

MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU –
SHENZHEN – HONG KONG EXPRESS RAIL LINK

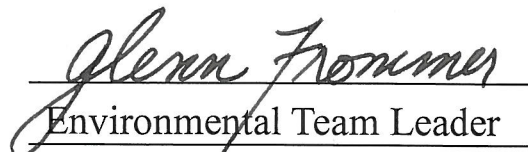
(No. EP-349/2009/B)

Groundwater Monitoring and Contingency Plan
for North Section of Approach Tunnel
(Contract 811A)

Certified by:

Position:

Date:


Environmental Team Leader

21 MAR 2011

MTR Corporation Limited

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Verified by:

A handwritten signature in black ink, appearing to read 'A. F. Chan', written over a horizontal line.

Position:

Independent Environmental Checker

Date:

23 March 2011

Express Rail Link Contract 811A:
WKT Approach Tunnel (North)



GROUNDWATER MONITORING PLAN
AND
CONTINGENCY ACTION PLAN

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Prepared By:	Checked By:	Approved By:	Date:
Kevin Wong Environmental Officer	Keith Gordon HSE Manager	Bob Aylmer Project Manager	21 March 2011

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Groundwater Monitoring and contingency action Plan

Groundwater monitoring shall be undertaken in accordance with the approved drawings for monitoring works, fulfill the condition 2.11 of Environmental Permit No. EP-349/2009/B and a monthly monitoring report presenting daily records of groundwater level and analyses for the variations shall be submitted to the Engineer. Any recommendations made and remedial actions taken in controlling the groundwater should also be documented in the monthly report.

1. General Requirements

- All necessary actions shall be taken to ensure that the works will not adversely affect the existing buildings, structures and utilities in the close proximity of the site;
- Prior to the commencement of construction works, base readings of all monitoring instruments shall be established and agreed with the Engineer. A set of initial readings for all instruments shall be submitted to the Engineer for record purpose;
- During the construction works, the piezometers and standpipe shall be monitored daily or more frequently as required by the Engineer. For Details the PZ&SP (Piezometer/ Standpipe) within 50m of active construction works (influence zone) are being monitored daily. The others are on a weekly basis;
- Whenever, a significant difference between successive readings is observed/ recorded, the Engineer is to be informed instantly;
- A complete set of monitoring records including plots of readings versus time shall be continuously updated and kept on site and made available for inspection upon request by the Engineer/ local authority; and
- Contractor shall be responsible for the maintenance of the monitoring points during the construction works. Any damaged instruments shall be repaired/ reinstated or replaced as directed by the Engineer or his representative on site;

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2. Monitoring Locations

Locations for the standpipes and piezometers were provided in Drawing No. 811AW/308/AAT/C05/101 B, A copy of the drawing is attached.

Summary of the standpipes and piezometers are:

Instrument Type	Instrument No.	Provisional Installation Depth (mPD)
Piezometer	PZ1	-30
	PZ2	-30
	PZ3	-30
	PZ4	-30
	PZ5	-30
	PZ6	-30
	PZ7	-30
	PZ8	-30
	PZ9	-30
	PZ10	-30
	PZ11	-30
Standpipe	PZ18	-30
	SP13	-8
	SP14	-8
	SP15	-8
	SP16	-8
	SP17	-8

Note:

- This table is abstracted from Drawing No. 811AW/308/AAT/C05/101B& 811AW/308/AAT/C06/014B.
- Except for PZ1 & SP17, all PZ&SP have been installed. Due to access problem , PZ1&SP17 which are locating outside 50m zone have not been installed yet. Alternative locations to be updated regularly for monitoring.

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3. Monitoring Frequency

With reference to Drawing No. 811A/W/308/AAT/C06/014 B, monitoring frequency for the standpipes and piezometers are shown as below:

Instrument type	Background/ Standard/ Active monitoring frequency		
	Background	Standard	Active
Piezometer (PZ)/ Standpipe (SP)	Monthly	Weekly	Daily

Our Site Engineer Mr. Ryan Cho will be in charge of the monitoring record and report the record regularly for client inspection. (sample of the daily monitoring report attached as appeneix)

Methodology of ground water level monitoring- as below extracted summary:

- Baseline reference shall be taken as lowest measured groundwater table from the standpipes, piezometers and observation wells before the commencement of dewatering works on site.
- Abnormally high or abnormally lower groundwater levels may have an adverse effect on the adjacent existing structure by inducing either over dewatering or water-logged soil conditions, respectively.
- It is expected that the dewatering for the construction of the tunnel may lower water levels locally, and in the short-term only. It is not anticipated that the construction of the tunnel would have a long term effect on groundwater levels as the hydro static pressures within the ground would allow the groundwater to equalize around the new structures.
- When groundwater levels fall below or rises above the permitted tolerance ranges, for any of the selected wells, for a period of more than 48 hours (without significant rainfall), then the contractor will, in accordance with the Event/ Action Plan, formulate a proposal for, and implement, a course of action to rectify the situation and bring ground water levels back within range.
- In general terms, where groundwater levels are observed to be too low within the selected well(s), additional water can be added through the recharge wells. Where the level is too high, excess groundwater can be pumped out of the ground and discharged into the mains drains.

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4. Alert, Action and Alarm (AAA) Level, EIA action level and Contingency Actions

With reference to Drawing No. 811AW/308/AAT/C06/014 B the AAA response values for the water table (lowest groundwater level) are shown as below:

Piezometer/ Standpipe No.	Alert (m)	Action (m)	Alarm (m)	EIA Action Level (m)
All Piezometers/ Standpipe	0.5	0.75	1.0	2.0

Note:

- The reference level is a baseline to check if any groundwater drawdown reaches AAA response values(0.5-0.75-1m)
- The reference level will be defined later as the lowest groundwater table measured before the commencement of dewatering works on site.
- In line with the recommendation made in the EIA report where its Appendix 11.8 "Hydrogeological Impact Assessment" refers, the "EIA action level"

The Alert, Action, Alarm levels for all geotechnical instrumentations are specified on drawing no. 811AW/308/AAT/C06/014 B Once the monitoring readings reach these levels. The following contingency actions should be taken:

A. Alert Level Exceed

1. The contractor shall inform the engineer;
2. The contractor shall immediately submit a written report to the engineer reviewing all total and differential movements/distortions to date. Assessing the effects of the movements/distortion on monitored elements and predicting further movements and their effect on monitored elements based on the trend to date;
3. Where it is considered and agreed by the engineer that movement trends indicate that "action level" may be reached during the course of works. The contractor shall submit proposals for remedial measures to limit further movement for the approval of the engineer. The remedial proposals shall be reviewed and the Engineer advised as to their likely efficacy.

B. Action Level Exceed

1. The contractor shall inform the MTR's Engineer and Building Department's Geotechnical Officer (BD/GEO) shall be informed immediately;

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2. The contractor shall immediately instigate the approved remedial measures in accordance with the contractor's method of construction. Agreed at the "alert level" status;
3. Works may then only proceed if the remedial measures have been implemented and are in the opinion of the engineer shown to be effective;
4. The contractor shall submit an updated report reviewing the movements including differential movements and distortion. The report shall assess the effects on monitored elements and predict further movement and their subsequent effect on monitored elements. In addition, revised "alert level" and "action level" values which take into account the implemented remedial works shall be submitted and approved by the engineer before works may continue.

C. Alarm Level Exceed

1. The contractor shall inform the engineer and BD/GEO shall be informed immediately;
2. The site works shall be suspended. Requirements for resumption of construction and a complete review of the construction methods will be required as instructed by the engineer;
3. The contractor shall be required to provide a report detailing the full history of the movements and remedial measures adopted in relation of the actual construction sequence. The report shall contain a review and interpretation of the events and give recommendations for enabling the work to proceed;
4. Works may only resume upon the written instruction of the engineer.

Note:

- In case of AAA exceedance, any actual remedial measures are proposed in an Investigation report by reviewing various surrounding conditions.

Procedure for Trigger Level Exceedance

Communication of Trigger Level Exceedance

It is essential that instruments that reach Response Values be promptly reported to MTRC and Construction Team so that the predefined Response Actions can be implemented. Communication of instruments that have reached a Response Value will be by a combination of verbal and written reports (e-mail Daily Summary of Response Value Breaches, Investigation Report).

Emergency contact numbers of the Contractor's Staff will be circulated to all relevant parties. The procedures for informing personnel and other relevant stakeholders when a

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Response Value is exceeded are described in attached Workflow for Instrumentation Monitoring.

Instruments which Reach Alert Value

Instruments that reach Alert Value will be reported to the Construction Team, MTRC and Independent Monitoring consultant (IMC)- MaxWell within 24 hrs after the exceedance. The contractor shall immediately submit a Investigation Report with an updated Investigation Report (IR) Log to the Engineer reviewing all total and differential movements/distortions to date, assessing the effects of the movements/distortions on monitored elements and predicting further movements and their effect on monitored elements based on the trend to date.

The initial IR shall, be based on the Generalised Plan of Action, incorporate initially more passive Response Actions to be implemented for reaching the Alert Level and more active Response Actions to be implemented upon reaching the Action Level. Implement the Response Actions identified in the IR for reaching an Alert Level. These may include the installation of additional instruments. Regular site inspection and closely monitoring shall be carried out.

It will be the responsibility of the Geotechnical Engineer (Instrumentation) (GEI) to coordinate preparation and submission of the initial IR and ensure that all relevant parties are informed. The IR will be agreed and endorsed by the Registered Geotechnical Engineer (RGE)- Aecom and will be submitted to the MTRC for record.

Where it is considered and agreed by the Engineer that movement trends indicate that "Action Level" may be reached during the course of the works, the Contractor shall submit proposals for remedial measures to limit further movement for the approval of the Engineer. The remedial proposals shall be reviewed and the Engineer advised as to their likely efficacy.

Instruments which Reach Action Value

Instruments that reach Action Value will be reported to the Construction Team, MTRC and IMC. Where considered necessary, the exceedance will also be reported to other relevant stakeholders, relevant utilities owner or other private owner.

The GEI will advise the relevant Section Head of the Construction Team to implement the predefined detailed plan of action to prevent the Alarm Value being reached. The actions may need to be revised depending on the actual site conditions and a review of the surrounding data and engineering interpretation. Other instruments at the surrounding, structures & utilities will also be reviewed to obtain a broader understanding of induced settlements and any adverse trends. Site inspections shall be carried out in the vicinity of the exceedance and report any signs of distress or damage immediately.

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An updated IR will be provided which will be reviewed against the current construction activities and whether the measured movements are in line with the predicted levels. A predefined emergency plan of action form will also be prepared which identifies the predefined actions including active response actions to be implemented in the event that the Alarm Level is reached. Where appropriate, the predefined emergency plan of action will be agreed with the relevant owner.

It will be the responsibility of the Instrumentation Engineer to coordinate preparation and submission of the updated IR and ensure that all relevant parties are informed. The updated IR will be agreed and endorsed by the RGE and will be submitted to the MTRC for record.

Instruments which Reach Alarm Value

Instruments that reach Alarm Value will be reported to the Construction Team, MTRC and IMC. Where considered necessary, the exceedance will also be reported to other relevant stakeholders, relevant utilities or other private owner. This will be communicated either through the Engineer or directly from the Contractor (to be agreed with the Engineer in the instrumentation meeting).

