JPP CONSULTING

Proposed Development at Pool House, Newtown Linford Lane, Groby Leicester LE6 0FR

DEVELOPMENT SERVICES
16 MAR 2010
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Site Specific Flood Risk Assessment Report

Report reference
M4895H

Report originator		
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Report Issue

Company	Name	Paper			Electronic		
		Issue	Date	n	Issue	Date	n
	James Everson-Crane	Planning	30/10	3	Planning	30/10	3
Wilbraham Associates	Sally Stroman	Planning	30/10	4	Planning	30/10	3

Executive summary

The following table is based on Planning and policy statement 25 'practice guide' and serves as an executive summary. This executive summary shall not be read in isolation to the main report which follows:

Item	Summary statement	Report ref
1 Development description and location		
1a What type of development is proposed and where will it be located? Include whether it is new development, and extension to existing development or change of use.	**Extension to an existing residential property**	**Section 2.1**
1b What is its vulnerability classification?	**More vulnerable.**	**Section 2.4.2**
1c Is the proposed development consistent with the local development documents?	**Yes**	
1d Please provide evidence that the sequential test and where necessary the exception test has been applied in the selection of this site for this development type?	**Site in flood zone1 and classified as more vulnerable, thus sequential test and exception test need not be applied.**	**Section 4.0**
2 Definition of the flood hazard		
2a What sources of flooding could affect the site?	**None identified.**	**Section 3.0**
2b For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available.	**Not applicable**	**Sections 3.1 to 3.4**
2c What are the existing surface water drainage arrangements for the site?	**Unknown, possibly natural**	**Section 5.1**

3 Probability		
3a Which flood zone is the site within?	**Flood zone 1**	**Section 3.1.1**
3b If there is a Strategic Flood Risk Assessment covering the site what does it show?	**Site in flood zone1**	**Section 3.1.1**
3c What is the probability of the site flooding taking account of the contents of the SFRA and of any further site specific assessment?	**Site in flood zone 1 and no other sources of flood sources considered to represent a risk identified.**	**Section 3.1**
3d What are the existing rates and volumes of runoff generated by the site?	**Greenfield Runoff**	**Section 5.3**
4 Climate Change		
4a How is flood risk at the site likely to be affected by climate change?	**Residential development with life likely to exceed 60 years, thus stormwater drainage designed for increase in storm intensities of 30%**	**Section 5.4.1**
5 Detailed development proposals		
5a Please provide details of the development layout, referring to the relevant drawings		**Appendix B**
5b Where appropriate, demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding.	**Not appropriate**	
6 Flood risk management measures		
6a How will the site be protected from flooding, including the potential impacts of climate change, over the developments lifetime?	**Site in flood zone 1, climate change not likely to affect zone classification during the lifetime of the development.**	

7 Off site impacts		
7a How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?	**Site development very small area, unlikely to cause flooding elsewhere.**	**Section 5.5 to 5.6**
7b How will you prevent run-off from the completed development causing impact elsewhere?	**Exceedance contained on site where possible overland flows directed towards Groby Pool**	**Section 5.6**
8 Residual risks		
8a What flood related risks will remain after you have implemented the measures to protect the site from flooding?	**Overland flows in storm design exceedance, and maintenance / management of the stormwater drainage system**	**Section 5.6**
8b How and by whom will these risks be managed over the lifetime of the development?	**Development in private ownership and will be maintained as existing drainage**	**Section 7.**

Aerial photograph of the site



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1.0 Introduction

1.1 This report describes a Site Specific Flood Risk Impact Assessment for a proposed residential development at Pool House, Newton Linford Road, Groby, Leicester. The National Grid reference for the site is 452050E,308000N. This report has been prepared by JPP Consulting Limited acting on instructions received through Wilbraham Associates on behalf of Mr James Everson-Crane. The benefit of this report is limited to our instructing Client.

1.2 The objective of this report is in support of a planning application for the redevelopment of the site and to advise interested parties in the development to the potential risk of flooding and management of the plant from a drainage perspective. The report both assesses flood risk and provides an outline strategy to drain the site in respect of stormwater drainage. The report is not intended as a final design for stormwater drainage, such a design will be subject to more detailed analysis, during the detail design stage.

1.3 This report has been prepared with reference to the following publications:-

- Planning Policy Statement 25 "*Development and flood risk*" (PPS 25)
- CIRIA Report C624 "*Development and flood risk*"
- Planning Policy Statement 25 *'Practice Guide'*
- Environment Agency guidance relating to PPS 25 (FRA Guidance note 1: Development greater than 1Ha in flood zone 1)
- Development and flood risk: a practical guide comparison to PPS 25 "*Living Draft*"
- CIRIA Report C697 (2007) "*The Suds Manual*"
- Institute of Hydrology (IOH) Report 124 *'Flood Estimates for small catchments'*
- DTLR *'Preparing for Floods'*
- Strategic flood risk assessment report for the area prepared by jba Consulting dated 2007, prepared for Hinckley & Bosworth Borough Council.

1.4 We have consulted with the Environment Agency (EA) who have responded to this proposal by letter, following this correspondence we have been in discussions with the EA Engineer relating to the flood mapping that is acknowledged to be "miss-aligned", we have undertaken a river modelling exercise on Slate Brook, in conjunction with the Environment Agency and in accordance with their requirements.

2.0 Description and history of the site and development proposals

2.1 Location and Description of the Site

2.1.1 The site is currently occupied by a number of buildings including Pool House and attached barns some of which have been converted into dwellings and are currently occupied, Pool House is in need of renovation. The site is positioned towards the floor of a wide and flat bottomed valley carrying Slate Brook, the channel of which is located along the west boundary of the site. A plan showing the location of the site is presented in appendix A.

2.2 History of the Site

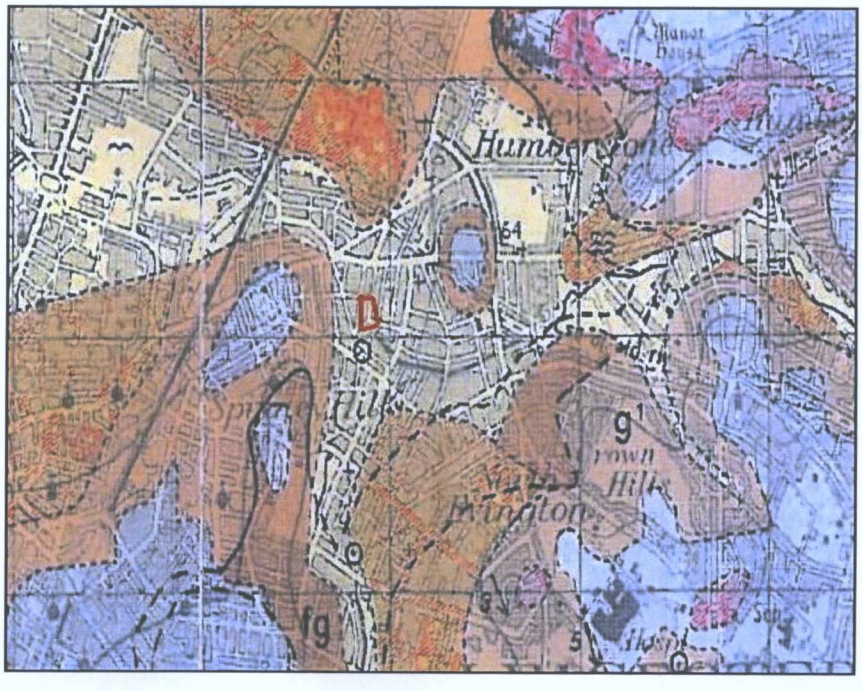
2.2.1 Inspection of the old Ordnance Survey maps dating back to first editions (1886) indicates the site was developed as Pool House, with some progressive development to its current footprint shortly afterwards.

