White Young Green

West Southall

Flood Risk Assessment

For National Grid Property

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DOCUMENT VERIFICATION

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FOREWORD

a) Planning Submission

1. This Report is one of a series of documents that has been prepared on behalf of National Grid Property Limited (NGPL), to support an outline planning application with details of all proposed accesses submitted in full for the comprehensive redevelopment of 44.7 hectares of land known as the Southall Gas Works site ('the Application Site'). This Report should be read in conjunction with the drawings and other documents submitted as part of this application, as follows:

- Environmental Statement, including a Non-Technical Summary
- Design and Access Statement (including Landscape and Accessibility Strategy)
- Development Specification
- Planning Statement
- Transport Assessment
- Framework Travel Plan
- Retail Assessment
- Sustainability Strategy
- Energy Strategy including Renewables
- Regeneration Strategy
- Housing Strategy
- Health Impact Assessment
- Remediation Strategy
- PADHI Report
- General Management Strategy
- Statement of Community Involvement

b) Local Planning Authority

2. The application is submitted to both the London Borough of Ealing (LBE) and the London Borough of Hillingdon (LBH) as the Application Site straddles the borough boundaries.

c) Application Proposals

3. The proposals are for a high quality residential-led mixed use development comprising the following:

An outline application for the demolition of the following properties: 16-32 (even) The Crescent; 1-11 (odd) Randolph Road; 137-143 (odd), 249 and 283 Beaconsfield Road; 30 The Grange; the remediation of the land and the redevelopment of the site to deliver a mixed use development for up to: 320,000sqm of residential, up to 14,200sqm for non-food retail, up to 5,850sqm of food retail, up to 1,750sqm of Class A3-A5 uses, up to 9,650sqm of hotel, up to 3,000 sqm of conference and banqueting, up to 4,700sqm of leisure forming a cinema, up to 2,550sqm of health care facilities, up to 3,450sqm of education facilities, up to 3,500sqm of office/studio units, up to 390sqm of sports pavilion, up to 600sqm of energy centre, up to 24,450sqm of multi-storey car park and associated car and cycle parking, landscaping, public realm, open space and children's playspace; and details are submitted for full approval (layout, scale, appearance and landscaping) of the following accesses:

- Pump Lane Link Road – New access road from the Hayes bypass to the Application Site for vehicle, cycle and pedestrian access, including drainage and a flood relief pond.
- Eastern Access – New access road from Southall centre to the site, including land currently occupied by properties on The Crescent.
- Minet Country Park Footbridge – Central pedestrian and cycle access to the Minet Country Park, bridging over the Canal and Yeading Brook.
- Springfield Road Footbridge – Northern pedestrian and cycle access to Minet County Park and Springfield Road.
- Widening of South Road across the railway line - Widening of south road over the railway line for the creation of a bus lane.
- Accesses (3no.) onto Beaconsfield Road.

4. The development shall be carried out in accordance with the Development Specification and the Parameter Plans appended to that document. An illustrative Masterplan (Drawing Ref. 0317_P1017Rev 00) has been devised to demonstrate how the application proposals could be delivered. Further details of the Application Site and proposed development are set out in the Design and Access Statement accompanying the outline planning application.

d) Application Site

5. The Application Site lies to the north of the Wales and Great Western Mainline Railway (with commercial uses beyond), to the south east of the Grand Union Canal (with Minet Country Park beyond) and to the south of residential developments in Southall, extending off Beaconsfield Road. A Grade II listed water tower is now in residential use, located adjacent to the south eastern corner of the Application Site. A retained operational gas works compound is located approximately mid-way along the southern boundary of the site. This comprises one working gasholders that creates the principal landmark within the Application Site. Please refer to the Design and Access Statement for further details

1.0 INTRODUCTION

a) Preamble

1.1 National Grid Property is proposing to redevelop the former Gas Works Site at Southall, which lies adjacent to the Yeading Brook. The approximate grid reference for the centre of the site is 512570, 179880.

1.2 This report addresses three matters relating to flood risk: hydrological and hydraulic implications of the proposed accesses across the Yeading Brook; hydrological and hydraulic implications of the Eastern Access; and matters relating to surface water drainage.

1.3 The proposed Pump Lane Link Road, Springfield Road Bridge and Minet Country Park Foot/Cycle Bridge are to be constructed across the Yeading Brook.

1.4 By way of background, a Flood Risk Assessment submitted in 2002 by National Grid considered an alternative alignment for the Pump Lane Link Road. Planning permission was granted for this link road route in the western corner of the former Gas Works site. However, this was subject to certain reserved matters, which had been addressed in a separate Environmental Statement (Pump Lane Link Road Reserved Matters Application Environmental Statement, May 2005). A further FRA (dated July 2006) addressed the Pump Lane Link Road alignment, a vehicular link road to Springfield Road and a foot/cycle bridge (Minet Foot/Cycle Bridge). Each of these were proposed to cross the Yeading Brook as part of the redevelopment proposals. These FRAs were subject to detailed consultation with the Environment Agency.

1.5 The Environment Agency advised in their letter, dated 14 November 2006, that they would not object to applications for the crossings on flood risk grounds if they complied with the recommendation of the FRA (reference Appendix FRA 2). Objections to the principle of Minet Foot/Cycle Bridge and Springfield Road Link Road, however, were maintained on the basis that the Environment Agency considered that the Pump Lane Link Road provided adequate access from the site to the Minet County Park and wished to avoid multi-river crossings.

1.6 The Environment Agency provided an updated hydrological model of the River Crane catchment, but advised that the physical data for the study area section of the model had not changed since the 2002 FRA report.

1.7 This Environment Agency model data was used as a base for a new model to assess the effect of the proposed structures. The new model also incorporated additional topographic data available for the site. The results of the model runs were extracted from the July 2006 report for use within the Version 2 assessment, issued March 2008. Local hydraulic modelling using the HECRAS programme was used to assess the effects of revised arrangements of the watercourse.

1.8 The Environment Agency has since advised that new mapping and modelling has been carried out for the River Crane. These latest flow and level details have been obtained and are used within this report.

1.9 Associated, but integral issues such as ecology, landscaping and ground conditions, have been considered holistically and are reported within complementary documents submitted in support of the planning application.

b) Brief

1.10 This FRA is prepared in accordance with the requirements of Planning Policy Statement (PPS) 25, 'Development and Flood Risk' published by the Department of Communities and Local Government. PPS 25 sets out the framework for planning decisions made by the local, regional and national government and the Environment Agency (EA). In order that planning authorities can make informed decisions on the development of sites in areas at risk of flood, PPS 25 requires the developer to carry out an assessment of flood risk.

1.11 This report addresses the requirements given in Annex E of PPS 25 and other issues which are deemed relevant to flood risk. These requirements include the following:

- Assessment of the magnitude and severity of flood risk to the site.
- Assess suitability of site and development through the use of the Sequential Test & Exception Test (if required).
- Assess impact of proposed development on flood risk to adjacent developments.
- Determine ability of existing and proposed drainage to accommodate development flows with respect to surface flooding.
- Demonstrate that appropriate mitigation measures have been taken to prevent flooding.
- Demonstrate that appropriate emergency situations have been considered e.g. overland flow paths, evacuation routes.

c) Description of the Site

1.12 The redevelopment site is located at the western edge of the London Borough of Ealing and the site has an elongated triangular shape formed by the Grand Union Canal to the north and northwest, and by the Great Western Railway to the south. The Application Site is circa 44ha, and has a maximum dimension, north to south, of about 450 metres and a maximum dimension east to west of about 1500 metres.

1.13 National Grid Gas (NGG) are retaining a single operational gasholder station along the southern boundary of the Application Site. Where appropriate, allowance for draining this area has been made in the infrastructure proposals for the surrounding redevelopment site.

1.14 Due to the previous use of the site as a gasworks, since Victorian times, contamination of the ground has occurred and the drainage systems take this into account. For example, soakaway systems are avoided, as agreed with the Environment Agency. Details of the proposed remediation to facilitate the redevelopment are details in the Remediation Strategy accompanying the planning application;

1.15 The site is generally level and flat, with a slight fall towards the canal and river, to the north and an embankment that rises to meet South Road as it crosses over the railway. A location plan can be viewed in Appendix A. Redevelopment proposals introduce some very gradual level changes.

1.16 Of the area for redevelopment, several large areas of the site are presently used for at grade car parking for users of Heathrow Airport, and other car areas for storage providers. The balance of the site is general disused or overgrown with bases, slabs and foundations of previous industrial developments remaining.

1.17 The area of land proposed for the Eastern Access currently comprises houses, small commercial and industrial units and an area (1500 sqm) of public open space. This will lead to the demolition of some of the properties in this area, as detailed in the description of development. A plan of the existing site can be viewed in Appendix B.

1.18 The site has remnants of the former surface water drainage system, some remaining live, some blocked, and a live waste water system primarily draining the eastern active NGG holders and compound.

d) Location and Watercourses

1.19 The Application Site is located between Hayes and Southall, approximately 1.5km north of Junction 3 of the M4. Refer to Figure 630.

1.20 The Pump Lane Link, Springfield Road Foot/Cycle Bridge, and the Minet Park Foot/Cycle Bridge would all cross the Yeading Brook floodplain.

1.21 The Yeading Brook rises in Harrow approximately 11km north of the site. It then flows south into the River Crane and then eastwards to join the River Thames at Isleworth.

1.22 The River Crane was the subject of a flood alleviation scheme in the early 1990s. This scheme included two flood storage reservoirs in the upper part of the catchment and channel works at five locations. One of the River Crane's flood relief channels is located just east and parallel to the Hayes bypass and joins the Yeading Brook immediately upstream of the railway bridge.

1.23 North of the study area, the Yeading Brook flows in a confined channel between an industrial estate and a housing area. It then enters a wide, flat valley and meanders to the western edge of the study area, where it outfalls through a bridge under the main railway line (which runs from London to the southwest).

1.24 Towards the northern edge of the study area the Brook receives flow from an overflow weir on the Grand Union Canal and a Thames Water surface water drainage discharge which crosses the study area.

1.25 The Paddington Branch of the Grand Union Canal follows a course along the south east side of the valley and adjacent to the site. It is an artificial waterway located at a higher elevation than the predicted flood levels. The proposed accesses would also cross this Canal. This will require clear span bridges, with clearance for barges and space on the banks for towpaths, maintenance, etc. As such, the canal crossings have a major effect on the vertical alignment of the access routes.

e) Hydrology and Existing Hydraulic Performance

1.26 The River Crane catchment, had been, historically, the subject of an area flood study by Peter Brett Associates (PBA) on behalf of the Environment Agency. The report by PBA identified the critical storm duration to be 15.5 hours for this reach.

1.27 Further studies had been carried out by the Environment Agency. The resulting model was utilised in conjunction with updated topographic survey data to more accurately assess potential flood levels and the effect of construction bridges across the brook. The Environment Agency floodplain map, as published on the internet, is shown in Fig 643.

1.28 Subsequently, the catchment has been remodelled as part of a Strategic Flood Risk Assessment. Outputs from this study have been provided and are contained in Appendix FRA 2. This latest information has been overlaid on the topographic survey to identify the functional floodplain and the 1:100 year flood outline. It is understood that the new model was based on Liddar Ground Level data. Some adjustments have been made to the plots in areas where high ground levels have been missed from the Liddar data due to interpolatation across wooded areas. Figure 632/B shows the 1:100 year flood outline, i.e Flood Zone 3, and Figure 643/A shows the 1:20 year flood outline.

1.29 Downstream of the confluence the railway line is carried over the river by a brick arched bridge (Photo 1). The bridge has a limited effect on the flow, with a head loss of 90mm for 1:100 year flood flows.

1.30 It can be seen that the floodplain is contained within an undeveloped valley upstream of the railway bridge. This extends north for approximately 1km as far as Beaconfield Road and Yeading Football Club. Any works proposed would limit any hydraulic effects to within this area.

f) Flood Risk to the Existing Site

1.31 The nearest watercourse to the Application Site is the Yeading Brook, which is located 1km west of the access road network. Interpretation of the Environment Agency's Flood Zone Map Appendix C, indicates that the site is within Flood Zone 1 (land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)); and is therefore suitable for all development, according to PPS25 Table D1.

g) Existing Development Drainage

1.32 Currently all surface water drains into the Thames Water Surface Water Sewers via gullies located along the road networks and parking areas, and pipes and guttering from the houses etc, Appendix D.

Total Area North of the Railway ***10,700 m²*** *approx* (1.1ha)

Impermeable Areas

Crescent Road	1,400 m^2 approx
South Road	2,600 m^2 approx
Water Tower Roads	1,050 m^2 approx
Garage area	800 m^2 approx
Houses in Crescent Road	850 m^2 approx
Houses in Randolph Road	500 m^2 approx
Play Area	300 m^2 approx
Total Impermeable	***7,500 m²***

Permeable Areas

Public Open Space	1,600 m^2
Garden	850 m^2
Railtrack	450 m^2
Highway Embankment	300 m^2
Total Permeable	***3,200*** **m^2**

Typical run-off rates from the existing development north of the railway, for a time concentration of 30 minutes, are presented in Table 2.1.

TABLE 2.1: APPROXIMATE RUNOFF RATES EXISTING SITE (0.75Ha Impermeable Area)

Return Period yrs	Modified Rational Method Calculations		
	30 min FEH Storm (mm)	Storm Volume V (m^3)	Peak Flow Q (l/s)
2	11.5	86.00	47.9
10	21.4	160.00	89.2
20	27.2	204.00	113.3
50	37.0	278.00	154.2
100	46.2	347.00	192.5

h) Existing Sewer Network

1.33 The Thames Water sewer records show a surface water sewer running around Crescent Road and discharging via a 300mm pipe into South Road and hence north.

1.34 A secondary connection at the head of the sewer will allow excess flow to pass down a further sewer in Randolph Road. Whilst we have no knowledge of surface water flooding in the area, the estimated gradient of the sewer is 1:272. This will give a pipe full capacity of around 67l/s. This is close to the Q_5 runoff value for the whole area. Surcharging would provide some extra capacity and it is also likely that the area around the Water Tower drains into the gas works system. The existing system can thus be expected to provide around a 1:5 year return period capacity provided there is no reduction in capacity downstream.

1.35 South of the railway the existing development drains into a 225 mm diameter public sewer which flows to the south. Insufficient details are available to enable an estimate of the capacity of this sewer to be made.

i) Vulnerability Classification

1.36 PPS 25 Table D.2 provides a detailed list of which types of development fall into the vulnerability classifications also defined within PPS 25. This list is recognised as not being exclusive and provides guidance on the various uses and their subsequent Flood Risk Vulnerability Classification.

1.37 The proposed re-development of the West Southall site will provide a mix of uses which will be residential led but also include retail, employment, leisure and community facilities including a health Centre and primary School. Therefore, the flood risk classification indicates that this falls within the **"More Vulnerable"** classification for the residential development, health and educational components and **"Less Vulnerable"** for the employment and retail components.

j) Sequential Test

1.38 A sequential test has not been undertaken by the local planning authorities, either in compliance with PPG 25 or PPS 25. However, this is not applicable in this case, because the site is located in Flood Zone.

2.0 YEADING BROOK

a) Proposed Structures

2.1 There are three proposed structures over the Yeading Brook (reference Figure 644), which comprise:

a) Pump Lane Link Road Crossing
b) Minet Park Foot/Cycle Bridge
c) Springfield Road Foot/Cycle Bridge

2.2 In addition, all the structures would need to cross the Grand Union Canal, and Pump Lane Link Road would also cross the Yeading Brook flood relief channel.

b) Pump Lane Link Road Crossing

2.3 This crossing is required to carry a three-lane road across both the Yeading Brook and the flood relief channel (a short distance from their confluence), as well as over the Canal, and forms essential access infrastructure for the overall development.

2.4 No suitable alternative sites for the link road have been identified. Alternative alignments of this crossing were the subject of Flood Risk Assessments, carried out by White Young Green in November 2002 and 2006.

2.5 The Environment Agency's previously approved solution comprised a highway embankment with a 17.5m span bridge over the Brook, a 5.5m span culvert over the flood relief channel, a diversion of the flood relief channel to minimise the length of culvert required, compensation storage formed by excavating within the bank of the flood relief channel north of the crossing, and flow attenuation provided for the peak run off from the new highway.

2.6 A similar strategy has been adopted for the new crossing. However, with the revision of the route to the north, the opportunity has been taken to provide enhancement to the diversion of the flood relief channel and a corresponding greater span over the combined Brook and channel, thereby avoiding culverting, which was not an Environment Agency favoured solution in the previous application.

2.7 This crossing creates the majority of new impermeable area of around 4,800m^2.

2.8 This can be considered in three sections:-

- The extreme western section has an existing drainage system discharging into the Yeading Brook. This will be maintained as far as possible. Some relocation of gullies will be required.

- From the edge of the existing Pump Lane carriageway to the Grand Union Canal. It is intended to drain this area to the low point in the region of the existing by-pass channel.

2.9 The discharge flow will need to be reduced to a peak of 11.5l/s for flows generated by rainfall of up to 1:100 year return period together with a 30% increase to allow for climate change.

2.10 This will require around 260m^3 of storage. It is anticipated that this will be contained within the modified upper section of the abandoned flood relief channel. The calculations show that for the volume of storage assessed, the peak can be restricted to a maximum of 11.5 l/s using a Hydrobrake control. If a throttle pipe is used the predicted discharge increases to 12.8 l/s for the 100 year plus 30% climate change event. However, the storage volume used excludes the volume available north of the embankment and as a throttle pipe is hydraulically inefficient a closer match to lower return period greenfield run-off rates will be achieved. Therefore, it is recommended that the outflow should be controlled by a throttle pipe. An overflow weir would be provided to protect the bank of the Brook.

- East of the Grand Union Canal – this will discharge in to the main site drainage system.

2.11 A schematic layout of the Link Road drainage system is depicted in Figure 649.

Sequential and Exception Tests

2.12 The floor of the valley is predominantly Flood Zone 3b (functional floodplain). PPS 25 Table D.1 states:

> "**Zone 3b the Functional Floodplain**
>
> **Definition**
> **This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).**
>
> **Appropriate Uses**
> **Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:-**
>
> - **Remain operational and safe for users in times of flood.**
> - **Result in no net low of floodplain storage.**
> - **Not impede water flows.**
> - **Not increase flood risk elsewhere.**
>
> **Essential infrastructure in this zone should pass the exception test.**
>
> **FRA Requirements**
> **All development proposals in this zone should be accompanied by an FRA. See Annex E for minimum requirements.**
>
> **Policy Aims**
> **In this zone, developers and local authorities should seek opportunities to:-**
>
> - **reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and**
> - **relocate existing development to land with a lower probability of flooding."**

2.13 PPS 25 Table D.3 requires that the exception test be passed for essential infrastructure to be constructed in Flood Zone 3b, stating:-

> **"D9. For the exception test to be passed:-**
>
> **a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by an SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS 12: *Local Development Frameworks* – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal.**
>
> **b) The development should be on developable[23] previously developed land or, if it is not on previously developed**

land[24], that there are no reasonable alternative sites on developable previously developed land, and

c) An FRA must demonstrate that the development still be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall."

2.14 In respect of (a) above the benefits to the community conveyed by the overall development are presented in other reports submitted with the application.

2.15 In respect of (b), the section of the link road crossing the flood zone is on undeveloped land. A road link from the development into Hayes and linking into the area network is essential and must cross the Yeading Brook. The only other possible location was a link to Springfield Road at the north of the Application Site. This was less suitable in terms of highway capacity and community impact. During negotiations in respect of the previous applications the local planning authority received consistent objections from the Environment Agency on the basis that they did not consider it to be necessary.

The approximate location of the crossing is thus fixed. However, the new alignment has now been adjusted to minimise impact on the floodplain whilst avoiding construction in close proximity to Network Rail's land.

2.16 Item (c), flood risk and hydraulic design are discussed below.

Flood Relief Channel Diversion

2.17 This involves the abandonment of around 225m of highly engineered U-shaped concrete channel.

2.18 The alignment of the proposed Pump Lane Link Road has presented the opportunity to create an enhanced diversion, in a more natural channel, provide a larger full span bridge for the crossing and avoid culverting.

2.19 The proposal includes provision for the flood relief channel to be directed to the left and join the existing brook just upstream of the link road.

2.20 An enlarged, combined channel would then follow the route of the Yeading Brook until it reaches the existing hard engineered section just upstream of the existing railway bridge confluence.

2.21 The channel will be a 2 stage channel and have a trapezoidal low flow channel with a circa 2.0m bed width with a high flow section of approximately 2m ledge width. Bank slopes will be an average of 1:3. Hydraulic calculations (Appendix FRA 6) show that as a result water levels upstream of the bridge will increase by between 20mm and 40mm for the flows analysed. This is negligible within the context of the valley and the back water effect will result in unchanged water levels within a short distance upstream.

2.22 Yeading Brook at this location is in close proximity to major infrastructure - the Hayes by-pass, the proposed link road and the main London to the West of England railway line. It is therefore necessary to ensure that the channel does not change course. Whilst flow velocities are predicted to be relatively low, constant flow and wavelets can cause significant erosion over time.

2.23 It is, therefore, intended that the low flow channel banks shall be protected by sensitively detailed rock armour at bends and junctions. This form of protection naturalises rapidly above the water surface, particularly if the surface is topsoiled, and provides a variation in habitat below the water surface, essentially providing an area of large gravel. Other forms of protection may be considered during the detailed design phase, e.g. pre-planted coir rolls (Photos 3 & 4 show typical uses of rock armour elsewhere).

2.24 The establishment of mature vegetation on the higher levels of the banks will provide protection during the shorter duration of flood flows.

2.25 The proposed route of the diversion is shown on Figure 646 and typical construction details on Figure 647.

2.26 Land drainage consent will be required for these proposals.

Yeading Brook/Flood Relief Channel Bridge

2.27 As a result of combining the channels, the bridge will be required to pass a $Q_{100+20\%}$ flow of 25.95m^3/s without affecting other properties. A clear span of 23m would achieve these objectives.

2.28 In order to maintain a wildlife corridor along the watercourse, a clear width of 4m will be provided between the main channel bank top and any abutment.

2.29 The soffit of the bridge would be a minimum of 600mm above the $Q_{100+20\%}$ flood level. The bridge levels are constrained by the existing road levels at Pump Lane and the need to pass over the Grand Union Canal. It is anticipated that the soffit will be around 1.5m above bank level at the west end and 2.5m above bank level at the east.

2.30 The local hydraulic model (Appendix FRA 6.1) indicates a 10 mm increase in the upstream water level compared to the proposed channel configuration without the bridge.

2.31 The total predicted increase in water level is thus between 30mm and 50 mm immediately upstream of the bridge for all the flows analysed. This rise is too small to affect the plotted extent of the floodplain.

2.32 The global model used in the previous FRA indicated that a 12mm increase in backwater had reduced to zero within 200m upstream.

Road Support Embankment

2.33 The proposed Pump Lane Link Road would be constructed on an embankment across the floodplain. The embankment's footprint will reduce the potential volume of flood storage by approximately 3,400m^3. This volume is too small to have any impact on flood flows as assessed by the river model.

2.34 Notwithstanding the above, the effects of loss of storage are cumulative and so it is proposed to excavate an equivalent volume upstream of the crossing outside of the existing floodplain as agreed previously with the Environment Agency.

2.35 In discussions with the Environment Agency and Hillingdon Council's Conservation Officer, an area adjacent to the flood relief channel was identified as being a suitable location for a compensatory storage site. The storage would be formed by excavating a layer from the channel bank which is already an artificially formed surface.

2.36 Embankment volumes within the floodplain and excavation volumes in the proposed storage area were obtained from the design drawings using MX 3D software. The results are presented in Appendix FRA 6.3 and demonstrate that a close correlation in volumes can be achieved.

2.37 It should be noted that in order to achieve the match, a large volume of material (approximately 8,000m^3) will have to be excavated from above the predicted $Q_{100+20\%}$ flood level for Pump Lane.

2.38 This may be of consideration in assessing other development proposals in the valley, e.g the possible expansion of Yeading Football Club.

2.39 It is anticipated that, subject to geotechnical assessment, the excavated material will be utilised to form the Pump Lane embankment.

2.40 Typical details of the compensatory storage area are given in Figure 648.

2.41 In addition, a tunnel would be provided through the embankment, in the form previously agreed with the Environment Agency, to mitigate any obstruction to wildlife movement.

c) Minet Country Park Foot/Cycle Bridge

2.42 A new bridge is required to provide pedestrian and cycle access for the new development, across the Canal and Brook into the Minet Country Park area. This is presented as both desirable and essential infrastructure as evidenced by the other supporting documents in the planning application and responses to requests of the planning authorities. PPS 25 requires the exception test to be passed if the structure is within Flood Zone 3. Parts (a) and (b) of the exception test are covered in other supporting documents. Flood risk is considered below.

2.43 The bridge would be formed from a series of three interlocking hyperbolic paraboloids providing a span of around 60m across the floodplain, with a central foundation between the Canal and the Yeading Brook, and end supports. The soffit would be a minimum of 600mm above the $Q_{100+20\%}$ level (Appendix FRA 4). The footings for the bridge are all in Flood Zone 1, i.e. low risk.

2.44 Analysis of the latest Environment Agency's flood model results show that the ground outside the bank tops is above the functional floodplain and that the Flood Zone 3a area to the west of the brook is actually protected. It is noted, however, that there is a gap in the defence embankment, around 200m upstream of the bridge. At this point the top of bank level is approximately 77.45m AOD. The predicted Q_{100} level at this location is approximately 27.3m AOD and the predicted $Q_{100+20\%}$ is approximately 27.44m AOD.

2.45 As the western end of the bridge gives access to the parkland, it is intended that the landing from the abutment will follow the top of the existing flood defence embankment. This alignment keeps the pedestrian access outside the 1:100 year floodplain and also avoids the Yeading Football Club pitch (and a proposed relocation of the pitch).

2.46 The landing also crosses a drainage ditch which serves the lower lying area behind the river bund. A pipe culvert will be provided so as to maintain a drainage connection to the football pitch area.

2.47 The proposed layout of the paths and ditches in this location are subject to amendment as proposed improvements to Yeading Football Club facilities may also impact this area.

2.48 Passages for wildlife would be available both sides of the ramp until the entire area is inundated. At the closest point, the abutment would be at least 4m from the top of the bank.

2.49 The main spans of this bridge will have no effect on the impermeable area of the floodplain, as it is proposed to form the deck from perforated steel plate allowing run-off to fall in close proximity to its natural landfall.

2.50 There will be a short ramp at the western end. A ramp length of around 55m will be needed to bring the footway down to existing ground level. It is anticipated that this will be formed from permeable or semi-permeable material. The runoff volumes will be too small to permit any practical methods of attenuation.

d) Springfield Road Foot/Cycle Bridge

2.51 A new bridge is required to provide cycle and pedestrian access from the north west of the development to Springfield Road.

2.52 This is presented as both desirable and essential infrastructure as evidenced by the other supporting documents in the planning application and responds to requests of the planning

authorities. PPS 25 requires the exception test to be passed if the structure is within Flood Zone 3.

2.53 The route is dictated by the connection point to the development and the requirement to connect to Beaconfield Road.

2.54 The bridge would comprise a two span structure from the northwest of the Gas Works Site to Beaconsfield Road north of Yeading Football Club ground. The alignment utilizes space provided by Yeading Football Club, which is relocating approximately 30m to the south as part of planned improvement works for the football pitch.

