

Groundwater control
Geotechnical instrumentation
Geothermal systems
Groundwater remediation
Pumping tests
Well drilling



Barry O’Sullivan - Projects Manager Qatar
Groundwater Control in Arid Environments.

7th November 2012

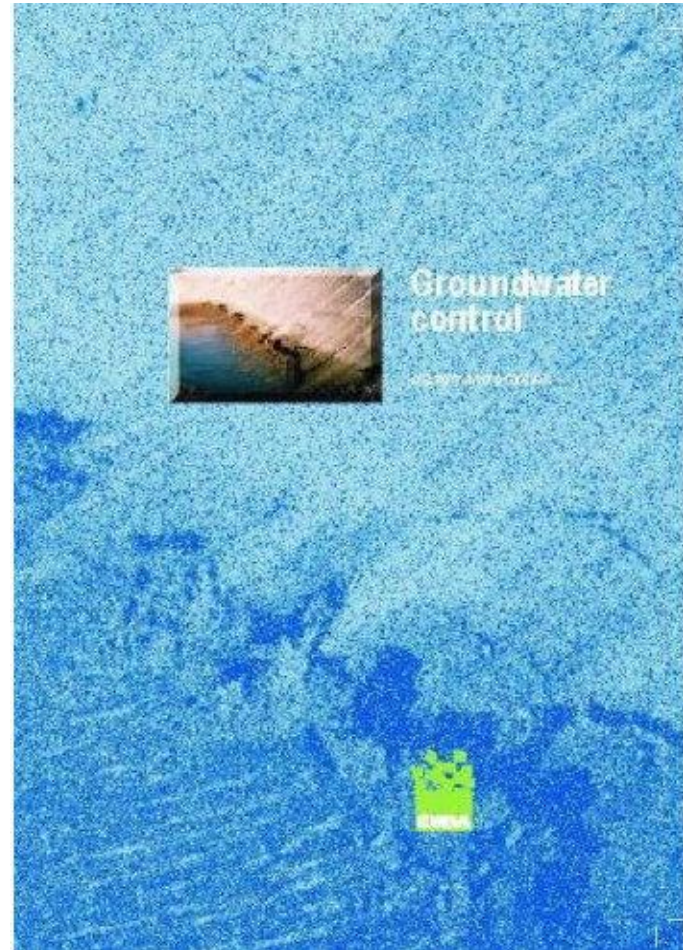
**Established for 30 years in UK and in Middle East for
15 years**

- Construction Dewatering
- Pumping Tests, Analysis & Modelling
- Treatment & Remediation of Contaminated Groundwater
- Instrumentation / Automated Monitoring
- Geothermal Wells and TRT testing
- Water Supply Wells
- Qatar, Dubai, Abu Dhabi, KSA, Hong Kong, UK & Ireland



sharing knowledge
building best practice

WJ Groundwater are the authors of the industry best practice publication on groundwater control design and practice



***CIRIA - C515 GROUNDWATER CONTROL
- DESIGN AND PRACTICE***

Construction Dewatering:
Temporary lowering of groundwater levels by pumping from wells or sumps to provide stable conditions for excavations below the natural groundwater level



Photo of the state of the practice

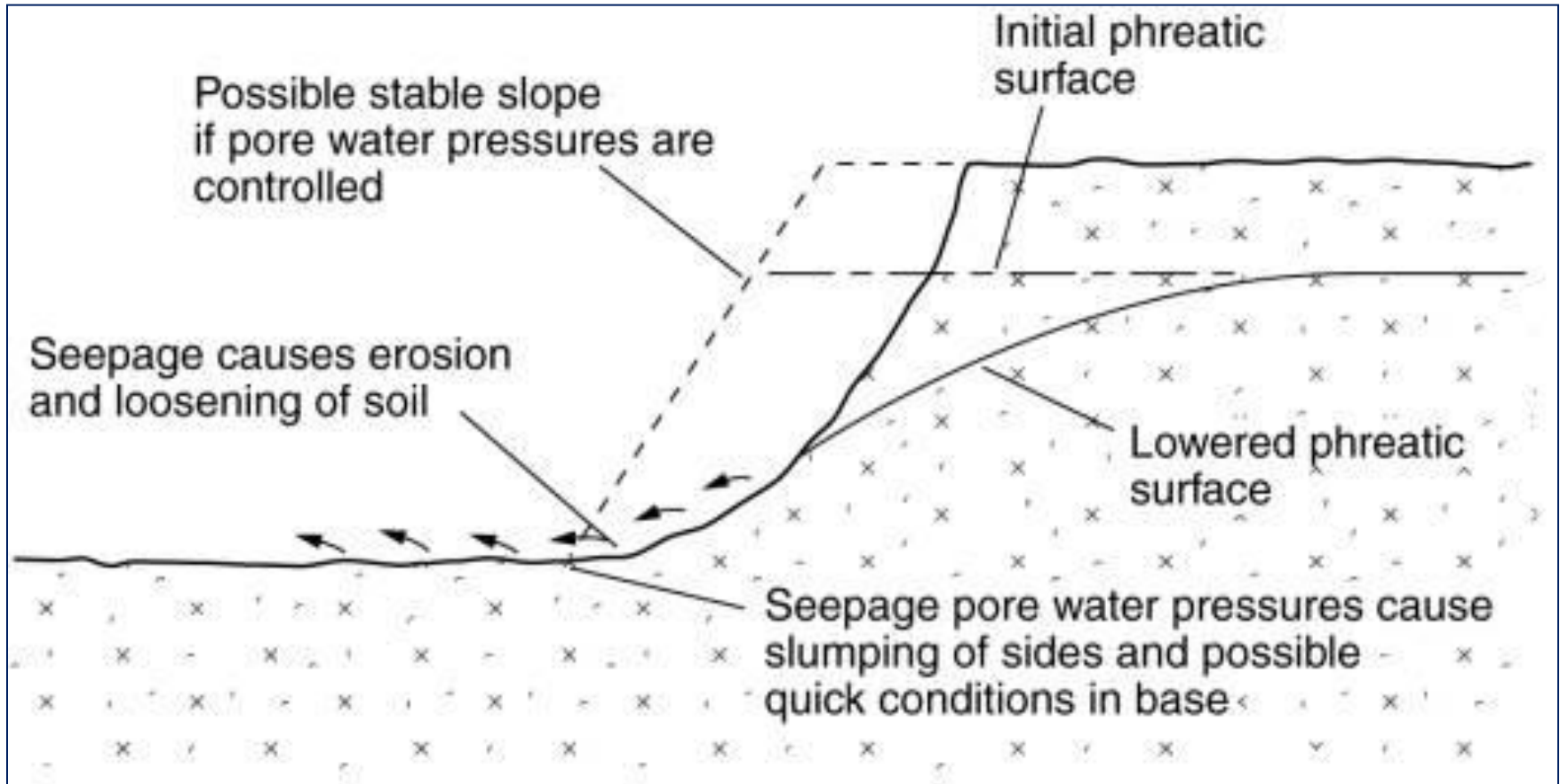
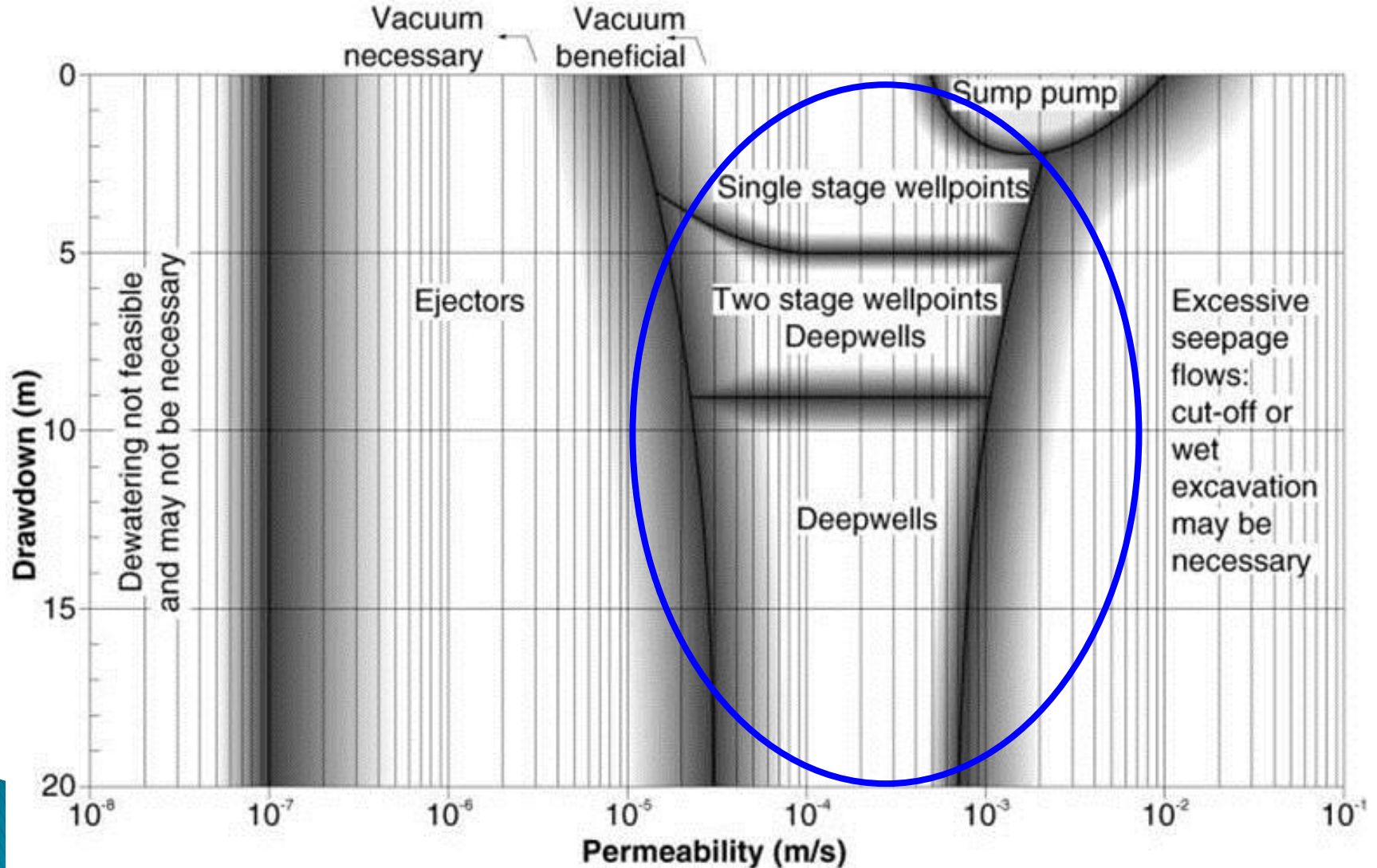


Diagram of the state of the theory

Outline of the Presentation

- Active pumping techniques in Qatar
 - Range of application of the dewatering techniques
 - Trenching & sump pumping
 - Wellpoints
 - Deepwells
- Cut-offs and dewatering
- Groundwater Control Case Studies in Qatar
 - Barwa Financial District
 - North East Car Park