2.3 Geology of the Site

2.3.1 Inspection of the geological map of the area (at 1:50000 scale) published by the British Geological Survey indicates the topography local to the site is formed in deposits of Alluvium (associated with Slate Brook), overlying at depth the Diorite, Granodiorite and Tonalite (Solid Geology). The thickness of the alluvial soils is not recorded at the site but probably is less than 5m.

Extract of 1:50000 Scale geological map

Site marked in red



2.3.3 A ground investigation has not yet been carried out at the site. Typically the alluvial soils comprise clays and sandy clays to depths of around 2 to 3m overlying more granular soils (typically clayey sands and sands) which typically contain groundwater.

2.3.4 It is unlikely that the near surface cohesive alluvial soils will exhibit permeability; however there is a possibility that the deeper more granular soils could, although these soils are likely to contain groundwater. The underlying Solid geology are likely to be impermeable but near surface could be fractured.

2.4 Development Proposals and Flood Risk Vulnerability

2.4.1 Current proposals are to convert an existing single storey long barn and to extend and convert an existing detached dwelling to the west of the site near Slate Brook.

2.4.2 With reference to Table D2 of PPS 25, the proposed development would be classified as "More Vulnerable". A copy of Table D2 is provided below with the development type highlighted.

Extract copy of table D2 from PPS 25.

Vulnerability	Development types
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • **Buildings used for: dwelling houses**; student halls of residence; drinking establishments; nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday short-let caravans and camping, subject to a specific warning and evacuation plan.

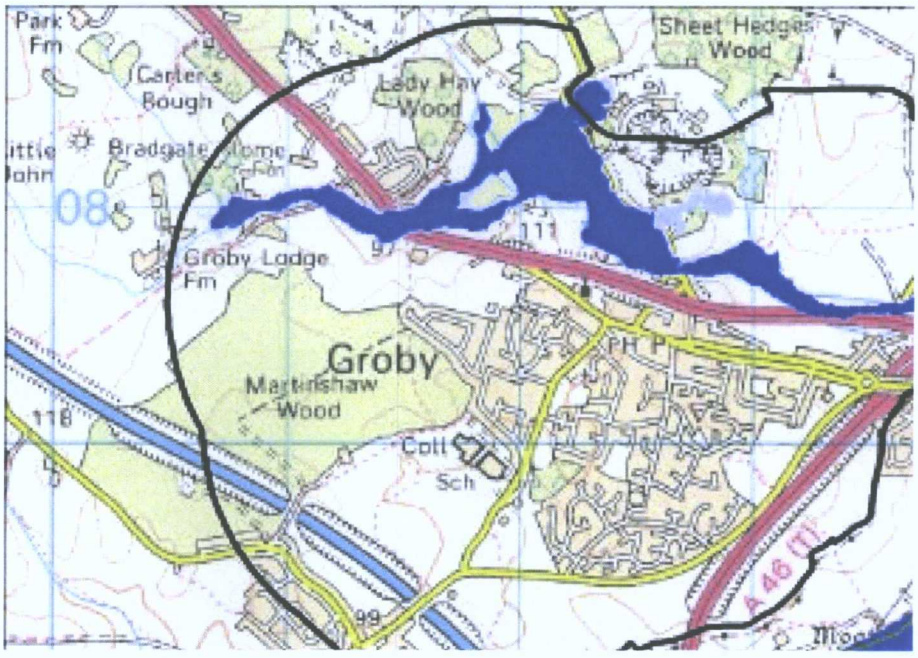
3.0 Flood Risk

3.1 Fluvial/Tidal Flooding

3.1.1 We have reviewed the strategic flood risk asssement report produced by Jba Consuting on behalf of Hinckley & Bosworth Borough Council. An extract copy of a plan contained within the report is provided below in the vicinity of the site.

Extract copy of flood risk map

Site boundaries outlined in red



Shading represents the following

Dark Blue	1 in 100 year modelled flooding
Light Blue	1 in 1000 year modelled flooding

The flood risk map indicates the site may be within the 1 in 100 year flood event, the east of the site is above the 1 in 100 event and the more extreme 1 in 1000 event. Based on this flood mapping the proposed conversion and extension are likely to be situated within flood zone 3a (High Probability) with an annual probability of flooding during the 1 in 100 event in any year (<0.1%). A copy of table D1 in PPS25 is presented below and defines flood zone 3a. However, JPP Consulting Ltd have carried out a site specific modelling of Slate Brook that re-defines the flood zones and clearly shows the proposed development site to be within Flood Zone 1. Details of the modelling of Slate Brook are presented in this report.

Extract copy of table D1 from PPS 25 (defining flood zones)

Flood Zones	Definition
Zone 1: Low Probability	**This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)**
Zone 2: Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
Zone 3a High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Zone 3b The Functional Flood plain	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 an 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).

3.2 Flooding from Groundwater

3.2.1 Groundwater within the area of the site is likely to be located within the lower horizons of the alluvial soils. Typically groundwater levels in alluvial soils will be dictated by water levels in the nearby watercourse (Slate Brook), although the more cohesive near surface alluvial soils will provide a form of vertical constraint to any rises in groundwater levels. Based on this and the analysis of fluvial flooding described above, then site is not considered to be at significant risk of flooding from groundwater.

3.3 Flooding from Sewers

3.3.1 At this stage we have not consulted Severn Trent water. Given the rural nature of the area, it is unlikely there are main sewers in the vicinity of the site. Stormwater sewers are likely to outfall into Slate Brook, upstream of the site, being the local natural drainage system, with any stormwater sewer outfall likely to be protected from upsteam flooding of stormwater sewers using flap valves, which is a common installation. We are not aware of any flooding issues from sewers in the area, there are no records of flooding from sewers.

3.3.4 Based on the above, it is considered that the site is unlikely to be at risk of flooding from sewers.

3.4 Flooding from Reservoirs, Canals and other Artificial Sources

3.4.1 Groby pool form the north boundary to this site, the pool water levels are artificially controlled by a weir to the east of the site and in recent years there is no reports of any flooding to the site from Groby Pool. Embankments were formed to the north east boundary of the pool to prevent flooding to adjacent quarry workings.

3.5 Flood Risk Vulnerability and Flood Zone Compatibility

3.5.1 Based on the above assessment of Flood Risk (Zone 1) and development vulnerability (more vulnerable) and with reference to PPS 25 Table D3 the proposed development of this site would be considered "appropriate". A copy of table D3 is presented below highlighting the above.

Flood risk Vulnerability classification	Essential Infrastructure	Water compatibility	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	X	Exception Test required	✓
Zone 3b	Exception Test required	√	X	x	X

It is noteworthy that if the site is considered to be located within flood zone 2 (adopting a favourable approach), then considering the site is located within the margins of the 1 in 1000 year modelled flood outline provided on the strategic flood risk assessment report, then the development still remains 'appropriate' with reference to the above table.

4.0 Sequential and Exception tests

4.1 Sequential test.

4.1.1 Following PPS 25 (paragraphs 16 and 17), it is the responsibility of the local planning authority (LPA) to apply the sequential test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding. As this site is within flood zone 1 and thus not at risk of fluvial flooding, we consider there is no need to apply the sequential test with respect to this site in relation to flood risk

4.2 Exception test.

4.2.1 Following table D3 of PPS 25, with the site located in flood zone 1, and deemed a 'more vulnerable' development, the development is considered 'appropriate', and thus an exception test is not required. A copy of table D3 is provided above.