The GEI will advise the relevant Section Head of the Construction Team to implement the predefined emergency plan of action to prevent any further movement. The actions may need to be revised depending on the actual site conditions and a review of the surrounding data and engineering interpretation. Other instruments at the surrounding, structures & utilities will also be reviewed to obtain a broader understanding of induced settlements and any adverse trends.

It will be the responsibility of the GEI to coordinate preparation and submission of the updated IR and ensure that all relevant parties are informed. If the GEI considers that there is a real risk to the safety of the construction works which may warrant stoppage of the Works, he will inform the Project Director and the MTRC immediately and make a recommendation that the works be stopped and/or that emergency actions be implemented. The Project Director will decide whether the works should be stopped. In the event that the Project Director decides to stop the works, the works may only recommence upon the agreement of the Project Director. Where appropriate, the Project Director will directly contact the relevant Section Heads of the Construction Team to discuss and agree the implementation of the proposed EPA(Emergency Action Plan) to prevent further movements. The common method may be applied such as re-charging method or other means of the temporary works (construct the slurry wall) etc.

Review of Effectiveness of Response Actions

Intense monitoring will continue following the implementation of the Response Actions to verify whether the Actions are having the desired effect of controlling movements and safeguarding the structure. The effectiveness of the Response Actions will be reviewed during the Regular Instrumentation Review Meeting.

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The effectiveness of the response actions will also be reviewed in the GIIR (Geotechnical Instrumentation Interpretative Report) The review may include the instrumentation data and trends, an assessment of the current stage of construction activities and a prediction of further deformation or responses as a result of implemented Response Actions and current construction activities.

5. Event/Action Plan for Excessive/ Insufficient Groundwater Levels

	Event	Contractor's Geotechnical Engineer (Instrumentation) (GEI)	Contractor	MTR	Potential measure will be taken by contractor	MTR's ET Leader
Trigger Levels	(a)Alert Level more than 0.5m below lower baseline level	(a1) will be reported to the Construction Team, MTRC and Independent Monitoring consultant (IMC)- MaxWell within 24 hrs after the exceedance. submit a Investigation Report with an updated Investigation Report (IR) Log to engineer	(a1)Regular site inspection and closely monitoring shall be carried out. (a2) continue to monitor, if groundwater level does not rise again to within tolerance range within 48 hours, and review the construction method to minimize the groundwater drawdown.	To review the Investigation Report with an updated Investigation Report (IR) Log	(a 1) No Action (a 2) Increase groundwater recharge rate. Daily monitoring until groundwater levels return to within tolerances	--
	(b)Action Level more than 0.75m below lower baseline level	(b1) will be reported to the Construction Team, MTRC and IMC. Where considered necessary, the exceedance will also be reported to other relevant stakeholders, relevant utilities owner or other private owner. GEI will advise the relevant Section Head of the Construction Team to implement the predefined emergency plan of action to prevent any further movement (b2) updated IR will be provided which will be reviewed against the current construction activities and whether the measured movements are in line with the predicted levels. A predefined emergency plan of action form will also be prepared which identifies the predefined actions including active response actions to be implemented in the event that the Alarm Level is reached	(b1)The actions may need to be revised depending on the actual site conditions and a review of the surrounding data and engineering interpretation. Other instruments at the surrounding, structures & utilities will also be reviewed to obtain a broader understanding of induced settlements and any adverse trends. Site inspections shall be carried out in the vicinity of the exceedance and report any signs of distress or damage immediately. (b2)The updated IR will be agreed and endorsed by the RGE and will be submitted to the MTRC for record. continue to monitor, if groundwater level does not rise again to within tolerance range within	To review the Investigation Report with an updated Investigation Report (IR) Log	(b1) No Action (b2) Increase groundwater recharge rate. Daily monitoring until groundwater levels return to within tolerances. Review dewatering and recharging rates to identify the suspected leakage location. Submit remedial proposal to MTR.	--

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			48 hours and investigate the ground movements and building movements in the adjacent areas.			
	(c)Alarm Level more than 1.0m below lower baseline level	<p>(c1) The GEI will advise the relevant Section Head of the Construction Team to implement the predefined emergency plan of action to prevent any further movement. The actions may need to be revised depending on the actual site conditions and a review of the surrounding data and engineering interpretation. Other instruments at the surrounding, structures & utilities will also be reviewed to obtain a broader understanding of induced settlements and any adverse trends.</p> <p>(c2)GEI to coordinate preparation and submission of the updated IR and ensure that all relevant parties are informed. If the GEI considers that there is a real risk to the safety of the construction works which may warrant stoppage of the Works, he will inform the Project Director and the MTRC immediately and make a recommendation that the works be stopped and/or that emergency actions be implemented.</p>	<p>(c1) will be reported to the Construction Team, MTRC and IMC. Where considered necessary, the exceedance will also be reported to other relevant stakeholders, relevant utilities or other private owner and to follow the emergency plan and remedial plan</p> <p>(c2) the Project Director decides to stop the works, Project Director will directly contact the relevant Section Heads of the Construction Team to discuss and agree the implementation of the predetermined EPA to prevent further movements. The common method may be applied such as re-charging method or other means of the temporary works (construct the slurry wall) etc. Continue to monitor, if groundwater level does not rise again to within tolerance range within 48 hours and Review the construction method and suspend the work if necessary</p>	To review the Investigation Report with an updated Investigation Report (IR) Log.	<p>(c1) No Action</p> <p>(c2) Increase groundwater recharge rate. Increase the monitoring frequency of ground and building settlement markers in the adjacent areas. Daily monitoring until groundwater levels return to within tolerances. Implement the predetermine EPA . Implement the remedial proposals and suspend the works until the groundwater level rises to within tolerance range.</p>	--
Trigger EIA Action level	(c) EIA Action level more than 1.0m below lower baseline level	Notify the MTR's ET leader or his representative EEII	Action per (a1), (b1), (b2), (c1) and (c2) as above. Submit the respective remedial mitigation proposal to MTR's ET Leader.	To review the Investigation Report with an updated Investigation Report (IR) Log	Action per (a1), (a2) (b1), (b2), (c1) and (c2) as above, Implement the predetermine EPA . Submit the respective remedial mitigation proposal to MTR's ET Leader.	Carry out investigation and repeat monitoring of the well to clarify the result. Record the investigation result and satisfactory remedial action implementation on the contemporaneous log-book.

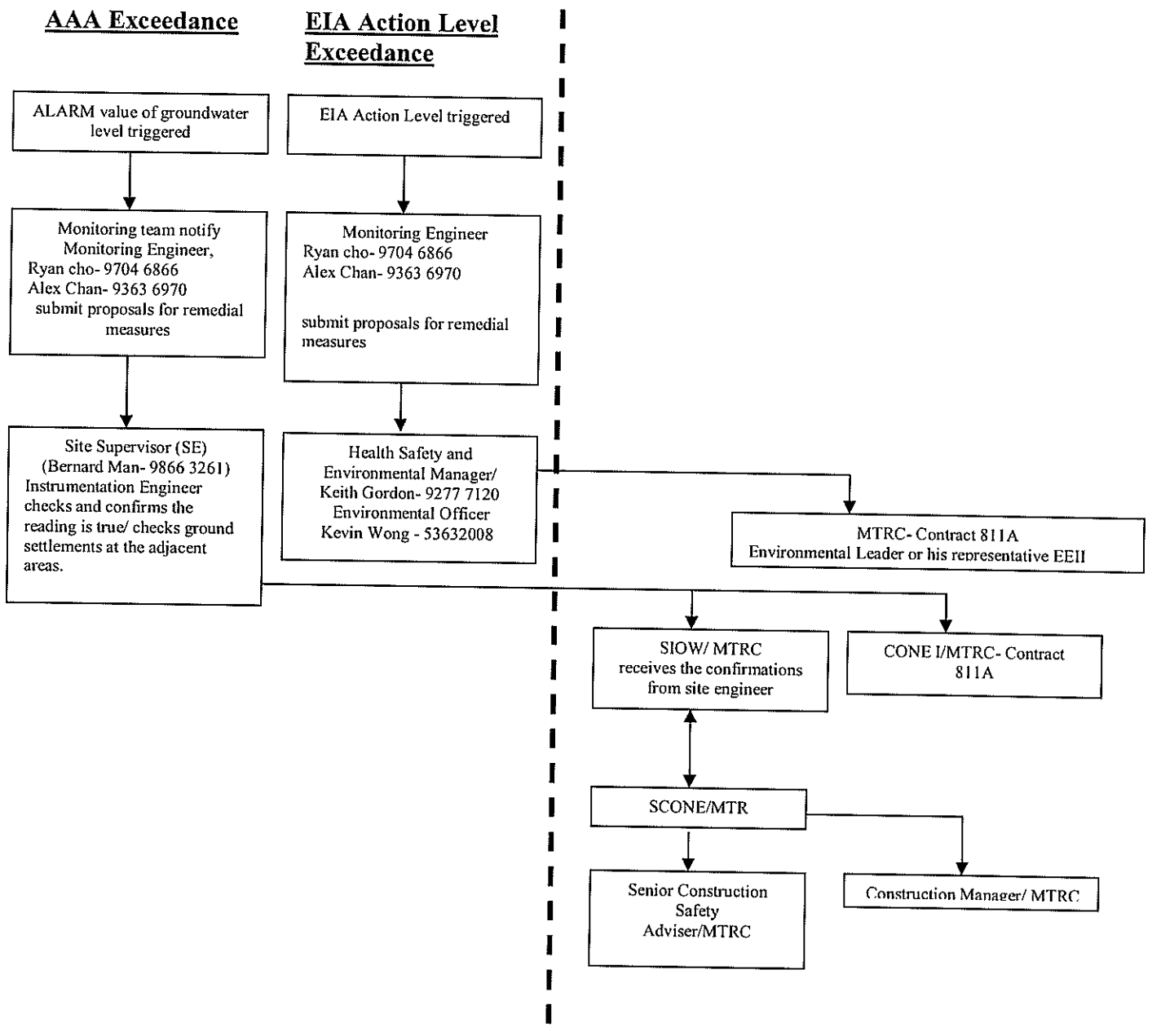
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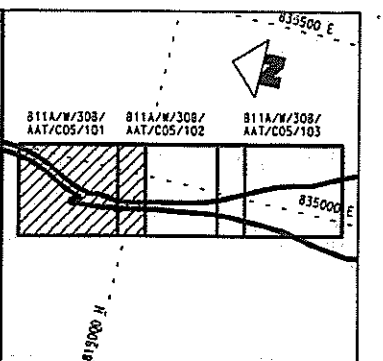
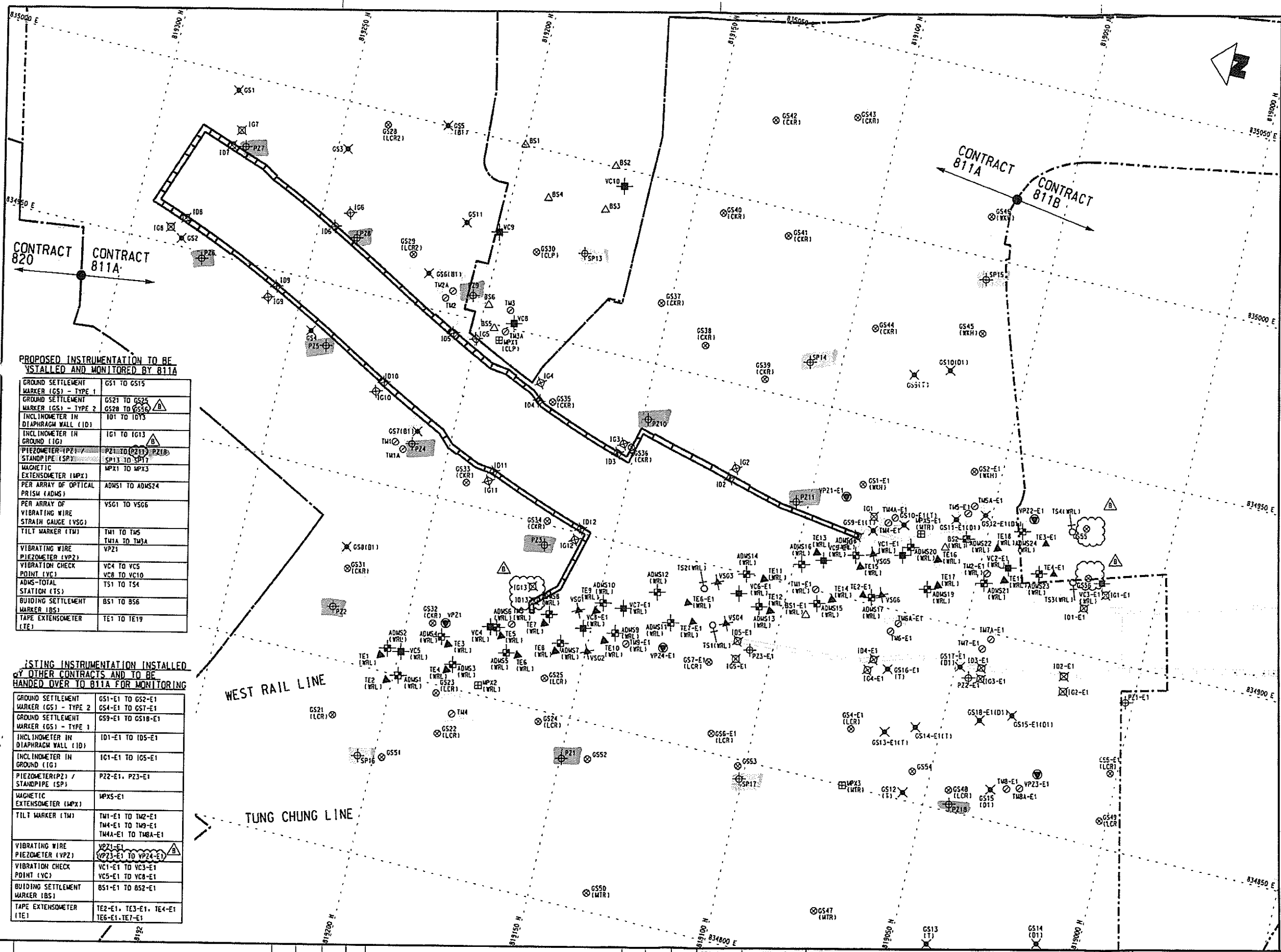


