

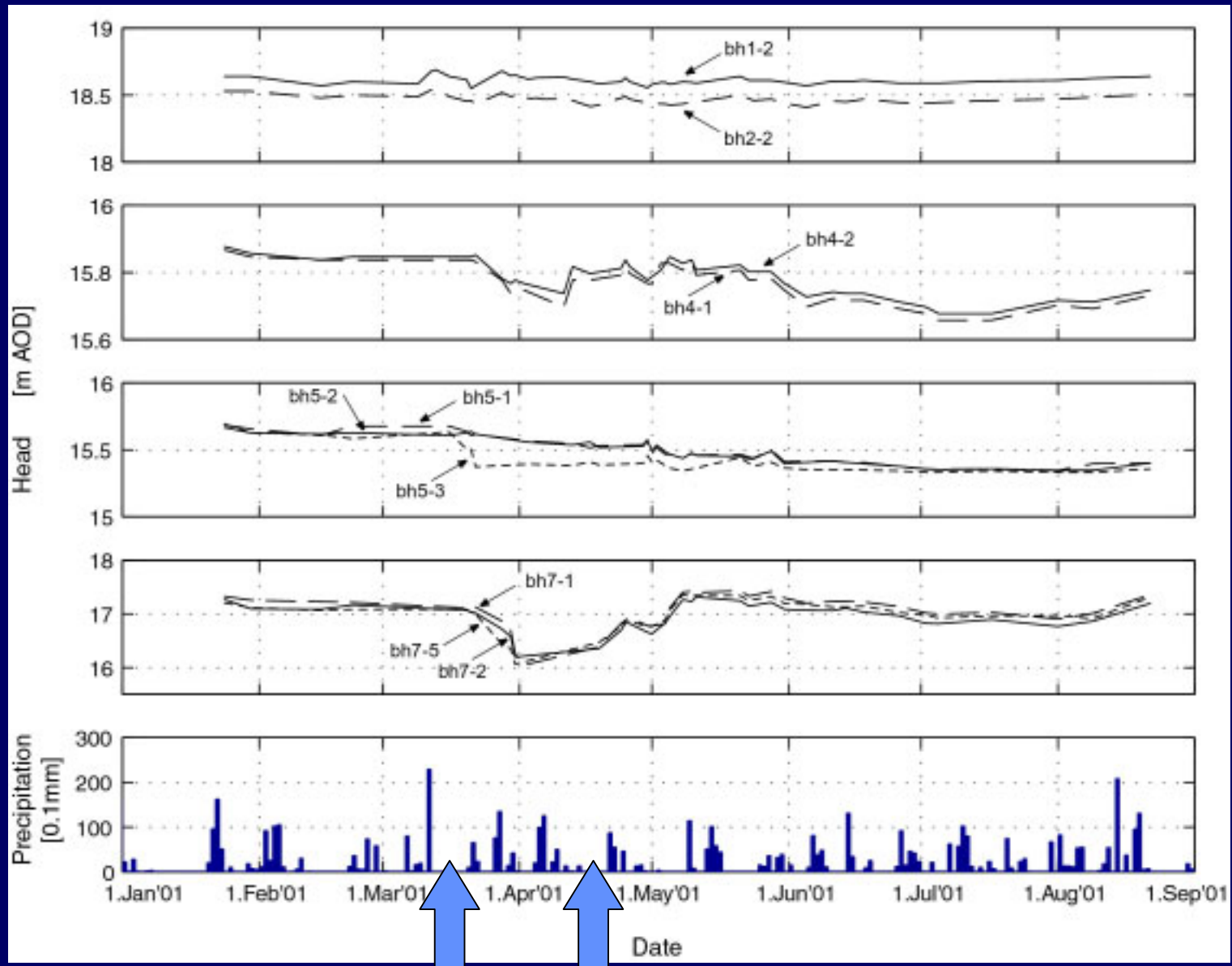
Site Work & Installation



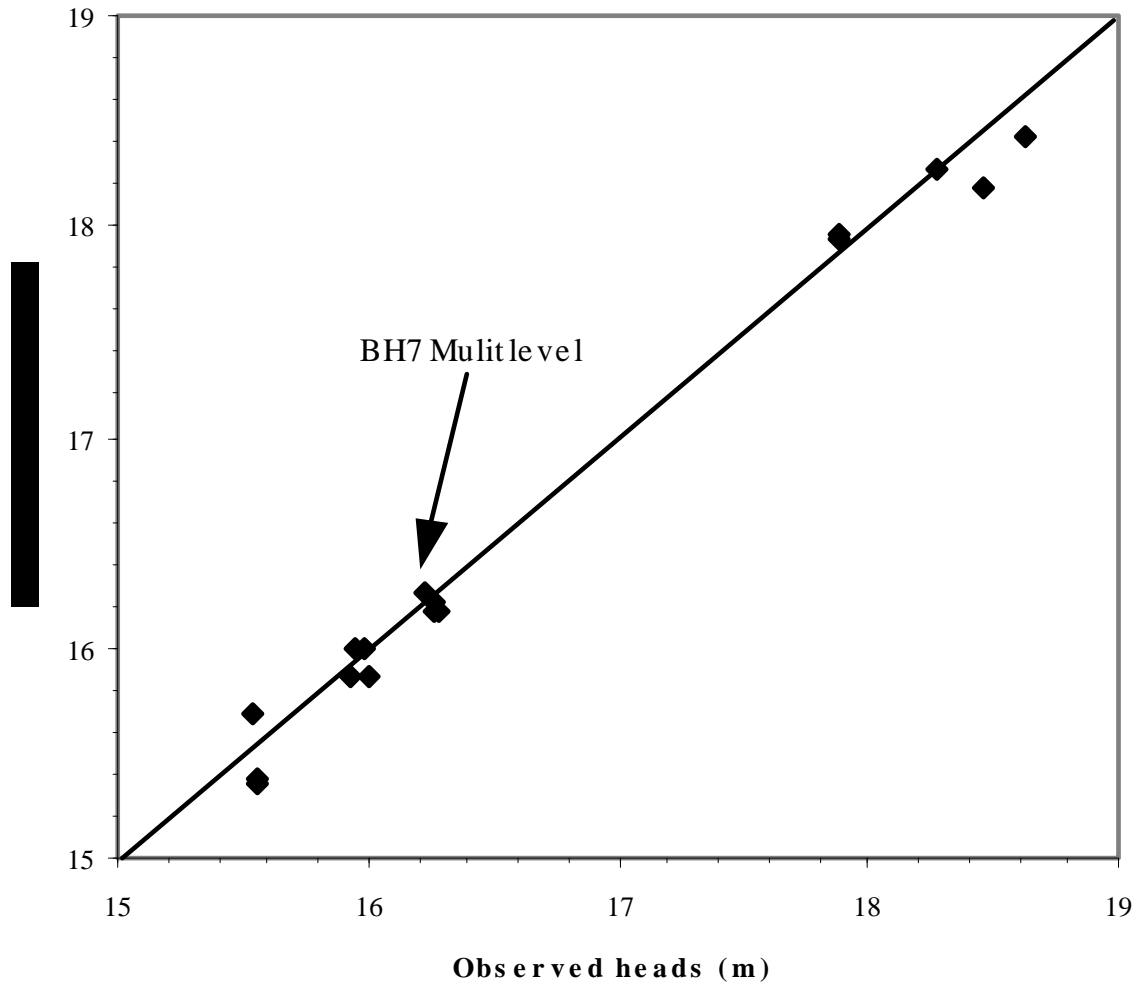
Dewatering of Site required for excavation of underground structures

