RSA GEOTECHNICS LTD

FLOOD RISK ASSESSMENT

FOR

PROPOSED VILLAGE HALL, PARISH PARK,
THE STREET, BRUISYARD, SUFFOLK

FOR

BRUISYARD PARISH COUNCIL

REPORT NUMBER 10915

SEPTEMBER 2007

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1. INTRODUCTION

Consideration is being given by Bruisyard Parish Council to the development of the Parish Park, The Street, Bruisyard, Suffolk. The scheme comprises the construction of a new village hall, taking the form of a single storey Suffolk style barn at the northern end of the park, with associated car parking on part of the field adjacent to the Parish Park.

The Environment Agency website indicates that the Parish Park site falls within Flood Zone 3 of the river floodplain i.e. within an area that is estimated to face at least a 1% chance of flooding each year, ignoring the presence of defences.

All development proposals for Zone 3 should be accompanied by a site specific Flood Risk Assessment. Prior to conducting the quantitative Flood Risk Assessment PPS25 requires that the Sequential Test is satisfied.

This Flood Risk Assessment has been undertaken by RSA Geotechnics Limited on behalf of Bruisyard Parish Council, to support the planning application for the scheme. The Flood Risk Assessment has been carried out both quantitatively and qualitatively.

It is a requirement of a Flood Risk Assessment that a site survey is carried out, with site levels being related to Ordnance Survey levels using global positioning survey equipment (GPS). RSA Geotechnics Limited appointed East Anglian Land Surveys to carry out this aspect of the scheme.

Where possible, the Flood Risk Assessment has been conducted based upon guidance given in the Department for Transport, Local Government and the Regions' Planning Policy Statement 25 (PPS25): Development and Flood Risk, Annex E, 2006.

The Flood Risk Assessment was authorised in a letter from C.B.M Smith and Partners, the Chartered Architects for the scheme, dated 25 April 2007, acting on behalf of the Client, Bruisyard Parish Council.

2. GEOGRAPHY AND TOPOGRAPHY

The area proposed for the village hall development is the Parish Park at Bruisyard Street, in the parish of Bruisyard, Suffolk. The site is situated to the south of Rendham Road and east of The Street, opposite the Bridge Works, an agricultural machinery and tyre supplier. The Parish Park's southern boundary was the River Alde. The site can be approximately located by National Grid Reference TM 334 656. The site is approximately 100 m long northeast to southwest and 48 m wide east to west.

The Parish Park is situated in the Parish of Bruisyard, in the hamlet known as Bruisyard Street. There are extensive areas of pastureland/flood meadow to the west and east of the site along the course of the River Alde. North and south of the flood meadows, where the land rises away, there are large areas of open arable farmland. To the immediate northwest and northeast of the park there are residential houses along The Street and Rendham Road. The village of Bruisyard itself is situated around the parish church, which is located approximately 1 km northeast of the site on the edge of the river valley. The overall slope of the Parish Park is to the south towards the River Alde.

Along the southern boundary of the park, the River Alde is in the order of 2.0 m deep, in the order of 2.5 m wide at the base of the channel and in the order of 6.0 to 8.0 m wide at the level of the crest of the banks.

The topographical survey showed the lower site boundary adjacent to the River Alde to be at a level of about 15.39 mAOD. The northern boundary to the parish park, at the crest of the bank with Rendham Road was at a level of about 17.45 to 17.79 mAOD. Rendham Road

itself was at a lower topographic level than the park, rising eastwards from 17.00 mAOD at the junction with The Street to 17.67 mAOD outside the terraced houses on Rendham Road to the northeast of the park. The Street, running down the western edge of the site, sloped down from 17.00 mAOD at the junction with Rendham Road to 16.95 mAOD at the Humpback Bridge. Road Level on the crest of the bridge was 18.08 mAOD, sloping away to the south of the bridge to 17.15 mAOD at the crossroads of The Street and Low Road. Ground level increased southwards from the junction, to approximately 17.68 mAOD, 26 m to the south of the crossroads.

At the time of the first site visit (25 June 2007), there was up to 2.00 m of water in the watercourse and the River Alde was in flood, with floodwater inundating the flood meadows upstream of the site, between the parish church and Bruisyard Arch, partially flooding the garden of The Forge, located on the crossroads southwest of the humpback bridge and partially flooding the depression in the southern corner of the Parish Park field adjacent to the humpback bridge. The flood water running beneath the humpback bridge was at a level of approximately 16.70 mAOD. The flood meadows to the east of the site, adjacent to the track crossing between the Rendham Road and the Low Road were also partially inundated with floodwater. The water in the channel was muddy, fast flowing and carrying some debris. Upon the second site visit, carried out on 26 July 2007, there was up to 0.40 m of water in the watercourse. The bed of the watercourse was covered in loose debris and the banks were well vegetated, with little sign of the vegetation having been flattened by the floodwaters.

Three bridges were present along the River Alde in the vicinity of the site. The downstream bridge was present at the track crossing the flood meadows between the Rendham Road and the Low Road and was a concrete slab structure supported on concrete piers and ironwork.

Upstream of the site there were two further bridges likely to have an influence on the site; the one immediately adjacent to the southwest corner of the Parish Park was a brick built arched 'humpback' bridge. The bridge furthest upstream, on a trackway running from the parish church towards Sandpit Farm, was an Irish Bridge (Pedestrian Footbridge) located on the downstream side of a concrete lined ford, with a partial weir beneath the bridge. These have been detailed on the topographical survey.

3. FIELDWORK

The site was initially visited in June 2007 to make preliminary observations. On 25 June and the 26 July 2007 site walkover reconnaissance visits were made to the site and along the course of the River Alde upstream and downstream of the site. This involved walking the course of River Alde and noting details of the bridges and drainage entries to River Alde at points immediately upstream and downstream of the site as well as looking at the profile of the River Alde in the immediate vicinity of the site. At the time of the first walkover reconnaissance visit on the 25 June the River Alde was in flood, with the fords around Bruisyard running with over 0.5 m of water. The flood meadows upstream and downstream of the site were also inundated with floodwater, notably between the Bruisyard Arch and Church Farm upstream of the site and Bruisyard Arch and Yew Tree Farm down stream of the site.

The floodwaters were just below the underside of the humpback bridge in the southwest corner of the Parish Park and had filled the hollow in that corner of the park. Wood Road, to the west of Bruisyard Church was impassable to normal vehicular traffic and the concrete road bridge was completely submerged.

A level survey was carried out by East Anglian Land Surveys Ltd between the 26 and 30 July 2007. One of the stations established by the surveyors at each cross section location and the site itself were levelled relative to the Ordnance Survey ellipsoid reference system, using global positioning. The survey was processed on 10 August 2007. Permission was gained from the relevant landowners prior to the surveys being undertaken. Where access was limited, the topographic survey was supplemented by Digital Terrain Model (DTM) data

derived from 5 m resolution aerial survey data supplied by Geoperspectives Ltd. This data was tied in and correlated to the topographic survey.

4. BACKGROUND RESEARCH

4.1 Published Reference Material

Relevant information regarding the site was obtained from the Environment Agency, Ordnance Survey Maps, the 1981 Hydrogeological Map of Southern East Anglia, Sheet 1 at 1:125,000 scale and published information supplied by the British Geological Survey.

The River Alde was situated immediately to the south of the Parish Park. It formed a south-easterly flowing watercourse along the southern boundary of the site. Approximately 200 m upstream of the brick arched Humpback Bridge, known as Bruisyard Arch; the watercourse bends to take a westerly direction along a reach of approximately 400 m through the flood meadows, before bending northwest for 500 m to the ford and Irish bridge located 100 m south of the parish church. Downstream of the arched bridge the river flows in a strongly meandering easterly direction before bending south for 550 m through the flood meadows adjacent to Yew Tree Farm. One hundred metres southeast of the farm the river bends to take an easterly course for 200 m, passing under the concrete bridge on the track way, linking the Rendham Road to the Low Road, continuing downstream through flood meadows to Rendham. The 1:250,000 Series Hydrogeological Map indicates that it is a perennial stream in the vicinity of Bruisyard becoming an intermittent stream upstream in the vicinity of Brundish and a perennial river downstream of Rendham.

The Hydrogeological Map shows that the solid geology of the area comprises the Crag Group; this is overlain in the river valleys by fluvioglacial sands and flint gravels. The bed of the River Alde upstream of the site was found to comprise sand and gravel.

The Environment Agency provided an Indicative Floodplain Map, used by the Environment Agency to provide guidance in the control of development within floodplains. The Indicative Floodplain Map covered the area surrounding the site and was based upon survey records, computer models and historical flood records. A copy of the Indicative Floodplain Map is shown as an appendix attached to this report.

The Indicative Floodplain Map showed the whole of the site to be situated within the natural floodplain of the River Alde. The Environment Agency has defined the area of purple shading as being the extent of land considered to be at risk of flooding from a 1 in 100 year flood event from a main river (Flood Zone 3) and the area of blue shading as being the extent of land considered to be at risk of flooding from a 1 in 1000 year flood event from a main river (Flood Zone 2). The actual risk of flooding of a specific site is controlled by a number of factors including: the detail of the site topography; the presence of any flood defence structures (which are not shown on the Indicative Floodplain Map); the detail of surface water drainage of both the property and the highways and any constrictions in the watercourse. For this reason a reconnaissance visit of the site, levelling and computer modelling were carried out in order to provide more detailed site information with respect to the potential for flooding.

4.2 Anecdotal Information

During the course of the site survey the occupants of The Forge, located on the southern bank of the watercourse, to the immediate southwest of the humpback bridge advised the Engineer from RSA Geotechnics that in the years they had lived at the property there had been flooding of the Alde that had flooded their garden and The Street as far as the

crossroads of the Low Road and The Street. The Parish Park was also known to have partially flooded, but apparently never more than halfway up the park.

Mention was also made by several villagers that since the upgrade/repair works to the A12 road-bridge, downstream of Rendham, had been carried out, the flood levels at Bruisyard, when they occurred during the winter months, were lower than previously experienced.

4.3 Existing Flood Alleviation Measures

During the site walkover, notes were made upon the condition of any existing flood alleviation measures, as flood defences were not shown on the Indicative Floodplain Map.

No flood alleviation measures other than the natural flood meadows were observed in the immediate vicinity of the site. Local structures, which may influence the hydraulics of the river system in the local area, include:-

- the concrete lined ford, spill weir and Irish bridge forming the upstream boundary of the assessment 100 m south of the parish church;
- the brick arch bridge on the immediate western boundary of the parish park;
- the concrete and sheet metal field bridge downstream of the site, on the trackway crossing the flood meadows southeast of Yew Tree Farm, forming the downstream boundary of the assessment;
- surface water discharges via culverts and drains entering the watercourse.

4.4 Sources of Potential Flooding

The Planning Policy Statement 25: 'Development and Flood Risk', December 2006, outlines the assessment of the sources of potential flooding. The sources applicable to this site may include floodplain development upstream of the site. Examination of the Ordnance Survey map indicates that such development is unlikely to occur in this predominantly rural area and the local planning authorities would be aware of any such proposals.

The evidence that has been obtained suggests that the most likely cause of flooding of this site is the occurrence of a major flood event, of a 1 in 20 year or greater return period, which would supply the necessary volume of floodwater to inundate the natural, functional floodplain of the River Alde. These conditions do not necessarily have to coincide with exceptional weather conditions, as the catchment has a flash response, reacting quickly and potentially violently to storm precipitation. Flood waters in the Bruisyard area are likely to rise more quickly and be of higher velocity than those further downstream. The arched bridge would also have an affect on the level and extent of flooding, especially if blocked by debris, resulting in the main flow of floodwater diverting around the structure.

5. REQUIREMENTS UNDER PPS25

Planning Policy Statement PPS25 sets out many requirements in relation to new development and the potential of flood risk. PPS25 also defines responsibilities of many parties involved in the planning and development process. It also states that a risk based approach should be adopted.

In broad terms the Local Planning Authority (LPA) makes the decision about whether development can be permitted within an area of risk from flooding. During the planning process the LPA consults with the Environment Agency (EA) who have the necessary expertise to advise with regard to flood issues. The EA provide advice to the LPA and the LPA is responsible for the final decision about permission for any development likely to be impacted by fluvial or tidal flooding.

Under the risk based approach a sequential test is required and this is particularly important for sites which are within Zone 3. This test is required to demonstrate that no other reasonable available site for the proposed development exists within either a Flood Zone 1 or Flood Zone 2 area.

The Parish Council have carried out a sequential test for the development which established that no suitable alternative sites within Flood Zone 2 or Flood Zone 1 are available for the development within the bounds of the village. A copy of the Parish Council letter which demonstrates that no alternative site exists, has been included in Appendix 4.

Flood Zone 3 is further divided into Zone 3a – High Probability of Flooding and Zone 3b – The Functional Floodplain. Based on the Flood Zone 3 classification, Table D1 of PPS25, states:-

Zone 3a – High Probability of Flooding

Zone 3a comprises land assessed as having a 1 in 100 or greater annual probability of river flooding' and that only water – compatible and less vulnerable land uses from Table D2 are appropriate in this zone, whilst highly vulnerable land uses should not be permitted. More vulnerable land uses and essential infrastructure should only be permitted in Zone 3a if the Exception Test is passed and should be designed and constructed to remain operational and safe for users in times of flood.

Zone 3b – The Functional Floodplain

Zone 3b comprises land where water has to flow or be stored in times of flood, identified as land which would flood with an annual probability of 1 in 20 or greater in any year. Only water – compatible land uses and essential infrastructure that has to be there should be permitted in this zone and should be designed and constructed to remain operational and safe for users in times of flood, result in no net loss of floodplain storage, not impede water flow and not increase flood risk elsewhere. Essential Infrastructure in this zone should pass the Exception Test.

The proposed development may be classed as having a Less Vulnerable classification based on Table D2 of PPS25. Based on the Flood Risk Vulnerability and Flood Zone Compatibility in Table D3 of PPS25, if the development is shown to fall within Flood

Zone 3a, then the development is appropriate. If the development is shown to be within Flood Zone 3b – The Functional Floodplain, then the development should not be permitted.

Under the requirements of PPS25 the LPA can reject proposals for development in Zone 3b. They will seek advice from the EA which they have the option to disregard. The EA are likely to state that development such as a village hall should not be permitted within the functional flood plain.

The site specific flood risk assessment presented in this report established that the proposed village hall falls within the functional flood plain. Notwithstanding the potential difficulties in persuading the LPA to permit the proposed development this report gives an account of the quantitative assessment (section 6) and discusses the implications and possible mitigation factors (section 7) which may help the Parish Council gain planning permission.

6. QUANTITATIVE FLOOD RISK ASSESSMENT

A quantitative risk assessment has been carried out by RSA Geotechnics Limited. The assessment was carried out using the Flood Estimation Handbook (FEH) Rainfall-Runoff Method (Volume 4 of the Flood Estimation Handbook). Catchment descriptors were obtained from the Flood Estimation Handbook CD-ROM Version 2 (2006) and were analysed using Mike 11, which forms part of the DHI software (2007). Mike 11 is a software package that has been developed for modelling inland surface waters.

A copy of the summary of the catchment descriptors has been appended to this report. The descriptors comprise details such as the area of the catchment, its average altitude and aspect, the maximum length of drainage path, median annual rainfall figures, the percentage run-off and the extent of urban development.

Mike 11 was used to create a hydrodynamic model of the River Alde from the ford and Irish bridge upstream of the site, to a position immediately downstream of the concrete and steel field bridge located southeast of Yew Tree Farm, downstream of the site. The model was run as an open network. A plan profile and longitudinal sections of the river valley were derived from the site survey and a 1:10,000 scale Ordnance Survey Sheet of the surrounding area as well as from a 5 m resolution Digital Terrain Model (DTM).

In accordance with Volume 4 of the FEH, Mike 11 can use the catchment descriptors to generate a triangular instantaneous unit hydrograph. This method was used to determine the upstream boundary conditions of the hydraulic model i.e. by calculating the 1:20, 1:100 and 1:1000 year flood discharge with a 20% increase in peak flow due to climatic change

(corresponding to a 1:35, 1:140 and 1:1000 year rainfall event as indicated in Figure 3.2 of Volume 4 of the FEH) at the head of each of the tributaries.

