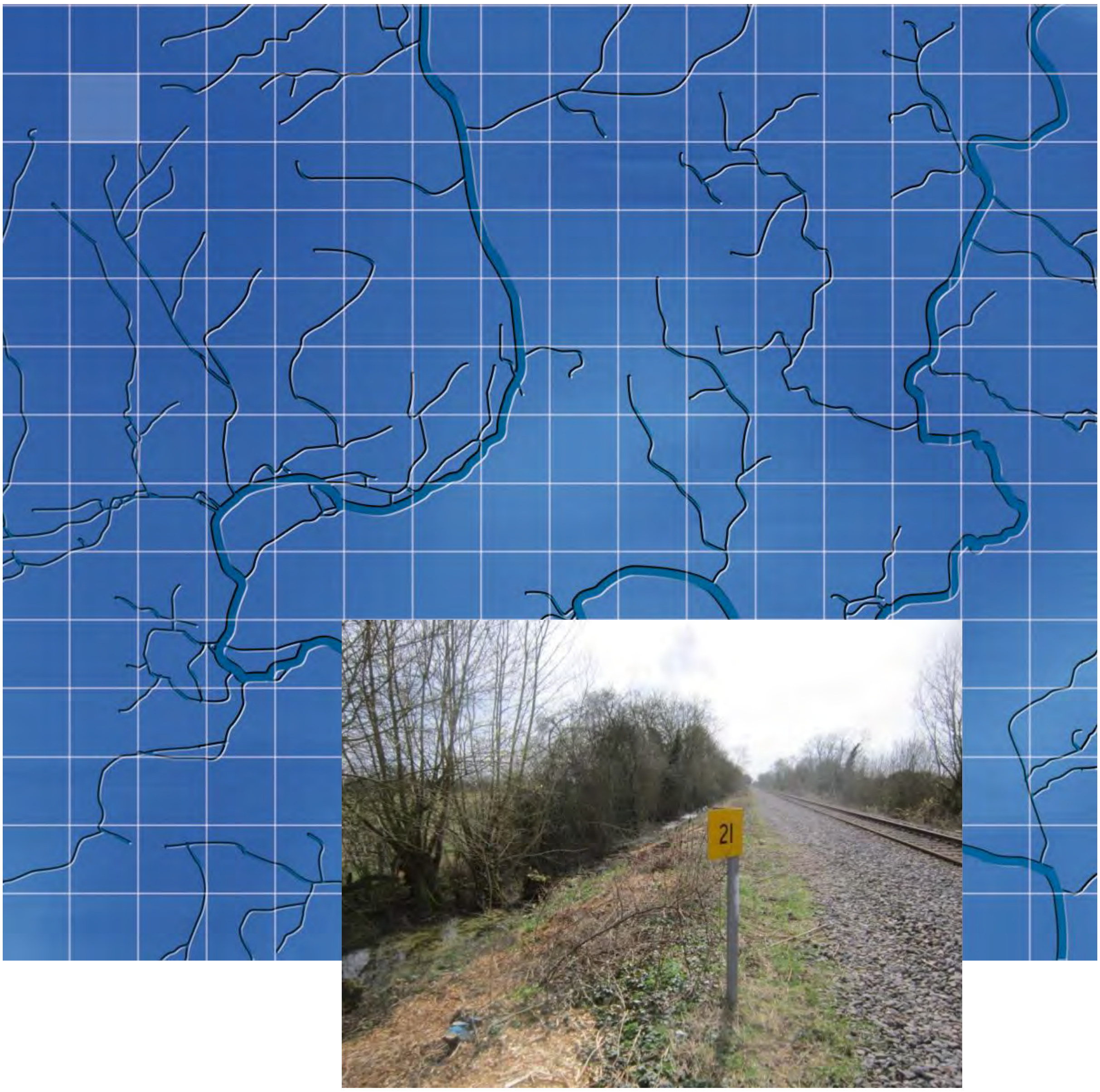
Network Rail and Chiltern Railways

March 2016

EWR P1 – SW Drainage Assessment (AP6)



Wallingford HydroSolutions Limited

Network Rail and Chiltern Railways

EWR P1 – SW Drainage Assessment (AP6)

Document issue details

WHS1337

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For and on behalf of Wallingford HydroSolutions Ltd.

Prepared by Paul Blackman

Approved by Paul Blackman
Position *Technical Director*

Date **7 March 2016**

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Contents

1 Purpose

This document constitutes a surface water drainage assessment (SWDA), as required by Condition 13 of the Order under the Transport and Works Act 1992 (TWA) obtained by Chiltern Railways for the construction of the East West Rail Phase 1 (EWR P1) project between Bicester and Oxford. This document also provides the information required by the National Planning Policy Framework (NPPF) in considering the surface water drainage aspects of a Flood Risk Assessment for new development.

This surface water drainage assessment considers the requirements for AP6 – Langford Lane Overbridge – required under Condition 13.

Figure 1 shows the location of the Assessment Points in relation to the overall railway development.

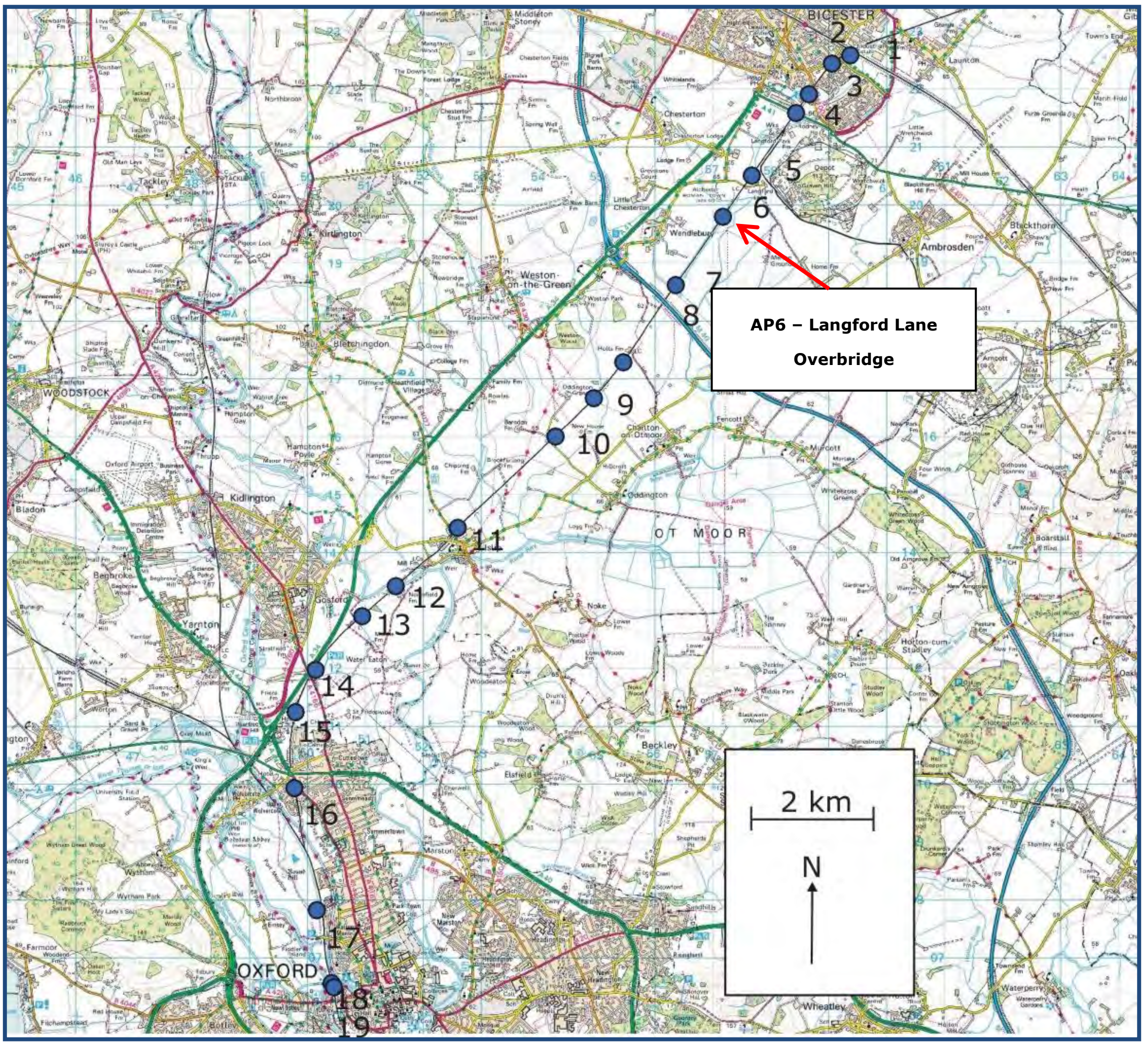

Figure 1 - Overview of the scheme with Assessment Points shown.