5.0 Management of Surface Water

5.1 Current Conditions

5.1.1 The site is currently partially occupied; storm water collected from roof areas and hardstandings is likely to be discharged into storm water sewers (probably private sewers) located across the site. These sewers are likely to ultimately outfall into Slate Brook. Investigations should be carried out to determine the location and points of discharge of any existing storm water sewers.

5.2 Stormwater Drainage Outfalls

5.2.1 It is a requirement of the Building Regulations 2000 (part H) to dispose of stormwater collected by a development in the following list of priorities:-

1. Infiltration systems where ground conditions permit.
2. To watercourses.
3. To sewers.

Each of these is considered separately below:

5.2.2 Infiltration Systems

5.2.2.1 An outline of ground conditions encountered on this site is provided in section 2.3 above. It is unlikely that infiltration systems will be feasible, although there is a slight possibility that stormwater could be discharged via soakaways into the more granular deposits of the alluvial soils, although clearly this will require on site investigations.

5.2.3 Watercourses

5.2.3.1 The subject site is about 40m distant from Slate Brook located to the west of the site. There are no ditches or other watercourses close to the site, it is likely existing storm water is discharged to Slate Brook and we would envisage the proposed development would also discharge to Slate Brook that discharges direct to Groby Pool.

5.2.4 Sewers

5.2.4.1 It is likely (subject to further enquiry) that there are no public storm water sewers, around the perimeter of the site or in close proximity to the proposed development.

5.3 Stormwater drainage strategy

5.3.1 Based on the above, the stormwater drainage strategy for the proposed development would be to investigate the possibility of soakaways, by carrying out infiltration tests. If these tests are successful then infiltration trenches could be installed at the extremities of the development, subject to achieving 5m distance from buildings (building regulation requirement). If infiltration systems are not feasible, either as a result of unsuccessful investigations or development constraints, then reuse of existing stormwater drainage infrastructure (sewers) will have to be adopted. Again onsite investigations and enquiry with Severn Trent water will be required.

5.4 Stormwater drainage design and management

5.4.1 Proposals are to design the stormwater drainage system to accommodate storms up to the 1 in 100 year event and allow for increase in storm intensities up to 30% (design life of 'residential' developments assumed at greater than 60 years), following the requirements of PPS 25 annex B. A copy of table B8.2 is presented below.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	**+30%**
Peak river flow	+10%	+10%	+20%	+20%
Offshore wind speed	+5%	+5%	+10%	+10%
Extreme wave height	+5%	+5%	+10%	+10%

5.4.2 The site is currently partially occupied by residential buildings and associated infrastructure including barns which cover part of the site. It is likely that stormwater collected by the existing development will drain into existing stormwater sewers around the site. Assuming, at this stage, infiltration systems are not feasible, then proposals are to utilise existing off site stormwater sewers.

5.4.3 Clearly if infiltration systems are feasible then discharge via sewers (and thus to Slate Brook) off site could be reduced. In either case this will have a positive effect in reducing flood risk downstream of the site.

5.5 Conveyance Possibilities

5.5.1 Assuming infiltration systems are not feasible, the positive drainage could be provided to discharge to Slate Brook, and this could be provided in the use of an open ditch or swale. Such methods comply with the SuDs manual and would reduce the time of entry from the development to Slate Brook mimicking the existing Greenfield conditions. The precise drainage will be subject to detailed design, it is sufficient at this stage to outline the strategy for storm water disposal from the site.

5.6 Overland flows

5.6.1 It is proposed to design the stormwater drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of global warming (30% increase in intensity). Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur.

5.6.2 Site levels will need to be designed to direct overland flows on site to be directed away from buildings. Overland flows shall be directed from the buildings across open land to discharge directly to Slate Brook.

5.7 Foulwater drainage strategy

5.7.1 Foulwater generated by the site will be directed to existing foulwater drainage infrastructure off site operated by Severn Trent Water.

5.8 Conclusions and flood risk from site drainage proposals

5.8.1 Based on the above, and the Modelling of Slate Brook as detailed in Section 6.0, providing the strategies are adopted the developed site will not have a significant impact on the receiving watercourse (Slate Brook and Groby Pool) downstream of the site, thus satisfying the principles of PPS 25. The modelling of Slate Brook has established there is no risk of flooding of this development for the nominal 1 in 100 event plus climate change, this also satisfies the principles of PPS25.

6.0 Slate Brook River Model Study

6.1 Catchment Hydrology

6.1.1 Catchment Description

The Slate Brook catchment consists of a total area of 5.61km^2 upstream of Groby Pool (NGR 451850mE 308000mN) which is located just downstream of Pool House (Refer to figure 6.1). The catchment is predominantly rural with a very small urban catchment encompassing the village of Field Head.

Figure 6.1: Slate Brook Catchment



6.1.2 Hydrological Data

There are no gauging stations on Slate Brook. Where no gauged data is available the Flood Estimation Handbook (FEH), an industry standard hydraulic assessment package, recommends the use of donor and analogue catchments to provide the necessary data set to undertake a hydrological analysis. There are however, no local catchments with gauged data of similar size, shape and other catchment descriptors that could be utilised as donor catchments. Consequently, the FEH Rainfall Runoff Model using catchment descriptors is the preferred method for peak flow estimation as the FEH recommends the rainfall runoff method in preference to the statistical method for small catchments such as Slate Brook.

6.1.3 FEH Peak Flow Estimation

The method to calculate the peak flow using Rainfall Runoff Method using catchment descriptors is detailed in Volume 4 of the Flood Estimation Handbook. The following catchment descriptors for Slate Brook catchment were obtained from the FEH CD-ROM for the catchment upstream of Groby Pool.

Table 6.1a: Catchment Descriptors for Slate Brook at Groby Pool (NGR 451850mE 308000mN):

Descriptor	Units	Value
AREA	km^2	5.61
FARL		0.981
PROPWET		0.30
ALTBAR	m	136.00
ASPBAR	Degrees	135.00
ASPVAR		0.480
BFIHOST		0.339
DPLBAR	km	2.55
DPSBAR	m/km	43.00
LDP	km	5.37
RMED-1H	mm	11.1
RMED-1D	mm	31.2
RMED-2D	mm	39.3
SAAR	mm	688
SAAR4170	mm	702
SPRHOST		43.4
URBCONC		0.633
URBEXT1990		0.008
URBLOC		0.599

The Results of the T-year flood estimation analysis of Slate Brook for the catchment upstream of Groby Pool are presented in the following table.

Table 6.1b: T-year Flood Estimation for Slate Brook

Peak Flow Estimation							
Location	Return Period						
	2	5	10	30	50	100	100+30%
Slate Brook Groby Pool	2.129	2.591	3.114	4.396	5.118	6.285*	8.170

** Note refer to Appendix C for Unit Hydrograph Output.*

In accordance with PPS 25 "Development and Flood Risk" and paragraph 5.4.1 of this report 30% additional flow will be included to make allowance for climate change. Therefore the 1:100 year flow plus 30% of 8.17m^3/s will be adopted for the flow of this study.

6.2 Hydraulic Modelling

6.2.1 Watercourse Description

The reach length of Slate Brook to be modelled is approximately 150m and includes no hydraulic structures. Water level in Groby pool is controlled by a weir located approximately 300m northeast of the end of Slate Brook.

Pool House is located approximately 40m from the Slate Brook with the floodplain consisting of open fields and dense vegetation.

6.2.2 Model Construction

6.2.2.1 *Model Software*

The reach length has been modelled using the HEC-RAS Version 4.0 software package developed by the Hydrological Engineering Centre of the US Army Corps of Engineers. The reach is one channel and the simulation of the duration of peak flooding is not required to establish the peak flood level, the use of a steady state one dimensional model is appropriate for the modelling peak flood flows in Slate Brook.