A manual check, using equation 2.10 of Volume 4 of the FEH, was carried out on the calculation of the unit hydrograph time to peak and storm duration for the input at the head of the main watercourse, in order to provide a check on the results from Mike 11. The results of the manual check have been reproduced below. They did confirm the results of the analysis carried out by Mike 11, as indicated by the computed hydrograph, which has been appended to this report.

$Tp(0) = 4.270\ DPSBAR^{-0.35}\ PROPWET^{-0.80}\ DPLBAR^{0.54}\ (1+URBEXT)^{-5.77}$

$= 4.270 \times 22.6^{-0.35} \times 0.26^{-0.80} \times 5.84^{0.54} \times (1+0.0058)^{-5.77}$

$= 10.56$ hours

The time to peak Tp(0) must be adjusted by Tp($\triangle$T) with a data interval of 10 to 20% of Tp(0) usually being suitable. For a Tp(0) of 10.56, $\triangle T = 1$ hr. So $Tp(\triangle T) = Tp(0) + \triangle T/2$ giving a revised time to peak (Tp) of 11.25 hrs.

The design storm duration is calculated from the unit hydrograph time to peak (Tp) using equation 3.1 of Volume 4 of the FEH:-

$D = Tp\ \{1+(SAAR/1000)\}$

$= 11.25\ \{1+(588/1000)\}$

$= 17$ hours

A second check, using the CEH Wallingford, Re-FEH rainfall runoff method software, was carried out using the derived storm duration for each of the 1 in 20, 1 in 100 and 1 in 1000 year flood events. The results of the calculations are presented on the Audit Sheets in Appendix 3 and show the design rainfall and resulting flood hydrographs without the influence of climatic change. These results also agree with the base values used by the Mike 11 Model.

The downstream boundary comprised a dynamic water level. The value used was calculated from the water level vs. discharge curve (q/h) for the cross sectional area of the downstream boundary.

Using Mike View, results from the DHI model can be presented in a variety of forms. Plots of the maximum water levels that were calculated during the modelling have been presented for chainages 1527 m, 1533 m and 1542 m downstream of the Irish bridge forming the upstream hydraulic boundary of the model. These sections correspond to sections of the river valley just upstream of the arched bridge adjacent to the site, just downstream of the arched bridge and along the eastern boundary of the parish park, forming the eastern boundary of the site.

The maximum water level for each of the three modelled flood events was associated with the upstream end of the site, with the flood level decreasing downstream along with the topography. Based on these values, it is considered that the DHI model indicates an average flood level across the site of approximately 17.48 m above Ordnance Datum for a 1:20 year flood event. This level defines the maximum extent of Zone 3b ‘the Functional Floodplain’, according to PPS25. The model also indicated an average flood level of 17.50 mAOD for a 1:100 year flood event, defining the maximum extent of Zone 3a; that affected by a High

Probability of Flooding. The model also derived an average flood level of 17.57 mAOD for a 1:1000 year extreme flood event, which defines the maximum extent of Zone 2; that affected by a Medium Probability of Flooding.

In accordance with Planning Policy Statement 25: Development and Flood Risk, Annex B consideration has been given to climatic change and the model was run with discharge inputs increased by 20%. Climatic change has been considered further in Section 6 of this report.

The findings indicate that the proposed development is likely to be affected by 1:20 year flood events as well as 1:100 and 1:1000 year flood events. The development site is therefore shown to be located within Zone 3b, the functional floodplain of the River Alde.

The majority of the Parish Park (Approximately 94%) falls within Flood Zone 3b as shown on drawing number 10915/1. The proposed building is mostly located within Zone 3b.

Part of the north east corner of the park, an area approximately 10 m by 38 m, is above the 1:20 year flood level and falls within Flood Zone 3a; this equates to only 6% of the Parish Park.

7. IMPLICATIONS FOR THE PROPOSED DEVELOPMENT

Bruisyard Parish Council is giving consideration to the development of part of the Parish Park at Bruisyard Street, Bruisyard, Suffolk to form a new village hall which would be used for meetings and functions but would not be occupied full time. Based upon the flood risk assessment, fieldwork and research for the site, the following comments can be made.

The Indicative Floodplain Map provided by the Environment Agency showed the whole of the site to fall within the fluvial floodplain. The Indicative Floodplain Map indicates that in the vicinity of the site the fluvial floodplain lies predominantly to the northern side of the River Alde, which suggests a maximum flood level of 17.00 mAOD based on a spot height at the junction of The Street and Rendham Road.

The findings of the numerical flood risk assessment have established a potential flood level of 17.48 m above Ordnance Datum for the site during a 1 in 20 year flood event, which agree with the indicative floodplain map, placing the site fully within Flood Zone 3b – The Functional Floodplain. Under current legislation, the Local Authority, Suffolk Coastal District Council, in liaison with the Environment Agency, would be expected to reject any planning application for any non-essential or non water-compatible development within Zone 3b – The Functional Floodplain.

The site survey has shown that the top of the arch of the Bruisyard Arch humpback bridge is at a level of 17.34 mAOD. This will impose a hydraulic constraint on the watercourse upstream of this point. The recent raising of the concrete ramp, adjacent to the bridge, outside the yard to the Bridge Works, will also constrain the flow on the north-eastern bank,

forcing floodwaters towards the south-western bank and the garden of 'The Forge', as well as forcing floodwaters to find a way around the high point, flowing through the yard itself north of the bridge and across the road into the Parish Park, potentially causing flood levels to rise quicker across this area.

Further to this, consideration also needs to be given to inputs to the watercourse from surface water run-off from the site, the surrounding roads, all of which run downslope to the river, as well as run-off from adjoining areas and from surface water discharges via culverts, to the watercourse, which will respond instantaneously. Mike 11 does not take these inputs into account as part of the modelling and these factors would potentially have the effect of increasing the flood level.

The 17.48, 17.50 and 17.57 mAOD contours for the 1:20, 1:100 and 1:1000 year flood events have been plotted on a copy of the site survey, included later in this report as drawing number 10915/1. In order to be outside of Zone 3b, the proposed development would need to be constructed at or above the 1 in 20 year flood level for the area, with a finished floor level above 17.48 mAOD. Consideration could be given to moving the building to the north east corner of the site immediately adjacent to the northern site boundary where part of the park (approximately 380 m^2) is located within Flood Zone 3a. However the area is only just larger than the proposal footprint of the village hall and such a location may also be aesthetically unacceptable.

It is also necessary to ensure that an exit route, above the flood level is provided, in order to provide protection for potential users of the development. During any floods at or greater than a 1 in 20 year event, the site itself, the humpback bridge, The Street and part of the

Rendham Road to the northwest of the site will be submerged beneath approximately 0.40 to 0.50 m of floodwater.

As there is potentially no flood free exit from the proposed village hall during times of flood it is recommended that consideration be given to the installation of a flood warning system. At best this could be an automatic alarm system located near the bridge within the river channel set at an appropriate level. The alarm should sound in the hall to alert occupants to the danger of a rising river level so that the building and site can be safely evacuated. As an alternative it may be possible to set up a policy of checks for flood warnings prior to any use of the hall. This would require consultation with the Environment Agency flood warning and flood alert system, via telephone or the internet.

From discussions with the Environment Agency, it has been established that the site is covered by the 'Floodline' service, which sends out texts, emails and faxes to properties located within flood plains. This system also updates the flood warning data on the Environment Agency website, which can be found in the Flood section, under 'Current Flood Warnings in Force' by entering the name of the village into the search engine.

However, during the discussion it became apparent that the warning system for Brusiyard relies on the monitoring station at Farnham, downstream of the site. By the time this station has registered an impending flood event, it is likely that the sections of the River Alde upstream of the monitoring station will already be in flood. The installation of a monitoring/alarm station adjacent to the site is still the best option.

It is possible that the cost of the installation and maintenance of the alarm system at Bruisyard Arch could be shared between the Environment Agency and the Parish Council, as

the installation would extend and improve the Environment Agency's coverage of the area and the River Alde in particular, as well as providing a benefit to the parishioners of Bruisyard itself. However, discussions would need to be undertaken with the Environment Agency to further explore this possibility.

Both the Environment Agency and insurance companies will look more favourably on a scheme that incorporates mitigation planning and design. The Department of Transport, Local Government and the Regions publication "Floods" (February 2002) provides interim guidance for improving the flood resistance of domestic and small business properties. This document incorporates some advice on the flood resistance of construction materials and techniques for tanking. For instance,

i) solid concrete floors are preferred to suspended floors as they provide an effective seal against water rising up through the floor

ii) should a suspended floor be adopted for the scheme additional flood protection can be achieved by draining the subfloor surface to a drainage point

iii) water resistant paints or coatings are available that help prevent floodwater soaking into external walls.

It is understood from Bruisyard Parish Council that the proposed scheme is to broadly follow this guidance. It is intended that the building will be constructed to permit water entry in the event of flooding, without damage to the building fabric, with impermeable stone/tiled floors. Initial proposals include internal and external walls formed of 600 mm high brick walls, with alternative construction above, comprising close boarded wooden external walls and presumably plasterboard walls internally. The initial proposals show all electrical points

will be above 600 mm FFL and power will drop from the roof within the walls. The underfloor heating for the development will be designed to be secure from flooding and the building's sewage plant will be designed to continue to operate and not pollute the floodwater. Furniture within the building will be stored in waterproof secure containers, so will not be washed away in any floodwater.

The proposed floor level for the building is shown on the Architects drawing to be approximately 3.06 m above the base of the channel in the lower southeast corner of the Parish Park, which from the results of the topographical survey is 14.38 mAOD. The proposed floor level of the current design is therefore at 17.44 mAOD, which roughly equates to the current ground level, which ranges from 17.14 to 17.52 mAOD beneath the proposed building footprint. The proposed design therefore only requires slight alteration to bring finished floor level to the Zone 3a flood level of 17.50 m, which with a 600 mm clearance puts the top of the masonry cladding wall and any electrical sockets at approximately 18.10 mAOD, well above the 1 in 100 and 1 in 1000 year flood levels. The proposal also allows for the lowering of ground levels to the north of the building as a flood compensation area.

The proposed building footprint itself is also located close to the edge of the functional floodplain in the top northwest corner of the Parish Park and the building footprint has a small surface area of approximately 230 m^2. It can be seen that the building footprint is so small in relation to the area of the floodplain that it is unlikely to affect the hydraulics of the floodplain, (which in the immediate vicinity of the site is approximately 165000 m^2) or adjacent properties. Furthermore, the proposed building will be close to the edge of the floodplain where any water flow would be at a low velocity. These factors help to reduce the risk to the building and its occupants.

The car park for the village hall will also be constructed on part of the adjacent field, accessed from the Rendham Road. The car park will be constructed of concrete grass blocks to allow natural percolation of rainwater and will not significantly increase the surface runoff.

Consideration will also need to be given by the Parish Council as to the acceptable functions that can be hosted at the village hall. Higher risk activities such as playgroups may be unacceptable due to the presence of very young children, unless a robust flood warning system is put in place.

Taking all of the above into account, the development may be feasible for this location. However the final judgement lies with the Local Planning Authority, who will consult with the Environment Agency, as the construction of the village hall would be contrary to the current National Government planning policy with regard to the construction of new buildings within river floodplains, according to guidance given in PPS25 – Development and Flood Risk, 2006.

8. LIMITATIONS

Flood forecasting only gives a general indication of risk areas, as it is not a precise science. The quantitative flood risk assessment can only be as reliable as the model and the data that has been used. There is a possibility that a statistically rarer flood could occur within the lifetime of the proposed development. Furthermore, there is a possibility that such a flood could occur in successive years. Equally, being in a natural river floodplain does not necessarily mean that the site would definitely be flooded, as many other factors are accountable.

Flooding can also occur from other sources such as sewer overflows, road drains, burst water mains and run-off from local hillsides, all of which were beyond the remit of this assessment.

RSA Geotechnics Limited have based this report on the sources detailed earlier in this report and believes them to be reliable but cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

Although beyond the remit of this report it is recommended that the advice of the insurers be sought prior to commencing the development, because there may be a reluctance to issue insurance to a site that entails redevelopment within the area that has been designated as fluvial floodplain.

This report has been prepared for the sole internal use and reliance of Bruisyard Parish Council. This report shall not be relied upon by other parties without the express written authority of RSA Geotechnics Limited. If any unauthorised third party comes into possession of this report they rely upon it at their own risk and the authors owe them no duty of care and skill.

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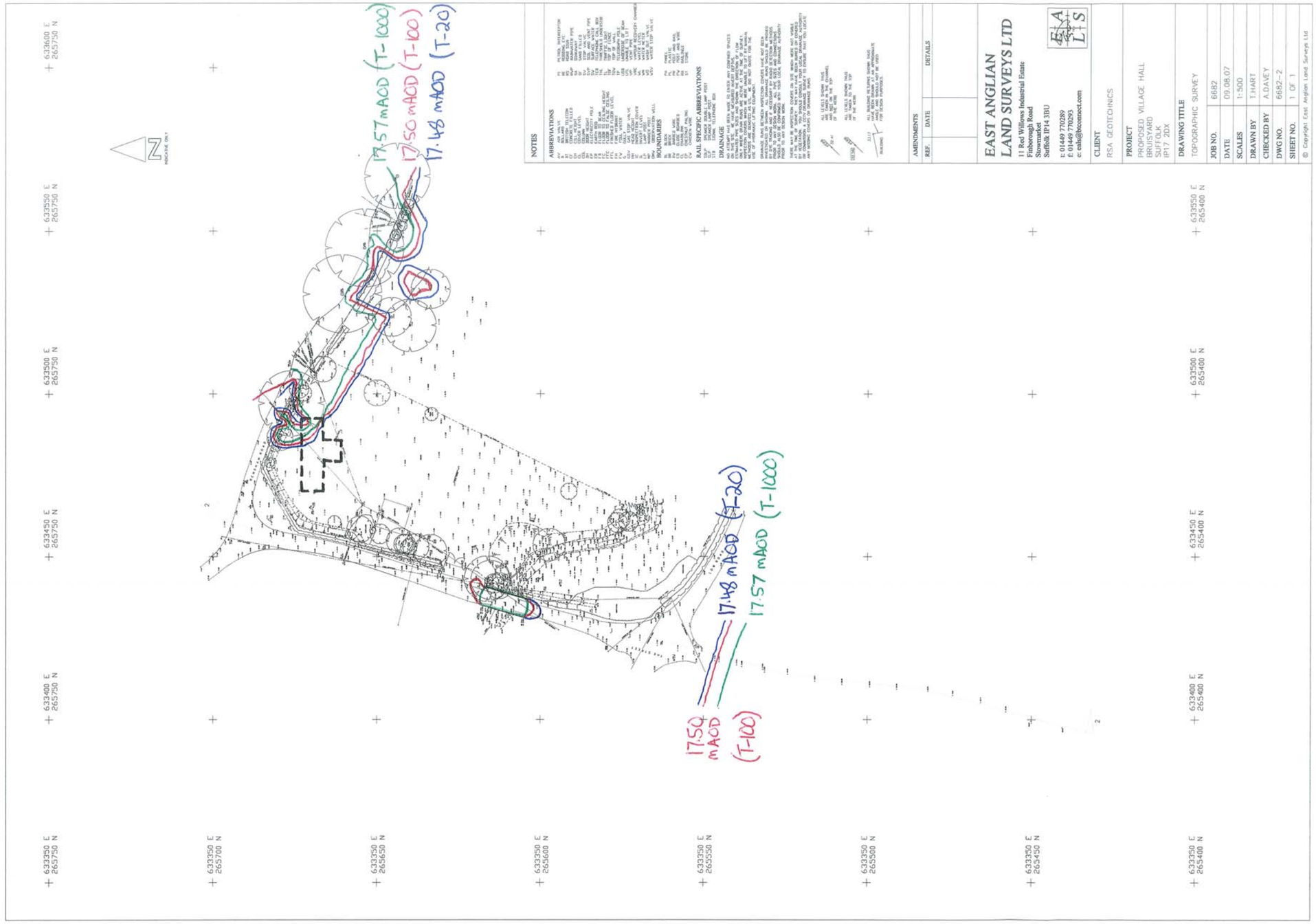
Geotechnical Engineer