Condition 13 of the TWA Order requires that:

'No construction of any one of the following elements of development shall commence until a surface water drainage assessment and scheme for that element (as identified in the Level 2 Flood Risk Assessment Revised, July 2010 (Inquiry document CD/2.22), unless stated otherwise here) has been submitted to and approved in writing by the local planning authority, in consultation with the Environment Agency:

- *AP1 Bicester Chord.*
- *AP2 Tubbs Lane footbridge.*
- *AP3 Bicester Town station.*
- *AP4 A41 overbridge.*
- *AP6 Elm Tree Farm/Langford Lane Overbridge (modified to accord with the revised proposal shown on Revised Sheets 8b, 35 and 37 of the Deposited Plans and Sections (Inquiry Document CD/1.28).*
- *AP7 Merton footbridge.*
- *AP8 Holts Farm overbridge.*
- *AP9 Oddington Footbridge No 5.*
- *AP10 Oddington overbridge.*
- *AP11 Islip station in Phase 1.*
- *AP11 Islip station in Phase 2.*
- *AP13 Northfield Farm overbridge.*
- *AP14 Water Eaton Parkway.*
- *AP14a Banbury Road Sidings*
- *AP15 Gosford and Water Eaton Footbridge No 10.*
- *AP18 Sheepwash Bridge.*
- *AP19 Oxford station.*

The surface water drainage assessments shall follow the methodology set out in the Scope of Surface Water Drainage Assessment, July 2010, agreed by the Environment Agency. Each surface water drainage assessment shall demonstrate that surface water discharge rates and volumes from that element of the development will not increase flood risk, or taken together with other relevant works in the same catchment, can be maintained at or below the agreed limits, using sustainable drainage techniques. Development shall be in accordance with the approved surface water drainage assessment and scheme.'

Therefore the purpose of this document is to obtain approval of the local planning authority, in consultation with the Lead Local Flood Authority (LLFA) and the Environment Agency (EA), for the surface water drainage assessment for AP6 Langford Lane Overbridge, thus discharging the requirements of Condition 13 of the TWA Order and meeting the surface water drainage requirements of NPPF/PPS25.

2 Proposed Development

2.1 Overview

EWR P1 is a major package of infrastructure investments including: the doubling of the line between Bicester town and Oxford North Junction; a new independent line being built between Oxford North Junction and Oxford station, using a disused track bed parallel to the existing railway; the existing stations at Bicester Town and Islip will be rebuilt, and a new station built at Water Eaton Parkway; and at Oxford the disused parcels platforms at the north end of the station will be removed and replaced for passenger use for Chiltern Railways services. The following section describes the proposed works at AP6 in more detail.

2.2 AP6 – Langford Lane Overbridge

Due to the requirement to close the Langford Lane level crossing and replace farm crossings to the south, a new road is proposed running from Elm Tree Farm, Wendlebury, to the existing Langford Lane at the hamlet of Bramlow. This will cross the railway 0.75 km east of Wendlebury, for which a new overbridge is to be built. The location of the development is shown in Figure 2. This area is heavily constrained in terms of archaeological sensitivities and the detailed design for the Langford Lane works will be carefully progressed with the EA and English Heritage to take account of flood risk and archaeological concerns.

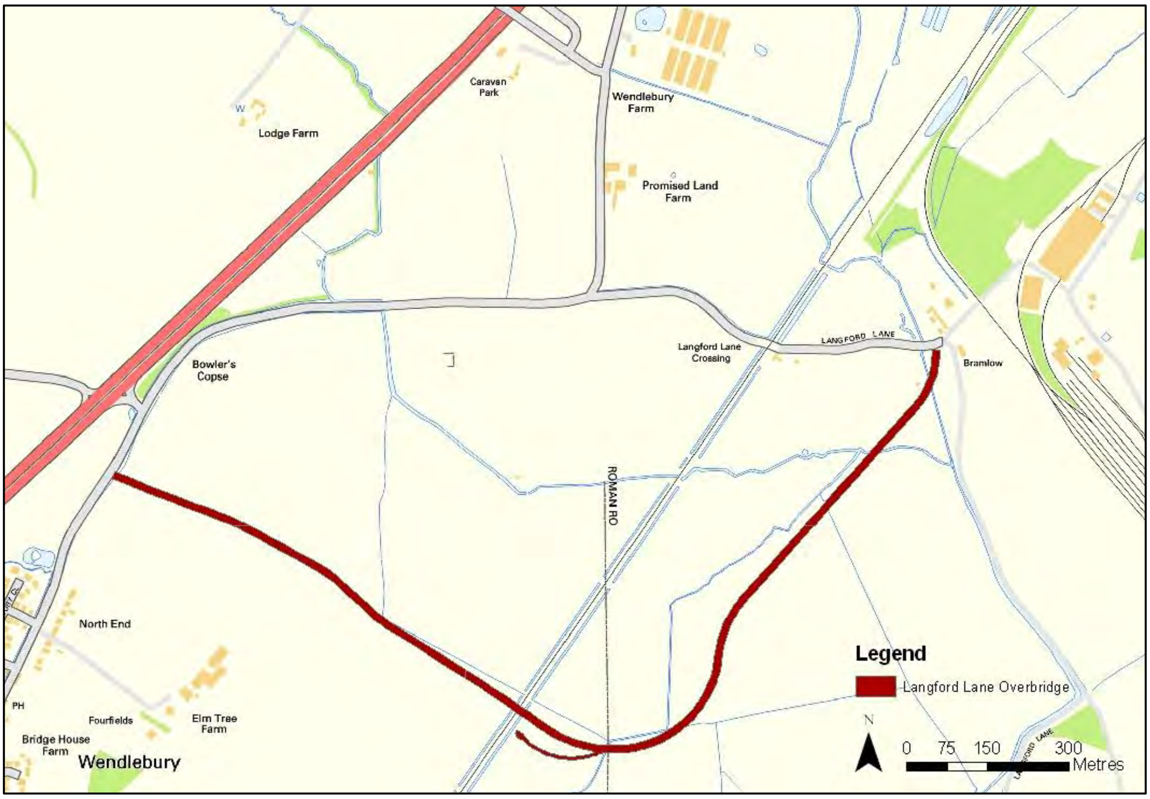

Figure 2. AP6, Langford Lane Overbridge. Contains Ordnance Survey Data © Crown copyright and database right 2013

3 Management of Surface Water Runoff

3.1 Planning Requirements

It is a recognised development requirement that post-development the stormwater runoff rates discharged from any new development should not increase flood risk and generally should not be greater than flows currently generated from the site, whether this be at greenfield or existing brownfield run-off rates. Exceptions generally only apply where it is not practical to achieve this due to the size of the hydraulic control unit or other constraints. These commitments are in line with guidance set out in the NPPF and through discussions with the EA. The following sections describe the calculation procedure followed to obtain the run-off rates.

3.2 Runoff Assessments

Greenfield peak surface water runoff rates have been calculated for the 1:1yr and 1:100yr events for AP6. Appendix 1 outlines the methodology used in the estimation of the peak surface water runoff rates. The calculation includes grassed areas and fields adjacent to the road that will discharge into the proposed highway drainage systems. The greenfield run-off rates are presented in Table 1 below. The method of calculation is described in Appendix 1.

Table 1 - Greenfield Run-Off Rates

Assessment Point	Total Area (including grassed areas)	1 in 1 year l/s	1 in 100 year l/s
AP6 – Langford Lane (*inc. Elm Tree Farm Access Track)*	7.57 ha	**13.32**	**50.01**

4 Design Statements & Commitments

Atkins has prepared outline drainage designs for AP6 Langford Lane Overbridge (please see Appendix 2). This design shows the general drainage arrangements proposed to sustainably manage surface water at this development. The following sections describe the drainage layout and SuDS components used to sustainably manage runoff.

4.1 AP6 – Langford Lane Overbridge

Although high level BGS data indicate that the surface geology at the site is unlikely to be suitable for infiltration drainage, at an early stage of design a ground investigation was undertaken to confirm infiltration rates. This confirmed that infiltration rates were poor and that an infiltration solution was unlikely to be achievable.

The proposed drainage along Langford Lane consists predominantly of ditches either side of the proposed road. The ditches have been sized to intercept runoff from the road, embankments and adjacent farm land (where applicable). These ditches have been oversized in places to provide surface water attenuation before discharge to the existing ditches and watercourses that cross the road. The flow rate is controlled by means of hydrobrake flow control units with a minimum discharge rate of 5l/s. Lower discharge rates would require smaller orifices that would be more prone to blockage and it has been agreed with the LLFA that 5l/s is a pragmatic minimum discharge rate.

However, although hydrobrakes and attenuation features are provided, this design does not achieve the greenfield run-off rates, primarily due to the relatively large number of outfalls (14No). This leads to a an attenuated design discharge rate for the 1 in 100 year event of 70l/s compared to the greenfield run-off rate of 50l/s. The arrangement of the drainage has been severely restricted by environmental constraints and existing ditch arrangements as described below.

The project requires that the finished level of the road is as low as possible to mitigate the visual impact of the road. The road is also traversed by a number of ditches that provides an additional constraint on the vertical alignment of road drainage. Hence the design splits the drainage into 14 separate outfall locations, each with a hydrobrake to control peak flows. Reducing the number of outfalls would require longer drainage runs that pass over the top of the culverts and the finished road level would need to be increased to provide the vertical clearance required for the drainage. The environmental constraints prevent this. In addition, the footprint of the earthworks would also increase requiring longer culverts below the road.

