C510 – Whitechapel and Liverpool Street Station Tunnels

Instrumentation and Monitoring Close Out Report
Block 14 Liverpool Street
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This document has been reviewed by the following individual for coordination, compliance, integration and acceptance and is acceptable for transmission to the above stakeholder for the above stated purpose.

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Stakeholder Organisation	Job Title	Name	Signature	Date	Acceptance
					☐
					☐

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[redacted] Date: 26/07/17

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1 Purpose of Close out Report

Materials and Workmanship Specification - Instrumentation and Monitoring (C122-OVE-Z4-RSP-CR001-00007), section KX10.2114 specifies the requirement for a close out report prior to the decommissioning of monitoring sensors and instruments. It is therefore, the purpose of this close out report to gain acceptance to decommission identified monitoring sensors in Block 14 of Crossrails's C510 Liverpool St. Acceptance to decommission sensors will result in ceasing measurements, stopping the reporting and removing sensors.

To gain approval to decommission instrumentation and monitoring, the monitoring data will be analysed to demonstrate settlement does not breach specified rates after the minimum monitoring period is complete.

This revision of the close out report (revision 2) proposes to decommission the remaining manual monitoring not agreed in Revision 1. The summary table and associated graphs for sensors agreed to be decommissioned in Revision 1 are provided in Appendix 1.

N.B. Monitoring sensors refers to all monitoring points; which includes BREs, road studs, extensometers, inclinometers, tilt meters, crack meters, retros (survey stickers) and prisms. Please note this is not an exhaustive list and does not include monitoring systems/equipment, such as communication boxes.

2 Scope of Monitoring Assessment for Close Out

Specification KX10.4103 of document C122-OVE-Z4-RSP-CR001-00007 states that to establish approval for decommissioning, the contractor is to produce a close out report which summarises the observations in correlation with the construction activities. The report is to demonstrate monitoring has reached acceptable settlement rates; whether to the specified rate, or where no rate is specified trigger values are evaluated against potential residual risks. I&M schedule C122-OVE-C2-DDJ-CR001-Z-31511 specifies the acceptable settlement rates with the requirements to monitor at different construction phases, and duration for completion. To summarise the I&M schedule states that the manual monitoring decommissioning specified rate is 2mm per year, following 16 months post construction monitoring (4 months step down and quarterly measurements for a minimum of 12 months long term monitoring). The I&M schedule does not identify the need for long term automated monitoring or specify a settlement rate requirement, it only states that monitoring must continue for 6 months post construction. At the 6 month juncture, agreement must be sought from the project manager to decommission automated monitoring programmes through a close out report or agreeing to cease the works with the project manager. In most cases decommissioning will be possible, as the residual risk will be captured through the remaining long term manual monitoring.

Contrary to the Specification for Instrumentation and Monitoring (*C122-OVE-Z4-RSP-CR001-00007)*, the Project Managers Instruction (PMI) C510-PMI-01102 replaces long term monitoring with satellite interferometry (InSAR) for the areas agreed by the project manager. If long term monitoring responsibilities are removed from BBMV and covered by satellite interferometry, the specified settlement criteria may not be met by BBMV. If this occurs, reference to the agreement will be provided to state BBMV are no longer responsible for the sensors and consequently decommissioning acceptance will be proposed.

In some cases it may be agreed with the project manager to cease monitoring prior to meeting the specified rates. The close out report will be revised to incorporate these agreements prior to decommissioning. Due to multiple influencers and large construction monitoring zones, it may be prudent to submit successive document revisions for close out reports, where the specification is not met or the minimum post construction monitoring has not been achieved.

3 Close Out Report Block Description and Location Plan

3.1 Block 14 Location

Figure 1 shows the Liverpool St general location plan, C510 tunnel construction and where Block 14 is situated. Detailed location plans can be found within the installation reports and photomontages as listed in Section 3.2. Each monitoring sensor's location is shown within the assessment plans (Section 5.4).

Numerous utilities are located on Moorfields and Fore Street Avenue, including gas mains (steel and plastic), a cast iron water main, and a brick sewer beneath Moorefield's Highwalk. It is understood that part of the cast iron water main on Moorfields was replaced with a plastic main. Location and details of these assets can be found in Instrumentation and Monitoring Plan: Liverpool Street Station Ground Movement and Asset Protection C122-OVE-C2-RGN-C101-50013 or the relevant C122 prepared Damage Assessment Reports.

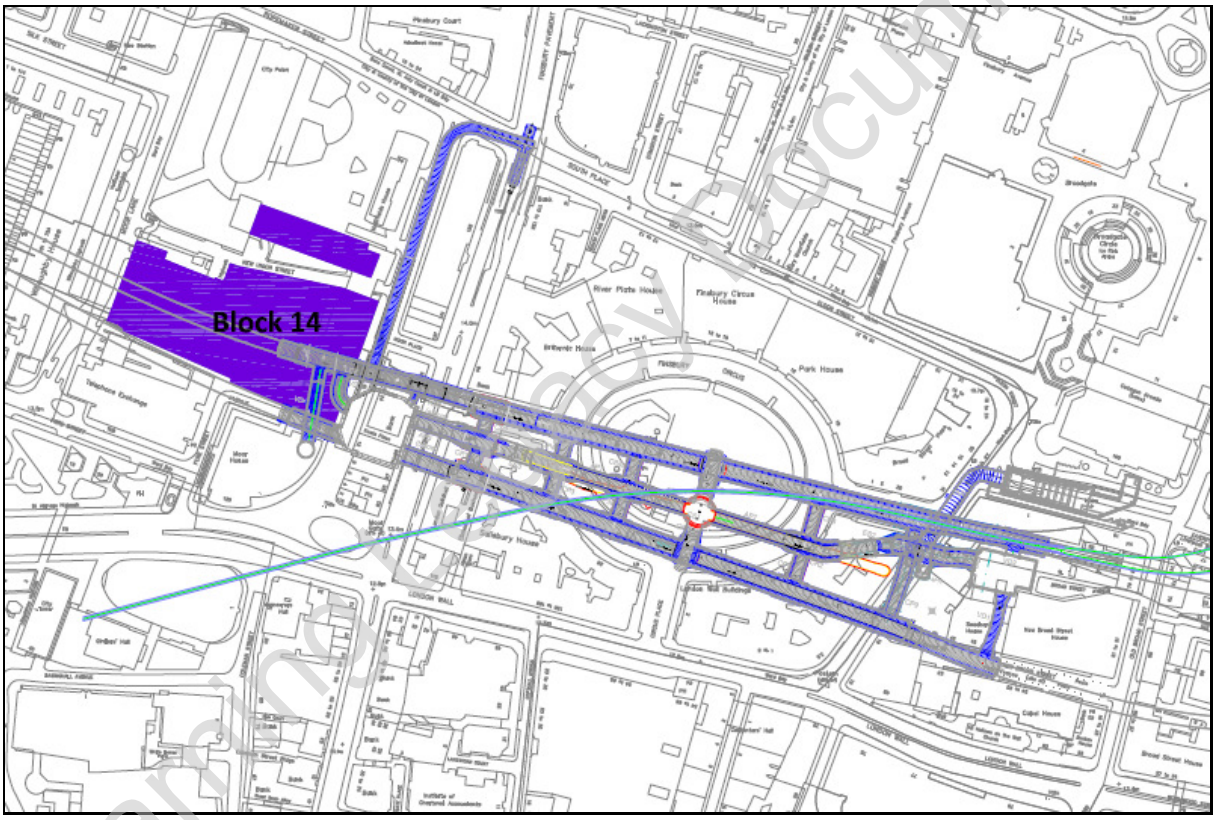


***Figure 1*- Liverpool St General Location Plan - including Block 14 monitoring area**

3.2 Block 14 Description

Block 14 is located between Moorgate and Moor Lane. The Block occupies Moorfields Highwalk and is adjacent to New Union St. Block 14 contains the following types of monitoring sensors:

- Road Studs (LP) - manual monitoring
- Building Prism monitoring (RP) – automated monitoring
- Tiltmeters (TB)- automated monitoring
- Building (BREs)- manual monitoring

Each monitoring assets details are listed within the Decommissioning Status Tracker (*Table 2*) and further relevant information can be sourced from the following reports.

Block 14 Report References:

- Monitoring Installation Report LIV-LB-14 – Liverpool Street

  CRL Document Number: C510-BBM-C2-RGN-C101-50132
- Monitoring Installation Report LIV-LP-14

  CRL Document Number: C510-BBM-C2-RGN-C101-50114
- Installation Report- Moorgate (Block 01), Liverpool Street
  CRL Document Number: C510-BBM-C2-RGN-C101-50004
- Installation Report- Tenter House (Block 15), Liverpool Street

  CRL Document Number: C510-BBM-C2-RGN-C101-50014

The Settlement Contour Drawing (C122-OVE-C2-DDA-CR001_Z-21313) predicts the Block 14 area to experience approximately 1-80mm of settlement.

4 Construction Programme Influencing Block 14

Extent of Influence (EOI) monitoring areas were established to record ground movements in relation to Crossrail construction. The EOI purpose is to ensure all assets and areas are adequately monitored for movement during construction, this is achieved by controlling when and how often monitoring occurs. The Asset Protection Instrument and Monitoring (I&M) Schedules (C122 –OVE-C2-DDJ-CR001_Z-31511) states the extent of influence (EOI) of an active tunnel is 2 x depth from the active tunnel face. The EOI is used to determine when monitoring sensors are no longer influenced by construction and can be considered for decommissioning.