Large
Scale
Pump
Test





Drawdown of BH7 During Dewatering



Fit of
Observed
and
Modelled
Water Table
at Site
during
Dewatering
Activity



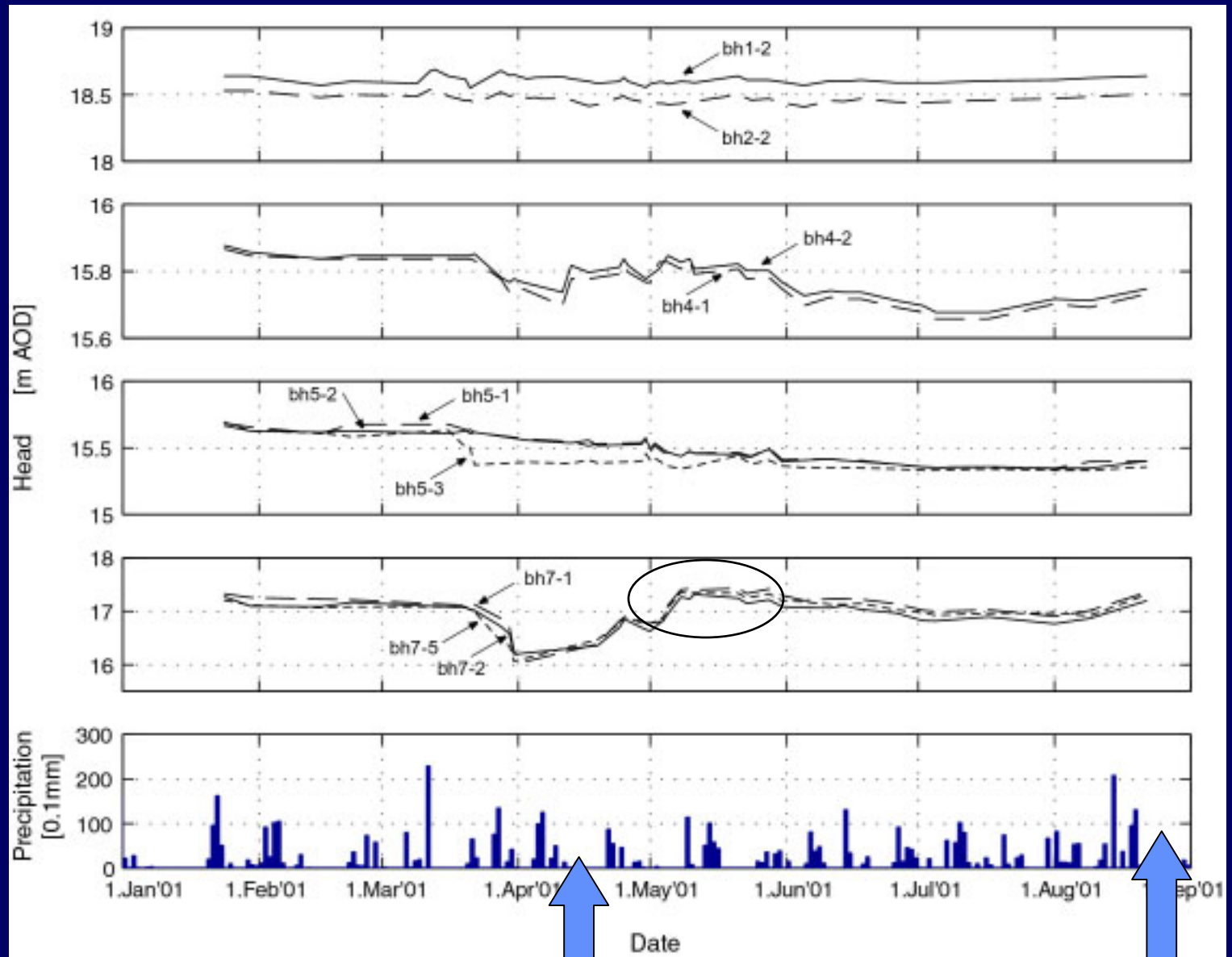






