

MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU -
SHENZHEN - HONG KONG EXPRESS RAIL LINK
(No. EP-349/2009/B)

Contingency Plan for Groundwater Level (Revision A)
(Contract 810B – West Kowloon Terminus Station South)

Verified by : 
Position : Independent Environmental Checker
Date : 29 August 2011

MTR Corporation Limited

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Contingency Plan for Groundwater Level (Revision A)
(Contract 810B – West Kowloon Terminus Station South)

Certified by : 
Position :  Environmental Team Leader
Date : 29 Aug 2011

GROUNDWATER MONITORING AND CONTINGENCY ACTION PLAN

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Prepared By:  Peter Ching Technical Manager	Checked By:  Keith Gordon HSE Manager	Approved By:  Mike O'Hanlon Project Manager
		Date: 19 August 2011

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Groundwater Monitoring and Contingency Action Plan

Contract XRL810B for construction of the southern end of the West Kowloon Terminus (WKT) comprises excavation to a depth of approximately 30 m below the existing ground level and construction of the southern end of the WKT structure by a combination of bottom up and top down methods. The site is bounded by diaphragm walls which act as both a water cut-off and retaining wall around the site. The diaphragm walls were constructed under the 803 contracts which also included the requirement to form a hydraulic cut-off around the site. Toe grouting below the base of the diaphragm wall has been carried out as part of the 803 works. In addition to construction of the southern end of the WKT, the 810B contract also includes bulk excavation work at the northern end of the WKT (i.e. the 810A area) and the implementation of various enabling and temporary works schemes.

In order to construct the WKT it will be necessary to dewater the site down to a level of approximately -24 mPD. If the hydraulic cut-off installed under the 803 contract is not adequate the dewatering could result in unacceptable drawdown of the water level outside the site and this could result in settlement of the adjacent sensitive receivers (i.e. buildings, utilities, water mains, and roads).

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 ("the Engineer" in this plan means MTRC representative). The monitoring results shall be submitted to the Engineer on a daily basis. 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, utilities and water mains 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;
- Whenever, a significant difference between successive readings is observed/ recorded, the Engineer is to be informed instantly; A significant difference will in general be a change in groundwater pressure of more than 1 m between successive readings unless the groundwater level is known to be tidal. Where the groundwater level is known to be tidal a significant difference will be a level which is either 0.5 m greater than the highest level previously recorded or 0.5 m lower than the lowest level previously recorded.
- 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;

2 Monitoring and Reporting Team

A. Work Flow

The proposed monitoring process can be represented by a flow chart as shown in Figure 1.

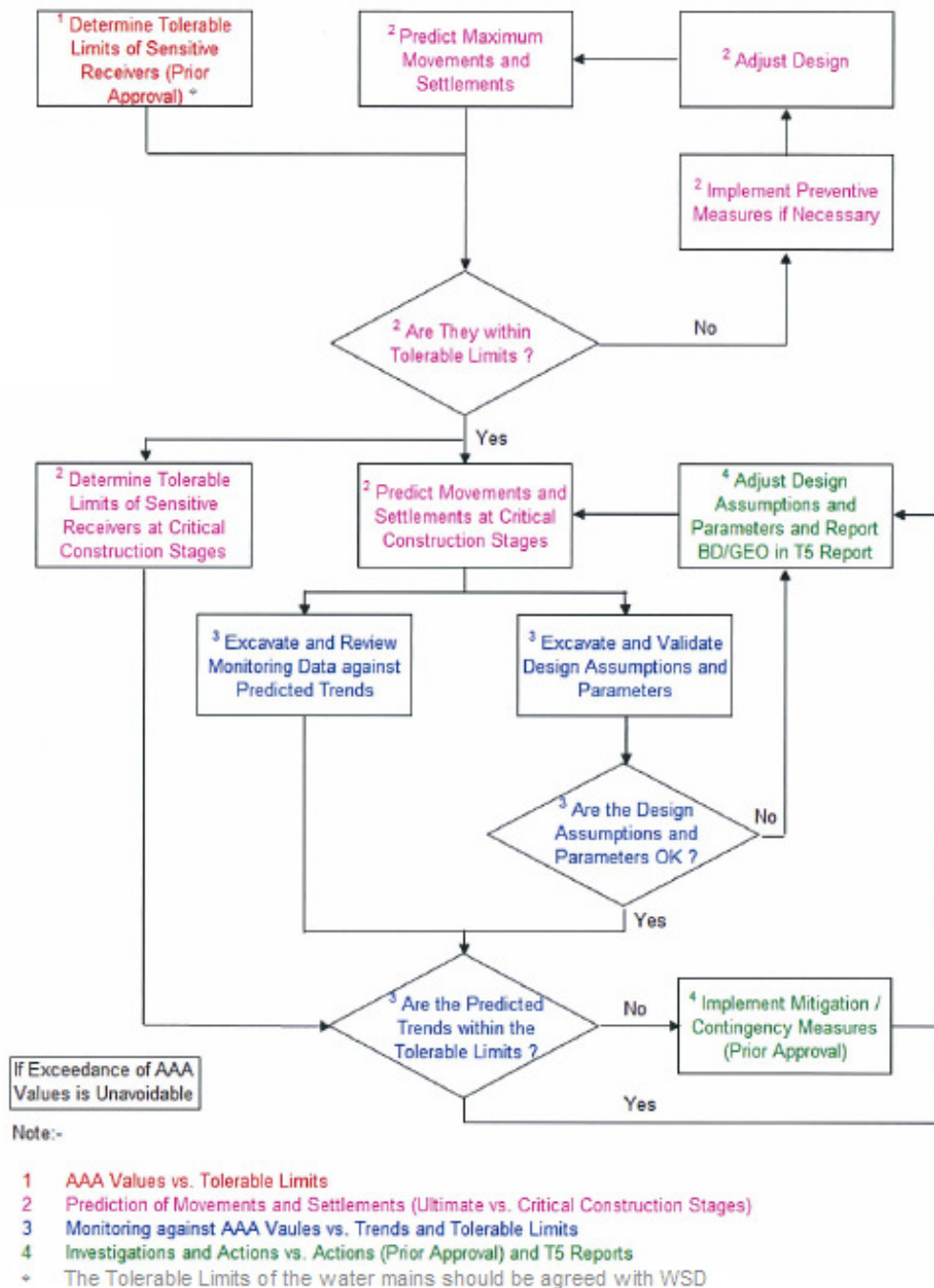
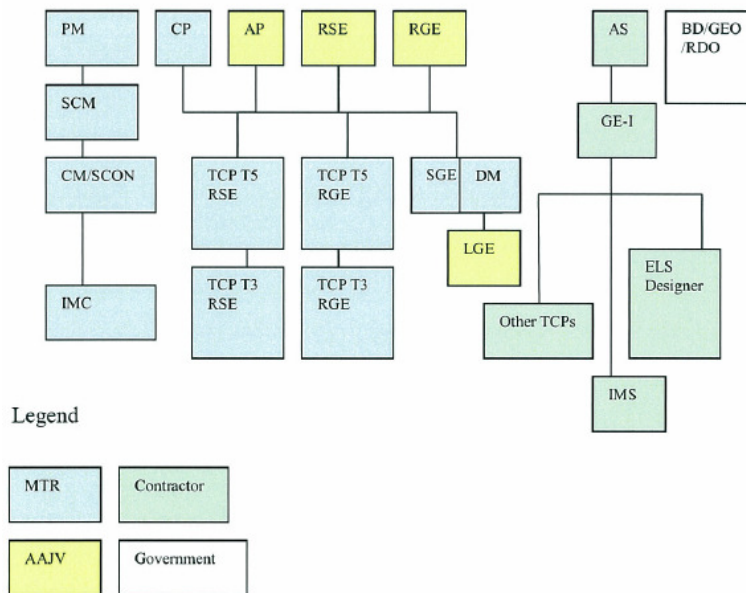