The design seeks to replicate the existing ditch catchment areas hence avoiding transfer of catchment areas to different ditches. Hence outfalls are provided into each drainage existing ditch that crosses the road. Notwithstanding this, in order to maximise the attenuation benefit of each outfall control, opportunities have been sought to keep catchment areas as large as possible, including the provision of additional drainage culverts to allow areas to be combined, where road levels and existing catchments permitted such a solution.

5 Conclusion

Although hydrobrake flow controls and attenuation features are provided to mitigate against increased surface water run-off, the constraints at the Langford Lane access road mean that it has not been reasonably practicable to provide a sustainable drainage system that fully complies with greenfield run-off rates. This is primarily due to the relatively large number of outfalls (14No). The arrangement of the drainage has been severely restricted by environmental constraints on the road vertical alignment and existing ditch arrangements as described in Section 4.

Appendix 1 – Surface Runoff Calculations Methodology

1.1 Introduction

Guidance issued by DEFRA[1] states that post development the stormwater runoff discharges from urban developments should approximate to the site greenfield response over an extended range of storm frequencies of occurrence (return periods). However, it is accepted that drainage proposals may be measured against the existing drainage performance of the site (brownfield). In addition the peak rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff, although similarly exceptions apply where it is not practical to achieve this. The guidance outlines methodologies for estimating storage volumes for stormwater control for development sites and also provides methodologies for the estimation of peak rates of runoff from greenfield sites.

For clarification, the greenfield rate refers to the volumes and peak flows associated with an undeveloped site whilst brownfield relates to a site which has been previously developed hence a proportion of the site is impermeable.

As part of the East West Rail Phase 1 development surface water runoff volumes for greenfield and brownfield conditions are required. In addition, peak runoff rates are also required for greenfield and brownfield conditions. Section 1.2 outlines the methodology for the estimation of the surface water runoff volumes whilst Section 1.3 outlines the methodology for estimating the peak runoff rates. Note that there is no guidance on estimating brownfield peak runoff rates, and the guidance states that greenfield runoff rates should be considered as indicative only due to the limitations of the methodologies.

1.2 Surface Water Runoff Methodology

The DEFRA guidance recommends the use of Institute of Hydrology Report 124 (IH124)[2] for estimating surface water runoff. However, recent research into flood design for small catchments[3] suggests that the FEH statistical method[4] and the Revitalised Flood Hydrograph (ReFH)[5] event-based method both outperform the older methods. The report states that these are applicable across the range of catchment sizes used in their development and that the continued recommendation of outdated methods such as IH124 and ADAS 345 is inappropriate. The research notes that there is little evidence to suggest that the accuracy of the FEH methods when applied to ungauged catchments is particularly scale dependent and recommends the use of current versions of the FEH statistical approach or the ReFH rainfall-runoff model except on highly permeable (BFIHOST > 0.65) or urbanised catchments (URBEXT2000>0.15) where the results of the ReFH model can be less reliable. The research recommends that for catchments smaller than 0.5 km^2 and plot scale, which is relevant for the development sites within the East West Rail Phase 1 development, runoff estimates should be derived from FEH methods applied to the nearest suitable catchment above 0.5 km^2 for which descriptors can be derived from the FEH CD-ROM and scaled down by the ratio of catchment areas.

[1] Kellagher R, 2012, Preliminary rainfall runoff management for developments, DEFRA R&D Technical Report W5-074/A/TR/1 Revision E

[2] Marshall D, C, W. Bayliss, A, C,. Flood Estimation for small catchments. Institute of Hydrology Report 124.

[3] Environment Agency, 2012, Estimating flood peaks and hydrographs for small catchments: Phase 1, SC090031

[4] Robson, A.J. and Reed, D.W. (1999) Statistical procedures for flood frequency estimation. Volume 3 of the Flood Estimation Handbook. Centre for Ecology & Ecology.

[5] NERC (CEH). 2005. Revitalised FSR/FEH rainfall runoff method. Spreadsheet application version 1.4.http://www.ceh.ac.uk/feh2/SpreadsheetimplementationofReFH.html

Following the guidance, and taking into account this research, greenfield runoff hydrographs were calculated using 6.25 hour duration design rainfall events for the required return period event using a conjunction of the IH124 and ReFH rainfall runoff method.

IH124

Greenfield peak runoff rates have been calculated using the small catchment statistical method, IH124 methodology, in conjunction with the growth curves factors specified within the NERC Flood Studies Supplementary Reports 2[6] and 14[7]

A catchment area of 50 ha was assumed for each site with the results expressed as runoff rates per unit area to facilitate scaling to the development area. A key catchment descriptor within the method is the soil class(es) as defined by the Winter Rainfall Acceptance Potential (WRAP) map[8]. This is an extremely coarse map which is mapped at a scale of 1:625,000 and as such does not contain sufficient information for determining local soil and underlying substrate permeability. At design level the selection of appropriate soil class values would be informed by local soil maps coupled within infiltration tests. For the purposes of defining runoff rates for this assessment the soil permeability classes and substrate classes within the Hydrology of Soil Types (HOST) classification[9] were used to guide soil class selection. The HOST classification has replaced the WRAP map in all current flood estimation procedures.

ReFH

Given that there is no available flood event data on which to calibrate the ReFH model, the catchment descriptors for each site were obtained from the FEH CD ROM v3. The nearest 1km cell to each site was used to obtain the rainfall parameters required for the rainfall Depth Duration Frequency (DFF) ReFH model. Where this is not possible catchment scale parameters were obtained for the nearest small river reach.

The ReFH model was run using the 6.25 hour event for the 1 in 1 year, 1 in 30 year and 1in 100 year events. Allowances for climate change were made for the 1:100 year event by increasing the rainfall intensity by 30% in accordance with current Planning Policy Statement guidance[10]. Note that current DEFRA[11] guidance advises increasing rainfall intensities by 20% for 2080 and beyond, so the adopted values are conservative. A catchment area of 50 hectares was assumed and results are then scaled to the site level.

Development of final runoff rates

The ReFH and IH124 methodologies produce independent runoff rates for the given return periods. Current research into small catchments[12] indicates that more recent methodologies are generally more reliable that the older (IH124) methodologies. The differences between the peak runoff rates

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[6] Faulkner, D.S. 1999. Rainfall Frequency Estimation. Flood Estimation Handbook Vol. 2, Institute of Hydrology, Wallingford, UK.

[7] Institute of Hydrology,1983 Review of regional growth curves. Flood Studies Supplementary Report 14. Institute of Hydrology, Wallingford, UK

[8] Natural Environment Research Council, 1975. Flood Studies Report.

[9] Boorman, D. B., Hollis, J. M. and Lilly, A., Hydrology of soil types: a hydrologically-based classification of the soils of the United Kingdom. Institute of Hydrology Report 126.

[10] Communities and Local government (CLG), 2010, Planning Policy Statement 25.

[11] Kellagher R, 2012, Preliminary rainfall runoff management for developments, DEFRA R&D Technical Report W5-074/A/TR/1 Revision E

[12] Environment Agency, 2012, Estimating flood peaks and hydrographs for small catchments: Phase 1, SC090031.

were resolved by adjusting the BFIHOST or WRAP classes. For most of the sites the peak runoff from IH124 was rescaled to be similar to ReFH. Since ReFH is not considered as reliable in high permeability catchments (taken to be where the BFIHOST is greater than 0.6) in highly permeable catchments the IH124 estimates for peak runoff were given a greater weighting.

Calculation of current brownfield and potential post development runoff volumes

The assessment of current brownfield and potential post-development runoff volumes for each return period is conducted:

- by assuming a runoff coefficient of unity for impermeable areas;
- calculating a gross direct runoff volume by taking the product of the areal extent of the impermeable area and the corresponding rainfall event profile;
- calculating the equivalent greenfield runoff profile for the impermeable area by taking the product of the greenfield runoff hydrograph (expressed in units of runoff per unit area) and the impermeable areas, and estimating the net runoff volume for the impermeable area.

This nett runoff volume represents the runoff volume that has to be captured, and preferably infiltrated to maintain runoff at the greenfield rate. For the 1:100 year event the runoff calculations have included an overall increase in event rainfall depth of 30% for the impermeable runoff estimate to allow for climate change.

Surfaces assumed to be impermeable in this outline design level assessment include roofs, car parks, pavements, roads, bridge structures and platforms. As such this represents a worst case scenario as it ignores the detailed design potential for at-source mitigation.

1.3 Brownfield Peak Runoff

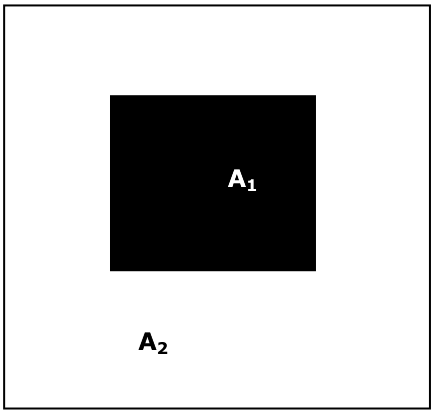
The greenfield peak runoff can be obtained from the IH124 and ReFH methodologies. However, DEFRA[13] do not provide guidance on producing peak runoff for brownfield sites. Whilst ideally runoff volumes and peak runoff should be returned to the greenfield level, it is accepted that this is not always possible. In these circumstances maintaining the current runoff or peak flows is acceptable hence brownfield peak runoff values are required.