The original specification received amendments to manual monitoring frequency within the EOI through several PMIs, with the latest PMI (C510-PMI-01103) establishing an Active ZOI (Zone of Influence) as 2 x tunnel diameter from the active tunnel face projected to the surface. The Active ZOI changed the rates of monitoring frequency, it did not replace EOI. The EOI is used to determine when a monitoring sensor is eligible for decommissioning. Whereas, active ZOI is used to analyse manual monitoring movement against construction.

To identify the tunnels that had the potential to significantly affect Block 14, a ZOI area was established by giving each monitoring sensor a radius of 2.0 x tunnel diameter. This area was then used to determine all the mining advances that occurred within its boundary, *Figure 2* shows the ZOI boundary (purple outline) and the tunnel constructions. Tunnel advance start and finish dates will be used in assessment of the monitoring data.

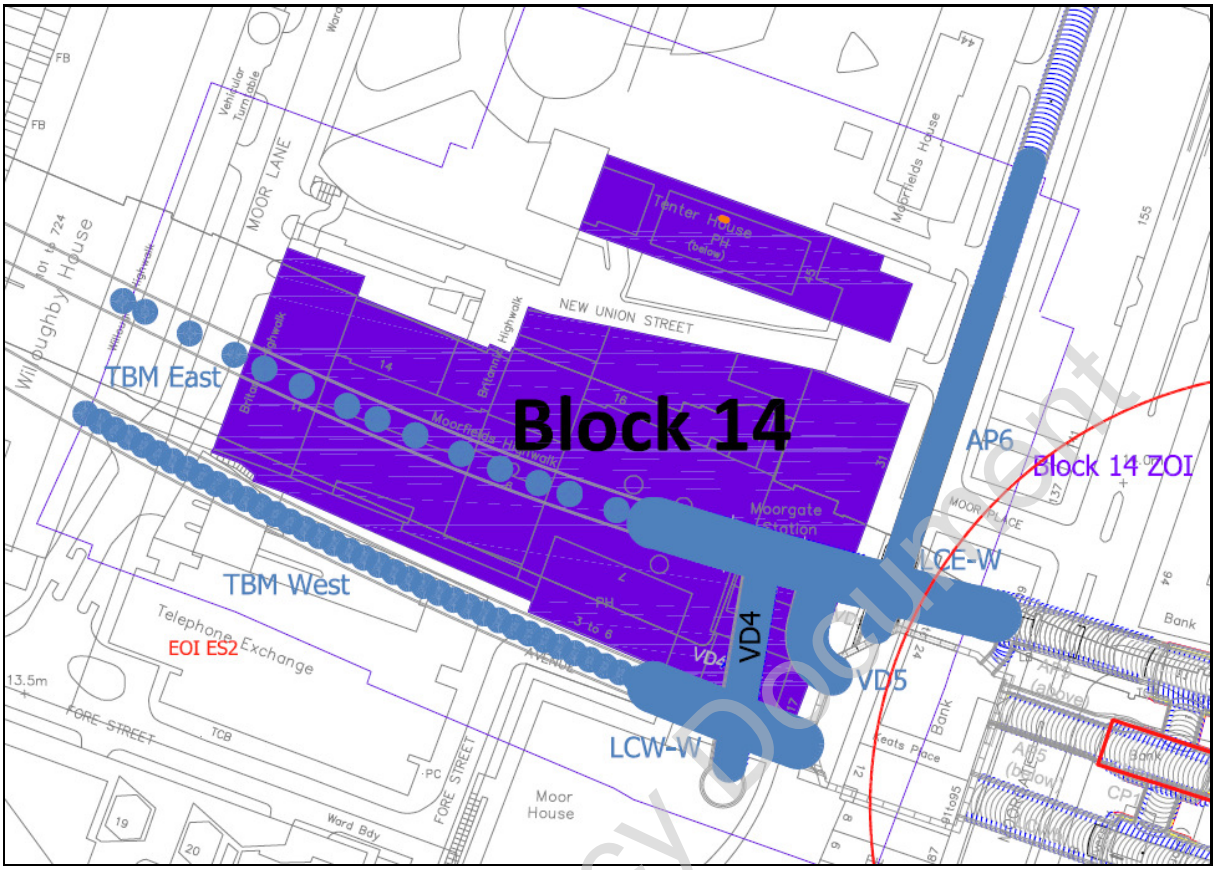


***Figure 2* - Block 14 ZOI Constructions**

N.B. ES3 EOI is represented in *Figure 2* to show that no Block 14 monitoring sensors should be influenced by ES3 construction.

Figure 2 shows the Block 14 ZOI and the tunnel advances that occurred within its boundary. The construction advances within the ZOI that have the potential to affect Block 14 are listed and summarised in *Table 1*. Further evidence for construction dates can be seen in *Table 2* or the appendix of this report which lists the latest tunnel advances for each point.

The last completed tunnel advance which had the potential to affect Block 14 within the ZOI was the AP6 Enlargement 2, which was completed in May 2015. As there is no further C510 construction that has the potential to influence Block 14, it is proposed to decommission all monitoring sensors.

N.B. It should be noted that C502 works may have affected Block 14. References should be made to C502 close out reports for construction dates.

4.1.1 Tunnel Advances Affecting Block 14

The information presented in *Table 1* is used in the monitoring graph (Section 5.1), to show the ground movements in relation to construction.

TUNNEL ADVANCES STARTS & ENDS FOR GRAPHS							
Tunnel Code	Tunnel Reference	Primary Layer Type	Start Date	End Date	Start Advance	End Advance	ZONE
AP6-2-Enlargement	AP6-2	Enlargement	01/04/2015	02/05/2015	4014	4100	ZOI
TBM-West-LC-Pilot	TBM-West-LC	Pilot	11/04/2015	27/04/2015	3915	3990	C305
TBM-East-LC-Pilot	TBM-East-LC	Pilot	07/04/2015	14/04/2015	3	56	C305
LCWa-Enlargement	LCWa	Enlargement	30/01/2015	12/02/2015	6	53	ZOI
LCWa-Pilot	LCWa	Pilot	18/01/2015	26/01/2015	4	35	ZOI
VD4-Enlargement	VD4	Enlargement	30/05/2014	11/09/2014	3	85	ZOI
AP6-1-Enlargement	AP6-1	Enlargement	17/06/2014	04/07/2014	3	43	ZOI
VD5-Enlargement	VD5	Enlargement	17/05/2014	24/05/2014	4	27	ZOI
VD5-Pilot	VD5	Pilot	11/05/2014	15/05/2014	3	24	ZOI
LCE-Enlargement	LCE	Enlargement	12/02/2014	21/03/2014	41	149	ZOI
LCE-Pilot	LCE	Pilot	12/08/2013	12/09/2013	26	93	ZOI

***Table 1*- Tunnel Advances Affecting Block 14**

Heading Index:

AP – Access Passage

CH - Chamber

CP - Cross Passage

ES – Escalator

GAD – Grout Adit

LCE - Launch Chamber East

LCW – Launch Chamber West

PTE – Platform Tunnel East

PTW – Platform Tunnel West

RCE – Reception Chamber East

RCW – Reception Chamber West

TBM – Tunnel Boring Machine

VD – Ventilation Drive

5 Monitoring Assessment of Block 14

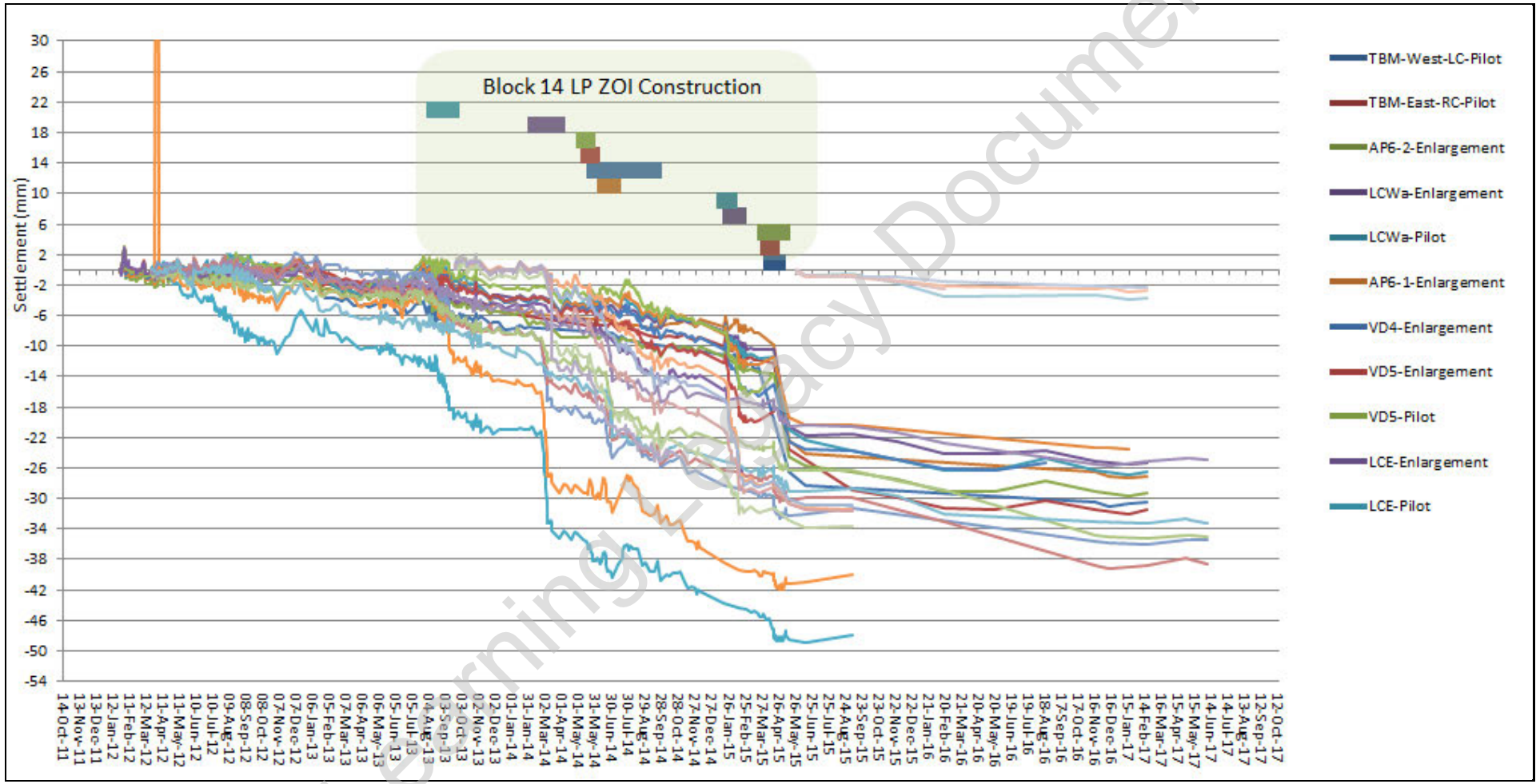
Evidence for decommissioning each monitoring sensor is shown through graphs, tables and plans. Each element of assessment compliments the other and is used together to determine acceptance of decommissioning. *Table 2,* highlights the monitoring sensors to be considered for decommissioning and provides the supporting evidence for the decision. In some cases supplementary evidence is required to prove stability or provide reasoning for decommissioning.