Contract 811A-West Kowloon Terminus Approach Tunnel (North)
Groundwater Monitoring AAA Value Emergency Notification

Contractor SIDE

MTRC SIDE





- NOTES:**
- FOR TYPICAL DETAILS REFER TO DRAWING NO. 811A/W/308/AAT/C05/012 & 013.
 - THE INSTRUMENTATION SHOWN ON THIS PLAN INCLUDES MONITORING OF EXISTING UTILITIES. SHOULD THERE BE DIVERSION OF EXISTING UTILITIES, THE SAME NO OF MONITORING POINTS AND SAME MONITORING FREQUENCY SHALL BE PROVIDED.
 - THE LOCATION OF INSTRUMENT SHALL BE DETERMINED ON SITE SUBJUGATED TO THE ENGINEER APPROVAL.
 - CONTRACTOR SHALL KEEP THE SAME FREQUENCY TO THE EXISTING INSTRUMENTATION HANDOVERRED BY 803A.

- LEGEND:**
- GAZETTE BOUNDARY
 - CONTRACT BOUNDARY
 - BUILDING SETTLEMENT MARKER (BS)
 - GROUND SETTLEMENT MARKER (GS) (TYPE 1)
 - GROUND SETTLEMENT MARKER (GS) (TYPE 2)
 - TAPE EXTENSOMETER (TE)
 - INCLINOMETER IN DIAPHRAGM WALL (ID)
 - INCLINOMETER IN GROUND (IG)
 - PIEZOMETER (PZ) / STANDPIPE (SP)
 - MAGNETIC EXTENSOMETER (MPX)
 - PER ARRAY OF OPTICAL PRISM (ADMS)
 - TILT MARKER (TM)
 - VIBRATING WIRE PIEZOMETER (VPZ)
 - VIBRATION CHECK POINT (VC)
 - BUILDING SETTLEMENT MARKER (BS)
 - TAPE EXTENSOMETER (TE)
 - ADMS-TOTAL STATION (TS)
 - BRIDGE D1
 - BRIDGE T
 - BRIDGE B1
 - LAI CHEUNG ROAD
 - CLP LAI CHEUNG ROAD SUBSTATION
 - WEST RAIL LINE
 - CENTRAL KOWLOON ROUTE
 - MTR TUNNELS (TCL & AEL)
 - LIN CHEUNG ROAD
 - WEST KOWLOON HIGHWAY
 - EXISTING INSTRUMENTATION BY OTHER CONTRACT

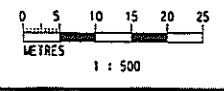
PROPOSED INSTRUMENTATION TO BE INSTALLED AND MONITORED BY 811A

GROUND SETTLEMENT MARKER (GS) - TYPE 1	GS1 TO GS15
GROUND SETTLEMENT MARKER (GS) - TYPE 2	GS21 TO GS25 GS28 TO GS50
INCLINOMETER IN DIAPHRAGM WALL (ID)	ID1 TO ID13
INCLINOMETER IN GROUND (IG)	IG1 TO IG13
PIEZOMETER (PZ) / STANDPIPE (SP)	PZ1 TO PZ13 SP13 TO SP17
MAGNETIC EXTENSOMETER (MPX)	MPX1 TO MPX3
PER ARRAY OF OPTICAL PRISM (ADMS)	ADMS1 TO ADMS24
PER ARRAY OF VIBRATING WIRE STRAIN GAUGE (VSG)	VSG1 TO VSG6
TILT MARKER (TM)	TM1 TO TM5 TM1A TO TM3A
VIBRATING WIRE PIEZOMETER (VPZ)	VPZ1
VIBRATION CHECK POINT (VC)	VC4 TO VC5 VC8 TO VC10
ADMS-TOTAL STATION (TS)	TS1 TO TS4
BUILDING SETTLEMENT MARKER (BS)	BS1 TO BS6
TAPE EXTENSOMETER (TE)	TE1 TO TE19

EXISTING INSTRUMENTATION INSTALLED BY OTHER CONTRACTS AND TO BE HANDED OVER TO 811A FOR MONITORING

GROUND SETTLEMENT MARKER (GS) - TYPE 2	GS1-E1 TO GS2-E1 GS4-E1 TO GS7-E1
GROUND SETTLEMENT MARKER (GS) - TYPE 1	GS9-E1 TO GS18-E1
INCLINOMETER IN DIAPHRAGM WALL (ID)	ID1-E1 TO ID5-E1
INCLINOMETER IN GROUND (IG)	IG1-E1 TO IG5-E1
PIEZOMETER (PZ) / STANDPIPE (SP)	PZ2-E1, PZ3-E1
MAGNETIC EXTENSOMETER (MPX)	MPX5-E1
TILT MARKER (TM)	TM1-E1 TO TM2-E1 TM4-E1 TO TM9-E1 TM4A-E1 TO TM8A-E1
VIBRATING WIRE PIEZOMETER (VPZ)	VPZ1-E1 VPZ3-E1 TO VPZ4-E1
VIBRATION CHECK POINT (VC)	VC1-E1 TO VC3-E1 VC5-E1 TO VC8-E1
BUILDING SETTLEMENT MARKER (BS)	BS1-E1 TO BS2-E1
TAPE EXTENSOMETER (TE)	TE2-E1, TE3-E1, TE4-E1 TE6-E1, TE7-E1

Source: from Caterone 14/8/2010



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 FILE NAME: 811A_W_308_AAT_C05_010B.dwg

DRAWN	JUN LI
DESIGNED	CHRIS CHEUNG
CHECKED	JOHN MENNIS
APPROVED	KELVIN KO
DATE	10MAY2010
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CONTRACT 811A WKT APPROACH TUNNEL (NORTH) APPROACH TUNNEL INSTRUMENTATION AND MONITORING LAYOUT PLAN (FOR STRUCTURES AND FACILITIES)	
SCALE	1 : 500 @ A1
DRAWING NO.	811A/W/308/AAT/C05/101
REV.	B

REV	DESCRIPTION	BY	DATE	APPROVED
B	ADDITION OF GROUND SETTLEMENT MARKER, LOCATION OF IG13 & ID13 REVISED. MINOR REVISION TO INSTRUMENTATION TABLES	JM	10JUN10	KK
A	WORKING DRAWING ISSUE	JM	10MAY10	KK

TABLE 1: MONITORING FREQUENCY

INSTRUMENT TYPE	BACKGROUND / STANDARD / ACTIVE MONITORING FREQUENCY		
	BACKGROUND	STANDARD	ACTIVE
ADMS/TOTAL STATION	CONTINUOUS	CONTINUOUS	CONTINUOUS
YSG	CONTINUOUS	CONTINUOUS	CONTINUOUS
GS TYPE 1	MONTHLY	WEEKLY	DAILY
GS TYPE 2	MONTHLY	WEEKLY	DAILY
BS	MONTHLY	WEEKLY	DAILY
US	MONTHLY	WEEKLY	DAILY
ID	MONTHLY	WEEKLY	DAILY
IG	MONTHLY	WEEKLY	DAILY
MPX	MONTHLY	WEEKLY	DAILY
TMI(OUTSIDE TUNNEL)	MONTHLY	WEEKLY	DAILY
SP / PZ/ VPZ	MONTHLY	WEEKLY	DAILY
VC	MONTHLY	WEEKLY	DAILY
TE	MONTHLY	MONTHLY	BI-WEEKLY
LEVEL/OFFSET	MONTHLY	MONTHLY	BI-WEEKLY
TMI(INSIDE TUNNEL)	MONTHLY	MONTHLY	BI-WEEKLY

