "spudding" in. Once spudded in, greater pressure can be applied to the rotation of the cutter head to allow reaming operations to fully commence. As the rotating cutter head advances upwards towards the surface, the cuttings fall through the cutter head and deposit at the base of the shaft.

Critical to safety is to ensure that the cuttings fall to the base of the shaft and do not get hung up and choke (block the shaft opening) in the shaft itself, potentially resulting in an unsafe and uncontrollable release situation. Monitoring of the cuttings volume as a function of shaft drilled is of utmost importance. This simple check is undertaken frequently to ensure that once removal of the cuttings (mucking out) is scheduled (usually at the end of each shift), the number of buckets removed from the shaft base equates to the volume of ground removed from the shaft during that shift. Further safety measures include the use of exclusion zones, dust curtains and earthen bunds to ensure access to the shaft base is totally excluded until the shaft is mucked. During mucking operations, the cuttings spill out from the base of the shaft allowing the excavation equipment (known as a bogger) to safely remove the cuttings ensuring that the bogger cabin remains outside of the shaft profile itself, not passing a set barrier fixed in the roof of the tunnel. Ensuring the bogger does not enter the shaft area is important as whilst the raisebore operations are temporarily stopped during mucking operations, the cutterhead is still suspended overhead and there is always a risk of the cutter head falling and or rock material falling.

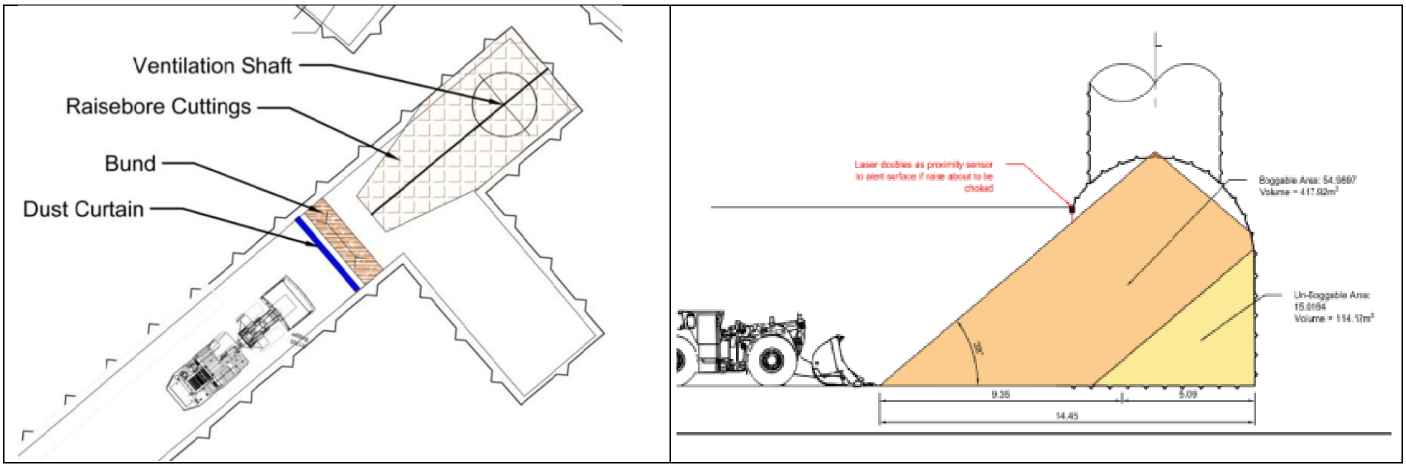

Figure 4: Mucking Operations (from left to right: Plan view of typical mucking operation at the base of the shaft; Section view of cuttings that have built up at the base of the shaft and spilling out to allow the bogger to remove the cuttings safely (orange zone) without passing beneath the shaft itself. As the cuttings are removed, they will ravel to their natural angle of repose and continue spilling forwards. The yellow section highlights the cuttings that cannot be removed whilst the cutterhead remains in the shaft itself)

The lesson learned relates to previous projects where shafts have choked and resulted in uncontrolled movement of cuttings into the bottom of the shaft and filling of the underground works with such force that equipment has been known to be transported up the tunnel drive. Ensuring good communication between underground and raise bore teams between shaft advanced, theoretical volume deposited and material removed from the shaft base is critical to managing this risk and investigating any instance where the theoretical volume does not align with the volume reamed. Allowing the cuttings to remain in the shaft without frequent removal is dangerous due to the almost certain potential of cuttings mobilising in an uncontrolled movement and entering the underground areas. That is why the shaft reaming operations need to stop frequently to allow cuttings to be removed and cannot continue reaming to the surface without cuttings being removed.

Assisting with the reduction in choking is ensuring the cutter head pattern and voids that allow the cuttings to fall through the reamer head is optimised to the ground being reamed to ensure cuttings are gravel sized particles that easily fall and do not bind up in the shaft.

3.4 Reamer Removal

Once the reamer has excavated the entire shaft and broken through, the reamer head is removed from the surface as opposed to lowering it back down the shaft to remove from underground. This avoids the time taken to reinstall the drill strings for the lowering and prevents the potential for the reamer head to catch on the shaft wall itself. Securing the reamer head at the surface is via chains into the foundation slab at four connection points. The raisebore rig is then removed leaving the exposed reamer head held by chains. A mobile crane is then used to remove the reamer. Bunding and guarding is installed to prevent access to the open hole and fall restraint equipment is required whenever the risk of a fall exists. Signage and restricted access / barriers are used to ensure controlled access. Ground quality is then assessed after reaming by means of a drone and colour LiDar scan. Geotechnical engineers then analyse these outputs to map the shaft and provide an assessment of the excavated ground to determine whether additional ground support is required for specific features.

Figure 5: Reamer Head Removal

The key lesson learned is the methodology and safety provisions required to allow the reamer head to be removed at the surface. This ensures time and cost are minimised as opposed to attempting to lower the reamer head to an underground chamber. At 250m depth, the reattachment of drilling strings to lower and then the subsequent removal of these, is time-consuming.