It is widely accepted that increasing the impermeable extents within a catchment, or development site in this case, increases runoff volume and decrease the response time within the catchment[14].

The following methodology has been developed to calculate the Brownfield peak flow:

1) Consider a site to contain an impermeable surface of area A_1 (m^2) and permeable surface of area A_2 (m^2), as per diagram below

[13] Kellagher R, 2012, Preliminary rainfall runoff management for developments, DEFRA R&D Technical Report W5-074/A/TR/1 Revision E
[14] Chow V. T., Maidment D. R. and Mays L. W., 1988, Applied Hydrology, McGraw-Hill, New York, USA.



2) Calculations within ReFH assume that A_1 and A_2 are both greenfield hence we already have the design rainfall *P* (mm) and the greenfield runoff *Q* (mm) for the design hydrograph.

3) For a completely impermeable surface, A_1 and A_2 are impermeable, the following is proposed:

$$Q = 0.7 \times P + 0.3 \times Q$$

It is assumed that 70% of the rainfall becomes direct runoff. The value of 70% is used as this is generally recommended for use within the UK[15,16]. A proportion of the rainfall is also delayed through the system and this is reflected by adding 30% of the greenfield runoff.

The result is a hydrograph which has a faster time to peak, higher peak and greater total runoff than the greenfield hydrograph.

4) For a mixed impermeable/greenfield site these two components are combined according to the proportion of each within the development site.

$$Q = \left[\frac{A_2}{A_1 + A_2} \times Q\right] + \left[\frac{A_1}{A_1 + A_2} \times 0.7 \times P\right] + \left[\frac{A_1}{A_1 + A_2} \times 0.3 \times Q\right]$$

5) The peak flows can then be extracted from the hydrographs and rescaled to cumecs.

[15] Institute of Hydrology, 1999, Flood Estimation Handbook, Vols 1 – 5.
[16] Department of Environment/National Water Council, 1981, Design and analysis of Urban Storm Drainage:the Wallingford Procedure, National Water Council, UK.

An example is presented within Figure 3.

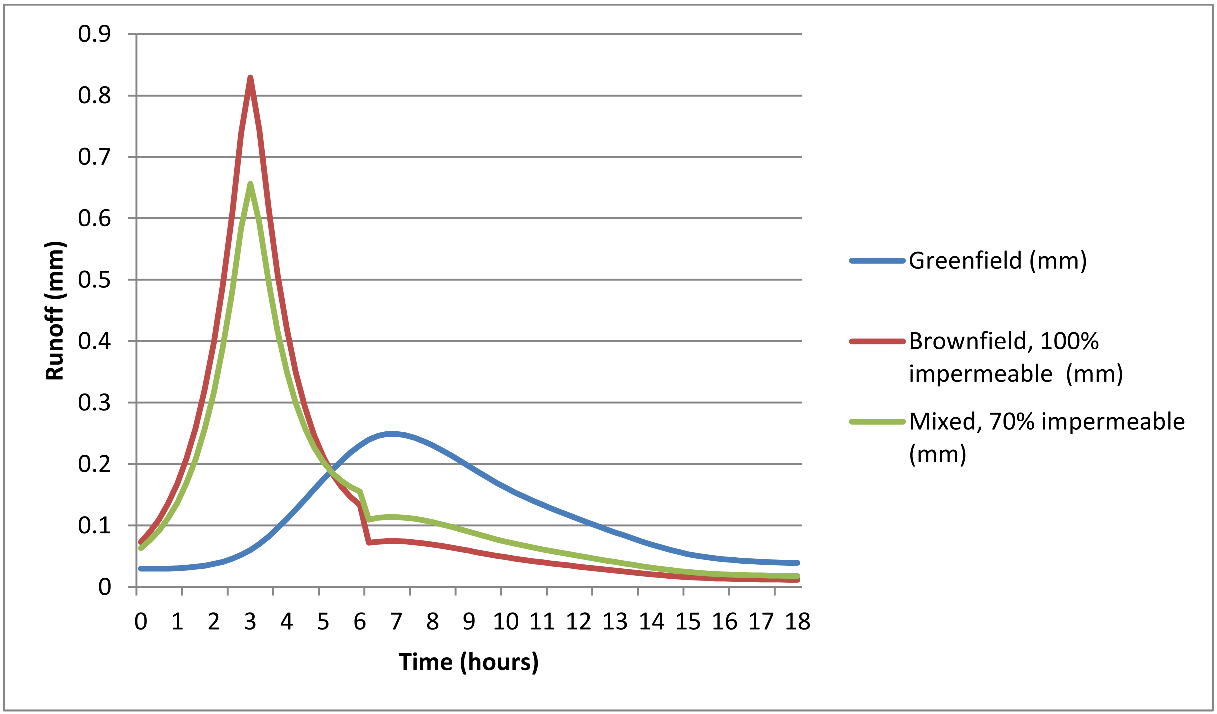


Figure 3 Example Hydrograph for a Greenfield, 100% impermeable and 70% impermeable site.

1.4 Determining the development site area

For most sites the development site considered is the same as the footprint of the development thus the post development will be 100% impermeable. i.e. if a footbridge is being built then the footprint of the footbridge is considered to be the development site and the site is initially 100% greenfield and post development 100% impermeable.

Some sites are more complex, for example the development of Islip and Water Eaton Parkway Stations. The proposal indicates that the aim will be to retain the runoff associated with the existing site (or greenfield where possible) which means that agreement of the development site extent may affect the amount of flood storage which must be allowed for. In these cases the development site is considered to be the addition of the existing and proposed development site. Post development all sites will be 100% impermeable unless land at any of the sites is returned to greenfield which is unlikely. This is illustrated for Islip Station, Figure 2, where the development site is the combined area of existing and proposed developments.

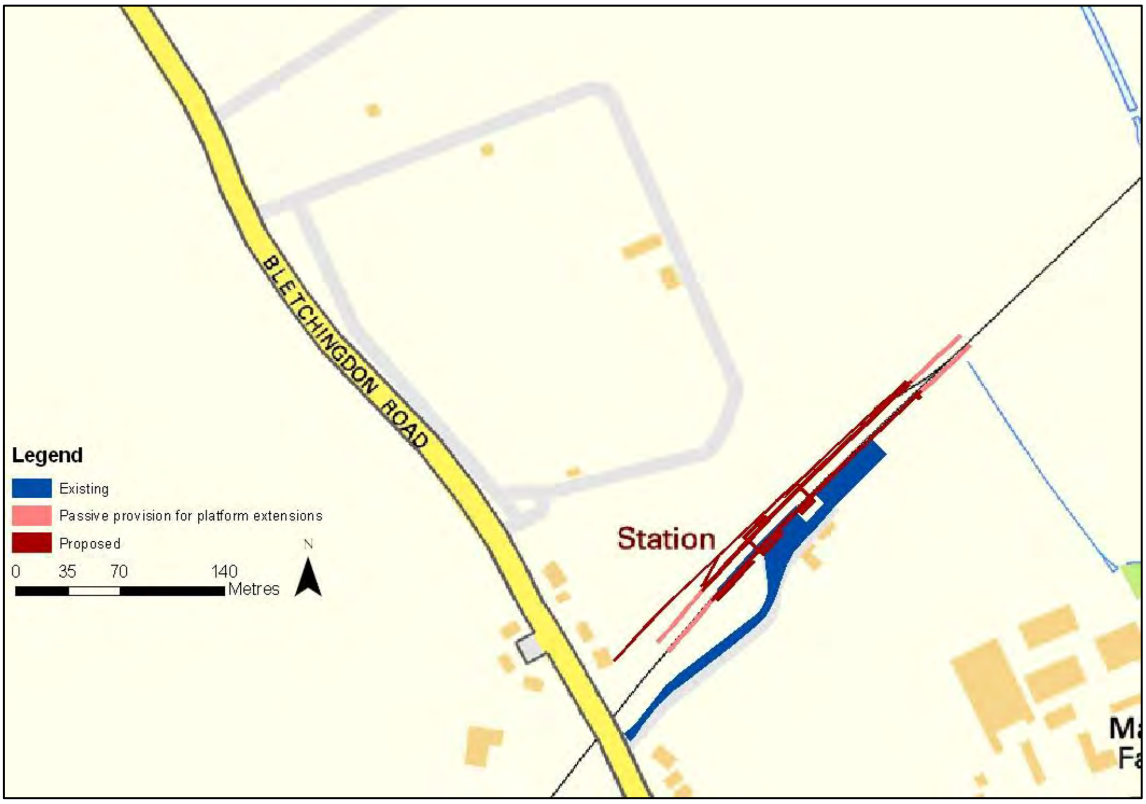


Figure 4 Existing and post development site at Islip Station.