TABLE 3: AAA RESPONSE VALUES FOR LATERAL DEFLECTION AT INCLINOMETERS

INCLINOMETER	AAA RESPONSE VALUES		
	ALERT (mm)	ACTION (mm)	ALARM (mm)
ID1	39.0	62.4	78.0
ID2	43.5	69.6	87.0
ID3	50.5	80.8	101.0
ID4	50.5	80.8	101.0
ID5	41.0	65.6	82.0
ID6	47.5	76.0	95.0
ID7	52.5	84.0	105.0
ID8	41.0	65.6	82.0
ID9	48.5	77.6	97.0
ID10	25.0	40.0	50.0
ID11	50.0	80.0	100.0
ID12	43.5	69.6	87.0
ID13	43.5	69.6	87.0
IG1	39.0	62.4	78.0
IG2	43.5	69.6	87.0
IG3	50.5	80.8	101.0
IG4	50.5	80.8	101.0
IG5	41.0	65.6	82.0
IG6	47.5	76.0	95.0
IG7	52.5	84.0	105.0
IG8	41.0	65.6	82.0
IG9	48.5	77.6	97.0
IG10	25.0	40.0	50.0
IG11	50.0	80.0	100.0
IG12	43.5	69.6	87.0
IG13	43.5	69.6	87.0
ID1 - E1	14.5	23.2	29.0
ID2 - E1	15.0	24.0	30.0
ID3 - E1	44.5	71.2	89.0
ID4 - E1	44.5	71.2	89.0
ID5 - E1	35.5	56.8	71.0
IG1 - E1	14.5	23.2	29.0
IG2 - E1	15.0	24.0	30.0
IG3 - E1	44.5	71.2	89.0
IG4 - E1	44.5	71.2	89.0
IG5 - E1	35.5	56.8	71.0

TABLE 2: AAA RESPONSE VALUES FOR SETTLEMENT, ANGULAR DISTORTION AND VIBRATION

NAME OF BUILDING, STRUCTURE OR UTILITY	AAA RESPONSE VALUES												PEAK DISPLACEMENT BELOW THE CROSS-OVER FREQUENCY *	PEAK ACCELERATION ABOVE THE CROSS-OVER FREQUENCY *		
	SETTLEMENT			ANGULAR DISTORTION			VIBRATION									
	ALERT (mm)	ACTION (mm)	ALARM (mm)	ALERT	ACTION	ALARM	TRANSIENT VIBRATION			PROLONGED VIBRATION						
							PPV (mm/s)	AMPLITUDE(mm)	ALARM	ALERT	ACTION	ALARM			PPV (mm/s)	AMPLITUDE(mm)
MRL TUNNELS(KDB300)	10	15	20	1:2000	1:1500	1:1000	-	-	-	-	-	-	-	-	-	-
TUNG CHUNG LINE & AIRPORT EXPRESS LINE TUNNELS	10	15	20	1:2000	1:1250	1:1000	-	-	-	-	-	-	-	-	-	-
FSD RESCUE TRAINING CENTRE	8	12	15	1:2000	1:1500	1:1000	-	-	25	0.2	-	-	15	0.2	-	-
CLP LAI CHEUNG ROAD SUBSTATION & CABLE JOINT	8	12	15	1:2000	1:1500	1:1000	-	-	-	-	-	-	13	0.1	0.035mm	0.5g
BRIDGE T & D1, B	15	20	25	1:3000	1:2250	1:1500	-	-	50	0.2	-	-	30	0.2	-	-
UTILITIES (GAS, ELECTRICITY, DRAINS & SEWER)	10	15	20	1:1500	1:1000	1:500	-	-	-	-	-	-	15	0.2	-	-
UTILITIES (WATER MAIN)	8	12	15	1:2000	1:1500	1:1000	-	-	-	-	-	-	15	0.2	-	-
BOX CULVERTS	10	15	20	1:1500	1:1000	1:500	-	-	25	0.2	-	-	25	0.2	-	-
GROUND SETTLEMENT (MEASURED BY GROUND SETTLEMENT MARKER)	12	18	25	-	-	-	-	-	-	-	-	-	-	-	-	-
SUB SURFACE SETTLEMENT (MEASURED BY MAGNETIC EXTENSIONMETER)	12	18	25	-	-	-	-	-	-	-	-	-	-	-	-	-

* CROSS-OVER FREQUENCY : THAT FREQUENCY AT WHICH THE CHARACTERISTIC OF A VIBRATION CHANGE FROM A CONSTANT DISPLACEMENT VALUE VERSUS FREQUENCY TO A CONSTANT ACCELERATION VALUE VERSUS FREQUENCY
 GN: STANDARD ACCELERATION OF GRAVITY, WHERE N INDICATES NORMAL, HAVING THE VALUE OF 9.81m/SEC.²
 RELAYS AND PROTECTION EQUIPMENT WILL BE SAVED IF THE ABOVE CONDITIONS ARE MET. THESE CONDITIONS ARE SET BASED ON INTERNATIONAL ELECTROTECHNICAL COMMISSION, IEC 60255-21-1 (VIBRATION, SHOCK, BUMP AND SEISMIC TESTS ON MEASURING RELAYS & PROTECTION EQUIPMENT, SECTION ONE - VIBRATION TESTS (SINUSOIDAL)). THE FREQUENCY RANGE FOR THE VIBRATION RESPONSE TEST IS 10HZ TO 150HZ AND THE CROSS-OVER FREQUENCY IS 58HZ TO 60HZ.

TABLE 4: AAA RESPONSE VALUES FOR GROUNDWATER DRAWDOWN

PIEZOMETER / STANDPIPE NO.	GROUNDWATER DRAWDOWN BELOW THE MEASURED LOWEST GROUNDWATER TABLE BEFORE THE COMMENCEMENT OF DEWATERING WORKS ON SITE		
	ALERT (m)	ACTION (m)	ALARM (m)
ALL PIEZOMETERS / STANDPIPES	0.5	0.75	1.0

* CONTRACTOR SHALL SUBMIT A REPORT ON THE GROUND WATER TABLE MONITORING AND ASSOCIATED LOWEST MEASURED GROUNDWATER TABLE TO ENGINEER FOR AGREEMENT BEFORE COMMENCEMENT OF DEWATERING.

TABLE 5: INSTRUMENTATION PROVISIONAL INSTALLATION DEPTH

INSTRUMENT TYPE & NO.	PROVISIONAL INSTALLATION DEPTH (mPD)
ID1	-37.5
ID2	-38
ID3	-40.6
ID4	-43.3
ID5	-48
ID6	-48
ID7	-48
ID8	-48
ID9	-48
ID10	-48
ID11	-48
ID12	-48
ID13	-48
IG1	-37.5
IG2	-38
IG3	-40.6
IG4	-43.3
IG5	-48
IG6	-48
IG7	-48
IG8	-48
IG9	-48
IG10	-48
IG11	-48
IG12	-48
IG13	-48

TABLE 6: PROVISIONAL INSTALLATION DEPTH OF INSTRUMENTS TO BE HANDED OVER BY CONTRACT 803A

INSTRUMENT TYPE & NO.	TENTATIVE END OF HOLE (mPD)
PZ2-E1	-29
PZ3-E1	-30
VPZ1-E1	-30
VPZ3-E1	-28
VPZ4-E1	-39
MPX5-E1	-46



INSTRUMENT TYPE & NO.	PROVISIONAL END OF HOLE (mPD)
PZ1	-30
PZ2	-30
PZ3	-30
PZ4	-30
PZ5	-30
PZ6	-30
PZ7	-30
PZ8	-30
PZ9	-30
PZ10	-30
PZ11	-30
PZ12	-30
PZ13	-30
SP13	-8
SP14	-8
SP15	-8
SP16	-8
SP17	-8
MPX1	-48
MPX2	-55
MPX3	-54
VPZ1	-46

NOTES:
 1. THE DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING NO. 811A/W/308/AAT/C06/101-106.
 2. LEVEL/OFFSET SURVEY OF THE MRL AND AEL/TCL TUNNEL BOX AND RAILWAY TRACKS WITHIN 811A CONTRACT BOUNDARY SHALL BE CARRIED OUT AT A SPACING OF 15m.

Source:
 from Cantonment 14/8/2016

PLOT DRW: C:\CIBR\001\CONTRACT\811A\W\308\AAT\C06\101-106\101.dgn
 MODELNAME: 811A_W_308_AAT_C06_101.dgn
 FILENAME: 811A_W_308_AAT_C06_101.dgn

DRAWN JUN LI
 DESIGNED CHRIS CHEUNG
 CHECKED JOHN MENNIS
 APPROVED: KELVIN KO
 DATE 10MAY2010



 EXPRESS RAIL LINK
 ORIGINATOR
 CADD REF. 811A_W_308_AAT_C06_014B.dgn

TITLE
CONTRACT 811A
WKT APPROACH TUNNEL (NORTH)
 APPROACH TUNNEL
 INSTRUMENTATION SCHEDULES
 SCALE AS SHOWN @ A1
 DRAWING NO. 811A/W/308/AAT/C06/014
 REV. B

REV	DESCRIPTION	BY	DATE	APPROVED
B	TABLE 4 REVISED TABLE 6 ADDED	JM	10JUN10	KK
A	WORKING DRAWING ISSUE	JM	10MAY10	KK

Appendix 1.

Standpipe Piezometer Monitoring Report

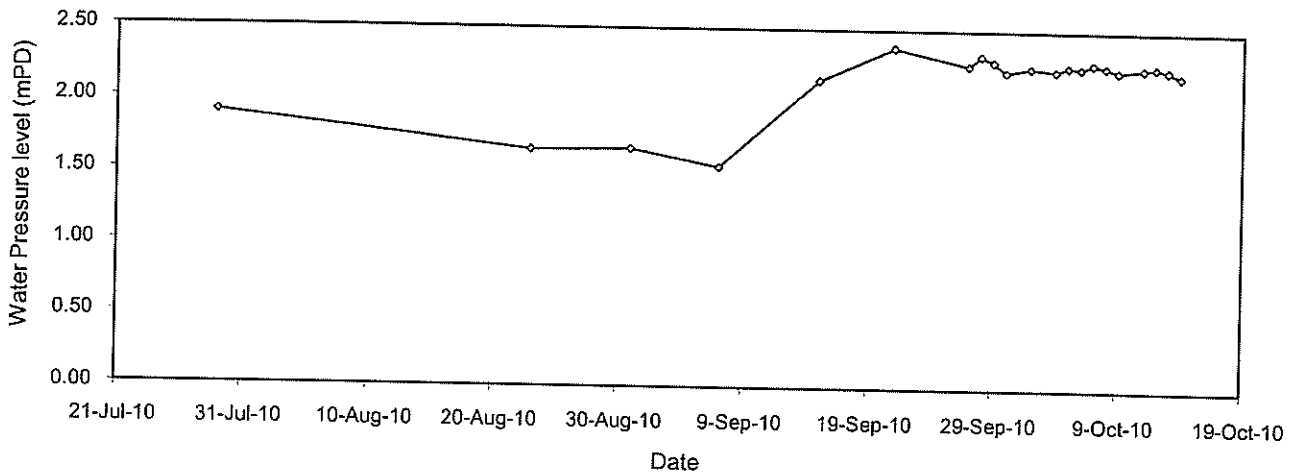
Sol Data

Standpipe Piezometer Monitoring Report

Express Rail Link Contract 811A
WKT Approach Tunnel (North)

Instrument ref. :	PZ3	G. L. (mPD) :	5.25
As-built coordinate :	819168.10 Northing	Pipe Top level :	5.40
	834894.43 Easting	Tip level (mPD) :	-29.86
Date of initial :	29-Jul-2010	Alert : 0.00mPD	-----
Initial reading (mPD) :	1.90	Action : 0.00mPD	-----
Reference level (mPD) :		Alarm : 0.00mPD	-----

The reference level for the AAA values is the lowest groundwater table measured before the commencement of dewatering works on site .



