wassara

WATER-POWERED DRILLING
IN DAMS

”The water-powered technology from Wassara was chosen for the Changuinola I Hydroelectric Project in Bocas del Toro, Panamá, this is since it was the only feasible drilling method to solve the drilling within the given time and quality frames.”

Lars Hässler, Technology Dr, Golder Associates

STRAIGHT FORWARD DRILLING

An absolute demand on drilling equipment used in dams is the ability to not cause harm or distress to any structure being penetrated. Wassaras water-powered drill hammer has proven to be benign, as well as giving high performance and creating high borehole quality. This is why it has become widely used in both rehabilitations of old dams as well as construction of new dams.

Dam drilling

When rehabilitating a seeping dam, there is a need of drilling many deep boreholes for installation of concrete walls/grout curtains of different designs. It is in this kind of applications the Wassara technology has proven its superiority.

There is always a concern when drilling in dam structures; factors like minimal borehole deviation and no pressuring of the formation are crucial. With Wassara you get this, together with an outstanding borehole accuracy and cleanness with very little impact on the formation.

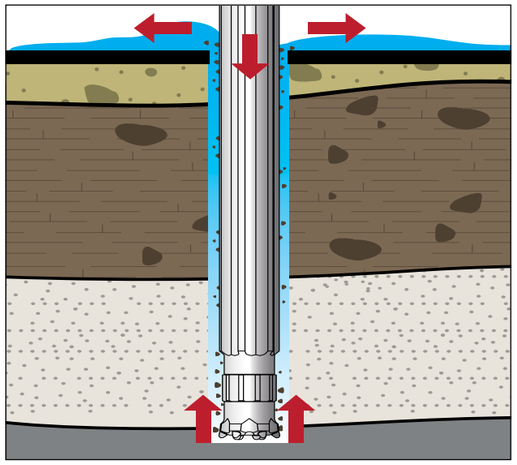
Suitable for most dam drilling applications

Reduction and control of water seepage is the key factor in dam management. The Wassara technology has several benefits regarding both different dam rehabilitation methods and construction of new dams:

- Installation of grout curtains and/or concrete walls in order to minimize leakage
- Strengthening/repairing existing drainage/service tunnels by injection of grout
- Drilling grout holes for new dams

How Wassara works

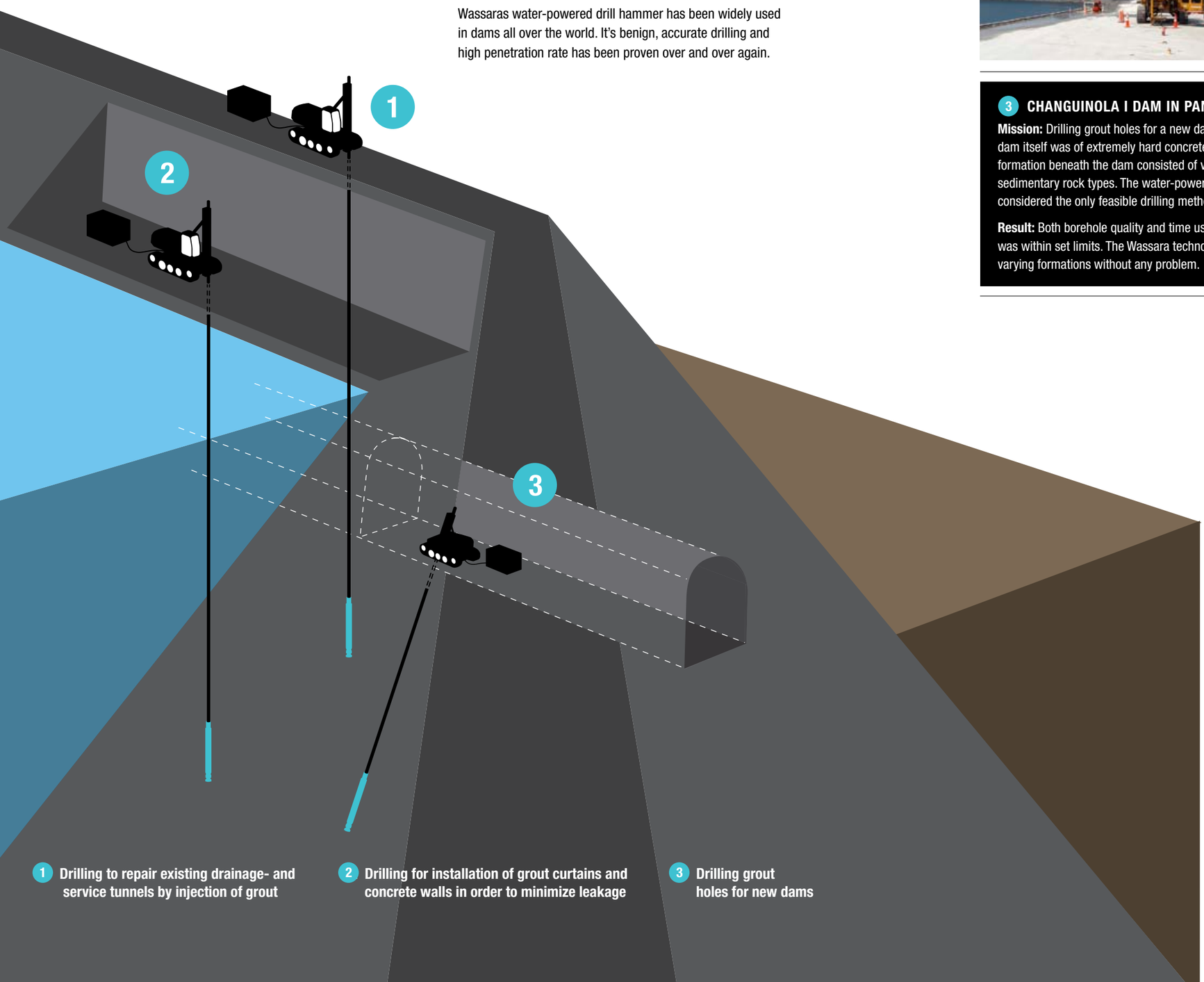
The Wassara technology uses high pressure water to power the DTH hammer. Water gives a high frequency and high energy per blow. When the water leaves the hammer it has a sufficient velocity to bring the cuttings and debris to the surface and clean the hole. Besides smooth and straight holes with a minimum of deviation, Wassara offers superior benefits like high productivity, borehole quality and minimum impact on the formation you are drilling in. On the next pages we will show you how, and why.