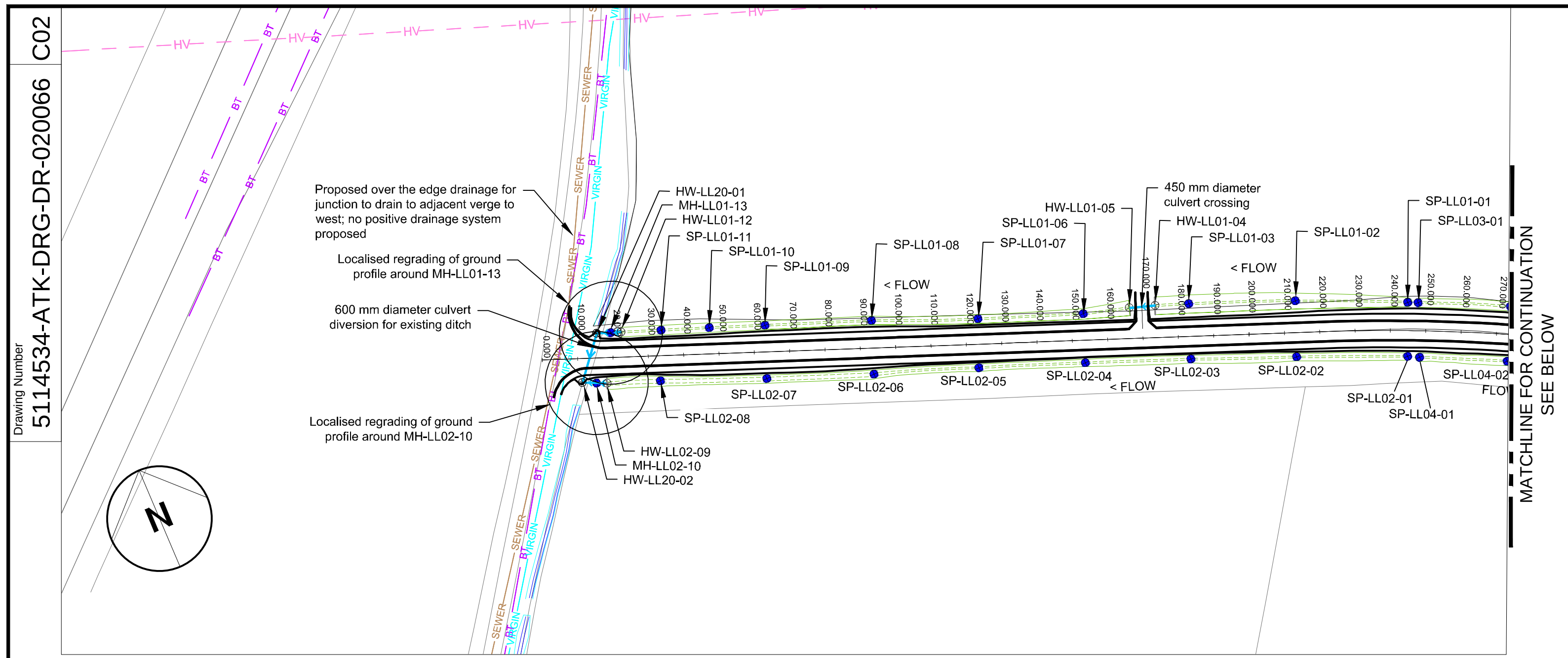
Appendix 2 – (AP6) Langford Lane Overbridge Drainage Design

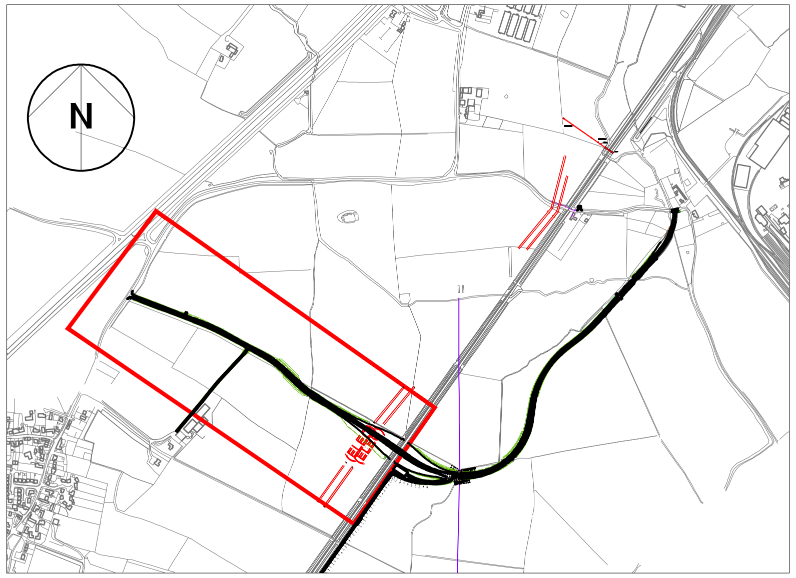
Flow Control Chambers - Langford Lane

Manhole	Cover Level	Invert Level	Discharge Flow	Design Head	Chamber size	Type of Control	Notes
MH-LL01-13	63.913	63.340	5.0 ltr / sec	0.5m	1500	Md5 SW Hydro Break	
MH-LL02-10	64.130	63.414	5.0 ltr / sec	0.6m	1500	Md5 SW Hydro Break	
MH-LL03-12	63.392	62.874	5.0 ltr / sec	0.4m	1500	Md5 SW Hydro Break	
MH-LL04-15	62.835	62.298	5.0 ltr / sec	0.4m	1500	Md5 SW Hydro Break	
MH-LL05-10	61.555	61.096	5.0 ltr / sec	0.4m	1500	Md5 SW Hydro Break	
MH-LL06-13	61.295	60.780	5.0 ltr / sec	0.5m	1500	Md5 SW Hydro Break	Can use proprietary 1.5m deep chamber.
MH-LL07-08	61.044	60.357	5.0 ltr / sec	0.7m	1500	Md6 SW Hydro Break	Can use proprietary 1.5m deep chamber.
MH-LL08-07	61.079	60.342	5.0 ltr / sec	0.5m	1500	Md5 SW Hydro Break	Can use proprietary 1.5m deep chamber.
MH-LL11-07	61.093	60.395	5.0 ltr / sec	0.5m	1500	Md5 SW Hydro Break	Can use proprietary 1.5m deep chamber.
MH-LL12-06	61.216	60.231	5.0 ltr / sec	0.9m	1500	Md6 SW Hydro Break	
MH-LL13-22	61.106	60.115	5.0 ltr / sec	0.9m	1500	Md6 SW Hydro Break	
MH-LL16-07	61.103	60.290	5.0 ltr / sec	0.9m	1500	Md6 SW Hydro Break	
MH-LL17-05	62.559	61.600	5.0 ltr / sec	0.6m	1500	Md5 SW Hydro Break	
MH-LL19-05	60.985	60.312	5.0 ltr / sec	0.6m	1500	Md5 SW Hydro Break	Can use proprietary 1.5m deep chamber.

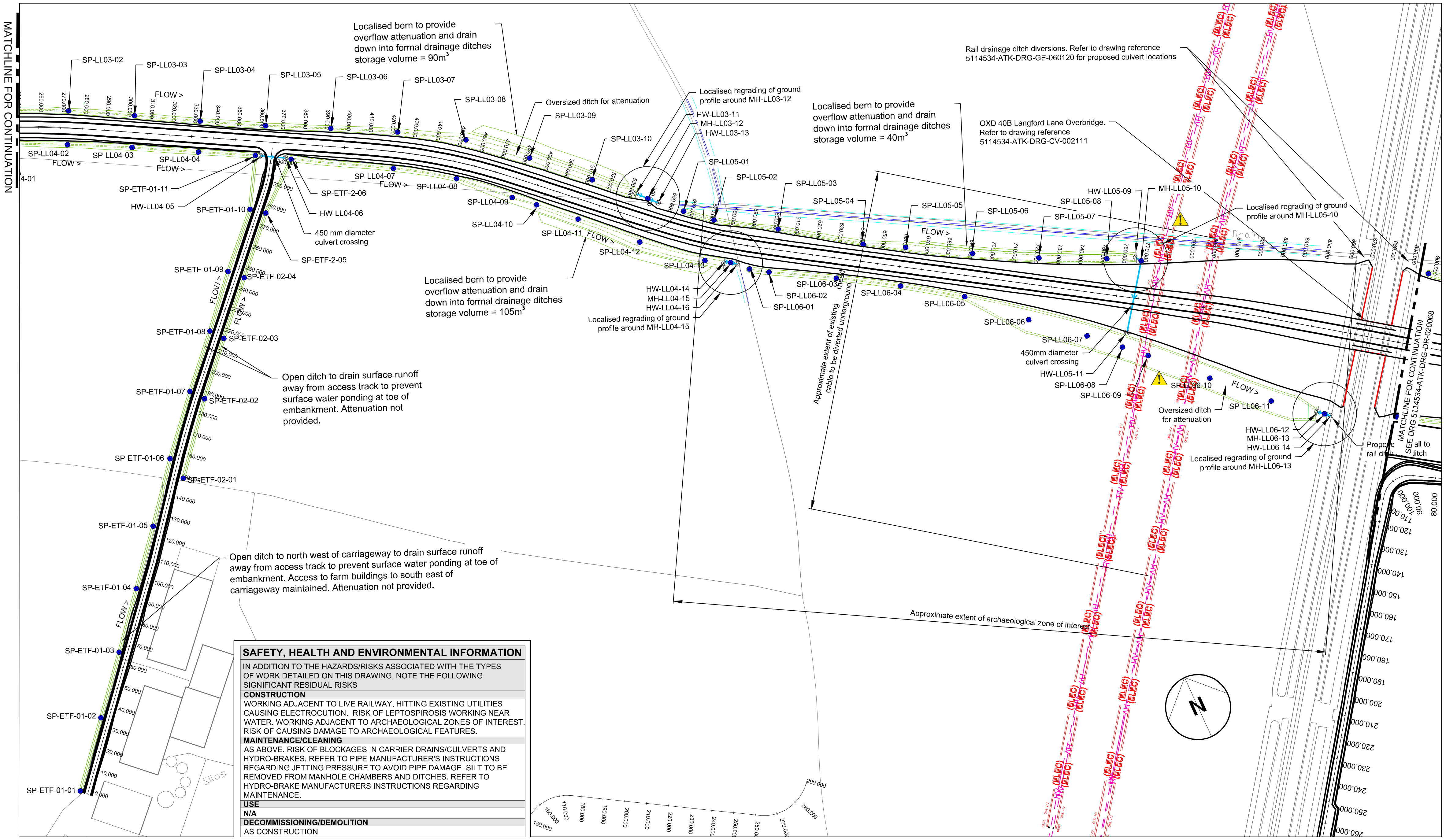
General Notes:

1. Refer to drawing 5114534-ATK-DRG-DR-020066 C02 and 020068 C03.
2. Manhole sump depths are dependent upon technical requirements of the flow control device. The supply will be able to advice minimum sump dimensions. Minimum sump depth is to be 300mm (see drawing 5114534-ATK-DRG-DR-020106).





LOCATION PLAN
SCALE 1:10000



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

CONSTRUCTION

WORKING ADJACENT TO LIVE RAILWAY. HITTING EXISTING UTILITIES CAUSING ELECTROCUTION. RISK OF LEPTOSPIROSIS WORKING NEAR WATER. WORKING ADJACENT TO ARCHAEOLOGICAL ZONES OF INTEREST. RISK OF CAUSING DAMAGE TO ARCHAEOLOGICAL FEATURES.

MAINTENANCE/CLEANING

AS ABOVE. RISK OF BLOCKAGES IN CARRIER DRAINS/CULVERTS AND HYDRO-BRAKES. REFER TO PIPE MANUFACTURER'S INSTRUCTIONS REGARDING JETTING PRESSURE TO AVOID PIPE DAMAGE. SILT TO BE REMOVED FROM MANHOLE CHAMBERS AND DITCHES. REFER TO HYDRO-BRAKE MANUFACTURERS INSTRUCTIONS REGARDING MAINTENANCE.

USE

N/A

DECOMMISSIONING/DEMOLITION

AS CONSTRUCTION

Legend/Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED. ALL LEVELS ARE IN METRES ABOVE PROJECT DATUM. ALL COORDINATES ARE BASED ON "OBB12 SNAKE GRID".
2. THIS DRAWING IS NOT TO BE SCALED.
3. REFER TO DRAWING SERIES 5114534-ATK-DRG-DR-023325-023332 FOR THE LOCATION AND DETAILS OF ALL MANHOLE CHAMBERS, PIPES AND DITCHES, INCLUDING SETTING OUT POINTS ALONG DITCHES.
4. ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION 5114534-ATK-DRE- SPC-020001.
5. REFER TO 5114534-ATK-DRG-DR-020100 AND 020101 FOR CONSTRUCTION DETAILS OF DITCHES AND FILTER DRAINS.
6. FOR DETAILS OF EARTHWORKS (EXCLUDING DITCHES) REFER TO EARTHWORKS DRAWINGS REF 5114534-ATK-DRG-DR-060130 - 060132.
7. TOPOGRAPHICAL SURVEY FROM 5114534-ATK-MOD-SU-000001 TRACK ALIGNMENT FROM 5114534-ATK-MOD-TR-000052.
8. THE SERVICE INFORMATION SHOWN ON THESE DRAWINGS HAS BEEN COLLATED FROM SERVICE RETURNS DATED DECEMBER 2013 AND SURVEY SITE INVESTIGATIONS BY OTHERS IN RELATION TO THE EAST WEST RAIL CORRIDOR. NO LIABILITY OF ANY KIND WHATSOEVER IS ACCEPTED BY ATKINS LIMITED, ITS SERVANT OR AGENTS, FOR ANY ERROR OR OMISSION IN RESPECT OF INFORMATION CONTAINED ON THE PLANS PROVIDED. THIS PLAN IS A COMPILATION OF A NUMBER OF PLANS PROVIDED AT DIFFERENT SCALES AND IS INTENDED TO PROVIDE A GRAPHICAL REPRESENTATION OF SERVICES WITHIN THE AREA AND IT IS IMPOSSIBLE TO GUARANTEE ACCURACY. IN ADDITION IT IS A COMPILATION OF INFORMATION SUPPLIED BY UTILITY COMPANIES WHO DO NOT GUARANTEE THE ACCURACY OF THE INFORMATION. THE UNDERGROUND SERVICES MUST BE VERIFIED AND ESTABLISHED ON SITE BEFORE ANY EXCAVATION IS CARRIED OUT. IT IS THE RESPONSIBILITY OF ANY ON SITE CONTRACTOR TO IDENTIFY AND LOCATE ANY UTILITY PLANT PRIOR TO DEVELOPMENT WORK GOING AHEAD.
9. NO FENCELINE OR LAND BOUNDARIES ARE SHOWN, REFER TO HIGHWAYS DRAWINGS 5114534-ATK-DRG-HW-010101TO 010103.
10. CULVERTS OF EXISTING DITCHES THAT ARE TO BE ABANDONED OR DIVERTED WILL REQUIRE PERMANENT + TEMPORARY WORKS WORKS CONSENT FROM THE LEAD LOCAL FLOOD AUTHORITY (OXFORDSHIRE COUNTY COUNCIL).
11. DRAWING TO BE READ IN CONJUNCTION WITH DRAWING 5114534-ATK-DRG-DR-020068.

FLOW > SP-LL01	PROPOSED SURFACE WATER DITCH
HW-LL01 < FLOW	PROPOSED HEADWALL AT START/END OF DITCH
	PROPOSED CULVERT
MH-LL01-02	PROPOSED SURFACE WATER CARRIER DRAIN WITH MANHOLE CHAMBER AND FLOW CONTROL

HIGH RISK UTILITY SERVICES

⚠	PROPOSED WORKS IN VICINITY OF HV CABLES
BT	BT (OVERHEAD)
HV	EHV MAIN (OVERHEAD)
HV	HV MAIN (OVERHEAD)
SEWER	FOUL WATER SEWER
VIRGIN	VIRGIN MEDIA
WATER	WATER MAIN

Rev	Date	Description of Revisions	Drawn	Chkd	Appr
C02	29/05/15	DRAINAGE ALIGNMENTS REVISED	BW	PL	AR
B02	05/12/14	DRAINAGE &OVERFLOW ATTENUATION REVISED	AS	JW	AR
C01	24/04/14	APPROVED FOR CONSTRUCTION	MS	ML	AR

Status
FOR CONSTRUCTION

Chiltern Railways
Marylebone Station, Great Central House, Melcombe Place, London, NW1 6JJ

NetworkRail

Contractor(s)

