ABERGELDIE
COMPLEX INFRASTRUCTURE

THE LARGEST FULLY LINED BLIND BORED VENTILATION SHAFT CONSTRUCTED TO DATE IN AUSTRALIA

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November 20, 2019
Grand Ballroom

WATER BRIDGES TRANSPORT UNDERGROUND ENERGY REMEDIATION

AGENDA

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- Introduction
- Overview of Southern Coalfields Vent Shaft Project
- The Blind Boring Method with Video Presentation
- Project Methodology and Industry Best Practice
- Project Phases
- Innovation
- Challenges
- Questions and Discussions

INTRODUCTION

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- Abergeldie Complex Infrastructure was established in 1994
- Operating throughout Australian and New Zealand.
- Abergeldie group employs over 500 people across 4 countries
- Offices in Sydney, Brisbane, Canberra, Melbourne (Australia), Auckland, (New Zealand) with a small presence in Newry (Northern Ireland) and Regina (Canada)
- Expertise includes: rail and transport, energy, water, dams and marine, tunnelling, pipe jacking and mine shafts, trenchless technologies for pipe re-lining, structural remediation

OVERVIEW OF SOUTHERN COALFIELDS VENT SHAFT

SOUTHERN COALFIELDS VENTILATION SHAFT NSW

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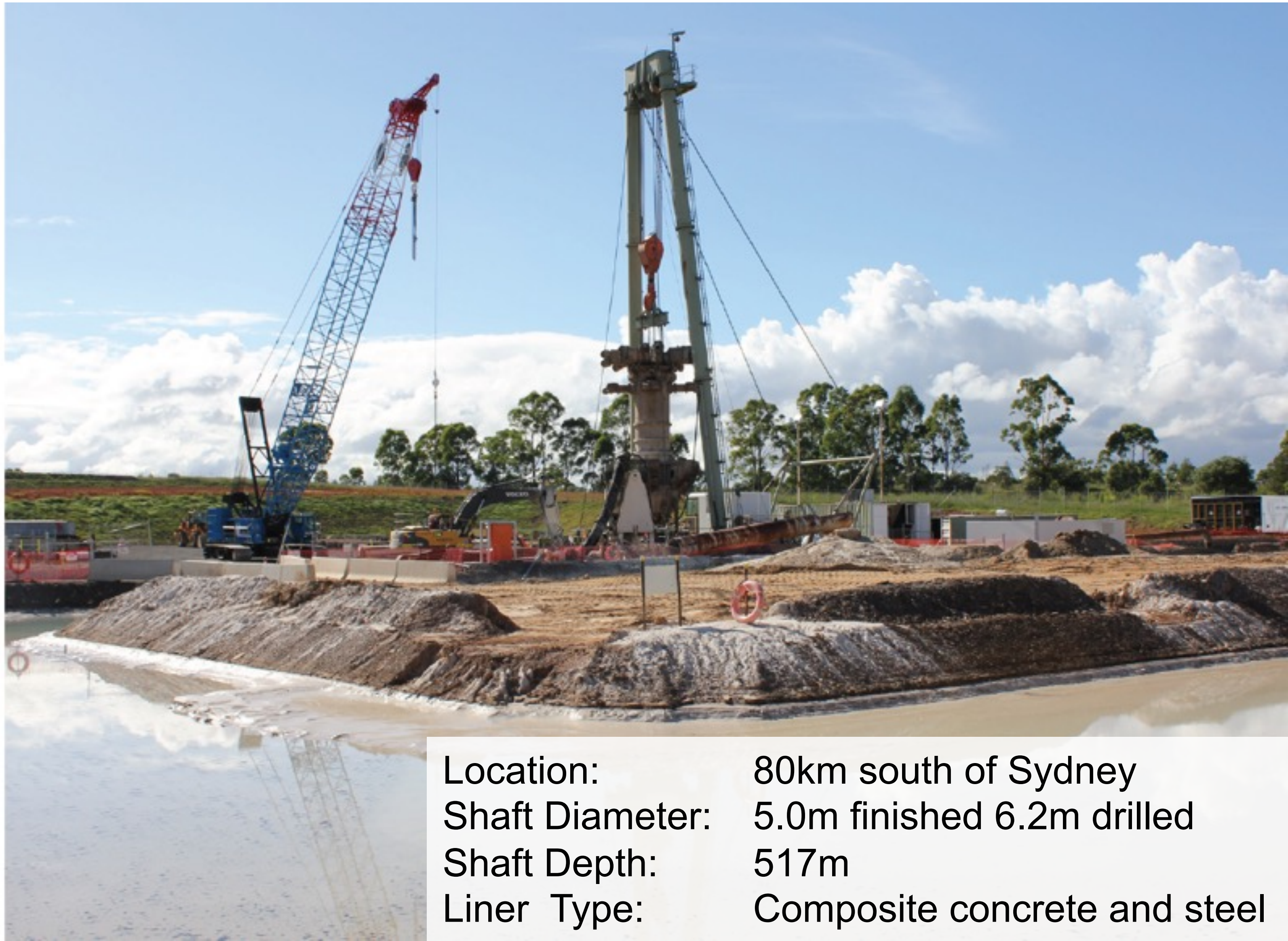