Range of application of techniques



WJ GROUNDWATER LIMITED – QIT QATAR LLC

Trenching & sump Pumping



WJ GROUNDWATER LIMITED – QIT QATAR LLC

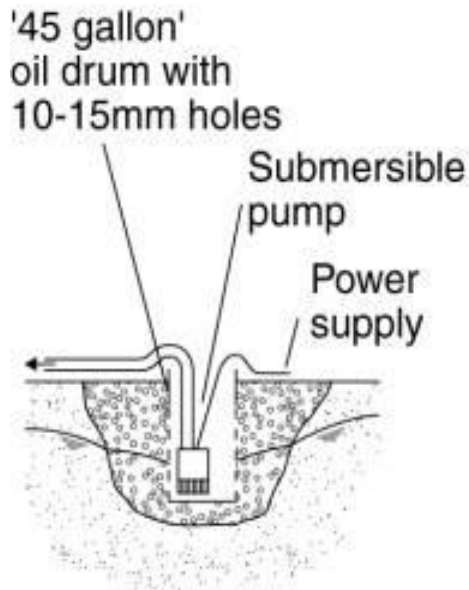




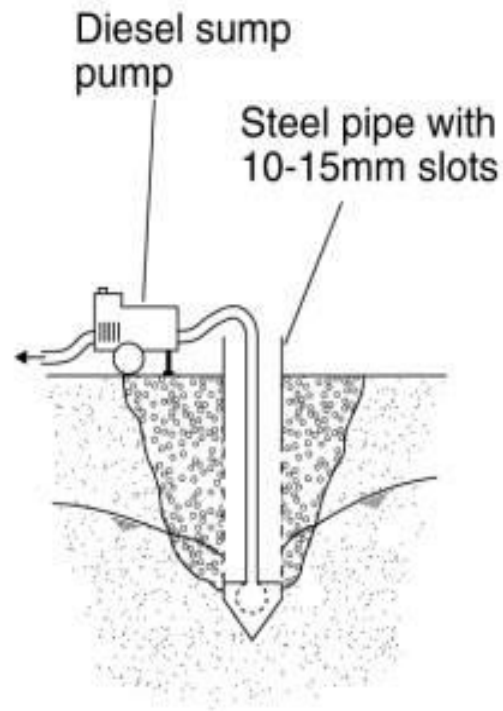
Trenches and sumps:

- Narrow
- Deep enough
- Free draining
- Sump / well

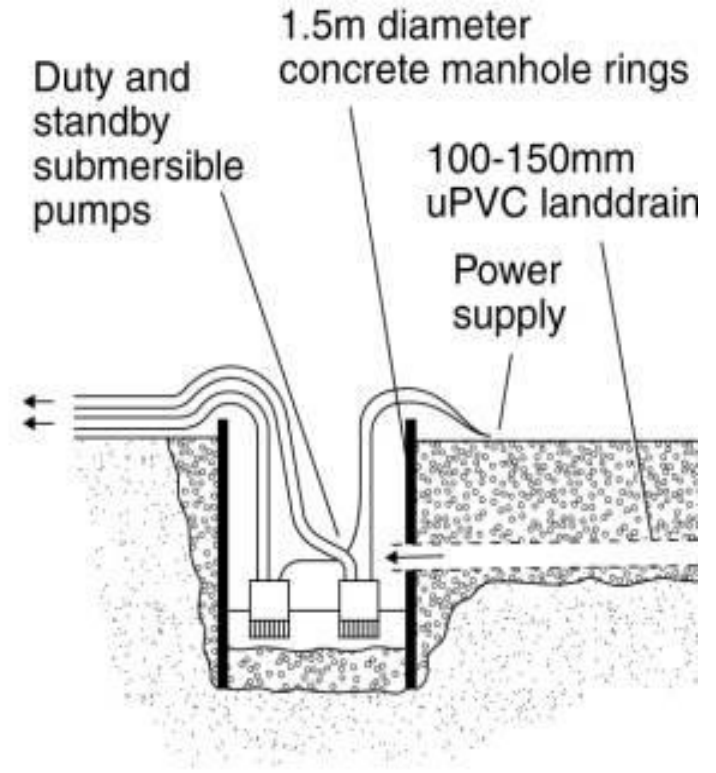
Typical sump pumping arrangements



a) Perforated oil drum



b) Perforated steel pipe with driving point



c) Concrete manhole rings fed by French drains

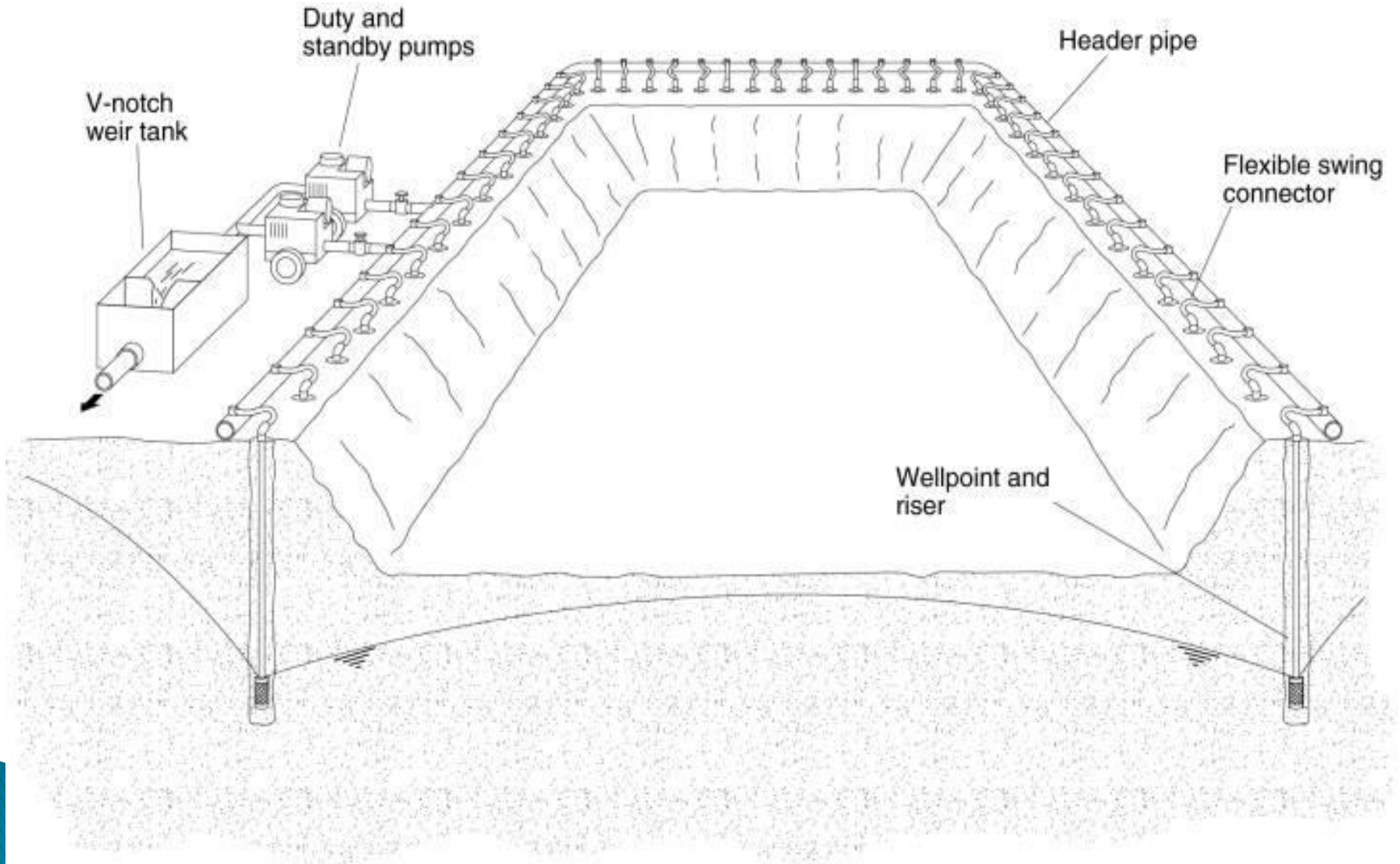
WJ GROUNDWATER LIMITED – QIT QATAR LLC



Same technique – Different out come



Wellpoints



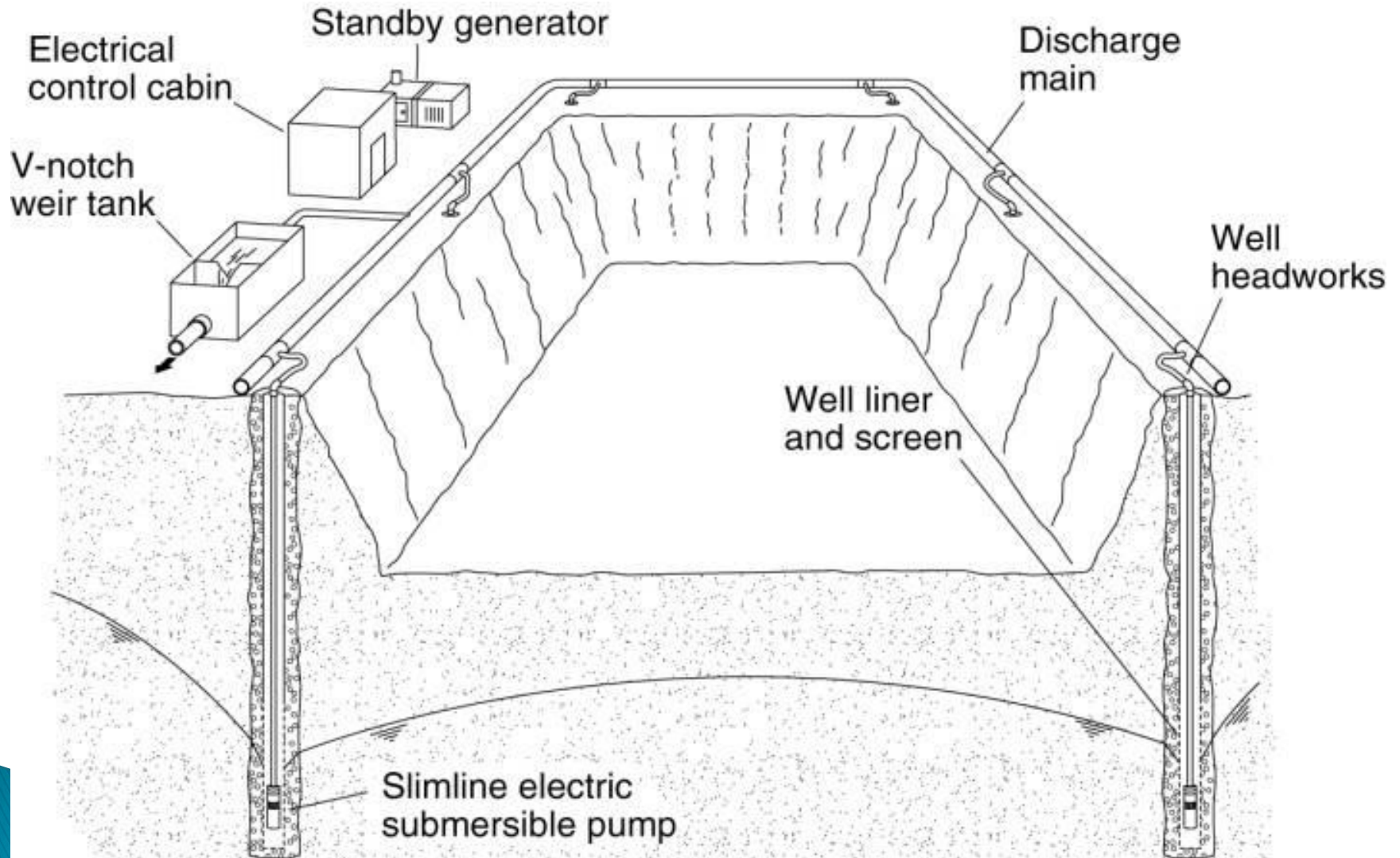
WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC

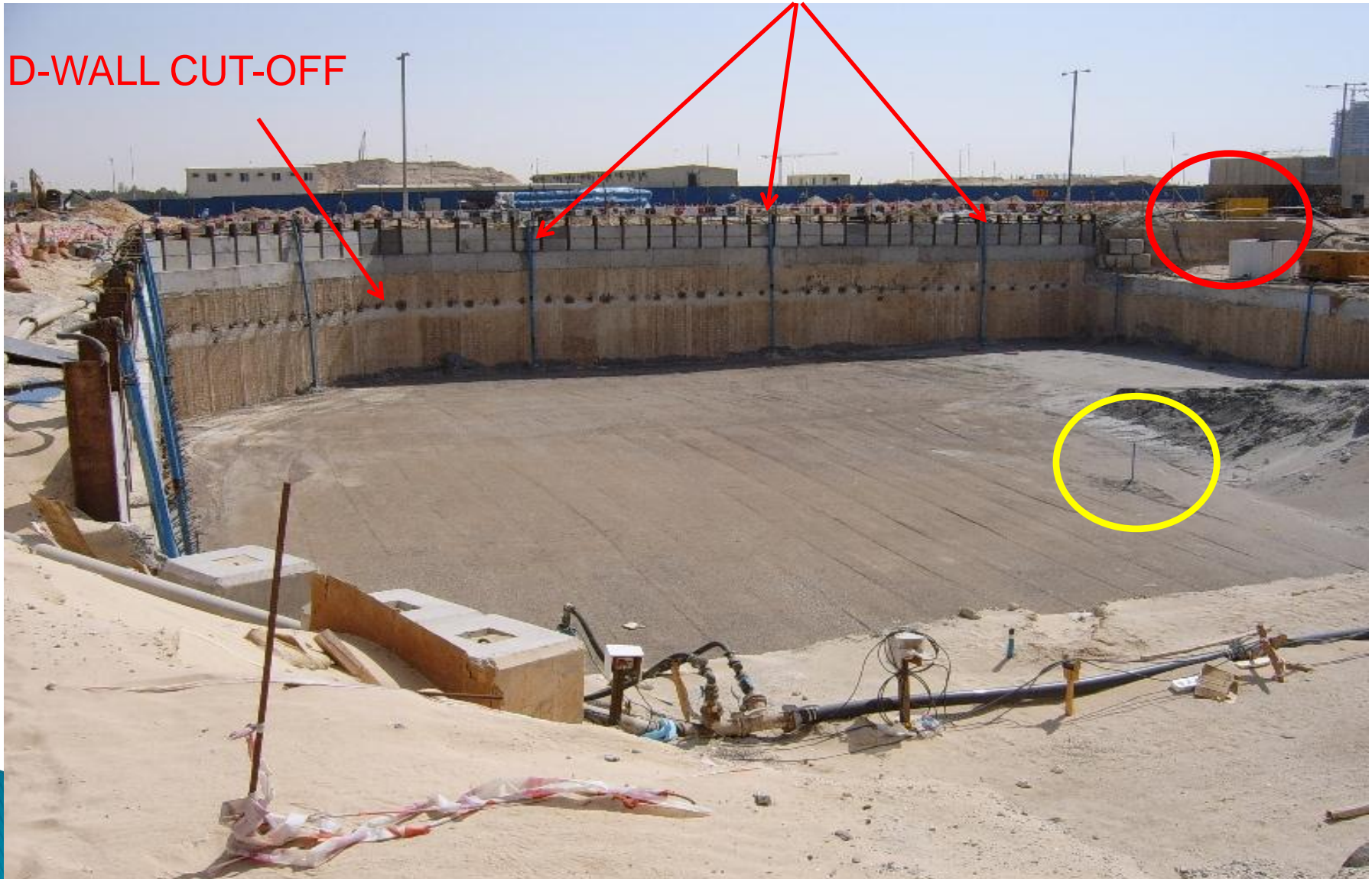


Deepwells



INTERNAL DEEPWELLS

D-WALL CUT-OFF



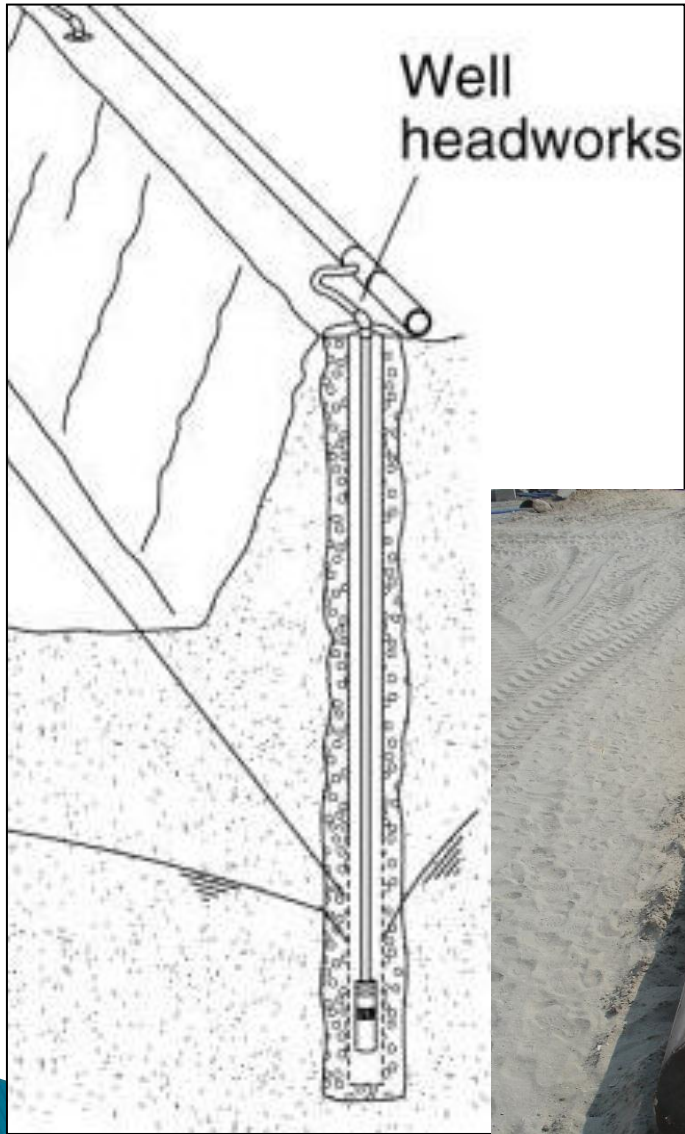
WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC



Summary of techniques

	Sumping	Wellpoints	Deepwells
Depth m	Limited to excavator depth/stability	6 (per stage)	Unlimited
Flow l/s	1 to 50	1	1 to 50
Spacing m	10 to 100	1 to 3	5 to 150
Quality of discharge	Poor (initially)	Very good	Very good

Cut offs and dewatering

Why install a cut off?

- inflows would be excessive
- there is no suitable discharge point
- the groundwater is contaminated and treatment prohibitively costly
- external drawdown may cause unacceptable impact on adjacent structures

Not all earth retaining structures form a hydraulic barrier

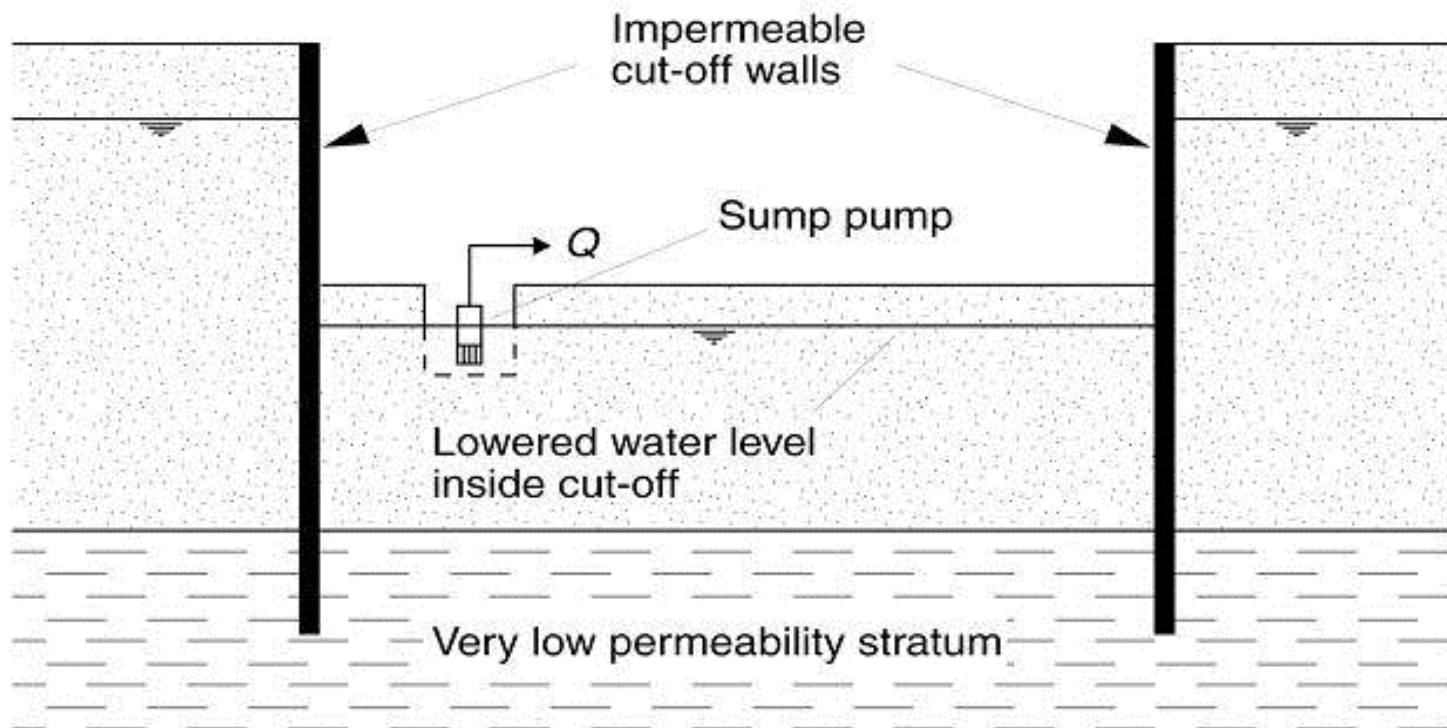
Hydraulic barrier

- Diaphragm Walls
- Secant Piles
- Sheet Piles

Non-hydraulic barrier

- Contiguous Piles
- Soldier Piles
- Battered Slopes

Groundwater control and physical cut-off wall toed into a low permeability strata



Groundwater control and physical cut-off wall toed into strata with some isotropy