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10 Holliday Street
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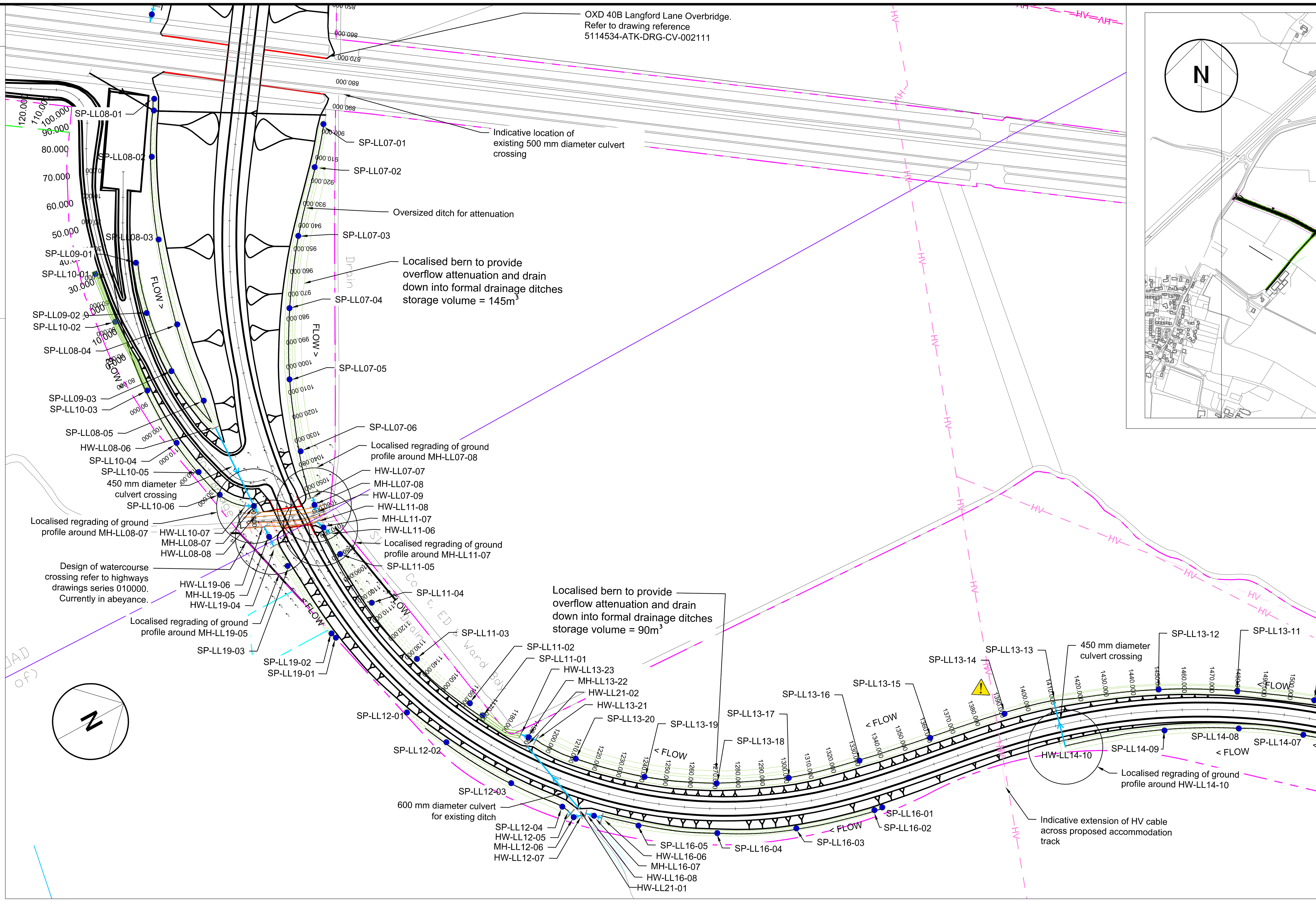
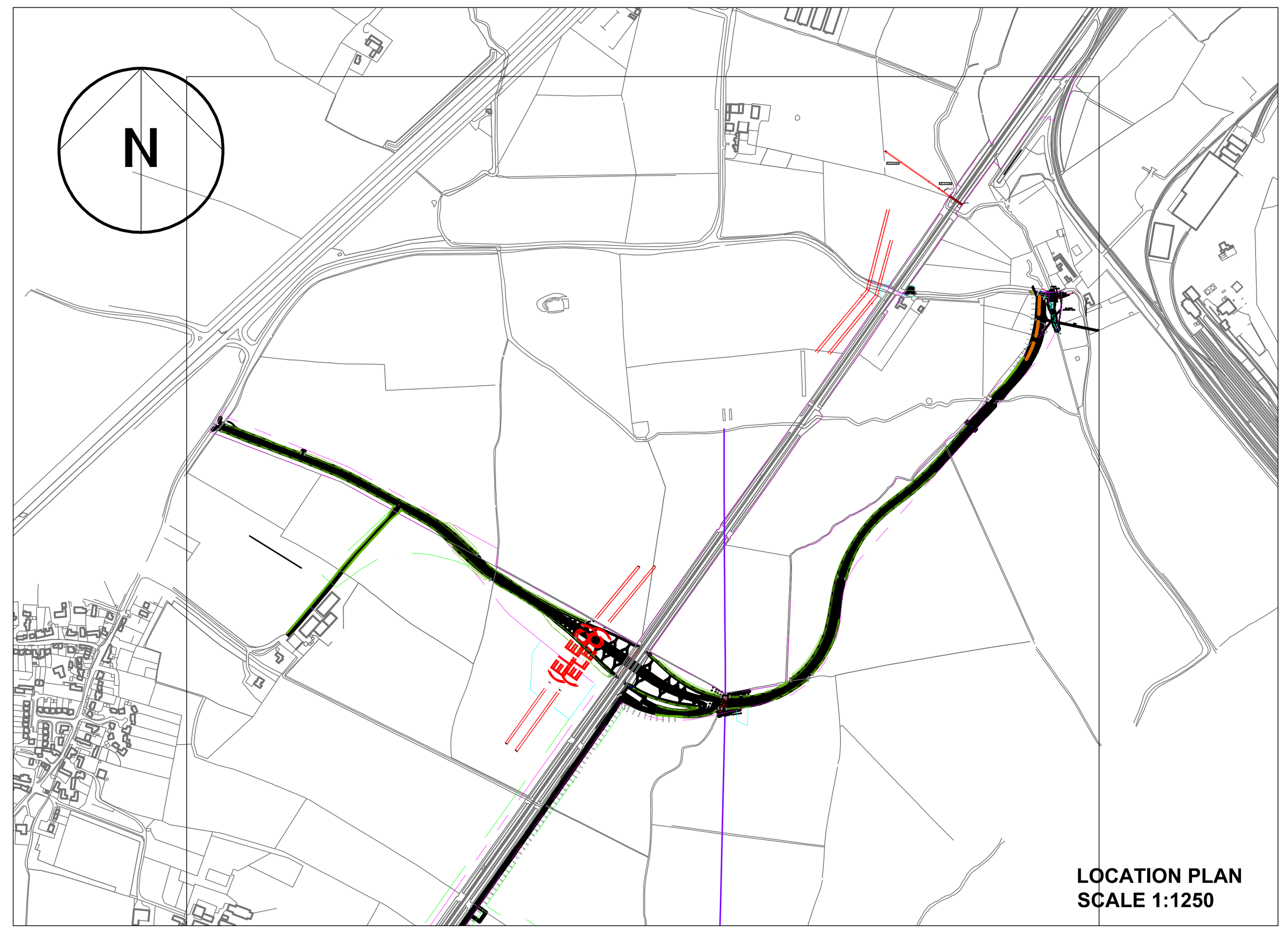
Project
EAST WEST RAIL PHASE 1

Drawing Title
GENERAL ARRANGEMENT LANGFORD LANE ACCOMMODATION TRACK PROPOSED DRAINAGE

Designed	M. STEVENS	Signed	Date 14/11/2013
Drawn	M .REHMAN	Signed	Date 14/11/2013
Checked	P .LAWRENCE	Signed	Date 14/11/2013
Approved	A .ROSE	Signed	Date 14/11/2013
Scale(s)	1:1000	ELR & Mileage	OXD 21M 12C
Alternative Reference		Sheet	1 of 2
Drawing Number	5114534-ATK-DRG-DR-020066	Revision	C02





SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

CONSTRUCTION

WORKING ADJACENT TO LIVE RAILWAY. HITTING EXISTING UTILITIES CAUSING ELECTROCUTION. RISK OF LEPTOSPIROSIS WORKING NEAR WATER. WORKING ADJACENT TO ARCHAEOLOGICAL ZONES OF INTEREST. RISK OF CAUSING DAMAGE TO ARCHAEOLOGICAL FEATURES.

MAINTENANCE/CLEANING

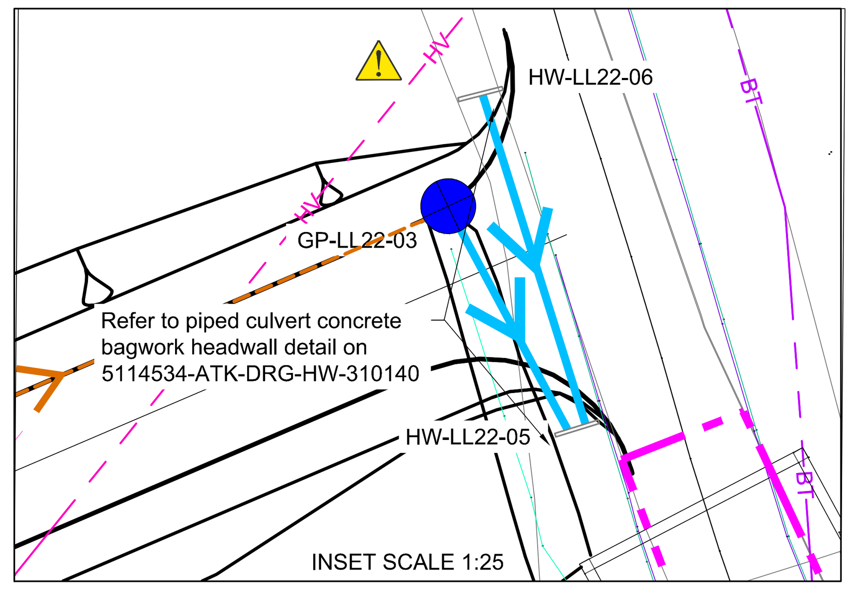
AS ABOVE. RISK OF BLOCKAGES IN CARRIER DRAINS/CULVERTS AND HYDRO-BRAKES. REFER TO PIPE MANUFACTURER'S INSTRUCTIONS REGARDING JETTING PRESSURE TO AVOID PIPE DAMAGE. SILT TO BE REMOVED FROM MANHOLE CHAMBERS AND DITCHES. REFER TO HYDRO-BRAKE MANUFACTURERS INSTRUCTIONS REGARDING MAINTENANCE.