Location:	80km south of Sydney
Shaft Diameter:	5.0m finished 6.2m drilled
Shaft Depth:	517m
Liner Type:	Composite concrete and steel

SOUTHERN COALFIELDS VENTILATION SHAFT NSW

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- The shaft constructed for a mine extension, 80 km south of Sydney. The 5 m finished diameter (6.2 m drilled) shaft reached a final drilled depth of 517 m, **the deepest fully lined blind bored vent shaft to date in Australia.**

- Fully lined to 512 m deep with steel/concrete composite liner that is hydrostatically sealed providing a dry shaft.

- The shaft lining is designed with a 50 year design life to meet the mine ventilation requirements for a service life of 20 years.

- The shaft was drilled through sedimentary measures of sandstones, siltstones and mudstones with strengths ranging from 20 – 80 MPa to intersect the top of the coal seam at a depth of approximately 513 m.

BLIND BORING METHOD OF SHAFT CONSTRUCTION

BLIND BORE SHAFT CONSTRUCTION

As an introduction to the blind bore drilling and composite lining method the following video is presented.

BLIND BORE SHAFT DRILLING

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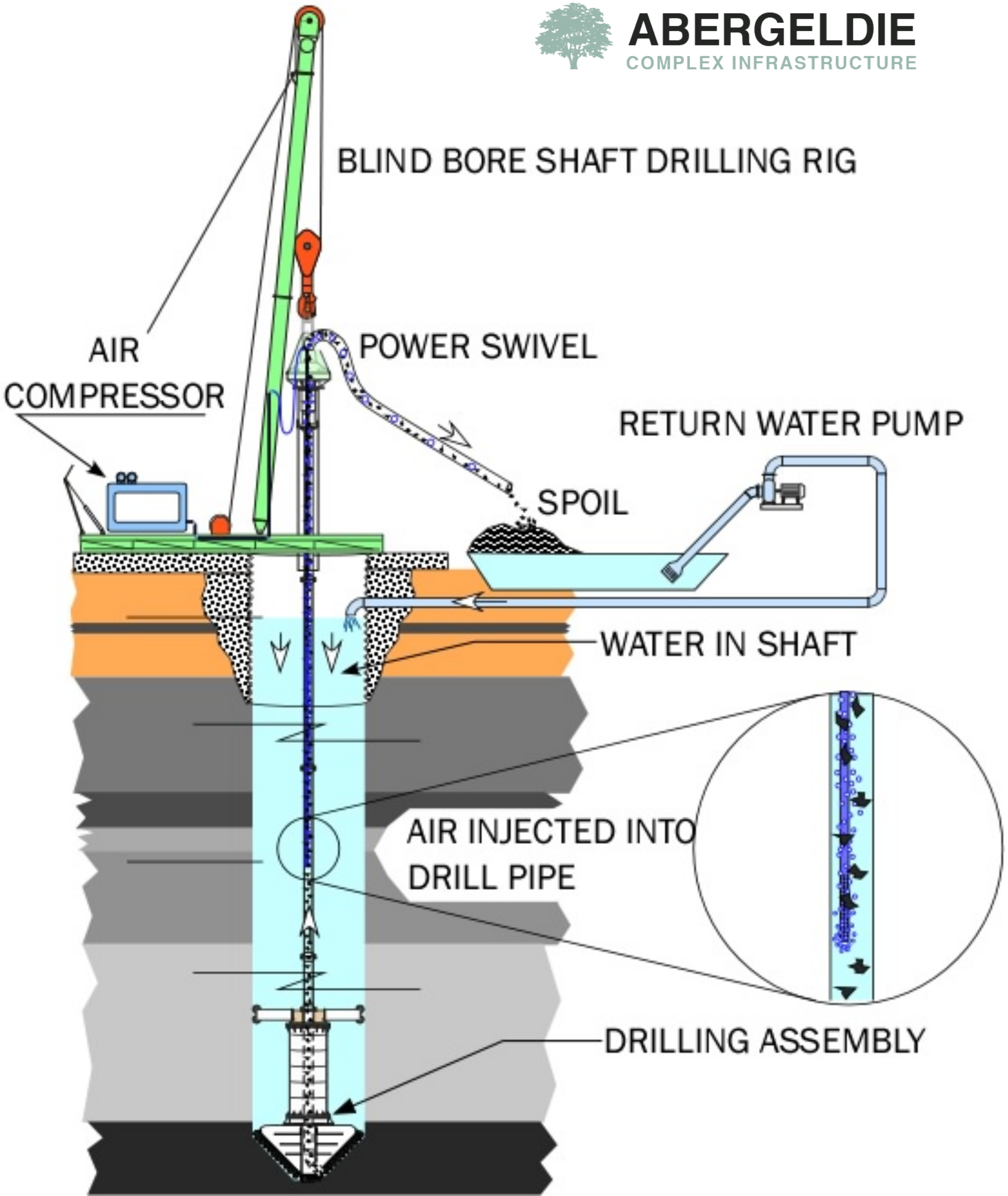
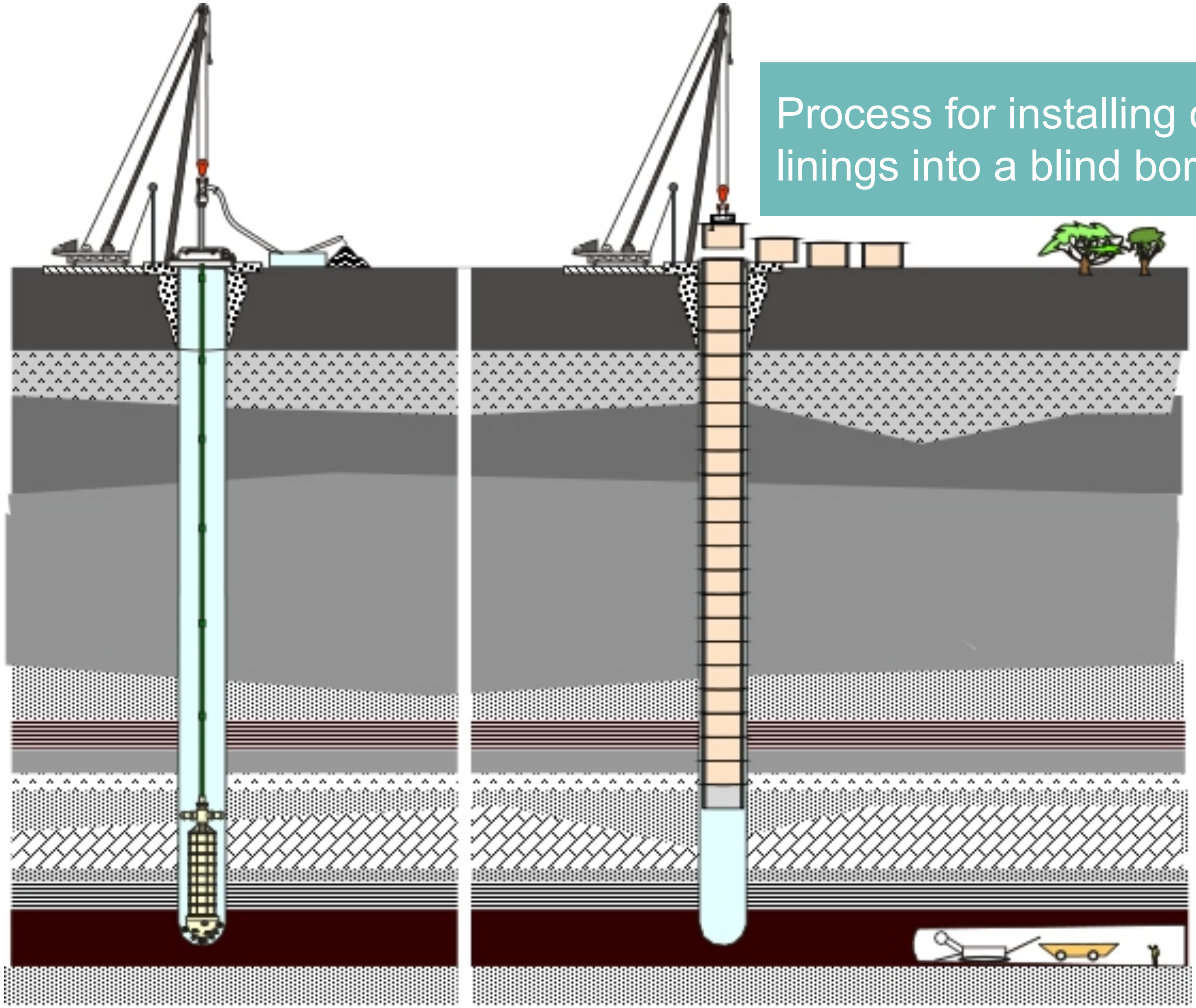
- Our shafts are bored from the surface.
- During construction the shaft remains full of water which provides stability to the shaft.
- Cuttings are removed using reverse circulation.
- No personnel enter the shafts during any phase of the work.