Figure 1 – Flow Chart of the Monitoring and Reporting Team

B. Management Organization



- AAJV - MTR's Detail Design Consultant (AECOM)
- PM - Project Manager
- SCM - Senior Construction Manager
- CP - Competent Person
- CM - Construction Manager
- DM - Design Manager
- SCON - Senior Construction Engineer
- IMC - Independent Monitoring Consultant
- TCP - Technical Competent Person of RSE and RGE's stream as stipulated in the Site Supervision Plan (SSP)
- LGE - Lead Geotechnical Engineer for monitoring
- RSE - Registered Structural Engineer
- RGE - Registered Geotechnical Engineer
- BD - Buildings Department
- GEO - Geotechnical Engineering Office
- RDO - Railway Development Office
- AS - Authorized Signatory
- GE-I - Geotechnical Engineer (Instrumentation) who shall be the representative of the Contractor for the liaison of the ELS works and instrumentation and be responsible for managing the validation of design assumptions
- TCP T5 - Technical Competent Person of AS's stream as stipulated in the Site Supervision Plan (SSP)
- ELS Designer - Contractor's designer for the excavation and lateral support works
- IMS - Instrumentation monitoring subcontractor of the Main Contractor

Figure 2 – Organization Chart of the Monitoring and Reporting Team

a) Authorized Signatory (AS)

This AS is the person appointed to act for the Contractor for the purposes of demonstrating compliance with the Building Ordinance. The AS shall provide continuous supervision to the works. The AS shall ensure the GE-I and the technically competent persons (TCP) carry out their duties and undertake the remedial works recommended by the AS. It is proposed that Mr. Francis Choi take on the role as an AS. Mr. Choi has over 20 years professional experience in management of civil, building and foundation construction projects. He is Chartered Engineer and has been recognised as an Authorised Signatory by Buildings Department since 2004.

b) Geotechnical Engineer- Instrumentation (GE-I)

The GE-I is responsible for submitting data to the AS of the Contractor Stream and then to the T5 of the RGE Stream and then to the T5 of the RGE Stream for review in the correct format as specified herein. The format should show the trend of the monitoring data with respect to the different stages of construction. Relevant construction activities will be identified in the summary of the data. The GE-I shall carry out the interpretation of instrumentation data and the submission of factual instrumentation data and any interpretation reports to the Project Manager and then to the Engineer.