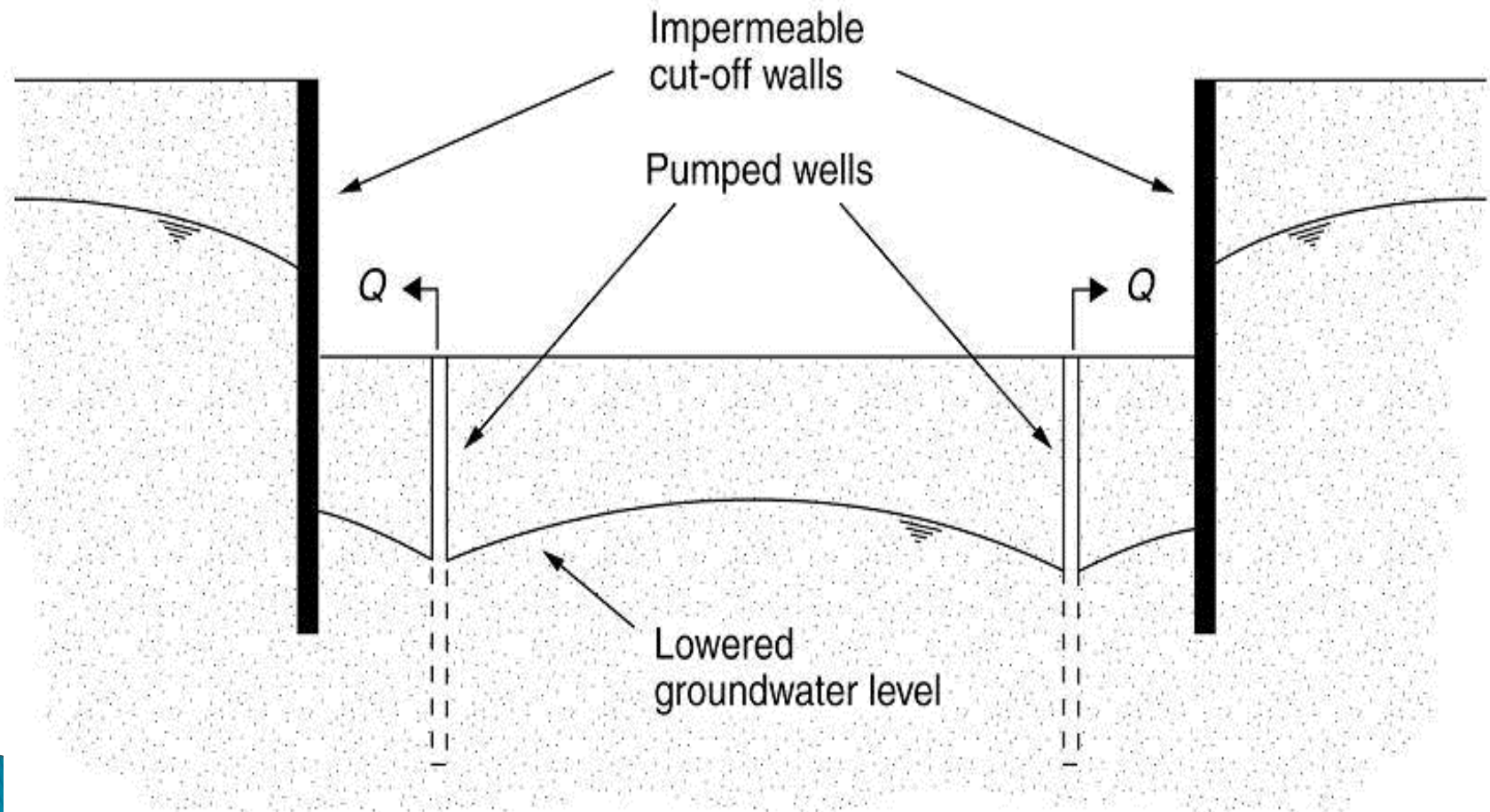


Diagram of the state of the theory

WJ GROUNDWATER LIMITED – QIT QATAR LLC

Barwa Financial District, Westbay, Qatar



Perimeter = 1,100 m





Perimeter ring main

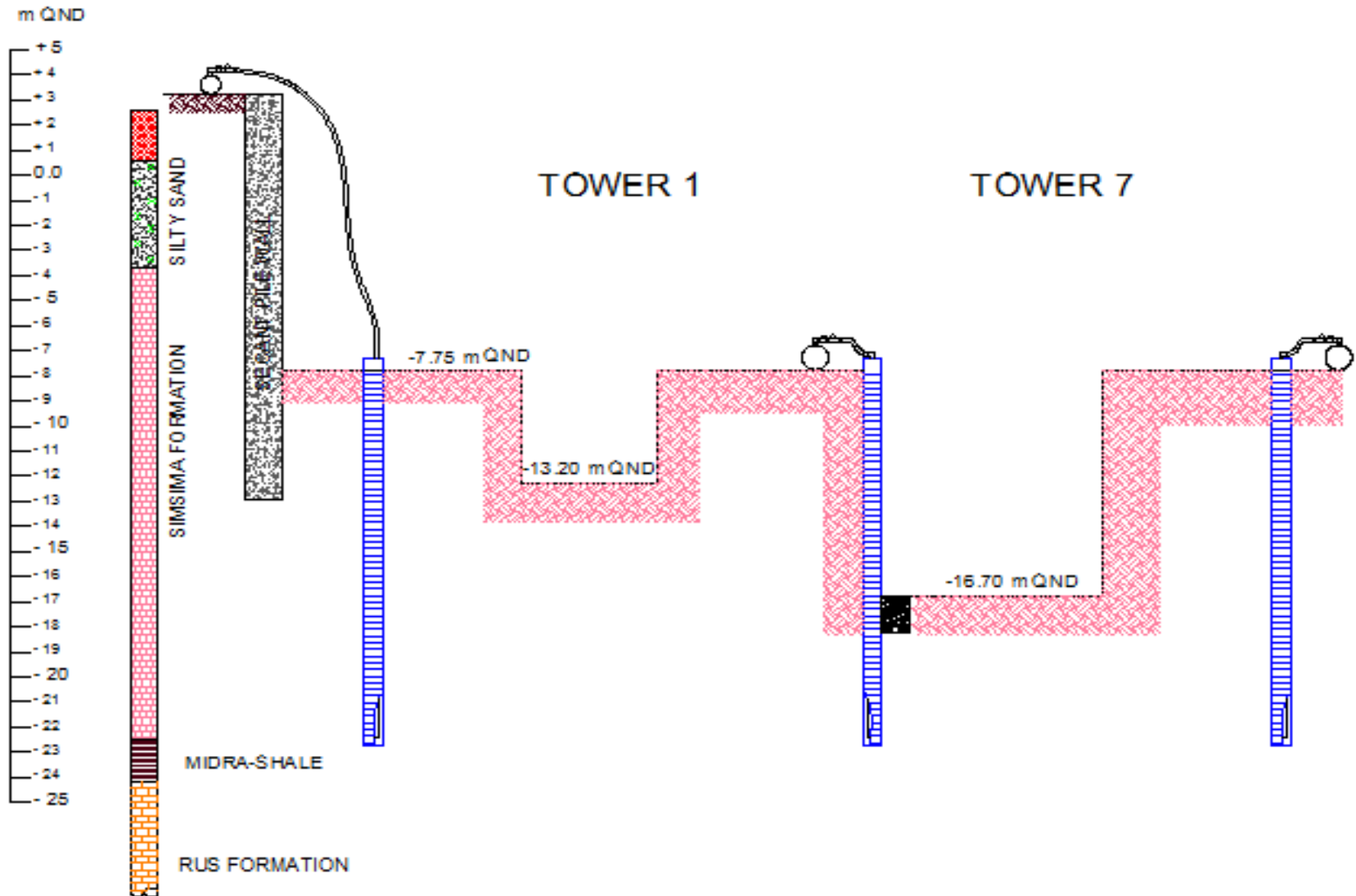
Non return valves

**Cables and ring main
protected**

**Control cabin with duty
and standby power
supply**



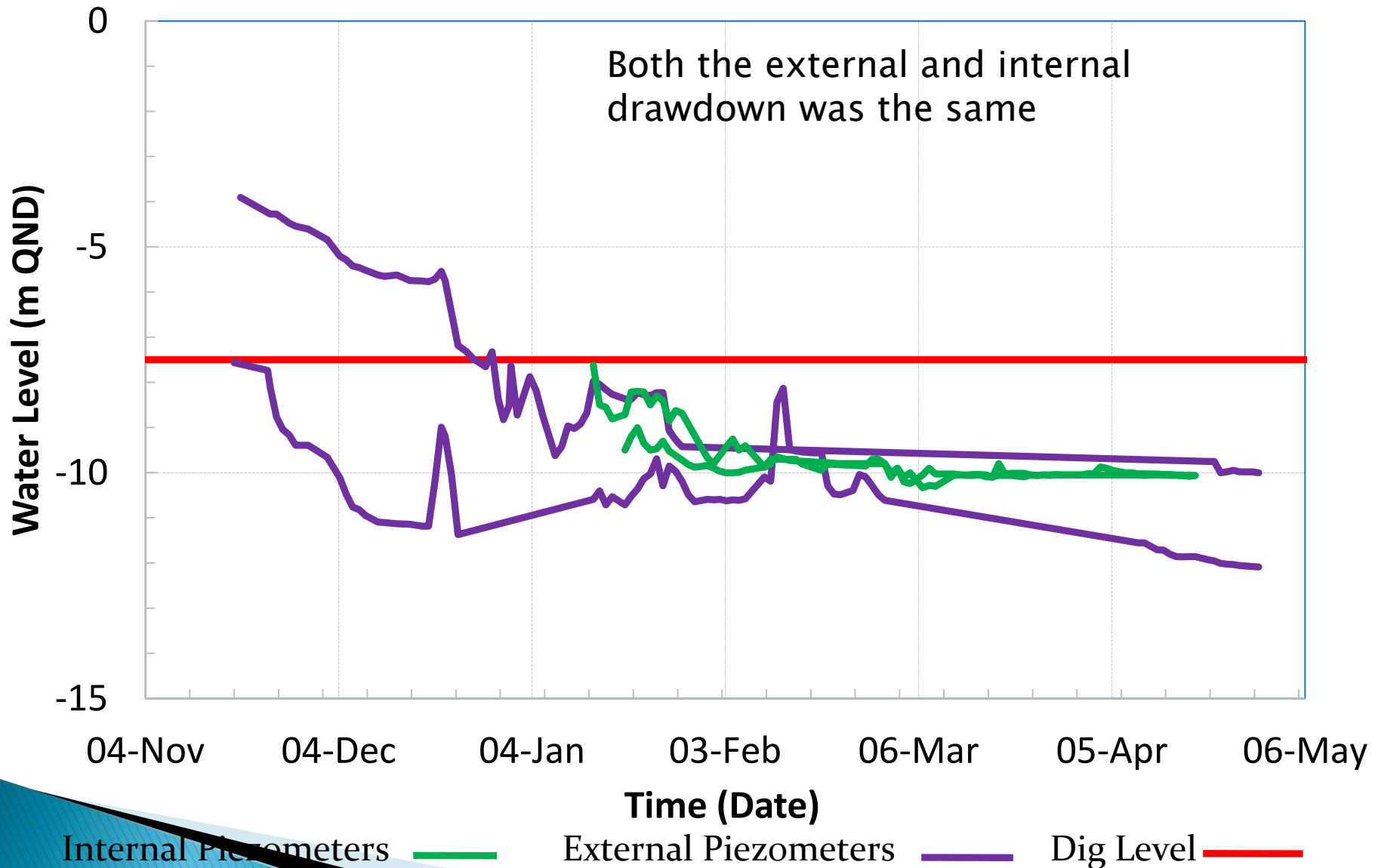
WJ GROUNDWATER LIMITED – QIT QATAR LLC

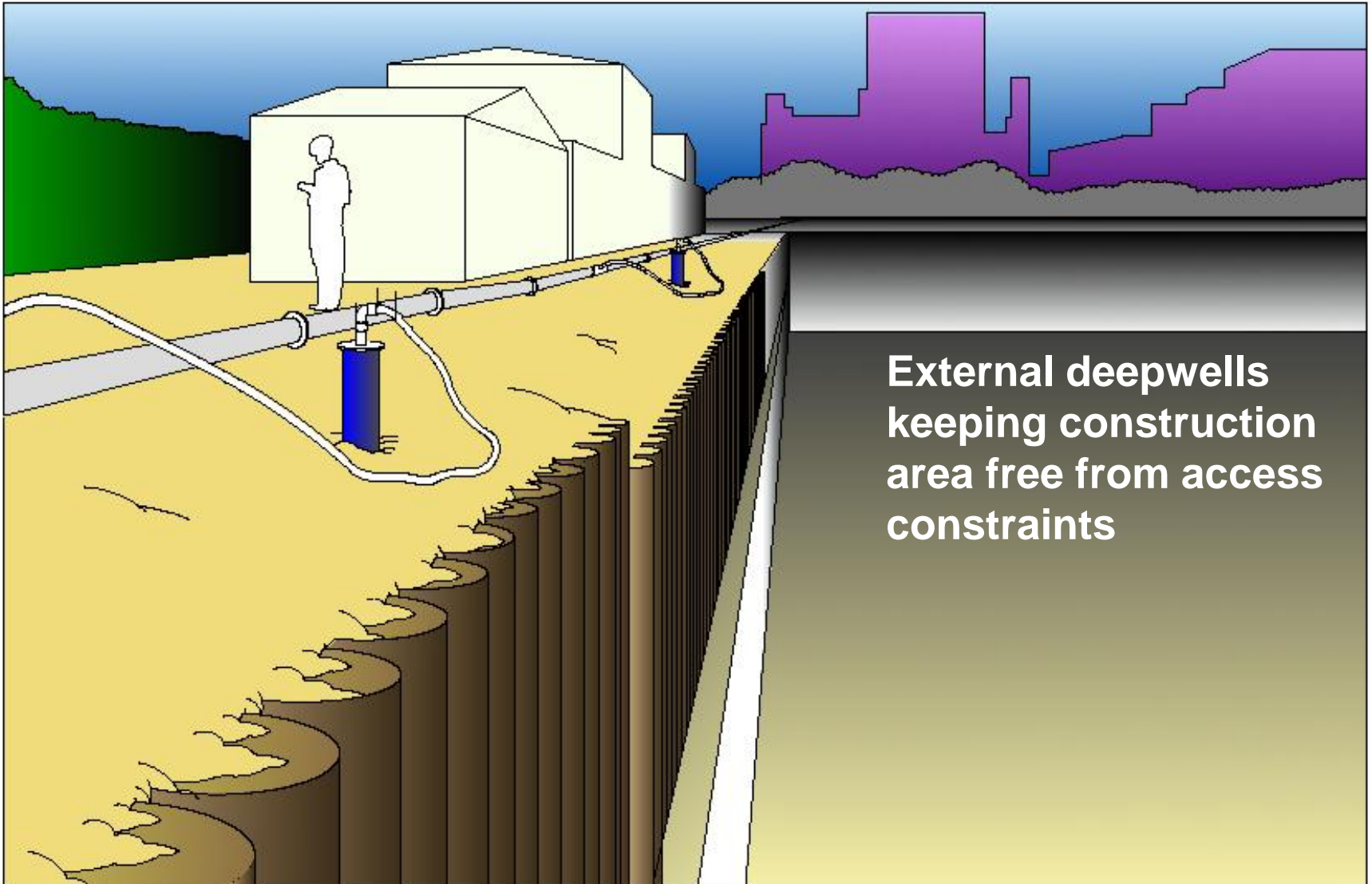




**Perimeter internal wells
(could have been external?)**

WJ GROUNDWATER LIMITED – QIT QATAR LLC





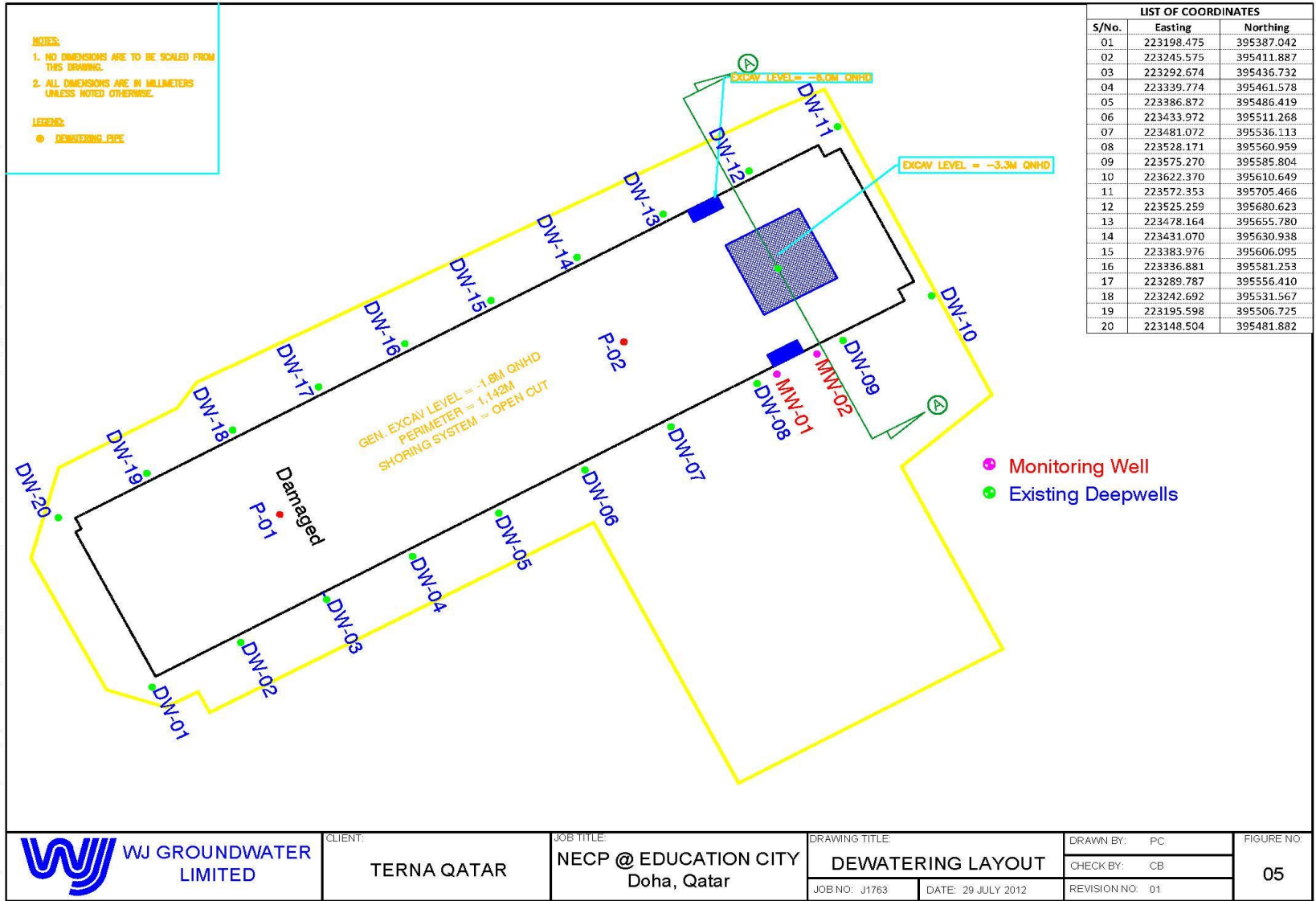
North East Car Park, Education City, Qatar



WJ GROUNDWATER LIMITED – QIT QATAR LLC

Quotation and Drawings Copyright Notice