5.1 Time Graphs Monitoring Full History and Construction Durations

To assess the movement of Block 14 monitoring sensors; each monitoring sensor data type is displayed in a line graph, with a gantt chart (bar) representing the construction identified in Section 4:

- *Graph 1* –All Block 14 Road Studs (LP) Manual Monitoring History in Relation to Construction

***Graph 1*- All Block 14 Road Studs (LP) Manual Monitoring History in Relation to Construction**



5.2 Block 14 Decommissioning Status Tracker

The decommissioning trackers identify *(Table 2)* each monitoring sensor and provides the critical information to enable decommissioning assessment for each sensor. The initial fields shown in the tracker are descriptors of the monitoring sensor, whilst the remaining fields are the assessment for decommissioning. The purpose of the tracker is to provide Crossrail reviewers with sufficient information in conjunction with construction movement graphs and plots, to accept BBMV's proposal to decommission sensors on an individual basis.

Detailed explanation of the tracker column headers:

Tracker Column Header – Last Construction Date and Traffic Lights

For each sensor the EOI parameter is used to determine the last completed construction advance that had the potential to cause settlement. All construction tunnel advances that had the potential to affect a sensor through its EOI are listed for each sensor, from the list the latest advance is used as a construction completion indicator. A traffic light system is used to highlight when a sensor has surpassed defined monitoring time frames; 4 months (120 days), 6 months (180 days) and 16 months (480 days).

> **N.B.** Each monitoring sensor's last affecting primary construction heading and advance number's completion date has been listed within the Decommissioning Status Tracker. The last construction heading listed, is not the closest to the monitoring sensor, but the last completed within the 2 x diameter radius.

Tracker Column Header – 120, 180 & 365 Days Average Settlement Trend

There are three average settlement trends, which tie into the defined monitoring time frames; 120, 180 and 365 days. The calculation used to determine the trend is the same for all three periods. It is a slope calculation (explained below) of the defined period, multiplied over one year. The trend is calculated from the latest reading and includes all readings within the defined period, which is averaged and then multiplied over 1 year. If there is no initial reading for the time frame date, the calculation will continue back to include the next available date. This is an important consideration when assessing the trend and to assist the reviewers, the time frame used within the calculation is included within the decommissioning tracker status table. Defined monitoring time frames:

- The 120 day average rate is used to show the completion of manual monitoring step down period, this is the minimum period of monitoring prior to InSAR taking monitoring responsibility.
- The 180 day average rate is the minimum monitoring period after construction for automated sensors.
- The 365 day average trend is a calculation to determine annual settlement rates using measurements taken across a full year. This measurement period is therefore the desired duration to be used to assess whether long term settlement meets the 2mm per annum specification.

Slope calculation Settlement Trend:

Description – The settlement trend calculates the slope of the linear regression line through data points in known_y's and known_x's. The slope is the vertical distance divided by the horizontal distance between any two points on the line, which is the rate of change along the regression line.

Calculation

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

Example - If the calculated trend for a 6 month period is 1.5mm, it is multiplied into 365 days, to equal a projected settlement trend of 3mm over 1 year.

Tracker Column Header – ERP Ceased date

ERP and CTC meetings have identified project efficiencies, by ceasing manual monitoring programmes early, or prior to reaching 2mm/yr. InSAR may have taken responsibility of monitoring or the perceived risk may be low enough to warrant ceasing the monitoring. In these situations the cease date is provided, along with a comment explaining the reasoning. Monitoring that has been ceased still requires approval to decommission and will be identified within the decommissioning status tracker as proposed to decommission.

Tracker Column Header – Decommissioning Status

The status is the decommissioning situation for each sensor within Block 14. The different statuses are as follows:

- Outstanding - Monitoring sensor has not met the close out requirements and approval to decommission will be sought in subsequent revisions of this close out report.
- Proposed - the sensor is proposed to be decommissioned. Crossrail to accept the sensor can be decommissioned.
- Agreed – Agreed to decommission through previous revision of the close out report. No further reporting or monitoring has taken place.
- Complete - Monitoring sensor has been removed and evidence gathered during decommissioning.

N.B. When monitoring sensors have not met the requirements, it may still be appropriate to decommission. In this scenario supplementary evidence will be provided to explain the reasoning for decommissioning.

Table 2 - Block 14 Decommissioning Status Tracker LP

12/06/2017

< 2.0 mm GREEN	< 3.5 mm AMBER	> 3.5 mm RED

AVERAGE SETTLEMENT TREND

C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	120 day	120 Days	120 Day Calculation Period	180 day	180 Days	180 Day Calculation Period	480 day	365 Days	365 Day Calculation Period	Ceased Date	General Comment	Decommissioning Status
C510-LP11414	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-50	29/04/2015	06/06/2017		1.20	178		0.75	202		-2.54	641		6 month monitoring specification has been met	Proposed
C510-LP11415	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/06/2017		2.12	178		1.75	202		-3.77	475		6 month monitoring specification has been met	Proposed
C510-LP11416	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/06/2017		0.47	178		0.18	202		-4.51	475		6 month monitoring specification has been met	Proposed
C510-LP11417	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/06/2017		1.88	178		1.76	202		-1.44	475		6 month monitoring specification has been met	Proposed
C510-LP11418	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/06/2017		0.20	202		0.20	202		-0.79	475		6 month monitoring specification has been met	Proposed

5.3 Supplementary Evidence for Decommissioning

In some cases supplementary evidence will be provided to support the decommissioning.

Block 14 Building Demolition

Figure 3 shows the Keltbray site demolition phasing plan. The Keltbray site demolition and construction has made monitoring access difficult and has been referenced throughout the report.