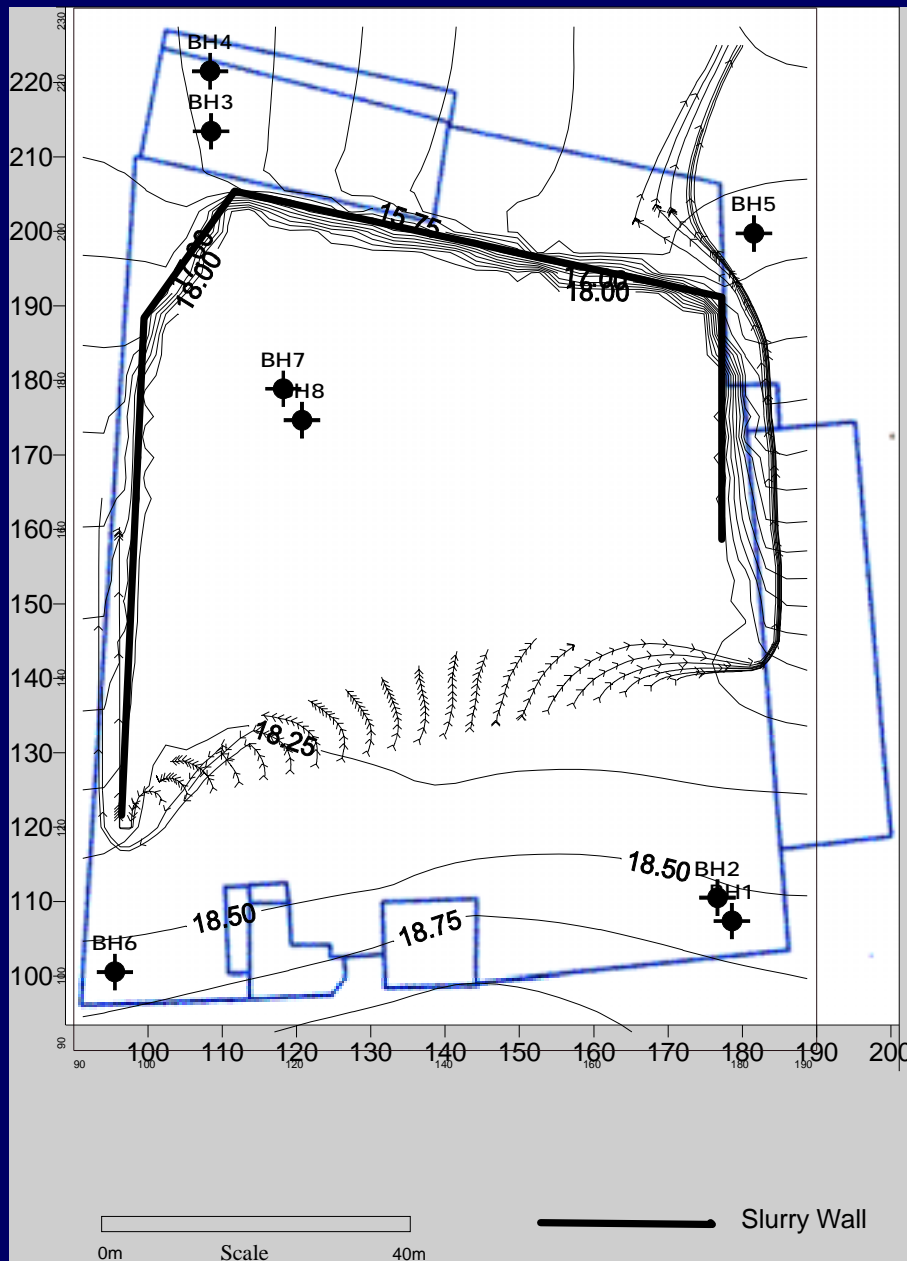


Hydrogeologic Study of Slurry Wall Installation

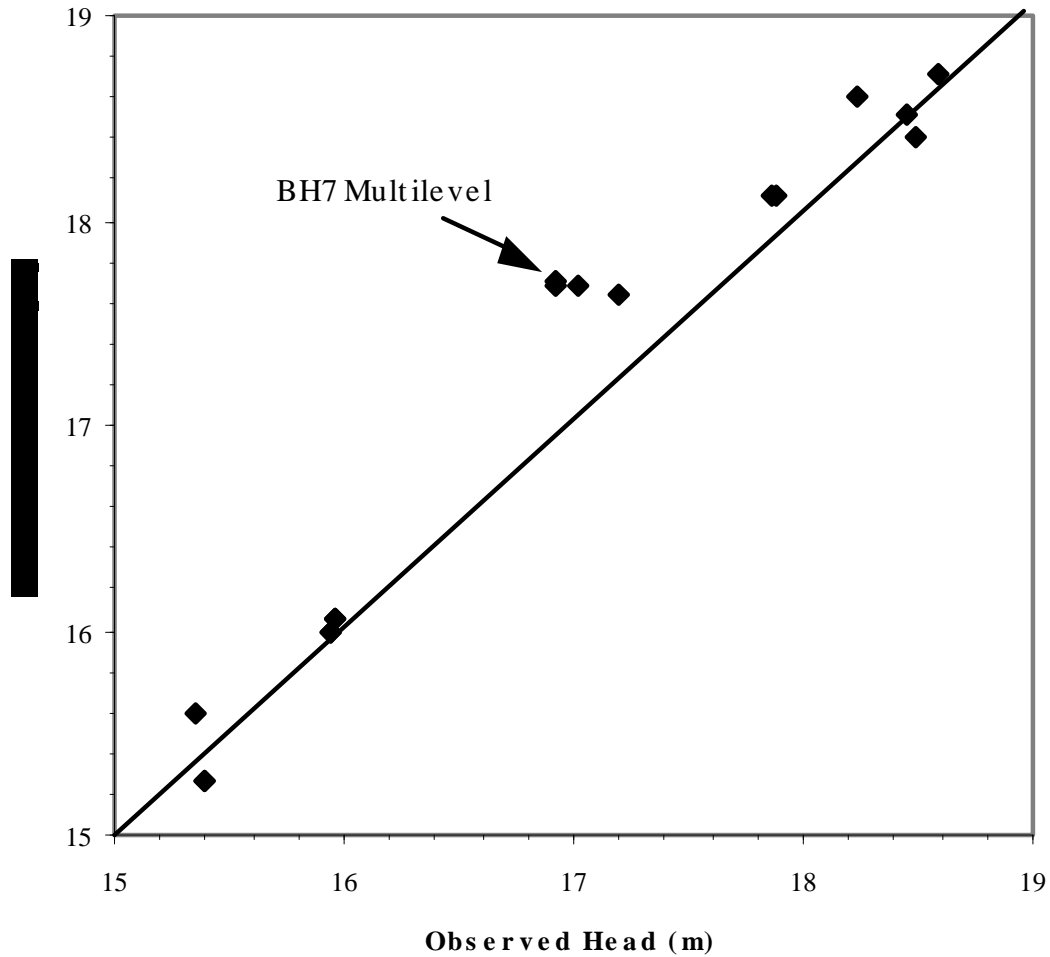


Impermeable Slurry Wall Water Table and Flow Lines

$$K=10^{-11}$$