Max. value (m)	2.380		Min. value (m)	1.540	
Date	Water Pressure level (mPD)	Movement previous (m)	Movement cumulative (m)		Remarks
29-Jul-10	1.90	-	0.00		Initial reading
2-Oct-10	2.25	0.03	0.35		
4-Oct-10	2.23	-0.02	0.33		
5-Oct-10	2.26	0.03	0.36		
6-Oct-10	2.25	-0.01	0.35		
7-Oct-10	2.28	0.03	0.38		
8-Oct-10	2.26	-0.02	0.36		
9-Oct-10	2.23	-0.03	0.33		
11-Oct-10	2.25	0.02	0.35		
12-Oct-10	2.26	0.01	0.36		
13-Oct-10	2.24	-0.02	0.34		
14-Oct-10	2.20	-0.04	0.30		

Appendix 2.

Gernal notes for dewatering

1. GENERAL NOTES FOR PUMPING TEST

- THE CONTRACTOR SHALL SUBMIT METHOD STATEMENT AND PUMP WELL DESIGN TO MTR & BD FOR AGREEMENT PRIOR TO PUMPING TEST.
- PUMPING TEST SHALL BE CARRIED OUT AFTER THE COMPLETION OF THE DIAPHRAGM WALL.
- THE PUMPING TEST SHALL BE CARRIED OUT OVER A PERIOD TO BE AGREED WITH THE ENGINEER.
- PUMPING TEST RESULTS WITH AN ASSESSMENT REPORT SHALL BE SUBMITTED TO THE ENGINEER AFTER THE SUCCESSFUL COMPLETION OF THE PUMPING TEST.
- DEWATERING WELLS SHOWN ARE MINIMUM REQUIREMENTS ONLY. NOTWITHSTANDING THESE MINIMUM REQUIREMENTS, THE CONTRACTOR MAY ADD ADDITIONAL DEWATERING WELLS OR TAKE SUITABLE MEASURES TO SUIT HIS DEWATERING METHOD.
- INSTALLATION RECORDS AND RESPONSE TEST RESULTS OF THE DEWATERING WELLS AND OBSERVATION WELLS SHALL BE SUBMITTED PRIOR TO THE COMMENCEMENT OF THE PUMPING TEST.
- THE MAXIMUM GROUNDWATER TABLE DRAW DOWN OUTSIDE DIAPHRAGM WALLS AS RECORDED BY THE OBSERVATION WELLS SHALL NOT EXCEED 1m BELOW THE EXISTING GROUND WATER LEVEL.
- DEWATERING WELLS AND OBSERVATION WELLS SHALL BE PROTECTED FROM DAMAGE. WORKS SHALL BE CARRIED OUT WITH DUE CARE IN PROXIMITY OF THESE WELLS.
- IF ANY DEWATERING/OBSERVATION WELL IS DAMAGED DURING THE PUMPING TEST, THE CONTRACTOR SHALL INFORM THE ENGINEER IMMEDIATELY AND REINSTATEMENT SHALL BE CARRIED OUT AS SOON AS POSSIBLE.
- LEVELS OF FLOAT SWITCH SHALL BE PROPOSED BY CONTRACTOR, AND CONFIRMED BY THE ENGINEER.
- MONITORING DATA SHALL BE CORRECTED TO ACCOUNT FOR ALL EXTRANEOUS CAUSES, SUCH AS RAINFALL, TIDAL WATER AND BAROMETRIC PRESSURE, BOTH BEFORE AND DURING TESTING.
- A COMPREHENSIVE PUMPING TEST SEQUENCE SHALL BE DEVISED, SEPERATED INTO FOUR TESTS: AN EQUIPMENT TEST, STEP TEST, CONSTANT DISCHARGE TEST AND RECOVERY TEST IN ACCORDANCE WITH BS 150 14686:2000.

2. PUMPING TEST DETAILS

1.0 PROCEDURES

- SUBMIT DETAILED DESIGN OF DEWATERING WELLS AND OBSERVATION WELLS TO THE SATISFACTION OF THE ENGINEER.
- BEFORE INSERTION OF SUBMERSIBLE PUMPS, DEWATERING WELLS SHALL BE CLEANED, FLUSHED AND THE DEPTH OF WELLS SHALL BE ACCURATELY MEASURED.
- DEWATERING WELLS INCLUDING DISCHARGE PIPES SHALL THEN BE COMPLETED AND TESTED TO BE FUNCTIONAL.
- DEWATERING PUMPS INSTALLED SHALL HAVE SUFFICIENT DISCHARGE CAPACITY TO LOWER THE WATER LEVEL AT THE MIDDLE LOCATION OF TWO ADJACENT DEWATERING WELLS TO -27,000 MPD IMMEDIATELY AHEAD OF THE DIAPHRAGM WALL. THE CONTRACTOR SHALL TAKE RESPONSIBILITY TO ENSURE THE PUMPS HAVE THE REQUIRED CAPACITY.
- FLOW METERS AND GATE VALVES TO CONTROL FLOW SHALL BE INCORPORATED INTO EACH DEWATERING WELL.
- BEFORE COMMENCEMENT OF THE PUMPING TEST, WATER LEVELS IN ALL DEWATERING WELLS AND OBSERVATION WELLS SHALL BE MEASURED AT 4-HOUR INTERVALS FOR A PERIOD OF 24 HOURS. THESE SHOULD FORM THE BASE SET OF INITIAL DATA FOR THE PUMPING TEST.
- DURING THE TEST, WATER LEVELS IN ALL DEWATERING WELLS AND OBSERVATION WELLS SHALL BE RECORDED AT REGULAR INTERVALS (SEE "WATER LEVEL MEASUREMENT" IN NOTE 2 TABLE 1).
- DURING THE TEST, THE ACCUMULATED OPERATION TIME OF DEWATERING WELLS SHALL BE RECORDED AT 12 HOUR INTERVALS.
- ALL MONITORING DATA SHALL BE PRODUCED IN BOTH TABULAR AND GRAPHICAL FORM DURING THE COURSE OF THE PUMPING TEST. THE FORMAT OF THE TEST RESULTS SHALL BE AGREED WITH THE ENGINEER.
- WATER LEVELS SHALL BE MONITORED AFTER CESSATION OF PUMPING UNTIL RECOVERY TO INITIAL LEVELS IS COMPLETED OR AS INSTRUCTED BY THE ENGINEER.
- ANY UNDUKE GROUND/BUILDING MOVEMENT OR GROUNDWATER DRAWDOWN SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY FOR FOLLOW UP ACTION.

2. WATER LEVEL MEASUREMENT

DURING PUMPING AND RECOVERY TESTS, WATER LEVELS IN DEWATERING WELLS AND OBSERVATION WELLS SHALL BE SIMULTANEOUSLY MEASURED AT THE FOLLOWING INTERVALS:

TABLE 1

TIME FROM COMMENCEMENT OF PUMPING TEST (MINS)	INTERVAL BETWEEN READINGS (MINS)
0 - 10	0.5
10 - 20	2
20 - 60	5
60 - 100	10
100 - 300	20
300 - 1000	50
1000 - END OF TEST	100

DURING RECOVERY PHASE, READINGS SHALL BE TAKEN CONTINUOUSLY UNTIL WATER LEVELS IN ALL THE OBSERVATION WELLS HAVE RECOVERED TO THEIR PRE-TEST LEVELS FOR A PERIOD OF TWO DAYS, WHICHEVER IS SOONER, OR AS DIRECTED BY THE ENGINEER. PRIOR TO TERMINATING READINGS THE ENGINEER SHALL BE NOTIFIED.

3. SETTLEMENT MONITORING POINTS

DURING THE PUMPING TEST AND UNTIL THE WATER LEVELS IN ALL THE OBSERVATION WELLS OUTSIDE THE SITE HAVE RECOVERED TO THEIR PRE-TEST LEVELS, THE SETTLEMENT MONITORING POINTS AS SHOWN ON DRAWING NO. 811A/W/308/AAT/CO5/101, 104 TO 106 SHALL BE MONITORED ONCE PER DAY. THE RESULTS SHALL BE PRODUCED IN ACCORDANCE WITH NOTE 2.1.10.

DIAPHRAGM WALL MOVEMENT MONITORING POINT AT COMMENCEMENT. DURING THE PUMPING TEST AND UNTIL ONE DAY AFTER THE GROUNDWATER RECOVERED TO ITS ORIGINAL LEVEL, THE INCLINOMETERS INSIDE AND OUTSIDE THE DIAPHRAGM WALLS SHALL BE MONITORED DAILY. THE RESULTS SHALL BE PRODUCED IN ACCORDANCE WITH NOTE 2.1.10.

5. PUMPING TEST CRITERIA

5.1 PUMPING TEST SHALL BE CONSIDERED ACCEPTABLE IF THE FOLLOWING CRITERIA ARE MET WHEN THE WATER LEVEL INSIDE THE SITE REACHES THE DESIGNATED LEVEL AS RECORDED BY THE OBSERVATION WELLS.

TABLE 2

CRITERIA	MAXIMUM MAGNITUDE
GROUNDWATER LEVEL OBSERVED IN OBSERVATION WELLS OUTSIDE SITE	DROPS NOT MORE THAN 1m BELOW THE LOWEST MEASURED GROUNDWATER LEVEL

5.2 IF GROUNDWATER LEVEL OUTSIDE THE SITE DROPS TO MORE THAN 1m BELOW THE LOWEST MEASURED GROUNDWATER LEVEL BUT THE GROUND SETTLEMENT DOES NOT EXCEED THE LIMIT GIVEN IN THE FOLLOWING TABLE, THE PUMPING TEST SHALL CONTINUE TO PROCEED. AFTER COMPLETION OF THE PUMPING TEST, THE DESIGN ASSUMPTIONS SHALL BE REVIEWED BASED ON THE TEST RESULTS AND THE RESULTS SHALL BE INCLUDED IN THE ASSESSMENT REPORT AS STATED IN CLAUSE 6.

TABLE 3: GROUND SETTLEMENT CRITERIA DUE TO DEWATERING

SECTION NO.	ALLOWABLE SETTLEMENT (mm)
SECT 1 (WE1-WE9A, WE14-WE20, WW1-WW9, WW14-WW20)	28
SECT 2 (EAST WALL) (WE8-WE13A)	16
SECT 2 (WEST WALL) (WW10-WW13A)	31
SECT 3 (RS1-RS8, RS16-RS22)	36
SECT 5 (WE21-WE27,)	22
SECT 5A (WE28-WE33)	11

5.3 PUMPING TEST SHALL BE STOPPED IN CASE THE GROUND/BUILDING SETTLEMENT EXCEEDS THE LIMIT AS SPECIFIED IN TABLE 2 OF DRAWING NO. 811A/W/308/AAT/CO6/014 THE CONTRACTOR SHALL INVESTIGATE THE CAUSE OF THE SETTLEMENT AND IMPROVEMENT MEASURES SHALL BE PROPOSED AND IMPLEMENTED.