It is proposed that Dr. Siew Wei Lee of GCG (Asia) Ltd be the GE-I for the purposes of this Management Plan. Dr. Lee is a Chartered Engineer and has previous experience in managing and interpretation instrumentation data for a major mass transit railway station excavation in a sensitive urban setting.

c) TCPs of the Contractor Stream

The TCPs are responsible for reviewing the summary of monitoring readings prepared by the Geotechnical Engineer- Instrumentation (GE-I). The TCPs shall gather the monitoring readings of geotechnical instruments where exceedences occur and they should also review the trend of the data to identify any potential problem associated with the construction works. The TCPs shall add any remark regarding nearby construction activities, submit remedial action plans to the TCP5 of the RGE Stream and report to the CP and RGE at regular intervals.

3 Monitoring Locations

Locations for the standpipes and piezometers were provided in Drawings No.810B/T/WKT/AAT/C06/021 and 810B/T/WKT/AAT/C06/031, A copy of the drawing is attached.

Summary of the standpipes and piezometers are:

Instrument Type	Instrument No.	Provisional Installation Depth (mPD)
Existing Piezometer	PZ1	-5
	PZ2(PZ), PZ2(SP)	-5
	PZ3(PZ), PZ3(SP)	-5
	PZ4	-5
	PZ5(PZ), PZ5(SP)	-5
	PZ6(PZ), PZ6(SP)	-5
	PZ7(PZ), PZ7(SP)	-5
	PZ8	-5
	PZ9(PZ), PZ9(SP)	-5
	PZ10	-5
	PZ11	-5
Additional Piezometer	APZ1, APZ4A	-10
Existing Standpipe	SP1 to SP3	-5
	SP4	-20
	SP5 to SP6	-4
	SP7	-5
	SP8	-4
	SP9	-20
	SP10	-5
	SP11 to SP15	-10
Additional Standpipe	ASP1 to ASP2	-5

Note:

- This table is abstracted from Drawing No. 810B/T/WKT/AAT/C06/043

4 Monitoring Frequency

With reference to Drawing No. 810B/T/WKT/AAT/C06/043 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)	Bi-weekly	Weekly	Daily

In accordance with Materials & Workmanship (M&W) Specification Clause 23.6.02 the Geotechnical Engineer – Instrumentation is Dr Lee Siew Wei and he will be in charge of the monitoring record and report the record regularly for client inspection. (sample of the daily monitoring report attached in Appendix A)

Methodology of ground water level monitoring will be carried out in accordance with M&W Specification Clause 23.14.04. Please refer to the submitted Method Statement for the installation of piezometer for details.

In accordance with M&W Specification Clause 23.19.04 the reporting of PZ&SP shall includes plots of groundwater elevation versus time. For PZ&SP in areas influenced by tidal variation, the plots of piezometer data shall also show the tide level plotted versus time on the same axis.

5 **Alert, Action and Alarm (AAA) Level and Contingency Actions**

With reference to Drawing No. 810B/T/WKT/AAT/C06/043 the AAA response values for the water table (lowest groundwater level) are shown as below:

Piezometer/ Standpipe No.	Alert (mPD)	Action (mPD)	Alarm (mPD)
All Piezometers/ Standpipe	+1.3	+0.8	+0.3

Note:

- The reference level is a baseline to check if any groundwater drawdown reaches AAA response values(+1.3-+0.8-+0.3mPD)
- The reference level will be defined later as the lowest groundwater table measured before the commencement of dewatering works on site.
- The reference levels will be reviewed against the data from the existing instrumentation and revised if considered appropriate

The Alert, Action, Alarm levels for all geotechnical instrumentations are specified on drawing no. 810B/T/WKT/AAT/C06/043. 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 the groundwater monitoring records and also the adjacent total and differential movements/distortions to date. Assessing the effects of the change in the groundwater level on the movements/distortion on monitored elements and predicting further movements and their effect on monitored elements should the groundwater level continue to change;
3. Where it is considered and agreed by the Engineer that groundwater level and associated movement trends indicate that "action level" may be reached during the course of works. The contractor shall submit a detailed action plan which will include proposals for remedial measures to limit further groundwater level change 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 Engineer and BD/GEO as appropriate shall be informed immediately;
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 groundwater monitoring records and associated movements including differential movements and distortion. The report shall assess the effects on monitored elements and predict further groundwater level change and associated 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 as appropriate 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 groundwater level changes and associated 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:

1. In case of AAA exceedance, any actual remedial measures are proposed in an Investigation report by reviewing various surrounding conditions.
2. Alarm Level exceedance and the mitigation measures implemented would be included in the monthly EM&A report.

6 Procedure for Trigger Level Exceedance

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

Reference is also made to Clause 23.7.08 of the M&W Specification with respect to the requirement for plans of action in the following sections.

B. Instruments which Reach Alert Value

Instruments that reach Alert Value will be reported to the Construction Team, MTRC and Independent Monitoring Consultant (IMC) within 24 hrs after the exceedance. The contractor shall immediately submit a Investigation Report (IR) with an updated IR Log to the Engineer reviewing the groundwater monitoring records and the associated total and differential movements/distortions to date, assessing the effects of the groundwater level changes and the movements/distortions on monitored elements and predicting further groundwater level changes and associated 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 RGE 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 prepare a detailed plan of action which will include 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.

C. 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 or owners such as HyD, relevant utilities owner (WSD, DSD, TGC, CLP, Telecoms, etc) or other private owner(LCSD, KLL, etc).

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.

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.