6.2.2.2 *Topographical Survey*

NJC Surveys Ltd., who undertook the survey of the main site, were commissioned to survey the watercourse and adjacent floodplains. A total of 4 watercourse cross-sections were undertaken. Cross Sections were spaced at approximately 40m-50m intervals, depending on sight line and accessibility, to give an appropriate level of detail for the model.

The cross sections comprised of the bottom of bank, top of bank and spot heights of the adjacent floodplain extended to the approximate line of the EA's indicative floodplain where appropriate. Detailed survey of the bed was not considered necessary due to the fact that lows flows were not being simulated.

The watercourse details were inputted into HEC-RAS by hand using the cross section details.

All level data used in this study are to OS levels.

6.2.2.3 *Hydraulic Roughness*

The main channel of the watercourse and floodplains are consistent along the modelled length in terms of watercourse features and vegetation cover. Therefore the same Manning's "n" values shown in table 6.2a have been applied to each cross section

Table 6.2a: Manning's n Values

	Left Floodplain	Main Channel	Right Floodplain
Manning's n	0.1	0.05	0.1

6.2.2.4 *Boundary Conditions*

The downstream boundary conditions has been set at the free discharging normal depth calculated from the localised bed gradient of 1:3,000 and the upstream boundary condition has been set to the critical depth.

6.2.2.5 *Calibration*

As there is no gauged data available the model cannot be calibrated. However this model has been carefully constructed to ensure that it is fit for purpose for determining the extent of the 1:100 year flood. Obtaining sufficient data, through long term onsite measurement, to enable the calibration of the model is beyond the scope of this work.

6.2.3 Model Simulation

The model has been simulated with peak flows for the 100 year return plus a 30% allowance for climate change. The geometry for the constructed model has used the detailed cross section provided by NJC Surveys Ltd. In order to best simulated existing conditions, Groby pool has been placed into the model with the initial water level at the weir level of 94.740m AOD, in the steady flow data to ensure that the modelled water level in Slate brook was accurately calculated.

6.3 Results

6.3.1 Model

The results of the simulation are illustrated in Figure 6.3 below and detailed in Table 6.3a. Appendix D presents the 1in100 +30% modelled flood plain.

Figure 6.3: 1in100 + 30% Model Results

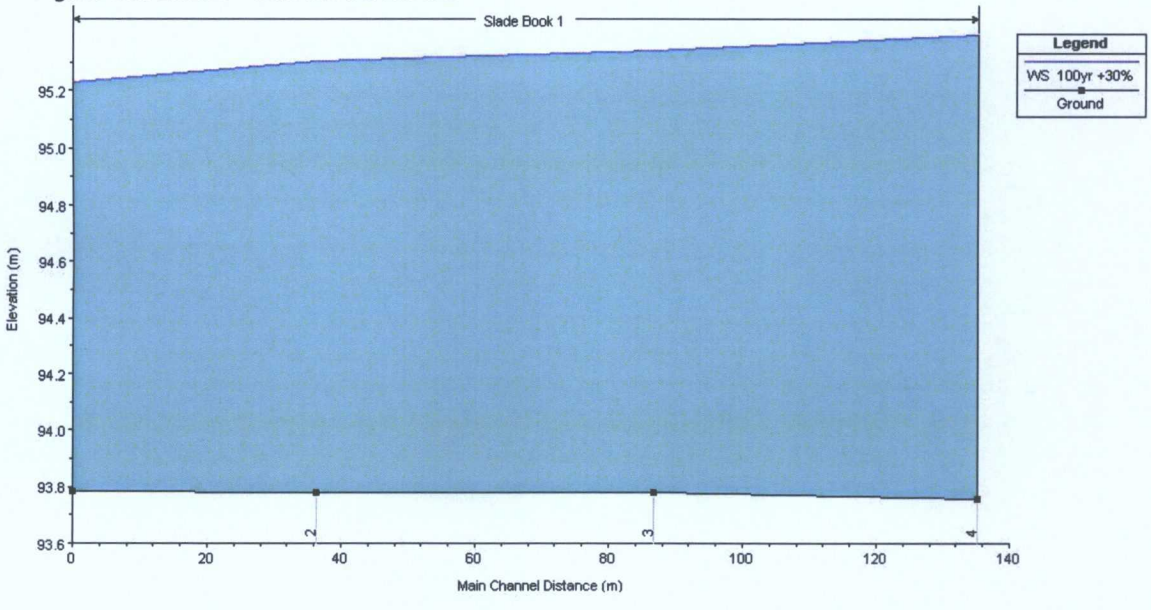


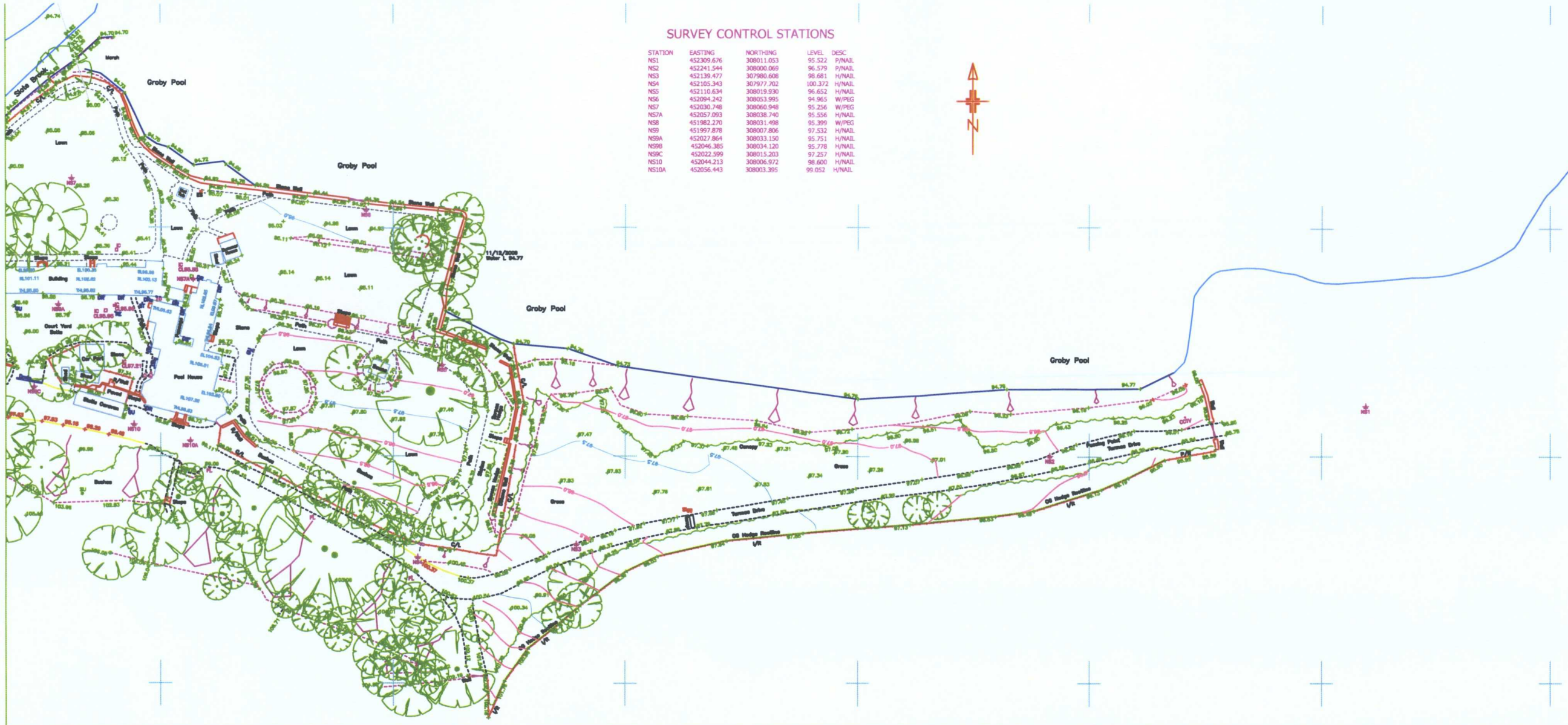
Table 6.3a: Summary of results

Water Surface Flood Level		
Station	Chainage (m)	Return Period (years)
		100 + 30%
4	0	95.397
3	49	95.340
2	99	95.304
1	136	95.228

