HPK/2012/0394

PETER MASON ASSOCIATES

Consulting Civil & Municipal Engineers

Stable Side
Marton Gate Farm
School Lane
Marton
Cheshire SK11 9HA
Telephone: 01260 224158
Facsimile: 01260 224159
e: pmauneng@btinternet.com

Goodyear Business Park
New Street
Mawdesley
Near Ormskirk
Lancs L40 2QP
Telephone: 01704 823245
Facsimile: 01704 823246
e: steve.douglas@btinternet.com

04 JUL 2012

Proposed Residential Development at 24 Macclesfield Road, Buxton. River Wye. Flood Risk Assessment. PPS 25.

1. Development Description and Location.

1.1. The site is located to the north of Macclesfield Road, Buxton and in the rear garden of number 24 Macclefield Road. The area of the site to be developed is a total of approximately 0.15 hectares in area and is generally surrounded by housing and open land.

1.2. The development comprises the provision of new residential dwelling house and access drive. See current architectural layout-0809-06. Prepared by Paul Dinsdale Associates Limited.

1.3. The site is on the southern bank of the River Wye and is shown on the Environment Agency's flood map as being affected by flood zone 2.

1.4. As the site is shown to be affected by flood zone 2 a Flood Risk Assessment is required in accordance with the requirements of PPS 25.

2. Definition of Flood Hazard.

2.1. The site is adjacent to the River Wye and is shown to be partially at risk from flooding during a 1 in 1,000 year flood event.

2.2. There is no flood risk from the public sewerage systems, the highway drainage system and no flood risk from any other natural watercourses. There are no other bodies of water within the area that constitute an additional risk.

2.3. There are no springs on the site that may lead to the seepage of ground water on the site.

2.4. The site is not shown to be at risk from coastal inundation flooding.

3. Probability of Flooding.

3.1. A detailed topographical survey of the site and the channel of the River Wye, the survey levels have been related to Ordnance Datum.

3.2. The 1 in 100 year and 1 in 1,000 year flood flows have been estimated by making use of the River Wye catchment parameters contained within the FEH CD-ROM 2. See appended flood flow calculation sheet.

3.3. A digital model of the stream channel has been constructed within the Hec Ras river modelling software, this software is approved by the Environment Agency as being acceptable for the estimation of flood levels.

3.4. The peak flood levels at the upstream site boundary are 297.75m for the 1 in 100 climate change flood and 297.81m for the 1 in 1,000 year flood flow. See appended summary of the Hec Ras results.

3.5. The proposed finished floor level of the proposed house is 299.66m that is well above the 1 in 1,000 flood level of 297.81m AOD.

3.6. The proposed footprint of the proposed house lies outside the 1 in 1,000 year flood plain boundary.

4.0. Climate Change.

4.1. The estimated 1 in 100 year flood flow in the River Wye has been increased by 20% to allow for the effects of global warming to the year 2115.

4.2. The detailed design of the on site surface water drainage system will be in accordance with the requirements for no surface flooding to occur during a site critical 1 in 30 year storm event.

4.3. Any necessary on site attenuation to limit the rate of surface water discharge to protect the natural watercourse will be designed using rainfall intensities that have been increased by 30% to allow for the effects of global warming to the year 2115.

4.4. The Environment Agency requires that the surface water discharge is limited to the green field rate of run off as calculated using IOH 124. This flow is less than 5.0 l/s and no flow control can be applied to the surface water drainage system that would comply with the building regulations.

5. Detailed Development Proposals.

5.1. The development comprises the provision of a new detached house. See current architectural layout-0809-06. Prepared by Paul Dinsdale Associates Limited.

5.2. Internal floor levels and vulnerable areas will be raised 150mm above the on site drive to ensure that they will not be susceptible to flooding from local on site blockages within the surface water drainage system.

5.3. The proposed foul drainage system will be connected by a private foul sewage pumping station to the existing public sewerage system in Macclesfield Road.

5.4. It is anticipated that the foul sewage flow generated by the pumping station will be 5.0l/s for about 10 minutes in any 24 hour period.

5.5. Site levels will always ensure that the residents from the proposed new house will always have a dry access to use at all times during any flood event.

6. Flood Risk Management Measures.

6.1. The occupiers of the new house will become responsible for the cleansing and maintenance of the on site drainage facilities.

6.2. They will also become riparian owners of a part of the river with responsibility for keeping it free of debris.

7. Off Site Impacts.

7.1. The proposed site drainage infrastructure will be designed and constructed in accordance with the requirements of the Building Regulation.

7.2. All roofed and paved areas are to be formally drained into the on site surface water drainage system, this will ensure that there are no off site flood flows generated by the proposed development.

7.3. There is no evidence to indicate that there will be any impact on the flora and fauna that depends on any downstream watercourse for its survival.

8. Residual Risk.

8.1. With careful design of the drainage elements as described above there will be no residual flood-related risks that will remain after the development has been completed.