D. Mitigation Measures on Reaching Action Value

In accordance with Section 11 of the EIA report the following measures will be put in place to mitigate any effects due to adverse drawdown of the groundwater table during the operation of the temporary dewatering works:

- Toe grouting will be applied beneath the toe level of the temporary / permanent cofferdam walls as necessary to lengthen the effective flow path of groundwater from outside and thus control the amount of water inflow into to the excavation.
- Recharge wells will be installed as necessary outside the excavation areas. Water pumped from the excavation areas should be recharged back into the ground.

E. 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 or owners such as HyD, relevant utilities owner (WSD, DSD, TGC, CLP, Telecoms, etc) or other private owner(LCSD, KLL, etc). 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 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 saurry wall) etc.*

F. 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.

The effectiveness of the response actions will also be reviewed in the GIIR. 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.

7 Event/ Action Plan for Excessive/ Insufficient Groundwater Levels

	Event	Contractor's Geotechnical Engineer- Instrumentation	Contractor	MTR	Potential measure will be taken by contractor	MTR's ET Leader
Trigger Levels	(a) Alert Level more than 0.5m below baseline level	(a1) will be reported to the Construction Team, MTRC and Independent Monitoring consultant (IMC)- MaxWell within 24hrs after the exceedance Submit a Investigation Report with an updated Investigation Report (IR) Log to the 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	(a1) No action (a2) Increase groundwater recharge rate. Daily monitoring until groundwater levels return to within tolerances	--

XRL Contract 810B West Kowloon Terminus (South)

	Event	Contractor's Geotechnical Engineer- Instrumentation	Contractor	MTR	Potential measure will be taken by contractor	MTR's ET Leader
Trigger Levels	(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 48 hours and review the construction method and suspend the work if necessary.	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.	--

XRL Contract 810B West Kowloon Terminus (South)

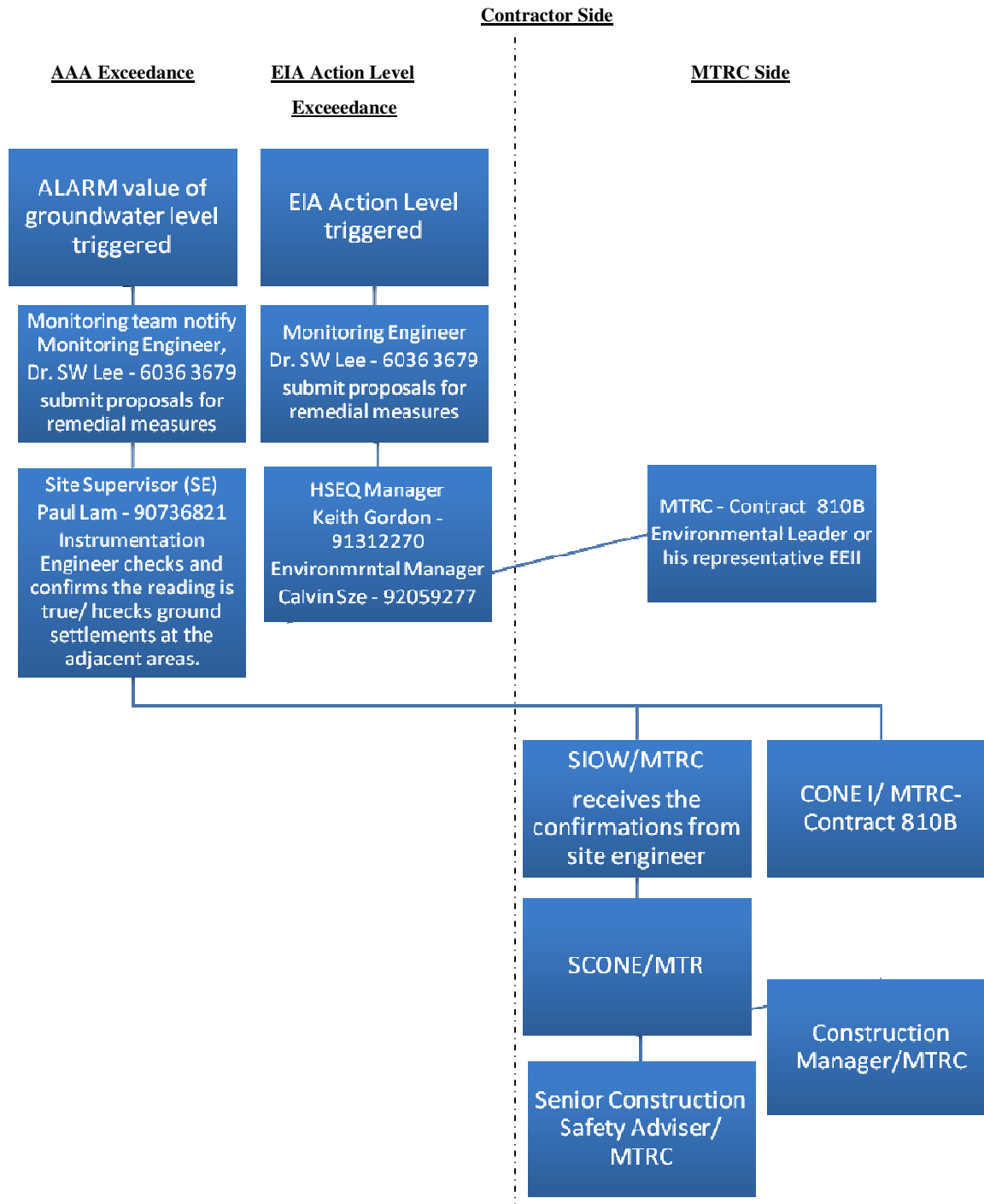
	Event	Contractor's Geotechnical Engineer- Instrumentation	Contractor	MTR	Potential measure will be taken by contractor	MTR's ET Leader
Trigger Levels	(c) Alarm Level more than 1.0m below baseline level	(c1) The GEI will advise the relevant Section Head of the Construction Team to implement the predefined 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. (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.	(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. (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 recharging 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.	To review the investigation report with an updated Investigation Report (IR) Log	(c1) No action (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 remedial proposals and suspend the works until the groundwater level rises to within tolerance range.	--