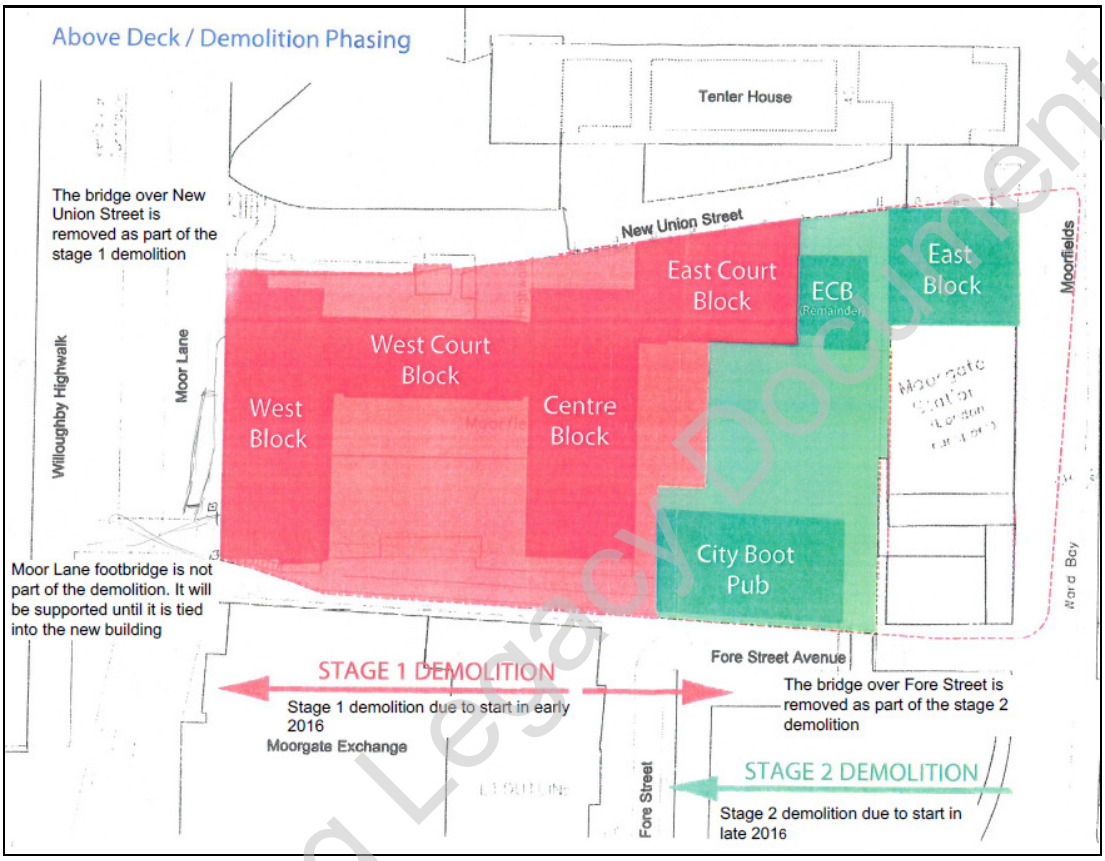


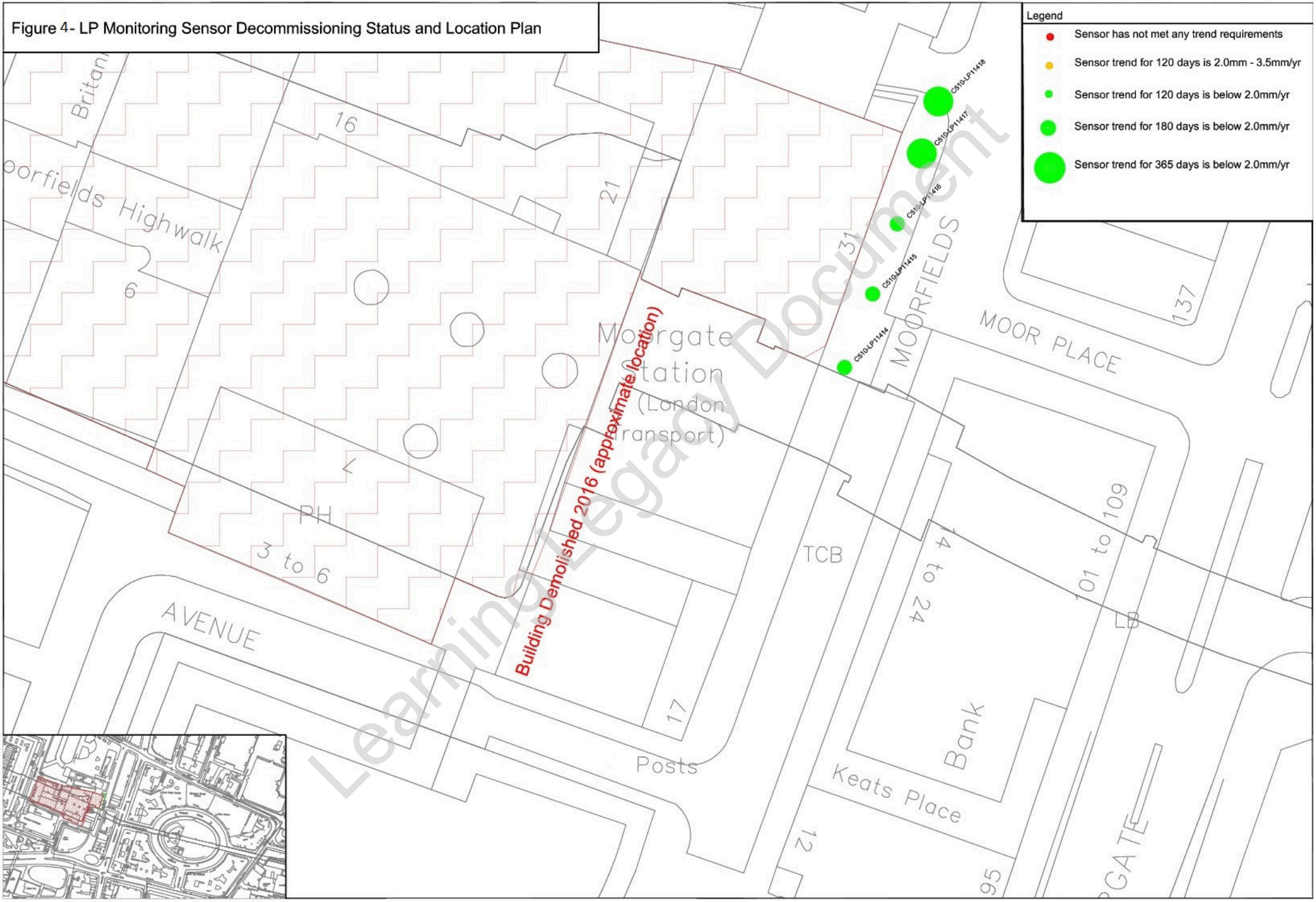
***Figure 3*- Block 14 Demolition Phasing**

5.4 Monitoring sensor Location Plan and Decommissioning Status

The following plot provides a visual representation of the remaining Block 14 monitoring sensors with a colour circle that defines its settlement status. A green circle represents when a trend is below 2mm/yr and the larger the circle the greater the trend period. When a trend has not been met, a small red circle will represent the monitoring sensor.

- *Figure 4*– LP Monitoring Sensor Settlement Status and Location Plan

Figure 4- LP Monitoring Sensor Decommissioning Status and Location Plan



6 Decommissioning Recommendations

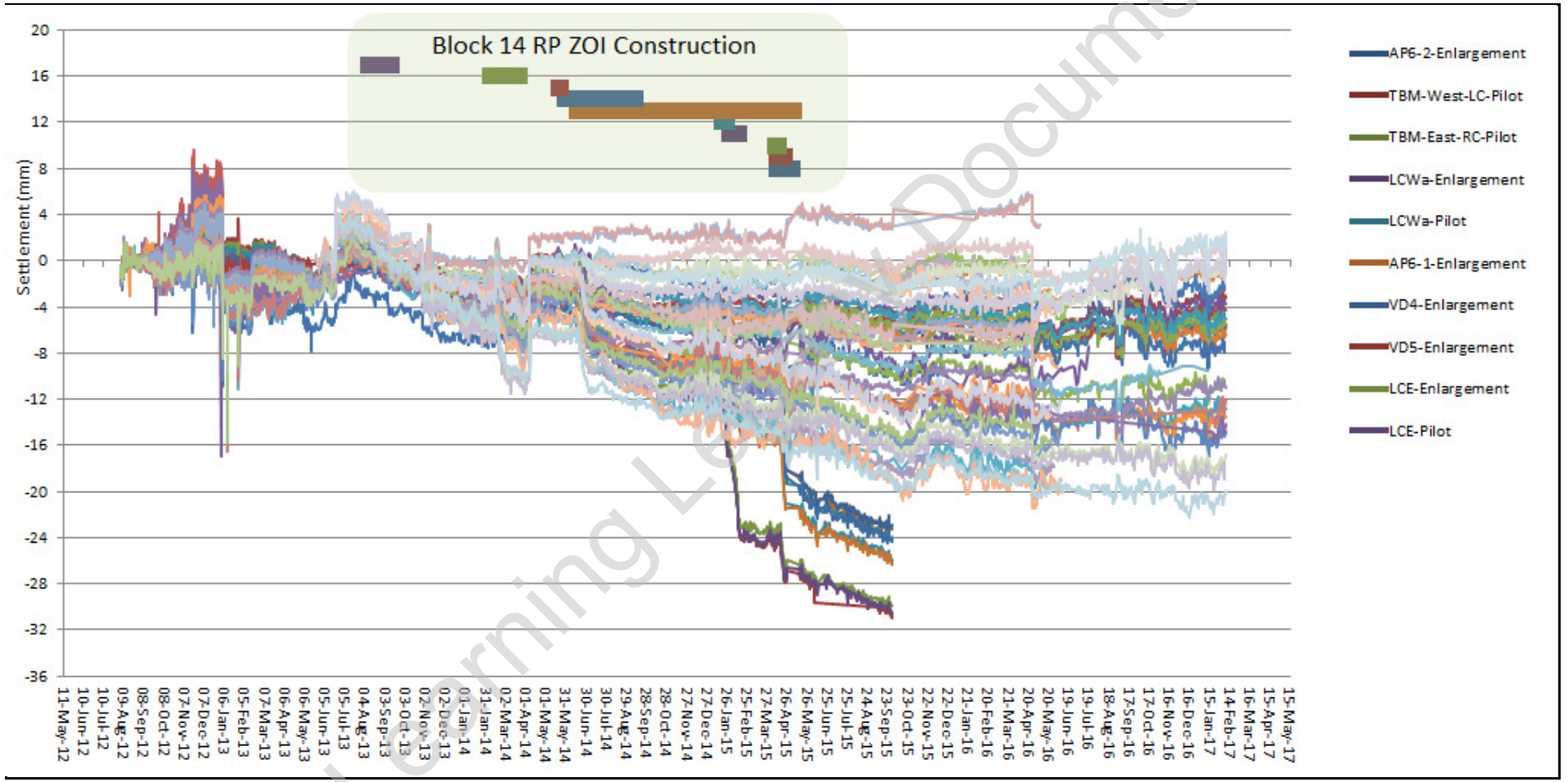
Revision 2 of Block 14's close out report requests to decommission the remaining road studs that have now achieved the manual monitoring specification.