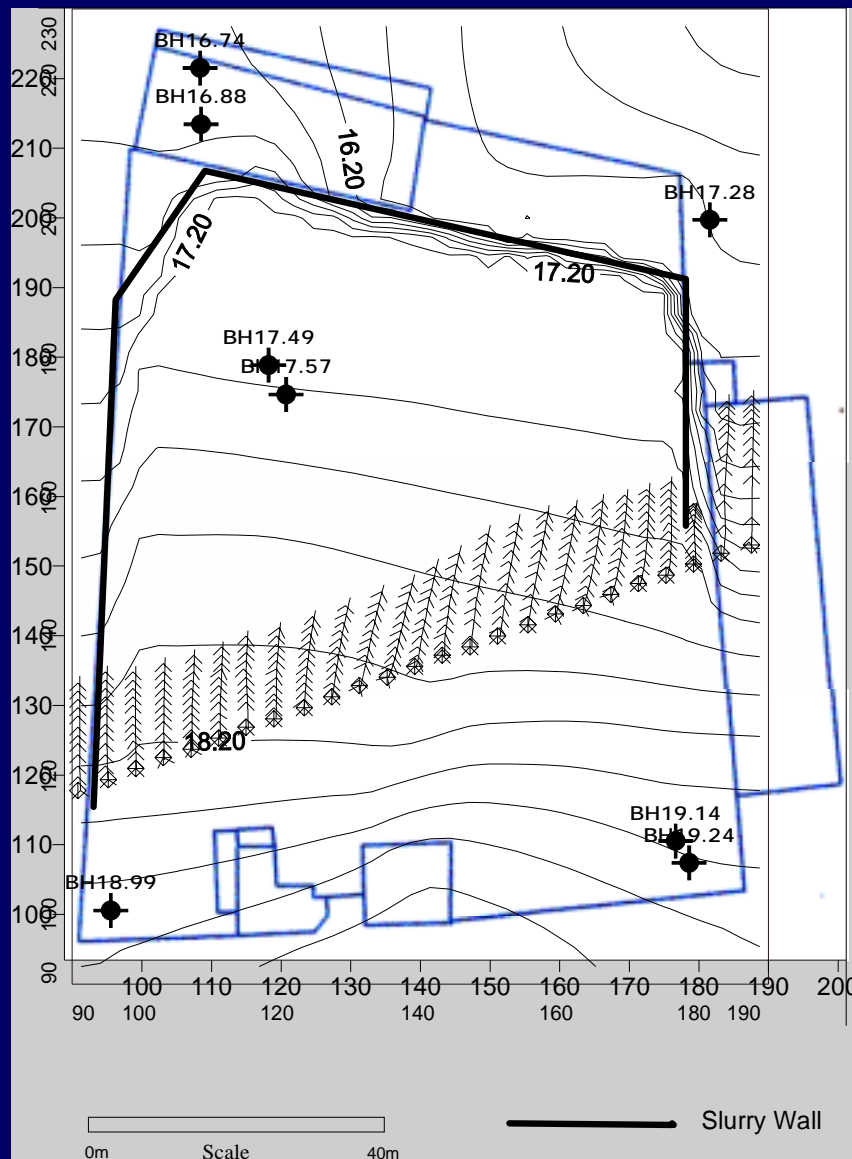


Impervious Slurry Wall



Fit of
Observed
and
Modelled
Water Table
at Site

Impervious
Slurry Wall
 $K=10^{-11}$

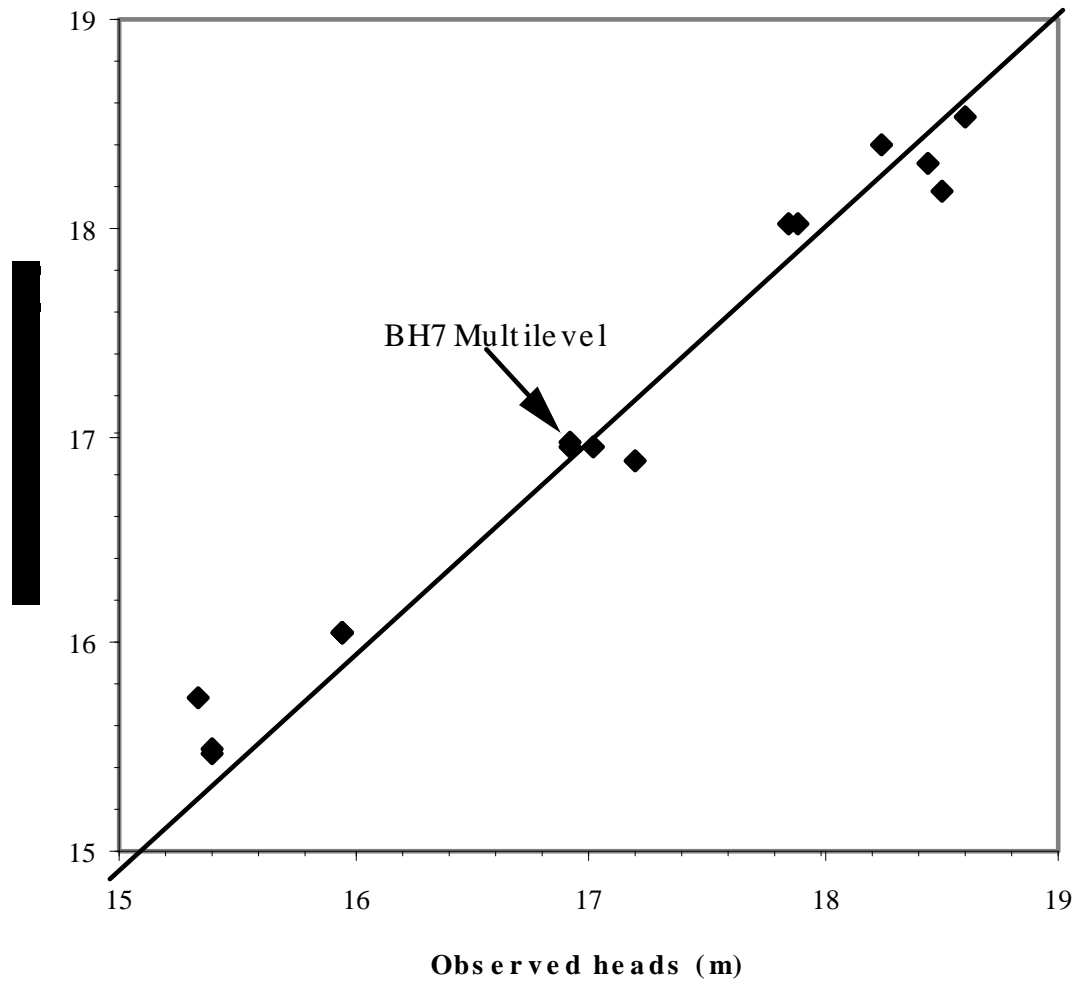