XRL Contract 810B West Kowloon Terminus (South)

	Event	Contractor's Geotechnical Engineer- Instrumentation	Contractor	MTR	Potential measure will be taken by contractor	MTR's ET Leader
Trigger EIA Action level	(d) 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), (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 logbook.

Contract 810B- West Kowloon Terminus South

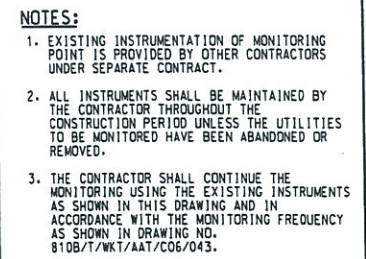
Groundwater Monitoring AAAv Value Emergency Notification



Laing O' Rouke- Hsin Chong- Paul Y. JV			
Staff Name	Position	Office	Mobile
Mike O' Hanlon	Project Manager	2472 9402	9277 6722
Francis Choi	Senior Construction Manager	2472 9403	9423 3469
Keith Gordon	Health, Safety, Environmental and Quality Manager	2472 9506	9131 2270
Otto Lee	Construction Manager	2472 9406	9138 8828
Peter Ching	Technical Manager	2472 9433	6190 4399
Jack Lai	Safety Manager	2472 9505	9654 2966
Ivan Summersby	Interface Manager	2472 9404	9852 0102
David Hung	Deputy Technical Manager	2472 9458	9354 9750
Marco Chan	Section Engineer- Austin Road West Excavation and lateral support (Operations Manager)	2472 9464	9275 7033
Gary Chow	Site Agent- Traffic and Utility (Operations Interface Manger)	2472 9463	9162 1142
Roy Stitt	Project Engineer (Instrumentation and Monitoring)	2472 9436	9470 2253
Albert Wong	General Foreman (Operations Coordinator)	TBC	9698 4178
Paul Lam	Section Foreman (Geotechnical Instrumentation Supervisor	2472 9471	9073 6821
S.W. Lee	Geotechnical Engineer- Instrumentation	2472 9437	6036 3679
MTR Corporation			
K.S. Lim	Construction Manager	29269098	93066634
William Mak	Senior Construction Engineer	29269238	94167057
Thomas Leung	Construction Engineer I	29269285	98706913
Rico Lai	Construction Engineer I	29269228	90777731
Edmund Choi	Construction Engineer I	29269284	98314087
Felix Li	Senior Inspector of Works	29269288	62934937
Jenny Tam	Project communication Manager	22083098	61177822
Lute Yip	PR Officer	22083097	TBC