2.55 The spans average 49m over the Brook and 56m over the canal.

2.56 There will be an intermediate support founded on buried pile caps. This is outside Flood Zone 3 and is approximately 11m from the Yeading Brook bank top at its closest point.

2.57 An approach embankment is required at the northern end of the bridge. This will be based on ground above the 1:100 year floodplain and would be a minimum of 4m from the bank top of the conveyance channel. The main spans of this bridge will have no effect on the impermeable area of the floodplain, as runoff will be directed over the sides to fall in close proximity to its natural landfall.

2.58 The ramp from the bridge to Springfield Road will create around 200m^2 of impermeable surface. This is too small an area to allow practical methods of flow attenuation and so it is anticipated that drainage will utilise existing facilities in the area. Additionally, it is likely that most of the ramp length will simply drain over the edge into adjacent landscaped areas.

e) Construction Stage Flood Risks

2.59 In parallel with consideration of the impact of the completed crossings, it is also critically important to establish an Construction Environmental Management Plan (CEMP), which considers the potential flood risks during the construction stage. This would seek support through pre-works consultation with the Environment Agency.

2.60 Such risks are most likely to arise through major activities and short-term storage within the floodplain area. Therefore, the principle would apply within the CEMP that all activities and storage would be planned outside the floodplain area where practical. However, when access is needed, this would be within a framework of minimization and monitoring of weather conditions to allow withdrawal or cancellation of such works during high risk periods.

2.61 In addition, the area required for construction would be minimized so as to limit the impact on ecology and the environment as discussed in complementary reports submitted in support of the planning application.

2.62 This aspect is covered in more detail in the Construction chapter of the ES.

2.63 The construction works will require temporary bridges over the watercourses. These together with any works within 8 m of the bank top will require temporary land drainage consents from the Environment Agency.

f) Surface Water Drainage

2.64 The proposed crossings would increase the impermeable area of the Yeading Brook valley by around 4,800m^2. The Environment Agency requires that discharges from land being developed should match greenfield flow rates for 1:100 year peak flows.

2.65 Using the IOH 124 method (reference 3), the greenfield runoff rates for this area are estimated to be Q_{bar} = 8/l/s/ha and Q_{100} = 24 l/ls/ha. This value is very conservative when compared to runoff figures obtained by the ADAS 345 method.Calculations in respect of greenfield runoff rates and attenuation volumes are presented in Appendix FRA 6.2.

2.66 The detailed design would ensure that runoff from the roads would initially pass through Class 1 bypass interceptors and then be held in underground retention tanks or open ponds before being discharged to the Brook or flood relief channel via a controlled outlet.

g) Summary

2.67 The Yeading Brook and its floodplain are proposed to be crossed by a new road and two pedestrian/cycle bridges.

2.68 The **Pump Lane Link Road Crossing** would be constructed to create:

a) The diversion of 225m of concrete lined channel into 120m of new open channel and 170m of combined, improved channel, with the Yeading Brook.

b) A 23m clear span bridge over the combined Yeading Brook/flood relief channel with 600mm freeboard to the soffit above the $Q_{100+20\%}$ flows and 4m clearance from the channel top of bank edge to each abutment.

c) A mammal tunnel along the line of the abandoned flood relief channel formed from 1.0m diameter pipes with the invert filled with natural ground.

2.69 Surface water discharges would be limited to a peak flow of 11.5l/s for 1:100 year return period rainfall events, with a 30% allowance for climate change. This will require a volume of around 260m^3 which can be contained within the upper section of the abandoned flood relief channel.

2.70 The **Springfield Road** foot/cycle bridge would pass over the floodplain on two spans totalling 105m.

2.71 The western abutment will be sited in Flood Zone 1, a minimum of 4m from the bank top.

2.72 The central support will be located between the Brook and the Grand Union Canal in Flood Zone 1, in an area not used for conveyance of flood flows and a minimum of 4m from the Yeading Brook bank top.

2.73 The main structure of the support will be a buried pile cap with only the supports required for the bridge bearings protruding above existing ground levels.

2.74 The bridge structure will not affect surface water runoff. However, the access ramp will create a small increase in impermeable area that will drain via the existing facilities.

2.75 Interference with river flow would be negligible and the narrow deck and relatively high clearance would minimise impact on the ecology of the floodplain below.

2.76 The **Minet Park Foot/Cycle Bridge** will comprise two spans totalling 129m over the floodplain with a minimum freeboard of 600mm above the $Q_{100 + 20\%}$ level.

2.77 Interference with river flow would be negligible and the narrow permeable deck and relatively high clearance would minimise impact on the ecology of the floodplain below.

h) Compensatory Storage

2.78 The construction of the embankment for the Pump Lane crossing will reduce the floodplain storage available. An area has been identified adjacent to the flood by-pass channel that could be excavated to provide level for level compensatory storage. The total volume required will be approximately 3,400m^3 for $Q_{100+20\%}$ levels.

i) Conclusions

2.79 The proposed structures are essential for the development of the Southall Gas Works site and there are no locations available away from the river corridor. They thus pass the sequential test and parts A and B of the exception test required under PPS 25.

2.80 The proposed structures would have a negligible effect on the hydraulic regime of the floodplain. An increase in flood level of up to 50mm is predicted immediately upstream of the Pump Lane Link Road Crossing. This backwater will reduce rapidly once the river is confined to channel and is expected to be negligible by the Minet Foot/Cycle Bridge with no appreciable increase in flood levels upstream of the foot/cycle bridge.

2.81 Compensatory storage would be provided for floodplain volume removed by embankments. Therefore, there would be no additional adverse flooding effect on properties either upstream or downstream from the study area in this context.

2.82 The structures, therefore, also pass Part C of the exception test according to PPS 25.

2.83 Surface water runoff from the new roads would be attenuated and treated prior to discharge, which would primarily be into the Yeading Brook.

2.84 All the structures would require land drainage consent from the Environment Agency and may be subject to certain changes as required by the detail design process which naturally follows planning approval to comply with such consents.

3.0 EASTERN ACCESS

a) Proposed Development

Development Description

3.1 The Eastern Access Road will provide entry to the proposed development at the former Southall Gas Works site; and will aim to provide suitable traffic flows between the West Southall development and the existing traffic network.

3.2 This proposal consists of the construction of a new junction onto South Road just north of the station, the construction of a new length of highway to serve the main site, amendments to the South Road/Beaconsfield Road junction, and minor connecting roads to serve properties no longer served by the original Crescent Road.

3.3 Ultimately, it is anticipated that in the future the bridge over the railway will be widened and the junction with Southbridge Way and The Green improved.

3.4 The proposed works to The Crescent will result in the removal of residential properties along the southern half of The Crescent (No's 20 to 32); a motor repair garage, and an area of public open space (0.15ha). 6 houses in Randolph Road will also be demolished.

3.5 As the public surface waster sewer is the only outfall available for the site flow, reduction methods are restricted to those constructed using 'hard' engineering techniques.

Proposed Drainage

3.6 Drainage of the proposals can be considered in respect of 4 zones(Reference: Appendix E):-

1. The junction of the straight and Randolph Road.
2. The new West Southall Access Road.
3. South Road north of the railway.
4. South Road south of the railway.

3.7 Flow reduction to the Environment Agency's requested standard would require discharge rates to be reduced to 23.9l/s/ha for a 1:100 year event including a climate change allowance.

Flood Risk from the Development

Foul Water Drainage

3.8 The new road link will result in a reduction in foul water flows from the site. Therefore, no additional infrastructure or changes to the existing network are proposed; except the abandonment of some pipes along The Crescent (subject to survey and the agreement of Thames Water).

Surface Water Drainage

3.9 Currently all surface water drains into the Thames Water Surface Water Sewers via gullies located along the road networks along Beaconsfield Road, The Crescent and Randolph Road and pipes and guttering from the houses etc.

3.10 The proposals will result in a reduction in impermeable area due to the removal of buildings and paved surfaces and the introduction of landscaped areas as follows:

North Area

10,700 **m^2** *approx* (1.1ha)

Impermeable Areas

South Road	2,600 m^2 approx
Remains of the Crescent	100 m^2 approx

New Access Road	1,800 m^2 approx
Water Tower Roads	1,050 m^2 approx
Residents' Access	650 m^2 approx
Plaza	550 m^2 approx
Total Impermeable	***6,750 m^2***

Permeable Areas

Play Area	1,050 m^2 approx
Plaza	550 m^2 approx
Southern Strip	1,550 m^2 approx
Misc	800 m^2 approx
Total Permeable	***3,950 m^2***

3.11 The resulting runoff rates from the proposed development, without attenuation, during a 100-year rainfall event 30-minute storm duration are presented in Table 3.1.

TABLE 3.1: APPROXIMATE RUNOFF RATES PROPOSED DEVELOPMENTS (0.67Ha Impermeable Area)

Return Period yrs	Modified Rational Method Calculations		
	30 min FEH Storm (mm)	Storm Volume V (m^3)	Peak Flow Q (l/s)
2	11.5	77.00	42.8
10	21.4	144.00	79.7
20	27.2	182.00	101.2
50	37.0	248.00	137.7
100	46.6	312.00	173.4

3.12 PPS 25 Para F6 states that:

> **"Surface water from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, whilst reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment."**

3.13 This is further clarified in the Planning Policy Statement 25 Practice Guide, June 2008 which states within Para 5.50:

> **"Runoff from previously developed sites should be compared with existing rates, not greenfield rates for the site before it was developed. Developers are, however, strongly encouraged to reduce runoff rates from previously developed sites as much as is reasonably practicable."**

3.14 The runoff rates presented in Table 3.1 when compared to Table 2.1 demonstrate that the proposals in themselves will reduce runoff by around 11%.

3.15 However, the new drainage system should be designed for no surface flooding for a 1:30 year return period storm in accordance with Sewers for Adoption 6 Edition. Additionally, the Environment Agency has requested that the discharge should be limited to undeveloped greenfield runoff rates, wherever practical. This standard is more severe than the Environment Agency's published policy (under PPS25 and the Environmental Agency/DEFRA Document "Preliminary Rainfall Run-off Management for Development, 2007").

3.16 The design should also take future climate change into account. PPS 25 recommends an increase in design rainfall rates of 30% up to the year 2115.

3.17 The incorporation of flow reduction facilities into existing infrastructure is not always practical. The opportunities to meet the requested standards are discussed in the following sections.

SUDS Options Matrix

3.18 An objective of this FRA is to investigate the feasibility of using SUDS to achieve the required reduction in runoff rates post development. A detailed drainage design for the proposals will be carried out in due course, once the concepts presented in this FRA have been agreed with the EA.

3.19 This following table provides an overview, in the form of a matrix, of the feasibility of a range of SuDs techniques, in order to identify which measures may be suitable for the proposed development.

TABLE 3.2: SUDS FEASIBILITY MATRIX

Technique	***Physical Constraints***	***Feasibility***
Permeable pavement/ porous hardstanding areas	Requires a reasonably level site	Not Feasible
Green roofs	Roof slope for proposed buildings will preclude their use; flat roofs are ideal; also known as brown roofs and garden roofs.	Not Applicable
Bio-retention – shallow landscaped infiltration areas	Primarily used to remove pollutants from runoff and due to their shallow nature are not as effective at runoff attenuation as other SUDS techniques.	Not Feasible, requires large areas of land
Soakaways and infiltration trenches	Require infiltration rates of 1×10^{-6} m/s or greater. Shallow soakaways or infiltration trenches would be required where groundwater is shallow (i.e. less than 2.0 mbgl).	Maybe considered subject to site investigation and agreement with Thames Water
Cellular Storage	Modular plastic Geocellular systems with a high void ratio that can be used to create a below ground infiltration (soakaway) or storage structure.	Not Feasible under major access road
Grassed filter strips – wide gently sloping areas of grass or other vegetation	Normally used to treat polluted runoff from car parks or roads. Not as effective at runoff attenuation as other SUDS techniques.	Not Feasible, require large area May be limited potential to residential access

TABLE 3.2: SUDS FEASIBILITY MATRIX		
Technique	***Technique***	***Technique***
Infiltration basins / swales	Are widely applicable for attenuation and treatment of surface runoff by infiltration into the ground. Require slope of no more than 4-10% and can act as a substitute for soakaways where groundwater is shallow – need to consider the impact these techniques have on local groundwater levels.	Limited potential - as for filter strips
Non-infiltration swales	Used in the same concept as carrier ditches or storage bunds.	Feasible; subject to agreement with Thames Water
Filter drains	These are normally used adjacent to areas of car parking or roads and convey runoff via flow through an engineered substrate (normally gravel).	Feasible; may use for access road with option of perforated pipe to convey water to other storage system for extreme storms
Balancing ponds	These are permanent ponds that provide storage above the resting water level in the pond. Are appropriate for most sites but require suitable space. Require impermeable soils, or can be lined.	Not Feasible
Rainwater Harvesting	The collection and recycling of rainwater to be used for irrigation and other non-potable use	Not Applicable
Balancing Tanks	Storage tanks; can be located inside buildings or underground; can work in conjunction with oversize pipes; location for this site would be beneath public highway.	Not Feasible or required
Oversize Drainage Pipes	Usually last resort when no other techniques possible. Generally only feasible where a minor reduction in peak flow is required.	Not Suitable

3.20 On the basis of the SUDS feasibility study, there are only a very few techniques that would be appropriate for use at this site. According to the building regulations, the preferred option would be to utilise infiltration-based methods, such as swales and infiltration basins and/or soakaways, which would mimic a natural hydrological regime at this site and provide recharge of any underlying aquifer.

3.21 The use of these methods is not generally suitable in the Greater London area due to clay sub suds. However, this is subject to geotechnical investigation results. Thames Water has advised that they will not accept discharge from open attenuation ponds or soakaways.

b) <u>Surface Water Attenuation</u>

<u>Zone 1</u>

3.22 This is an area of approximately 1,650m^2 which will drain via the existing public surface water sewer in Randolph Road. Flows to this sewer will be reduced by around 32% due to the demolition of 6 properties on Randolph Road.

3.23 Further reduction flows to undeveloped runoff rates would require a small diameter control. For this area the Q_{100} flow would be 3.9l/s and a typical control would be a 43mm orifice. This would be prone to blocking and is not practicable (reference CIRIA CR609, Sustainable Drainage Systems).

Zone 2

3.24 This zone would be the subject of major reconstruction and will require a new drainage system. It covers an area of approximately 7,200m^2. It would, therefore, be feasible to provide attenuation storage as part of the works.

3.25 The main runoff collection route is down the new access to the south-west of the zone and then into a diverted public sewer.

3.26 Areas of open space that would have potential for use as ponds are addressed as follows:-

(a) South of the access road: Part of this area is at a suitable low level but is located behind the Network Rail boundary and hence is not available.

The remaining section is infill between the higher ground of the access road, piazza and south Road, dropping down to meet the railway.

Use of this area would require gradients of 1:3 or steeper resulting in a very artificial depressed area.

(b) There is a small area of landscaping at the end of Randolph Road. This again would require steep slopes but would still not provide a significant volume of storage.

(c) The play area at the north of the site:
Existing ground levels are above the surrounding areas to the north and west. Excavation to produce a pond would destroy the existing mature trees which are intended to remain. The use of a play area to attenuate any but the more infrequent storms is not desirable.

3.27 In addition to the above, Thames Water has indicated that they would consider drainage connections from open areas to be 'land drainage' and would not accept any flows from these areas.

3.28 Accordingly, the only practical means of attenuation for this area is by the provision of a tank under the new highway.

3.29 The undeveloped Greenfield runoff rates from this area for a 1:100year storm would be 15.1l/s. This could be achieved (including a 30% climate change allowance) by the construction of a 150m^3 attenuation tank, with the outlet controlled by a 25m X 100mm diameter throttle pipe. This will give a reasonable match to undeveloped flow rates from more frequent storms (see Appendix G).

Zone 3

3.30 This comprises South Road to the centre of the railway bridge.

3.31 The road is to be widened, resulting in a slight increase in area draining to the existing sewer connection. However, a section of The Crescent will be removed from the main site drainage. This leaves the impermeable area draining to the connection manhole almost unchanged at approximately 2750m^2. Attenuation to undeveloped run-off rates would require around 150m^3 of storage, similar to the main site. This would need to be installed under a major traffic route incurring additional expense and disruption to the public. Accordingly, it is proposed to continue to utilise the existing 225 mm diameter public sewer as the outfall.

Zone 4

3.32 Zone 4 is an area of highway improvements to the south of the railway line and extends over an area of around 4000m^2. Of this 230m^2 is a landscaped island and 300m^2 is located over Network Rail land, the remainder being fully paved.

3.33 The junction improvements will result in all the area being hard surfaced, an increase of 15%.

3.34 It is not practical to construct a large attenuation tank (approx. 250m^3) under a large major junction as would be required to reduce the run-off from the whole area to undeveloped sites.

3.35 The new area would have an approximate rate of run-off of 1.3 l/s. This would require a storage volume of around 32m^3 for a Q_{100} + 30% event with a 25mm diameter orifice as the control. The control size is too small to be practicable. However, subject to available space between utility services, it would be possible to provide this volume by means of an off-line 1.2m diameter pipe 29m long within the footprint of the current island. The discharge will be effectively limited by the capacity of the existing 225mm pipe, which will remain unchanged.

c) Conclusions

3.36 Interpretation of the Environment Agency's Flood Zone Map indicates that the site is within Flood Zone 1 (land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%); and is therefore suitable for all development.

3.37 The proposals will actually result in a reduction of impermeable area through removal of buildings and the introduction of landscaped areas in and around the development. As a result flood risk elsewhere will be reduced.

3.38 The proposals thus meet with the requirements of PPS 25 and hence the Local Plans without the incorporation of any additional attenuation.

3.39 Greenfield run-off from the existing site, north of the railway, as defined by PPS 25, is estimated to be 173.4 l/s for a 1:100 year 30 minute storm.

3.40 The Environmental Agency have requested that flows are reduced to undeveloped Greenfield rates. This is a requirement more severe than required by either PPS 25 or the Environmental Agency's published policy.

3.41 The undeveloped Greenfield run-off rates north of the railway have been estimated using the I0H124 method to be 25.6 l/s/ha for a 1:100 year event.

3.42 Based on the findings of this report, it is considered that there will be no increase in flood risk either to the development or to other properties as a result of implementing the proposals. The development thus meets the requirements of PPS 25.

3.43 It is not practicable to provide attenuation in all zones of the development due to either a zone being too small to have an effective control or an attenuation facility would involve major excavation in a heavily used highway.

3.44 The new works do provide some opportunity to provide attenuation. A tank of 150m^3 with a 25m x 150m dia through pipe control will reduce the Q_{100} + 30% peak flow from Zone 2 from 95 l/s to the undeveloped Q_{100} flow of 15.1 l/s.

3.45 South of the railway a 32m^3 could be installed within the current landscaped area, subject to the presence of other utilities. This would allow the flow from the local increase in surface area to be reduced to Greenfield rates.

4.0 SURFACE WATER DRAINAGE

a) Flood Hazards

Sources of Flooding

Fluvial

4.1 Fluvial flooding is flooding caused by rivers and occurs when the river channel capacity is exceeded by the flow. Most rivers have a natural floodplain which in built up areas is sometimes encroached upon by development.

4.2 The nearest watercourse to the site is the Grand Union Canal, immediately adjacent to the north-west boundary of the site. However, the nearest designated main river is the Yeading Brook, which runs roughly parallel to the north-west boundary of the site and Grand Union Canal at a distance from the site boundary varying from 50m to 150m and at a lower topographical level. The Yeading Brook is not tidal.

4.3 The river Crane is located, at the closest point to the site, about 0.25Km to the west. The Yeading brook is a tributary of the Crane, which in turn enters the Thames at Isleworth, about 6km to the south east of the site.

4.4 The site itself is higher than the Brook and its flood potential and is not considered as vulnerable to fluvial flooding.

Tidal

4.5 Tidal flooding from the sea occurs when high tides and storm surges raise the level of tidal waters above the level of the shore or river bank. They can be sudden and severe, but are dependent upon a number of factors.

4.6 The site is not considered as vulnerable to tidal flooding.

4.7 The general level of the site approximately 30.0 to 33.0 metres AOD is comfortably above the 1 in 1000 year event (0.1%) level of the tidal River Thames, approximately 5.20m AOD.

Overland Flow

4.8 Within a highly dense urban area where there are large areas of impermeable surfacing, e.g. roof areas, car parking and roads, it is possible for high intensity rainfall storms to exceed the available capacity for water not be able to soak into the ground or enter the man made drainage system at a quick enough rate to cope with the volume of water. Where this occurs, the excess water can flow across land and potentially cause flooding.

4.9 In order to assess the flood risk to the site from this source of flooding, the site needs to be analysed in the larger context. To the North, the land form falls toward the Yeading Brook, and the site is significantly higher than the Brook and its floodplain. Whilst the Grand Union Canal, (Paddington Branch) lies between the site and the Yeading brook, it too is slightly lower than the site as it is connected to an overflow spillway down to the Brook.

4.10 To the South, the site is bounded by the Great Western Railway. Because the railway is on embankment, it protects the site from any potential overland flow from the south.

4.11 Overland flow is conceivable from the direction of South Road, which is to the east, and from the existing densely built up residential area of Beaconsfield Road to the north and north east.

4.12 Since in overland flow conditions, the water will find the easiest way to the lowest point, which in this case will be extensive road network around the site, the risk of flooding due to overland flow can be minimised by sympathetic design adopted for the levels regime of the site itself.

Groundwater

4.13 In areas where the level of groundwater is high, rainfall that soaks into the ground can raise it to a level where structures within the ground are at risk of flooding. Structures such as basements or detention ponds can be at risk, although this is dependent upon the ground conditions of the site.

4.14 From the Wallingford Winter Rainfall Acceptance Maps, the site is located within W.R.A.P class 2, which given the information from the EA regarding the permeability of the soils in the area would indicate that the soil is:

"(i) Very permeable soils with shallow ground water"

4.15 The extensive ground investigation for the site revealed groundwater in the majority of the boreholes and trial pits, varying from seepages to rapid inflows, and at depths ranging from 0.3m to 4.5m but in general circa 2m down. The direction of groundwater flow is from south east to northwest, i.e. towards the water bodies of the grand Union Canal and Yeading Brook. Groundwater flow is very slow and assessed as very complex and affected by underground obstructions. It is seen to vary seasonally too. It is likely to be altered to some extent at near surface levels by the introduction of new below ground drainage to serve the proposed development.

4.16 The EA have no record of any flooding occurring due to groundwater on the site. The risk of flooding due to groundwater is likely to reduce due to, first, the installation of new positive well designed drainage systems, and second, the increase in impermeable cover due to buildings, roads and external pavings.

Sewers

4.17 Flooding from sewers occurs when the quantity of water flowing into the sewers exceeds the capacity of the sewer and backs up to an extent where it floods out of manholes or gullies. Alternatively and more commonly, sewers flood when a blockage occurs in a pipe. This is more likely on private sewers, but is usually less severe than flooding from larger public sewers which can cause extensive flooding due to the greater quantity of surface area which they drain.

4.18 At the present time the site is substantially devoid of a fully active and positive drainage systems, other than the sectional remains of old systems that used to serve the previous industrial uses of the site. Completely new systems for below ground drainage are necessary for the redevelopment of the site. Separate systems will be provided for surface water and foul. These will be designed in accordance with contemporary drainage standards and built out in increasing capacity to suit the phasing programme.

4.19 At just two locations, within the entire main site, there are existing sewers that pass through the site. The surface water sewer, mid way along the site, is intended to be re-laid as part of the development, and will be designed to comply with current standards, that require, at minimum, the design to demonstrate no flooding in a 1 in 30 year event.

4.20 The foul sewer that passes through the narrow western end of the site has been assessed by Thames Water to have adequate capacity.

4.21 In the event that any sewer, new or existing, became blocked or overloaded, the resultant surface flood that might occur in consequence would disperse via the road network in the direction of the prevailing fall, towards the north. Property thresholds would be protected by judicious setting of finished floor levels with an appropriate "freeboard" above the surrounding external ground level, and a fully co-ordinated scheme of and external works levels schemes.

Artificial Sources

4.22 The Grand Union Canal, a man-made structure, is located immediately adjacent the site on its north side. The length of the Grand Union Canal in question is the Paddington Branch.

Canals are normally isolated from other watercourses, and therefore do not generally receive storm-water from streams, rivers or sewers. Accordingly, they are impacted by rainstorms only to the extent of the precipitation falling on their plan area and adjacent verges banks and tow path areas. The latter are typically not impermeably surfaced, especially in rural areas. So if, say, 50mm of rain were to fall on a section of canal between adjacent lock structures, its water level would raise by the same amount, 50mm. The Paddington Branch of the Grand Union Canal is set at a slightly lower level than the site, and in the event of an unprecedented inflow of storm water, or failure of a bank, the canal would spill northwards towards the Yeading Brook noting that there is an existing spillway in place midway along the site boundary. Accordingly there is no conceivable mechanism for flooding of the site from the canal.

b) Description of Flooding

4.23 The analysis of the sources of flooding has indicated that the most significant source in the wider area is that of fluvial flooding from the Yeading Brook. Other sources of flooding are considered as insignificant when compared with the fluvial event.

4.24 In a 1 in 100 year fluvial event, the Yeading Brook would come out of bank and occupy its floodplain. The modelled $Q_{100+20\%}$ flood level at the location of the proposed Springfield Road footbridge is 27.75m AOD. The lowest point on the main site, at approximately 30.00m AOD, therefore has a 2.25m freeboard above the worst 1 in 100 year flood.

4.25 In a 1 in 100 year fluvial event, the Yeading Brook would come out of bank and occupy its floodplain. The modelled $Q_{100+20\%}$ flood level at the location of the proposed Springfield Road footbridge is 27.75m AOD. The lowest point on the main site, at approximately 30.00m AOD, therefore has a 2.25m freeboard above the worst 1 in 100 year flood.

4.26 Historically the EA have no record of this main site flooding from a fluvial event or from groundwater. In addition Thames Water has no record of the site flooding due to sewers.

c) Flood Zone Delineation

4.27 From the analysis of the various flood events, the main scenario that could be a potential concern because of its severity is that of fluvial flooding from the Yeading Brook.

Modelled interpolated flood levels for present day:
1 in 100 year event (1%)+20% for climate change = 27.75m AOD

Existing site levels:

Typical minimum level:	30.25m AOD
Typical maximum level:	32.95m AOD

4.28 Based on a simple inspection of the current modelled flood levels for the Yeading Brook, the site appears to have better than 1 in 1000 year protection against flooding on account of its elevation.

4.29 Accordingly, the site is at a level raised adequately above the worst flood level in the Yeading Brook, as described in PPS 25, to meet the desirable, and proposed, Zone 1 classification.

d) Surface Water Drainage

4.30 New drainage systems for collecting and dissipating surface water will be provided. The outfall will be to the Yeading Brook. Attenuation to the allowable run-off discharge based on Greenfield run off rates will be incorporated. The new system(s) will be designed to cope with storms of 1 in 30 year return period without flooding, allowing for the elevated level of storm water in the Yeading Brook. Additionally, the site will be laid out, and the drainage systems designed, to ensure that in storms of up to 1 in 100 year return period including an additional 30% for climate change, all storm water will be held within the site except for the Allowable Run-off Discharge Rate.