7.0 Maintenance

7.1 The drainage system will be designed to minimise maintenance requirements, however a full maintenance scheme will be established during the detailed design stage. Much of the onsite drainage is likely to remain in private ownership requiring future owners of the site to adhere to a documented maintenance regime. Off site sewers are likely to be maintained by Severn Trent Water


308100N
308050N
308000N
307950N
451900E
451950E
452000E
452050E
452100E
452150E
452200E
Slate Brook
Slate Brook
Groby Pool
Groby Pool
Groby Pool
Lawn
Lawn
Lawn



SURVEY CONTROL STATIONS

STATION	EASTING	NORTHING	LEVEL	DESC
NS1	452309.676	308011.053	95.522	P/NAIL
NS2	452241.544	308000.069	96.579	P/NAIL
NS3	452139.477	307980.608	98.681	H/NAIL
NS4	452105.343	307977.702	100.372	H/NAIL
NS5	452110.634	308019.930	96.652	H/NAIL
NS6	452094.242	308053.995	94.965	W/PEG
NS7	452030.748	308060.948	95.256	W/PEG
NS7A	452057.093	308038.740	95.556	H/NAIL
NS8	451982.270	308031.498	95.399	W/PEG
NS9	451997.878	308007.806	97.532	H/NAIL
NS9A	452027.864	308033.150	95.751	H/NAIL
NS9B	452046.385	308034.120	95.778	H/NAIL
NS9C	452022.599	308015.203	97.257	H/NAIL
NS10	452044.213	308006.972	98.600	H/NAIL
NS10A	452056.443	308003.395	99.052	H/NAIL

Survey Notes

1: This Survey is related OS Grid Base (OSGB36 02).

2: All Levels are related to OS Datum (OSGB36 02).

3: The information shown on this drawing is surveyed to the accuracy of the base scale shown.

4: Main entry to sewers has not been undertaken. Depths and pipe sizes are measured / estimated from the ground. This should be checked with Local Authority records or on site prior to the commencement of any works.

5: Boundaries shown are physical features and may not represent legally conveyed ownership.

6: This plan should only be used for its original purpose. NJC Surveys LTD accepts no responsibility for this plan if it is supplied to any party other than the original client.

Survey Key

Street Furniture Symbols & Abbreviations

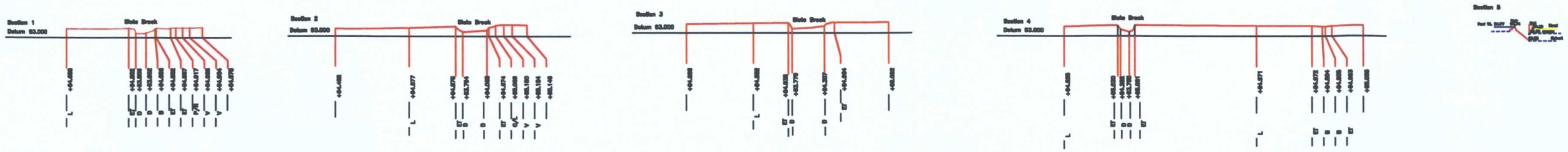
BB	Belisha Beacon	Mkr	Marker Post
BH	Borehole	MP	Mile Post
BL	Bollard	PB	Pillar Box
BS	Bus Stop	Pi	Pipe
Dr	Drain	PM	Parking Meter
EP	Electric Pole	PO	Post
FL	Flood Light	RE	Rodding Eye
FS	Flag staff	RP	Reflector Post
GP	Gate Post	RS	Road Sign
GU	Gully	ST	Stop Tap
GV	Gas Valve	SI	Sign
IC	Inspection Cover	Su	Stump
LB	Litter Bin	SV	Stop Valve
LP	Lamp Post	TP	Telegraph Pole
TL	Traffic Light	VP	Vent Pipe
MH	Manhole	TC	Telecommunication
NP	Name Plate	WT	Water Tap
FH	Fire Hydrant	KO	Kerb Outlet
WO	Wash Out	AV	Air Valve
WM	Water Meter	TCB	Tel Cell Box
TV	Cable Television	T/P	Trial Pit
		STN	Survey Control Station

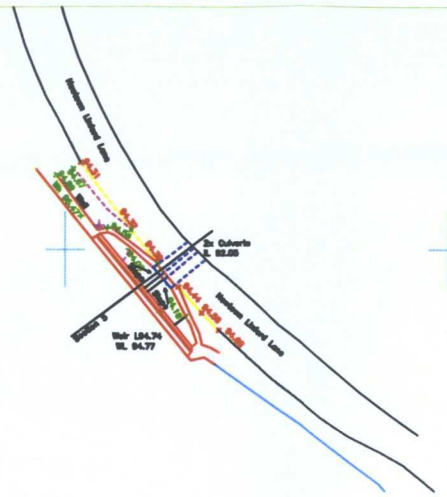
Fence Types & Abbreviations

C/P	Chestnut Paling
C/B	Close Boarded
C/L	Chain Link
Con/P	Concrete Panel
C/I	Corrugated Iron
CB	Crash Barrier
Elc	Electric
H/M	Hill and Mine
Hrd	Hoarding
Iwn	Interwoven
I/R	Iron Railings
O/L	Overlap
Pal	Paling
P/K	Picket (Wooden)
P/Bw	Post & Barbed Wire
P/C	Post & Chain
P/R	Post & Rail
P/W	Post & Wire
P/M	Post & Wire Mesh
T/R	Trip Rail

Feature Lines

	Hedge		Overhead Power Line
P/W	Fence		Individual Tree-Sized
	Gate		
	Stile		
	Footpath		
	Kerbline	Building	Structure
	Verge/Edge of Track or Change Of Surface	Wall	Wall
FW / SW	Sewer Lines	R/Wall	Retaining Wall
	Ditch / Embankment etc		





REV	DATE	DESCRIPTION	BY	APP.