APPENDIX A- PROFORMA OF THE MONITORING RECORD AND PLOTTING

APPENDIX B- DRAWINGS

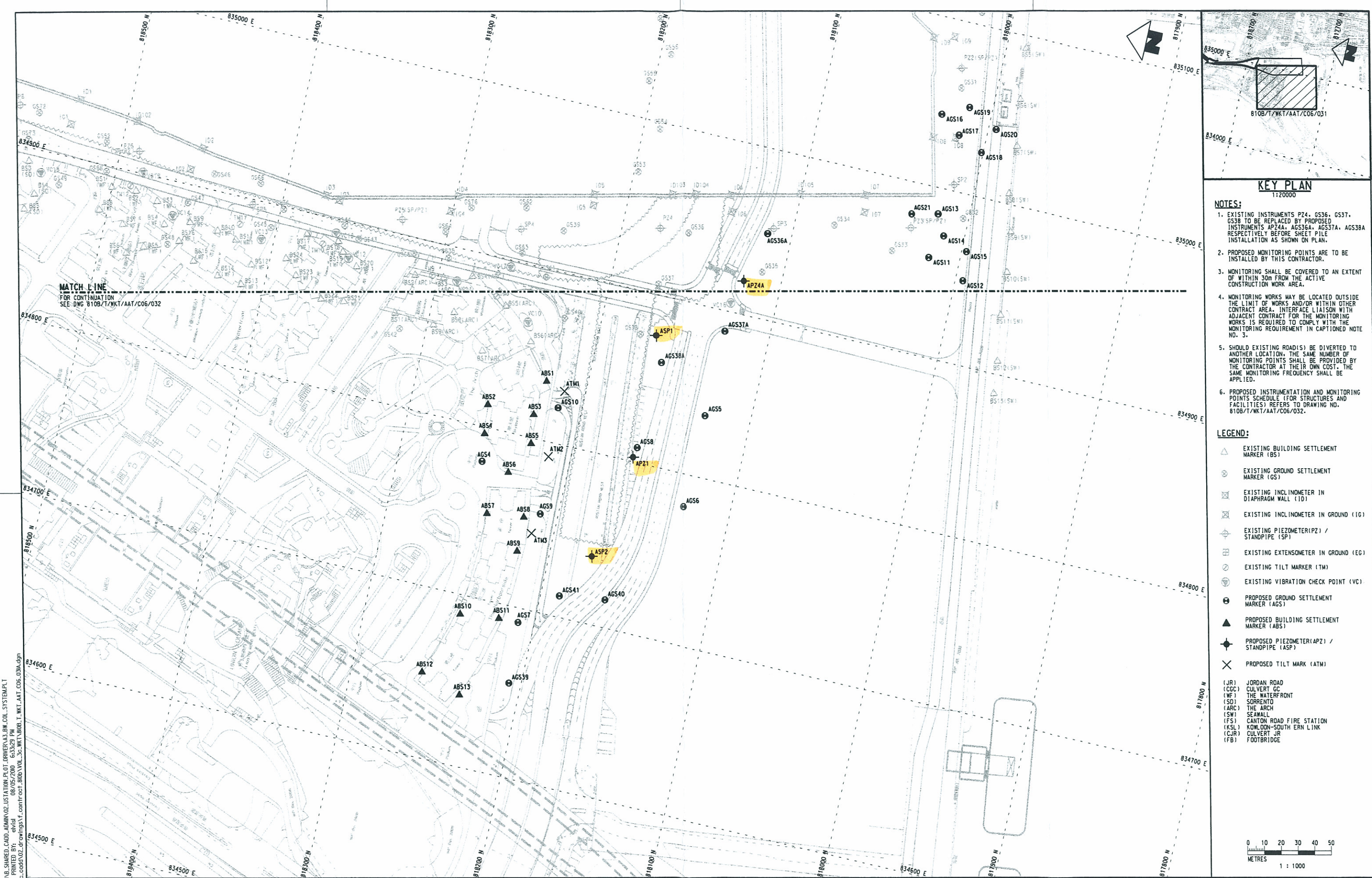


△	EXISTING BUILDING SETTLEMENT MARKER (BS)
⊗	EXISTING GROUND SETTLEMENT MARKER (GS)
⊠	EXISTING INCLINOMETER IN DIAPHRAGM WALL (ID)
⊠	EXISTING INCLINOMETER IN GROUND (IG)
⊕	EXISTING PIEZOMETER(PZ) / STANDPIPE (SP)
⊞	EXISTING EXTENSOMETER IN GROUND (EG)
○	EXISTING TILT MARKER (TM)
⊙	EXISTING VIBRATION CHECK POINT (VC)

TYPE	INSTRUMENT NO.
EXISTING BUILDING SETTLEMENT MARKER (BS)	BS1 TO BS24 (WF) BS1 TO BS58 (SD) BS1 TO BS10 (FB) BS1 TO BS28 (NSL) BS1 TO BS9 (ARC) BS1 TO BS13 (SW) BS1 TO BS8 (FS)
EXISTING GROUND SETTLEMENT MARKER (GS)	GS4 TO GS66, GS68 TO GS78
EXISTING INCLINOMETER IN DIAPHRAGM WALL (ID)	ID1 TO ID12 ID14 TO ID20 ID101 TO 110
EXISTING INCLINOMETER IN GROUND (IG)	IG1 TO IG12 IG14 TO IG20
EXISTING PIEZOMETER(PZ) / STANDPIPE (SP)	PZ1, PZ2(SP), PZ2(PZ), PZ3(SP), PZ3(PZ), PZ4, PZ5(SP), PZ5(PZ), PZ6(SP), PZ6(PZ), PZ7(SP), PZ7(PZ), PZ8, PZ9(SP), PZ9(PZ), PZ10 TO PZ11
EXISTING EXTENSOMETER IN GROUND (EG)	EG1 TO EG4
EXISTING TILT MARKER (TM)	TM1 TO TM13
EXISTING VIBRATION CHECK POINT (VC)	VC1 TO VC22



TITLE CONTRACT 810B WEST KOWLOON TERMINUS STATION SOUTH EXISTING INSTRUMENTATION AND MONITORING LAYOUT PLAN (FOR STRUCTURES AND FACILITIES) (SHEET 1 OF 4)			
SCALE	DRAWING NO.	REV.	
1 : 1000 @ A1	810B/T/WKT/AAT/C06/021	A	

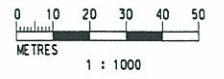


KEY PLAN

1:20000

- NOTES:**
- EXISTING INSTRUMENTS PZ4, GS36, GS37, GS38 TO BE REPLACED BY PROPOSED INSTRUMENTS AP24A, AGS36A, AGS37A, AGS38A RESPECTIVELY BEFORE SHEET PILE INSTALLATION AS SHOWN ON PLAN.
 - PROPOSED MONITORING POINTS ARE TO BE INSTALLED BY THIS CONTRACTOR.
 - MONITORING SHALL BE COVERED TO AN EXTENT OF WITHIN 30M FROM THE ACTIVE CONSTRUCTION WORK AREA.
 - MONITORING WORKS MAY BE LOCATED OUTSIDE THE LIMIT OF WORKS AND/OR WITHIN OTHER CONTRACT AREA. INTERFACE LIAISON WITH ADJACENT CONTRACT FOR THE MONITORING WORKS IS REQUIRED TO COMPLY WITH THE MONITORING REQUIREMENT IN CAPTIONED NOTE NO. 3.
 - SHOULD EXISTING ROAD(S) BE DIVERTED TO ANOTHER LOCATION, THE SAME NUMBER OF MONITORING POINTS SHALL BE PROVIDED BY THE CONTRACTOR AT THEIR OWN COST. THE SAME MONITORING FREQUENCY SHALL BE APPLIED.
 - PROPOSED INSTRUMENTATION AND MONITORING POINTS SCHEDULE (FOR STRUCTURES AND FACILITIES) REFERS TO DRAWING NO. 810B/T/WKT/AAT/C06/032.