Strategic Flood Risk Assessment Implications

4.31 Since there is no SFRA available for this area no comment can be made on its implications. It is noted that at the time of writing one is understood to be advanced in its course of preparation.

Probability of the Site Flooding

4.32 Based on the information and analysis, it is concluded that the probability of wide-scale or catastrophic flooding due to fluvial or tidal events is low.

4.33 Nonetheless, the possibility remains of localised flooding in the event of blocked drains, defective rainwater goods or short duration localised rain storm events. Detailed design of the project will consider how to best mitigate damage to property and disruption to normal activity due to these eventualities.

Climate Change

4.34 The factors for climate change that will affect the design 1 in 100 year flood level of the Yeading brook adjacent to the site have been included in the hydraulic analysis carried out in the complimentary river FRA report.

4.35 The 1 in 100 year flood level in the Yeading brook, including climate change, is as quoted in this report, and includes for a 20% increase in peak flow allowance for climate change.

4.36 The other climate change factor that will affect the site is that of the increased rainfall event. From Table B.2 of PPS 25, the design peak rainfall intensity applicable until 2115 is + 30%. This figure will be incorporated into the design of the on-site drainage system.

Development Proposals and Layout

4.37 The proposed re-development of the West Southall site will provide a mix of uses which will be residential led but also include retail, employment, leisure and community facilities, including a health centre and primary school.

4.38 These are illustrated on the extracts from the Design and Access Statement, which has been prepared by Make Architects, in support of the planning application, and which are included at Appendix E.

Existing Drainage Arrangements

4.39 The site is in the natural catchment of the Yeading Brook, a watercourse classified as main river and in the control of the Environment Agency. The Yeading Brook is located to the north and northwest of the site, separated from the site by the Grand Union Canal.

4.40 Some significant areas of the site are covered in hard paving, albeit less than the impermeable cover intended when redeveloped. A proportion of the existing paved areas have positive drainage, with gully outlets and manholes, generally connecting to an existing 300mm diameter public sewer that crosses the site from south to north and discharging into the Yeading Brook. Minor outfalls to the canal are also seen to exist. Some incomplete records of these systems exist but cannot be relied upon.

4.41 The balance of the site area, not positively connected by the public sewer referred to above, is informally drained by infiltration. It is understood that infiltrating surface water is potentially in continuity with the Yeading Brook, through the underlying soils, especially the gravels, but is impeded by obstructions and the Minet tip feature.

4.42 There are public foul sewers at two locations within the site. A 300mm diameter public sewer enters the western tip of the site from under the Great Western Railway, and leaves in a westerly direction, crossing the valley of the Yeading Brook and under the Grand Union Canal, to join the Crane Valley trunk sewer some 300 metres further west. In addition, a

smaller diameter sewer leaves the site in a southerly direction from the vicinity of the NGG, now decommissioned, gasholders compound. At this location holder water historically was drained into an open triangular holding pit from where it was pumped to the 225mm via public sewer referred to above. However, these water sealed holders are now decommissioned and the function no longer exists.

Surface Water Drainage Proposal (SuDS)

4.43 A range of sustainable options for inclusion within a satisfactory surface water drainage system have been considered by WYG. The Environment Agency and Thames Water have previously been consulted about the applicable policies, site restrictions, preferences and available option.

4.44 Infiltration techniques will not be utilised within the proposed drainage scheme as agreed with the Environment Agency due land contamination history and remediation strategy associated with the site.

4.45 The relevant authorities are in support of the level of structuring shown on the current plans. Therefore, it is not possible to set aside large open areas for sustainable drainage alone.

4.46 Although there is restricted opportunity for the inclusion of certain SuD's solutions for reasons stated above, there are many other methods of SuD's that can be incorporated into the development proposals. Therefore, drain will be to the Yeading Brook, restricted to the natural greenfield runoff rate and on-site storage will be provided to contain the critical 1 in 100 year plus climate change storm event. On-site storage will be provided via the following methods during the stated storm events below.

During storm events up to the critical 1 in 30 year:

- Adopted large diameter pipes/box culverts.
- Private geo-cellular/steel tanks
- Wetland features (to be construction in later phases)

Consideration will be given during the detail drainage submission of all phases to the use of:

- Green roofs (assumed zero storage)
- Rain water harvesting (assumed zero storage)

During storm events between the critical 1 in 30 year and 1 in 100 year plus climate change:

- Permeable paving, with lined sub base storage, where the land use is deemed appropriate.
- Above ground storage, in the form of controlled area ponding.
- Lined swales (if land becomes available following detailed design).
- Dry detention basins (where land is available following detailed design).
- Private geo-cellular/steel tanks (should lined swales/dry detention basin be proven not to be feasible as a first option due to site density within a particular phase).
- Wetland features (to be constructed in later phases).

During storm events between the critical 1 in 30 year and 1 in 100 year plus climate change the SuDs Hierarchy Table below should be used to provide the most Sustainable Solution:

Most Sustainable ↑	SUDS Techniques	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	√	√	√
↑	**Basins & Ponds** - wetland - balancing pond - detention basin - retention pond	√	√	√
↑	**Filter Strips & Swales**	√	√	√
↓	**Infiltration** - soakaways - infiltration trenches - infiltration basin	√	√	√
↓	**Permeable Surface & Filter Drains** - gravelled areas - paving blocks - porous paving	√	√	
↓ **Least Sustainable**	**Tanked Systems** - oversized pipes & box culverts - storm cells	√		

4.47 The exact SuDs methods used will depend on which phase of the development is being constructed. The density of any particular phase once the detail layout and level design has been finalised will greatly influence the SuDs methods chosen during the detailed drainage design. It should also be reinforced that infiltration techniques are not permitted due to contamination issues on-site. Therefore other storage techniques such swales, ponds, permeable paving etc will require lining to prevent infiltration as well.

4.48 Additional features of the surface water scheme proposals, and considerations affecting the choice and type of system are as follows:

a) There are two options in respect of piped outfall connections to the Yeading Brook. Option 1 is based on two outfalls, while Option 2 is based on only one outfall, being the refurbished existing public surface water sewer outlet.

b) The existing surface water sewer which crosses the site from south to north will be diverted in order to follow the new street pattern and to avoid “building over”, as it is believed to be in an aged state.

c) The public sewer diversion described in b) will be constructed in extra large diameter pipes, of 1.8 m, 2.1 m or 2.4 m diameter, in order to provide balancing and storage of storm water.

d) The existing public sewer outfall to Yeading Brook, laid underneath the Grand Union Canal, is to be retained and potentially refurbished, subject to condition survey. The additional public sewer outfall to the Yeading Brook, proposed for Option 1 is the preferred solution, subject to reaching agreement with the British Waterways as this will require temporary closure of the canal to enable constructing it in temporary coffer dams unless other jacked methods prove economically feasible.

e) Allowable Flow Rates: discussion and correspondence received from the Environment Agency have confirmed that the site shall discharge at the natural greenfield run-off rate as detailed in this report and Appendix D.

f) Petrol/oil interceptors, on larger car parking areas and service areas will be incorporated, in line with Environment Agency document PPG3, typically installed upstream of the connection into the adoptable surface water sewer in the adjacent road.

g) Roof water will by-pass the petrol/oil interceptors, in line with Environment Agency's recommendations, wherever practical and be used if feasible in mains water harvesting systems.

e) Allowable Run-Off Rates

4.49 After consultation with the EA, the aspiration for greenfield run-off in the London area is acknowledged. PPS 25 recommends in strong terms that any new development should replicate the greenfield run-off rate where possible, unless there are mitigating circumstances. Frequently sites enjoy prescriptive rights to discharge to adjacent water courses, and compliance with the PPS25 recommendation, is an onerous requirement for the site infrastructure.

4.50 The greenfield run-off rates for central London are generally considered to be in the range 2 to 8 litres per second per Hectare (l/s/h) depending upon soil type and topography.

Existing Run-off Rate – Discussion

4.51 Whilst parts of the site have been positively drained in previous uses, mainly for gas production and other industrial uses, it cannot be demonstrated that the site is extensively connected by below ground pipes to the outfall watercourse. Some below ground piped gravity drainage systems are shown on historic site plans, and a public surface water sewer crosses the site.

4.52 However the process of the past and recent demolitions appears to have removed the visible evidence of existing systems – typically, manholes have their tops removed and are in-filled with demolition rubble.

4.53 The public sewer is known to be in poor condition – several attempts to prove its condition were frustrated by the presence of debris, so it not known if the debris is loose or corresponds to a collapse of the pipe. The Statutory Sewerage Undertaker, Thames Water, who own are responsible for the maintenance of the sewer have advised that it is in very poor condition, and should be re-laid.

4.54 Whilst some of the car parking facilities now occupying the site are informal hard-standings comprising gravel spread over compacted demolition rubble, others have entailed re-surfacing work in dense bitumen macadam, which is effectively impermeable. Run-off from these areas is guided by surface falls to existing outlets or to new gullies and channel drains. It is unlikely that new mains drainage was installed, and more likely that systems were located and new connections made. The extent to which these outlets now connect directly to the existing 300mm Dia. public surface water sewer and hence to the Yeading Brook cannot be determined, because there is little or no access through which a CCTV survey could be carried out.

Existing Outfall via Public Sewer

4.55 A further factor in analysing the existing run–off rate to the Yeading Brook is the finite capacity of the single 300mm Dia. pipe that connect the entire site – its capacity is very much lower than the developed, un-attenuated discharge rate from the site would be.

Existing Run-off Rate – Summary

4.56 In summary, most of the site presently drains surface water by infiltration, and a small proportion drains via former systems understood to be in poor condition These may in turn drain by infiltration into the ground at blockages and collapses. However, it may connect, perhaps slowed by passing through silted pipes, to the main outfall to main river.

Policy for PPS 25

4.57 PPS 25 states that *"The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development…"*

4.58 Given the foregoing, it is proposed that the new development will discharge at the green-field rate, as determined by an acceptable hydraulic estimation method.

4.59 It is proposed that allowable rates will be based on the Institute of Hydrology Report IH124, which was used to produce the computer output reproduced at Appendix D.

4.60 It is proposed that on-flow rates will be controlled with regard to rainstorm severity, so as to mimic the corresponding undeveloped run-off rate. In order to mimic the higher on-flow rates in more severe storms, the outflow control mechanisms will incorporate multiple orifices, weirs, vortex flow controllers or pumps, (or a combination of these) as appropriate. The construction of the flow restriction mechanism is subject to detailed design in due course.

4.61 Based on the net site area, IH124 gives the following run-off rates for each of the storm return periods shown:-

Return period.	**Allowable Run-off, litres per second**
1 year	49.4
2 years	51.2
5 years	74.4
10 years	94.1
20 years	116.4
25 years	124.8
30 years	131.7
50 years	152.2
100 years	185.4

4.62 These figures are proposed in undertaking the detailed design of the drainage system.

Storage Calculations

4.63 The proposed development will be constructed in phases. The initial phasing of the development can be seen in the drawing in Appendix G.

4.64 Calculation sheet A17014_3201_C_001 in Appendix H demonstrates the approximate greenfield runoff rates for each phase base on the rates provided. It also provides approximate storage requirement for each phase during storm events up to the 1 in 30 year and storm events between the 1 in 30 year and 1 in 100 year plus climate change.

4.65 The storage requirement up to the 1 in 30 year event will be provided using underground attenuation. The additional storage requirements during storm events between the 1 in 30 year and 1 in 100 year plus climate change will be provided within an above ground open storage system. Only when the density of the development will not allow this, will underground storage be used to provide the additional attenuation required.

4.66 Drawing No. A17014_3201_C_600_P1 in Appendix G shows potential areas for above ground storage within each phase. The above ground storage requirements and available land for each phase has been considered and approximate flood depths calculated as shown on Calculation sheet A17014_3201_C_001 in Appendix H.

4.67 The above calculations demonstrate that it is possible to provide the required on-site storage for the 1 in 100 year plus climate change storm event. The required storage will also be provided using a wide range of Sustainable Drainage Systems (SuDs) as previously discussed.

4.68 The required storage volumes and greenfield run-off rates will vary for each phase depending on the exact impermeable areas proposed during the detailed layout design. Therefore during the detail drainage design the exact storage volumes and greenfield run-off rates should be calculated for each phase accordingly and implemented into the detailed drainage design.

Development Phasing

4.69 The construction and occupation of the West Southall redevelopment is planned to be phased over a number of years and, as such, the drainage demand will increase over a period of years. Preliminary phasing plans of the site have shown there to be a total of thirteen phases as shown in the drawing in Appendix G.

4.70 The provision of adoptable mains drainage, both surface water and waste, can be phased to cope with such.

4.71 Conventional arrangements for accessing and servicing of a major development could typically entail the construction of infrastructure, comprising adoptable roads, mains drainage and incoming mains services, in advance of the construction of individual buildings. When buildings are completed, they may then be connected directly to incoming mains supplied and waste water systems for commissioning and early occupation.

4.72 Conventional arrangements for accessing and servicing of a major development could typically entail the construction of infrastructure, comprising adoptable roads, mains drainage and incoming mains services, in advance of the construction of individual buildings. When buildings are completed, they may then be connected directly to incoming mains supplied and waste water systems for commissioning and early occupation.

4.73 Due to the size of this development and a period of build, circa 15 years, it is practical to phase drainage provision to match demand, such phases being constructed to a pre-determined strategy and plan.

4.74 The design of the adoptable waste and surface water mains drainage infrastructure will therefore be given careful consideration at the detail design stage, in conjunction with the Developers and the Adopting Authority – Thames Water Utilities. Factors to be taken into account include:

- Meeting the minimum hydraulic loading on gravity pipelines to provide adequate velocities for self cleaning flow regime.
- Configuring pump stations and rising mains so that part loaded systems have a satisfactory hydraulic regime. In particular, design against septicity in rising mains will require close attention, and it may be necessary to add flushing and/or dosing equipment into the foul pumping stations.
- An optional strategy for the design for phased completions associated with the installation of twin rising mains in place of one single pumped main of larger size. This would be subject to detailed design and the agreement of the adopting authority.
- It is possible that at the earliest stages in the development it will be appropriate to make temporary connections into existing outfalls, such as the existing public surface water and foul sewers respectively. These temporary arrangements may also be applicable for the drainage of temporary construction site welfare facilities.

4.75 More specifically for the waste water system, once the primary connection is made to the main sewer passing below the Brent Road tunnel, phasing will progressively add local gravity systems each with its own gravity pipe network and pump stations.

4.76 Each local pump station, of which there is estimated to be three or more will then discharge via the rising mains which may be multiple in nature as discussed above. Thereby the distribution of new “first time” drainage availability can match the increasing development demand, generally moving from north east to west.

4.77 More specifically for the surface water system, once the existing outfall under the Grand Union Canal is regenerated, phased local systems, including storm water storage, can be established (including any primary infrastructure system below main roads connecting to the outfall) allowing progressive satisfaction of demand. Subsequently the second, western half of the site, can similarly progress linked to the second outfall system, assuming that Option 2 is taken up.

4.78 In such a manner, the phased increasing demand can be practically satisfied by a sectional completion of drainage designed to an overall agreed design strategy at the outset.

Detailed Design

4.79 It is proposed that the mitigation measures set out above are controlled by condition to the planning consent which will be approved by the LPA and their consultees.

f) Off Site Impacts

Impact of Development on Hydrological Morphology

4.80 Additional flood risk in the catchments of the River Crane and Yeading Brook due to the proposed development is fully mitigated by the proposals for surface water drainage within the site for storms of up to 1 in 100 year return fluvial including climate change.

g) Waste Water (Foul) Drainage Proposals

4.81 It is proposed that the individual plots within the development will be served by a conventional system of adoptable below ground drainage, featuring sewers laid within the new street pattern, with manholes at suitable maximum spacing intervals, junctions and major building connections. All foul discharge/waste water will be connected into Thames Water's maintained system at a point having adequate hydraulic capacity.

4.82 On account of the length of the site, and that it is effectively topographically level from end to end, it will be necessary to install intermediate pump stations. A gravity outfall from end to end of the site would be too deep to be practical and difficult to construct.

4.83 A scheme has been conceived which relies upon 3 pump stations. Space will be provided within these stations as appropriate to facilitate additional capacity for long term future redevelopment of the remaining single operational eastern gasholder land.

4.84 Rising mains laid under the new streets will connect each of the three pump stations to the outfall, an existing manhole at the western end of the site.

4.85 It is envisaged that all of the main foul sewers located within the new street layout, together with the three pump stations and their associated rising mains, will be the subject of a Section 104 Agreement for their adoption by Thames Water.

4.86 Following consultations with Thames Water, and in order to determine that the existing Thames Water system will be capable of receiving the new additional waste water flows from the redevelopment, a study is being carried out by Thames Water, commissioned by the Developer and at his cost, to carry out flow monitoring and to appraise the available spare capacity in the existing system. The study confirmed that the existing foul sewerage system is capable of receiving the predicted waste water flows volumes generated by the development. This study was competed in March 2005, and the report is included at Appendix F and remains fundamentally valid at the time of reporting.

4.87 In order for the foul drainage system described above to become vested as public sewer, and to be maintained by Thames Water in perpetuity, it will require to meet the all relevant Thames Water Utility specifications including the nationally recognised "Sewers for Adoption, 6th Edition" specification.

4.88 The strategic design shown on drawing number 305/P1 is subject to further design development of the site plans, detailed design development of the sewage system, detailed design of the pump station compounds and the approval of Thames Water Utilities.

4.89 The existing single eastern holder compound foul system will remain as existing.

h) Residual Risks

Remaining Flood Risks

4.90 It has been established that risks due to fluvial and tidal flooding are minimal. The site is not reliant upon any maintained defences. However, some risk remains of flooding due to sewer failure onto overland flows. These residual risks should be taken into account in the detailed design of the site, for instance by construction such that:

- Building thresholds are set higher than adjacent works areas and semi basement and basements are sympathetically designed.
- Adoptable drainage systems meet the requirements of "Sewers for Adoption" and Thames Water in all regards.
- Non adoptable drainage systems are adequately maintained, such as by twice yearly inspections and cleaning out as and when necessary.

i) Conclusions

4.91 WYG's investigations have determined that viable solutions exist in principle to draining the redevelopment of Southall Gasworks. They are illustrated on the enclosed plans.

4.92 These solutions will ensure that flood risk to the main site is satisfactorily mitigated.

4.93 Results of preliminary consultations with the Environment Agency and Thames Water Utilities have been incorporated into these proposals.

4.94 Thames Water's Impact Study established that there is adequate capacity in the existing public wastewater drainage system to which it is proposed the site will connect.

4.95 SUDS opportunities have been investigated for feasibility and are proposed for inclusion where practical.

PHOTOGRAPHS

Photo 1
Flood Relief Channel

Photo 2
Railway Bridge

Photo 3
River Stour, Kidderminster
Naturalised Rock Armour

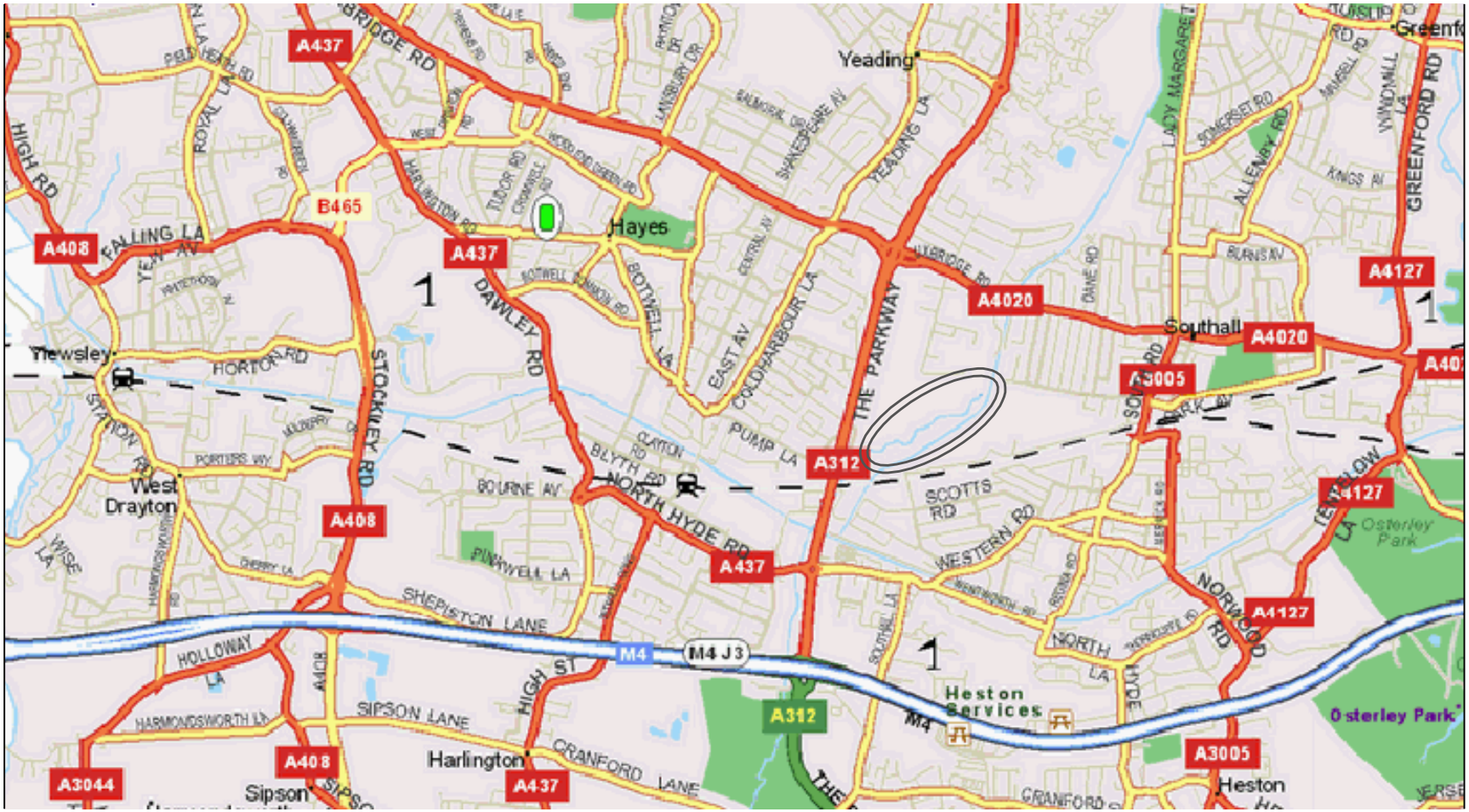
Photo 4
River Wye, High Wycombe
150 mm Rock Armour to Q_{100} Level After Naturalisation

FIGURES

N

INDICATIVE ONLY

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



Rev	Description	By	Chk	App	Date
A	New Map Used in Background	AB	RB	RB	26/07/06

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

Drawing Title:

LOCATION PLAN

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
N.T.S.	B.C.E.	23.03.05				

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	630	A

N

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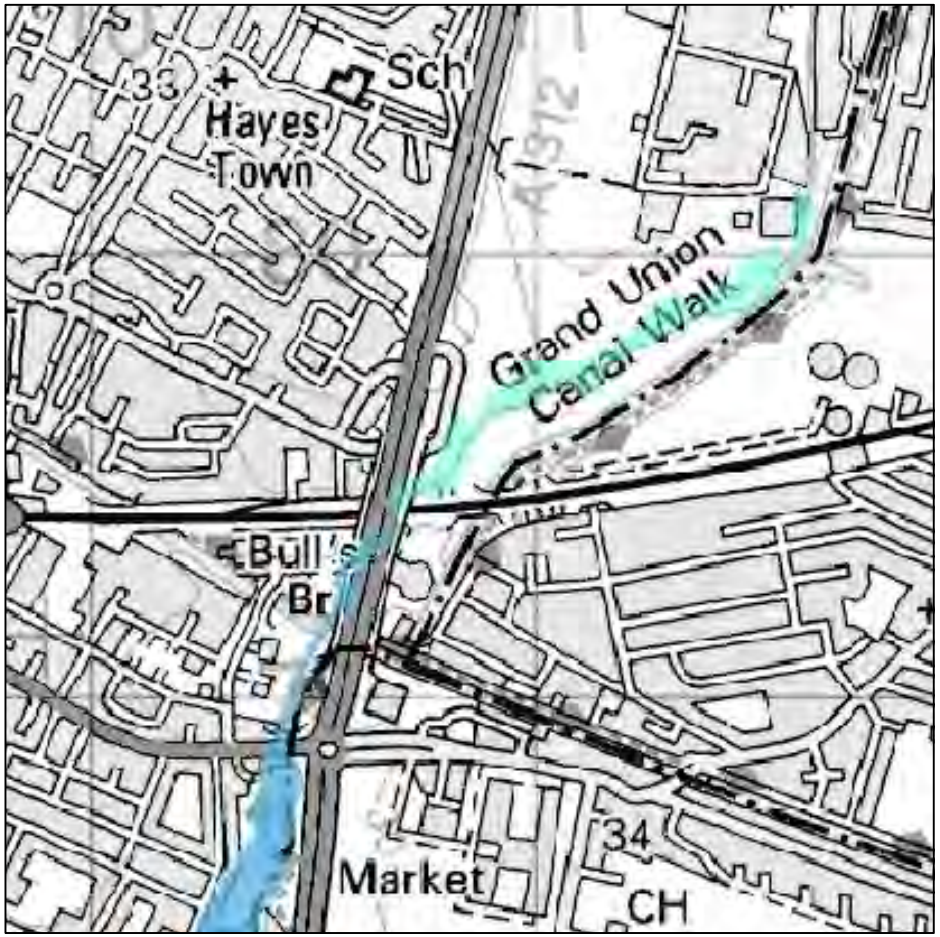

Rev	Description	By	Chk	App	Date
A	Flood zone map updated	DW	RB	RB	12/02/08

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

Drawing Title:

EA FLOOD ZONE MAP (CURRENTLY PUBLISHED)
(SEE DWG. No. 632)

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
N.T.S.	DW	12/02/08	RB	12/02/08	RB	12/02/08

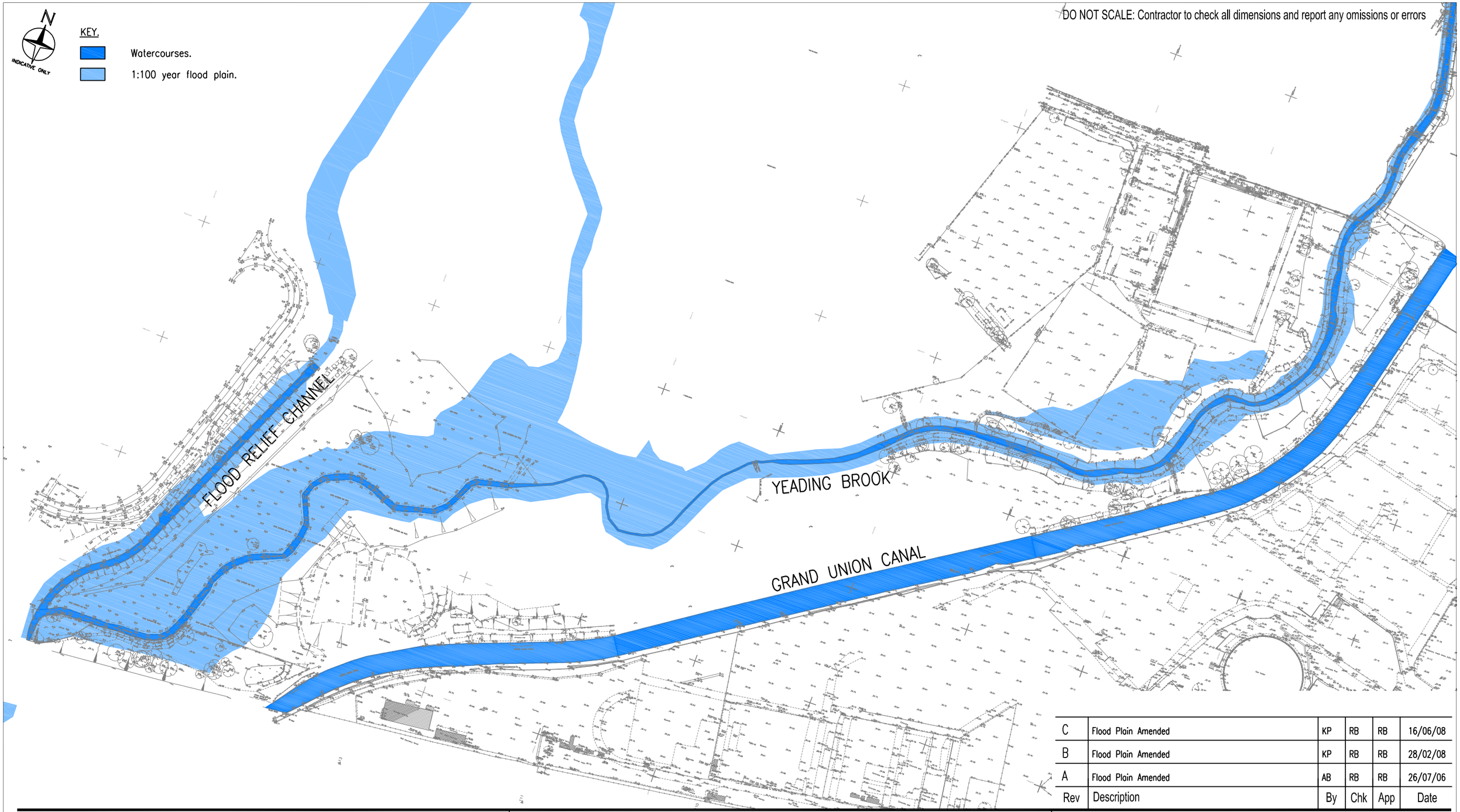
Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	631	A

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors

KEY.