6. ASSESSMENT REPORT

AFTER COMPLETION OF THE PUMPING TEST, THE CONTRACTOR SHALL PREPARE AN ASSESSMENT REPORT BASED ON THE TEST RESULTS DISCUSSING THE ASSUMED AND ACTUAL CONDITIONS ON SITE, INTERPRET THE RESULTS AND ASSESS THE EFFECTS TO THE SURROUNDING STRUCTURES AND UTILITIES. THIS REPORT SHALL BE SUBMITTED TO THE BUILDINGS DEPARTMENT'S SATISFACTION AFTER REVIEWED AND APPROVED BY THE ENGINEER AS PART OF THE REQUIREMENTS FOR CONSENT APPLICATION OF EXCAVATION.

3. NOTES FOR RECHARGE WELL MONITORING:

- WHEN THE DRAWDOWN AT ANY ONE OF THE PIEZOMETERS IN THE VICINITY SHOWN ON DRG. No. 811A/C/308/BCN/T04/002 EXCEEDS 1.0m FROM THE MEASURED GROUND WATER TABLE THE RECHARGE WELLS NEARBY SHALL BE OPERATED.
- THE READINGS OF PIEZOMETERS IN THE SPECIFIED VICINITY, ALL FLOW METERS AND PRESSURE GAUGES SHALL BE RECORDED PROPERLY FOR EVERY RECHARGE OPERATION AND SUBMITTED TO THE ENGINEER FOR RECORD.
- TURN ON THE MAIN VALVE TO OBTAIN WATER PRESSURE EQUAL TO 0.5 BAR AT ALL PRESSURE GAUGES.
- TURN ON THE VALVES AT THE ALTERNATIVE RECHARGE WELLS AS DETERMINED BY THE ENGINEER ON SITE.
- MEASURE THE GROUND WATER LEVELS AT THE PIEZOMETERS IN THE SPECIFIED VICINITY 4 TIMES HOURLY.
- ADJUST NO. OF TURNS OF MAIN VALVES AND THE VALVES OF RELEVANT RECHARGE WELLS AFTER EACH ROUND OF MEASUREMENT, UNTIL THE GROUND WATER LEVEL IS RECOVERED TO INITIAL LEVEL AT STEADY STATE.
- TURN ON THE REMAINING RECHARGE WELLS IF NECESSARY AS DIRECTED BY THE ENGINEER.
- THE CONTRACTOR SHALL EXERCISE WITH CARE TO ENSURE THAT THE GROUND WATER LEVEL AT EACH PIEZOMETER SHALL NOT BE RAISED ABOVE THE INITIAL GROUND WATER LEVEL.
- AFTER THE GROUND WATER LEVEL IS STEADY AS DETERMINED BY THE ENGINEER, THE CONTRACTOR SHALL MONITOR THE GROUND WATER LEVELS AT THE RELEVANT PIEZOMETERS TWICE DAILY, AND ADJUST THE VALVES AFTER EACH ROUND OF MONITORING. OPERATION OF THE RECHARGE WELLS SHALL CONTINUE UNTIL GROUND WATER LEVELS RECOVER TO INITIAL LEVELS.
- SETTLEMENT MARKERS IN THE SPECIFIED VICINITY SHALL BE SURVEYED AND THE READINGS OF FLOWMETER SHALL BE TAKEN DAILY.
- THE CONTRACTOR SHALL SUBMIT THE REPORT OF THE ABOVE OPERATIONS DAILY TO THE ENGINEER AT THE END OF EACH WORKING DAY.

4. NOTES FOR RECHARGE WELL:

- THE RECHARGE SYSTEM IS TO PREVENT ANY EXCESSIVE DRAWDOWN OF GROUND WATER LEVEL OUTSIDE THE DIAPHRAGM WALL. THE PROVISION OF RECHARGE SYSTEM SHOWN ARE MINIMUM REQUIREMENT. THE CONTRACTOR SHALL TAKE ADDITIONAL MEASURES AS NECESSARY TO SATISFY THE LIMITING DRAWDOWN OF 1m.
- THE GATE VALVES SHALL BE TURNED ON WHEN THE DRAWDOWN OF GROUND WATER LEVEL AT NEARBY STANDPIPES EXCEED 1.0m. RECHARGE SHALL BE CONTINUOUS UNTIL THE GROUND WATER LEVEL RECOVERS TO THE INITIAL READING.
- EXACT LOCATIONS OF RECHARGE WELLS SHALL BE DETERMINED ON SITE AND TRIAL PITS SHALL BE EXCAVATED PRIOR TO SINKING RECHARGE WELLS TO AVOID DAMAGING EXISTING SERVICES AND UTILITIES.
- GRADING OF FINE SAND FOR SAND BRIDGE SHALL BE BETWEEN 600 MICRONS AND 1200 MICRONS.
- BENTONITE/CEMENT GROUT MIX SHALL BE

35 kg	BENTONITE	1	PER 1m GROUT	3
350 kg	CEMENT	1		
BALANCE	WATER	1		
- THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER A DETAILED ARRANGEMENT OF THE WATER SUPPLY AND PIPE GROUTING PRIOR TO THE COMMENCEMENT OF THE WORKS.
- WATER SUPPLY TO THE RECHARGE WELLS SHALL BE ADEQUATE TO MAINTAIN THE REQUIRED WATER LEVELS AS SHOWN ON THE DRAWING.
- FLOW METERS AND PRESSURE GAUGES COMPATIBLE WITH THE PIPE FITTING TO RISER PIPES SHALL BE PROVIDED FOR ROUTINE MONITORING OF FLOW RATE AND WATER PRESSURE. THE WORKING CONDITION OF ALL FLOW METERS AND PRESSURE GAUGES SHALL BE DEMONSTRATED TO THE SATISFACTION OF THE ENGINEER PRIOR TO COMMENCEMENT OF MONITORING AND SHALL BE PERIODICALLY CHECKED THEREAFTER. ANY DEFECTIVE EQUIPMENT SHALL BE REPAIRED OR REPLACED AT THE DIRECTION OF THE ENGINEER.
- THE WATER PRESSURE AT THE INLET TO INDIVIDUAL RECHARGE WELLS SHALL NOT EXCEED 1 BAR.

- AFTER COMPLETION OF INSTALLATION OF RECHARGE WELLS, A RESPONSE TEST FOR ALL RECHARGE WELLS SHALL BE CONDUCTED TO CONFIRM THE EFFECTIVENESS/FUNCTIONING OF THE RECHARGE WELLS TO THE SATISFACTION OF THE ENGINEER.

5. SUPERVISION

- ONE PERSON SHOULD BE APPOINTED TO SUPERVISE THE VARIOUS TESTS. ALL DECISIONS REGARDING THE COLLECTION AND RECORDING OF DATA BEFORE, DURING AND AFTER THE TEST SHALL BE REFERRED TO THE SUPERVISOR.
- THE SUPERVISOR SHOULD ENSURE THAT ALL STAFF ARE FAMILIAR WITH THE TASKS THEY ARE TO PERFORM DURING THE TEST AND WITH ANY INSTRUMENTS THAT THEY MAY BE REQUIRED TO USE. ALL STAFF SHOULD BE AWARE OF THE FREQUENCY OF WATER-LEVEL MEASUREMENTS TO BE TAKEN (SEE PUMPING TEST DETAIL SECTION 2) AND THE ACCURACY OF MEASUREMENT REQUIRED. STAFF NEED TO BE ADVISED OF ANY SAFETY REGULATIONS IN FORCE.
- THE SUPERVISOR SHOULD ENSURE THAT ALL EQUIPMENT IS ON SITE AND IN WORKING ORDER AND THAT SPARE EQUIPMENT OR SPARE PARTS, INCLUDING BATTERIES FOR DIPPERS ARE READILY AVAILABLE.
- THE SUPERVISOR SHOULD BE RESPONSIBLE FOR DETERMINING THE ACTUAL TIMES AT WHICH THE TEST STARTS AND STOP, AND THE TIMES AT WHICH INDIVIDUAL PARTS OF THE TEST START. THE SUPERVISOR SHOULD ALSO ENSURE THAT THE MOMENTS WHEN MEASUREMENT ARE TO BE TAKEN ARE CLEARLY SIGNALLED TO THE STAFF.
- THE SUPERVISOR SHOULD BE RESPONSIBLE FOR ISSUING SUITABLE FORMS FOR RECORDING MEASUREMENTS AND COLLECTING /COLLATING THE COMPLETED FORMS. THE SUPERVISOR SHOULD ALSO KEEP A RECORD OF PROGRESS OF THE TEST WITH DETAILS OF ALL OPERATIONS CARRIED OUT INCLUDING RUNNING PLOTS OF DRAWDOWN LEVELS AGAINST TIME IN THE CASE OF A CONSTANT-DISCHARGE TEST OR DISCHARGE RATE AGAINST TIME IN THE CASE OF A CONSTANT-DRAWDOWN TEST. SO THAT AN INDICATION CAN BE GAINED OF THE TYPE OF AQUIFER RESPONSE.

6. FUNCTIONING TEST PROCEDURE OF RECHARGE WELLS:

- READINGS OF PIEZOMETERS IN THE SPECIFIED VICINITY SHALL BE TAKEN. ALL FLOWMETERS AND PRESSURE GAUGES SHALL BE READ AND ALL VALVES INCLUDING THE MAIN VALVE SHALL BE TURNED OFF PRIOR TO COMMENCEMENT OF TESTING.
- TURN ON THE MAIN VALVE TO OBTAIN WATER PRESSURE EQUAL TO 0.5 BAR AT ALL PRESSURE GAUGES.
- TURN ON THE MAIN VALVES AT ALTERNATIVE RECHARGE WELLS.
- MEASURE THE GROUND WATER LEVEL AT THE PIEZOMETERS IN THE SPECIFIED VICINITY 4 TIMES HOURLY.
- ADJUST THE NO. OF TURNS OF MAIN VALVE AND THE VALVES AT THE OPERATING RECHARGE WELLS AFTER EACH ROUND OF MEASUREMENT. THE CONTRACTOR SHALL EXERCISE DUE CARE DURING THE TEST TO ENSURE THAT THE GROUND WATER LEVEL AT EACH PIEZOMETER SHALL NOT RISE BY 0.5m.
- AFTER THE GROUND WATER LEVEL IS RAISED BY 0.25m. THE CONTRACTOR SHALL ADJUST TO OBTAIN STEADY GROUND WATER LEVEL FOR AT LEAST ONE HOUR.
- OPEN THE REMAINING RECHARGE WELLS.
- CONTINUE MEASURING THE GROUND WATER LEVEL AT ALL PIEZOMETERS IN THE SPECIFIED VICINITY 4 TIMES HOURLY.
- THE TEST IS COMPLETED WHEN THE GROUND WATER LEVEL RISE BY 0.5m.
- TURN OFF THE MAIN VALVE.
- TURN OFF THE VALVE AT EACH RECHARGE WELL.
- TAKE THE READINGS OF ALL FLOWMETERS.
- SURVEY THE SETTLEMENT MARKERS AFTER THE TEST.
- SUBMIT REPORTS TO THE ENGINEER IMMEDIATELY AFTER THE TEST.