The principles of water-powered drilling

ACCURATE AND BENIGN DRILLING IN DAMS

Wassaras water-powered drill hammer has been widely used in dams all over the world. It's benign, accurate drilling and high penetration rate has been proven over and over again.



1 Drilling to repair existing drainage- and service tunnels by injection of grout

2 Drilling for installation of grout curtains and concrete walls in order to minimize leakage

3 Drilling grout holes for new dams

2 WOLF CREEK DAM IN KENTUCKY, USA

Mission: Dam rehabilitation for seepage reduction/control by installation of concrete walls. The challenge was to keep the boreholes straight and clean for the following grouting. The project also faced a short timeframe.

Result: Both borehole deviation and time used for the drilling was according to specification.

3 CHANGUINOLA I DAM IN PANAMÁ

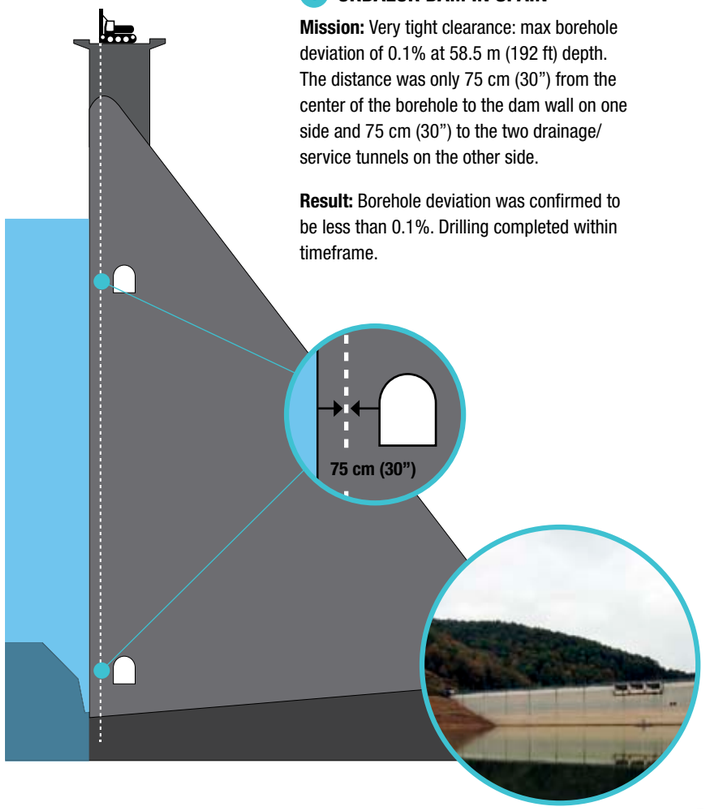
Mission: Drilling grout holes for a new dam. The body of the dam itself was of extremely hard concrete whereas the formation beneath the dam consisted of very soft volcanic and sedimentary rock types. The water-powered technology was considered the only feasible drilling method to solve the task.