NJC SURVEYS LTD
17 Western Close, Ashby-de-la-Zouch, Leicestershire
Telephone: 01530 414304-Mobile: 07876 792 994
Mail: nclarke@njcsurveys.co.uk
Web: www.njcsurveys.co.uk

Client

JPP CONSULTING

Drawing Title

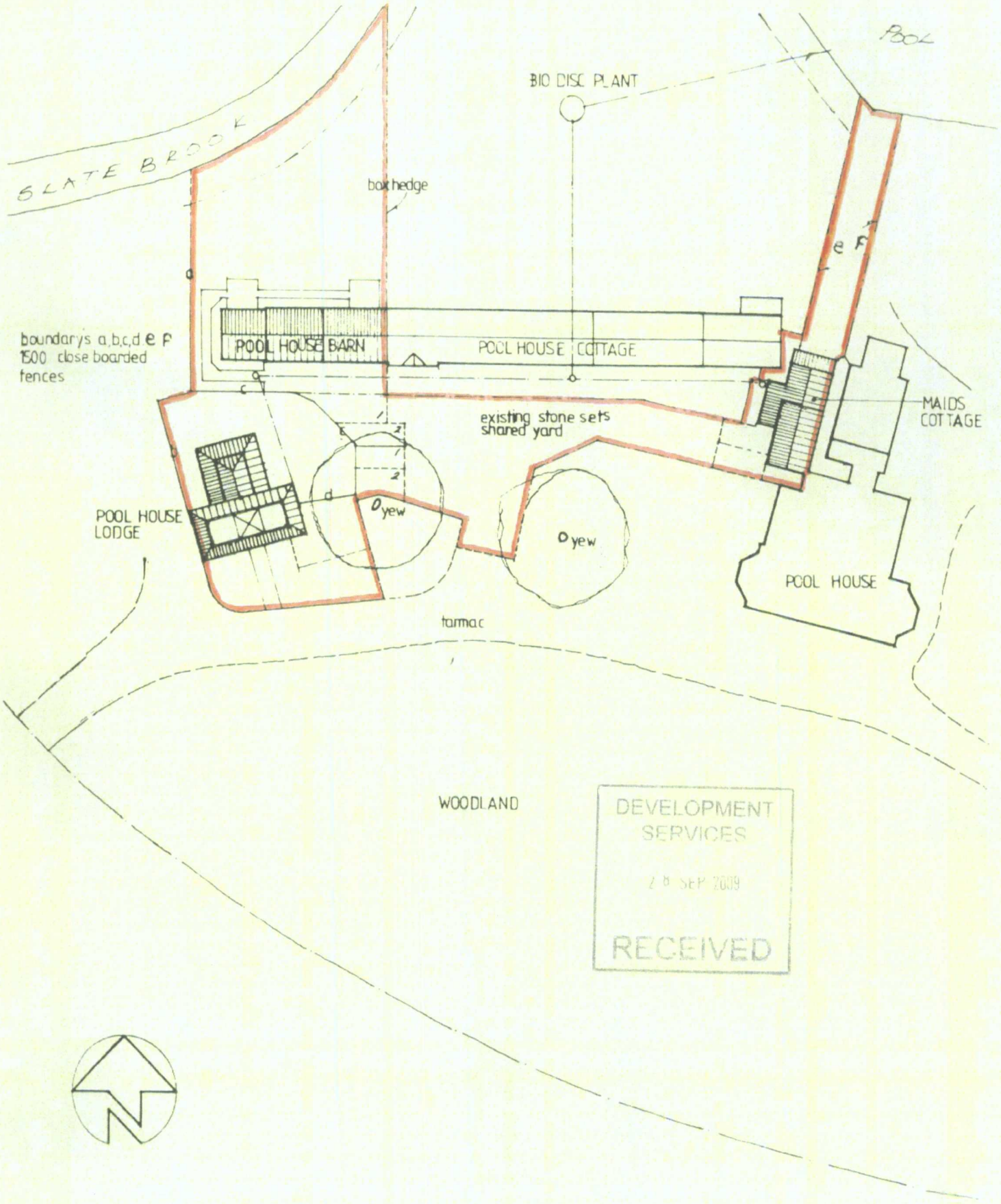
Pool House
Newton Linford Lane
Groby
Leicestershire

Topographical Survey

Drawn	Checked	Authorised
LD	NJC	NJC
Date	**Scale**	**Sheet size**
14/12/2009	1/500	A1

Drg. No. S520/03

Revision



DEVELOPMENT
SERVICES
28 SEP 2009
RECEIVED

block plan
1:500

Additional Hydrograph Details - 1

Input Variables

Site Location	451850 308000 SK 51850 08000
C	-0.02800
D1	0.35300
D2	0.36100
D3	0.26200
E	0.31000
F	2.37400
Area (Ha)	561.000
SAAR (mm)	689
CWI	103.020
Urban (1990)	0.0080
SPR	43.400
DPSBAR	43.000
DPLBAR	2.550
PROPWET	0.300
LAG (hrs)	0.000
Base Flow (l/s)	(Calculated)
Areal Reduction Factor	1.000
BFIHOST	0.339
FARL	0.981

Output Variables for 480 Mins (Summer)

TP(0) (mins)	285	Q (l/s)	2477.3	PR (%)	43.046
T (mins)	28	TB (mins)	753		
TPt (mins)	299	Base Flow (l/s)	75.6		

Additional Hydrograph Storm Duration 480 Mins (Summer)

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
2	89	64	153	126	314	188	660	250	1511	312	2767
4	89	66	156	128	321	190	679	252	1549	314	2809
6	89	68	159	130	330	192	698	254	1586	316	2851
8	89	70	162	132	339	194	718	256	1624	318	2893
10	89	72	166	134	347	196	737	258	1661	320	2935
12	89	74	171	136	356	198	757	260	1699	322	2977
14	89	76	176	138	364	200	776	262	1737	324	3019
16	91	78	180	140	373	202	796	264	1774	326	3061
18	93	80	185	142	381	204	815	266	1812	328	3103
20	95	82	190	144	390	206	834	268	1851	330	3145
22	97	84	194	146	398	208	854	270	1893	332	3186
24	99	86	199	148	407	210	873	272	1934	334	3228
26	101	88	204	150	416	212	898	274	1975	336	3270
28	103	90	208	152	424	214	928	276	2017	338	3312
30	105	92	213	154	433	216	958	278	2058	340	3354
32	107	94	217	156	443	218	988	280	2099	342	3396
34	109	96	222	158	456	220	1018	282	2141	344	3438
36	111	98	227	160	468	222	1048	284	2182	346	3480
38	113	100	232	162	480	224	1078	286	2223	348	3522
40	115	102	238	164	493	226	1109	288	2265	350	3564
42	117	104	245	166	505	228	1139	290	2306	352	3605
44	120	106	251	168	518	230	1169	292	2347	354	3647
46	123	108	257	170	530	232	1199	294	2389	356	3688
48	127	110	264	172	543	234	1229	296	2430	358	3729
50	130	112	270	174	555	236	1259	298	2472	360	3770
52	133	114	276	176	568	238	1289	300	2514	362	3812
54	136	116	283	178	580	240	1323	302	2556	364	3853
56	140	118	289	180	592	242	1360	304	2598	366	3894
58	143	120	295	182	605	244	1398	306	2640	368	3935
60	146	122	301	184	621	246	1436	308	2683	370	3976

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Additional Hydrograph Details - 1

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
62	149	124	308	186	640	248	1473	310	2725	372	4018

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Additional Hydrograph Details - 1