© WJ Groundwater Limited (WJGL) 2006. The copyright, database rights and any other rights in this drawing belong to WJGL or its suppliers and are WJGL's confidential information. This drawing may be used solely for submitting a bid or for the purpose of the contract to which it relates. No part of this drawing may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of WJGL. All rights are reserved. In any event, the copyright notice must appear in all copies or extracts from the drawing, any right not expressly granted in this notice or otherwise by WJGL, are reserved.



CLIENT: **TERNA QATAR**

JOB TITLE: **NECP @ EDUCATION CITY Doha, Qatar**

DRAWING TITLE: **DEWATERING LAYOUT**

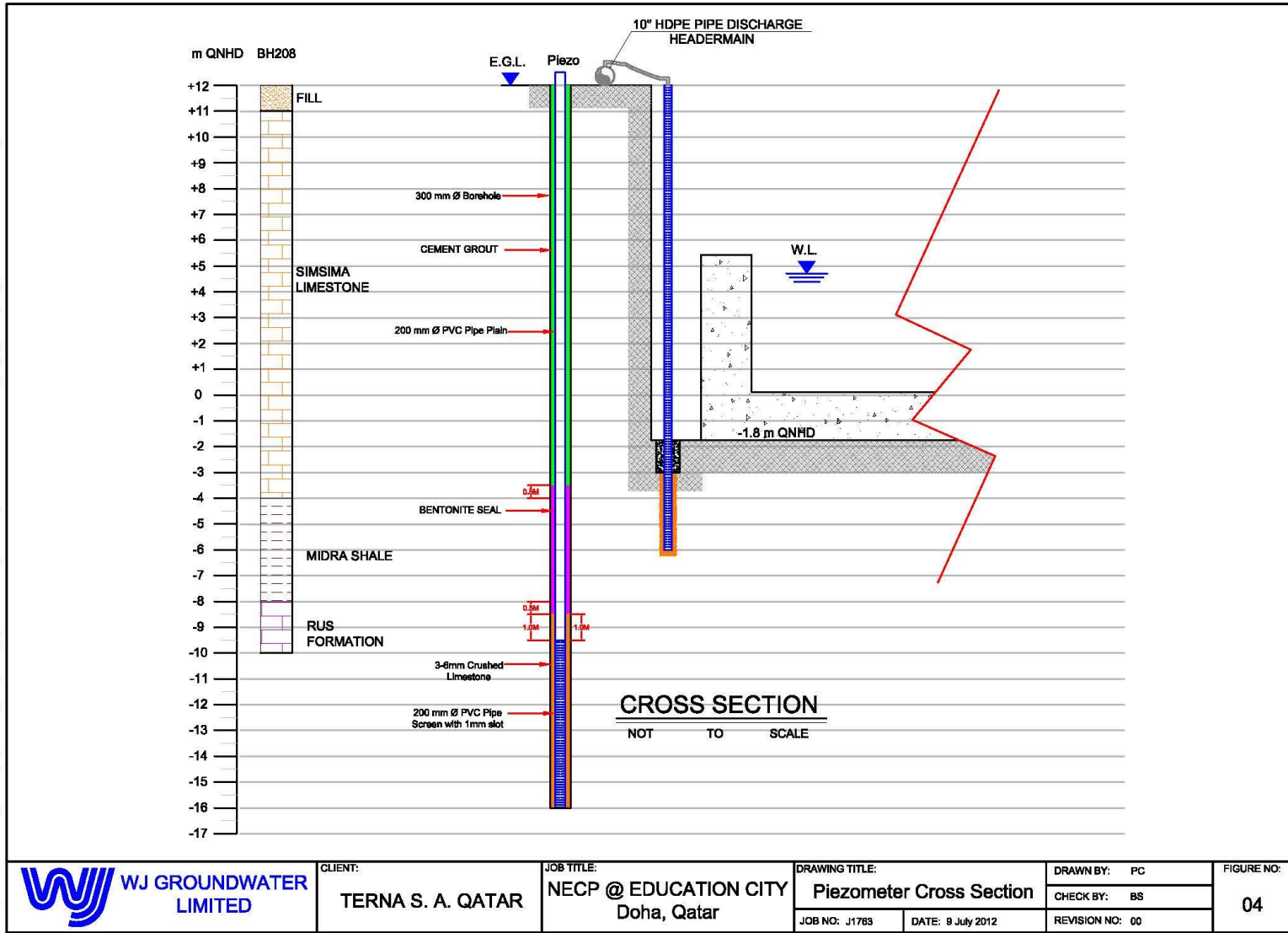
DRAWN BY: PC
CHECK BY: CB
REVISION NO: 01