G J T SOUTHGATE, BSc, CEng, MICE

Director

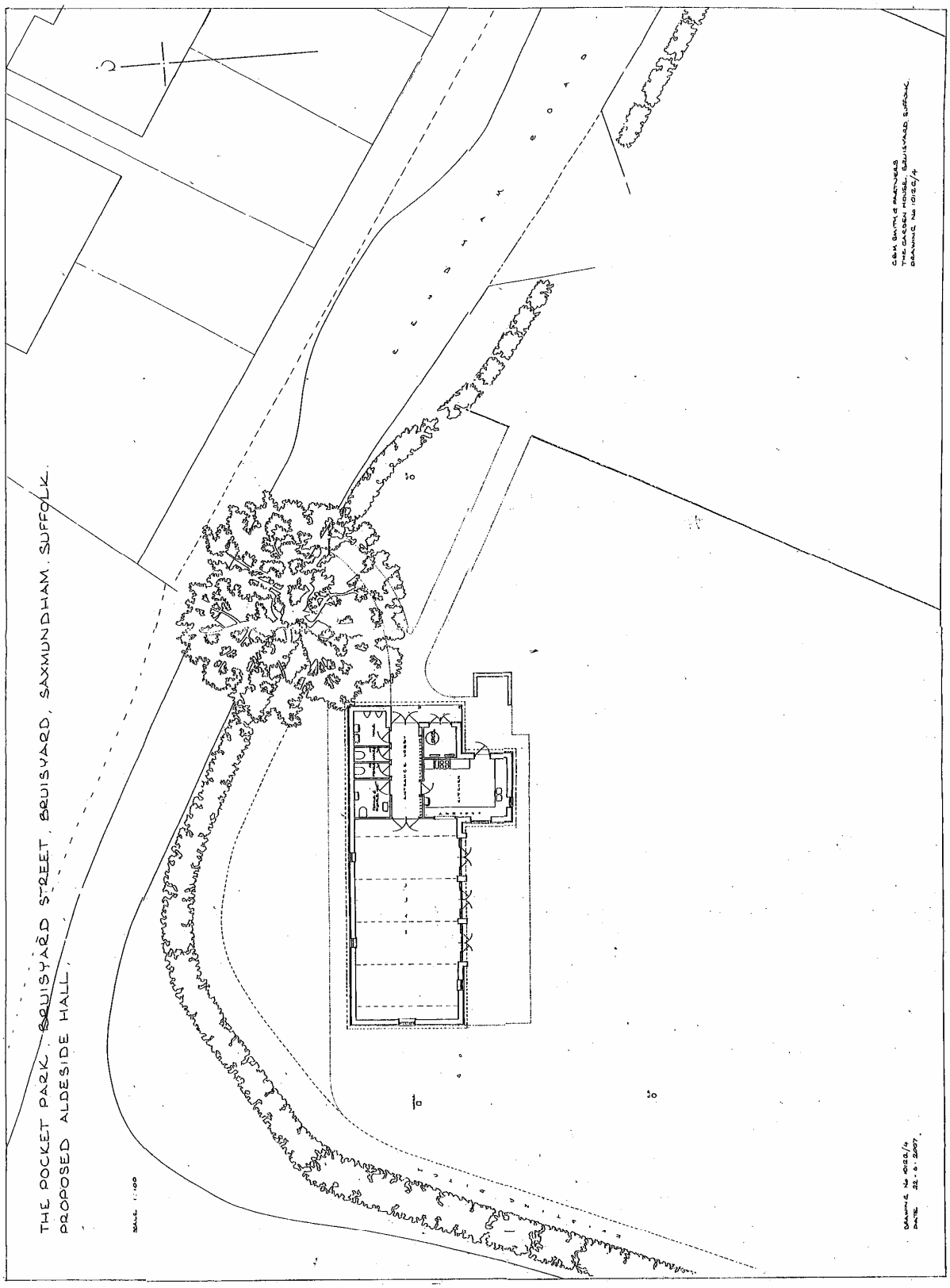
Report Number 10915

12 September 2007



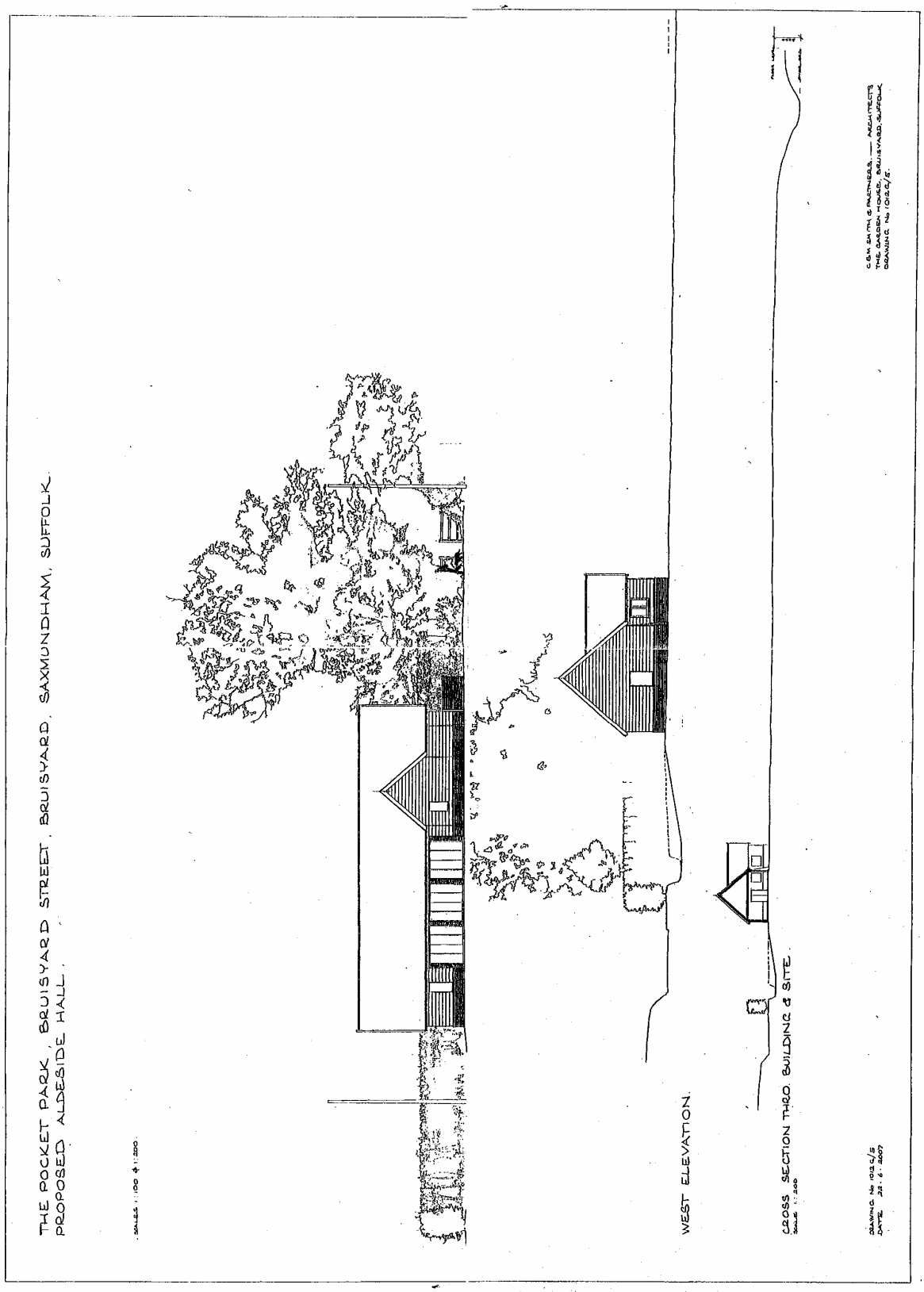
NOTE: All locations are approximate

SITE PLAN SHOWING PREDICTED 1 IN 20 YEAR, 1 IN 100 YEAR AND 1 IN 1000 YEAR FLOOD EVENT CONTOURS PROPOSED VILLAGE HALL, PARISH PARK, THE STREET, BRUISYARD, SUFFOLK	Date 12 SEPTEMBER 2007 Scale NOT TO SCALE
RSA GEOTECHNICS LIMITED	Drawing No 10915/1 Version A



NOTE: All locations are approximate

PROPOSED DEVELOPMENT LAYOUT PLAN	Date 12 SEPTEMBER 2007
PROPOSED VILLAGE HALL, PARISH PARK, THE STREET, BRUISYARD, SUFFOLK	Scale NOT TO SCALE
RSA GEOTECHNICS LIMITED	Drawing No 10915/2 Version A



NOTE: All locations are approximate

PROPOSED DEVELOPMENT ELEVATIONS	Date 12 SEPTEMBER 2007
PROPOSED VILLAGE HALL, PARISH PARK, THE STREET, BRUISYARD, SUFFOLK	Scale NOT TO SCALE
RSA GEOTECHNICS LIMITED	Drawing No 10915/3 Version A

APPENDIX 1

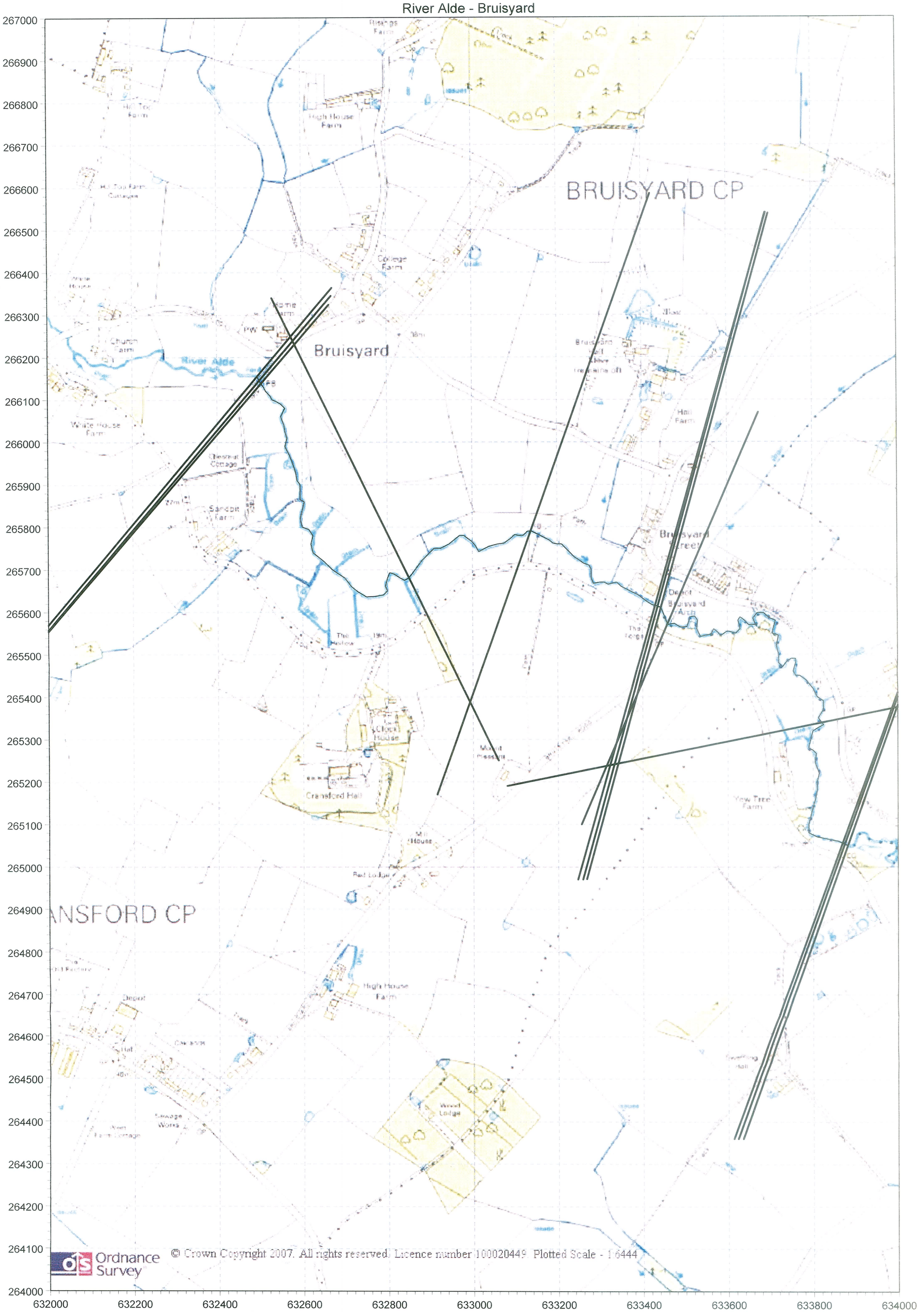
TOPOGRAPHICAL SURVEY DATA

THE DRAWINGS FOR APPENDIX 1 ARE ATTACHED ON THE CD

APPENDIX 2

EXTRACT OF 1:10,000 SERIES ORDNANCE SURVEY SHEET SHOWING LOCATION OF CROSS SECTIONS AND EXTENT OF MODELLED CHANNEL

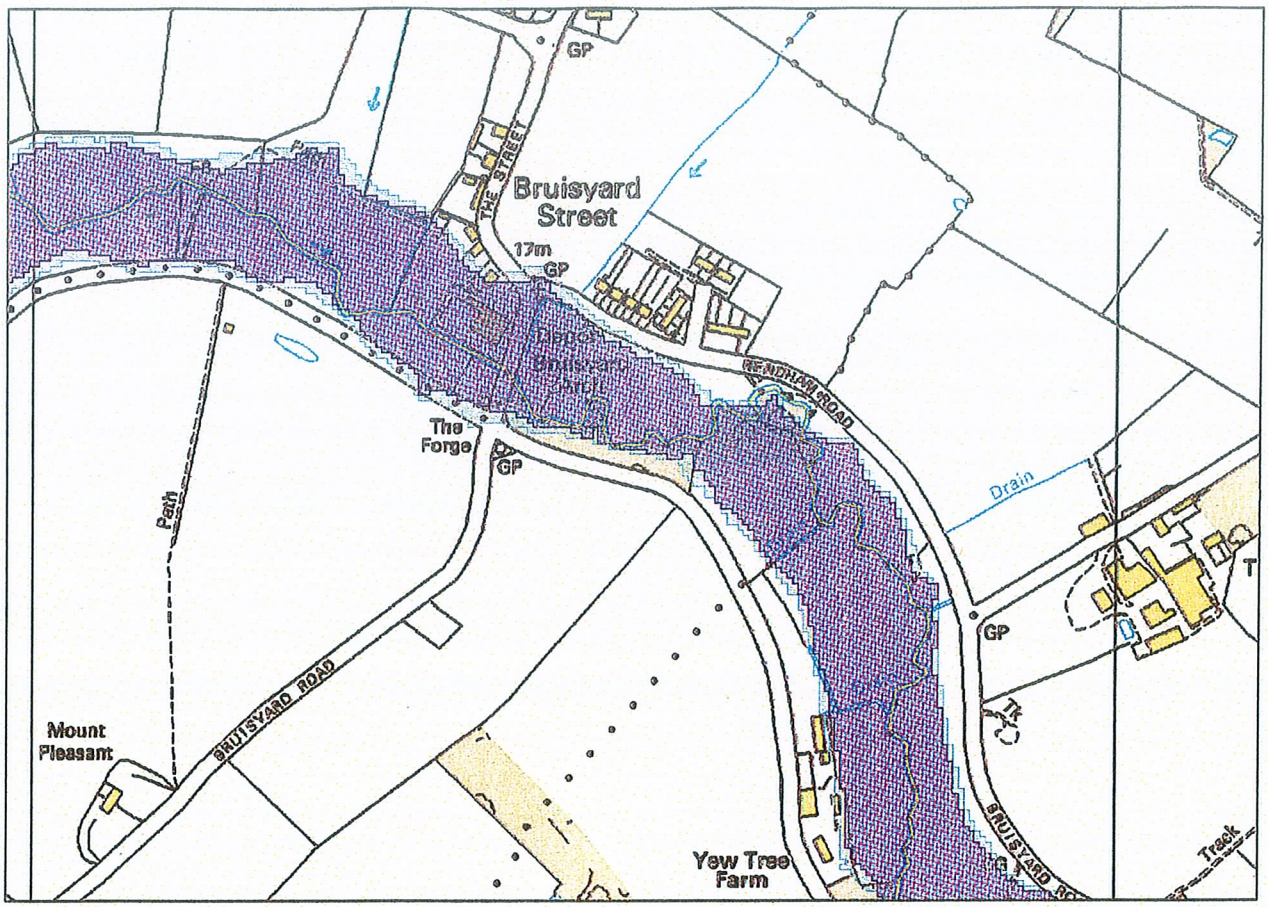
River Alde - Bruisyard



APPENDIX 3

- INDICATIVE FLOODPLAIN MAP SUPPLIED BY THE ENVIRONMENT AGENCY
- THE CATCHMENT DEFINED BY THE FEH-CD ROM VERSION 2.0
- RESULTS OF THE QUANTITATIVE FLOOD RISK ASSESSMENT:-
  - FEH CATCHMENT DESCRIPTORS FOR THE UPSTREAM END OF THE MAIN TRIBUTORY
  - T-20, T-100 AND T-1000 FLOOD HYDROGRPAHS COMPUTED FOR THE INPUT AT THE HEAD OF THE MAIN WATERCOURSE DERIVED FROM THE Re-FEH SPREADSHEET USING THE CATCHMENT DESCRIPTORS
  - T-20, T-100 AND T-1000 FLOOD HYDROGRAPHS COMPUTED BY MIKE 11 FOR THE INPUT AT THE HEAD OF THE MAIN WATERCOURSE INCLUDING 20% INCREASE IN PEAK FLOW DUE TO CLIMATIC CHANGE DERIVED FROM CATCHMENT DESCRIPTORS
  - CROSS SECTIONS FOR T-20, T-100 AND T-100 FLOOD EVENTS AT THE PARISH PARK, SHOWING THE CALCULATED FLOOD LEVELS DERIVED FROM THE MIKE 11 MODEL