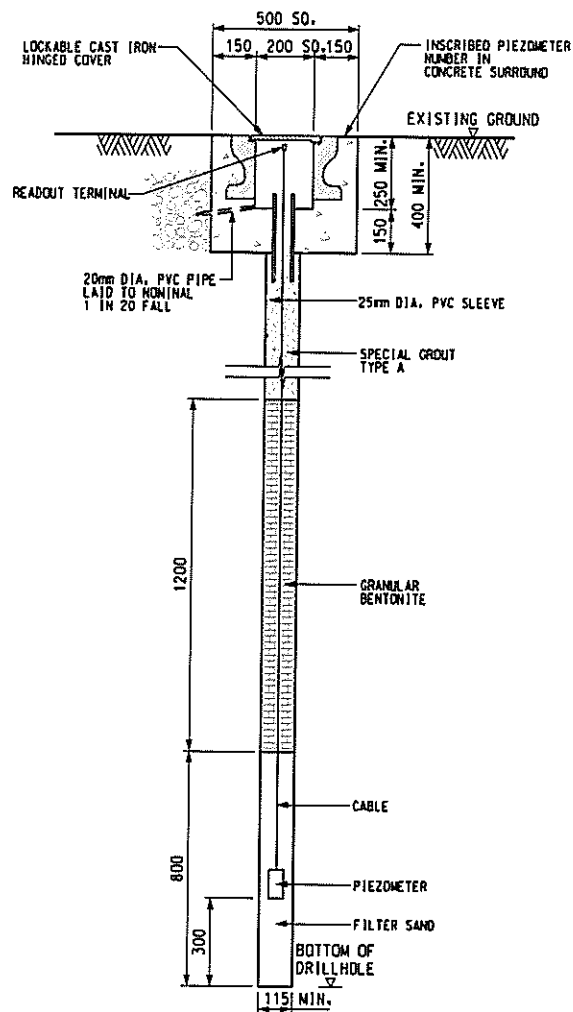
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 6/05/2010 PM 12/19/2010

DRAWN	PIT	 EXPRESS RAIL LINK JV CONTRACTOR   	TITLE
DESIGNED	MY		CONTRACT 811A
CHECKED	MY		WKT APPROACH TUNNEL (NORTH)
APPROVED	WD		GENERAL NOTES FOR DEWATERING
DATE	04/06/2010	CADD REF.	SCALE
		811A.C.308.BCN.T04.0018.dgn	N.T.S.
			DRAWING NO.
			811A/C/308/BCN/T04/001
			REV.
			B

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED
B	NOTES AMENDED	AA	10DEC10	JC					
A	FIRST ISSUE	MY	18AUG10	WD					

Appendix 3.

Typical dewatering system



VIBRATING WIRE PIEZOMETER

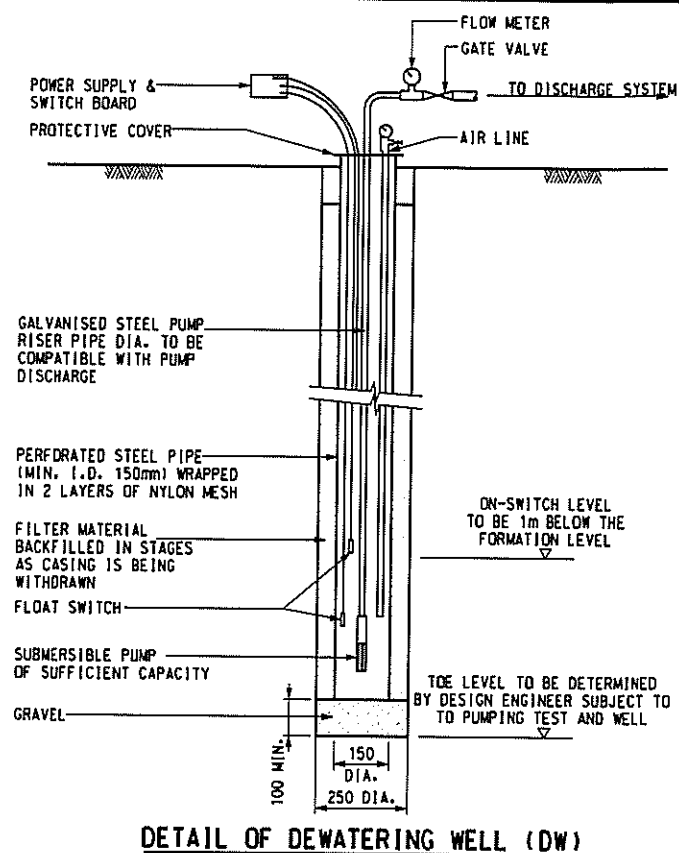
(FOR INSTALLATION IN BOREHOLE WITH GRANULAR BENTONITE SEAL)
N.T.S.

DEWATERING WELLS	ASSOCIATED RECHARGE WELLS	SELECTED OBSERVATION WELLS TO CONTROL THE ASSOCIATED RECHARGING WELLS
DW1, DW22, DW23 & DW24	RW1, RW2, RW3 & RW24	DW1, DW22 & DW23
DW2, DW21	RW3, RW22	DW2, DW21
DW3, DW20	RW4, RW21	DW3, DW20
DW4, DW19	RW5, RW20	DW4, DW19
DW5, DW18	RW6, RW19	DW5, DW18
DW6, DW17	RW7, RW18	DW6, DW17
DW7	RW8	DW7, DW8
DW8	RW9	DW8, DW9
DW9	RW10	DW10
DW10, DW11	RW11, RW12	DW11, DW12
DW12	RW13	DW13
DW13	RW15	DW14
DW14	RW14	DW14
DW15	RW17	DW17
DW16	RW16	DW15, DW24
DW37	RW15	DW14

RECHARGE WELL AND CORRESPONDING SELECTED OBSERVATION WELL FOR SWITCH CONTROL

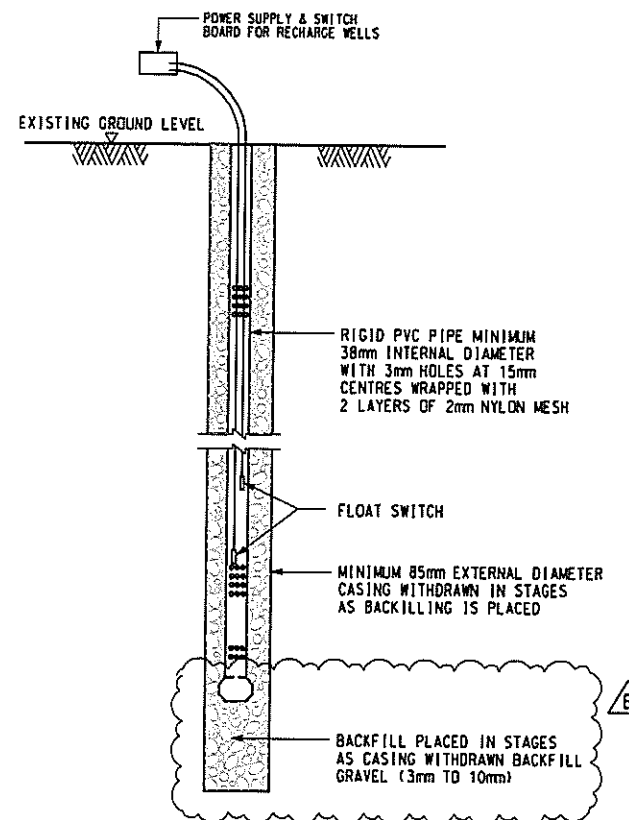
NOTE:

1. THE RW16 IS REQUIRED TO OPERATE DURING PHASE 2 DEWATERING PROCESS. REALTIME MONITORING OF GROUND WATER LEVELS IS REQUIRED AT THE ZONE WITHIN 10m OF RW16. AN AUTOMATIC FEEDBACK SYSTEM SHALL BE INSTALLED TO OPERATE RW16 TO REINSTATE THE ORIGINAL GROUND WATER LEVEL WHEN THE GROUND WATER LEVELS DRAWN DOWN TO 0.5m BELOW THE ORIGINAL GROUND WATER LEVEL.
2. THE RW15 IS THE RESERVE WELL, WHICH SHALL BE OPERATED IN THE EVENT THAT RW16 IS DAMAGED.



DETAIL OF DEWATERING WELL (DW)

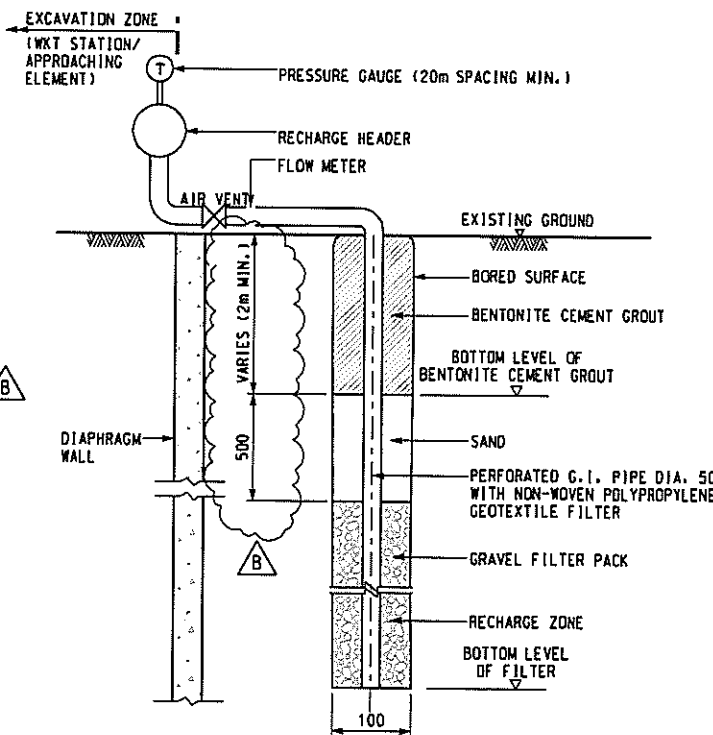
N.T.S.



TYPICAL DETAILS OF OBSERVATION WELL (OW)

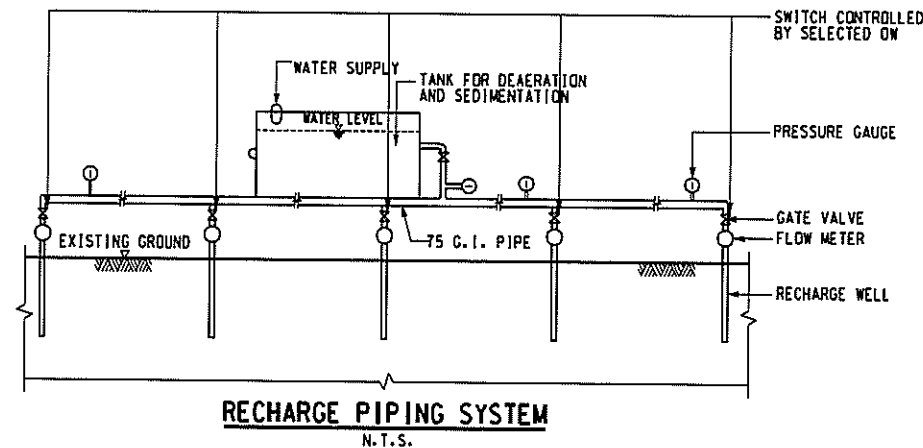
N.T.S.