FIGURE NO: **05**

WJ GROUNDWATER LIMITED – QIT QATAR LLC

Quotation and Drawings Copyright Notice

© WJ Groundwater Limited (WGL) 2008. The copyright, database rights and any other rights in this drawing belong to WGL or its suppliers and are used solely for submitting a bid or providing services including WGL or any other services provided by WGL or its suppliers. You must not make copies or extracts from this drawing or any part of it without the express written consent of WGL. In any event, the copyright notice in this drawing to the extent necessary for those purposes. In any event, the copyright notice must appear in all copies or extracts from the drawing. Any right, not expressly granted in this notice or otherwise by WGL, are reserved.

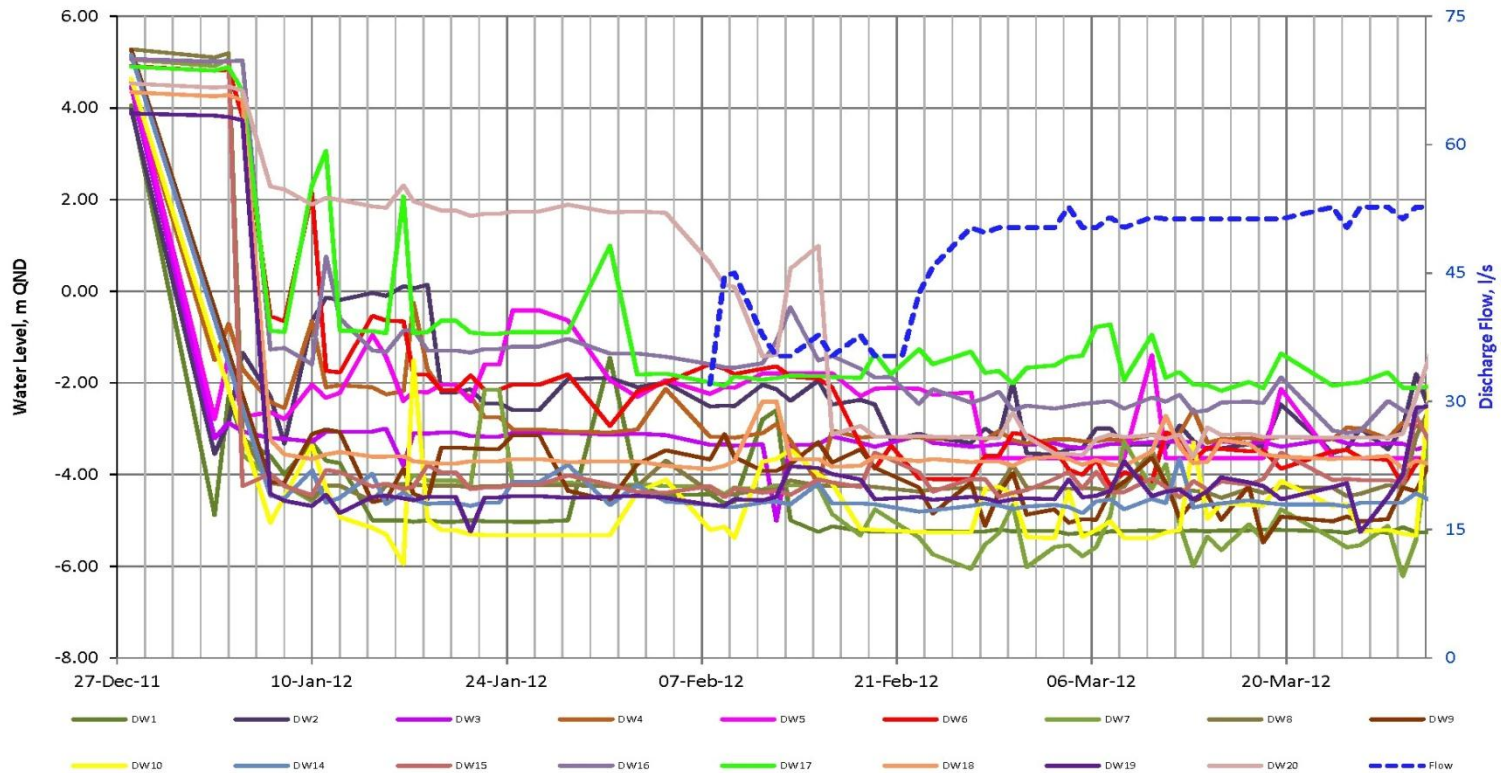


WJ GROUNDWATER LIMITED – QIT QATAR LLC

WJ GROUNDWATER - QIT QATAR LLC
J1763 - Northeast Carpark Project,
Doha, Qatar - Dewatering



Reduced Dynamic Water Levels



WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC



WJ GROUNDWATER LIMITED – QIT QATAR LLC



Thank you for your time.