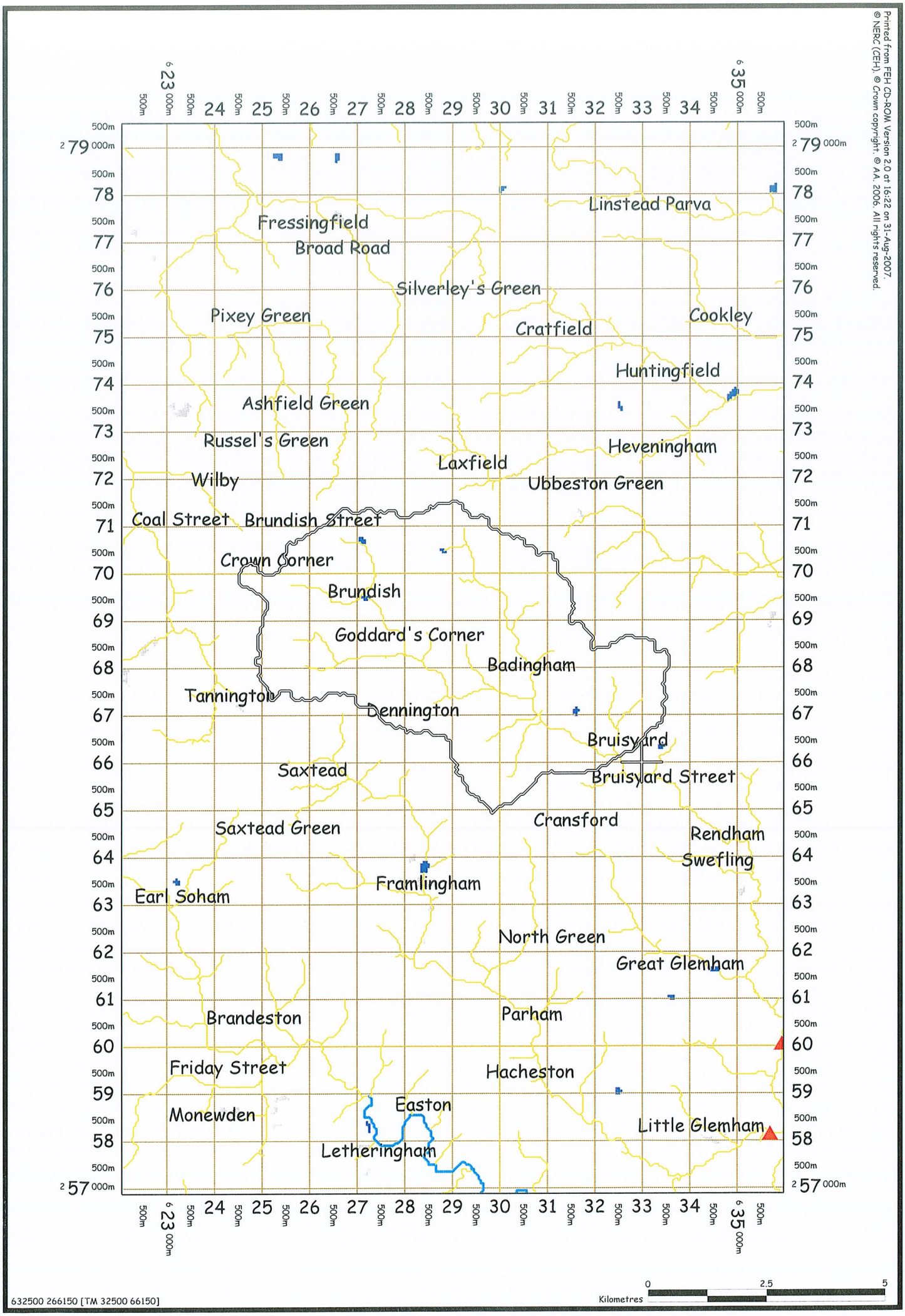
Flood Map, Bruisyard



Layer	Key
Flood Zone 3 - Anglian Eastern Area	
Flood Zone 2 - Anglian Eastern Area	

Flood Zone 3 - Anglian Eastern Area	The best estimate of the floodplain associated with a 1:100 year fluvial or 1:200 year tidal event.
Flood Zone 2 - Anglian Eastern Area	The best estimate of the floodplain associated with a 1:1000 year return period fluvial/tidal event.

The Flood Zone Map is the output of recent modelling work undertaken to establish areas of flood risk associated with fluvial (river based) and tidal flooding. It is primarily to aid in the planning process and does not distinguish visually between tidal and fluvial flood plains. The flood zones



632500 266150 [TM 32500 66150]

CATCHMENT DECRIPTORS FOR RIVER ALDE AT BRUISYARD

VERSION	FEH CD-ROM Version 2
EXPORTED AT	12:52:11 GMT Thursday 23 August 2007
CATCHMENT	TM 32500 66150
AREA	34.12
ALTBAR	48
ASPBAR	131
ASPVAR	0.21
BFIHOST	0.326
DPLBAR	5.84
DPSBAR	22.6
FARL	0.989
LDP	11.69
PROPWET	0.26
RMED-1H	11
RMED-1D	29.9
RMED-2D	37.5
SAAR	588
SAAR4170	614
SPRHOST	43.39
URBCONC1990	-999999
URBEXT1990	0.0015
URBLOC1990	-999999
URBCONC2000	0.503
URBEXT2000	0.0058
URBLOC2000	0.904
C	-0.02195
D1	0.30673
D2	0.28252
D3	0.24269
E	0.31108
F	2.50087
C(1 km)	-0.022
D1(1 km)	0.293
D2(1 km)	0.285
D3(1 km)	0.247
E(1 km)	0.31
F(1 km)	2.494

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name	Gavin Bell	**Catchment name**	Bruisyard	**Date/time modelled**	31-Aug-2007 16:39
Company name	RSA Geotechnics Ltd	**Catchment easting**	632500	**Version**	1.3
Project name	Bruisyard FRA	**Catchment northing**	266150		
		Catchment area	34.12		

Summary of model setup

Design rainfall parameters		Loss model parameters		Routing model parameters		Baseflow model parameters	
Return period (yr)	20	**C_{max} (mm)**	284	**T_p (hr)**	8.13	**BL (hr)**	44.3
Duration (hr)	17	**C_{ini} (mm)**	122	**U_p**	0.65	**BR**	0.69
Timestep (hr)	1	**α factor**	0.94	**U_k**	0.8	**BF_0 (m^3/s)**	1.1
Season	Winter						

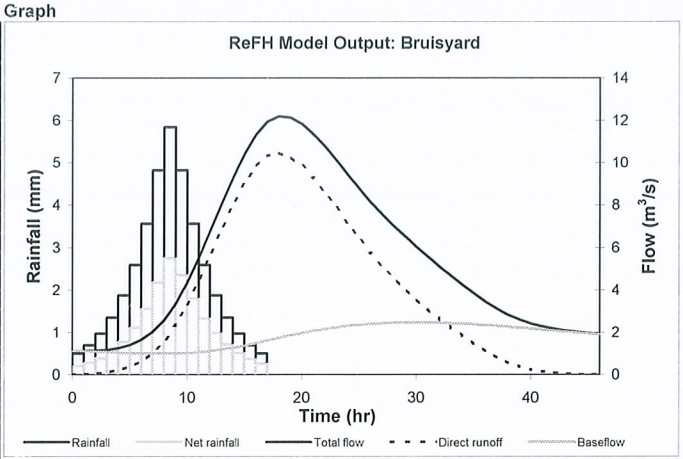
Summary of results

FEH DDF rainfall (mm)	60.4	**Peak rainfall (mm)**	5.8
Design rainfall (mm)	38.5	**Peak flow (m^3/s)**	12.2

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m^3/s	m^3/s	m^3/s
0	0.5	0.2	0.0	1.1	1.1
1	0.7	0.3	0.0	1.1	1.1
2	1.0	0.4	0.0	1.1	1.1
3	1.3	0.6	0.1	1.1	1.2
4	1.9	0.8	0.2	1.0	1.3
5	2.6	1.1	0.4	1.0	1.4
6	3.6	1.6	0.6	1.0	1.7
7	4.8	2.2	1.0	1.0	2.0
8	5.8	2.7	1.6	1.0	2.6
9	4.8	2.4	2.3	1.0	3.4
10	3.6	1.8	3.3	1.0	4.4
11	2.6	1.3	4.4	1.1	5.5
12	1.9	1.0	5.6	1.1	6.8
13	1.3	0.7	6.9	1.2	8.1
14	1.0	0.5	8.0	1.3	9.3
15	0.7	0.4	9.0	1.4	10.4
16	0.5	0.3	9.9	1.5	11.4
17	0.0	0.0	10.3	1.6	12.0
18	0.0	0.0	10.5	1.7	12.2
19	0.0	0.0	10.3	1.9	12.1
20	0.0	0.0	9.9	2.0	11.8
21	0.0	0.0	9.3	2.1	11.4
22	0.0	0.0	8.6	2.2	10.8
23	0.0	0.0	7.9	2.2	10.1
24	0.0	0.0	7.1	2.3	9.4
25	0.0	0.0	6.4	2.4	8.8
26	0.0	0.0	5.7	2.4	8.1
27	0.0	0.0	5.1	2.4	7.6
28	0.0	0.0	4.6	2.5	7.0
29	0.0	0.0	4.1	2.5	6.5
30	0.0	0.0	3.6	2.5	6.0
31	0.0	0.0	3.1	2.5	5.6
32	0.0	0.0	2.7	2.5	5.1
33	0.0	0.0	2.2	2.4	4.7
34	0.0	0.0	1.8	2.4	4.3
35	0.0	0.0	1.5	2.4	3.9
36	0.0	0.0	1.1	2.4	3.5
37	0.0	0.0	0.8	2.3	3.1
38	0.0	0.0	0.6	2.3	2.8
39	0.0	0.0	0.4	2.2	2.6
40	0.0	0.0	0.2	2.2	2.4
41	0.0	0.0	0.1	2.1	2.3
42	0.0	0.0	0.1	2.1	2.2
43	0.0	0.0	0.0	2.0	2.1
44	0.0	0.0	0.0	2.0	2.0
45	0.0	0.0	0.0	2.0	2.0
46	0.0	0.0	0.0	1.9	1.9
Total (mm)	**38.5**	**18.1**	**18.1**	**9.0**	**27.1**

Graph



Audit comments

Catchment

Catchment descriptors imported from file
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PROPWET value of 0.26 used
SAAR value of 588 used
DPLBAR value of 5.84 used
DPSBAR value of 22.6 used
URBEXT value of 0.0015 used
C value of -0.02195 used
D1 value of 0.30673 used
D2 value of 0.28252 used
D3 value of 0.24269 used
E value of 0.31108 used
F value of 2.50087 used

Rainfall

Recommended season is Winter, as URBEXT < 0.125
ReFH design standard Seasonal Correction Factor of 0.67 applied
ReFH design standard Areal Reduction Factor of 0.96 applied

Loss Model

C_{Max} derived from catchment descriptors
ReFH design standard C_{ini} used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

ReFH design standard α factor used

Routing Model

T_p derived from catchment descriptors

ReFH design standard used for U_p

ReFH design standard used for U_k

Baseflow Model

BL derived from catchment descriptors

BR derived from catchment descriptors

ReFH design standard BF_0 used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name	Gavin Bell	**Catchment name**	Bruisyard	**Date/time modelled**	31-Aug-2007 16:39
Company name	RSA Geotechnics Ltd	**Catchment easting**	632500	**Version**	1.3
Project name	Bruisyard FRA	**Catchment northing**	266150		
		Catchment area	34.12		

Summary of model setup

Design rainfall parameters		Loss model parameters		Routing model parameters		Baseflow model parameters	
Return period (yr)	100	**C_{max} (mm)**	284	**T_p (hr)**	8.13	**BL (hr)**	44.3
Duration (hr)	17	**C_{ini} (mm)**	122	**U_p**	0.65	**BR**	0.69
Timestep (hr)	1	**α factor**	0.83	**U_k**	0.8	**BF_0 (m^3/s)**	1.1
Season	Winter						

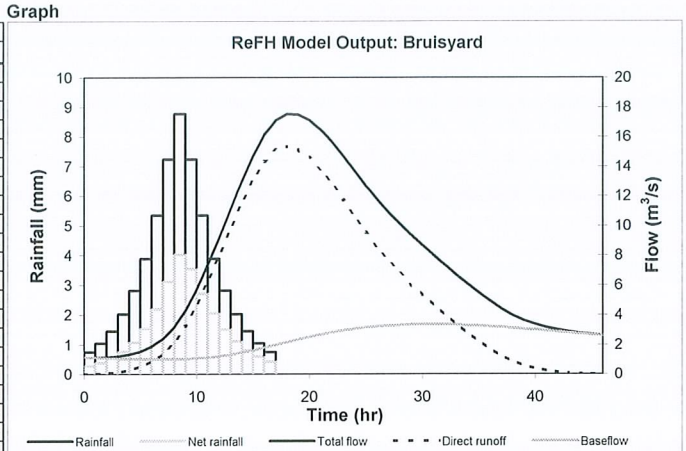
Summary of results

FEH DDF rainfall (mm)	90.6	**Peak rainfall (mm)**	8.8
Design rainfall (mm)	57.8	**Peak flow (m^3/s)**	17.5