‘Z’ Leakage to
underlying glacial
till deposits

$$K_z = 10^{-9}$$

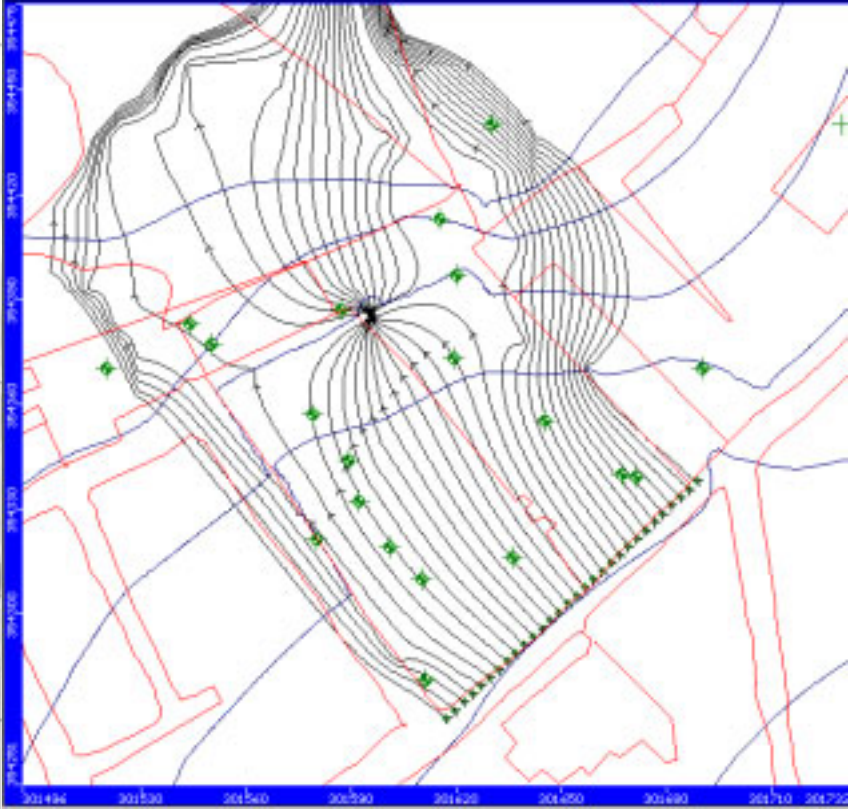
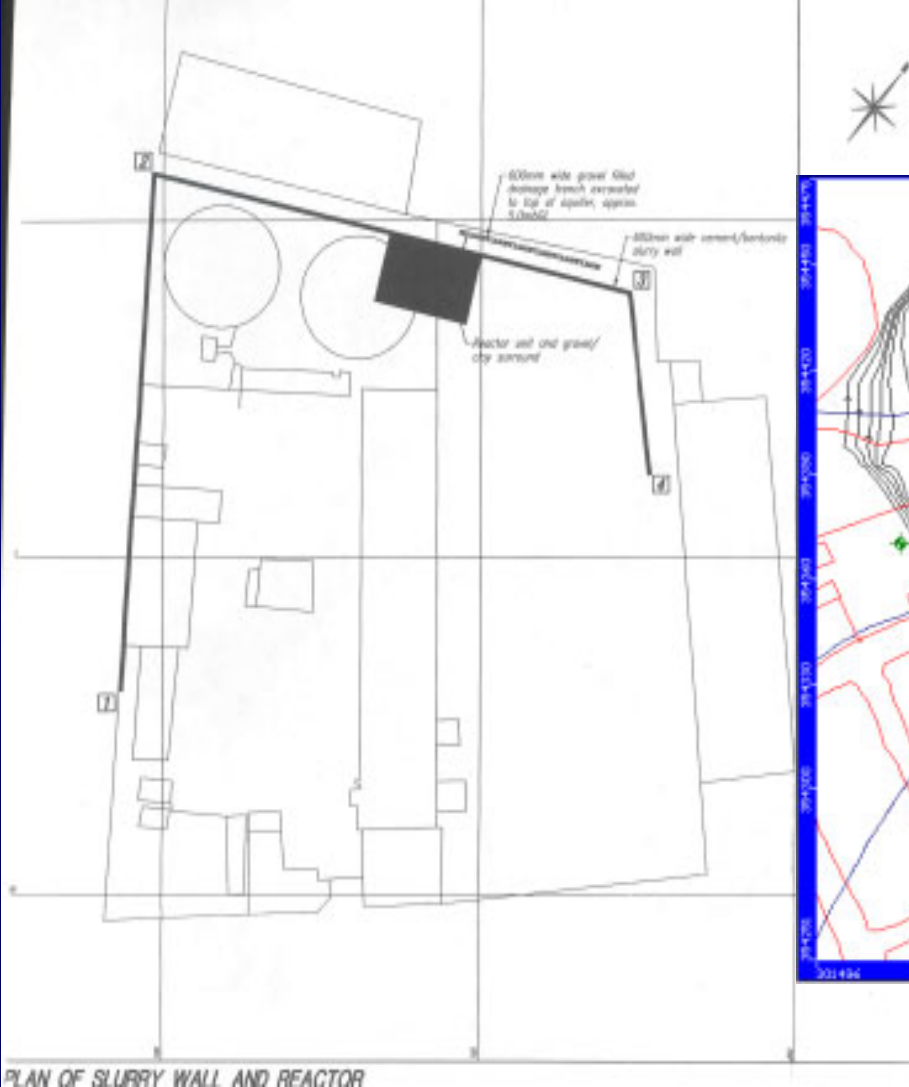
Water Table and
Flow Lines