COMPOSITE SHAFT LINING



Process for installing composite shaft linings into a blind bored shaft

PROJECT METHODOLOGY AND INDUSTRY BEST PRACTICE

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- The shaft was drilled using the blind bore method.

- The blind bore method allows the shaft to be drilled from the surface down without anyone having to enter the shaft or the mine during the construction process. By far the safest method of shaft construction and is especially suitable for difficult ground conditions.

- As this method involves drilling from the surface downward, shafts can be completed ahead of the underground mine development.

PROJECT PHASES

SHAFT PAD AND COLLAR

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- The shaft collar, pre-sink and pad provide stability to the ground at the top of the shaft to support the drill rig and to provide a base for the vent elbow.
- The collar was constructed by first creating a 7 m diameter by 9 m deep excavation, installing a 9 m deep pre-sink liner concreted into place to form a 6.2 m diameter shaft collar.

RIG ASSEMBLY

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- The drill rig consisted of a 450 tonne lifting capacity A-frame.
- The rig's winch was powered by 2 x 450kW hydraulic driven motors.
- The drill head consisted of cutting discs arranged in a hemispherical profile cutting head assembly.

SHAFT EXCAVATION (DRILLING)

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- The shaft was excavated using blind bore rotary drilling.

- The drilling head assembly (DHA) was heavily weighted to provide vertical thrust to a hard rock cutterhead equipped with disc type cutters.

- During all phases of the shaft drilling and lining process, the shaft remained filled with water to within a few metres of the surface.

SHAFT LINING

- Once the shaft had reached the intended total depth, the shaft was lined with the steel reinforced concrete composite liner sections.

- All work to manufacture 170 liner segments occurred at the shaft site to avoid additional transport costs and so the quality of each segment could be controlled and assured.

- The composite liner was terminated at the top of the coal seam.

SHAFT LINING

- The installation of the liner was a technically complex process involving the fitting of a ‘stem’ of liners weighing in excess of 8,000 tonnes.

- As the lifting capacity of the drilling rig was limited to 450 tonnes, the liners were installed from the surface by ‘floating’ them into the water filled shaft.

INNOVATION

INNOVATION

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- During construction, dirty process water was passed through a series of treatment processes and circulation ponds.

- The use of tooth cutters on this project produced a substantially larger amount of fines within the drilling fluid in the excavation process particularly whilst breaking up the spalled material.

- This caused the material to be reprocessed resulting in process water containing over 115,000 mg/L of suspended solids.

- The suspended solids needed to be brought down from to <50 mg/L so that the process water could be reused again as boring proceeded.

Process water before and after treatment

INNOVATION

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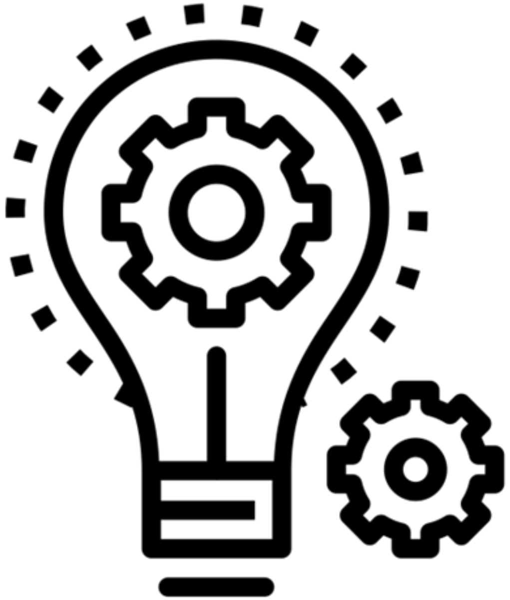
- After many months of trials the project team adopted a very effective process by injecting a flocculant solution into the drilling water upon entering a centrifuge.
- This treatment process solution was highly effective at reducing turbidity levels to below the discharge limits.



CHALLENGES

CHALLENGES

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- Difficult strata conditions presented complex challenges.

- Based on rock samples recovered on top of the DHA it was determined that there was sizeable material coming away from shaft wall as a result of stress relieving creating voids in the shaft walls.

- To counteract the loss of stabilisation and improve cleaning of the fallen material from the shaft floor, tooth cutters were installed on the cutter head. The tooth cutters provided a larger, more stable, platform for the DHA working like a sheep’s foot roller in breaking up the loose material.

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REMEDIATION