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m^3/s	m^3/s	m^3/s
0	0.7	0.3	0.0	1.1	1.1
1	1.0	0.4	0.0	1.1	1.1
2	1.5	0.5	0.1	1.1	1.1
3	2.0	0.8	0.1	1.1	1.2
4	2.8	1.1	0.3	1.0	1.3
5	3.9	1.5	0.5	1.0	1.5
6	5.3	2.2	0.9	1.0	1.9
7	7.2	3.1	1.4	1.0	2.4
8	8.8	4.0	2.2	1.0	3.2
9	7.2	3.5	3.2	1.0	4.3
10	5.3	2.7	4.6	1.1	5.7
11	3.9	2.0	6.3	1.1	7.4
12	2.8	1.5	8.0	1.2	9.2
13	2.0	1.1	9.8	1.3	11.1
14	1.5	0.8	11.5	1.5	13.0
15	1.0	0.6	13.1	1.6	14.7
16	0.7	0.4	14.3	1.8	16.1
17	0.0	0.0	15.1	2.0	17.1
18	0.0	0.0	15.4	2.2	17.5
19	0.0	0.0	15.1	2.4	17.5
20	0.0	0.0	14.6	2.5	17.1
21	0.0	0.0	13.8	2.7	16.5
22	0.0	0.0	12.8	2.8	15.6
23	0.0	0.0	11.7	3.0	14.7
24	0.0	0.0	10.6	3.1	13.7
25	0.0	0.0	9.5	3.2	12.7
26	0.0	0.0	8.5	3.2	11.8
27	0.0	0.0	7.6	3.3	10.9
28	0.0	0.0	6.8	3.3	10.1
29	0.0	0.0	6.0	3.3	9.4
30	0.0	0.0	5.3	3.3	8.7
31	0.0	0.0	4.6	3.4	8.0
32	0.0	0.0	4.0	3.3	7.3
33	0.0	0.0	3.4	3.3	6.7
34	0.0	0.0	2.8	3.3	6.1
35	0.0	0.0	2.2	3.3	5.5
36	0.0	0.0	1.7	3.2	4.9
37	0.0	0.0	1.2	3.2	4.4
38	0.0	0.0	0.9	3.1	4.0
39	0.0	0.0	0.6	3.1	3.6
40	0.0	0.0	0.4	3.0	3.4
41	0.0	0.0	0.2	2.9	3.2
42	0.0	0.0	0.1	2.9	3.0
43	0.0	0.0	0.1	2.8	2.9
44	0.0	0.0	0.0	2.7	2.8
45	0.0	0.0	0.0	2.7	2.7
46	0.0	0.0	0.0	2.6	2.6
Total (mm)	**57.8**	**26.5**	**26.5**	**11.5**	**38.1**

Graph



Audit comments

Catchment

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SAAR value of 588 used
DPLBAR value of 5.84 used
DPSBAR value of 22.6 used
URBEXT value of 0.0015 used
C value of -0.02195 used
D1 value of 0.30673 used
D2 value of 0.28252 used
D3 value of 0.24269 used
E value of 0.31108 used
F value of 2.50087 used

Rainfall

Recommended season is Winter, as URBEXT < 0.125
ReFH design standard Seasonal Correction Factor of 0.67 applied
ReFH design standard Areal Reduction Factor of 0.96 applied

Loss Model

C_{Max} derived from catchment descriptors
ReFH design standard C_{ini} used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

ReFH design standard α factor used

Routing Model

T_p derived from catchment descriptors

ReFH design standard used for U_p

ReFH design standard used for U_k

Baseflow Model

BL derived from catchment descriptors

BR derived from catchment descriptors

ReFH design standard BF_0 used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name	Gavin Bell	**Catchment name**	Bruisyard	**Date/time modelled**	31-Aug-2007 16:38
Company name	RSA Geotechnics Ltd	**Catchment easting**	632500	**Version**	1.3
Project name	Bruisyard FRA	**Catchment northing**	266150		
		Catchment area	34.12		

Summary of model setup

Design rainfall parameters		Loss model parameters		Routing model parameters		Baseflow model parameters	
Return period (yr)	1000	**C_{max} (mm)**	284	**T_p (hr)**	8.13	**BL (hr)**	44.3
Duration (hr)	17	**C_{ini} (mm)**	122	**U_p**	0.65	**BR**	0.69
Timestep (hr)	1	**α factor**	0.7	**U_k**	0.8	**BF_0 (m^3/s)**	1.1
Season	Winter						

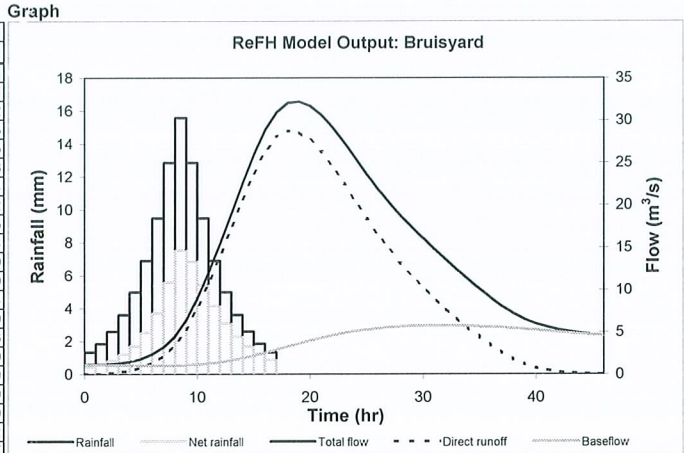
Summary of results

FEH DDF rainfall (mm)	160.9	**Peak rainfall (mm)**	15.6
Design rainfall (mm)	102.7	**Peak flow (m^3/s)**	32.2

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m^3/s	m^3/s	m^3/s
0	1.3	0.4	0.0	1.1	1.1
1	1.8	0.6	0.0	1.1	1.1
2	2.6	0.8	0.1	1.1	1.2
3	3.6	1.2	0.2	1.1	1.3
4	5.0	1.7	0.4	1.1	1.5
5	6.9	2.5	0.8	1.0	1.8
6	9.5	3.7	1.3	1.0	2.4
7	12.9	5.6	2.2	1.0	3.2
8	15.6	7.5	3.5	1.1	4.5
9	12.9	6.8	5.3	1.1	6.4
10	9.5	5.4	7.8	1.2	9.0
11	6.9	4.1	10.7	1.3	12.0
12	5.0	3.1	14.0	1.5	15.4
13	3.6	2.3	17.3	1.7	19.0
14	2.6	1.7	20.7	1.9	22.6
15	1.8	1.2	23.7	2.2	26.0
16	1.3	0.9	26.3	2.5	28.9
17	0.0	0.0	28.0	2.9	30.9
18	0.0	0.0	28.8	3.3	32.0
19	0.0	0.0	28.6	3.6	32.2
20	0.0	0.0	27.7	4.0	31.7
21	0.0	0.0	26.2	4.3	30.6
22	0.0	0.0	24.5	4.6	29.1
23	0.0	0.0	22.5	4.9	27.4
24	0.0	0.0	20.4	5.1	25.5
25	0.0	0.0	18.3	5.3	23.6
26	0.0	0.0	16.4	5.4	21.8
27	0.0	0.0	14.7	5.5	20.2
28	0.0	0.0	13.1	5.6	18.7
29	0.0	0.0	11.7	5.7	17.4
30	0.0	0.0	10.3	5.7	16.0
31	0.0	0.0	9.0	5.8	14.8
32	0.0	0.0	7.8	5.8	13.5
33	0.0	0.0	6.6	5.7	12.3
34	0.0	0.0	5.5	5.7	11.2
35	0.0	0.0	4.4	5.7	10.1
36	0.0	0.0	3.4	5.6	9.0
37	0.0	0.0	2.5	5.5	8.0
38	0.0	0.0	1.8	5.4	7.2
39	0.0	0.0	1.2	5.3	6.5
40	0.0	0.0	0.8	5.2	6.0
41	0.0	0.0	0.5	5.1	5.6
42	0.0	0.0	0.3	5.0	5.3
43	0.0	0.0	0.1	4.9	5.0
44	0.0	0.0	0.1	4.8	4.8
45	0.0	0.0	0.0	4.7	4.7
46	0.0	0.0	0.0	4.6	4.6
Total (mm)	**102.7**	**49.5**	**49.5**	**18.3**	**67.9**

Graph



Audit comments

Catchment

Catchment descriptors imported from file
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Catchment decriptor file exported from CD ROM version 2
Catchment descriptor file exported on 23-Aug-2007 12:52
BFIHOST value of 0.326 used
PROPWET value of 0.26 used
SAAR value of 588 used
DPLBAR value of 5.84 used
DPSBAR value of 22.6 used
URBEXT value of 0.0015 used
C value of -0.02195 used
D1 value of 0.30673 used
D2 value of 0.28252 used
D3 value of 0.24269 used
E value of 0.31108 used
F value of 2.50087 used

Rainfall

Recommended season is Winter, as URBEXT < 0.125
ReFH design standard Seasonal Correction Factor of 0.67 applied
ReFH design standard Areal Reduction Factor of 0.96 applied

Loss Model

C_{Max} derived from catchment descriptors
ReFH design standard C_{ini} used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

ReFH design standard α factor used

Routing Model

T_p derived from catchment descriptors

ReFH design standard used for U_p

ReFH design standard used for U_k

Baseflow Model

BL derived from catchment descriptors

BR derived from catchment descriptors

ReFH design standard BF_0 used

Computed Hydrographs With 20% Increase in Peak Flow due to Climatic Change

	Time	1:Flood return period: 20.0 [m^3/s]	2:Flood return period: 100.0 [m^3/s]	3:Flood return period: 1000.0 [m^3/s]
0	17/08/2007 12:00:00	0.137606	0.137606	0.137606
1	17/08/2007 13:00:00	0.16799	0.183923	0.222523
2	17/08/2007 14:00:00	0.229805	0.278151	0.395282
3	17/08/2007 15:00:00	0.326319	0.425274	0.66502
4	17/08/2007 16:00:00	0.463201	0.633932	1.04757
5	17/08/2007 17:00:00	0.650476	0.919408	1.57097
6	17/08/2007 18:00:00	0.909374	1.31406	2.29453
7	17/08/2007 19:00:00	1.28026	1.87943	3.33109
8	17/08/2007 20:00:00	1.86772	2.77493	4.9729
9	17/08/2007 21:00:00	2.76242	4.13878	7.4734
10	17/08/2007 22:00:00	3.87369	5.83276	10.5792
11	17/08/2007 23:00:00	5.09695	7.69746	13.9979
12	18/08/2007 00:00:00	6.35381	9.61337	17.5106
13	18/08/2007 01:00:00	7.60938	11.5273	21.0196
14	18/08/2007 02:00:00	8.84911	13.4171	24.4844
15	18/08/2007 03:00:00	10.0589	15.2613	27.8656
16	18/08/2007 04:00:00	11.2207	17.0323	31.1125
17	18/08/2007 05:00:00	12.3027	18.6817	34.1366
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19	18/08/2007 07:00:00	13.8118	20.9821	38.354
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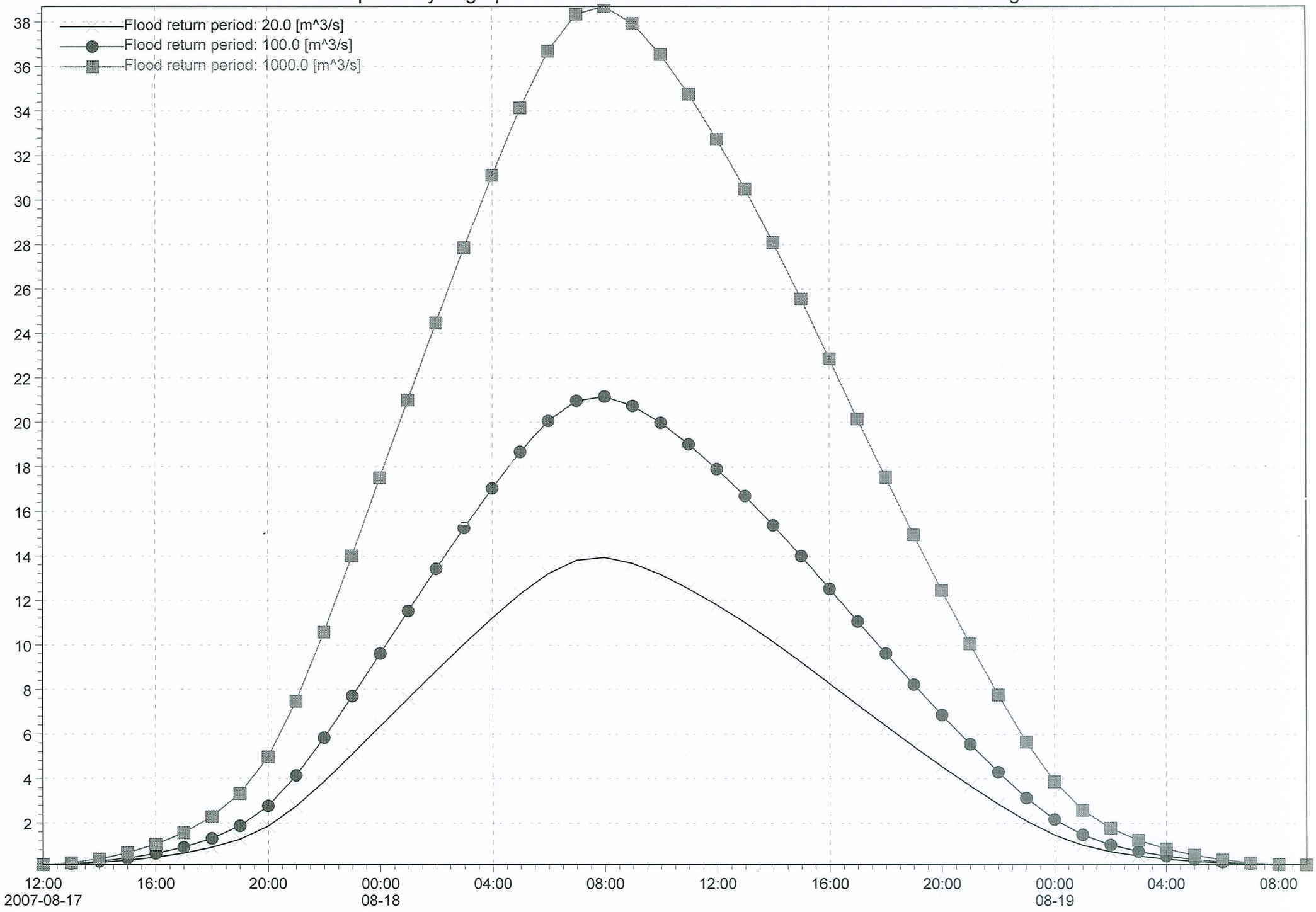
24	18/08/2007 12:00:00	11.7998	17.9151	32.7309
25	18/08/2007 13:00:00	11.0011	16.6976	30.4988
26	18/08/2007 14:00:00	10.1426	15.3889	28.0994
27	18/08/2007 15:00:00	9.23063	13.9987	25.5507
28	18/08/2007 16:00:00	8.26787	12.5311	22.86
29	18/08/2007 17:00:00	7.306	11.0649	20.1717

Computed Hydrographs With 20% Increase in Peak Flow due to Climatic Change

	Time	1:Flood return period: 20.0 [m^3/s]	2:Flood return period: 100.0 [m^3/s]	3:Flood return period: 1000.0 [m^3/s]
30	18/08/2007 18:00:00	6.36457	9.62979	17.5407
31	18/08/2007 19:00:00	5.44525	8.2284	14.9713
32	18/08/2007 20:00:00	4.55122	6.86558	12.4727
33	18/08/2007 21:00:00	3.68812	5.54989	10.0605
34	18/08/2007 22:00:00	2.86742	4.29885	7.76687
35	18/08/2007 23:00:00	2.11143	3.14644	5.65403
36	19/08/2007 00:00:00	1.47468	2.1758	3.87445
37	19/08/2007 01:00:00	1.01991	1.48257	2.60347
38	19/08/2007 02:00:00	0.727776	1.03724	1.78701
39	19/08/2007 03:00:00	0.532559	0.73966	1.24142
40	19/08/2007 04:00:00	0.393434	0.527582	0.852591
41	19/08/2007 05:00:00	0.292181	0.373234	0.569609
42	19/08/2007 06:00:00	0.219713	0.262767	0.367077
43	19/08/2007 07:00:00	0.171333	0.189019	0.231867
44	19/08/2007 08:00:00	0.144359	0.147899	0.156478
45	19/08/2007 09:00:00	0.137606	0.137606	0.137606