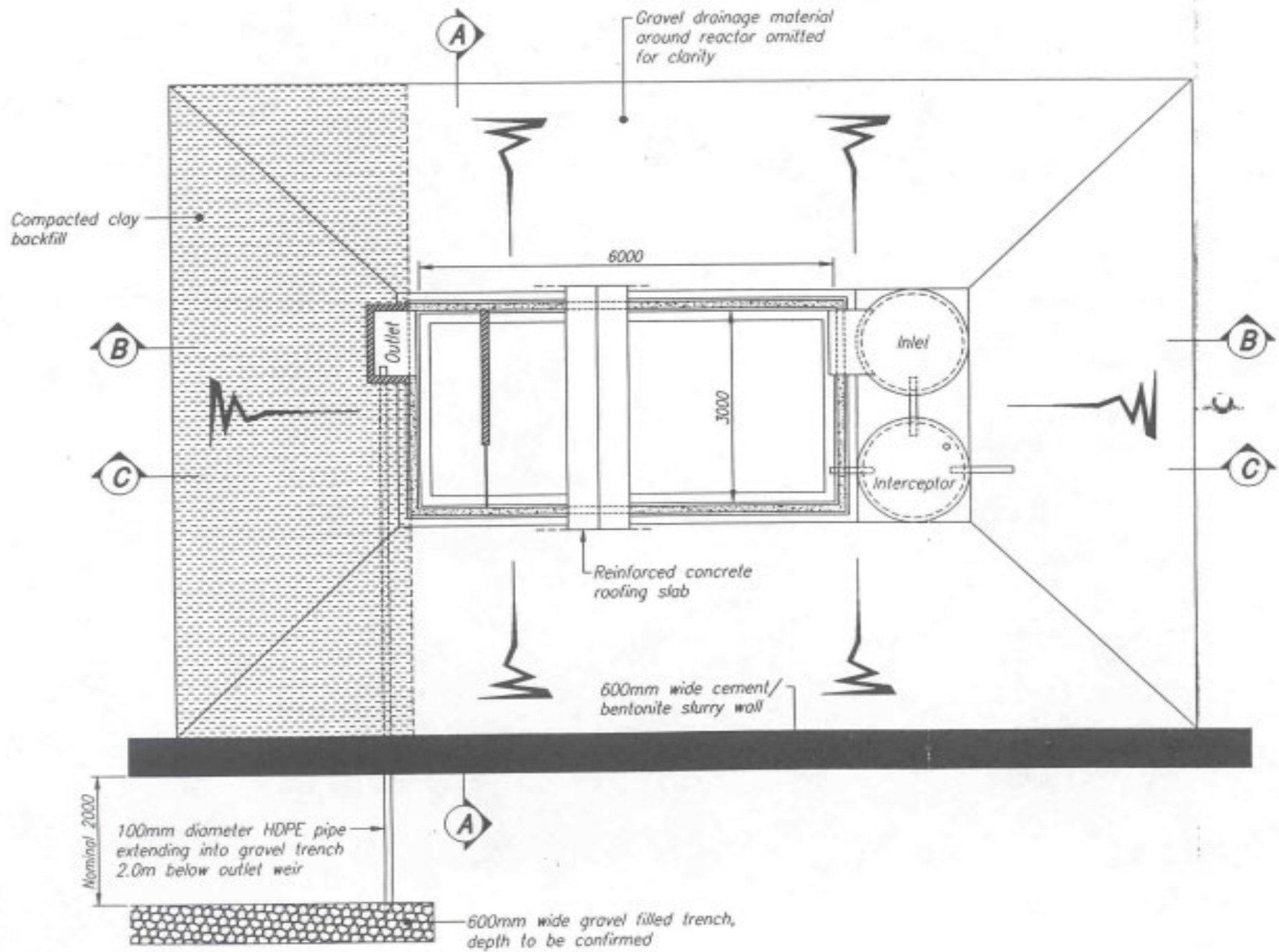
'Leaky' Glacial Till



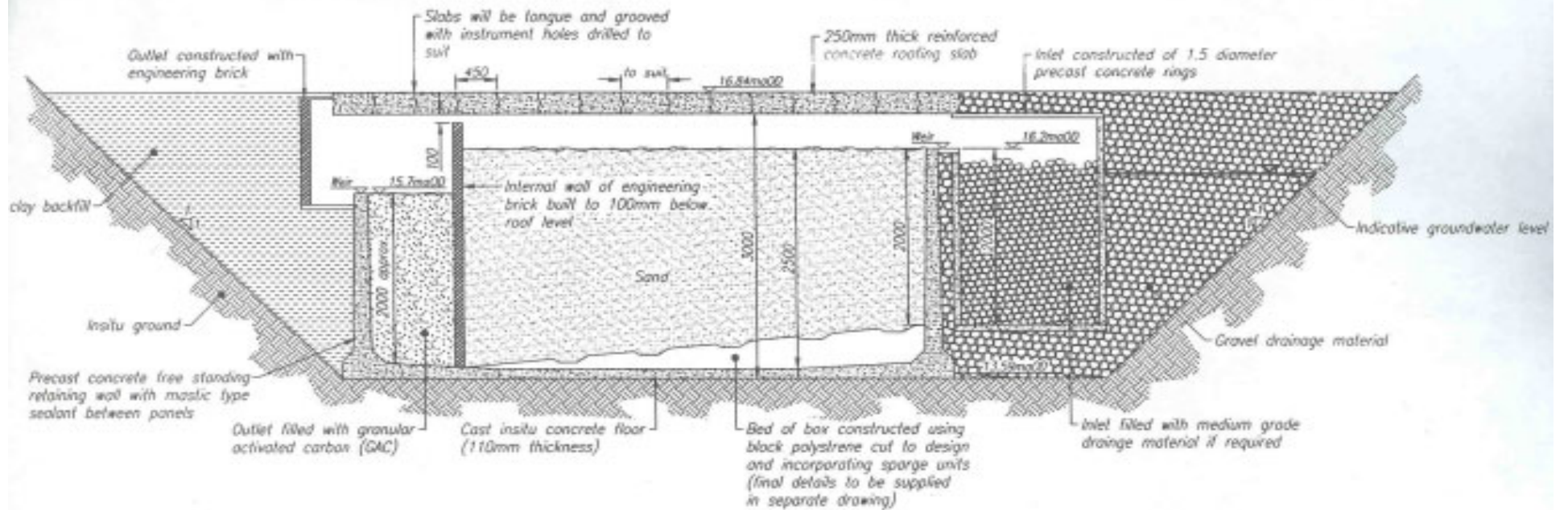