(NOTES : FLOAT SWITCH SHALL BE INSTALLED FOR SELECTED OW)



TYPICAL DETAIL OF RECHARGE WELL (RW)

N.T.S.



RECHARGE PIPING SYSTEM

N.T.S.

NOTES:

1. FOR DEWATERING WELLS TEST LAYOUT PLAN REFER TO DRAWING NO. 811A/C/308/BCN/T04/010.
2. FOR RECHARGE WELL LAYOUT PLAN REFER TO DRAWING NO. 811A/C/308/BCN/T04/012.

PLOT DWG: G:\Cadd Admin\02_11_2010\PILOT_APPROACH_TUNNEL_NORTH.dwg
 MODELNAME: DW001
 FILENAME: G:\200909 - 811A\WKT\TUNNEL_NORTH.dwg
 PRINTED BY: JET
 DATE: 12/19/2009 6:05:30 PM

DRAWN	PJT
DESIGNED	MY
CHECKED	MY
APPROVED	WD
DATE	04/06/2010

MTR

EXPRESS RAIL LINK

JV CONTRACTOR: **BACHY SOLETANICHE** 法蘭西地產有限公司

JV CONTRACTOR'S DESIGNER: **LAINO O'Rourke**

benaim

TITLE: **CONTRACT 811A**
WKT APPROACH TUNNEL (NORTH)
TYPICAL DEWATERING SYSTEM

CADD REF: 811A.C_308_BCN_T04_002B.dgn

SCALE: N.T.S. DRAWING NO: 811A/C/308/BCN/T04/002

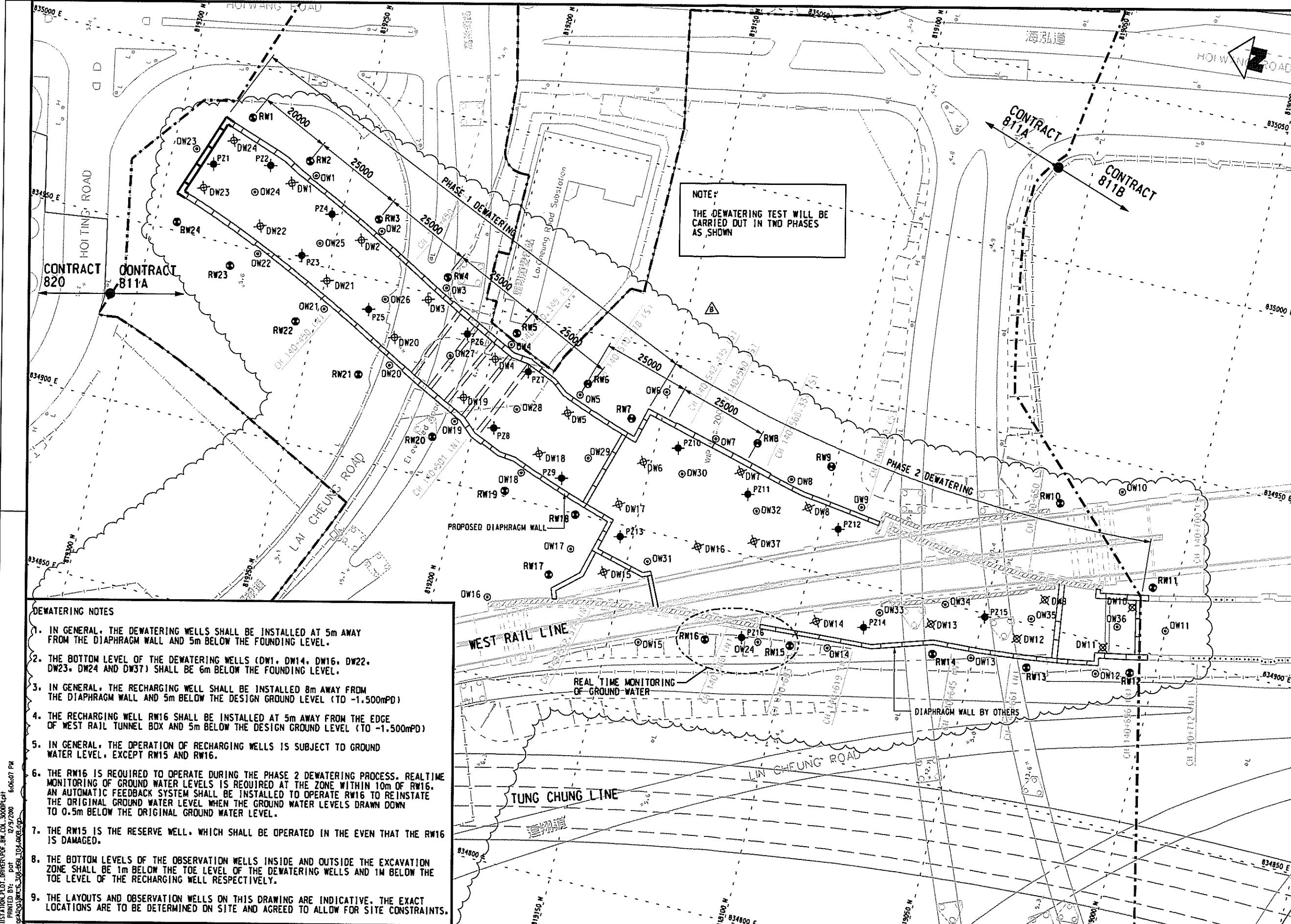
REV. B

B	TABLE REVISED	AA	10DEC10	JC
A	FIRST ISSUE	MY	18AUG10	WD

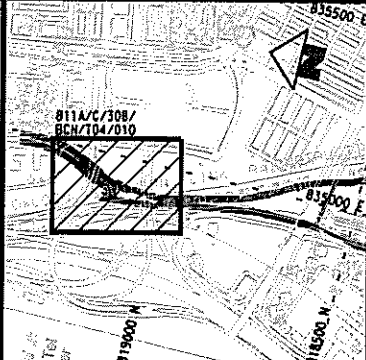
DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.
NO NEW CONSTRUCTION IS PERMITTED WITHOUT THE WRITTEN CONSENT OF THE MTR CORPORATION LIMITED.
RESPECT OF THIS DRAWING / DOCUMENT IS OWNED BY THE MTR CORPORATION LIMITED. NO REPRODUCTION OR TRANSMISSION OF ANY PART BY WHATEVER MEANS IS PERMITTED WITHOUT THE PRIOR WRITTEN CONSENT OF THE MTR CORPORATION LIMITED.

Appendix 4.

Dewatering and observation well



NOTE:
THE DEWATERING TEST WILL BE CARRIED OUT IN TWO PHASES AS SHOWN



KEY PLAN
(SCALE 1:10000)

NOTES:
1. THIS DRAWING TO BE READ IN CONJUNCTION WITH 811A/C/308/BCN/T04/001 & 002.

- LEGEND:**
- GAZETTE BOUNDARY
 - - - CONTRACT BOUNDARY
 - ⊗ DW1 PROPOSED DEWATERING WELL (DW)
 - ⊙ DW1 PROPOSED OBSERVATION WELL (DW)
 - PZ1 PIEZOMETER (PZ)
 - ⊙ RW1 PROPOSED RECHARGE WELL (RW)

- DEWATERING NOTES**
1. IN GENERAL, THE DEWATERING WELLS SHALL BE INSTALLED AT 5m AWAY FROM THE DIAPHRAGM WALL AND 5m BELOW THE FOUNDING LEVEL.
 2. THE BOTTOM LEVEL OF THE DEWATERING WELLS (DW1, DW14, DW16, DW22, DW23, DW24 AND DW37) SHALL BE 6m BELOW THE FOUNDING LEVEL.
 3. IN GENERAL, THE RECHARGING WELL SHALL BE INSTALLED 8m AWAY FROM THE DIAPHRAGM WALL AND 5m BELOW THE DESIGN GROUND LEVEL (TO -1.500mPD)
 4. THE RECHARGING WELL RW16 SHALL BE INSTALLED AT 5m AWAY FROM THE EDGE OF WEST RAIL TUNNEL BOX AND 5m BELOW THE DESIGN GROUND LEVEL (TO -1.500mPD)
 5. IN GENERAL, THE OPERATION OF RECHARGING WELLS IS SUBJECT TO GROUND WATER LEVEL, EXCEPT RW15 AND RW16.
 6. THE RW16 IS REQUIRED TO OPERATE DURING THE PHASE 2 DEWATERING PROCESS. REALTIME MONITORING OF GROUND WATER LEVELS IS REQUIRED AT THE ZONE WITHIN 10m OF RW16. AN AUTOMATIC FEEDBACK SYSTEM SHALL BE INSTALLED TO OPERATE RW16 TO REINSTATE THE ORIGINAL GROUND WATER LEVEL WHEN THE GROUND WATER LEVELS DRAWN DOWN TO 0.5m BELOW THE ORIGINAL GROUND WATER LEVEL.
 7. THE RW15 IS THE RESERVE WELL, WHICH SHALL BE OPERATED IN THE EVEN THAT THE RW16 IS DAMAGED.
 8. THE BOTTOM LEVELS OF THE OBSERVATION WELLS INSIDE AND OUTSIDE THE EXCAVATION ZONE SHALL BE 1m BELOW THE TOE LEVEL OF THE DEWATERING WELLS AND 1m BELOW THE TOE LEVEL OF THE RECHARGING WELL RESPECTIVELY.
 9. THE LAYOUTS AND OBSERVATION WELLS ON THIS DRAWING ARE INDICATIVE. THE EXACT LOCATIONS ARE TO BE DETERMINED ON SITE AND AGREED TO ALLOW FOR SITE CONSTRAINTS.

C:\Cad Admin\02\1\STATION\PLT.DWG
 PLOT DATE: 12/01/2008
 MODEL NAME: 811A/C/308/BCN/T04/010B.dgn
 FILE NAME: 811A.C_308_BCN_T04_010B.dgn

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED
B	LOCATIONS REVISED	AA	10DEC10	JC					
A	FIRST ISSUE	MY	18AUG10	WD					

DRAWN	PIT		
DESIGNED	MY		
CHECKED	MY		
APPROVED	WD		
DATE	04/06/2010		

MTR
EXPRESS RAIL LINK

JV CONTRACTOR
BACHY SOLSTANCHE
 法國地質工程公司

JV CONTRACTOR'S DESIGNER
LAINO D'ORVILLE
 benaim

CADD REF. 811A.C_308_BCN_T04_010B.dgn

TITLE
 CONTRACT 811A
 WKT APPROACH TUNNEL (NORTH)
 DEWATERING AND OBSERVATION WELLS
 LAYOUT PLAN

SCALE 1 : 500 (A1)
 DRAWING NO. 811A/C/308/BCN/T04/010
 REV. B