8.2. The on site drainage systems will become the householders responsibility for all future maintenance of the on site drainage services. This will ensure that the drainage systems will always operate at maximum efficiency.

8.3. There will be no residual risks to any of the neighbouring properties by any uncontrolled flood flows escaping from the proposed redevelopment.

Peter Mason
6th October 2008

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Flood Estimation Handbook. Volume 4. Flood Studies Report Rainfall Runoff method. Flow workout sheet. River Wye, 24 Manchester Road. Buxton.

1. Obtain catchment descriptors by using NGR and FEH CD.

VERSION	FEH CD-ROM Version	2 exported at	09:24:55	
CATCHMENT	GB	404100	372500 SK 04100 72500	
AREA	2.44			
ALTBAR	443			
ASPBAR	32			
ASPVAR	0.4			
BFIHOST	0.331			
DPLBAR	1.39			
DPSBAR	132.9			
FARL	0.995			
LDP	2.76			
PROPWET	0.52			
RMED-1H	10.6			
RMED-1D	41.6			
RMED-2D	56.3			
SAAR	1407			
SAAR4170	1382			
SPRHOST	50.53			
URBCONC1990	0.5			
URBEXT1990	0.0087			
URBLOC1990	0.219			
C	-0.025			
D1	0.41247			
D2	0.38352			
D3	0.38565			
E	0.30369			
F	2.4431			
C(1 km)	-0.025			
D1(1 km)	0.43			
D2(1 km)	0.385			
D3(1 km)	0.39			
E(1 km)	0.303			
F(1 km)	2.434			

2. Use equation 2.10 to obtain Tp_o

$Tp = 4.27DPSBAR^{-0.35} \times PROPWET^{-0.8} \times DPLBAR^{0.54} \times (1+URBEXT)^{-5.77}$

$Tp = 4.27 \times 132.9^{-0.35} \times 0.52^{-0.8} \times 1.39^{0.54} \times (1+0.0087)^{-5.77}$

$Tp = 4.27 \times 0.1806 \times 1.6873 \times 1.195 \times 0.951 = 1.48$ hours

3. Now adjust Tp_o using equation 2.4

Delta T is 10-20% of Tp so add ½ Delta T
$Tp = Tp_o + 0.5$ Delta T
$Tp = 1.48 + 0.25/2 = 1.605$ hours

Delta T should be taken as 0.25, 0,5, 1 or 2 hours
Now use Tp not Tp_o

4. Design Storm Duration use equation 3.1

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

$$D = 1.605(1 + \frac{1407}{1000}) = 3.86 \text{ hours}$$

4. Total rain in D hours = P from DDF modelling section of the FEH CD ROM.
5. For 1 in 140 year storm P = 73.7mm (140 year for wholly rural catchment)

6. PR percentage run off, SPR means SPR HOST off the descriptor sheet. = 50.53%

7. $PR_{RURAL} = SPR + DPR_{CWI} + DPR_{RAIN}$
   $DPR_{CWI} = 0.25(CWI - 125)$ and $DPR_{RAIN} = 0.45(P - 40)^{0.7}$
   $PR_{RURAL} = 50.53 - 0.0 + 0.45(73.7 - 40)^{0.7} = 55.81$
   $PR = PR_{RURAL}(1 - 0.615\ URBEXT) + 70(0.615\ URBEXT)$
   $PR = 55.9$
8. Work out base flow using equation 2.19
   Base Flow $= \{33(CWI - 125) + 3.0\ SAAR + 5.5\}\ 10^{-5}\ AREA =$
   $= \{33(125 - 125) + 3.0 \times 1407 + 5.5\}\ 10^{-5}\ 2.44 = 0.103 m^3/s$

9. Routing coefficient RC

This is D/Tp and figure 3.10 and should be 0.3 – 0.35 ish = 0.36

10. Flow from equation 3.3 plus baseflow to obtain flood figure.

$$Q = RC \frac{PR}{100} \frac{P}{D} AREA \text{ plus baseflow} = 0.36 \times 0.559 \times 19.09 \times 2.44 + 0.103 = 9.48 m^3/s$$

1 in 100 year flow $9.48 m^3/s$

Add 20% to allow for the effects of global warming.
Flow to use for Flood Risk Assessment is $11.37 m^3/s$

Peter Mason 4 October 2008

FEH Book Statistical Procedures for flood frequency estimation.
24 Macclesfield Road, Buxton. River Wye.

Book 3. Para 3.3 Estimation of $QMED_{rural}$

$$QMEDrural = 1.172AREA^{AE}\left(\frac{SAAR}{1000}\right)^{1.560}FARL^{2.642}\left(\frac{SPRHOST}{100}\right)^{1.211}0.0198^{RESHOST}$$

For Radley Park Ditch Catchment the following parameters have been obtained from the FEH CD Rom 2.