Watercourses.

1:100 year flood plain.



Rev	Description	By	Chk	App	Date
C	Flood Plain Amended	KP	RB	RB	16/06/08
B	Flood Plain Amended	KP	RB	RB	28/02/08
A	Flood Plain Amended	AB	RB	RB	26/07/06

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

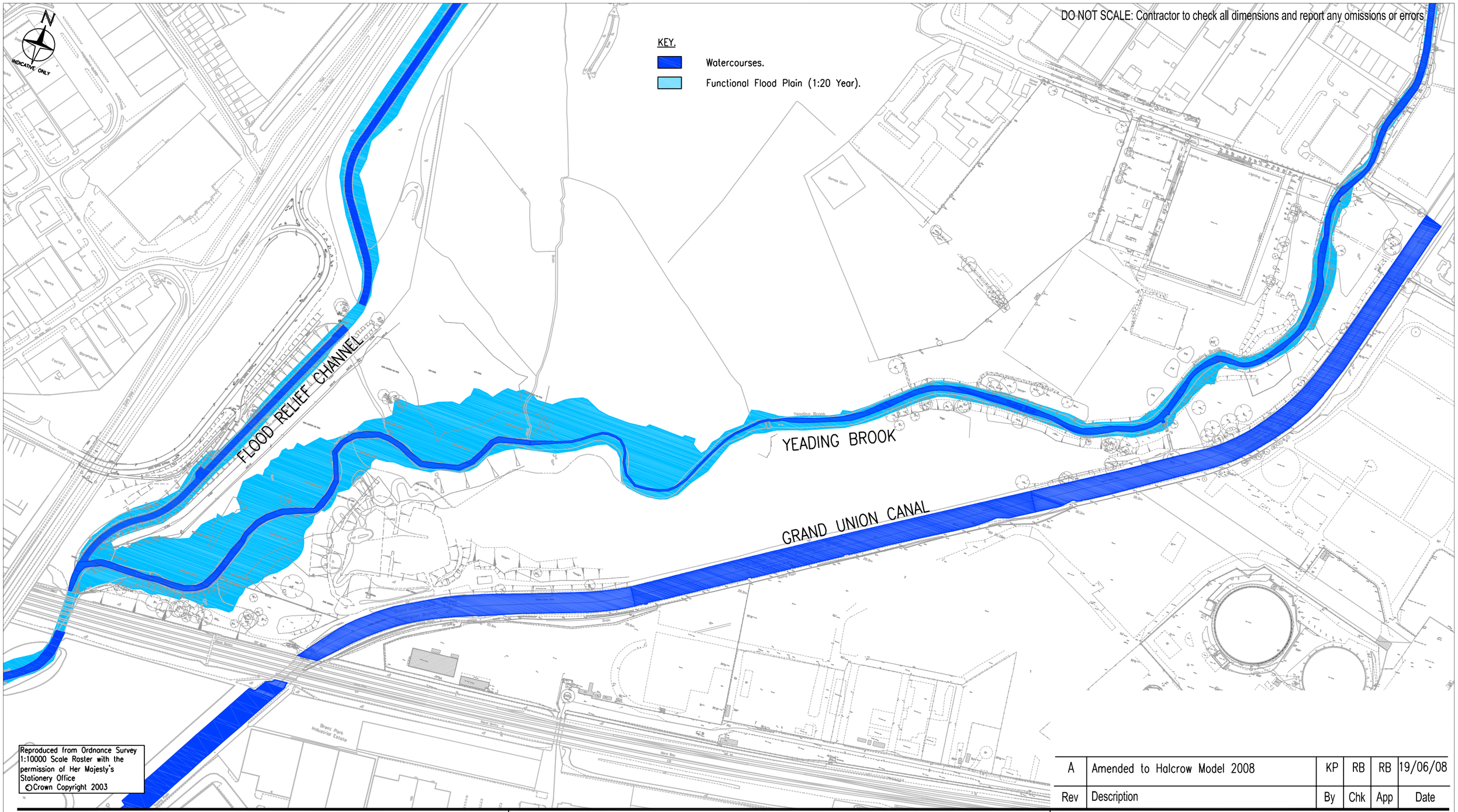
Drawing Title:

FLOOD PLAIN MAP (ENHANCED TO REFLECT LATEST EA DATA AVAILABLE)

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
N.T.S.	B.C.E.	23.03.05	R.H.	01.04.05	R.H.	01.04.05

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	632	C

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



Rev	Description	By	Chk	App	Date
A	Amended to Halcrow Model 2008	KP	RB	RB	19/06/08

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

Drawing Title:

FUNCTIONAL FLOOD PLAIN

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
N.T.S.	D.W	12/02/08	R.C.B.	12/02/08	R.C.B.	12/02/08

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	643	A

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KEY.

Watercourses.

1:100 year flood plain.

INDICATIVE ONLY

Compensatory storage area

Springfield Footbridge

FLOOD RELIEF CHANNEL

Flood Relief Channel Diversion

YEADING BROOK

GRAND UNION CANAL

Minet Footbrige

Rev	Description	By	Chk	App	Date
A	Extent of Flood Plain amended (Halcrow Model 2008). Compensation Area Design amended to suit. Flood relief channel diversion added.	AB	RB	RB	20/06/08

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Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

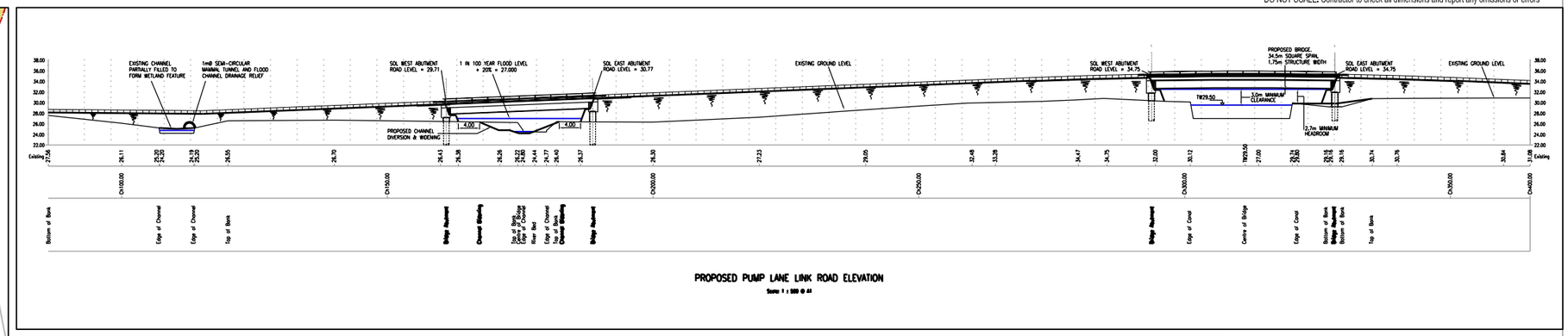
Drawing Title:

BRIDGE AND COMPENSATORY STORAGE LOCATIONS

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
N.T.S.	DW	13/02/08	RB	13/02/08	RB	13/02/08

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	644	A

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



PROPOSED PUMP LANE LINK ROAD ELEVATION

Scale: 1 : 500 @ A1

Rev	Description	By	Chk	App	Date
A	Compensation Area Design revised. Flood relief channel design amended.	KP	RB	RB	20/06/08

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White Young Green

Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

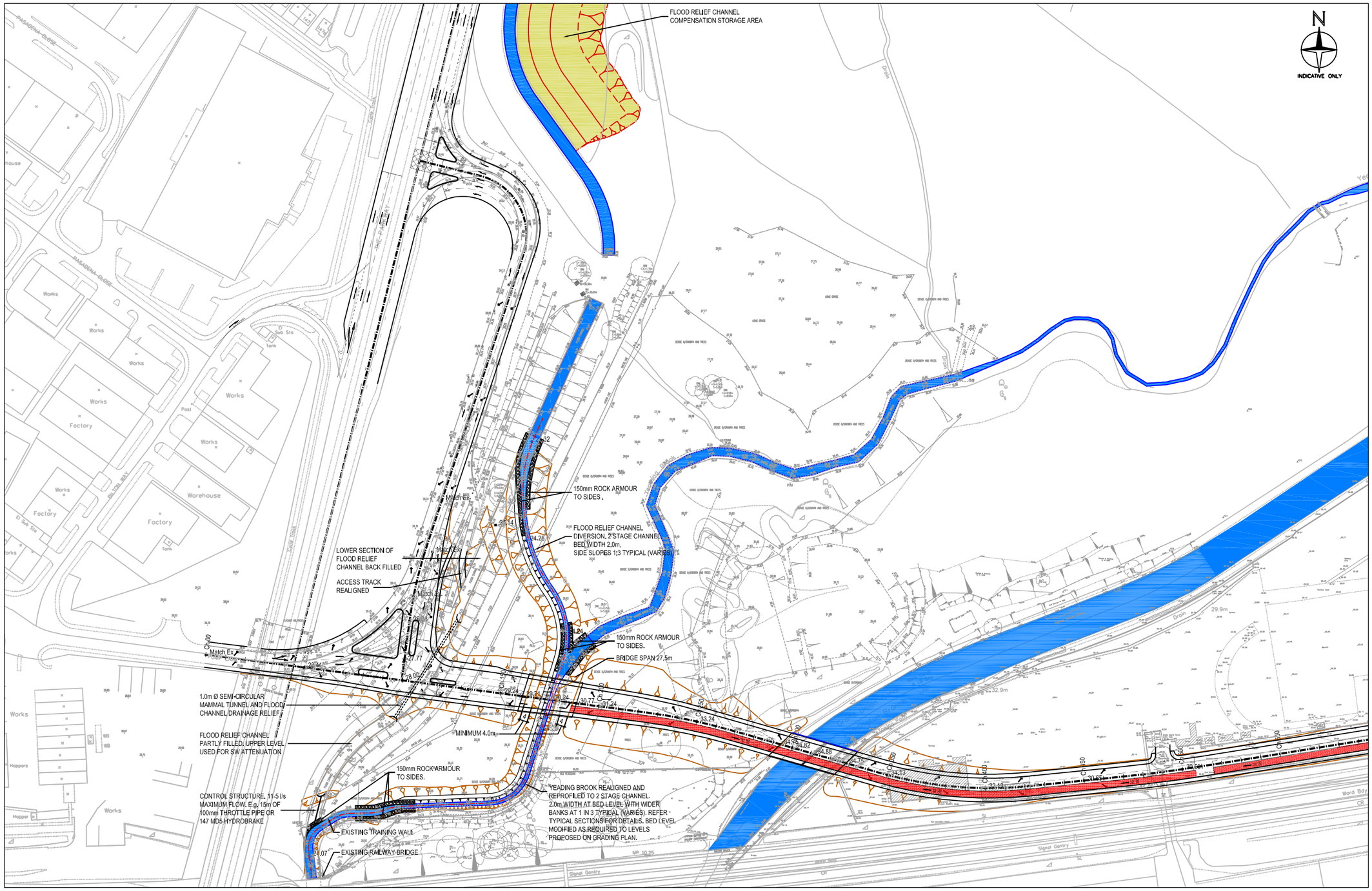
Drawing Title:

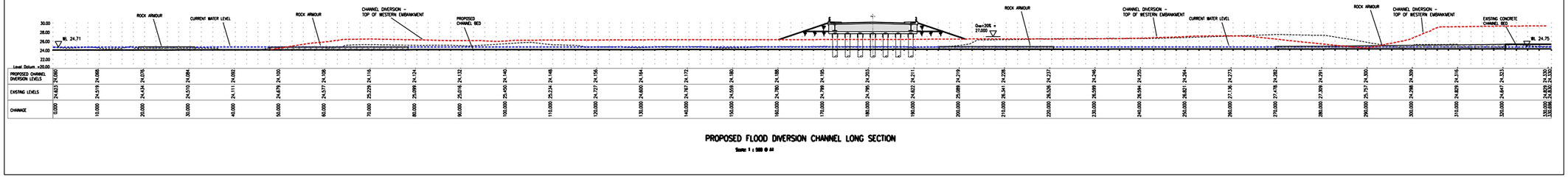
PUMP LANE LINK ROAD
GENERAL ARRANGEMENT
AND ELEVATION

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
1:1000	DW	13/02/08	RB	13/02/08	RB	13/02/08

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	645	A

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors





PROPOSED FLOOD DIVERSION CHANNEL LONG SECTION

Scale: 1 : 500 @ A1

A	Compensation Area Design revised. Flood Relief Channel Diversion amended to 2 Stage channel.	KP	RB	RB	20/06/08
Rev	Description	By	Chk	App	Date

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Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

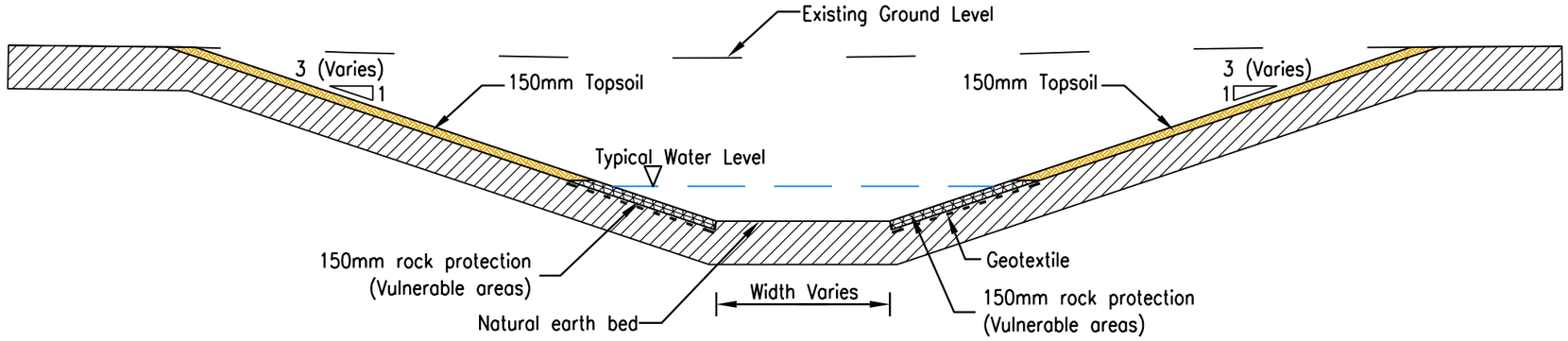
Drawing Title:

PUMP LANE LINK ROAD
FLOOD RELIEF CHANNEL DIVERSION

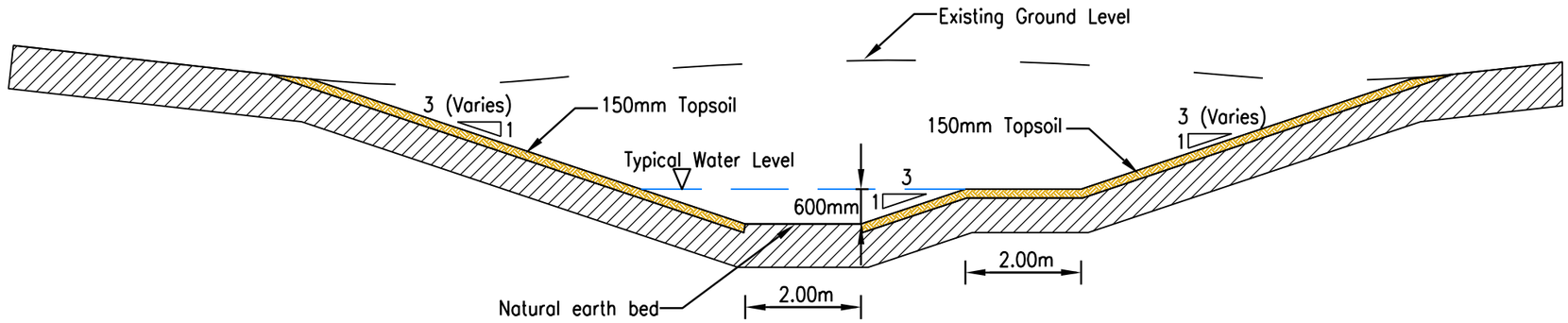
Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
1:1000	DW	13/02/08	R.C.B	13/02/08	R.C.B	13/02/08

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	646	A

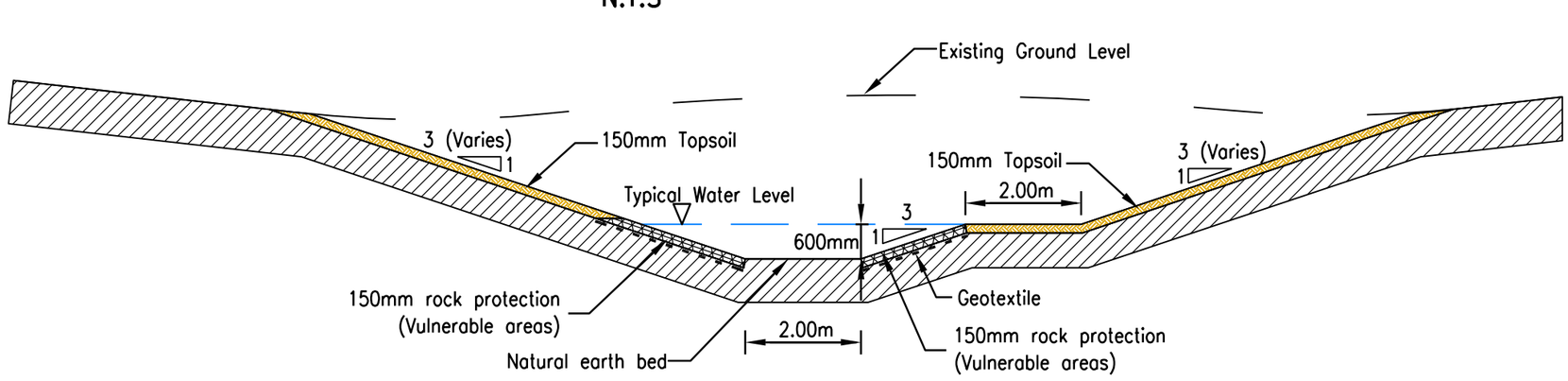
DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



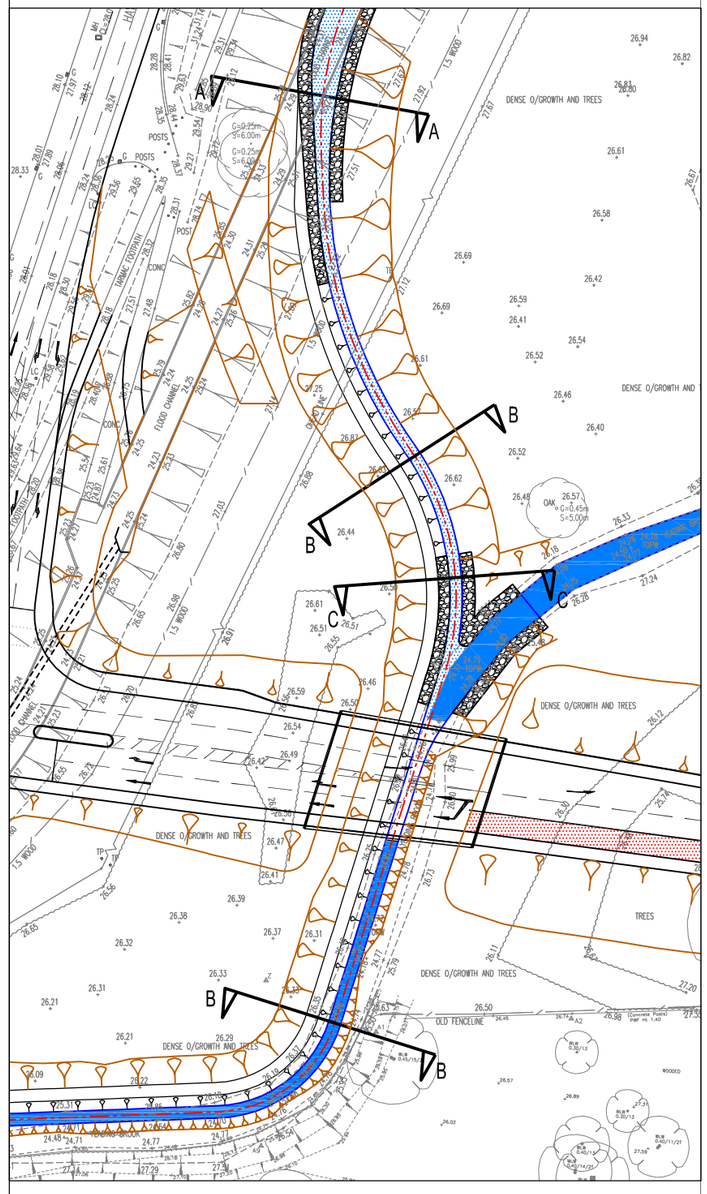
PROPOSED TYPICAL SECTION A-A
N.T.S



PROPOSED TYPICAL SECTION B-B
N.T.S



PROPOSED TYPICAL SECTION C-C
N.T.S



Rev	Description	By	Chk	App	Date
A	Typical Cross Sections amended to reflect New Flood Relief Channel Design.	KP	RB	RB	20/06/08

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White Young Green

Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

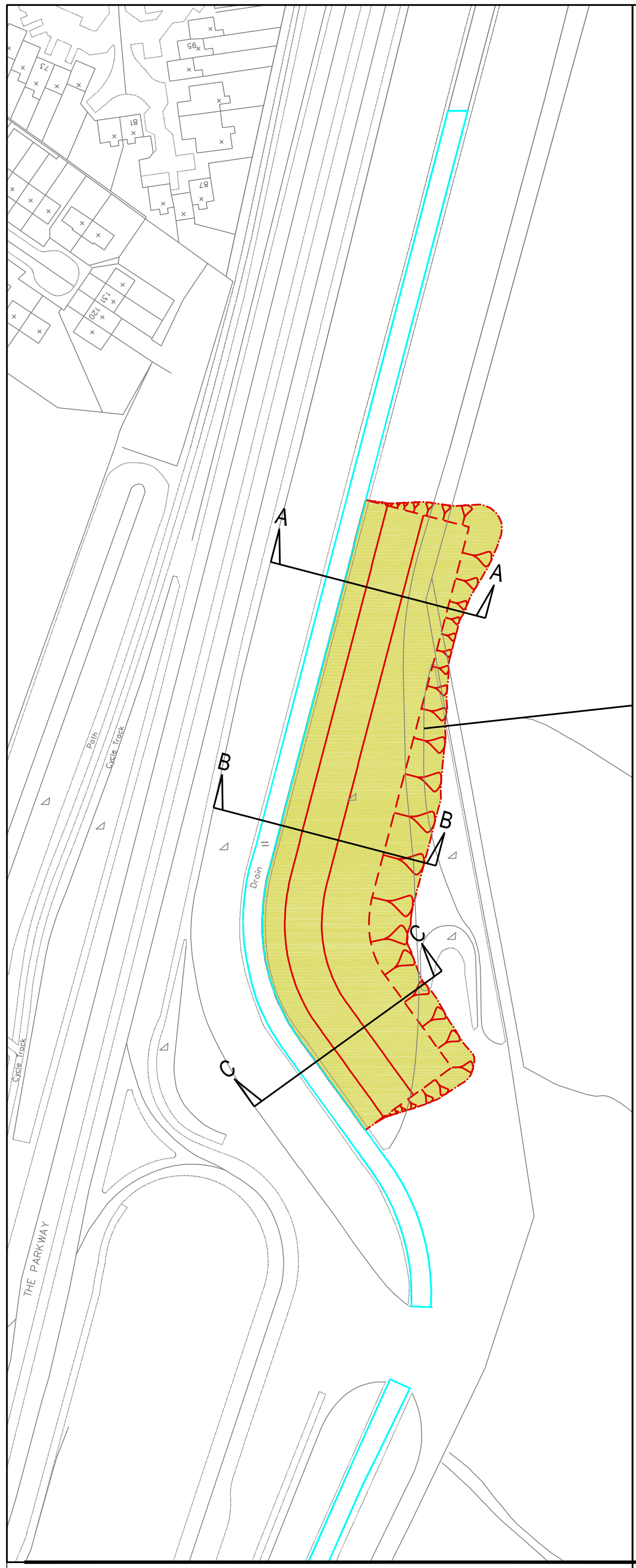
Project:
WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

Client:

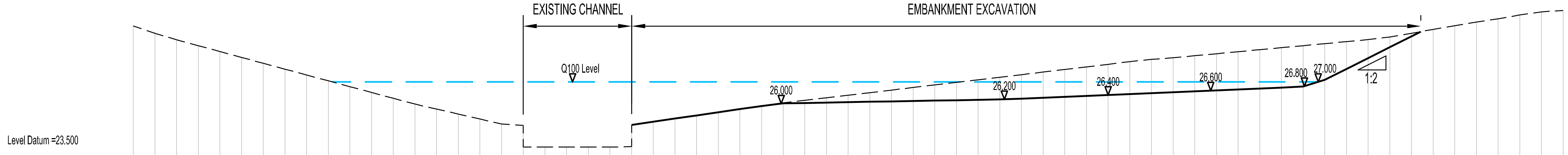
Drawing Title:
FLOOD RELIEF DIVERSION CHANNEL
TYPICAL SECTIONS