N.B. When required, decommissioning and re-instatement evidence will be collected during the removal of monitoring sensors, which will be included within the final report.

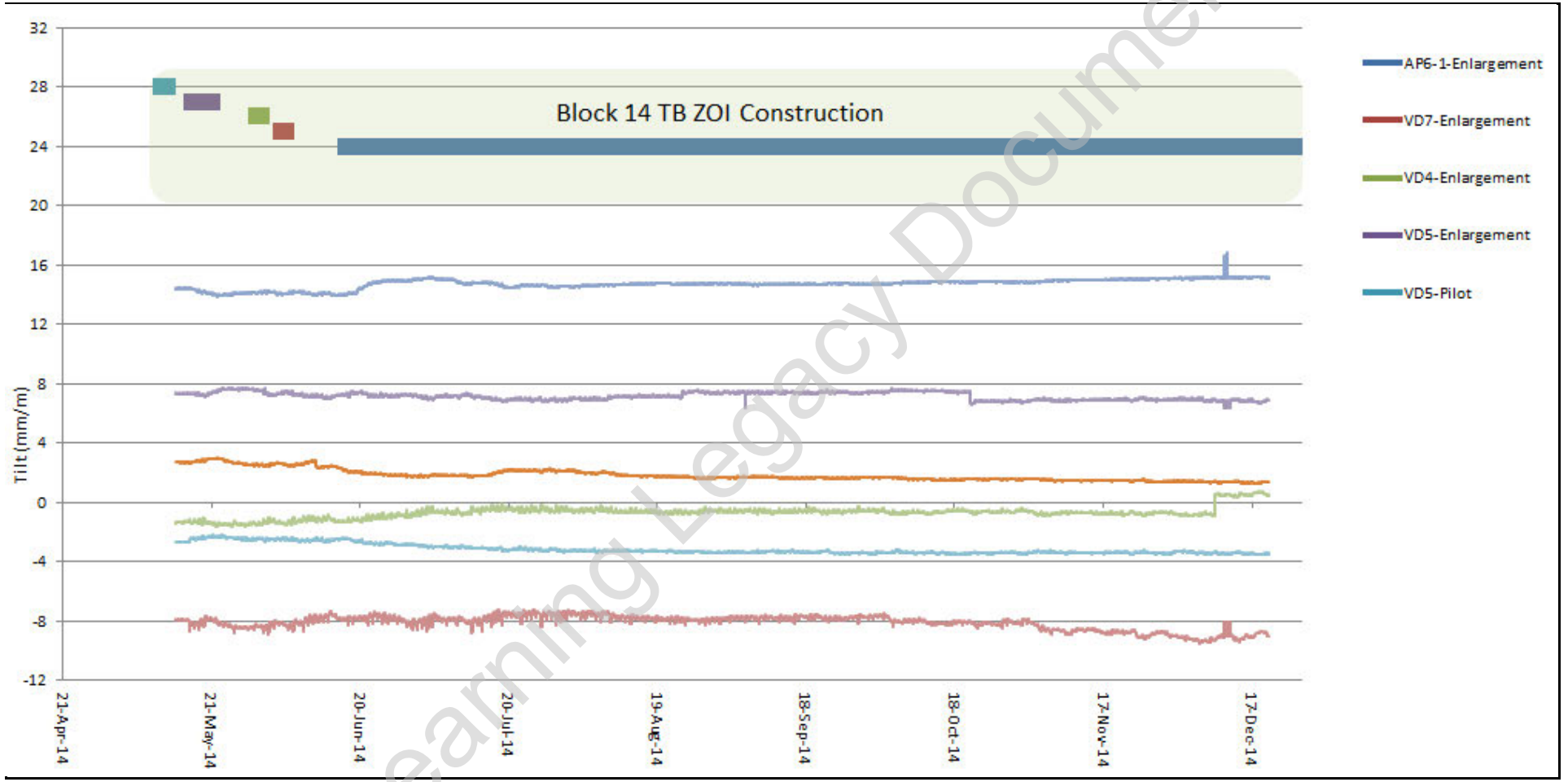
7 Appendix 1

Appendix 1 includes the Graphs, Tables, Supplementary Evidence and Figures that were used as evidence to agree decommissioning in Revision 1 of Block 14 Close out Report.

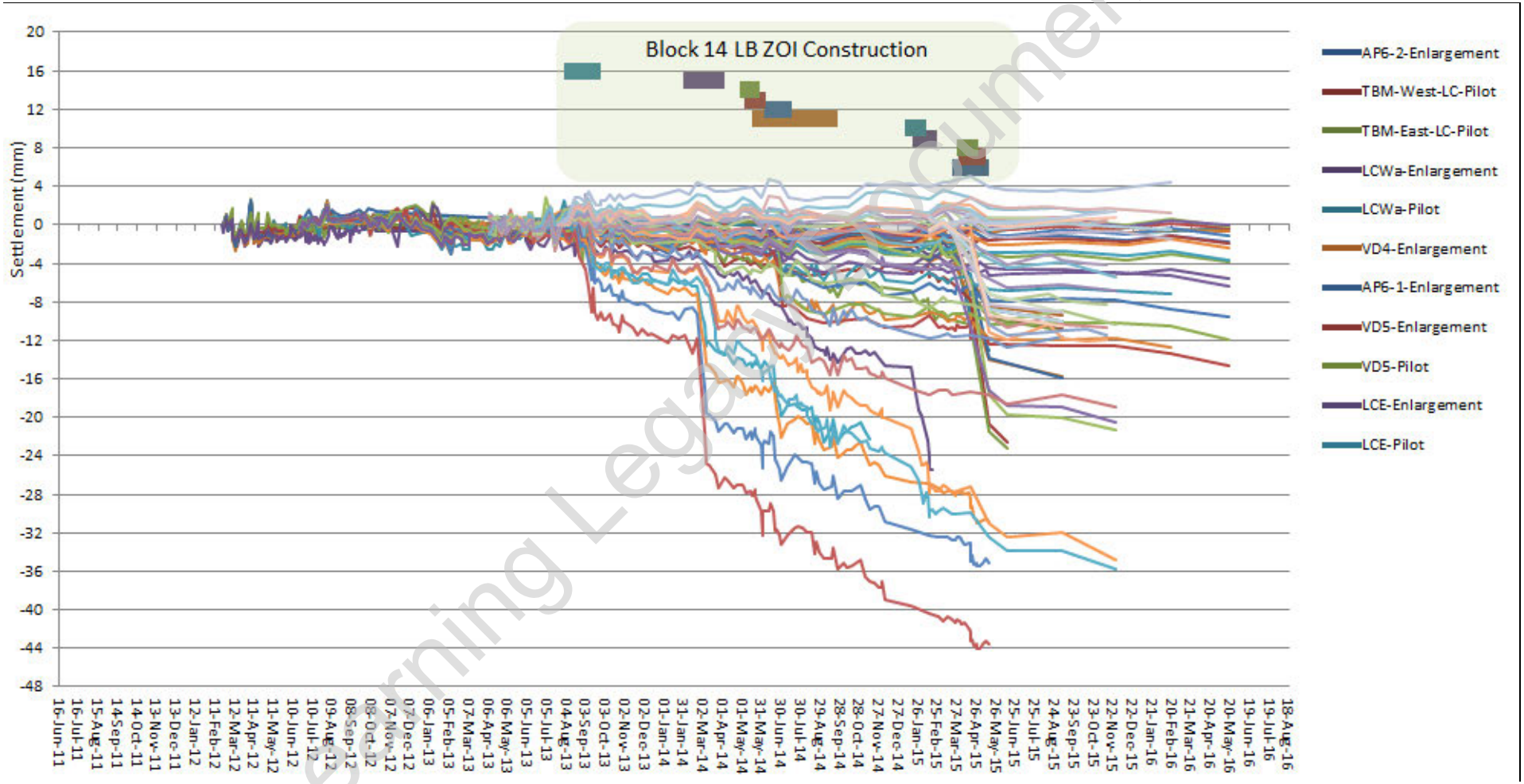
7.1 All Block 14 Geodetic Prisms (RP) Automated Monitoring History in Relation to Construction (Agreed to Decommission in Rev 1)



7.2 All Block 14 Tiltmeters (TB) Automated Monitoring History in Relation to Construction (Agreed to Decommission in Rev 1)