- LEGEND:**
- EXISTING BUILDING SETTLEMENT MARKER (BS)
 - EXISTING GROUND SETTLEMENT MARKER (GS)
 - EXISTING INCLINOMETER IN DIAPHRAGM WALL (ID)
 - EXISTING INCLINOMETER IN GROUND (IG)
 - EXISTING PIEZOMETER (PZ) / STANDPIPE (SP)
 - EXISTING EXTENSOMETER IN GROUND (EG)
 - EXISTING TILT MARKER (TM)
 - EXISTING VIBRATION CHECK POINT (VC)
 - PROPOSED GROUND SETTLEMENT MARKER (AGS)
 - PROPOSED BUILDING SETTLEMENT MARKER (ABS)
 - PROPOSED PIEZOMETER (APZ) / STANDPIPE (ASP)
 - PROPOSED TILT MARK (ATM)
- (JR) JORDAN ROAD
(CC) CULVERT CC
(WF) THE WATERFRONT
(SO) SORRENTO
(ARC) THE ARCH
(SW) SEAWALL
(FS) CANTON ROAD FIRE STATION
(KSL) KOWLOON-SOUTH ERN LINK
(CJR) CULVERT JR
(FB) FOOTBRIDGE



PLOT DRW: G:\C06\000\COMMON\B_SHARED\CADD_ADMIN\02_UTILITY\02_DRAWING\A3\B_W_C06_031A.dgn
PRINTED BY: 08/05/2010 16:33:23 PM
MODEL NAME: 810B-T-WKT-AAT-C06-031A.dgn
FILE NAME: 810B-T-WKT-AAT-C06-031A.dgn

DRAWN JUN LI				DESIGNED CHRIS CHEUNG				CHECKED JOHN MENNIS				APPROVED KELVIN KO				DATE 14MAY2010			
A TENDER DRAWING ISSUE				JM				14MAY10				KK				BY DATE APPROVED			
DESCRIPTION				DESCRIPTION				BY DATE APPROVED				BY DATE APPROVED				BY DATE APPROVED			
REV				REV				REV				REV				REV			

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

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CADD REF. 810B-T-WKT-AAT-C06-031A.dgn

CONTRACT 810B

WEST KOWLOON TERMINUS STATION SOUTH

PROPOSED INSTRUMENTATION AND MONITORING

LAYOUT PLAN (FOR STRUCTURES AND FACILITIES)

(SHEET 1 OF 5)

SCALE 1 : 1000 @ A1

DRAWING NO. 810B/T/WKT/AAT/C06/031

REV. A

TABLE 1: MONITORING FREQUENCY

INSTRUMENT TYPE	BACKGROUND / STANDARD / ACTIVE MONITORING FREQUENCY		
	BACKGROUND	STANDARD	ACTIVE
GS	B1-WEEKLY	WEEKLY	DAILY
BS	B1-WEEKLY	WEEKLY	DAILY
US	B1-WEEKLY	WEEKLY	DAILY
ID	B1-WEEKLY	WEEKLY	DAILY
IG	B1-WEEKLY	WEEKLY	DAILY
EG	B1-WEEKLY	WEEKLY	DAILY
TM	B1-WEEKLY	WEEKLY	DAILY
SP / PZ	B1-WEEKLY	WEEKLY	DAILY
VC	B1-WEEKLY	WEEKLY	DAILY
STRAIN GAUGE	B1-WEEKLY	WEEKLY	DAILY

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

NAME OF BUILDING. STRUCTURE OR UTILITY	AAA RESPONSE VALUES													
	SETTLEMENT			ANGULAR DISTORTION			VIBRATION							
							TRANSIENT VIBRATION				PROLONGED VIBRATION			
	ALERT (mm)	ACTION (mm)	ALARM (mm)	ALERT	ACTION	ALARM	PPVC (mm/s)			AMPLITUDE (mm)	PPVC (mm/s)			AMPLITUDE (mm)
ALERT							ACTION	ALARM	ALERT		ACTION	ALARM		
AUSTIN STATION & TUNNELS	10	15	20	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
SEAWALL ALONG WKCD	12	18	25	1:1500	1:1000	1:500	25	40	50	0.2	15	24	30	0.2
TST FIRE STATION & BUILDINGS	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
BOX CULVERT GC/JR	10	15	20	1:1500	1:1000	1:500	12	18	25	0.2	12	18	25	0.2
UTILITIES (GAS, ELECTRICITY, DRAINS & SEWER, TELEPHONE)	10	20	25	1:1500	1:1000	1:500	12	18	25	0.2	12	18	25	0.2
UTILITIES (WATER MAIN, COOLING MAIN)	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	12	18	25	0.2
GROUND	12	18	25	-	-	-	-	-	-	-	-	-	-	-
KOWLOON STATION DEVELOPMENT - SORRENTO	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
KOWLOON STATION DEVELOPMENT - THE WATERFRONT	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
KOWLOON STATION DEVELOPMENT - THE ARCH	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
KOWLOON STATION DEVELOPMENT - THE HARBOURSIDE	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
FOOTBRIDGE FB14	8	12	15	1:2000	1:1500	1:1000	12	18	25	0.2	8	12	15	0.2
SEAWALL (BARGING POINTS)	12	18	25	1:1500	1:1000	1:500	25	40	50	0.2	15	24	30	0.2
UTILITIES (GAS MAIN GOVERNOR, HIGH VOLTAGE CABLE JOINT)	10	20	25	1:1500	1:1000	1:500	12	18	25	0.2	6	10	13	0.2