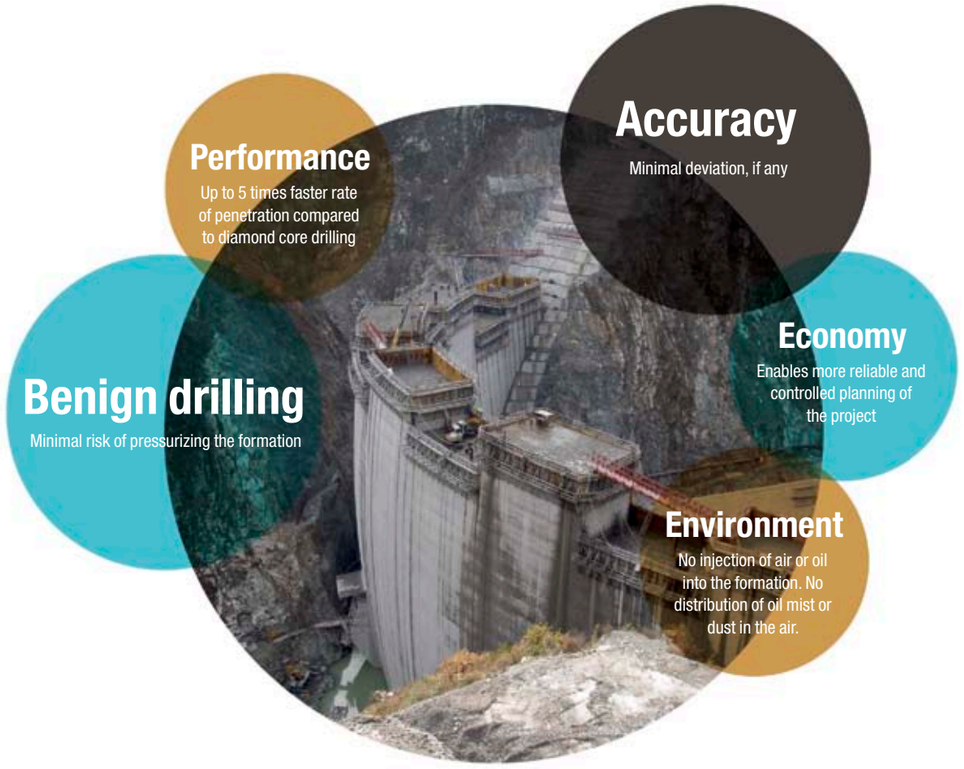
Result: Both borehole quality and time used for the drilling was within set limits. The Wassara technology handled the varying formations without any problem.

1 URDALUR DAM IN SPAIN

Mission: Very tight clearance: max borehole deviation of 0.1% at 58.5 m (192 ft) depth. The distance was only 75 cm (30") from the center of the borehole to the dam wall on one side and 75 cm (30") to the two drainage/ service tunnels on the other side.

Result: Borehole deviation was confirmed to be less than 0.1%. Drilling completed within timeframe.





THE KEY BENEFITS WITH WASSARA

Safer and more benign drilling

The Wassara drilling technique minimizes the risk of pressurizing the formation, which ensures a minimum of disturbance to the surrounding formation and infrastructures within dams, urban areas, railways, etc.

Better borehole quality and accuracy

With Wassara you get straight boreholes. You also get cleaner, smoother and more stable holes, which simplifies geophysical pre-grouting tests and optimizes the conditions for grouting. The stability is maintained by the water column's hydrostatic pressure. The low up-hole velocity of the water prevents creation of cavities along the bore-hole.

High and versatile performance

Since the Wassara technique itself uses water, it drills through water-rich formations without problems. The high penetration rate also provides very efficient and fast drilling through almost any material, from boulders and wood to dense clay and old foundations