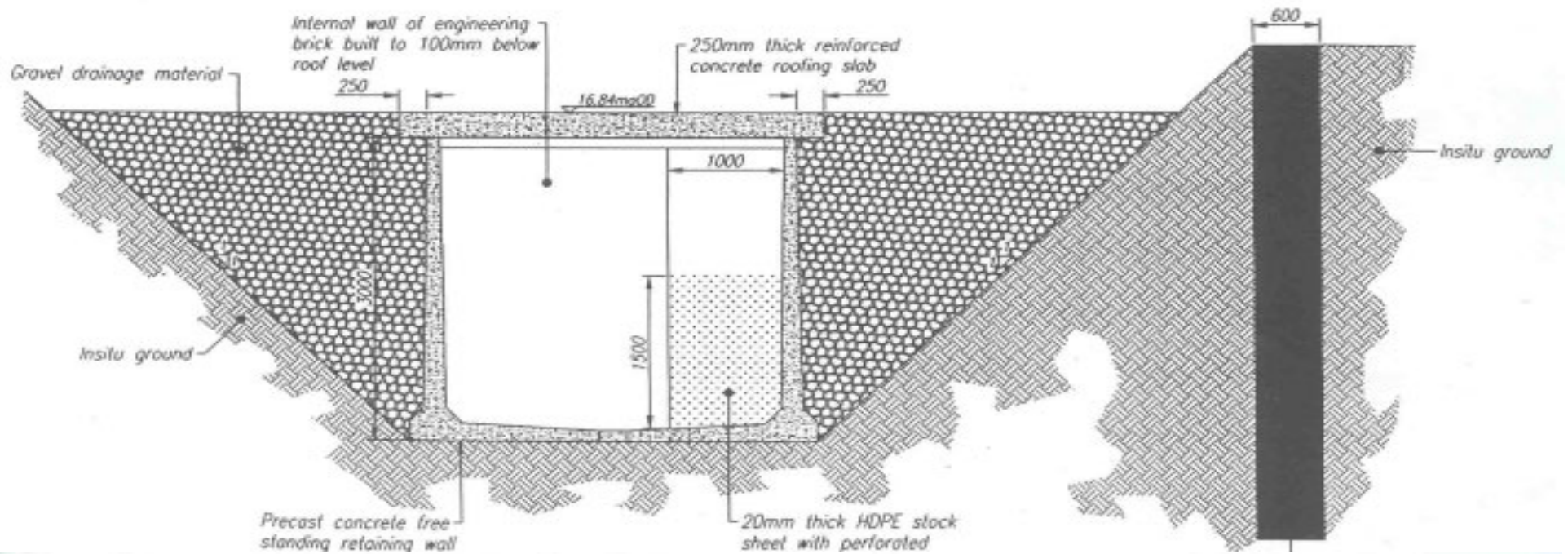
Fit of
Observed
and
Modelled
Water Table
at Site