7.3 All Block 14 BREs (LB) Manual Monitoring History in Relation to Construction (Agreed to Decommission in Rev 1)



Block 14 Sensors Agreed to Decommission in Revision 1

06/06/2017

< 2.0 mm GREEN | < 3.5 mm AMBER | > 3.5 mm RED

AVERAGE SETTLEMENT TREND

C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	120 day	120 Days	120 Day Calculation Period	180 day	180 Days	180 Day Calculation Period	480 day	365 Days	365 Day Calculation Period	Ceased Date	General Comment	Decommissioning Status
C510-LB11401	Block 114	S11405;S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4078	24/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 04/09/2015	Agreed
C510-LB11402	Block 114	S11405;S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4074	24/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 04/09/2015	Agreed
C510-LB11403	Block 114	S11405;S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4070	24/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 04/09/2015	Agreed
C510-LB11404	Block 114	S11405;S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4066	23/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 04/09/2015	Agreed
C510-LB11405	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4060	23/04/2015	16/04/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 16/04/2015	Agreed
C510-LB11406	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4064	23/04/2015	14/05/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 14/05/2015	Agreed
C510-LB11407	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4068	23/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 14/05/2015	Agreed
C510-LB11408	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4070	24/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 14/05/2015	Agreed
C510-LB11409	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4058	23/04/2015	11/06/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 14/05/2015	Agreed
C510-LB11410	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4050	21/04/2015	11/06/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 14/05/2015	Agreed
C510-LB11411	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	16/02/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since- 14/05/2015	Agreed
C510-LB11412	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	18/05/2016		1.19	157		-1.07	257		0.00	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11413	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	18/05/2016		0.41	157		-0.98	257		-0.01	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11414	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	18/05/2016		-0.61	157		-0.76	257		-0.28	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11415	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	18/05/2016		-0.63	157		-0.45	257		-0.12	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11416	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	18/05/2016		-0.61	157		-0.76	257		-0.47	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11417	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/05/2016		-1.34	157		-1.15	257		-0.89	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11418	Block 114	S11403;S11409	External	Manual	LB	BRE	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	17/02/2016		-1.32	166		-0.48	251		-1.85	370	10/03/2016	Monitoring ceased ERP meeting 10/03/2016	Agreed
C510-LB11419	Block 114	S11403;S11409	External	Manual	LB	BRE	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	17/02/2016		-1.76	166		-0.91	251		-3.66	370	10/03/2016	Monitoring ceased ERP meeting 10/03/2016	Agreed
C510-LB11420	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/05/2016		-3.77	174		-2.83	257		-1.62	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11421	Block 114	S11402	External	Manual	LB	BRE	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/05/2016		-4.42	174		-3.19	257		-2.06	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11422	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/05/2016		-3.81	174		-2.47	257		-1.25	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11423	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/05/2016		-3.17	174		-2.12	257		-0.97	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11424	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-1_Enlargement_Adv-67	30/06/2014	18/05/2016		-1.09	157		-0.88	257		-0.48	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11425	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-1_Enlargement_Adv-67	30/06/2014	18/05/2016		-0.90	157		-0.68	257		-0.01	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11426	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-1_Enlargement_Adv-67	30/06/2014	18/05/2016		-0.61	157		-0.62	257		0.13	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11427	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-1_Enlargement_Adv-67	30/06/2014	18/05/2016		-0.34	157		-0.12	257		0.28	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11428	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-1_Enlargement_Adv-67	30/06/2014	18/05/2016		-0.39	157		-0.59	257		0.29	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11429	Block 114	S11401	External	Manual	LB	BRE	Tenter House	LIV_AP6-1_Enlargement_Adv-67	30/06/2014	18/05/2016		0.10	157		-0.60	257		0.37	370	14.06.2016	CTC 14.06.2016 Confirmed monitoring to be replaced by InSAR.	Agreed
C510-LB11430	Block 114	S11403	External	Manual	LB	BRE	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-55	02/05/2015	13/11/2014		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 13/11/2014	Agreed
C510-LB11431	Block 114	S11403	External	Manual	LB	BRE	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-50	29/04/2015	14/05/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 14/05/2015	Agreed
C510-LB11432	Block 114	S11403	External	Manual	LB	BRE	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-45	26/04/2015	14/05/2015		N/A			N/A			N/A		10/03/2016	Blocked by Keltbray site hoarding- No survey data since 14/05/2015	Agreed
C510-LB11433	Block 114	S11403	External	Manual	LB	BRE	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-39	23/04/2015	14/05/2015		N/A			N/A			N/A		10/03/2016	Blocked by Keltbray site hoarding- No survey data since 14/05/2015	Agreed
C510-LB11434	Block 114	S11405	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4056	23/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11435	Block 114	S11406	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4054	22/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11436	Block 114	S11407	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4034	20/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11437	Block 114	S11408	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4038	21/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11438	Block 114	S11404	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3915	07/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished - No survey data since 04/09/2015	Agreed
C510-LB11439	Block 114	S11404	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3920	10/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11440	Block 114	S11404	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3930	11/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11441	Block 114	S11404	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3940	11/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11442	Block 114	S11404	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3945	11/04/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11443	Block 114	S11407	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4096	27/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11444	Block 114	S11407	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4100	27/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11445	Block 114	S11407	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4100	27/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11446	Block 114	S11407	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4096	27/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11447	Block 114	S11407	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3990	14/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11448	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3980	14/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11449	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3975	13/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11450	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3975	13/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11451	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3970	13/04/2015	11/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 11/11/2015	Agreed
C510-LB11452	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3960	12/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-LB11453	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3955	12/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-LB11454	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3950	12/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-LB11455	Block 114	S11408	External	Manual	LB	BRE	Britanic Highwalk	LIV_TBM-East-LC_Pilot_Adv-3945	11/04/2015	12/02/2015		N/A			N/A			N/A		10/03/2016	Building Demolished - No survey data since 12/02/2015	Agreed
C510-LB11456	Block 114	N/A	N/A	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3945	11/04/2015	17/02/2016		2.90	127		1.73	188		-0.61	370		Met 2mm per annum specification	Agreed
C510-LB11457	Block 114	N/A	N/A	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-East-LC_Pilot_Adv-3945	11/04/2015	17/02/2016		-1.21	127		-1.24	188		-0.24	370		Met 2mm per annum specification	Agreed
C510-LB11471	Block 114	S11409	External	Manual	LB	BRE	New Union St	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	17/02/2016		-1.32	166		-0.04	251		-1.44	370	10/03/2016	Met 2mm per annum specification	Agreed
C510-LB11472	Block 114	S11409	External	Manual	LB	BRE	New Union St	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	17/02/2016		-1.54	166		-0.43	251		-0.55	370	10/03/2016	Met 2mm per annum specification	Agreed
C510-LB11473	Block 114	S11409	External	Manual	LB	BRE	New Union St	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11474	Block 114	S11409	External	Manual	LB	BRE	New Union St	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	26/11/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 26/11/2015	Agreed
C510-LB11475	Block 114	S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4062	23/04/2015	16/04/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 16/04/2015	Agreed
C510-LB11476	Block 114	S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4084	25/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-LB11477	Block 114	S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4088	26/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-LB11478	Block 114	S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4090	26/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-LB11479	Block 114	S11410	External	Manual	LB	BRE	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4090	26/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Building Demolished- No survey data since 04/09/2015	Agreed
C510-RP114100	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4050	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP114101	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4054	22/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP114102	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4054	22/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11494	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4038	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11495	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11496	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11497	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4044	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11498	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4044	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11499	Block 114	S11401	External	Automated	RP	3D Geodetic prism	Fore St Avenue	LIV_TBM-West-LC_Pilot_Adv-4050	21/04/2015	30/09/2015		N/A			N/A			N/A			ATS C131 decommissioned- Building demolished+ Supplementary Evidence	Agreed
C510-RP11510	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		3.01	120		3.90	181		-0.20	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11511	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		0.47	121		0.22	181		-0.31	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11512	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-1_Enlargement_Adv-68	30/06/2014	06/02/2017		3.06	121		3.50	181		-0.17	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11513	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-1_Enlargement_Adv-68	30/06/2014	06/02/2017		0.66	121		-0.54	181		-0.34	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11514	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	24/12/2014		N/A			N/A			N/A			C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11515	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/02/2017		1.13	121		0.55	181		-1.22	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11516	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/07/2016		-1.04	124		0.80	181		-2.60	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11517	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		3.46	121		3.12	181		-0.86	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11518	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		1.20	121		-0.39	181		-0.97	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11519	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		-1.40	121		-4.93	181		-1.53	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11520	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	17/04/2016		-0.93	168		0.11	189		-0.78	371		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11521	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		-1.77	121		-1.77	180		-1.58	369		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed