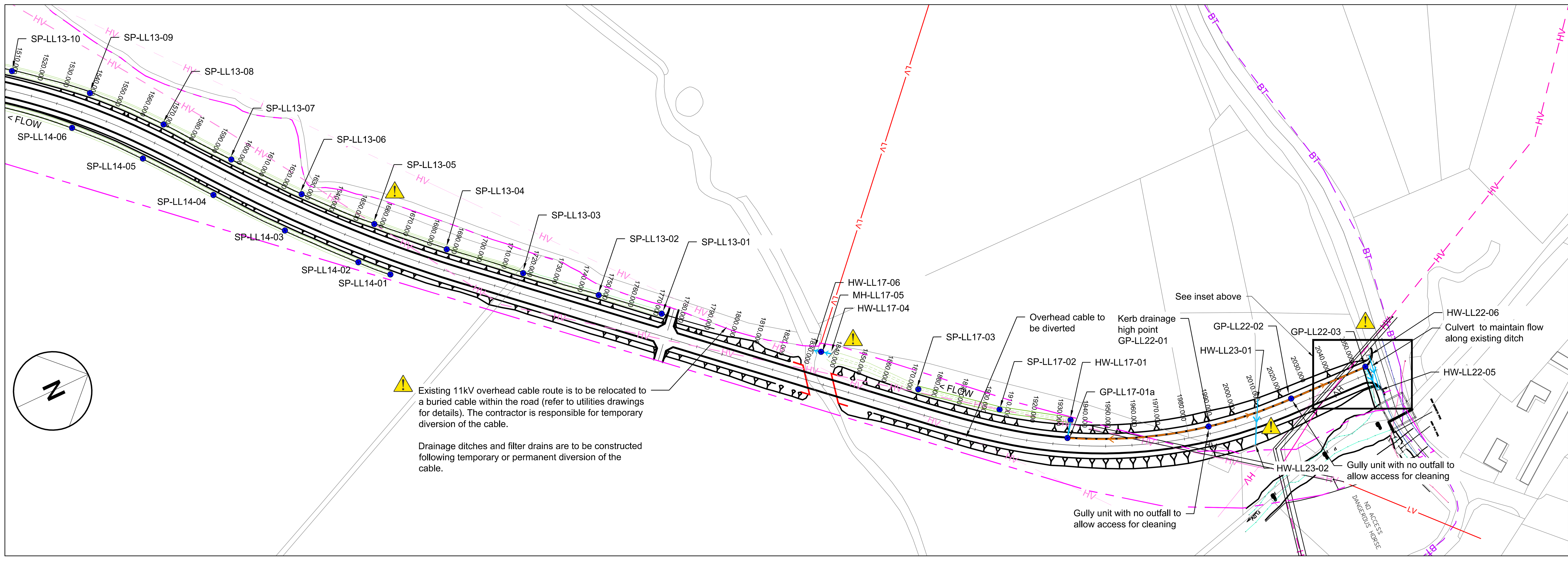
USE

N/A

DECOMMISSIONING/DEMOLITION

AS CONSTRUCTION





HIGH RISK UTILITY SERVICES

- ⚠ PROPOSED WORKS IN VICINITY OF HV CABLES
- BT (OVERHEAD)
- EHV MAIN (OVERHEAD)
- HV MAIN (OVERHEAD)
- FOUL WATER SEWER
- VIRGIN MEDIA
- WATER MAIN

Legend/Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED. ALL LEVELS ARE IN METRES ABOVE PROJECT DATUM. ALL COORDINATES ARE BASED ON "OBB12 SNAKE GRID".
2. THIS DRAWING IS NOT TO BE SCALED.
3. REFER TO DRAWING SERIES 5114534-ATK-DRG-DR-023325-023332 FOR THE LOCATION AND DETAILS OF ALL MANHOLE CHAMBERS, PIPES AND DITCHES, INCLUDING SETTING OUT POINTS ALONG DITCHES.
4. ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION 5114534-ATK-DRE- SPC-020001.
5. REFER TO 5114534-ATK-DRG-DR-020100 AND 020101 FOR CONSTRUCTION DETAILS OF DITCHES AND FILTER DRAINS.
6. FOR DETAILS OF EARTHWORKS (EXCLUDING DITCHES) REFER TO EARTHWORKS DRAWINGS REF 5114534-ATK-DRG-DR-060130 - 060132.
7. TOPOGRAPHICAL SURVEY FROM 5114534-ATK-MOD-SU-000001 TRACK ALIGNMENT FROM 5114534-ATK-MOD-TR-000052.
8. THE SERVICE INFORMATION SHOWN ON THESE DRAWINGS HAS BEEN COLLATED FROM SERVICE RETURNS DATED DECEMBER 2013 AND SURVEY SITE INVESTIGATIONS BY OTHERS IN RELATION TO THE EAST WEST RAIL CORRIDOR. NO LIABILITY OF ANY KIND WHATSOEVER IS ACCEPTED BY ATKINS LIMITED, ITS SERVANT OR AGENTS, FOR ANY ERROR OR OMISSION IN RESPECT OF INFORMATION CONTAINED ON THE PLANS PROVIDED. THIS PLAN IS A COMPILATION OF A NUMBER OF PLANS PROVIDED BY UTILITY COMPANIES AND IS INTENDED TO PROVIDE A GRAPHICAL REPRESENTATION OF SERVICES WITHIN THE AREA AND IT IS IMPOSSIBLE TO GUARANTEE ACCURACY. IN ADDITION IT IS A COMPILATION OF INFORMATION SUPPLIED BY UTILITY COMPANIES WHO DO NOT GUARANTEE THE ACCURACY OF THE INFORMATION. THE UNDERGROUND SERVICES MUST BE VERIFIED AND ESTABLISHED ON SITE BEFORE ANY EXCAVATION IS CARRIED OUT. IT IS THE RESPONSIBILITY OF ANY ON SITE CONTRACTOR TO IDENTIFY AND LOCATE ANY UTILITY PLANT PRIOR TO DEVELOPMENT WORK GOING AHEAD.
9. NO FENCELINE OR LAND BOUNDARIES ARE SHOWN, REFER TO HIGHWAYS DRAWINGS 5114534-ATK-DRG-HW-010101TO 010103.
10. CULVERTS OF EXISTING DITCHES THAT ARE TO BE ABANDONED OR DIVERTED WILL REQUIRE PERMANENT + TEMPORARY WORKS CONSENT FROM THE LEAD LOCAL FLOOD AUTHORITY (OXFORDSHIRE COUNTY COUNCIL).
11. DRAWING TO BE READ IN CONJUNCTION WITH DRAWING 5114534-ATK-DRG-DR-020066.

- FLOW > SP-LL01 — PROPOSED SURFACE WATER DITCH
- HW-LL01 — PROPOSED HEADWALL AT START/END OF DITCH
- PROPOSED CULVERT
- MH-LL01-02 — PROPOSED SURFACE WATER CARRIER DRAIN WITH MANHOLE CHAMBER AND FLOW CONTROL
- CP01-01 — PROPOSED RAIL SURFACE WATER FILTER DRAIN
- GP01-01 — KERB DRAINAGE ROUTE AND GULLY UNIT (ACO MINI BEANY 210 OR SIMILAR)

Rev	Date	Description of Revisions	Drawn	Chkd	Appr
C04	18/09/15	SAM ROUTE DIVERSION	SG	PL	AR
C03	29/05/15	DRAINAGE ALIGNMENT REVISED	UH	PL	AR
B02	05/12/14	OVERFLOW ATTENUATION REVISED	AS	JW	AR
C02	31/07/14	HIGHWAYS BRIDGE STRUCTURES ADDED	SH	ML	AR
C01	24/04/14	APPROVED FOR CONSTRUCTION	MS	ML	AR

Status

FOR CONSTRUCTION

Chiltern Railways
Marylebone Station, Great Central House, Melcombe Place, London, NW1 6JJ

NetworkRail

Contractor(s)

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Fax: +44 (0)121 483 6333

Project

EAST WEST RAIL PHASE 1

Drawing Title

GENERAL ARRANGEMENT
LANGFORD LANE
ACCOMMODATION TRACK
PROPOSED DRAINAGE

Designed: M. STEVENS	Signed	Date 14/11/2013	
Drawn: S. GENEVER	Signed	Date 14/11/2013	
Checked: P .LAWRENCE	Signed	Date 14/11/2013	
Approved: A .ROSE	Signed	Date 14/11/2013	
Scale(s): 1:1000	ELR & Mileage: OXD 21M 12C		
Alternative Reference		Sheet: 2 of 2	
Drawing Number: 5114534-ATK-DRG-DR-020068			Revision: C04

Drawing Number 5114534-ATK-DRG-DR-020068 C04