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
374	4059	502	6176	630	5446	758	3545	886	1579	1014	348
376	4100	504	6189	632	5421	760	3512	888	1552	1016	340
378	4141	506	6202	634	5395	762	3480	890	1524	1018	332
380	4182	508	6214	636	5368	764	3447	892	1497	1020	323
382	4222	510	6227	638	5342	766	3414	894	1469	1022	315
384	4262	512	6240	640	5316	768	3382	896	1442	1024	308
386	4302	514	6253	642	5289	770	3349	898	1414	1026	302
388	4342	516	6265	644	5263	772	3317	900	1387	1028	297
390	4382	518	6278	646	5237	774	3285	902	1359	1030	291
392	4422	520	6283	648	5210	776	3253	904	1332	1032	285
394	4462	522	6280	650	5184	778	3221	906	1304	1034	280
396	4502	524	6277	652	5158	780	3189	908	1277	1036	274
398	4542	526	6273	654	5132	782	3157	910	1249	1038	268
400	4582	528	6270	656	5105	784	3125	912	1223	1040	263
402	4622	530	6267	658	5079	786	3093	914	1199	1042	257
404	4662	532	6264	660	5052	788	3062	916	1174	1044	251
406	4702	534	6261	662	5023	790	3030	918	1149	1046	246
408	4742	536	6257	664	4995	792	2998	920	1124	1048	240
410	4780	538	6254	666	4966	794	2966	922	1100	1050	234
412	4818	540	6251	668	4938	796	2934	924	1075	1052	229
414	4856	542	6248	670	4909	798	2902	926	1050	1054	225
416	4894	544	6245	672	4880	800	2870	928	1025	1056	221
418	4932	546	6241	674	4852	802	2839	930	1001	1058	217
420	4970	548	6233	676	4823	804	2808	932	976	1060	213
422	5008	550	6219	678	4795	806	2777	934	951	1062	209
424	5046	552	6205	680	4766	808	2746	936	927	1064	205
426	5084	554	6191	682	4738	810	2715	938	902	1066	201
428	5122	556	6177	684	4709	812	2684	940	880	1068	197
430	5160	558	6163	686	4681	814	2653	942	860	1070	192
432	5198	560	6149	688	4651	816	2621	944	840	1072	188
434	5236	562	6135	690	4621	818	2590	946	820	1074	184
436	5272	564	6121	692	4590	820	2559	948	800	1076	180
438	5307	566	6107	694	4560	822	2528	950	780	1078	176
440	5341	568	6093	696	4529	824	2497	952	760	1080	172
442	5376	570	6079	698	4499	826	2466	954	740	1082	169
444	5410	572	6065	700	4469	828	2435	956	720	1084	166
446	5445	574	6051	702	4438	830	2405	958	700	1086	163
448	5479	576	6034	704	4408	832	2375	960	681	1088	160
450	5513	578	6015	706	4377	834	2345	962	661	1090	157
452	5548	580	5995	708	4347	836	2314	964	641	1092	154
454	5582	582	5975	710	4316	838	2284	966	621	1094	151
456	5617	584	5955	712	4286	840	2254	968	604	1096	148
458	5651	586	5935	714	4255	842	2224	970	591	1098	145
460	5686	588	5915	716	4224	844	2194	972	578	1100	142
462	5720	590	5895	718	4192	846	2163	974	565	1102	139
464	5750	592	5875	720	4160	848	2133	976	552	1104	136
466	5777	594	5855	722	4127	850	2103	978	539	1106	133
468	5803	596	5835	724	4095	852	2073	980	526	1108	131
470	5829	598	5815	726	4063	854	2043	982	513	1110	129
472	5856	600	5795	728	4031	856	2013	984	500	1112	126
474	5882	602	5775	730	3999	858	1984	986	486	1114	124
476	5908	604	5753	732	3967	860	1955	988	473	1116	122
478	5935	606	5729	734	3934	862	1926	990	460	1118	120
480	5961	608	5706	736	3902	864	1897	992	447	1120	118
482	5987	610	5682	738	3870	866	1868	994	434	1122	116
484	6014	612	5658	740	3838	868	1838	996	423	1124	114
486	6040	614	5635	742	3806	870	1809	998	415	1126	112
488	6066	616	5611	744	3773	872	1780	1000	407	1128	110
490	6093	618	5587	746	3741	874	1751	1002	398	1130	108
492	6112	620	5564	748	3708	876	1722	1004	390	1132	105
494	6125	622	5540	750	3675	878	1693	1006	382	1134	103
496	6138	624	5517	752	3643	880	1664	1008	373	1136	102

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Additional Hydrograph Details - 1

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
498	6150	626	5493	754	3610	882	1635	1010	365	1138	100
500	6163	628	5469	756	3578	884	1607	1012	357	1140	99

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Additional Hydrograph Details - 1

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1142	98	1150	92	1158	87	1166	84	1174	84		
1144	96	1152	91	1160	86	1168	84	1176	84		
1146	95	1154	90	1162	85	1170	84	1178	0		
1148	94	1156	89	1164	84	1172	84				

Output Variables for 480 Mins (Winter)

TP(0) (mins)	285	Q (l/s)	2477.3	PR (%)	43.046
T (mins)	28	TB (mins)	753		
TPt (mins)	299	Base Flow (l/s)	75.6		

Additional Hydrograph Storm Duration 480 Mins (Winter)

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
2	85	96	215	190	737	284	2193	378	4146	472	5792
4	85	98	220	192	758	286	2233	380	4187	474	5815
6	85	100	225	194	779	288	2273	382	4227	476	5837
8	85	102	232	196	801	290	2313	384	4266	478	5860
10	85	104	239	198	822	292	2353	386	4306	480	5883
12	85	106	246	200	843	294	2393	388	4346	482	5906
14	85	108	252	202	864	296	2434	390	4386	484	5929
16	86	110	259	204	885	298	2475	392	4426	486	5952
18	87	112	266	206	907	300	2517	394	4466	488	5975
20	89	114	273	208	928	302	2559	396	4506	490	5998
22	91	116	279	210	949	304	2601	398	4546	492	6015
24	93	118	286	212	974	306	2643	400	4585	494	6026
26	95	120	293	214	1003	308	2685	402	4625	496	6038
28	97	122	300	216	1031	310	2727	404	4665	498	6050
30	99	124	306	218	1060	312	2769	406	4705	500	6062
32	101	126	313	220	1088	314	2811	408	4744	502	6073
34	103	128	321	222	1117	316	2853	410	4781	504	6085
36	105	130	331	224	1146	318	2895	412	4818	506	6097
38	106	132	341	226	1174	320	2937	414	4855	508	6108
40	108	134	351	228	1203	322	2979	416	4892	510	6120
42	110	136	361	230	1231	324	3021	418	4929	512	6132
44	113	138	371	232	1260	326	3063	420	4966	514	6143
46	116	140	381	234	1289	328	3105	422	5003	516	6155
48	119	142	391	236	1317	330	3147	424	5041	518	6167
50	122	144	401	238	1346	332	3189	426	5078	520	6172
52	126	146	411	240	1378	334	3231	428	5115	522	6172
54	129	148	421	242	1413	336	3273	430	5152	524	6172
56	132	150	431	244	1448	338	3316	432	5189	526	6172
58	135	152	441	246	1483	340	3358	434	5226	528	6172
60	139	154	451	248	1519	342	3400	436	5261	530	6172
62	142	156	463	250	1554	344	3442	438	5292	532	6172
64	145	158	478	252	1589	346	3484	440	5324	534	6171
66	148	160	493	254	1624	348	3526	442	5356	536	6171
68	152	162	508	256	1660	350	3568	444	5387	538	6171
70	155	164	522	258	1695	352	3609	446	5419	540	6171
72	159	166	537	260	1730	354	3651	448	5451	542	6171
74	163	168	552	262	1765	356	3692	450	5483	544	6171
76	168	170	567	264	1800	358	3733	452	5514	546	6171
78	173	172	581	266	1836	360	3775	454	5546	548	6165
80	177	174	596	268	1873	362	3816	456	5578	550	6155
82	182	176	611	270	1913	364	3857	458	5610	552	6145
84	187	178	626	272	1953	366	3898	460	5641	554	6134
86	192	180	641	274	1993	368	3940	462	5673	556	6124
88	196	182	655	276	2033	370	3981	464	5700	558	6114
90	201	184	673	278	2073	372	4022	466	5723	560	6103
92	206	186	695	280	2113	374	4064	468	5746	562	6093

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Additional Hydrograph Details - 1

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
94	210	188	716	282	2153	376	4105	470	5769	564	6083

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Additional Hydrograph Details - 1