Computed Hydrographs With 20% Increase in Peak Flow due to Climatic Change



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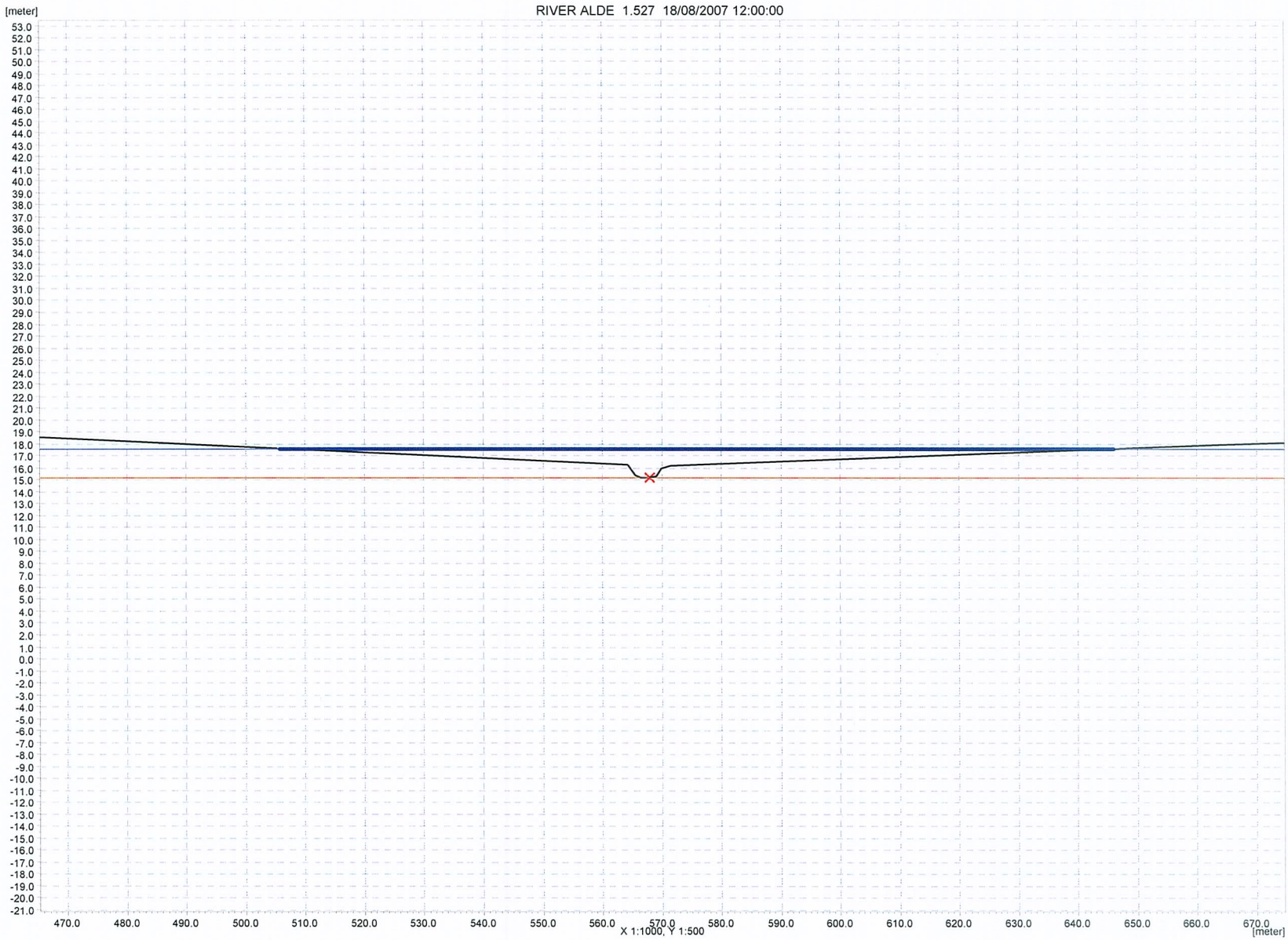
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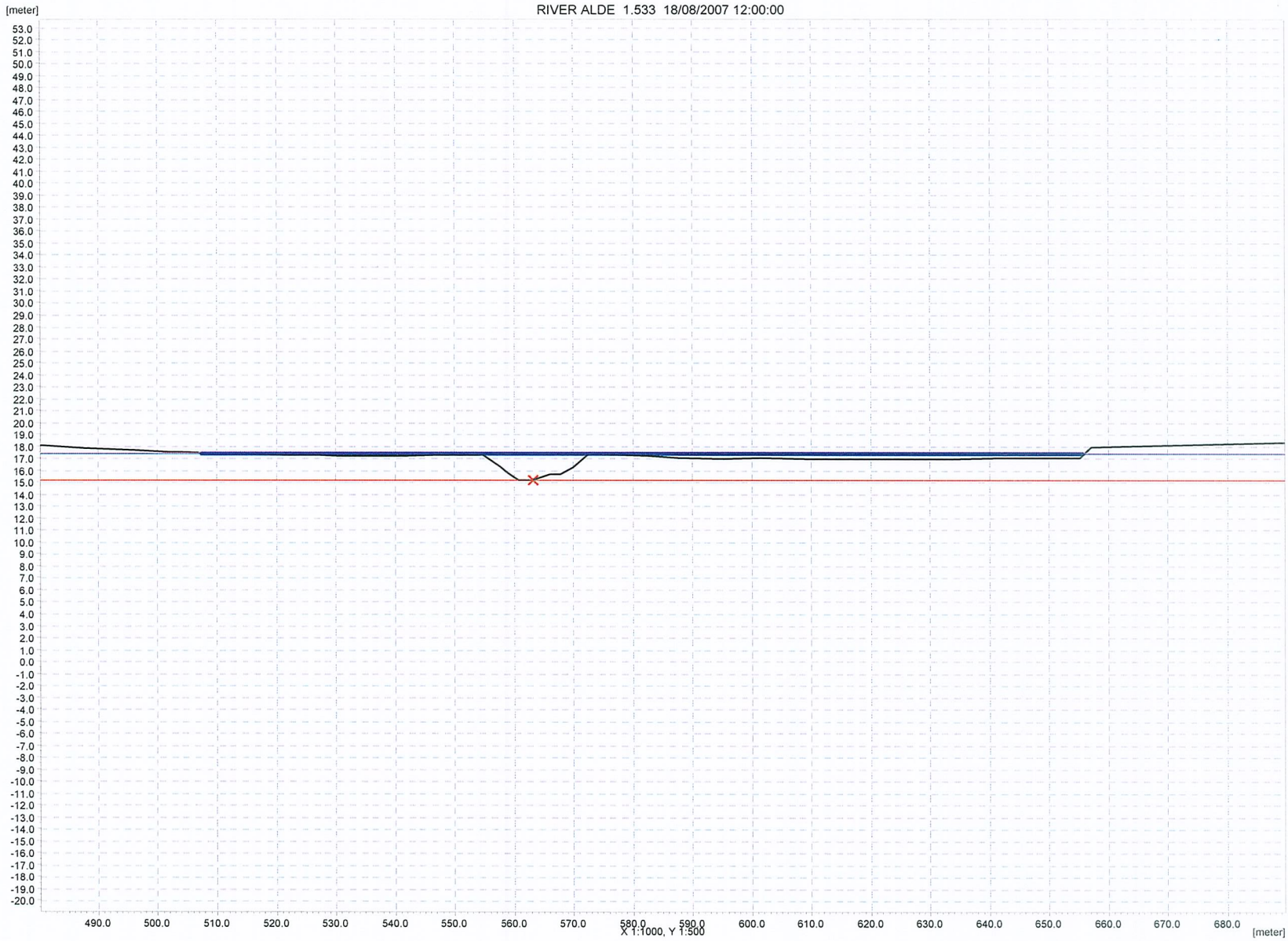
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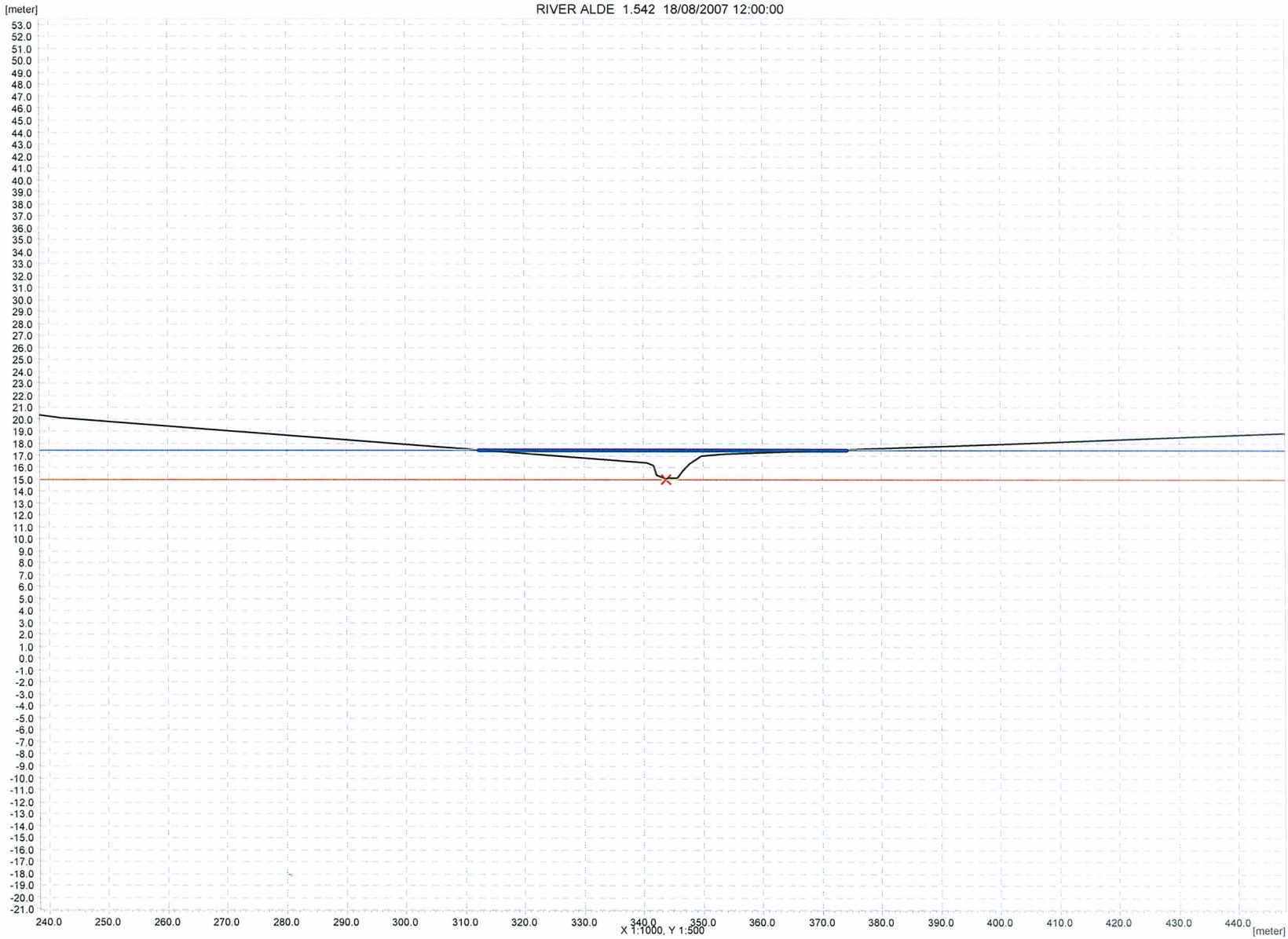
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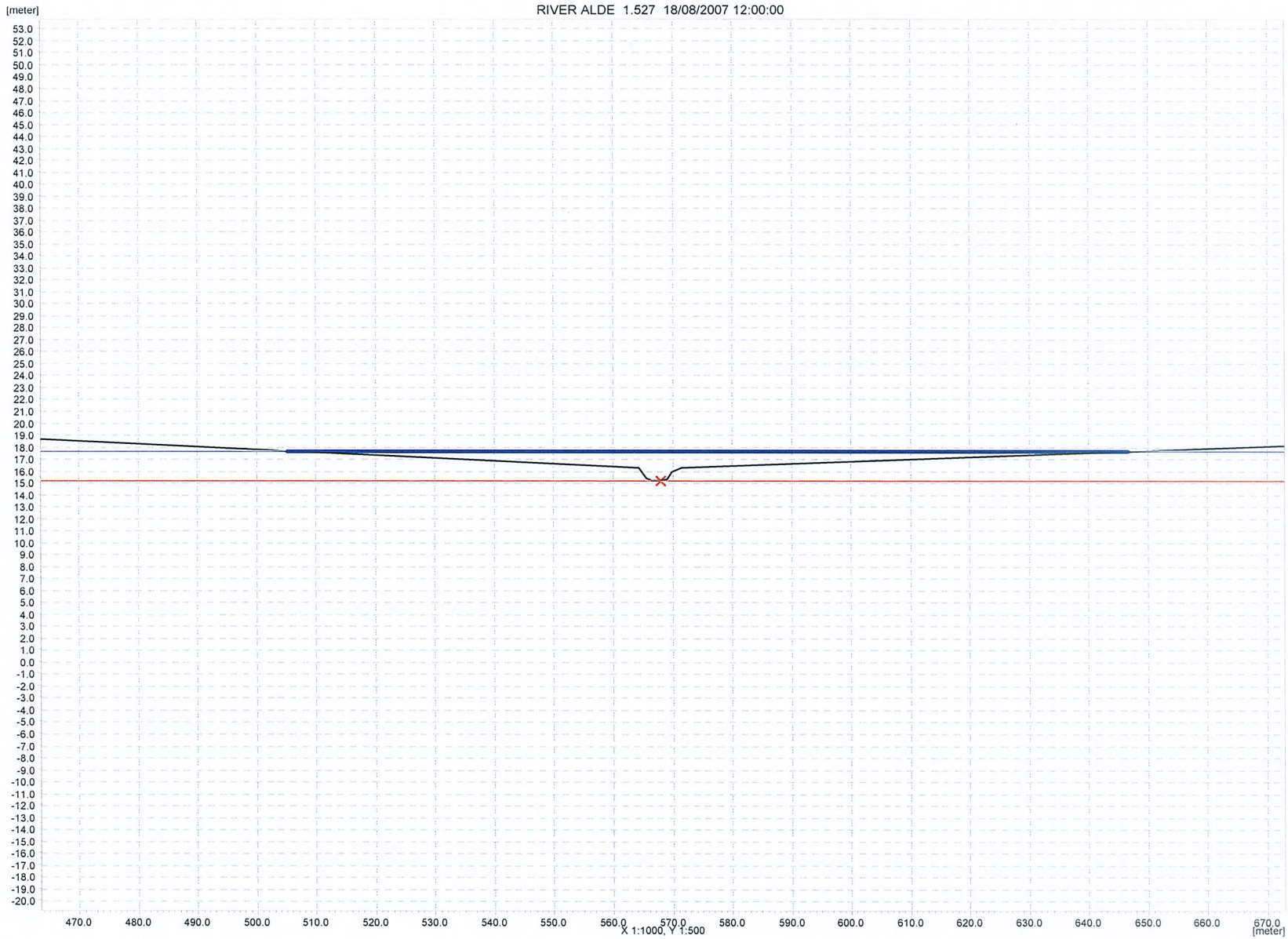