TABLE 3: AAA RESPONSE VALUES FOR GROUNDWATER TABLE (LOWEST GROUNDWATER LEVEL)

PIEZOMETER / STANDPIPE NO.	ALERT (mPD)	ACTION (mPD)	ALARM (mPD)
ALL PIEZOMETERS / STANDPIPES	+1.3	+0.8	+0.3

REMARKS : THESE AAA VALUES ON GWT WILL BE FURTHER REVIEWED UPON THE LATEST GWT MONITORING RECORDS.

TABLE 4: INSTRUMENTATION PROVISIONAL INSTALLATION DEPTH

INSTRUMENT TYPE & NO.	PROVISIONAL INSTALLATION DEPTH (mPD)
PZ1	-5
PZ2(PZ)	-5
PZ2(SP)	-5
PZ3(SP)	-5
PZ3(PZ)	-5
PZ4	-5
PZ5(PZ)	-5
PZ5(SP)	-5
PZ6(PZ)	-5
PZ6(SP)	-5
PZ7(PZ)	-5
PZ7(SP)	-5
PZ8	-5
PZ9(PZ)	-5
PZ9(SP)	-5
PZ10	-5
PZ11	-5
SP1	-5
SP2	-5
SP3	-5
SP4	-20
SP5	-4
SP6	-4
SP7	-5
SP8	-4
SP9	-20
SP10	-5
SP11	-10
SP12	-10
SP13	-10
SP14	-10
SP15	-10
EG1	-30
EG2	-17
EG3	-23
EG4	-25
ID1	-24
ID2	-26
ID3	-27.5
ID4	-39
ID5	-47
ID6	-51
ID7	-43
ID8	-41
ID9	-25
ID10	-23
ID11	-20
ID12	-25
ID14	-31
ID15	-46
ID16	-31
ID17	-17
ID18	-23
ID19	-26
ID20	-22
ID101	-27
ID102	-25.5
ID103	-55
ID104	-56
ID105	-54
ID106	-37
ID107	-28

ID108	-48
ID109	-20
ID110	-20.5
IG1	-25.5
IG2	-28
IG3	-27.5
IG4	-40
IG5	-48
IG6	-51
IG7	-43
IG8	-41
IG9	-25
IG10	-23
IG11	-20
IG12	-25
IG14	-28
IG15	-48
IG16	-31
IG17	-17
IG18	-22
IG19	-26
IG20	-23
* IS1	-22
* IS2	-23
* IS3	-25
* IS4	-26
* IS5	-35
* IS6	-35
* IS7	-49
* IS8	-49
* IS9	-49
* IS10	-53
* IS11	-43
* IS12	-38
* IS13	-20
* IS14	-32
* IS15	-28
* IS16	-33
* IS17	-33
* IS18	-43
* IS19	-43
* IS20	-41
* IS21	-33
* IS22	-20
* IS23	-18
* IS24	-26
* IS25	-25
* IS26	-24
* APZ1	-10
* APZ4A	-10
* ASP1	-5
* ASP2	-5

* PROPOSED INSTRUMENTS TO BE INSTALLED BY THE CONTRACTOR.

NOTES:

- THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING NO. 810B/T/WKT/AAT/C06/021-024, 031-035.
- EXISTING PIEZOMETER PZ4 TO BE REPLACED BY PROPOSED PIEZOMETER APZ4A BEFORE SHEET PILE INSTALLATION.

PLOT DRW: Q:\C06\001\COMMON\B_SHARED\CADD_ADMIN\02_UTILITY\PLT_DRIVER\A3_BW_COL_SYSTEM\PLT
 MODELNAME: 02/05/2010 10:55:51 AM
 FILENAME: Q:\C06\001\COMMON\B_SHARED\CADD_ADMIN\02_UTILITY\PLT_DRIVER\A3_BW_COL_SYSTEM\PLT

DRAWN JUN LI
 DESIGNED CHRIS CHEUNG
 CHECKED JOHN MENNIS
 APPROVED KELVIN KO
 DATE 14MAY2010

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 EXPRESS RAIL LINK
 AECOM Aedas
 CADD REF. 810B.T.WKT.AAT.C06.043A.dgn

TITLE CONTRACT 810B
 WEST KOWLOON TERMINUS STATION SOUTH
 INSTRUMENTATION AND MONITORING
 TYPICAL DETAILS
 (SHEET 3 OF 3)
 SCALE N.T.S.
 DRAWING NO. 810B/T/WKT/AAT/C06/043
 REV. A