Block 14 Sensors Agreed to Decommission in Revision 1

06/06/2017

< 2.0 mm GREEN | < 3.5 mm AMBER | > 3.5 mm RED

AVERAGE SETTLEMENT TREND

C510 Sensor Name	Block	Section	Int / Ext	Measurement Type	Sensor Type	Sensor Description	Asset/Location	EOI Last Primary Layer Construction	Last Construction Date	Latest Surveyed Date	120 day	120 Days	120 Day Calculation Period	180 day	180 Days	180 Day Calculation Period	480 day	365 Days	365 Day Calculation Period	Ceased Date	General Comment	Decommissioning Status
C510-RP11521B	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Tenter House	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	21/06/2016		-15.22	120		-9.74	180		N/A			C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring of Block 14	Agreed
C510-RP11522	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	14/05/2016		-4.92	120		-2.90	190		-1.87	367		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11522A	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	26/05/2016		-5.26	120		-4.17	180		-3.38	367		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11523	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		1.64	121		1.64	196		-0.75	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11523A	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/06/2016		-5.92	121		-5.48	180		-2.06	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11524	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/02/2017		5.05	121		6.00	180		-0.64	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11524A	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	21/05/2016		-6.67	120		-5.09	180		-2.02	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11525	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	11/01/2017		4.22	121		4.92	180		-4.32	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11526	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	31/05/2016		-10.23	120		-9.02	192		-0.46	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11527	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	31/05/2016		-22.07	120		-12.25	180		-3.13	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11528	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	18/04/2016		0.38	200		0.38	200		-1.71	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11529	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	27/04/2016		0.52	210		0.52	210		-2.20	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11531	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	27/05/2016		-8.22	121		-5.99	181		-1.19	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11532	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/06/2016		-5.09	121		-5.53	181		-2.49	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11533	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	06/06/2016		-1.15	121		-3.73	181		-3.40	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11537	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	04/05/2016		2.07	217		2.07	217		1.27	376		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11538	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	07/05/2016		0.86	220		0.86	220		0.68	379		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11539	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	16/05/2016		-2.03	230		-2.03	230		-0.41	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11542	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	27/04/2016		1.46	211		1.46	211		-1.43	369		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11542A	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_LCE_Enlargement_Adv-124	14/03/2014	08/05/2016		-6.45	120		-6.80	180		-1.70			C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11543	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_LCE_Enlargement_Adv-124	14/03/2014	27/04/2016		-0.81	210		-0.81	210		-1.57	368		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11543A	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_LCE_Enlargement_Adv-125	14/03/2014	23/05/2016		-4.71	120		-6.41	180		-2.45			C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11544	Block 114	N/A	External	Automated	RP	3D Geodetic prism	Moorfields Highwalk	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	27/04/2016		-0.30	209		-0.30	209		-2.00	369		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11549	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-1_Enlargement_Adv-79	03/07/2014	21/05/2016		-7.00	120		-4.98	180		-1.43	366		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-RP11550	Block 114	N/A	External	Automated	RP	3D Geodetic prism	17-31 Moorfields	LIV_AP6-1_Enlargement_Adv-89	04/07/2014	06/06/2016		-4.51	121		-4.40	180		-1.70	365		C510-RFI-001014- Crossrail confirms InSAR can replace automated long term monitoring. Subsequently building demolished	Agreed
C510-LP11401	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4058	23/04/2015	15/02/2017		-1.89	615		-1.89	615		-1.89	615		Met 2mm per annum	Agreed
C510-LP11402	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4056	23/04/2015	15/02/2017		-1.50	615		-1.50	615		-1.50	615		Met 2mm per annum	Agreed
C510-LP11403	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4054	22/04/2015	15/02/2017		-2.74	182		-2.74	182		-1.11	447		Met 2mm per annum	Agreed
C510-LP11404	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4052	22/04/2015	15/02/2017		-3.35	182		-3.35	182		-1.09	447		Met 2mm per annum	Agreed
C510-LP11405	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4050	21/04/2015	15/02/2017		-3.30	182		-3.30	182		-2.00	447		Met 2mm per annum	Agreed
C510-LP11406	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4048	21/04/2015	15/02/2017		-3.91	182		-3.91	182		-0.94	447		Met 2mm per annum	Agreed
C510-LP11407	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4046	21/04/2015	14/01/2017		N/A			N/A			N/A			Trends unreliable for past 12 months- Sensor not accessible due to Keltbray site hoarding	Agreed
C510-LP11408	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4044	21/04/2015	17/08/2016		1.81	182		1.81	182		-2.09	433		2mm over 6 month period achieved- Sensor no longer accessible due to Keltbray site hoarding	Agreed
C510-LP11409	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4042	21/04/2015	16/04/2015		N/A			N/A			N/A			Inaccessible due to Keltbray site hoarding since April 2015- Trends Not Applicable	Agreed
C510-LP11410	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	16/04/2015		N/A			N/A			N/A			Inaccessible due to Keltbray site hoarding since April 2015- Trends Not Applicable	Agreed
C510-LP11411	Block 114	S11401	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4038	21/04/2015	19/02/2015		N/A			N/A			N/A			Inaccessible due to Keltbray site hoarding since February 2015- Trends Not Applicable	Agreed
C510-LP11412	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-35	21/04/2015	04/09/2015		N/A			N/A			N/A			Inaccessible due to Keltbray site hoarding since August 2015 + Supplementary Evidence	Agreed
C510-LP11413	Block 114	S11402	External	Manual	LP	Road Stud	Moorfields	LIV_AP6-2_Enlargement_Adv-42	24/04/2015	04/09/2015		N/A			N/A			N/A			Inaccessible due to Keltbray site hoarding since August 2015 + Supplementary Evidence	Agreed
C510-LP11419	Block 114	S11403	External	Manual	LP	Road Stud	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4036	21/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Road Stud no longer exsits- Keltbray site demolition- No data since 04/09/2015	Agreed
C510-LP11420	Block 114	S11403	External	Manual	LP	Road Stud	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4036	21/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Road Stud no longer exsits- Keltbray site demolition- No data since 04/09/2015	Agreed
C510-LP11421	Block 114	S11403	External	Manual	LP	Road Stud	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4034	20/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Road Stud no longer exsits- Keltbray site demolition- No data since 04/09/2015	Agreed
C510-LP11422	Block 114	S11403	External	Manual	LP	Road Stud	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4032	20/04/2015	04/09/2015		N/A			N/A			N/A		10/03/2016	Road Stud no longer exsits- Keltbray site demolition- No data since 04/09/2015	Agreed
C510-LP11423	Block 114	S11403	External	Manual	LP	Road Stud	Moorfields Highwalk	LIV_TBM-West-LC_Pilot_Adv-4028	20/04/2015	30/10/2014		N/A			N/A			N/A		10/03/2016	Road Stud no longer exsits- Keltbray site demolision- No data since 23/10/2014	Agreed
C510-LP11438-REL	Block 114	S11404	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4044	21/04/2015	15/02/2017		-0.12	364		-0.12	364		-1.10	447		Met 2mm per annum	Agreed
C510-LP11439-REL	Block 114	S11404	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4042	21/04/2015	15/02/2017		-0.67	364		-0.67	364		-1.21	530		Met 2mm per annum	Agreed
C510-LP11440-REL	Block 114	S11404	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4040	21/04/2015	15/02/2017		-0.82	364		-0.82	364		-1.08	447		Met 2mm per annum	Agreed
C510-LP11441-REL	Block 114	S11404	External	Manual	LP	Road Stud	Fore St Ave	LIV_TBM-West-LC_Pilot_Adv-4038	21/04/2015	17/02/2016		-3.52	166		-2.62	251		-2.81			All other section 4 road studs met 2mm per annum. No access to sensor due to C512 site	Agreed
C510-TB11401A	Block 114	N/A	Unknown	Automated	TB	Tiltmeter-Biaxial	Moorgate Station	LIV_AP6-2_Enlargement_Adv-56	02/05/2015	20/12/2014		-1.14	120		-1.33	180		N/A			Decommissioning agreed- Uninstalled by soldata June 2015- It should be noted that values are- Tilt (mm/m)	Agreed
C510-TB11401B												1.64			0.75			N/A				
C510-TB11402A	Block 114	N/A	Unknown	Automated	TB	Tiltmeter-Biaxial	Moorgate Station	LIV_AP6-2_Enlargement_Adv-51	30/04/2015	20/12/2014		-4.89	120		-2.87	180		N/A			Decommissioning agreed- Uninstalled by soldata June 2015- It should be noted that values are- Tilt (mm/m)	Agreed
C510-TB11402B												1.29			0.57			N/A				
C510-TB11403A	Block 114	N/A	Unknown	Automated	TB	Tiltmeter-Biaxial	31 Moorfields	LIV_AP6-2_Enlargement_Adv-35	21/04/2015	20/12/2014		-2.37	120		-0.48	180		N/A			Decommissioning agreed- Uninstalled by soldata June 2015- It should be noted that values are- Tilt (mm/m)	Agreed
C510-TB11403B												-0.23			-0.89			N/A				

7.5 Supplementary Evidence used for Decommissioning in Revision 1

Block 14 Tiltmeters Decommissioning

Includes: C510-TB11401, C510-TB11402 and C510-TB11403

Block 14 Tiltmeters experienced issues with the power supply and as a result it was agreed to decommission all Block 14 Tiltmeters. The below *figure* is a copy of the Soldata technicians shift report from the decommissioning of the sensors in June 2015.

SOLDATA

Shift Report

Job Number: SD1005 **Site:** C510 **Location:** Whitechapel/Finsbury Circus **Date** 04-06-2015 **Night**

Personnel:

Name and Designation	Company	Name and Designation	Company
F. Trinkler – Tech	Soldata		
G. Ellis – Electrician	BBMV		

Record of visual inspection of hand tools (Provision and use of work equipment)

Description of equipment and ID number (where applicable):	Defects/Faults Identified or all in Good Condition:	Repairs, alterations or taken out of use:
Hand tools	Good Condition	
Mobile Podium	Good Condition	

SABRE No.		Notes: (Frustrated access, incidents, general comments)
Time On Site	22:00	
Break		
Call Back	02:00	
Shift time (working)	4 hrs.	

Planned shift:

- Removal of Moorgate station tiltmeters 1, 2 & 3, including the Control and power supply boxes.

Actual Shift Summary:

- **Moorgate station tiltmeters 1, 2 & 3 –** Removed the tiltmeters along with the control box, power box and all cabling (pictures taken).
  TM-11041 S/N-119884, TM-11402 S/N-119889, TM-11403 S/N-1320412

Other comments:

Completed by: F. Trinkler **Date:** 05-06-2015 **Time :** 02:00

Print: [illegible] **Sign:** [illegible] **Date:** 15.06.15

Block 14- ATS 131 Decommissioning

Includes: C510-RP11494-102

ATS 131 experienced issues with the power supply in September 2015 and the building was due to be demolished, as a result ATS 131 was decommissioned in November 2015. The *figure* below is a copy of the Soldata Technicians shift report of the ATS decommissioning.