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
N.T.S.	DW	17/01/08	R.C.B.	17/01/08	R.C.B.	17/01/08

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	647	A



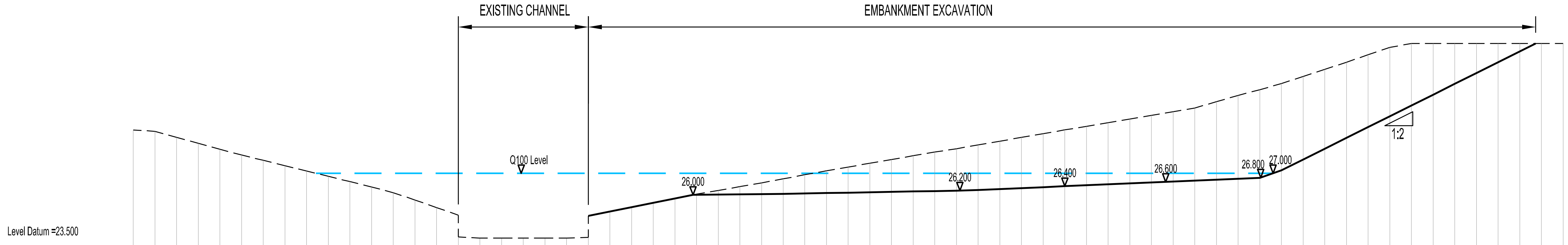
DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



DISTANCE	EXISTING GROUND LEVELS	PROPOSED COMPENSATION AREA
	29.572	
1.000	29.234	
2.000	28.936	
3.000	28.666	
4.000	28.395	
5.000	28.125	
6.000	27.854	
7.000	27.585	
8.000	27.317	
9.000	27.048	
10.000	26.780	
11.000	26.512	
12.000	26.244	
13.000	25.979	
14.000	25.751	
15.000	25.523	
16.000	25.292	
17.000	25.061	
18.000	25.000	
19.000	25.000	
20.000	25.000	
21.000	25.000	
22.000	25.000	
23.000	25.021	25.021
24.000	25.166	25.166
25.000	25.312	25.312
26.000	25.457	25.457
27.000	25.602	25.602
28.000	25.748	25.748
29.000	25.893	25.893
30.000	26.032	26.011
31.000	26.150	26.029
32.000	26.268	26.048
33.000	26.386	26.066
34.000	26.505	26.084
35.000	26.623	26.102
36.000	26.741	26.120
37.000	26.859	26.138
38.000	26.978	26.157
39.000	27.096	26.175
40.000	27.214	26.193
41.000	27.332	26.226
42.000	27.451	26.269
43.000	27.569	26.312
44.000	27.687	26.355
45.001	27.806	26.397
46.001	27.930	26.440
47.001	28.033	26.483
48.001	28.111	26.526
49.001	28.203	26.568
50.001	28.296	26.611
51.001	28.388	26.654
52.001	28.480	26.697
53.001	28.572	26.740
54.001	28.665	26.782
55.001	28.757	27.094
56.001	28.849	27.594
57.001	28.942	28.094
58.001	29.064	28.594
59.001	29.236	29.094
60.001	29.409	
61.001	29.581	
62.001	29.754	
63.001	29.896	
64.001	30.075	
65.001	30.219	
66.001	30.284	

SECTION A-A

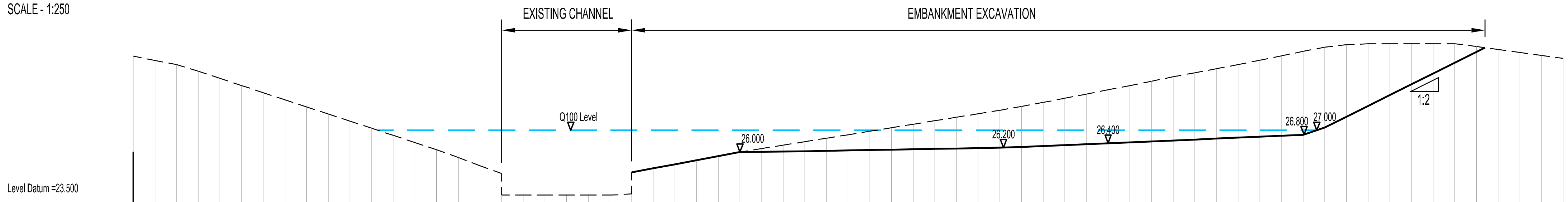
SCALE - 1:250



DISTANCE	EXISTING GROUND LEVELS	PROPOSED COMPENSATION AREA
	29.000	
1.000	28.940	
2.000	28.662	
3.000	28.383	
4.000	28.105	
5.000	27.842	
6.000	27.597	
7.000	27.351	
8.000	27.105	
9.000	26.859	
10.000	26.613	
11.000	26.368	
12.000	26.103	
13.000	25.765	
14.000	25.414	
15.000	25.064	
16.000	24.000	
17.000	24.000	
18.000	24.000	
19.000	24.000	
20.000	24.000	
21.000	25.035	25.035
22.000	25.236	25.208
23.000	25.436	25.357
24.000	25.636	25.507
25.000	25.836	25.656
26.000	26.032	25.805
27.000	26.206	25.954
28.000	26.381	26.013
29.000	26.555	26.031
30.000	26.741	26.049
31.000	26.930	26.067
32.000	27.111	26.085
33.000	27.286	26.104
34.000	27.462	26.122
35.000	27.636	26.140
36.000	27.810	26.158
37.000	27.984	26.176
38.000	28.135	26.194
39.000	28.310	26.230
40.000	28.483	26.272
41.000	28.657	26.315
42.000	28.831	26.358
43.000	29.004	26.401
44.000	29.172	26.444
45.001	29.340	26.486
46.001	29.508	26.529
47.001	29.675	26.572
48.001	29.843	26.615
49.001	30.019	26.657
50.001	30.308	26.700
51.001	30.597	26.743
52.001	30.864	26.786
53.001	31.146	27.134
54.001	31.475	27.634
55.001	31.803	28.134
56.001	32.135	28.634
57.001	32.478	29.134
58.001	32.820	29.634
59.001	33.000	30.134
60.001	33.000	30.634
61.001	33.000	31.134
62.001	33.000	31.634
63.001	33.000	32.134
64.001	33.000	32.634
65.001	33.000	
66.001	33.000	

SECTION B-B

SCALE - 1:250



DISTANCE	EXISTING GROUND LEVELS	PROPOSED COMPENSATION AREA
	30.429	
1.000	30.233	
2.000	30.037	
3.000	29.730	
4.000	29.399	
5.000	29.069	
6.000	28.739	
7.000	28.410	
8.000	28.080	
9.000	27.751	
10.000	27.421	
11.000	27.092	
12.000	26.762	
13.000	26.433	
14.000	26.103	
15.000	25.740	
16.000	25.361	
17.000	25.000	
18.000	24.000	
19.000	24.000	
20.000	24.000	
21.000	24.000	
22.000	24.000	
23.000	25.054	25.054
24.000	25.241	25.206
25.000	25.428	25.355
26.000	25.614	25.504
27.000	25.801	25.654
28.000	25.991	25.803
29.000	26.152	25.952
30.000	26.312	26.012
31.000	26.473	26.031
32.000	26.633	26.049
33.000	26.793	26.067
34.000	26.953	26.085
35.000	27.117	26.103
36.000	27.280	26.121
37.000	27.442	26.140
38.000	27.603	26.158
39.000	27.764	26.176
40.000	27.925	26.194
41.000	28.100	26.229
42.000	28.287	26.272
43.000	28.478	26.315
44.000	28.673	26.357
45.001	28.868	26.400
46.001	29.066	26.443
47.001	29.270	26.486
48.001	29.473	26.528
49.001	29.661	26.571
50.001	29.848	26.614
51.001	30.038	26.657
52.001	30.240	26.700
53.001	30.443	26.742
54.001	30.646	26.785
55.001	30.843	27.126
56.001	30.956	27.626
57.001	31.000	28.126
58.001	31.000	28.626
59.001	31.000	29.126
60.001	31.000	29.626
61.001	31.000	30.126
62.001	30.877	30.626
63.001	30.738	
64.001	30.599	
65.001	30.460	
66.001	30.320	

SECTION C-C

SCALE - 1:250

Rev	Description	By	Chk	App	Date
A	Compensation Area amended to suit Flood Levels (Halcrow Model 2008).	KP	RB	RB	20/06/08

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White Young Green

Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:
WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

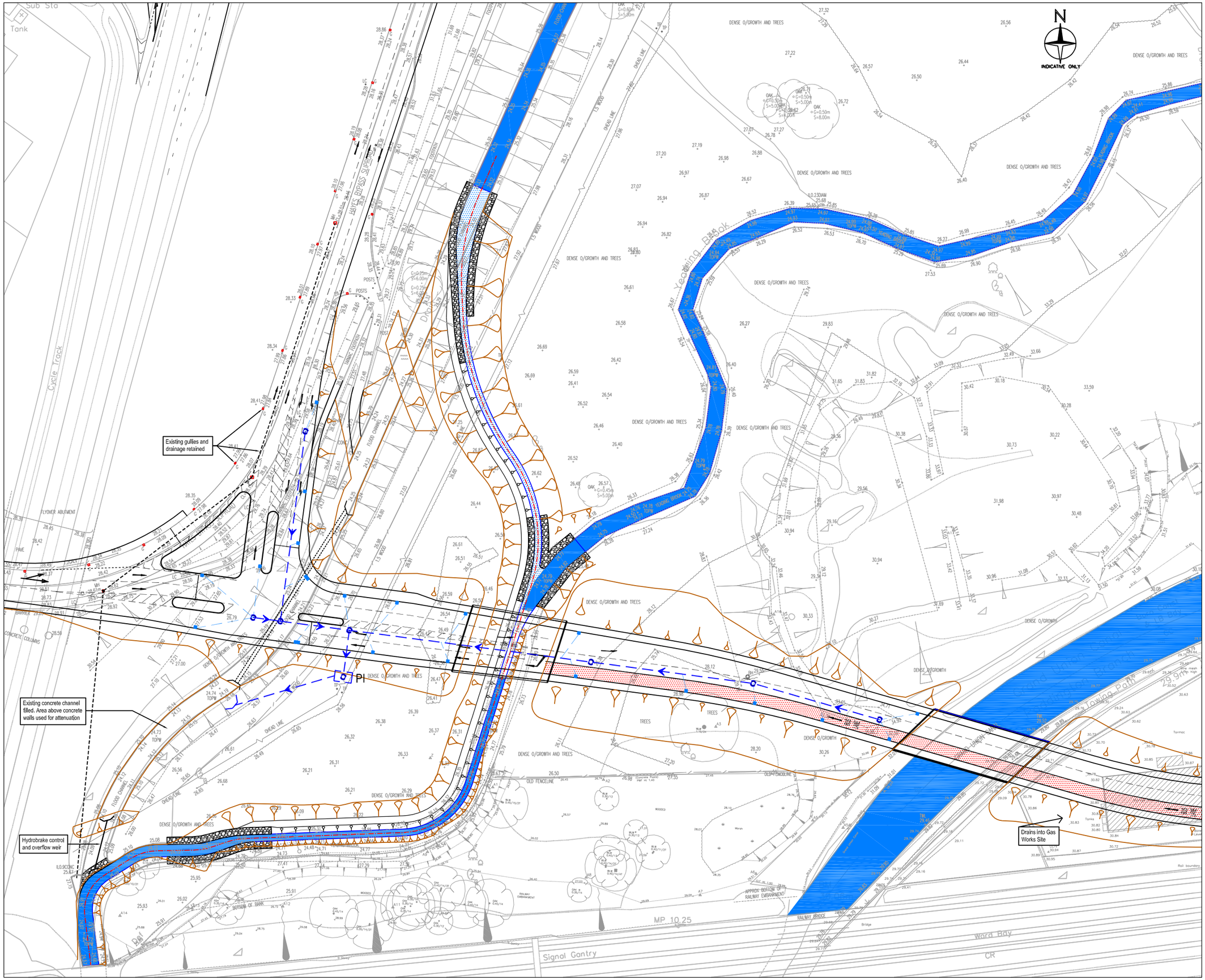
Drawing Title:
FLOOD RELIEF CHANNEL
COMPENSATION AREA

Scale	Drawn By	Date	Checked By	Date	Approved By	Date
1:2000	KP	28/02/08	RB	28/02/08	RB	28/02/08

Project No.	Office	Type	Drawing No.	Revision
A012564	28	C	648	A

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors



Rev	Description	By	Chk	App	Date
A	Flood Relief Channel Diversion amended to 2 Stage Channel.	KP	RB	RB	20/06/08

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White Young Green

Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEADING BROOK
FLOOD RISK ASSESSMENT

Drawing Title:

PUMP LANE LINK ROAD
ROAD DRAINAGE PLAN

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
1:500	DW	17/01/08	R.C.B	17/01/08	R.C.B	17/01/08

Project No.	Office	Discipline	Drawing No.	Revision
A012564	28	C	649	A

APPENDIX FRA 1

Topographic Survey

APPENDIX FRA 2

Environment Agency Correspondence

FRA 2.1 **May 2008 Flood Data**

FRA 2.2 **Response to FRA version 3**

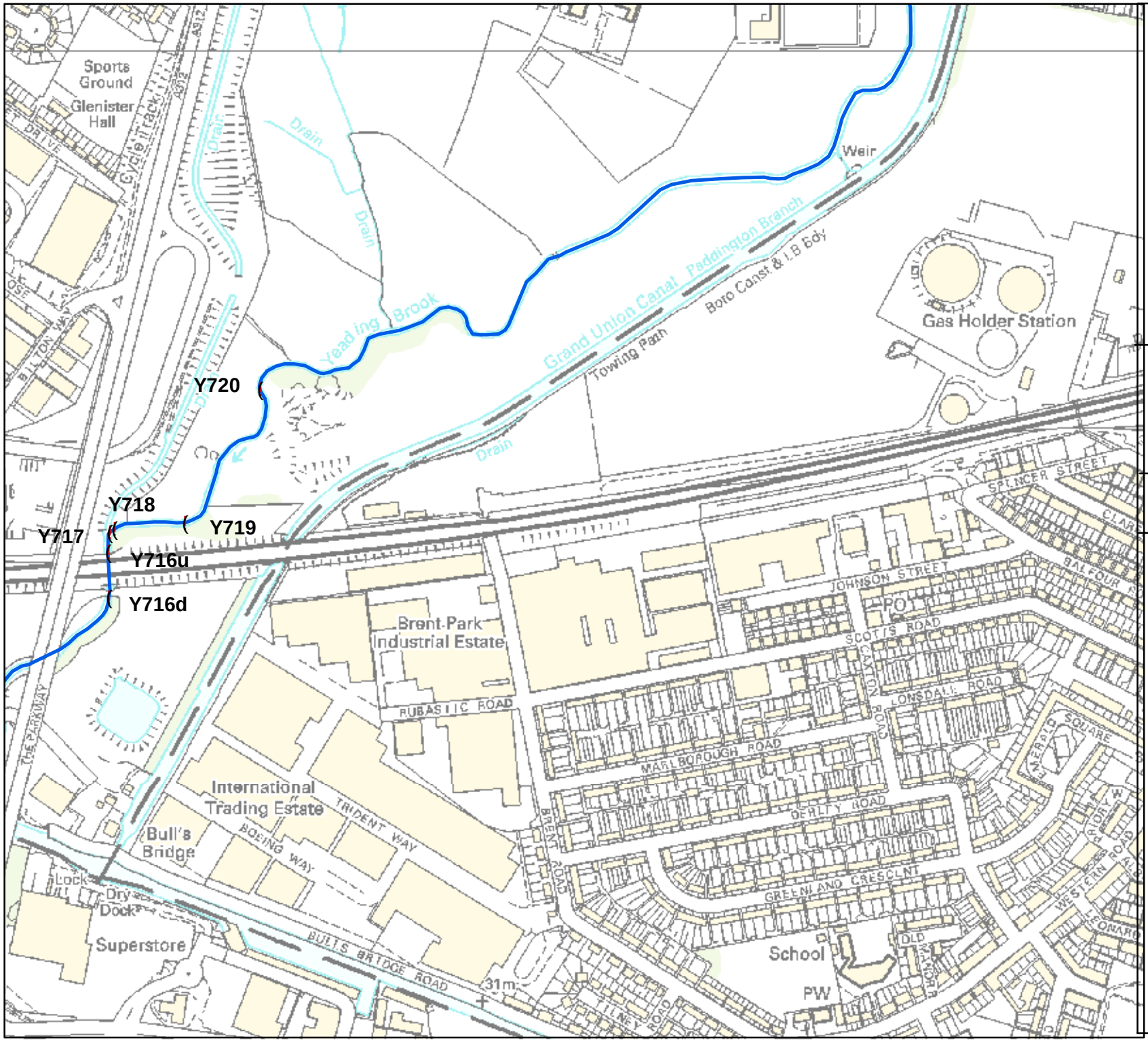
FRA 2.3 **Response to FRA version 2**

FRA 2.4 **Original Correspondence**

APPENDIX FRA 2.1

Environment Agency Correspondence 2.1

May 2008 Flood Data



Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

Crane Modelled Outlines 2 (Yeading Brook) TQ1127579812

Our ref: NE16962JM
228May 2008

Main River

Crane Nodes

0 25 50 100 150 200 Meters

Produced by:
Flood Risk Mapping & Data Management
Thames Region (North East Area)

Environment Agency ref: NE16962JM

The following information has been extracted from the River Crane Mapping Study (Halcrow 2008)

Caution:
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites across the entire catchment.

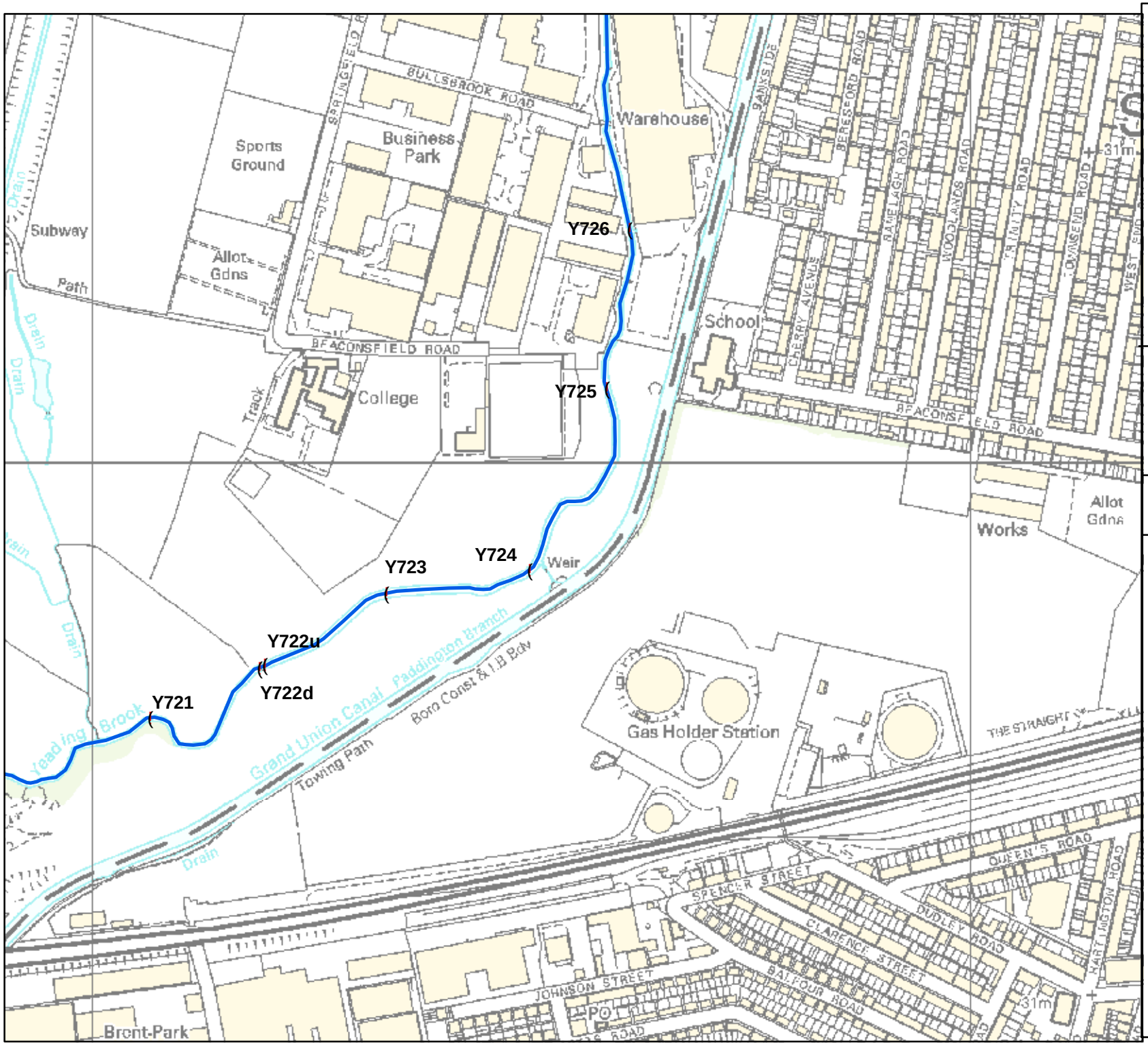
All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

MODELLED FLOOD LEVEL

			Return Period						
Node Label	**Easting**	**Northing**	**5 yr**	**10yr**	**20 yr**	**50 yr**	**100 yr**	**100yr + 20%**	**1000yr**
Y720	510870	179619	26.56	26.65	26.74	26.91	27.03	27.22	29.06
Y719	510771	179465	26.48	26.58	26.68	26.87	26.99	27.20	29.05
Y718	510691	179457	26.43	26.53	26.65	26.85	26.97	27.18	29.05
Y717	510684	179455	26.43	26.53	26.65	26.85	26.97	27.18	29.05
Y716u	510687	179430	26.37	26.47	26.58	26.77	26.89	27.09	28.98
Y716d	510684	179380	26.31	26.40	26.51	26.68	26.80	26.99	28.83

MODELLED FLOWS

			Return Period						
Node Label	**Easting**	**Northing**	**5 yr**	**10yr**	**20 yr**	**50 yr**	**100 yr**	**100yr + 20%**	**1000yr**
Y720	510870	179619	10.85	11.58	12.34	13.79	14.78	16.12	24.54
Y719	510771	179465	11.21	11.93	12.65	14.05	15.02	16.58	25.11
Y718	510691	179457	11.78	12.58	13.37	14.92	15.98	17.71	25.90
Y717	510684	179455	15.90	17.22	18.67	21.34	23.10	25.96	42.47
Y716u	510687	179430	15.90	17.22	18.66	21.34	23.10	25.95	42.47
Y716d	510684	179380	15.90	17.22	18.66	21.34	23.10	25.95	42.47



Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

Crane Node Map (Yeading Brook) TQ1127579812

Our ref: NE16962JM
22 May 2008

Main River

Crane Nodes

0 25 50 100 150 200 Meters

Produced by:
Flood Risk Mapping & Data Management
Thames Region (North East Area)

Environment Agency ref: NE16962JM

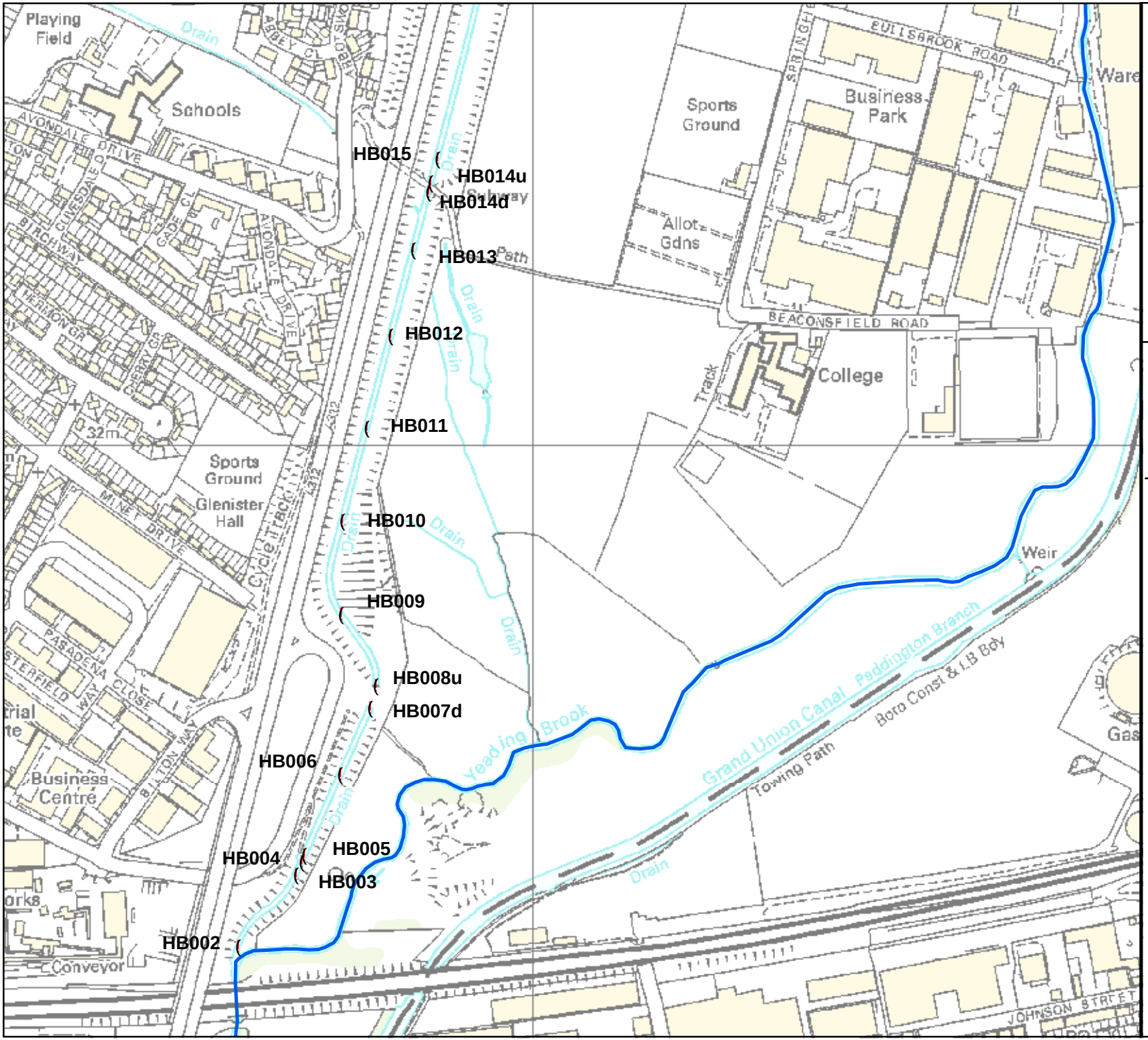
The following information has been extracted from the River Crane Mapping Study (Halcrow 2008)

Caution:
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites across the entire catchment.