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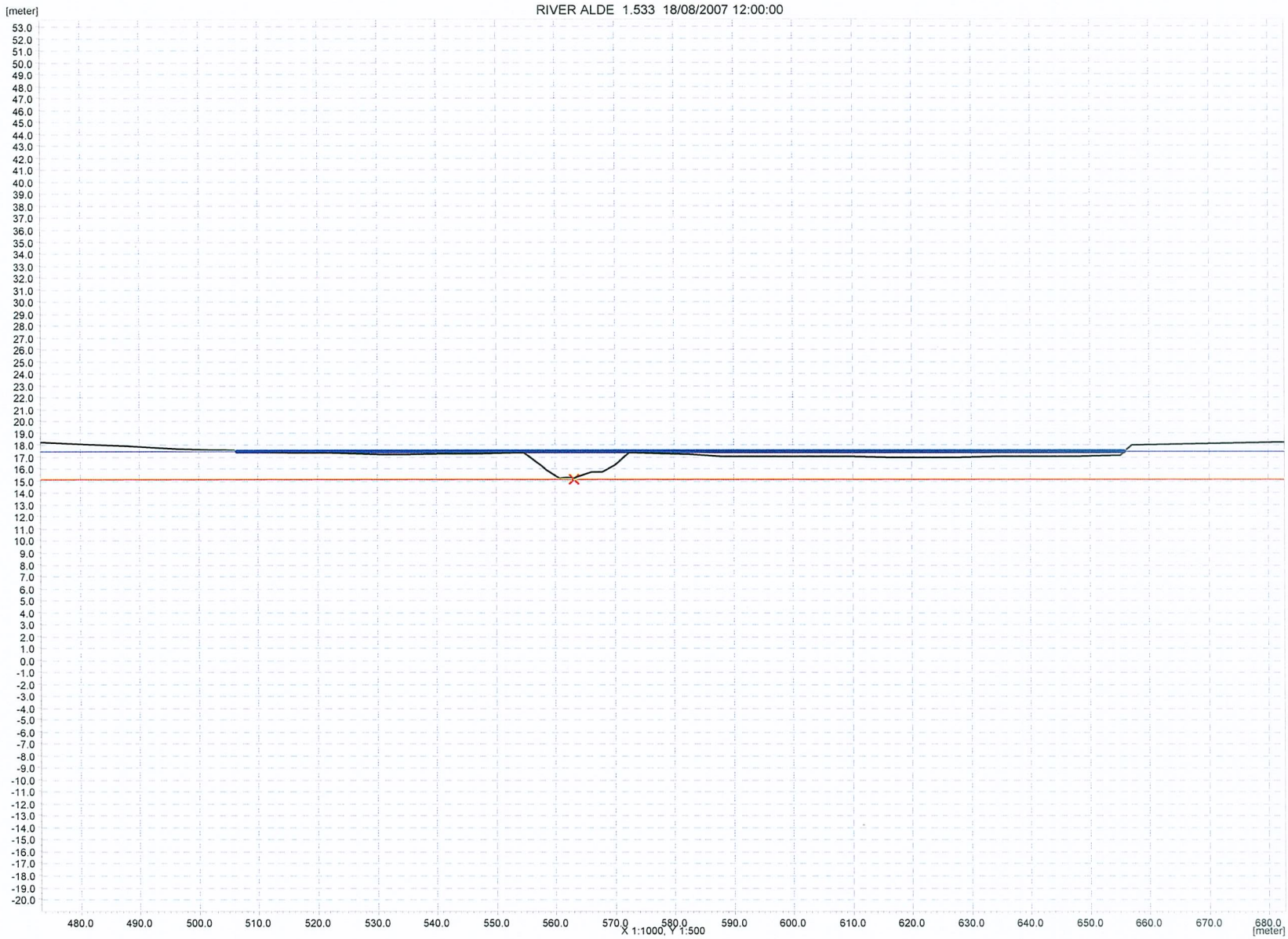
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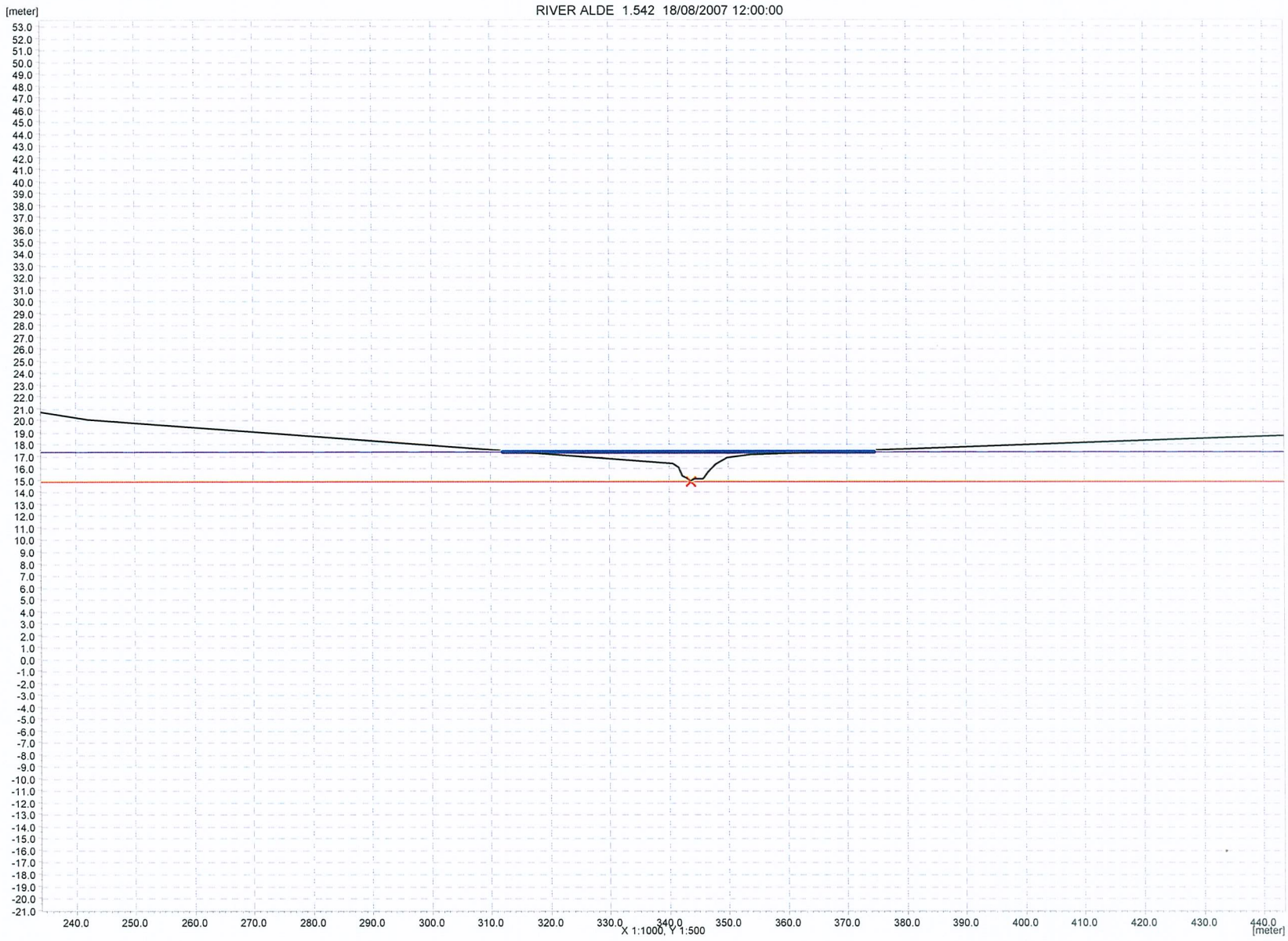
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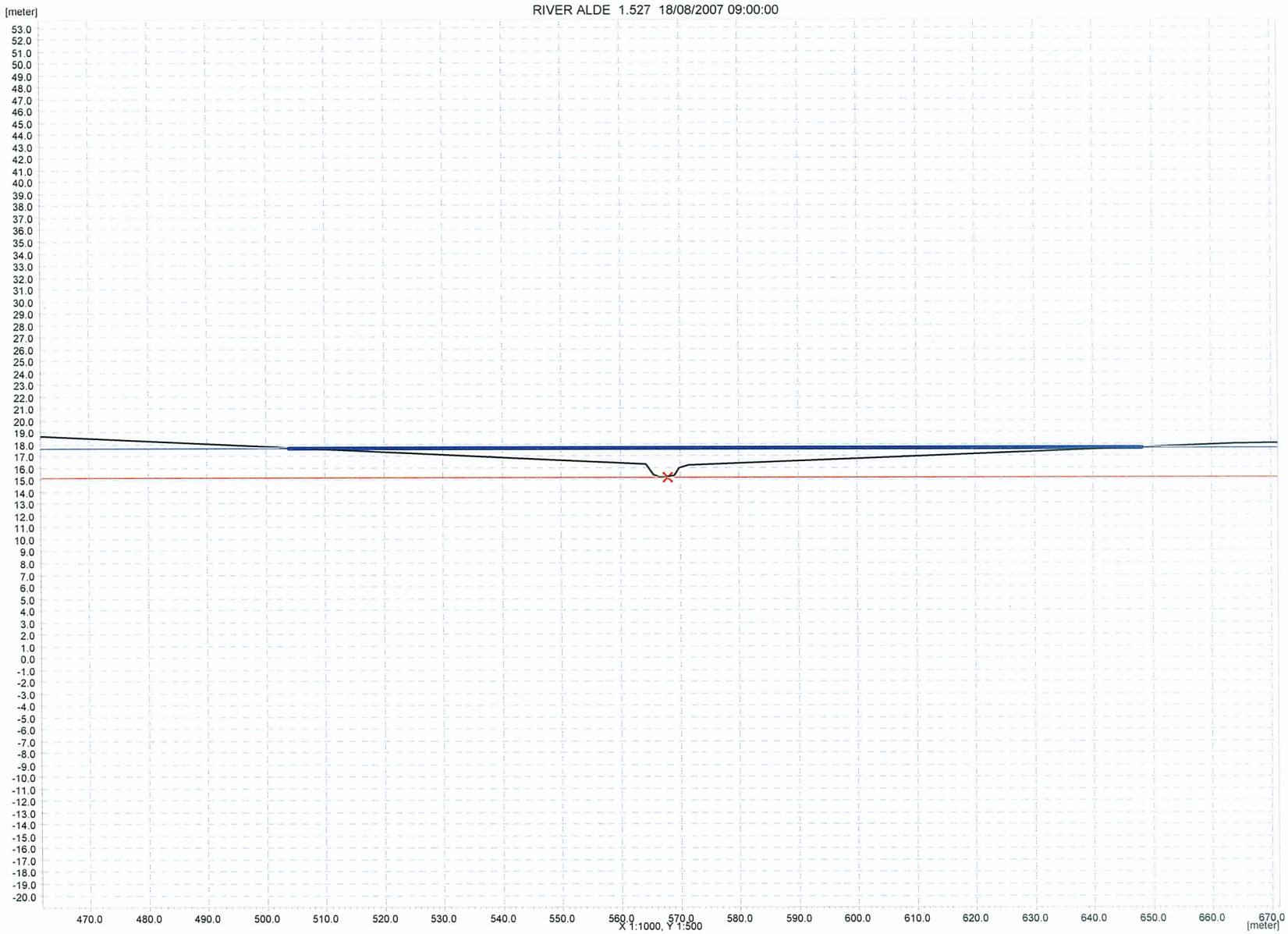
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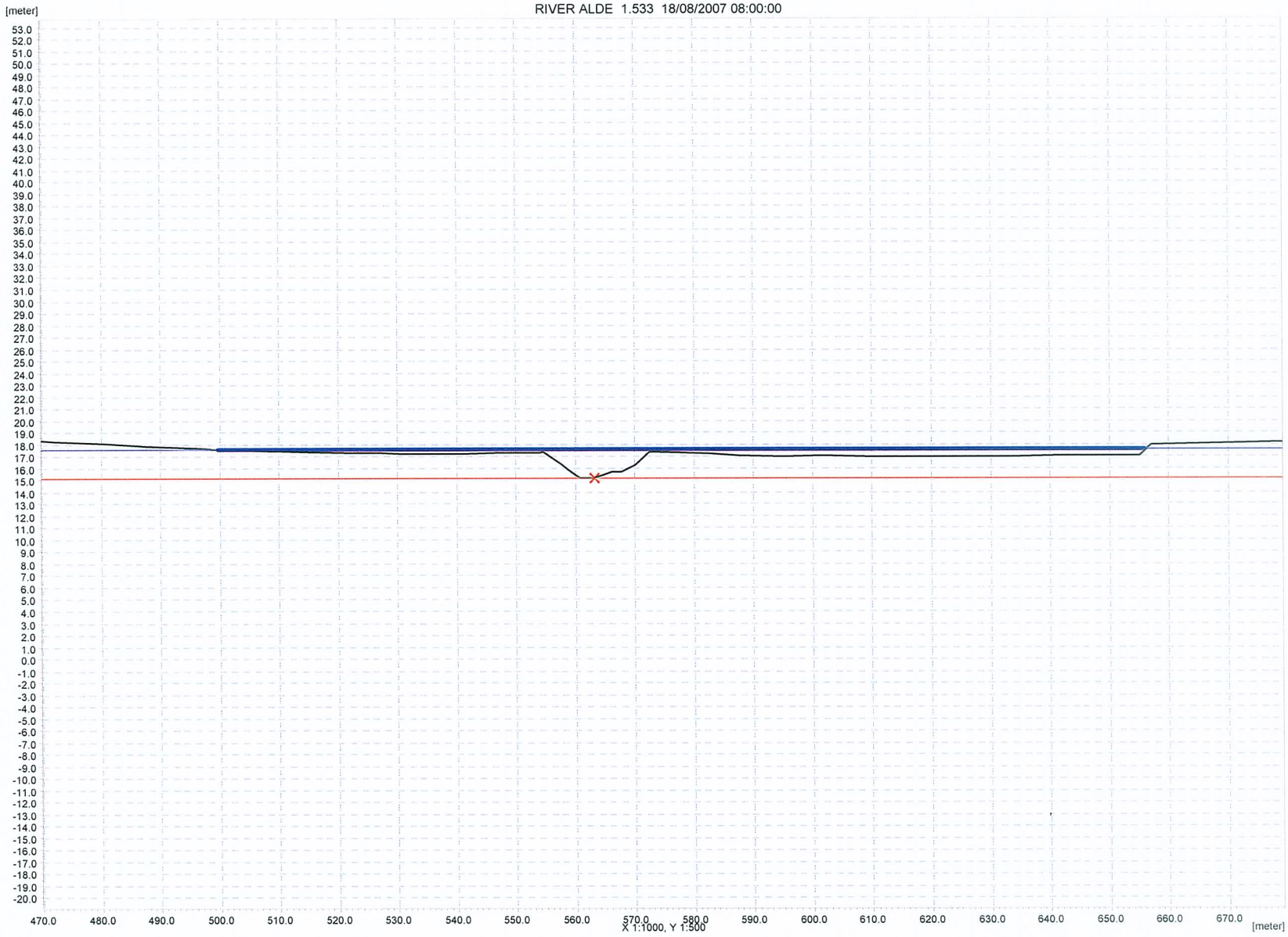
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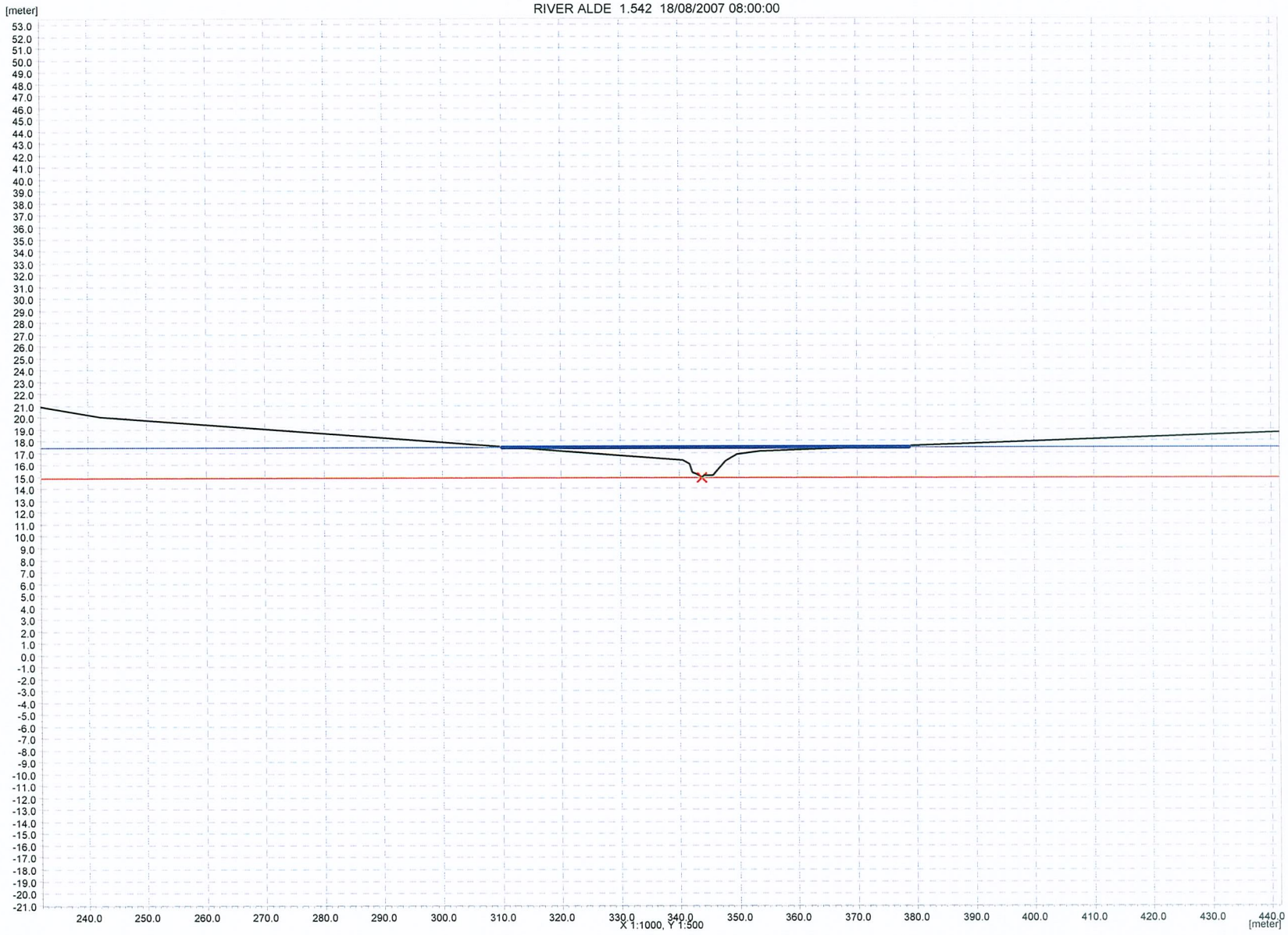
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APPENDIX 4