Install Reactor





PLAN OF REACTOR UNIT



SECTION B-B











Contaminant (mg/l)	Groundwater Plume	Interceptor	After Aerobic PRB Reactor
DRO	13.3	2.6	<0.01
Acenaphthlene	4.8	6.4	<0.01
Acenaphthylene	10.2	5.5	<0.01
Anthracene	1.0	1.6	<0.01
Flouranthene	0.6	0.9	<0.01
Flourine	5.7	9.8	<0.01
Napthalene	320.8	57.7	<0.01
Phenanthrene	3.7	5.4	<0.01
Pyrene	0.4	0.4	<0.01
Substituted Phenol Isomers	4.3	0.6	<0.01
Benzene	6.2	0.4	<0.01
Toluene	1.7	0.07	<0.01
Xylenes	1.0	0.05	<0.01
TOC	83	20	3
Total Cyanides	10.5	8.9	1.5
Arsenic	0.06	0.12	0.07
Nitrate	<0.3	<0.3	6.2
Ammonia	74	19.4	0.8
Sulphate	450	590	530
COD	295	NA	15 (?)

The following compounds are not found above detection limits in the groundwater plume at the EPSRC WPM site: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)flouranthene, Benzo(ghi)perylene, Chrysene, Dibenzo(ah)anthracene, Indeno(123cd)pyrene, Chromium, Cadmium, Copper, Lead, Zinc, Nickel, Mercury

Bob's team took it apart Oct 2002 – Why and lessons:

- ✓ Collect microbiological samples
- ✓ LDPE Liner ripped during heavy rain event
- ✓ 'Cheap construction' allowed by-pass flow (honourable idea but not sustainable)
- ✓ How easy is it to clean one of these out? (Pick Your Weather!!!)
- ✓ Try new hydraulic design internally for controlled flow

✓ We are changing box
as Flood ruined the structure
(1 monthly average rainfall in
1.5 hours saw all streets and
site completely flooded!)

✓ Sampling for microbial repopulation
Using DNA arrays and microtox.

New Box will be shuttered



QUB Strategic Research Infrastructure Grant

Prof. R. Kalin PI

Geo-environmental Engineering Lab

Environmental Tracers Laboratory

Research Offices

Microbial Biotechnology Labs

Mass Spectrometry Labs

SRIF Environmental
Engineering Equipment
Analytical & Field

SRIF Microbial
Biotechnology Equipment
Complete DNA Array

SRIF = £ 2,429,750

QUESTOR Tools = £2,145,000

Technology Development Grant

QUESTOR Tools Staffing

21 new Research Staff

Treatment train (TT)

cf. Source
oxidation (SO)
or EMNA



Source
Reduction
(SR)

cf. Permeable
Reactive Barrier
(PRB)



Pathway
Interception

cf. Monitored Natural
Attenuation (MNA)



Plume
management



QUB Brownfield Development R&D Strategy:

30 Years Source Reduction at active sites

30 Years Boundary Interception at active sites

30 Years MNA Plume in urban environment

New R&D Projects 2003 for
Sustainable Urban Brownfield Remediation Design

BBSRC Link – SEREBAR £1.65M
PRB at active industrial site

EPSRC InStep & NERC Impart - £750K
Enhanced in-situ source treatment
at active industrial site

New Installation Methods & Treatment Cells

Review of existing PRB's with respect to Guidance



Treatment Cell at
QUB Science Park

Treatment of TPH
Source via in-situ
bioremediation over
next 10 years

ECOMESH
UNIQUE VERTICAL HYDRAULIC CLAY BARRIER SYSTEM

Design of geotechnical systems to protect funnel and simplify the use of trench-and-gate PRB Installations



EcoMESH and Keller Ground Engineering (Hayward Baker)

**PRBs in the UK:
New Agency Guidance
Old Friends &
New Sequential Reactors**

**Message from UK to USA...
What about decommissioning
Iron walls?**