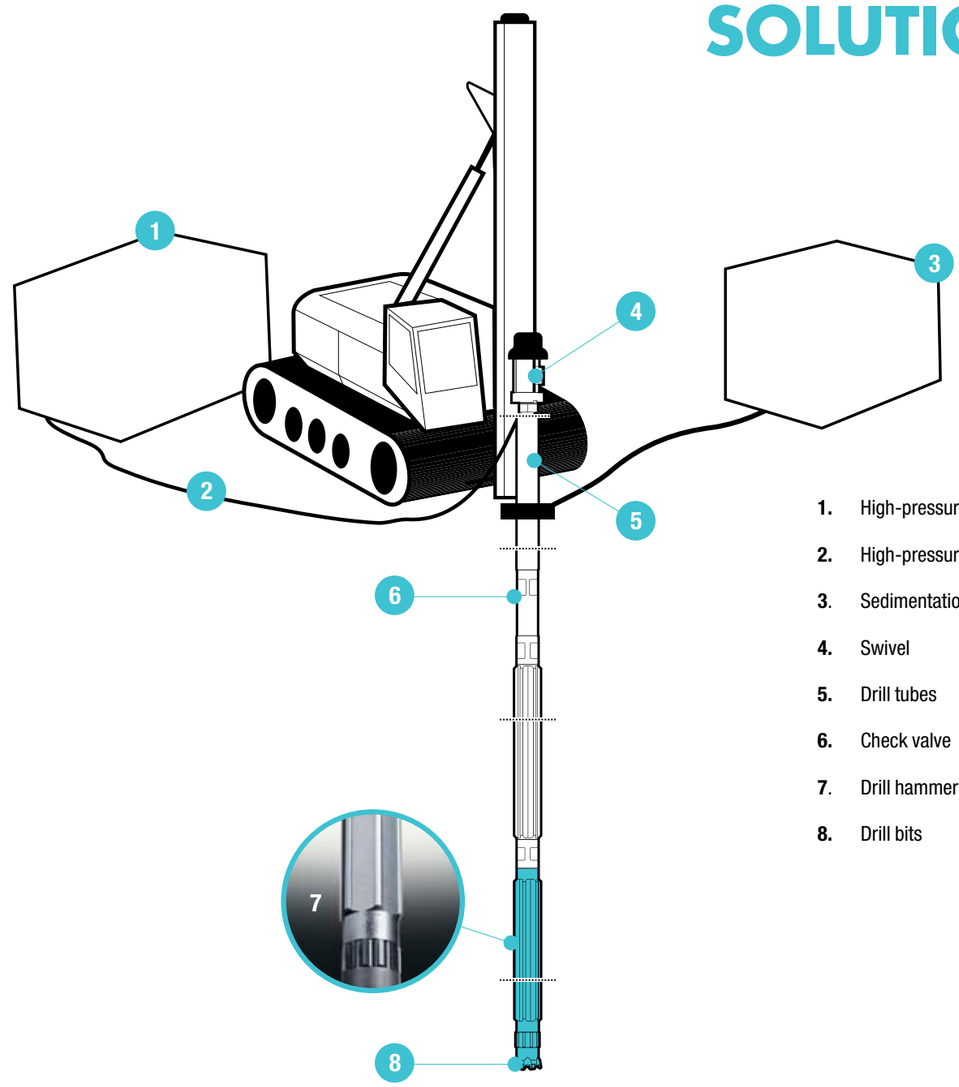
Cost effective

The Wassara technique gives a minimum of wear on the equipment. The steady pace and efficiency when drilling in different soils, enable more reliable and controlled planning of project production.

Less environmental impact

The water-powered technique gives far less pollution as no oil is used to lubricate the hammer – you get no injection of air or oil in the formation, no influence of oil in the water table, and no oil mist or dust distribution in the air. These benefits also heavily improve the work environment.

THE WASSARA SOLUTION



1. High-pressure pump
2. High-pressure hose
3. Sedimentation container
4. Swivel
5. Drill tubes
6. Check valve
7. Drill hammer
8. Drill bits

Hammer range

Hammer	Ø Drill bit	Water consumption	Max operating pressure
W50 (2")	60mm, 64mm (2 3/8'', 2 ½")	80-130 l/min (20-35 USgpm)	170 bar (2500 psi)
W70 (3")	82mm, 89mm (3 ¼", 3 ½")	130-260 l/min (35-70 USgpm)	180 bar (2600 psi)
W80 (3.5")	95mm (3 ¾")	130-260 l/min (35-70 USgpm)	180 bar (2600 psi)
W100 (4")	115mm, 120mm (4 ½", 4 ¾")	225-350 l/min (60-95 USgpm)	180 bar (2600 psi)
W120 (5")	130mm, 140mm (5 ⅛", 5 ½")	300-450 l/min (80-120 USgpm)	180 bar (2600 psi)
W150 (6")	165mm (6 ½")	350-500 l/min (95-130 USgpm)	150 bar (2200 psi)
W200 (8")	216, 254mm (8 ½", 10")	470-670 l/min (125-180 USgpm)	150 bar (2200 psi)

Wassara – cost-efficient and environmentally friendly drilling

LKAB Wassara is a Swedish company developing and manufacturing unique water-powered drilling systems for high performance in surface- as well as underground drilling operations. The heart of the Wassara drilling system is the world patented water-powered down-the-hole hammer.

The drilling systems have been used for more than 20 years in various applications within many industries; mining, exploration, ground engineering, dams, geothermal, marine, oil & gas storage. Our experience covers more than 25 million drilled metres working in different locations around the world. Reference studies can be found on our website.

LKAB Wassara was founded in 1988 and is owned by LKAB. LKAB is an international high-tech minerals group that produces iron ore products for the steel industry and other mineral products for many other industries and applications.

Explore more at www.wassara.com

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