Sample of WJ dewatering , instrumentation and treatment projects in Qatar



Email qatar@wj-me.com
or visit our website
www.wj-me.com for
further details

11:30 – 11:45

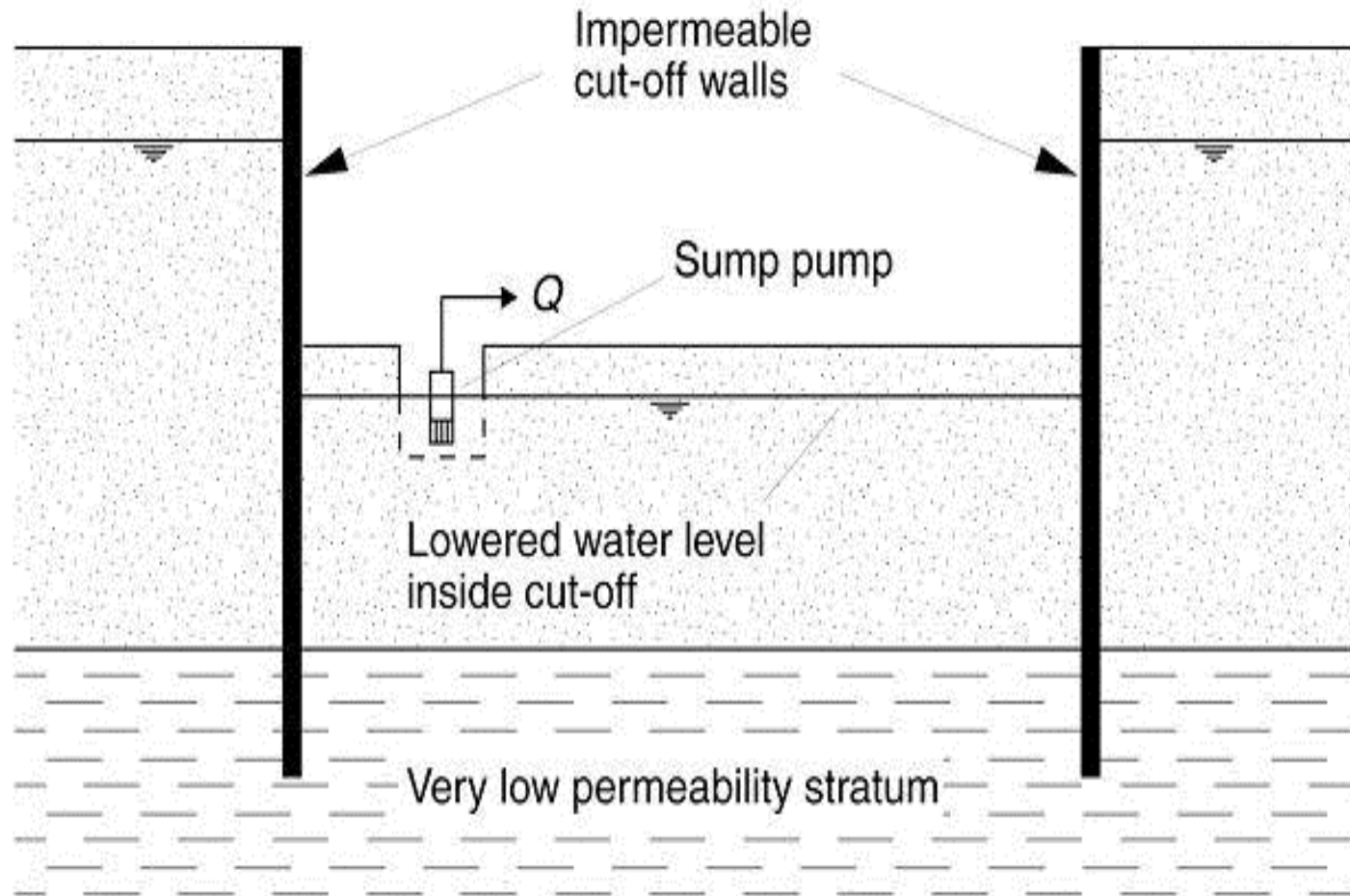
Morning Break

Sponsored by



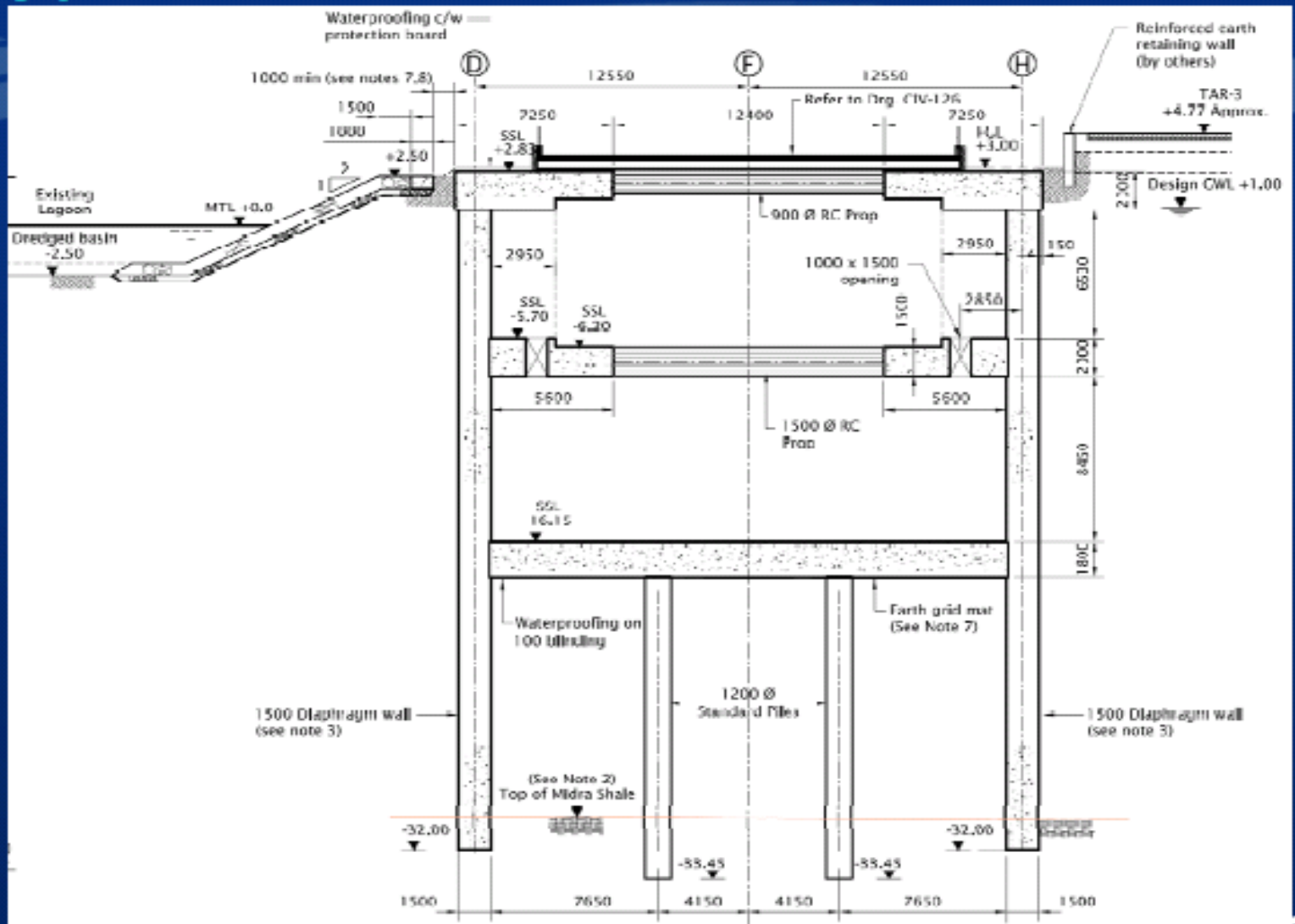
Bentley[®]