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
566	6073	670	4935	774	3299	878	1706	982	563	1086	163
568	6062	672	4906	776	3267	880	1677	984	549	1088	160
570	6052	674	4878	778	3235	882	1649	986	535	1090	157
572	6042	676	4849	780	3202	884	1621	988	521	1092	154
574	6031	678	4821	782	3170	886	1594	990	506	1094	151
576	6017	680	4792	784	3138	888	1568	992	492	1096	148
578	5999	682	4764	786	3106	890	1541	994	478	1098	144
580	5982	684	4735	788	3074	892	1515	996	466	1100	141
582	5964	686	4707	790	3042	894	1488	998	456	1102	138
584	5946	688	4677	792	3010	896	1461	1000	446	1104	135
586	5928	690	4647	794	2978	898	1435	1002	436	1106	132
588	5910	692	4616	796	2946	900	1408	1004	426	1108	129
590	5893	694	4585	798	2914	902	1382	1006	416	1110	127
592	5875	696	4555	800	2882	904	1355	1008	406	1112	125
594	5857	698	4524	802	2851	906	1328	1010	396	1114	123
596	5839	700	4493	804	2819	908	1302	1012	386	1116	121
598	5821	702	4462	806	2788	910	1275	1014	376	1118	118
600	5803	704	4432	808	2757	912	1250	1016	366	1120	116
602	5786	706	4401	810	2726	914	1227	1018	357	1122	114
604	5765	708	4370	812	2695	916	1204	1020	347	1124	112
606	5742	710	4340	814	2663	918	1180	1022	337	1126	110
608	5720	712	4309	816	2632	920	1157	1024	328	1128	108
610	5697	714	4278	818	2601	922	1134	1026	322	1130	106
612	5674	716	4247	820	2570	924	1111	1028	315	1132	103
614	5651	718	4214	822	2538	926	1087	1030	308	1134	101
616	5628	720	4182	824	2507	928	1064	1032	302	1136	100
618	5605	722	4149	826	2476	930	1041	1034	295	1138	98
620	5583	724	4117	828	2445	932	1017	1036	288	1140	97
622	5560	726	4084	830	2415	934	994	1038	281	1142	96
624	5537	728	4052	832	2385	936	971	1040	275	1144	94
626	5514	730	4019	834	2355	938	947	1042	268	1146	93
628	5491	732	3987	836	2324	940	926	1044	261	1148	92
630	5468	734	3954	838	2294	942	907	1046	255	1150	91
632	5444	736	3922	840	2264	944	888	1048	248	1152	89
634	5418	738	3889	842	2234	946	869	1050	241	1154	88
636	5392	740	3857	844	2203	948	850	1052	235	1156	87
638	5366	742	3824	846	2173	950	831	1054	231	1158	85
640	5340	744	3791	848	2143	952	812	1056	226	1160	84
642	5314	746	3759	850	2113	954	793	1058	222	1162	83
644	5287	748	3726	852	2083	956	774	1060	217	1164	82
646	5261	750	3693	854	2052	958	755	1062	213	1166	82
648	5235	752	3660	856	2023	960	736	1064	208	1168	82
650	5209	754	3627	858	1994	962	717	1066	204	1170	82
652	5183	756	3594	860	1965	964	698	1068	199	1172	82
654	5157	758	3561	862	1936	966	679	1070	195	1174	82
656	5131	760	3528	864	1908	968	663	1072	190	1176	82
658	5105	762	3495	866	1879	970	648	1074	186	1178	0
660	5077	764	3462	868	1850	972	634	1076	181		
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664	5020	768	3396	872	1793	976	606	1080	173		
666	4992	770	3363	874	1764	978	592	1082	170		
668	4963	772	3331	876	1735	980	577	1084	166		

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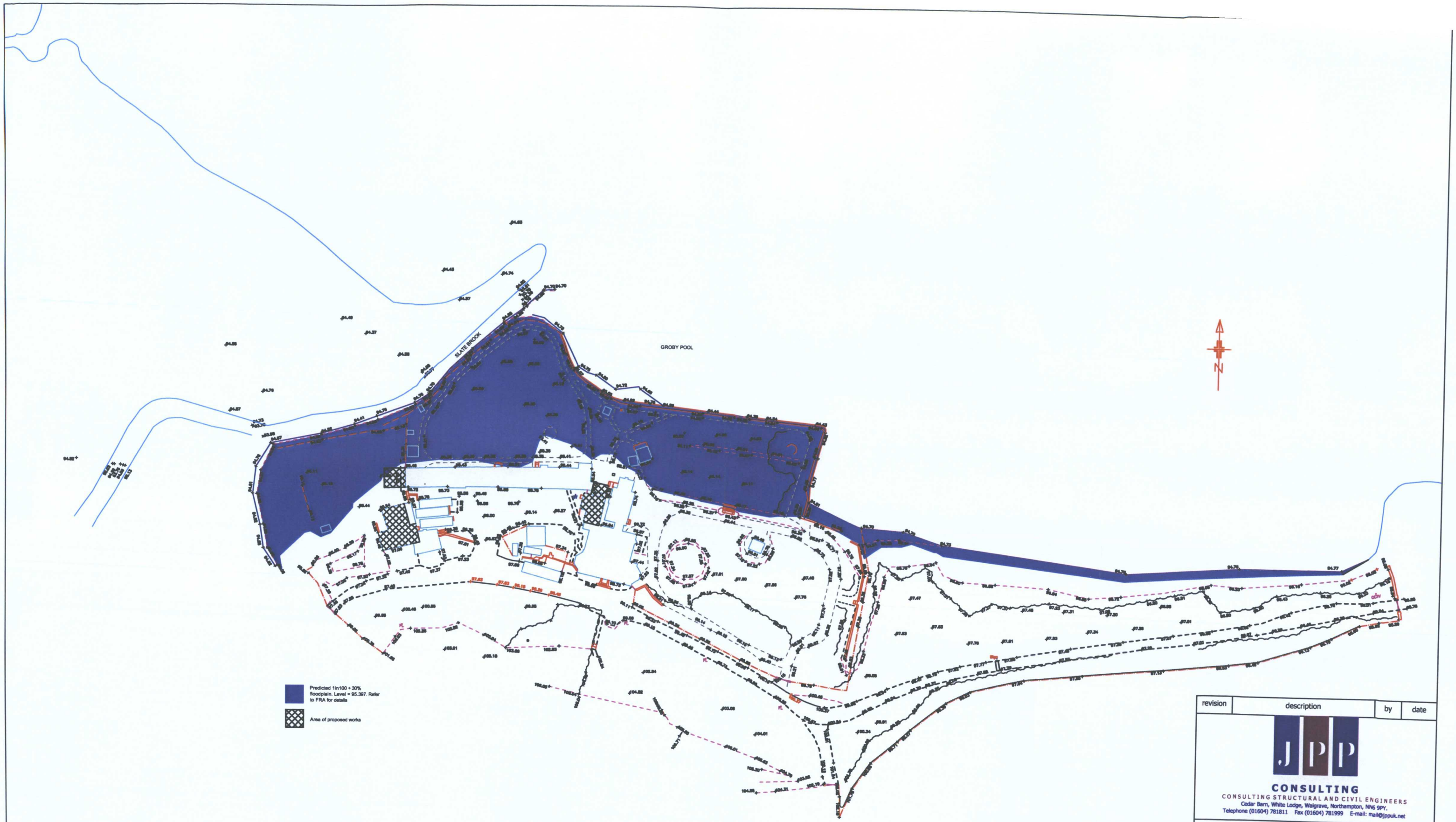

revision	description	by	date

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Project PROPOSED WORKS
POOL HOUSE
GROBY

Title PREDICTED 1IN100 + 30% FLOODPLAIN

Status FOR INFORMATION

scale @ A1	date	drawn by	checked by
1:500	MARCH 2010	WA	

project ref	drg No.	revision
M4895H	E01	