SOLDATA

Shift Report

Job Number: SD1005	**Site:** C510	**Location:** Whitechapel/Finsbury Circus	**Date:** 20-11-2015 Night

Personnel:

Name and Designation	Company	Name and Designation	Company
F. Trinkler – Tech	Soldata		
Chris – MEWP Operator	Nationwide		

Record of visual inspection of hand tools (Provision and use of work equipment)

Description of equipment and ID number (where applicable):	Defects/Faults Identified or all in Good Condition:	Repairs, alterations or taken out of use:
Hand tools	Good Condition	
20m Truck mounted MEWP	Good Condition	

SABRE No.		Notes: (Frustrated access, incidents, general comments)
Time On Site	20:00	
Break		
Call Back	03:00	
Shift time (working)	7 hrs.	

Planned shift:

- Prism cleaning on Britannic House.
- C125 - Replacement.
- C131 – ATS and bracket removal.

Actual Shift Summary:

- **Britannic House** – Cleaned prisms – **10305, 10306, 10307, 10308. 10309, 10310 & 10311** using a truck mounted MEWP.
- **C-125** – replaced ATS, set the V0 and left the instrument running/online. **Old S/N - 100429, New S/N – 100447.**
- **C-131** – Removed the ATS **(S/N – 100659)** and bracket/arms using the truck mounted MEWP.

Other comments:

Completed by: F. Trinkler	**Date:** 21-11-2015 **Time:** 03:00

Print: D E North **Sign:** D E North **Date:** 25.11.15

Figure 6- LP & TB Monitoring Sensor Decommissioning Status and Location Plan

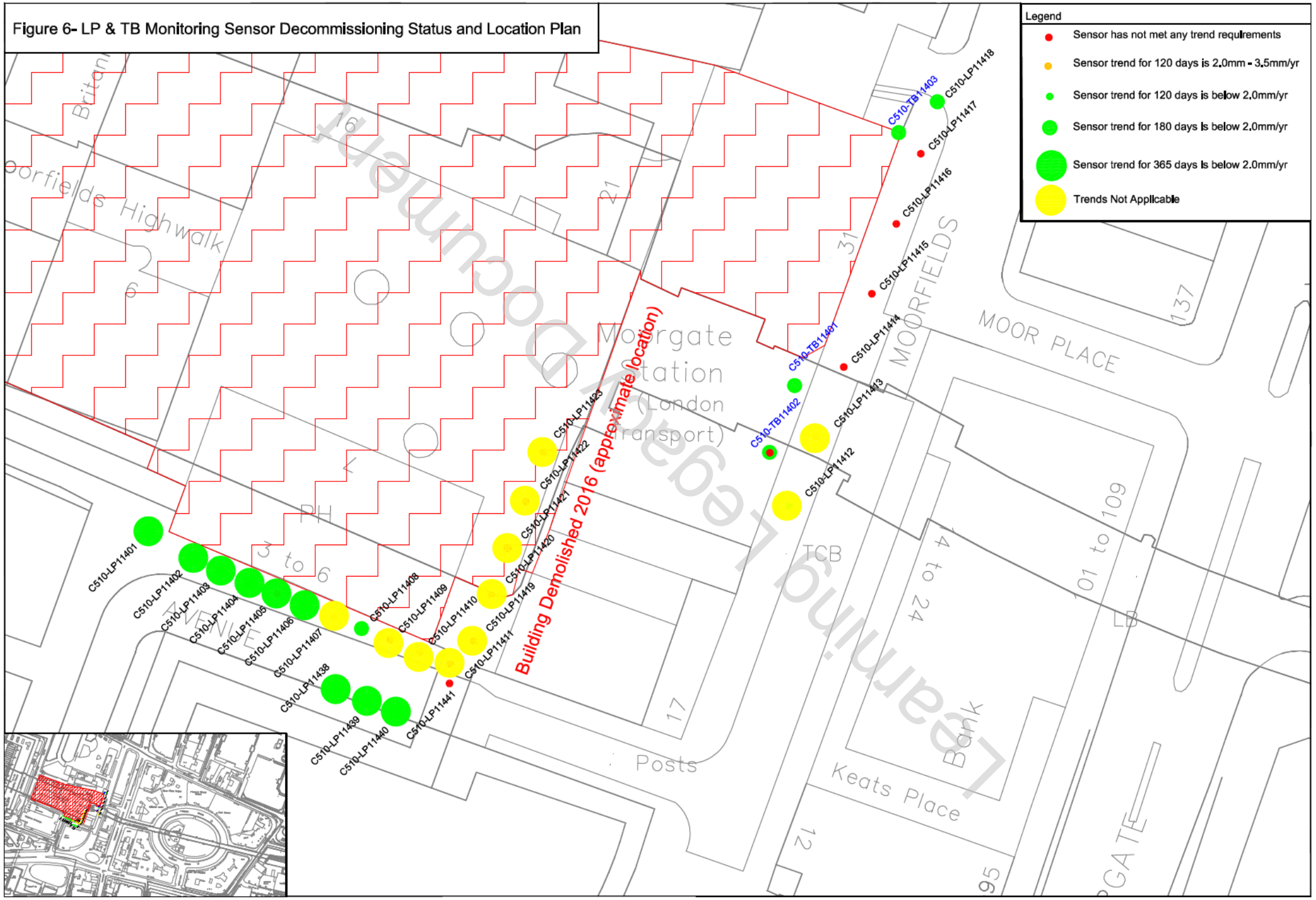


Figure 7- LB Monitoring Sensor Decommissioning Status and Location Plan

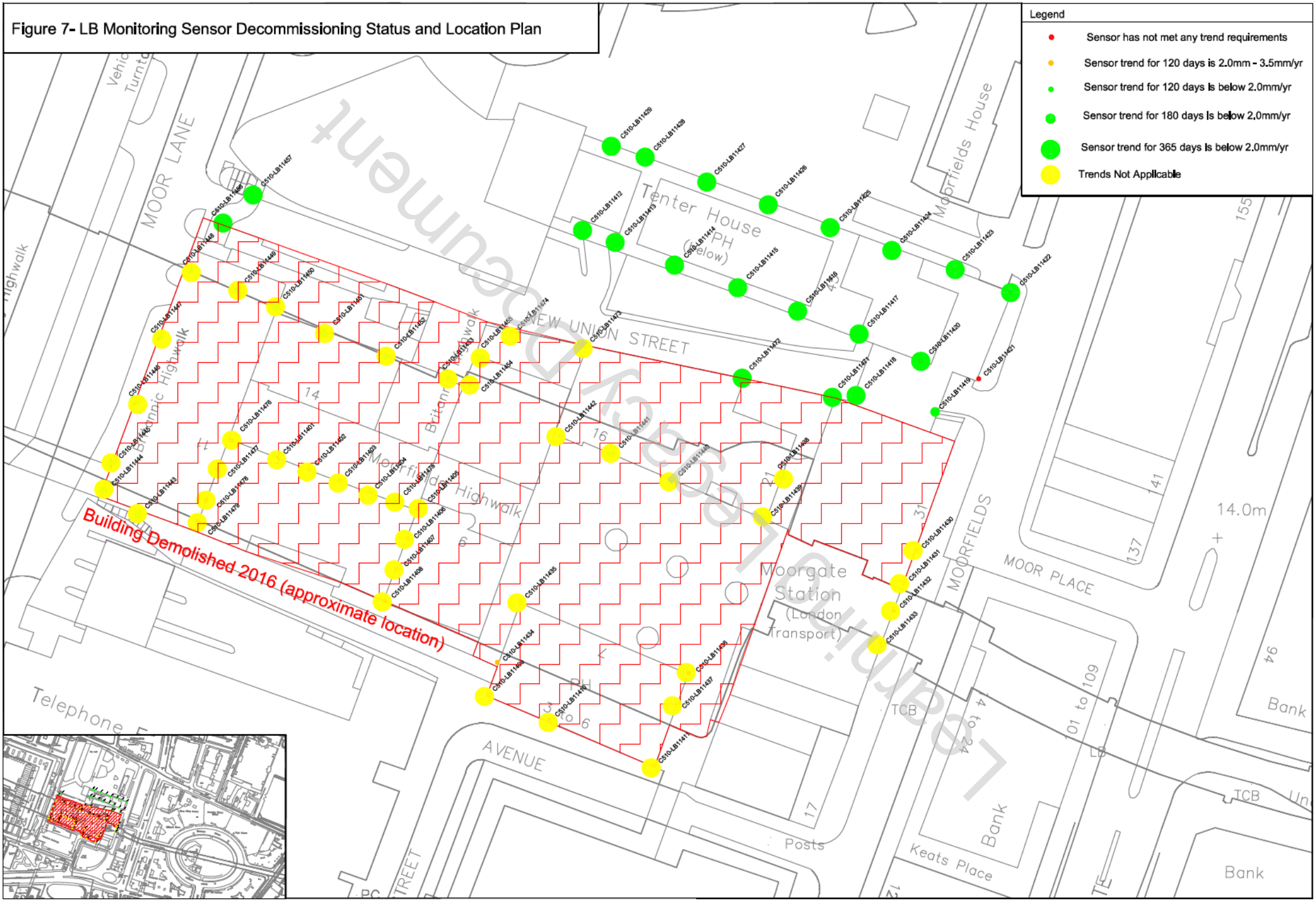


Figure 8- RP Monitoring Sensor Decommissioning Status and Location Plan