Sustaining Infrastructure



Cut-Off: State of the Theory

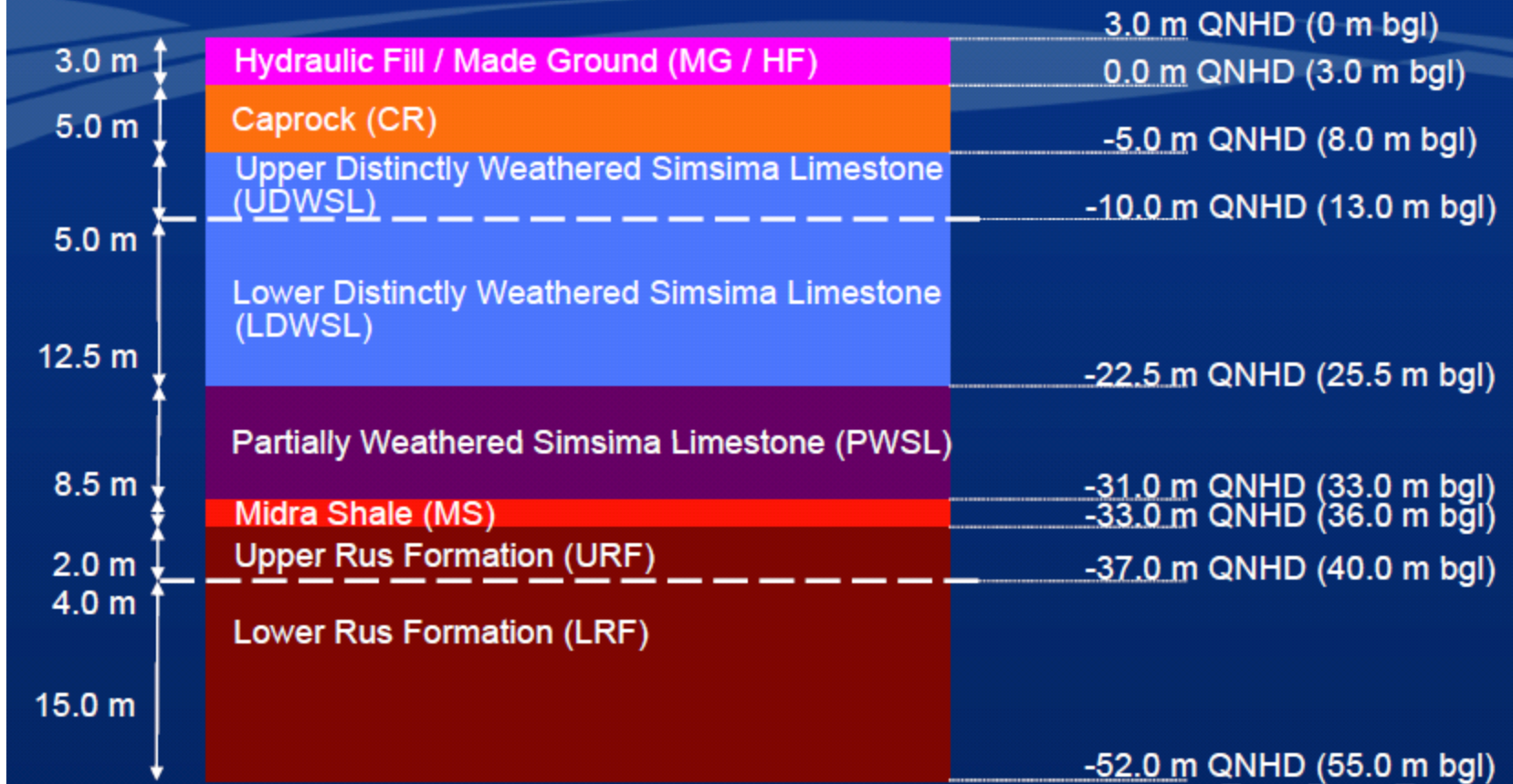
Typical Cross Section – Central Zone



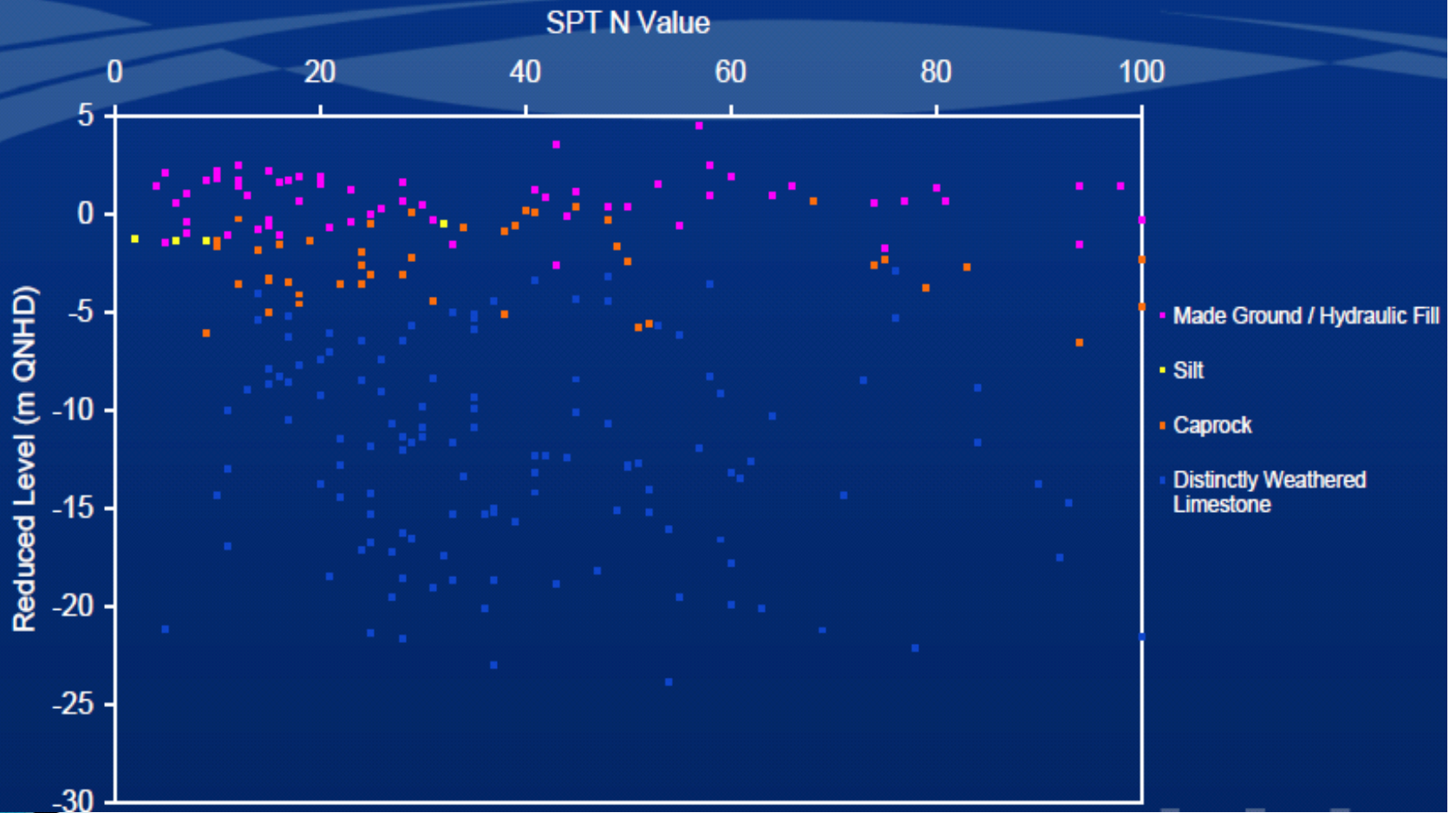


Cut-Off: State of the practice

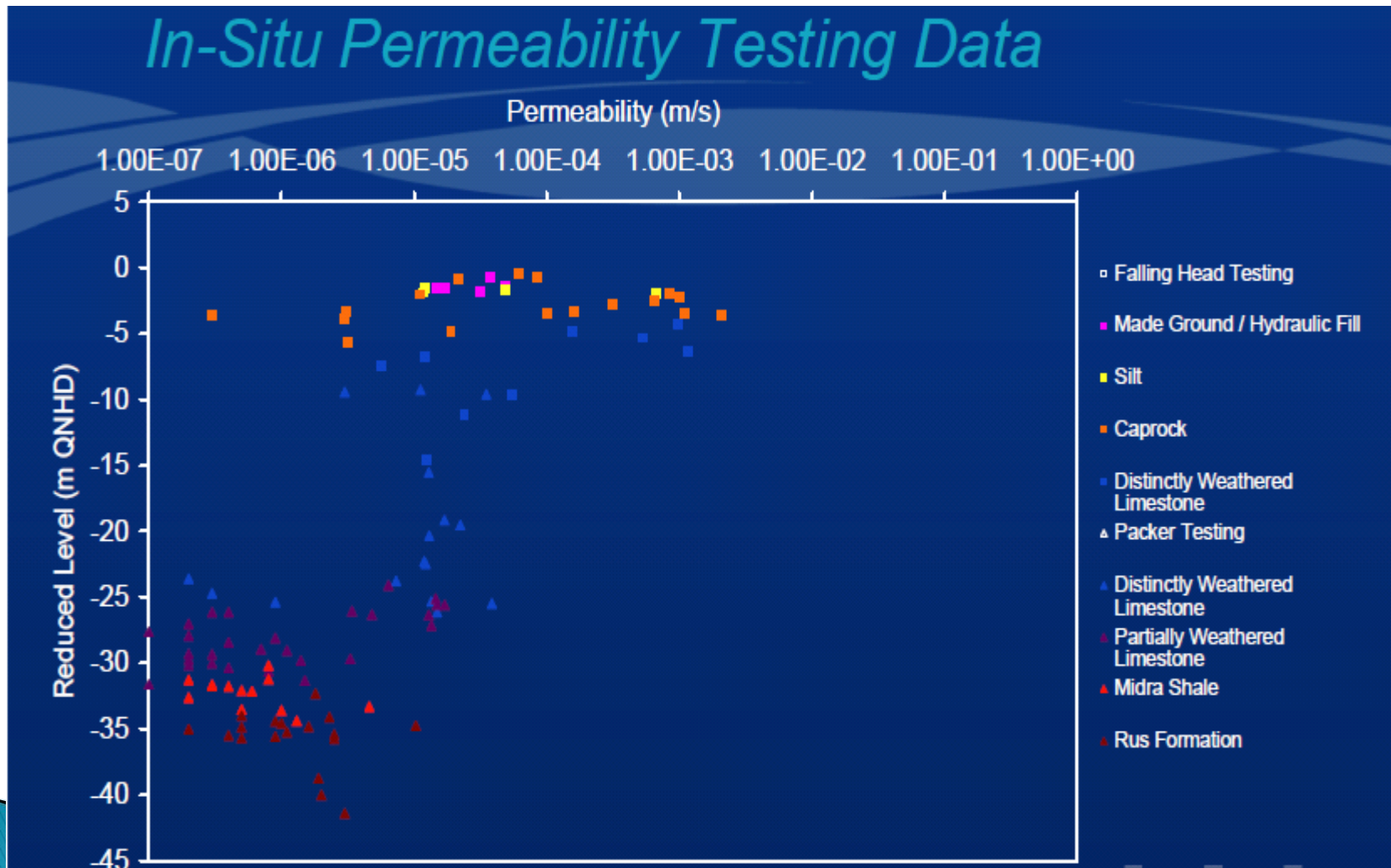
NDIA Conceptual Ground Model



Standard Penetration Test (SPT) Data

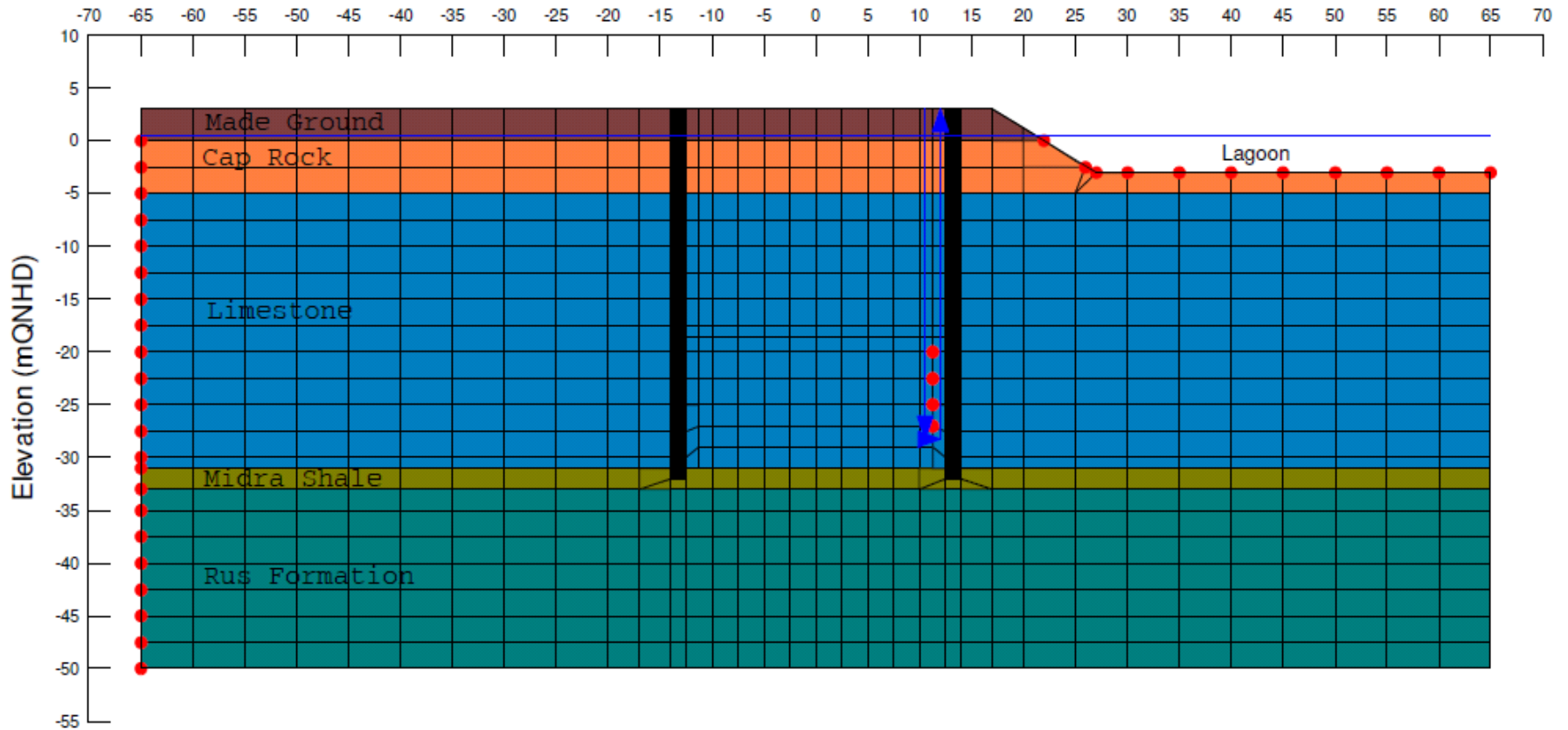


The Current Hydrogeological thinking



WJ GROUNDWATER LIMITED – QIT QATAR LLC

Figure 1: Groundwater Model



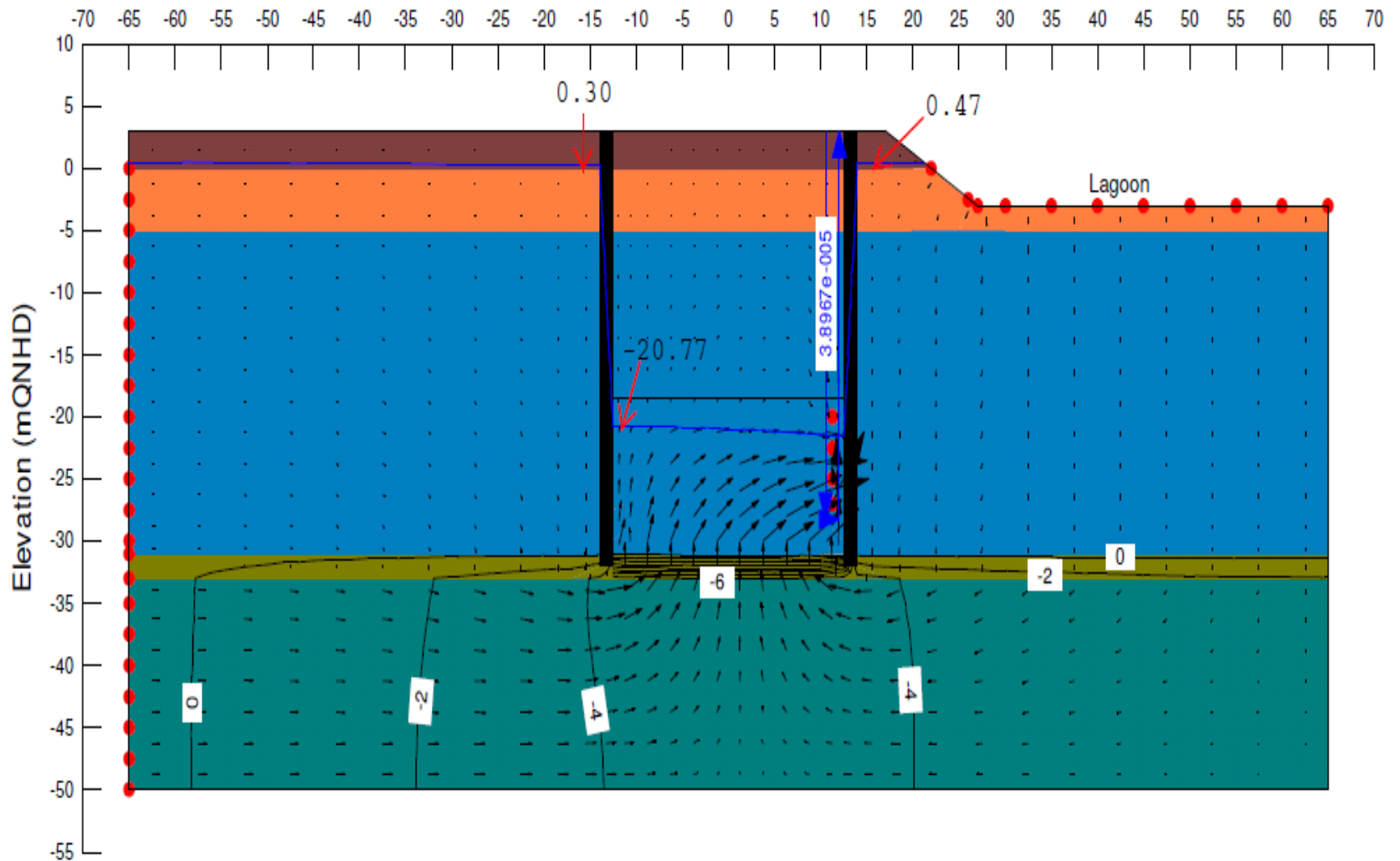
WJ GROUNDWATER LIMITED – QIT QATAR LLC

The following permeabilities have been assumed.

Strata	Permeability (m/s)	k_v/k_h
Made Ground	5×10^{-5}	1
Cap Rock	5×10^{-5}	1
Limestone	5×10^{-5}	14
Midra Shale	2×10^{-7}	1
Rus Formation	5×10^{-5}	1

WJ GROUNDWATER LIMITED – QIT QATAR LLC

Figure 2: Model Output





WJ
WJ GROUNDWATER
Dewatering Solutions
www.wjg.com