All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

MODELLED FLOOD LEVEL

			Return Period						
Node Label	**Easting**	**Northing**	**5 yr**	**10yr**	**20 yr**	**50 yr**	**100 yr**	**100yr + 20%**	**1000yr**
Y726	511612	180266	27.21	27.26	27.32	27.42	27.48	27.59	29.09
Y725	511584	180082	27.03	27.09	27.15	27.26	27.34	27.47	29.08
Y724	511498	179877	26.90	26.96	27.03	27.16	27.25	27.40	29.08
Y723	511335	179849	26.85	26.92	26.99	27.12	27.21	27.36	29.07
Y722u	511196	179767	26.78	26.84	26.92	27.05	27.14	27.31	29.06
Y722d	511192	179765	26.76	26.83	26.90	27.03	27.12	27.28	29.06
Y721	511065	179708	26.70	26.77	26.85	26.99	27.09	27.27	29.06



Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

Hayes Bypass Channel (Crane)
Node Map
TQ1099979900

Our ref: NE17148SS
11 June 2008

(Hayes Bypass Channel Nodes

Main River

0 50 100 200 Meters

Produced by:
Flood Risk Mapping & Data Management
Thames Region (North East Area)

Environment Agency ref: NE17148SS

The following information has been extracted from the River Crane Mapping Study (Halcrow 2008)

Caution:
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites across the entire catchment.

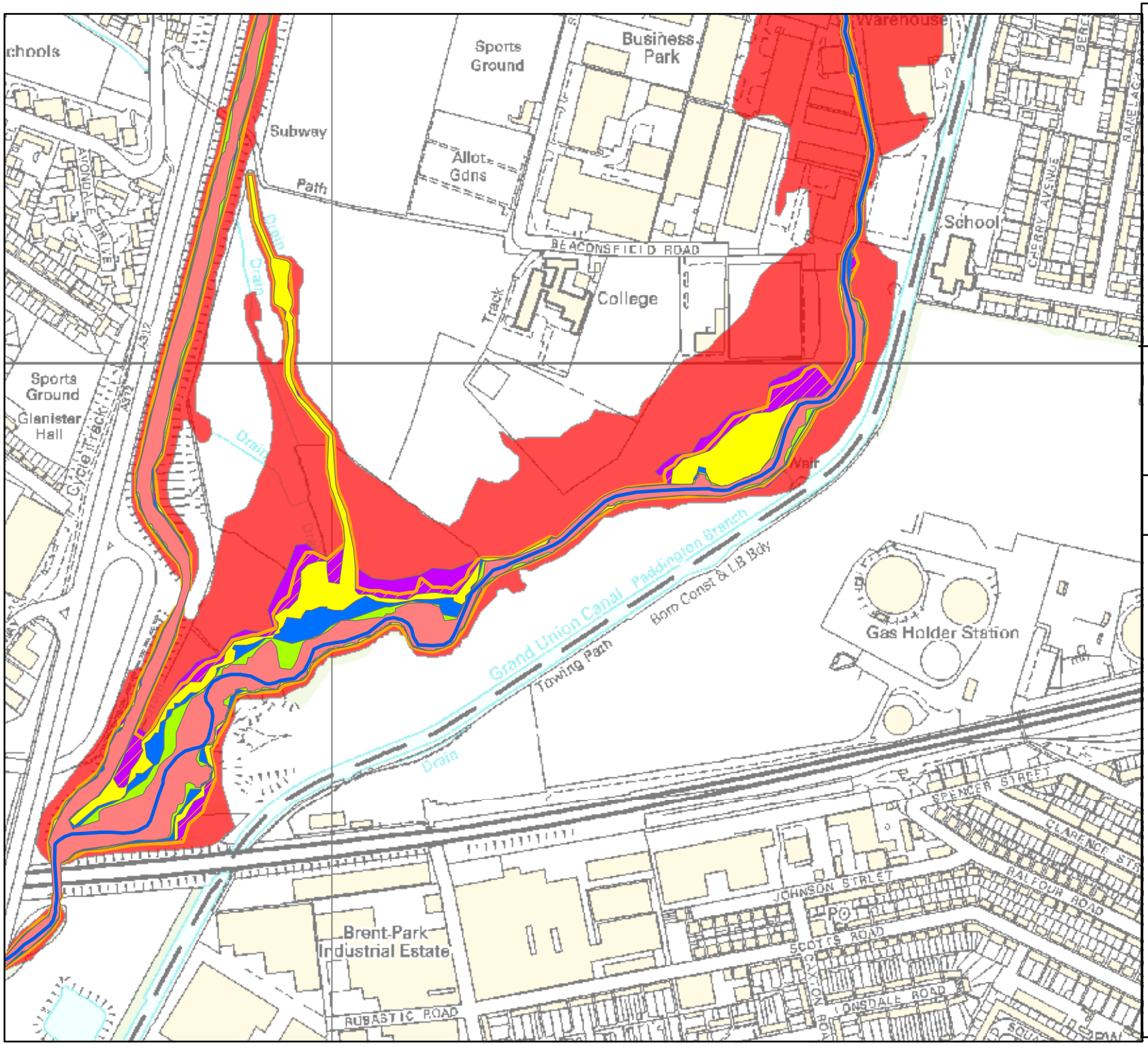
All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

MODELLED FLOOD LEVEL

			Return Period					
Node Label	**Easting**	**Northing**	**5 yr**	**20 yr**	**50 yr**	**100 yr**	**100yr + 20%**	**1000yr**
HB015	510900	180304	26.50	26.72	26.91	27.04	27.24	29.18
HB014u	510893	180276	26.50	26.72	26.91	27.03	27.24	29.18
HB014d	510893	180276	26.50	26.71	26.91	27.03	27.24	29.17
HB013	510870	180208	26.49	26.71	26.90	27.03	27.24	29.16
HB012	510846	180116	26.48	26.70	26.90	27.02	27.23	29.16
HB011	510820	180020	26.47	26.69	26.89	27.01	27.22	29.16
HB010	510799	179919	26.47	26.69	26.89	27.01	27.22	29.16
HB009	510796	179820	26.46	26.68	26.88	27.00	27.21	29.16
HB008u	510832	179745	26.44	26.66	26.86	26.98	27.19	29.13
HB007d	510829	179720	26.44	26.66	26.86	26.98	27.19	29.05
HB006	510797	179650	26.44	26.66	26.86	26.98	27.19	29.06
HB005	510756	179565	26.44	26.65	26.85	26.98	27.19	29.06
HB004	510756	179557	26.44	26.65	26.85	26.98	27.19	29.06
HB003	510750	179543	26.43	26.65	26.85	26.98	27.19	29.05
HB002	510684	179469	26.43	26.65	26.85	26.97	27.18	29.05

MODELLED FLOWS

			Return Period					
Node Label	**Easting**	**Northing**	**5 yr**	**20 yr**	**50 yr**	**100 yr**	**100yr + 20%**	**1000yr**
HB015	510900	180304	4.77	5.98	6.96	7.59	8.75	19.74
HB014u	510893	180276	4.77	5.98	6.96	7.58	8.74	19.72
HB014d	510893	180276	4.77	5.98	6.96	7.58	8.74	19.72
HB013	510870	180208	4.78	5.99	6.95	7.56	8.72	19.66
HB012	510846	180116	4.79	6.00	6.95	7.56	8.70	19.58
HB011	510820	180020	4.81	6.02	6.96	7.57	8.71	19.50
HB010	510799	179919	4.83	6.05	6.98	7.60	8.74	19.41
HB009	510796	179820	4.87	6.11	7.05	7.68	8.86	19.24
HB008u	510832	179745	4.88	6.13	7.07	7.71	8.90	19.20
HB007d	510829	179720	4.88	6.13	7.07	7.71	8.90	19.20
HB006	510797	179650	4.90	6.15	7.10	7.74	8.94	19.16
HB005	510756	179565	4.91	6.18	7.14	7.79	9.00	19.10
HB004	510756	179557	4.92	6.19	7.14	7.79	9.00	19.10
HB003	510750	179543	4.92	6.19	7.15	7.80	9.01	19.09
HB002	510684	179469	4.94	6.22	7.19	7.85	9.07	19.05



Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

Crane Modelled Outlines (Yeading Brook) TQ1127579812

Our ref: NE16962JM
22 May 2008

- 5yr Defended
- 10yr Defended
- 20yr Defended
- 50yr Defended
- 100yr Defended
- 100yr 20% Defended
- Main River
- 1000yr Defended

0 2550 100 150 200 Meters

Produced by:
Flood Risk Mapping & Data Management
Thames Region (North East Area)

APPENDIX FRA 2.2

Environment Agency Correspondence

Response to FRA version 3

Richard Blacknell
White Young Green Environmental Ltd
richard.blacknell@wyg.com

Our ref: TL/2008/100682/04-L01
Your ref: West Southall

Date: 22 July 2008

Dear Mr Blacknell

SUBMISSION OF REVISED FLOOD RISK ASSESSMENT FOR THE YEADING BROOK CROSSINGS AND THE EASTERN ACCESS.
FORMER SOUTHALL GAS WORKS SITE, SOUTHALL.

Thank you for the revised Flood Risk Assessment (FRA) for the bridge works and eastern access at Southall Gas works.

Bridge works

The revised FRA for the bridge works has dealt with most of the outstanding issues, there are however a couple of points which need to be addressed prior to submission:

- Flood storage compensation should be provide accounting for climate change, this must be demonstrated ad part of you plans and cross sections. Due to the stability works being undertaken, this volume may already be provided at the correct levels but this must be shown in the FRA.
- Please confirm the run-off rates from the surface water attenuation. It is stated in the report that this will be to Greenfield rates as agreed, but the calculations for the detention basin show run-off rates in excess of this, will this remaining run-off be catered for in the drainage system?
- Please provide a topographic site survey suitably sized so it is legible as part of the planning application, and include the surveys of the river and other channels.
- Please confirm that the channel on the bridge design sections is indicative as this does not meet with our discussions regarding a two-stage channel approach.

We will condition the details of the bridges, river diversion and channel design as part of the planning application. Further discussion with us will be required at discharge of condition stage to ensure the appropriate design is used.

Flood Defence Consent will be required from us for works in, over, under or within 8m of the Yeading Brook. Works to ordinary watercourses such as the flood relief

Cont/d..

channel will require consent for any works will affect the flow of the watercourse, such as diversions.

Eastern Access

At the planning application stage we would object to the planning application for the Eastern Access as the FRA has failed to provide the information we previously requested as follows:

- It must be confirmed that SUDS will be used on site, this is part of the drainage strategy and the attenuation volume and method must be confirmed at this stage. This is the developers responsibility, the requirements of Thames Water are separate to our requirements and Planning Policy Statement 25, as Thames Water deal with the sewer capacity and not on site attenuation.
- The run-off has not been restricted to the Greenfield rate as agreed and as required by the Development Control policy messages in Ealing's SFRA and our requirements.
- Calculations must be provided to demonstrate the volume of attenuation provided.

Please note we have not provided comments on the surface water strategy for the main site as the revised version has not yet been received.

Please contact me if you have any questions to the above.

Yours sincerely

Ms Anna Scott
Major Projects Officer

Direct dial 020 7091 4042
Direct e-mail anna.scott@environment-agency.gov.uk

End

APPENDIX FRA 2.3

Environment Agency Correspondence

Response to FRA version 2

Doug Ford
White Young Green Environmental Ltd
Sunley House Bedford Park
doug.ford@wyg.com

Our ref: TL/2008/100682/01-L01
Your ref: West Southall

Date: 29 April 2008

Dear Mr Ford

SUBMISSION OF BRIDGE CROSSING DETAILS, ECOLOGICAL MITIGATION PLAN AND GAS HOLDER WEST FACTUAL REPORT AND INITIAL INTERPRETATION REPORT.
FORMER SOUTHALL GAS WORKS SITE, SOUTHALL.

Thank you for submitting the above documents for our consideration. We are happy to meet with you to discuss the below comments in relation to the reports. We suggest a meeting be held on 16 May 2008 in our offices in Hatfield from 2pm to 4pm.

Flood Risk Assessment for bridges

New mapping and modelling is now available on the Crane which may assist you in your calculations. If you wish to use this information please contact our External Relations team by emailing thnortheast@environment-agency.gov.uk.

Bridge Design

1. Springfield road bridge and Minet Park Bridge

In terms of the two footbridges, we understand that the height of the bridges relative to the water levels has been maximised, of which we approve. However, both pedestrian bridges are proposed to cross the Yeading brook diagonally, which is likely to impact on the river and its corridor more than if they were to cross at 90 degrees to the watercourse.

We would like confirmation of why they have been proposed to cross at this angle and would like to question if they can be changed?

In relation to the Spring field road bridge (which we assume is a pedestrian bridge) the abutment on the land between the GUC and the Yeading Brook is a large structure that seems to impinge in terms of space into the 4m buffer zone to the Yeading Brook. Can you please confirm why this distance is required.

Cont/d..

In relation to the Minet Park Bridge, does the access ramp on the Minet Country Park side have to run parallel with the riverbank? The design should minimise impacts on the river corridor which includes disturbance, and in this case is there any reason why the ramp could not be at 90 degrees to the Yeading Brook.

2. Link Road Crossing

Is there any opportunity for the embankments to be replaced with abutments and piers, to reduce the amount of flood storage compensation required? Having an embankment would also have a much greater impact on the wildlife site than would abutments and piers.

We would also like to question if the road bridge been designed so that the height of the bridge relative to the water level has been maximised? Road bridges are wide and we need to see more details of the shading study to know the extent of shading.

While the bridge must be designed so that there is minimal shading, it should be recognised that there is still a negative impact on the river, even if it is considered to be reasonably low, and such an effect should be put on balance sheet of negatives against which appropriate positives through mitigation and enhancement should be weighed up against.

The mitigation report does not comment on the scale of impact of this bridge in terms of the severing of the wildlife site. We recognise that mammal tunnels have been proposed, but in terms of the current cohesive and relatively undisturbed nature of the site for example, nesting birds have not been considered in terms of impact. There is also the impact in terms of loss of area of the wildlife site, i.e. the physical footprint. This has not been addressed in the mitigation report.

Trying to weigh up all impacts is a difficult task, but following guidelines set out by IEEM (Institute of Ecology and Environmental Management) for Ecological Impact Assessments (EcIA) would be of much use here, especially considering the scale of the works. In fact, the mitigation plan refers to an EcIA, but this has not been sent to us. We are aware from previous consultations that this southern area of the site is the most valuable for wildlife, and we do not consider that the impacts have been fully considered, and therefore cannot be sure that full appropriate mitigation is proposed.

Please note that once we are satisfied with the proposed bridge designs we are likely to condition the details of the bridge design at the planning application stage and the works would require Flood Defence Consent from us.

Flood Storage Compensation

Insufficient information has been provided regarding the compensation. The volumes lost at each level must be demonstrated and the replacements shown in a similar manner for comparison.

The area designated for compensation appears to be constrained by its situation in relation to the existing floodplain. It must be demonstrated that this area is hydraulically connected to the existing floodplain to ensure that floodwaters will reach the compensation area and not be forced elsewhere.

Channel diversion

Insufficient information has been submitted regarding the channel diversion. It must be demonstrated that the new channel has sufficient hydraulic capacity, not just increased channel width for the combined flows. The channel should be two stage to accommodate low and high flows and set at the existing invert levels.

FRA for Eastern Access

The flood risk information submitted is not acceptable to us for the following reasons:

- Inadequate information has been submitted regarding the assessment of surface water as existing and likely to be generated as a result of the development
- Calculations regarding the volume of storage required, including an allowance for climate change, up to the 1 in 100 year critical storm duration have not been provided.
- Surface water run-off has not been restricted as far as possible to the greenfield rate.
- Sustainable Drainage systems have not been employed.

Please note that is not acceptable to rely on a reduction in hardstanding to create improvements. There is ample space as part of the Eastern Access to include Sustainable Drainage Systems to act as attenuation including ponds, detention basins and swales. The FRA must comply with the requirements of PPS25 and the London Plan. See further surface water advice below.

Surface Water FRA for masterplan site

The greenfield run-off rate proposed is acceptable to us. However, the surface water FRA has failed to meet the requirements of PPS25 and the London Plan for the reasons outlined above. The previous FRA was written under old legislation which has now been superseded.

Calculations must be submitted to demonstrate the surface water system as existing and as a result of the proposed development, including 30% rainfall intensity as an allowance for climate change, outlined in PPS25.

Plans to illustrate the SUDS features proposed on site must be included at outline stage to ensure that adequate space is left in the design phase to include these. Plans of SUDS on site and the levels of attenuation provided by these must be submitted. The most sustainable methods possible on site must be used, with any barriers to the use of SUDS clearly justified as part of the FRA.

Phased Application

Where phased development of the site is proposed, the surface water FRA should demonstrate each phase of the development to ensure that adequate surface water facilities are provided as part of each stage. Only if this is demonstrated are we able to provide conditions which would be discharged at each phase of the development, otherwise the detailed design of the entire site will be required prior to discharge of conditions.

Surface water information:

Planning applications under PPS25 should be 'reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SUDS)'.

The London Plan states in Policy 4A.3 The Mayor will, and boroughs should, ensure future developments meet the highest standards of sustainable design and construction and reflect this principle in DPD policies. These will include measures to:

- Manage flood risk, including through sustainable drainage systems (SUDS) and flood resilient design for infrastructure and property
- Encourage major developments to incorporate living roofs and walls where feasible (Policy 4A.11)

Further policies, Policy 4A.9 Adaptation to Climate Change, Policy 4A.11 Living Roofs and Walls, Policy 4A.14 Sustainable drainage, Policy 4C.3 The natural value of the Blue Ribbon Network and Policy 4A.17 Water quality are relevant to this application.

For the Surface Water Flood Risk Assessment to be acceptable to us the drainage system shall be designed as follows:

- Surface water discharge from the site shall be restricted to the greenfield rate.
- 1 in 100 year on-site attenuation shall be provided, including an allowance for climate change as outlined in PPS25.
- Sustainable Urban Drainage solutions shall be employed.

Any barriers to providing the above criteria must be clearly justified.

Sustainable drainage is the practice of controlling surface water runoff as close to its origin as possible, before it is discharged to a watercourse or to ground. This involves moving away from traditional piped drainage systems towards softer engineering solutions which seeks to mimic natural drainage regimes. For a drainage scheme to be termed 'sustainable' it must meet the following three criteria:

- Reduce flood risk
- Improve water quality
- Improve the environment

When designing a site's drainage scheme the type(s) of SUDS techniques selected should aim to meet all three criteria. The most sustainable techniques should be included your drainage design. Traditional piped/tanked systems are the least sustainable of all SUDS techniques and should be avoided, they will only be accepted if it has been demonstrated that they are the only viable technique. A site's drainage design can be made up of a range of SUDS techniques.

Flood Channel Enhancements

The documents refer to works in regards the flood channel, and the proposals for this indicate that there will be ecological benefit here. We look forward to discussing the details on these proposals.

Proposed Wetland

There is a wetland proposed within the central park area, but at this stage no details have been submitted. Although this is an outline application we would need to be sure that a wetland was viable in a area with the availability/water levels having been investigated and known to be able to support a wetland.

The park is currently managed by Hillingdon Council and they have to balance many different park user needs. We need to be satisfied that there is sufficient and appropriate space for a fully functioning wetland.

Yeading Brook

No enhancement has been proposed to the Yeading Brook itself through the site. It is an wide and deep channel that has poor flow diversity and there is good scope to improve in-channel habitat. This has not been explored at all in the reports. In addition, there is some bank rock cladding proposed about which we have great concern.

In channel enhancements could be a way of mitigating the impact of the bridges on the Yeading Brook and its corridor.

There is the additional argument of increased numbers of people to the park from the development and if these pedestrian bridges are to be put in to encourage people to use the park, extra funds should be made available to enhance the park given the size of this new development, and the number of people likely to use the park. The Yeading Brook is such a feature of this park that there should be more consideration to its enhancement.

Balance Sheet

In order to be satisfied with a mitigation plan we will need more details than currently provided. To re-iterate, a balance of negatives and positives should be produced in order to satisfy us that all impacts have been addressed. Impacts should be given appropriate weight in terms of scale of impact, and that appropriate mitigation and compensation has been proposed. Currently this has not been provided. We are happy to discuss these comments in more detail at the meeting.

Consents

Under the terms of the Water Resources Act 1991, our prior written consent is required for dewatering from any excavation or development to a surface watercourse. Contact Consent Department on 08708 506506 for further details.

Under the terms of the Water Resources Act 1991, our prior written consent of the is required for any discharge of sewage or trade effluent into controlled waters (e.g. watercourses and underground waters), and may be required for any discharge of surface water to such controlled waters or for any discharge of sewage or trade effluent from buildings or fixed plant into or onto ground or into waters which are not controlled waters. Such consent may be withheld. Contact Consent Department on 08708 506506 for further details.

Under the terms of the Water Resources Act 1991 our prior written consent is required for any works within 8 metres of the Yeading Brook.

Cont/d..

Ground Contamination

Due to current resourcing issues we have been unable to provide detailed comments on the Gas Holder Factual Reports submitted. However, we will try to submit comments to you as soon as we are able.

Please contact me if you wish to discuss the following.

Yours sincerely

Ms Anna Scott
Major Projects Officer

Direct dial 020 7091 4042
Direct e-mail anna.scott@environment-agency.gov.uk

End

APPENDIX FRA 2.4

Environment Agency Correspondence

Original Correspondence

richard.blacknell

From: Calver, Penelope [penelope.calver@environment-agency.gov.uk]
Sent: 10 December 2007 17:42
To: richard.blacknell
Subject: RE: West Southall, Yeading brook crossings

Richard,

Following on from our recent discussions regarding the functional floodplain, having reviewed the outlines and plans submitted by yourself, it is my consideration that in this instance the approach you have used is satisfactory.

I am happy for you to use the functional outlines submitted. For clarity, this is the area covered by both the light blue and the hatched blue in your plan SK100.

I trust the above is of use to you, please do not hesitate to contact me should you require any further guidance. I am aware that there are still comments outstanding regarding the revised bridge design, you will receive these from our Planning Liaison team shortly.

Kind regards,

Penelope Calver

Development Control Engineer
For the Brent and Crane catchments
Environment Agency, NE Thames

Direct dial: 01707 632401
Email: penelope.calver@environment-agency.gov.uk

From: richard.blacknell [mailto:richard.blacknell@wyg.com]
Sent: 06 December 2007 14:49
To: Calver, Penelope
Subject: RE: West Southall, Yeading brook crossings

Penelope

The colours on SK 100 are as follows:

Dark blue – normal extent of the Yeading Brook and the canal

Light blue – functional flood plain

Speckled blue - Functional flood plain - estimated extent due to limited topographic data.

Green - Location of attenuation/compensatory storage.

The functional flood plain will extend further up the flood relief channel than shown, but will be tightly constrained.

SK's 101 &103 only show watercourse and diversion routes. Flood plains are omitted.

Hope the above helps

Regards

Richard

From: Calver, Penelope [mailto:penelope.calver@environment-agency.gov.uk]
Sent: 06 December 2007 13:56
To: richard.blacknell
Subject: RE: West Southall, Yeading brook crossings

Richard,

I will send this drawing onto our Planning liaison team for consultation as it is not solely myself who would need to comment.

I am currently still trying to resolve the issues about the functional floodplain. Could you possibly confirm what the differing coloured zones relate to, i.e. dark blue, light blue, hatched blue? The outline of all of these areas appears similar to the functional floodplain outline, but not the dark blue or light blue outlines. If you could clarify I would be grateful.

Kind regards,

Penelope Calver

Development Control Engineer
For the Brent and Crane catchments
Environment Agency, NE Thames

Direct dial: 01707 632401
Email: penelope.calver@environment-agency.gov.uk

From: richard.blacknell [mailto:richard.blacknell@wyg.com]
Sent: 05 December 2007 14:39
To: Calver, Penelope
Subject: West Southall, Yeading brook crossings

Penelope

Further to our discussion on Monday please find attached our sketch no SK103. This indicates our current thinking in respect of the road alignment and diversion of the Flood relief channel. Please note that these are very much first drafts

The main changes from the layout applicable to the previous FRA are:

The road alignment has been moved north to avoid network rail land.

The diversion of the flood relief channel has been extended so as to pass under the Yeading Brook bridge.

The 5.5 m wide flood relief channel culvert is omitted.

The bridge span has been widened by 5.5 m to accommodate both channels.

I would appreciate your confirmation that you are, in principle, in agreement with this arrangement. Following which we can discuss and firm up the details these would include:

Treatment of the junction of the Flood relief channel and the brook

The extent, and details of, the widening of the Yeading brook

The extent of the embankment base

Compensatory storage provisions

Attenuation storage provisions

Mammal pass provision

I will be posting you a CD containing most of the previous FRA for your information. This includes the BPA modelling report.

The disk also includes .pdf's of the previous two sketches sent.

Please call me if you need to discuss any of the above

Regards

Richard Blacknell
Associate

WHITE YOUNG GREEN
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www.wyg.com

richard.blacknell

From: richard.blacknell
Sent: 20 November 2007 15:28
To: 'penelope.calver@environment-agency.gov.uk'
Cc: 'anna.scott@environment-agency.gov.uk'
Subject: West Southall redevelopment

Dear Penelope

I refer to Anna Scott's letter dated15 Nov 2007. After Speaking to Anna I understand that the technical discussion is best held directly between ourselves.

You have advised that our functional flood plain outline differs from that produced by Scott Wilson as part of Hillingdon's SFRA. I have spoken to Hillingdon and Scott Wilson in this respect.
I understand that the SFRA is not yet available for public issue. Also, Scott Wilson are very reluctant to release their results until, at least, their modelling have been accepted by yourselves. I understand that this is due this week.

As a result I am unable to comment on any differences between the predicted flood extents. Although as the results were produced using different methods it is not surprising that there are some differences.

Scott Wilson have advised that their results were obtained by overlaying EA flood level figures over a Liddar survey of the area.

The PBA figures used in our previous report were obtained by running the latest EA model of the River Crane/Yeading Brook catchment (as of December 2005, I was given understand that there have been no significant changes since then). The model was updated to include topographic survey data of the watercourse in this valley. The FRA report included comments on the reduction in flood level for the base condition and it was accepted by the EA in November last year.

The PBA model should thus be a more accurate representation of the Brook than a simple overlay of flood levels.

Not withstanding the above is important that we agree on the values to use and I would appreciate the opportunity to discuss the appropriate approach (and confirmation that you would be happy for Hillingdon/Scott Wilson to release their flood zone plans)

I anticipate that the overall principles of our proposals will remain unchanged i.e.

Foot bridges : Min 600 mm clear above 1:100 year +20% level
Abutments/piers 4 m min set back from bank
Abutments/piers ; preferably outside but otherwise with minimum impact on the flood plain

Pump Lane crossing: Bridge 17 .5 m min span, abutments 4 m back from embankments
Min 600 mm clear above 1:100 year +20% level
The embankment will be in the flood plain Therefore compensatory storage to be provided

Culvert As short as possible
As much freeboard as possible
Provision for mammal ledge

I will try to call you later this week to discuss the above or, alternatively you may prefer to contact me when you are free.