COPY OF CORRESPONDENCE FROM BRUISYARD PARISH COUNCIL

Bruisyard Parish Council

Peter Robinson
The Swallows
The Street
Bruisyard
Saxmundham
Suffolk IP17 2DT

Tel: 01728 663479

RSA Geotechnics Ltd
Ashburnham House
1 Maitland Road
Lion Barn Estate
Needham Market
Suffolk IP6 8NZ

For the attention of Mr G Southgate

12 June 2007

Dear Mr Southgate,

Flood Risk Assessment – New Village Hall, Bruisyard, Suffolk

Thank you for your letter of 6 June 2007 which has been forwarded to me by Robert Smith of CBM Smith & Partners.

Bruisyard Parish Council, of which I am Chairman, is responsible for the proposed development of a new Village Hall to be located on the Parish Park. The Parish Council have undertaken the Sequential Test as stipulated in the Environment Agency Planning Policy Statement 25 with the following outcome;

1. As stated in Table D.2 of PPS25, the Flood Risk Vulnerability Classification for a Village Hall is 'Less Vulnerable'. As such, a Flood Risk Assessment Survey would be required for the development in either Zone 2 or 3 if a Zone 1 site is unavailable.

2. Our understanding from the Environment Agency Flood Map is that the Parish Park is in Zone 3 and consequently the Parish Council has investigated all other potential sites in categories Zone 1 and 2 for this development within the village.

3. The only alternative site identified for this development is on land owned by the Rous Estate (landowner: Mr Robert Rous) – OS reference TM332660. This site is approximately ¼ mile outside Bruisyard Street and about ½ mile from the Parish Park. A Victorian corrugated iron Sunday School was previously on this site and was used for many years as a Village Hall until the building became structurally unsafe and was demolished in the late 1960s. This site is however too small to accommodate both a hall and a car park. The landowner, Mr Robert Rous, has been approached to seek his approval to lease this site and some adjoining land to the Parish Council for this development. Unfortunately, Mr Rous will not agree to lease this land, which is highly productive agricultural land, for the development of a hall and car park. A letter to this effect from Mr Rous can be forwarded to you in due course if required.

4. After due consideration of all the alternatives, the Parish Council have unanimously agreed that the only site for building the Village Hall is on the north side of the Parish Park. In addition, the Parish Council has consulted the oldest inhabitants in the Village and has confirmed that within living memory (80 years), the proposed site for the hall at the north side of the Parish Park has never flooded. The Parish Council did however recognise that with the impact of global warming/climate change, there is a probability of river flooding, but that this risk can be appropriately managed by the building design as no Zone 1 or 2 site for this development is available.

The Parish Council wish you to proceed with the Flood Risk Assessment as agreed with our Architect, Mr Robert Smith.

If you require any further information, please do not hesitate to contact me.

Your faithfully,

Peter Robinson

Chairman – Bruisyard Parish Council

cc. Robert Smith – CBM Smith & Partners
copy for RSA Geotechnics Ltd to forward to the Environment Agency

C.B.M.SMITH & PARTNERS ----------CHARTERED ARCHITECTS

Ref: CBMS/1012G/RSAG/3

THE GARDEN HOUSE
BRUISYARD, SAXMUNDHAM
SUFFOLK, IP17 2ED

Telephone: (01728) 638822
Mobile: 07715 699 714
Fax: (01728) 638304

28 June 2007

RSA Geotechnics Limited
Attn Mr G J T Southgate
Ashburnham House
1 Maitland Road
Lion Barn Estate
Needham Market, Suffolk
IP6 8NZ

Reference 1012G: Proposed Village Hall in Bruisyard .

Dear Sir,

Further to our telephone conversation, we now enclose herewith one copy each of Drawing Nos. 1012G/4, 1012G/5 and 1012G/6 showing proposed building which is to provide a reception seating capacity of 52 persons, W.C. accommodation and kitchen.

1. The building is to be constructed to give the visual appearance of a Suffolk barn with 47.5° pitch pantile roof finish. Black-boarded external walls above a 600mm high fair-faced brick plinth .
2. Building constructed to permit water entry in the event of flooding without damage to fabric with stone/tile paved floor finishes, fair-faced brick wall up to 600 high and fully glazed tiled wall surfaces to kitchen and W.C. accommodation.
3. The building to achieve sustainability with (a) solar collection to south roof slope with internal storage providing underfloor heating and hot water. (b) rainwater to be harvested (c) sewage treatment plant to be provided (d) all materials and equipment to be from local and sustainable sources.
4. Ground to the north of the building to be graded down to base of existing perimeter ditch to provide flood compensation volume equivalent to building displacement
5. All external pedestrian and vehicular traffic areas to grass block construction to allow natural percolation of rainwater and retain grassed appearance.

There is no record of the site for the building having ever flooded. The oldest local inhabitant of Bruisyard advises that to her knowledge this has not happened in the last eighty years. The Parish Council have carried out local research and demonstrated a local need for the facility. Due to the Environment Agency designation of a flood zone the council have approached local land owner for alternative siting out of the flood plain, but without success, so have now instructed provision of a flood risk assessment from yourselves. The siting of the building is at the highest point of land on the site which is over 3 metres above river bed. Drawing No. 1012G/6 shows adjoining land allowed for use as car parking, providing twenty parking spaces with turning facility and space for one lorry for waste collection. This will be provided with facilities for cycle racks, bottle and waste collection facility and disabled parking.

We should have the scheme prepared for submission together with F.R.A. and Design and Access Statement by 24 July 2007.

With thanks for your attention to this matter.

Yours faithfully,

Robert J M Smith
C.B.M.Smith & Partners

R.J.M.SMITH Dipl.Arch.R.I.B.A

APPENDIX 5

COPY OF CORRESPONDENCE FROM THE ENVIRONMENT AGENCY

creating a better place

Environment Agency

Mr Greg Southgate
RSA Geotechnics Ltd
Maitland Road Lion Barn Industrial Estate
Needham Market
Ipswich
IP6 8NZ

Our ref: MX/2007/100282/01-L01
Your ref: GJTS/10915/PJB

Date: 21 June 2007

Dear Mr Southgate

BRUISYARD VILLAGE HALL. FLOOD RISK ENQUIRY. ADJACENT TO RIVER ALDE, BRUISYARD STREET.

Thank you for your letter regarding the Flood Risk Assessment (FRA) in relation to the proposed village hall at Bruisyard.

I will answer your questions in the order raised:

1) The River Alde has not been modelled by us, therefore we do not hold any information in relation to estimated flood levels. This information will need to be ascertained by the site specific FRA.
2) I have enclosed a copy of the Flood Map with this letter.
3) We do not hold any information regarding historical flooding at this Location.
4) There are no built flood defences in the area, only the natural river banks.
5) I have passed your request for flow data to our Field Monitoring & Data team who will send the relevant flow data to you in due course.

Following our recent discussions the following information may also be of interest.

It should be ensured that the principle of development in the proposed location is established before the site specific FRA and associate work is carried out. The risk-based Sequential Test should be applied at all stages of planning with the aim of steering new development to area at the lowest probability of flooding (zone 1). We will require confirmation from the local authority that the sequential test has been applied in relation to the proposed village hall development.

It should be ensured that the outline of the "Functional Floodplain" in the area is ascertained in any FRA carried out. This is land which would flood with an annual

Cont/d..

probability of 1 in 20 or greater in any one year. Planning Policy Statement 25 (PPS 25) states that only water compatible uses and the essential infrastructure listed in D2 that has to be there should be permitted in this zone.

The FRA should also ascertain the expected flood level in the 1% annual probability of occurrence flood event including allowances for climate change, as well as providing a statement of the expected level in the 0.1% annual probability of occurrence event including climate change. In order to assess the safety of the development in relation to access and egress, the velocity of flood waters in these two events will need to be quantified. Ideally there should be safe unaided escape from the proposed development in the 1% annual probability of occurrence flood event including allowances for climate change. Preferably this should be dry, but if not it should be safe in accordance with table 13.1 in the EA/Defra document FD2320 "Flood Risk Assessment guidance for new developments".

The safety of visitors to the proposed village hall will need to be thoroughly managed through the production of a flood plan and flood evacuation plan for the development.

The building itself should be protected from flooding in the 1% annual probability of occurrence flood event including allowances for climate change, and flood resistance/resilience methods incorporated as appropriate.

The issue of the off site flood risk will also need to be addressed to ensure there is no adverse impact on flood storage or conveyance as a result of the development. If flood storage is being removed this will need to be provided on a "level for level" basis to ensure the river continues to operate as it does at present.

The likelihood of blockages at the upstream road bridge should also be addressed in the FRA. If a blockage is likely in the design flood event (1% annual probability of occurrence including climate change) the impact this may have on the routing of flood flows and the resulting flood extent at the development site should be addressed.

Due to the nature of the proposed development it may be acceptable for "less precisely computed" modelling methods to be utilised for this site. If this approach is adopted then a freeboard of 600mm should be added to any resulting flood level. If "precisely computed" modelling methods are adopted (such as building a hydraulic model for this section of the River Alde) then a 300mm freeboard would be appropriate.

It should be noted that under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws, the prior written consent of the Environment Agency is required for any proposed works or structures in, under, over or within 9 metres of the top of the bank of the main river (Alde).

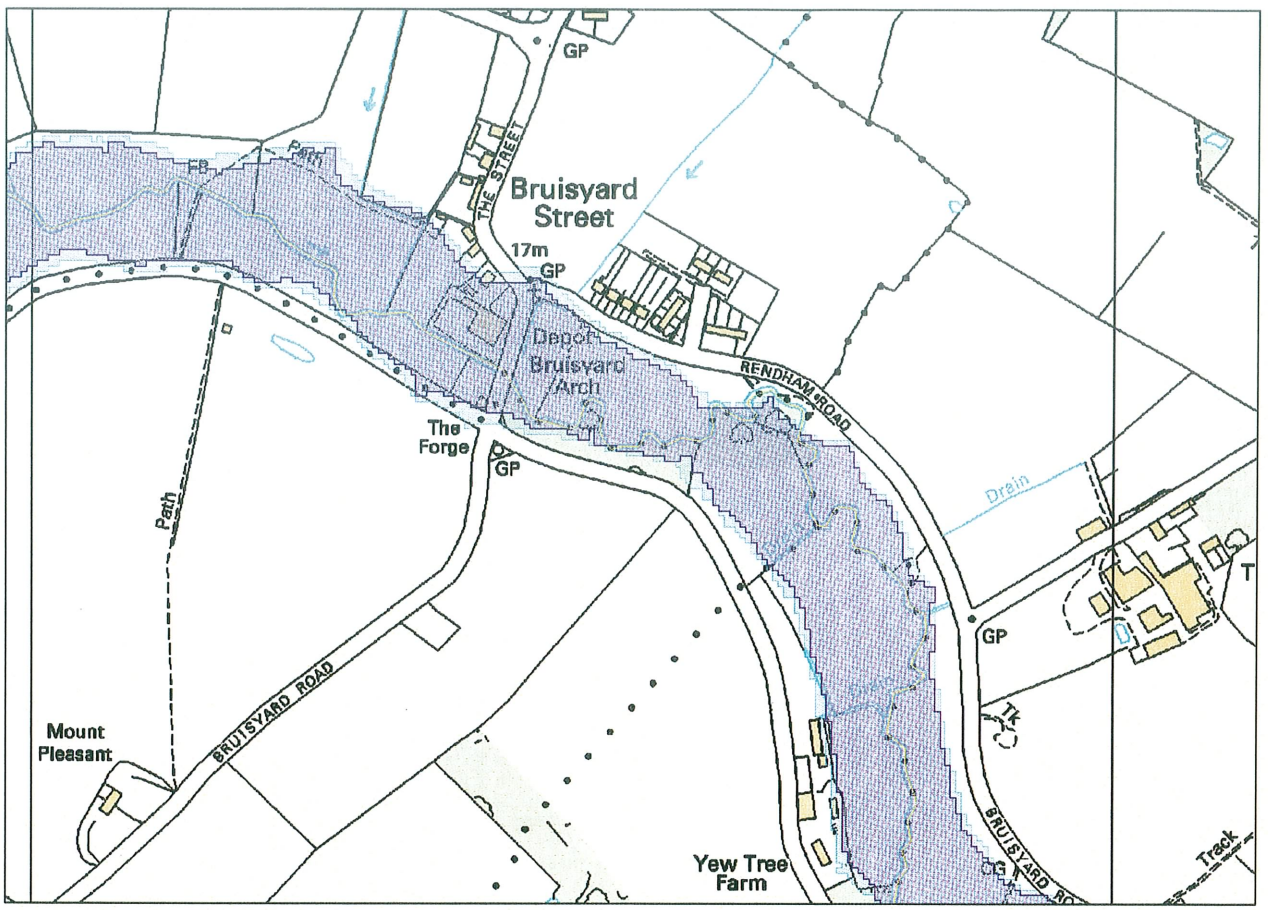
Yours sincerely

Mr William Todd
Development Control Engineer

Direct dial 01473 706718

End

Flood Map, Bruisyard



Layer	Key
Flood Zone 3 - Anglian Eastern Area	
Flood Zone 2 - Anglian Eastern Area	

Flood Zone 3 - Anglian Eastern Area	The best estimate of the floodplain associated with a 1:100 year fluvial or 1:200 year tidal event.
Flood Zone 2 - Anglian Eastern Area	The best estimate of the floodplain associated with a 1:1000 year return period fluvial/tidal event.

The Flood Zone Map is the output of recent modelling work undertaken to establish areas of flood risk associated with fluvial (river based) and tidal flooding. It is primarily to aid in the planning process and does not distinguish visually between tidal and fluvial flood plains. The flood zones

shown represent the current modelled extent of flooding for the above return periods but do not illustrate the potential impact of future climate change scenarios.

The map ignores the presence of any defences (barriers, enlarged channels etc.) and they do not indicate flood depths and should not be used to infer depths for specific probabilities of flood.

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