Regards

Richard Blacknell
Associate

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Our Ref: RB/A012564/fc-01

Date: 29 October 2007

Penelope Culver
The Environment Agency
Apollo Court
2 Bishop's Square Business Park
St. Albans Road West
HATFIELD
Herts AL10 9EZ

Dear Penelope

WEST SOUTHALL REDEVELOPMENT
YEADING BROOK – FLOOD RISK ASSESSMENT
FLOOD ZONE 2

I refer to our telephone conversation on 17 October 2007 and Alex Robinson's email to Doug Ford dated 11 October 2007.

I enclose a copy of our sketch A012564/SK100 which depicts my interpretation of Flood Zone 2, the functional flood plain.

The outline is based on the 1:50 year flood levels predicted by the latest PBA modelling exercise.

The model for this return period produces a combined flow downstream of the confluence of the Yeading Brook and the Hayes Bypass channel of 17.02m^3/s.

The Hiflow-UK website contains details of gauging station reference 39057 which is located a short distance further downstream. This station has recorded 5 annual maximum flows greater than 17m^3/s in the 28 years between 1974 and 2002.

The station does serve a larger catchment than the reach we are considering and the flow figures are not considered sufficiently reliable to be included in the FEH database. However, I consider that this figure can be deemed to provide a reasonably conservative estimate of the functional flood plain.

I would be grateful if you would confirm that you are happy for this approach to be used within the Flood Risk Assessment that is being prepared for the crossings of the brook.

Yours sincerely

RICHARD BLACKNELL
Associate

Enc.

c.c. Doug Ford - White Young Green Environmental
Brian Wilkins - White Young Green, Norwich

creating a better place

Environment Agency

Mr Richard Blacknell
White Young Green
29-31 Cumberland Street
Bristol
Avon
BS2 8NL

Our ref: NE/2007/104791/01-L01
Your ref: RB/A012564/fc-01

Date: 15 November 2007

Dear Mr Blacknell

WEST SOUTHALL REDEVELOPMENT. YEALDING BROOK FLOOD RISK ASSESSMENT.
WEST SOUTHALL.

Thank your for your letter dated 29 October 2007 that we received on 31 October 2007. In places the proposed functional floodplain outline is smaller than that mapped by Scott Wilson as part of Hillingdon's Strategic Flood Risk Assessment (SFRA) which has recently been signed off.

You are advised to contact Hillingdon to obtain their modelled shapefile for the functional floodplain which is being mapped as part of their SFRA and establish why your flood outlines are different to theirs.

This exercise should also be undertaken for the 1 in 100 year, 1 in 100 year climate change outlines, it should also be checked that you have our most recent flood zone 2 shapefiles.

Scott Wilson are using our data to create their shapefiles for this SFRA and this data is more up to date than the PBA data you refer to in your letter.

The most accurate and up to date data should always be used to represent all of the flood zones identified in line with Planning Policy Statement 25 (PPS25) to ensure that the Flood Risk Assessment for this site is fully updated.

Lastly, It is unclear why you refer to the functional floodplain as Flood Zone 2 in your letter, as in accordance with PPS25, the functional floodplain is called as Flood Zone 3b.

Please contact me if you have any questions to the above.

Environment Agency
Apollo Court, 2 Bishops Square Bussines Park, St Albans Rd West, Hatfield, Herts, AL10 9EX.
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Cont/d..

Yours sincerely

Ms Anna Scott
Major Projects Officer

Direct dial 01707 632323
Direct e-mail anna.scott@environment-agency.gov.uk

Please note that the North East London Planning Team are moving office on 19 November 2007. My direct dial will be changing to ***0207 091 4042****. Email and postal addresses will remain unchanged.*

End

From: Robinson, Alex [mailto:alex.robinson@environment-agency.gov.uk]
Sent: 11 October 2007 10:33
To: doug.ford
Cc: Calver, Penelope
Subject: RE: SOUTHALL GAS WORKS REDEVELOPMENT

Doug,

I have received some preliminary comments back for Penelope Calver (Development Control Engineer). These are as follows.

The impact of the new structures cannot be adequately assessed with respect to flood risk because an updated Flood Risk Assessment has not been submitted. We require an FRA to be submitted which is inline with PPS25 and not PPG25 as with the previous submission.

We would require the following information:

1) The FRA needs to establish Flood Zone 3b, 3a and 2. The FRA should include the impact of the bridges and details, plans, cross sections and calculations on flood storage compensation. If the site is found to fall within Flood Zone 3b, the Exception test would need to be passed and the applicant would need to demonstrate that all the structures within the functional floodplain were "essential". Climate change of +20% should be accounted for as outlined in Table B2 of PPS25.

2) The drainage FRA for the site should be updated in line with PPS25. As stated previously, the drainage strategy should restrict the run-off to between 2-8l/s/ha, up to and including the 1 in 100 year + 30% climate change as outlined in Table B2 of PPS25. The use of SUDS on site should be maximised. The Environment Agency has previously agreed the restriction of 7l/s to the Flood Relief channel and 16l/s to the Yeading Brook for the site run-off.

3) The bridge designs should meet with the parameters previously set: bridges should be clear span with soffit levels 600mm above the 1 in 100 year inc climate change flood level, with abutments set a minimum of 4m from bank top. **We are unable to agree to the bridge designs and principles until the FRA has been updated.**

4) A 5m undeveloped green buffer strip measured from canalside should be included in the development. The masterplan submitted conflicts with this agreement by showing hardstanding to canalside.

Please feel free to contact me on the number below or Penelope Calver on 01707 632401.

Kind regards

Alex Robinson
Planning Liaison Officer
Environment Agency

Tel 01707 632405
Fax 01707 632515

Apollo Court, 2 Bishops Square Business Park, St Albans Road West, Hatfield, Hertfordshire, AL10 9EX

A01254

White Young Green Environmental Ltd
Yeoman House
Croydon Road
London
SE20 7TS

Our ref: NE/2005/013231/04-L01 (Springfield Road)
NE/2005/013227/04-L01 (Pump Lane)
NE/2005/013229/04-L01 (Minet Park)

Your ref: 54814/APP/2005/1775
54814/APP/2005/1773
54814/APP/2005/1781

Date: 14 November 2006

FAO Douglas Ford

Dear Douglas

PROPOSED NEW LINK ROAD BETWEEN SPRINGFIELD ROAD/BEACONSFIELD ROAD, HAYES AND THE FORMER SOUTHALL GAS WORKS WITH ASSOCIATED EMBANKMENT AND BRIDGES OVER THE YEADING BROOK AND GRAND UNION CANAL.
LAND TO SOUTH EAST OF BEACONSFIELD ROAD, HAYES, AND TO THE WEST OF FORMER SOUTHALL GAS WORKS, HAYES.

Thank you for your letter dated 6 October 2006, which was received on 12 October 2006. You are asked to quote our reference in any correspondence. We have the following comments:

- **Pump Lane Bridge and Culvert**

Biodiversity
We are happy with the detail and basis of the Ecological Mitigation proposals. If these proposals were submitted as part of a planning application to the London Borough of Hillingdon, we would remove/not object to the application on the grounds of loss of species habitat.

Flood Risk
If the flood risk details were submitted to us as part of a planning application to the London Borough of Hillingdon, we would remove/not object in detail to the application because the following elements now meet our requirements:

- flood risk assessment,
- surface water drainage design,

- bridge design,
- culvert design,
- level for level floodplain compensation and
- design of the new channel.

We would require the following conditions be attached to any planning permission that was granted:

- No development approved by this permission shall be commenced until the detailed drawings of the bridge crossing has been approved in writing by the Local Planning Authority.
  - To prevent the increased risk of flooding and to protect the river corridor.

- No development approved by this permission shall be commenced until the detailed design of the culvert has been approved by the Local Planning Authority.
  - To prevent the increased risk of flooding and to protect the river corridor.

- The detailed design of the diversion channel shall have been submitted to and agreed in writing by the Local Planning Authority before development commences.
  - To alleviate the increased risk of flooding that would otherwise be caused by a reduction in flood storage capacity.

- Level for level compensatory flood storage works shall be carried out in accordance with details which shall have been submitted to and approved in writing by the Local Planning Authority before the development commences.
  - To alleviate the increased risk of flooding that would otherwise be caused by a reduction in flood storage capacity.

- There shall be no building or raising of existing ground levels, nor deposition of spoil/material on that part of the site lying within land liable to flood.
  - To prevent the increased risk of flooding due to impedance of flood flows and reduction of flood storage capacity.

- Surface water drainage works shall be carried out in accordance with details which shall have been submitted to and approved in writing by the Local Planning Authority before development commences.
  - To prevent the increased risk of flooding, to improve water quality and to provide improved amenity and wildlife habitat.

Under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws 1981, the prior written consent of the Environment Agency is required for certain proposed works or structures in, under, over or within 8 metres of the brink of the Yeading Brook and the Hayes By-Pass Channel. Land Drainage Consent is required irrespective of any planning permission granted.

- **Springfield Road Bridge (DPS 13231)**

Biodiversity
As detailed in the Introduction of the Ecological Mitigation Plan (V3A August 2006), we would maintain our objection to the principle of development at Springfield Road.

Regarding the mitigation proposals in the case of the Local Authority granting permission on the Springfield Road, we do not consider the current proposals sufficiently compensate for the residual impacts of the bridges (those impacts that remain after mitigation). If these were to be granted planning permission we would consider ecological enhancements to the Yeading Brook within Minet Country Park to be appropriate compensation. This could include removal of invasive species, bank reprofiling and selective scrub clearance. The plans would have to be agreed by ourselves.

Flood Risk
The following elements now meet our requirements:

- flood risk assessment,
- surface water drainage design,
- bridge design,
- level for level floodplain compensation.

If these flood risk details were submitted to us as part of a planning application to the London Borough of Hillingdon, we would remove/not object in detail to the planning application.

However, we would object to the principle of this bridge crossing because we do not believe it to be necessary given the fact that access to the park could be achieved by the Pump Lane Bridge.

We also wish to see and comment on the detailed design proposals for the highways drainage attenuation wetland feature (drawing number Appendix C revision C).

- **Minet Footbridge (DPS 13229)**

Biodiversity
As detailed in the Introduction of the Ecological Mitigation Plan (V3A August 2006), we would maintain our objection to the principle of development at Minet Park.

Regarding the mitigation proposals in the case of the Local Authority granting permission on the Minet Park, we do not consider the current proposals sufficiently compensate for the residual impacts of the bridges (those impacts that remain after mitigation). If these were to be granted planning permission we would consider ecological enhancements to the Yeading Brook within Minet Country Park to be appropriate compensation. This could include removal of invasive species, bank reprofiling and selective scrub clearance. The plans would have to be agreed by ourselves.

Flood Risk
The following elements now meet our requirements:

- flood risk assessment,
- surface water drainage design,
- bridge design,
- level for level floodplain compensation.

If these flood risk details were submitted to us as part of a planning application to the London Borough of Hillingdon, we would remove/not object in detail to the planning application.

However, we would object to the principle of this bridge crossing because we do not believe it to be necessary given the fact that access to the park could be achieved by the Pump Lane Bridge.

We also wish to see and comment on the detailed design proposals for the highways drainage attenuation wetland feature (drawing number Appendix C revision C).

If you have any questions, please contact me directly on my number below.

Yours sincerely

Deborah Coates
Planning Liaison Officer

Direct dial 01707 632388
Direct fax 01707 632515
Direct e-mail debbie.coates@environment-agency.gov.uk

cc London Borough of Hillingdon

H:\Projects\E00001 - E01000\E00357\4004\E00357\DF02OCT06L EA.doc

6th October 2006

Mr James Burstow
Environment Agency
Apollo Court
2 Bishops Square Business Park
St Albans Road West
Hatfield
Herts AL10 9EX

Dear James,

RE: SOUTHALL GAS WORKS REDEVELOPMENT

Further to our various correspondence and consultations to address the EA's comments following the planning application for the above which culminated in our concluding consultation meeting of 5th June 2006, please find attached a copy of our enhanced reports, drawings and documentation as listed below.

These documents have addressed all of the issues raised and discussed at the referenced meeting which has resulted in these clarified and developed solutions. The documents should be read together.

1. **Detailed Ecological Mitigation Plan (BOUND REPORT)**
(Ref: E0357/jaAug06ecolmitplan/V3A)

- **Included drawings:**

ECO100/101	- River Corridor Survey
A012564/AppC Rev C	- Pump Lane General Arrangement
RE01/RE02 Rev B	- Flood Relief Channel Diversion Plan and Section Detail
SK02 Rev A	- Ecological Impact Areas
4142-4-100 G	- Pump Lane Landscape Proposals
4142-3-100F	- Minet Footbridge Landscape Proposals
4142-2-100 G	- Springfield Road Landscape Proposals
Open Space Parameter Plan	

2. **Flood Risk Assessment (BOUND IN FOLDER)**
(Ref: SOUTHALL/RBFRA/24.July.06/V6A)

- **Included Drawings**

Figures:

Fig. 630 Rev A	- Location Plan
Fig. 631	- Environment Agency Flood Zone Map (currently published)
Fig. 632 Rev A	- Flood Plain Map (enhanced to latest data)
Fig. 633Rev B	- Bridging and Compensatory Structure Locations
Fig. 634 Rev D	- Springfield Road Link Road Bridge Area
Fig. 635	- Pump Lane Link Road

Yeoman House, 63 Croydon Road, London SE20 7TS
Tel: 020 8659 9959 Fax: 020 8676 9968 Email: enviro.london@wyg.com Website: www.wyg.com

White Young Green Environmental Ltd
Registered in England Number 3050297 Registered Office: Arndale Court, Headingley, Leeds LS6 2UJ

Drawings in Appendices:

App A Rev A	- E0357/800 Topographical Survey
App C(Rev C)	- Pump Lane Link Road Bridge – General Arrangement
App D(Rev A)	- Pump Lane Link Road Bridge – Drainage Strategy
App E	- 013 RevA Minet Footbridge – General Arrangement
App F Rev A	- Minet Footbridge – Drainage Strategy
App G	- 011 RevA Springfield Road Link Bridge – General Arrangement and 012 Details
App H	- SK05 RevD Springfield Road Link Road Bridge – Drainage Strategy
App J (Rev B)	- Flood Relief Channel Diversion Plan and RE01/RE02 Channel Details
App K(Rev A)	- Flood Compensatory Storage Area

3.A Structural Layout Drawings (IN WALLET)

001 Rev A / 002 Rev A	- Pump Lane Canal Bridge Crossing and Detail
003 Rev A / 004	- Pump Lane Yeading Brook River Crossing and Detail
005	- Pump Lane Flood Relief Channel Diversion Culvert
011 Rev A	- Springfield Road General Arrangement and Detail
013 Rev A	- Minet Footbridge General Arrangement and Detail

3.B Minet Country Park Plans (for information only) (IN WALLET)

Minet Country Park Suppport Text

4142-05-01	- Existing Landscape Plan
4142-05-02	- Landscape Character Zoning Plan
4142-05-03	- Character Images, Sheet 1/2
4142-05-04	- Character Images, Sheet 2/2
4142-05-05	- Public Access Zoning Diagram
4142-05-06	- Landscape Proposals

For ease of reference we also attach a further copy of the agreed minutes of our meeting of 5th June 2006, so that when you are reviewing the provided details you can assure yourselves that all points raised have been appropriately dealt with in line with our recorded discussions.

If, during your considerations of these details, any items require clarification then to avoid further correspondence may we request that such items can be discussed over the telephone, or by email, to the following contacts:

Ecology – Joe Attwood (joe.attwood@wyg.com – tel: 020 8659 9959)
Flood Risk and Structures (richard.blacknell@wyg.com – 0117 924 4144)
Landscape – Kate Rusholme (krusholme@lovejoylondon.uk.com – 0207 901 9911)
General Issues – Doug Ford (doug.ford@wyg.com – 020 8659 9959)

We trust that you find these details comprehensive and appropriate to allow us to conclude our consultations in line with our meeting. At the appropriate time we would be grateful if you could issue correspondence to confirm this (noting your retained in principle objection to the three river crossings as minuted) such that the planning authorities and other stakeholders can be informed of our mutually agreed position.

Yours sincerely,
For **WHITE YOUNG GREEN ENVIRONMENTAL LTD**

DOUGLAS M FORD
Managing Director

Encs:

c.c.	Lydia Bruce-Burgess	- EA (plus docs)
	Sarah Boyd	- EA (plus docs)
	Keith Fenwick	- Castlemore (plus docs)
	Myra Barnes	- Salisbury Jones Planning for National Grid (plus docs)
	Simon Slatford	- RPS (plus docs)
	Kate Rusholme	- Lovejoys
	Richard Blacknell	- WYG
	Joe Attwood	- WYGE

BRISTOL

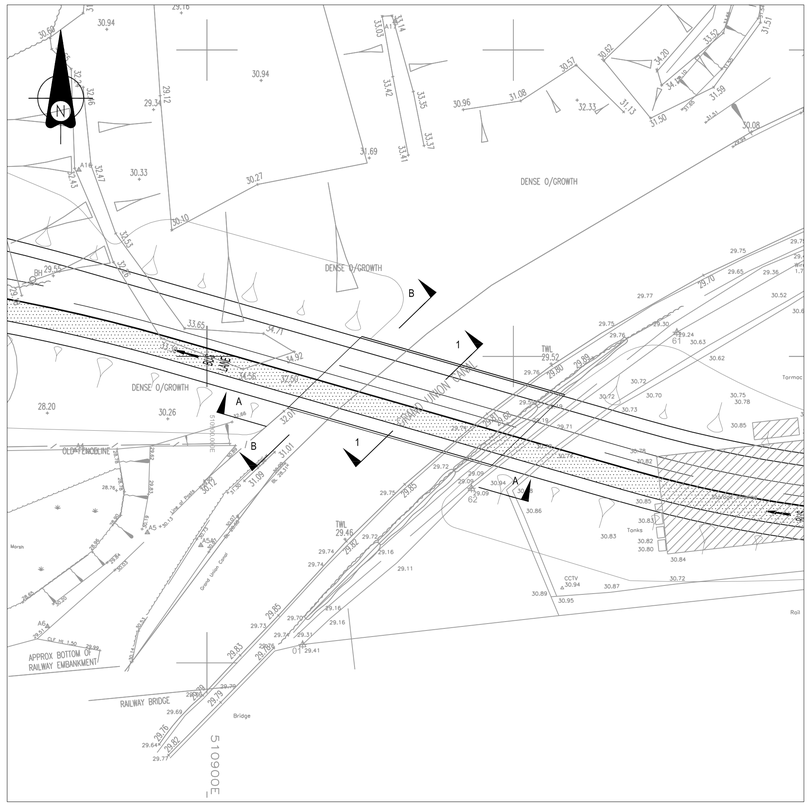
APPENDIX FRA 3

Pump Lane Link Road Bridge Details

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors

NOTES

1. ALL LEVELS IN METERS AND ARE BASED ON ORDINANCE DATUM
2. ALL DEMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

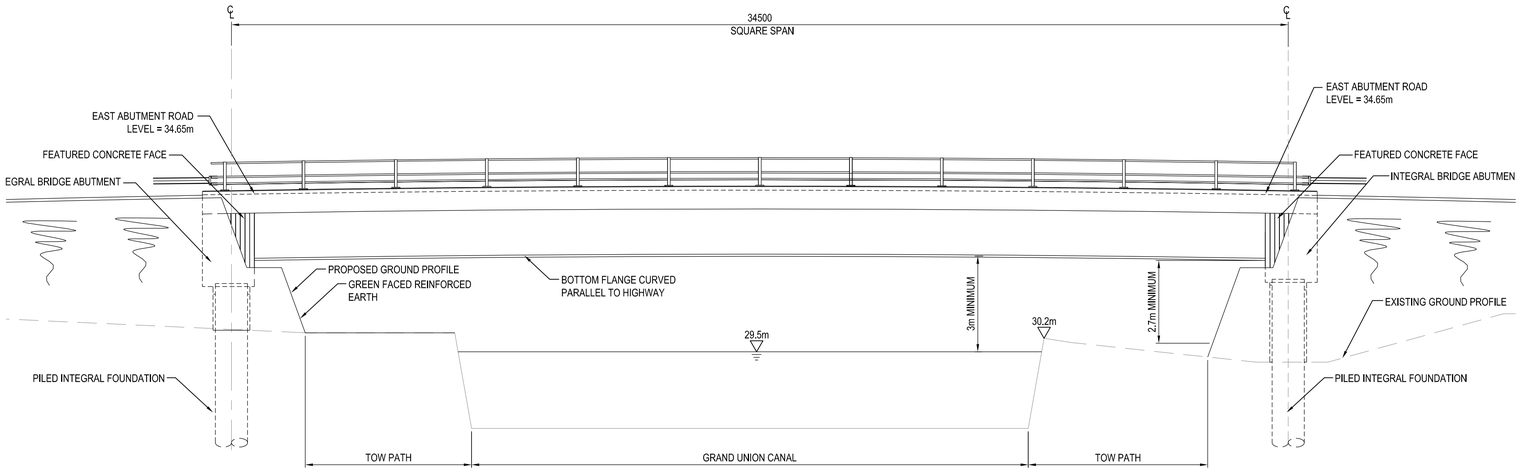


SITE PLAN

SCALE 1:500

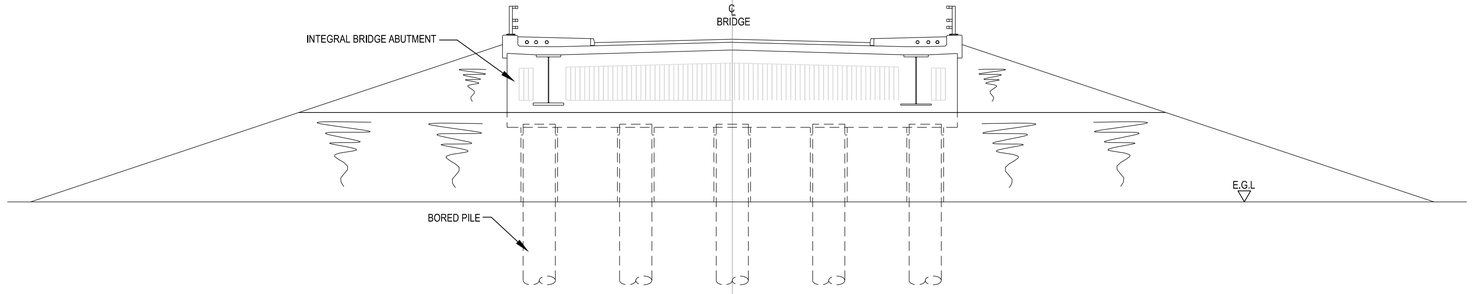
NOTE

CONFIGUATION IS INDICATIVE ONLY AND SUBJECT TO CHANGE DURING DETAILED DESIGN STAGE.



SOUTH ELEVATION A-A

SCALE 1:100



ELEVATION B-B

SCALE 1:50

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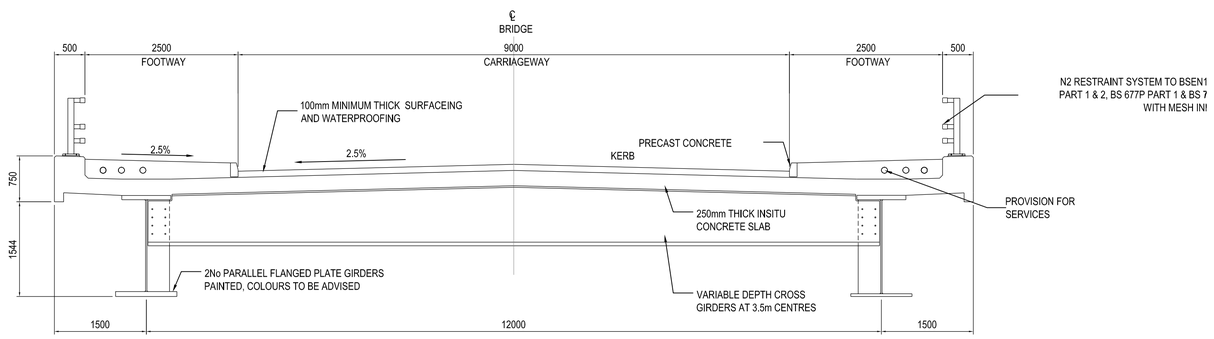
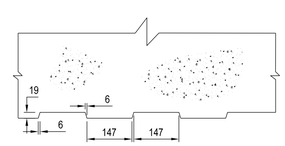
0	DRAFT	SLW	BS	DH	16.01.08



SECTION 1-1

SCALE 1:50



DETAIL OF FEATURED CONCRETE FACE

SCALE 1:10

Brigantine House
27-31 Cumberland Street
Bristol
BS2 8NL

Tel: 0117 924 4144
Fax: 0117 924 4145
e-mail: bristol@wyg.com

White Young Green

Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
GRAND UNION CANAL BRIDGE

Drawing Title:

PROPOSED COMPOSITE STEEL LADDER DECK AND INTEGRAL ABUTMENTS

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
	SLW	16/01/2008	BS	16/01/2008	DH	16/01/2008

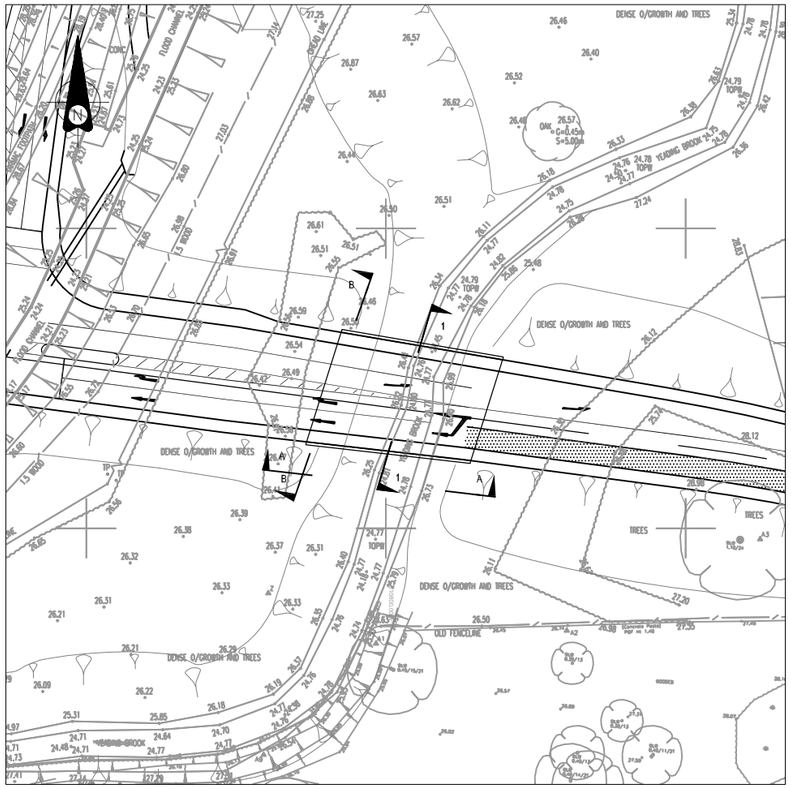
Project No.	Office	Type	Drawing No.	Revision
A012564-1	28	R	201	1

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors

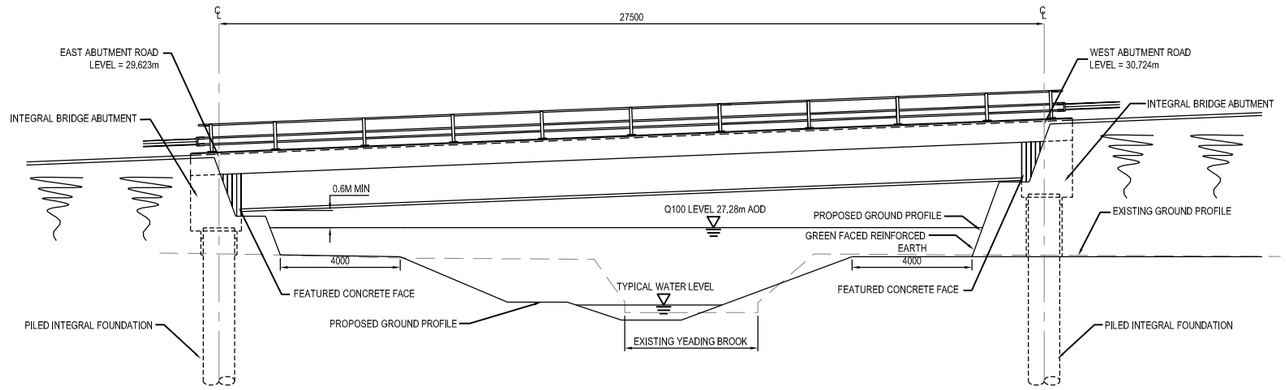
NOTES

1. ALL LEVELS IN METERS AND ARE BASED ON ORDINANCE DATUM
2. ALL DEMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED



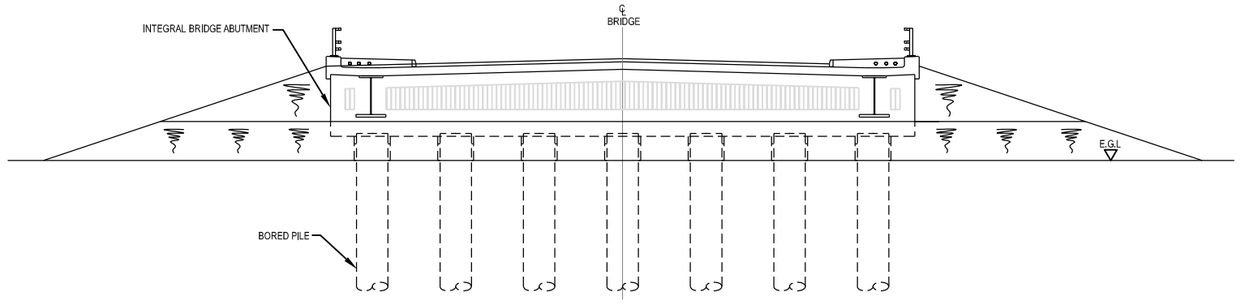
SITE PLAN

SCALE 1:500



SOUTH ELEVATION A-A

SCALE 1:100



ELEVATION B-B

SCALE 1:100

NOTE

CONFIGUATION IS INDICATIVE ONLY AND SUBJECT TO CHANGE DURING DETAILED DESIGN STAGE.

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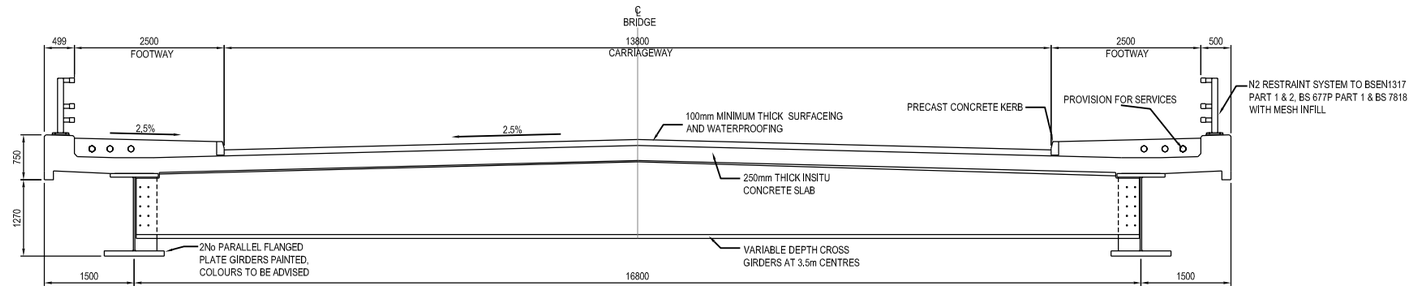

SECTION 1-1

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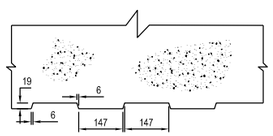


DETAIL OF FEATURED CONCRETE FACE

SCALE 1:10

Brigantine House
27-31 Cumberland Street
Bristol
BS2 8NL

Tel: 0117 924 4144
Fax: 0117 924 4145
e-mail: bristol@wyg.com

White Young Green

Consulting Engineers

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

Project:

WEST SOUTHALL
YEALDING BROOK BRIDGE

Drawing Title:

PROPOSED COMPOSITE STEEL LADDER DECK AND INTEGRAL ABUTMENTS

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
AS SHOWN	SLW	15.01.08	BS	15.01.02	DH	15.01.02

Project No.	Office	Type	Drawing No.	Revision
A012564-1	28	R	200	2

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

APPENDIX FRA 4

Minet Park Foot/Cycle Bridge General Arrangement

Notes :

1. This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety : All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. For general notes refer to Drawing No. 17056/100

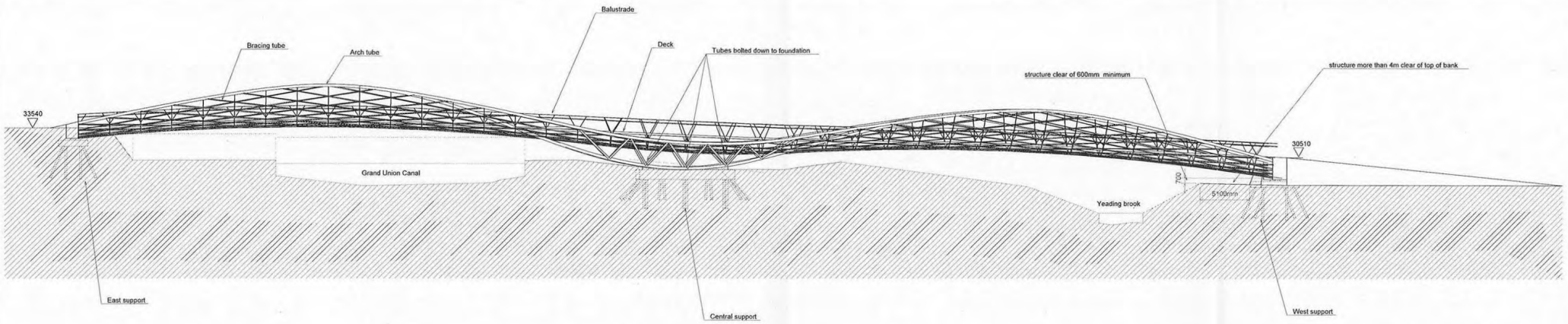
Rev	Date	Drawn	Eng	Amendment
P1	07/03/08		RN	Issued for planning

Minet Park Bridge

Plans, Elevations

Drawn RP	Eng RN
Scales at A1	at A3
Drawing No	Rev
17056.001/100	P1

PRICE&MYERS
Consulting Engineers
30 Newman Street London W1T 1LT
T 020 7631 5128 F 020 7642 1390
E name@pricemyers.com www.pricemyers.com



NORTH ELEVATION
Scale: 1:200

EAST ELEVATION
Scale: 1:100

PRELIMINARY ISSUE

Notes :

1. This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety :
   All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. For general notes refer to Drawing No. 17056/100

Rev	Date	Drawn	Eng	Amendment
P1	070306	RP	RN	Issued for planning

Minet Park Bridge

Elevations

Drawn RP	Eng RN
Scales at A1	at A3
Drawing No 17056.001/101	Rev P1

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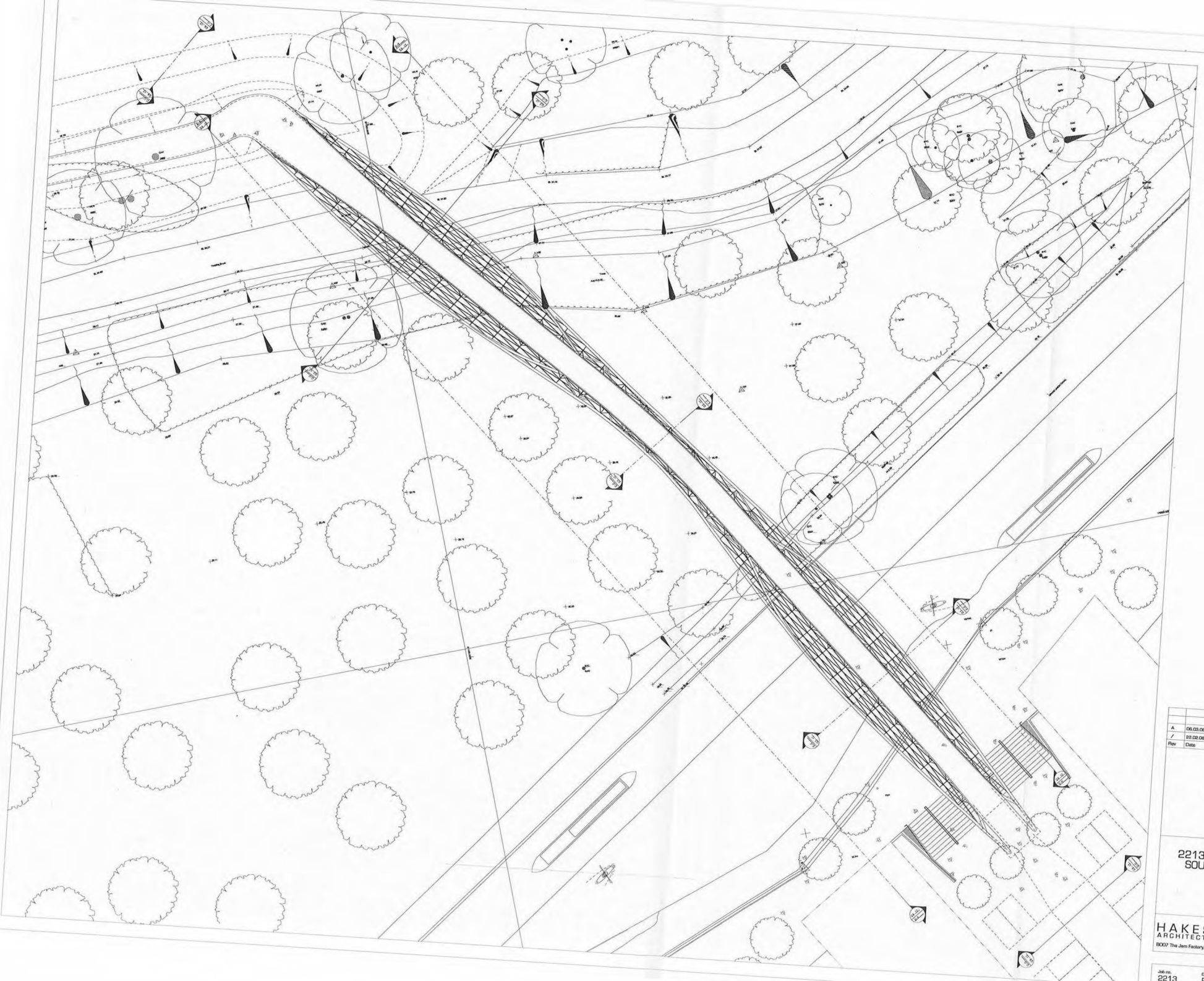
Consulting Engineers
30 Newman Street London W1T 1LT
T 020 7631 5128 F 020 7642 1390
E name@pricemyers.com www.pricemyers.com



NOTES:
Do not scale from this drawing

All information is to be checked on site for accuracy and fit. Only drawings with WD status with the most recent revision are to be used for construction. Report any discrepancies and omissions to Hakes Associates

Status codes:
EX = existing
SK = preliminary sketch design drawings
PP = drawings for planning submission
DD = design drawings for stage E/F
SP = space planning options
TT= tender
WD = working drawings for construction

Rev	Date	Description
A	05.03.08	Ammended geometry and re-issued for draft planning review
/	22.02.08	Issued for draft planning review

PLANNING

2213 MINET PARK BRIDGE SOUTHALL GAS WORKS

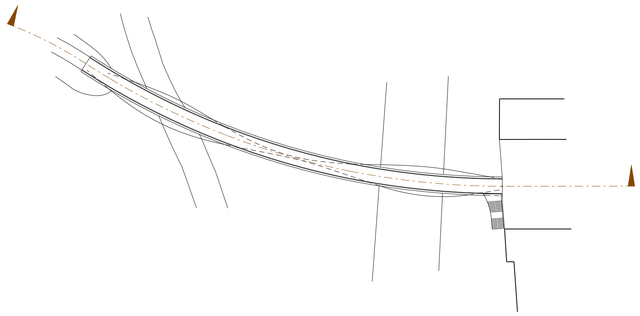
PLAN

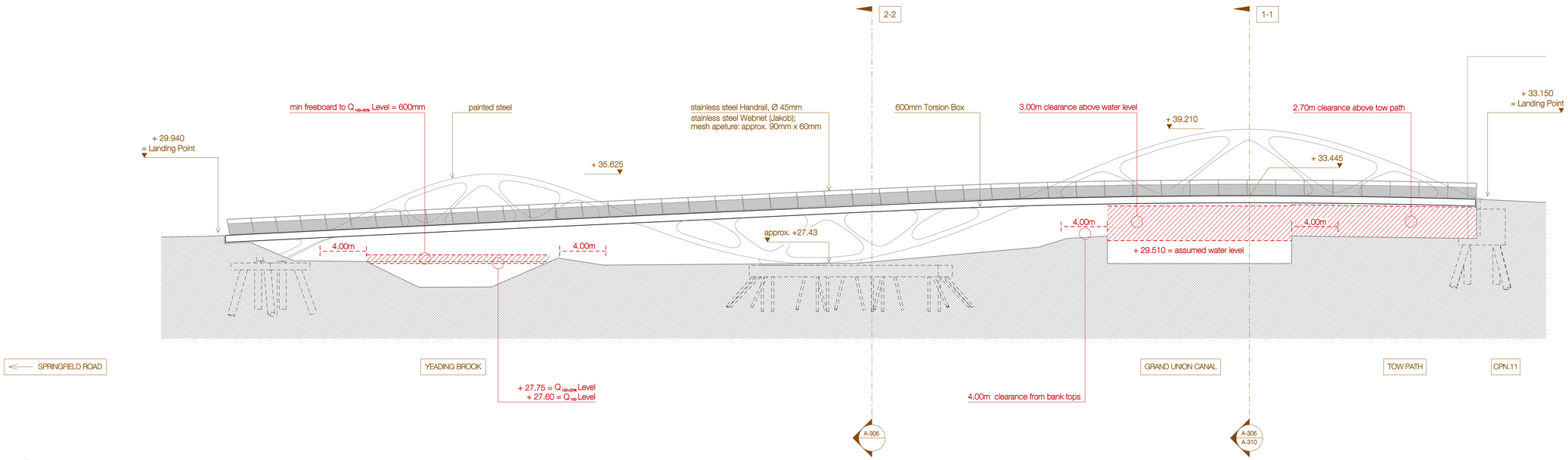
HAKES ASSOCIATES
ARCHITECTS AND BRIDGE DESIGNERS
BOO7 The Jam Factory, 27 Green Walk, London SE1 4TX. T: 020 7631 5330

Job no. 2213 | DWG NO PP-02 | REVISION: A | DRAWN: HH

APPENDIX FRA 5

Springfield Road Foot/Cycle Bridge





306 SECTION
SCALE 1:200

Rev	Date	By	Description

Notes:

Structural Engineer:
PRICE & MYERS LLP
30 Newman Street
London W1T 1LT

Client:
national grid properties
Priory Court
Pilgrim Street
London
EC4V 6DR
Tel: 020 7583 0146
Fax: 020 7329 7301

Architect:
marks barfield architects
60 Bromells Road
London SW4 0BG
Tel 020 7501 0180
Fax 020 7498 7103

Springfield Road Bridge

Drawing Title
Sections 02

Job No	Scale	Package No	Drawing No	Rev	Status
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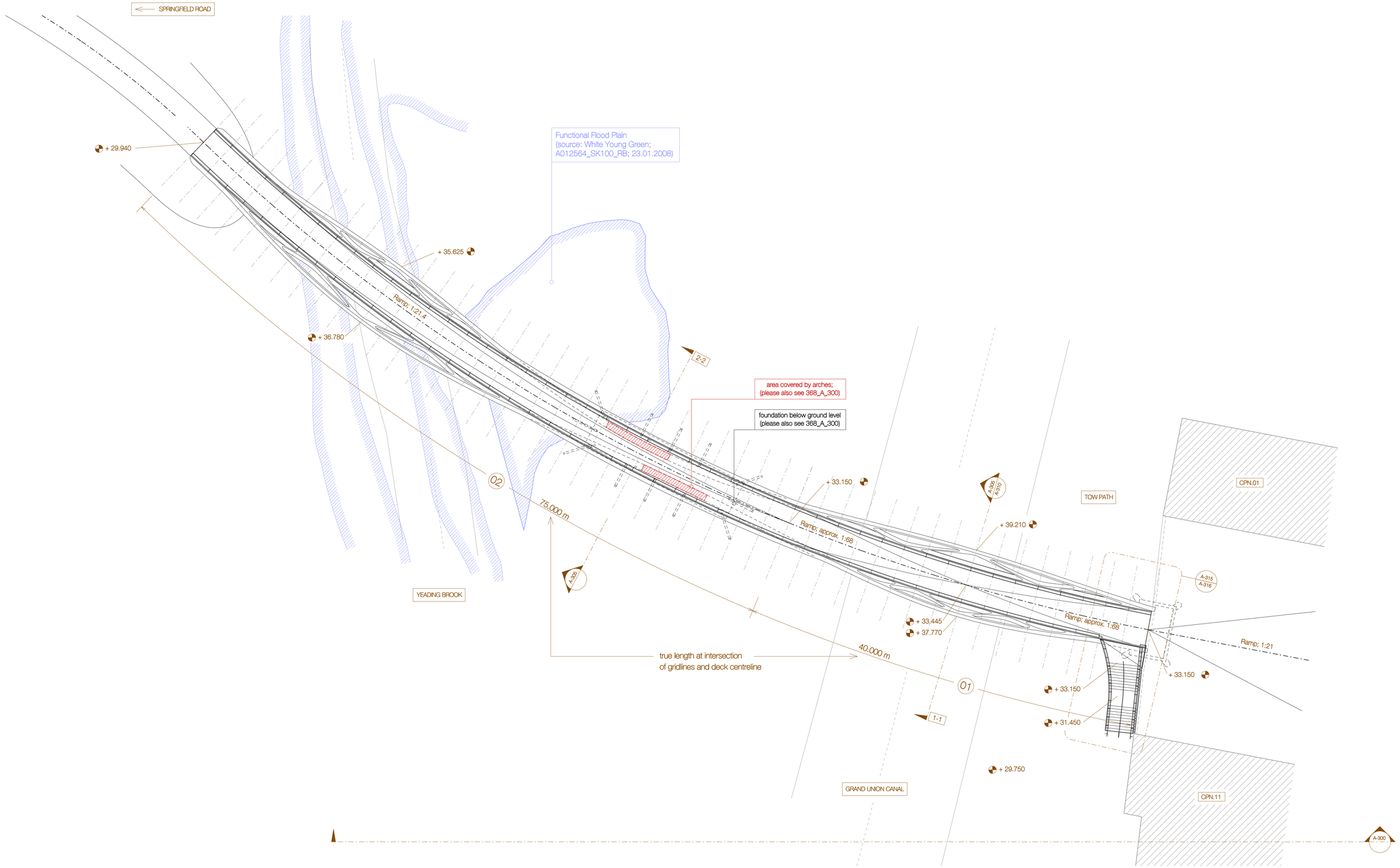
Date 21.02.2008	Checked SC				



200 DECK LEVEL
SCALE 1:200

Rev	Date	By	Description
A	21.02.08	TE	Stair + Arches updated
B	25.02.08	TE	Central footing added

Notes:

Structural Engineer:

PRICE & MYERS LLP
30 Newman Street
London W1T 1LT

Client:

national grid properties
Priory Court
Pilgrim Street
London
EC4V 6DR

Tel: 020 7583 0146
Fax: 020 7329 7301

Architect:

marks barfield architects
50 Bromells Road
London SW4 0BG

Tel 020 7501 0180
Fax 020 7498 7103

Springfield Road Bridge

Drawing Title
Deck Level

Job No	Scale
368	1:200 @ A1
Date	Checked
13.02.2008	SC

Package No	Drawing No	Rev	Status
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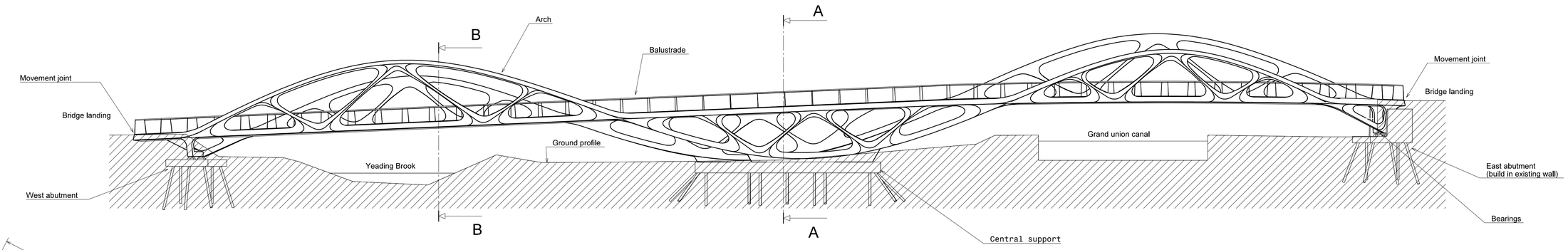

FRONT ELEVATION
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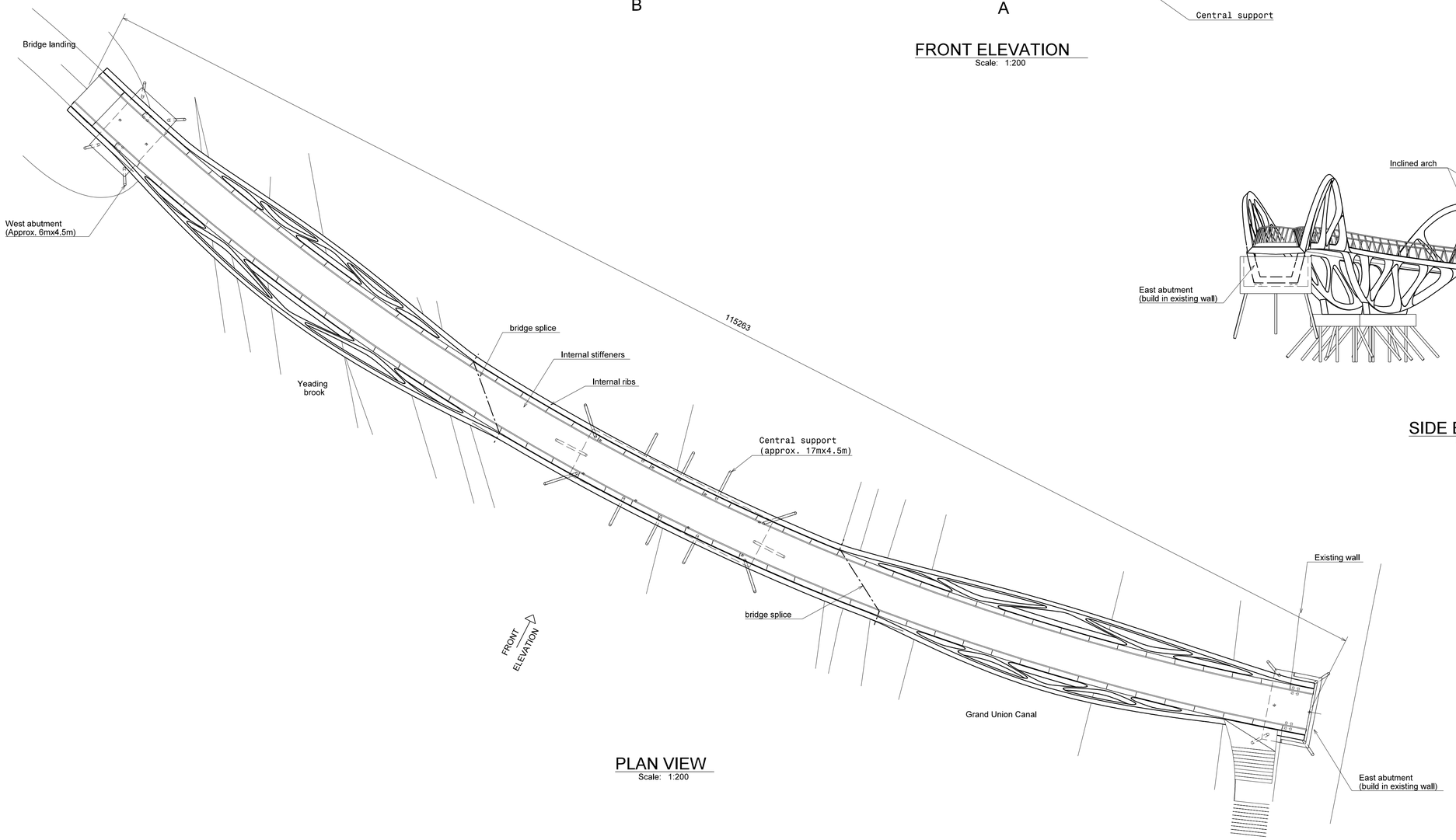

PLAN VIEW
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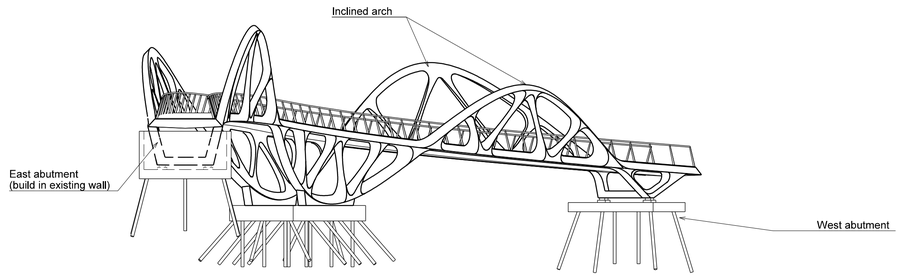

SIDE ELEVATION
Scale: 1:200

PRELIMINARY ISSUE

Notes :

1. This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety :
   All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4.

Rev	Date	Drawn	Eng	Amendment
P1	270208	EV	BG	Issued for planning

SPRINGFIELD ROAD
BRIDGE

PLAN AND ELEVATIONS

Drawn EV	Eng BG
Scales at A1	at A3
Drawing No 17056/100	Rev P1

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