AREA 2.44km^2, SAAR 1407, FARL 0.995, SPRHOST 50.53, BFIHOST 0.331, URBEXT 1990 0.0087.

$$AE = 1 - 0.0015.\ln\left(\frac{AREA}{0.5}\right)$$ ln = natural logarithm

$$AE = 1 - 0.0015.\ln(4.88) = 0.9976$$

$$RESHOST = BFIHOST + 1.30\left(\frac{SPRHOST}{100}\right) - 0.987$$

$$RESHOST = 0.331 + 1.3\left(\frac{50.53}{100}\right) - 0.987 \quad = 0.00089$$

$QMED_{rural} = 1.172 \times 2.435 \times 1.703 \times 0.9868 \times 0.4375 \times 0.9965 = 2.09m^3/s.$

Site is in growth area 10, from growth curve growth factor is about 2.1

$Qrural_{100} = 2.1 \times 2.09m^3/s = 4.39m^3/s.$

$Qrural_T = QMED_{rural}\ xrural_T$

$QMED = UAF\ QMED_{rural}$ where $UAF = PRUAF\ (1 + URBEXT)^{0.83}$ and

$$PRAUF = 1 + 0.615\ URBEXT\ \left(\frac{70}{SPRHOST} - 1\right)$$

$PRAUF = 1 + 0.615 \times 0.0086 \times 0.385 = 1.002$

$UAF = 1.124 \times (1 + URBEXT)^{0.83} = 1.124 + 1.007 = 2.13$

$QMED = 2.13 \times 2.09 = 4.45m^3/s$

$Q_{100} = 2.1 \times 4.45 = 9.35m^3/s$ add 20% for the effects of global warming $= 11.22m^3/s.$

1.1 The list of gauged data sites (Book 5. Catchment Descriptors) has been inspected and no gauged catchment has been identified that is in any way similar to the catchment of the River Wye.

1.2 The FEH rainfall-runoff method estimates a flood peak of 9.48m^3/s that rises to 11.37m^3/s when a 20% increase is added to allow for the effects of global warming over the next 100 years.

1.3 In FEH Book 4, Para 3.4.2 states that 'A comparison of peak flows obtained from the two methods concluded that, subject to an assumed use of identical run off coefficients for small lowland catchments, the rational method yield flood peaks typically twice as large as those from the FRS rainfall runoff method, but the two methods tend to a greater similarity for larger and steeper catchments'.

1.4 The catchment of the River Wye is definitely a small upland catchment.

1.5 The ReFH rainfall-runoff method estimates a flood peak of 8.70m^3/s that rises to 10.44m^3/s when a 20% increase is added to allow for the effects of global warming until 2115.

1.6 Therefore we have 3 estimates of the Q_{100} (cc) flood peak.

a) 11.22m^3/s from the statistical method. Plus or minus the factorial standard error.

b) Potentially 11.37m^3/s from the FEH/FSR short cut method.

c) And 10.44m^3/s from the ReFH method.

1.7 Therefore it would appear that we should be using a flood peak that is in the range 10.44m^3/s as a minimum and 11.37m^3/s as an absolute maximum.

1.8 Therefore I have initially used the maximum figure as a peak flood flow for the Hec Ras modelling exercise.

Peter Mason 4 October 2008

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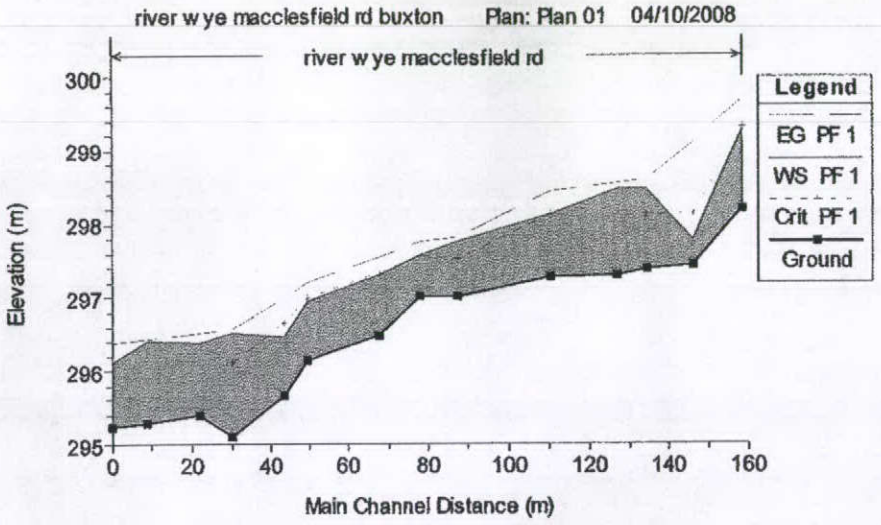
24 Macclesfield Road Buxton Hec Ras summary of results.



HEC-RAS Plan: extg River: river wye Reach: macclesfield rd Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		
macclesfield rd	158.4	PF 1	11.37	298.19	299.26	299.30	299.69	0.018007	2.91	3.91	5.21	1.07
macclesfield rd	146.1	PF 1	11.37	297.43	297.79	298.11	299.11	0.160948	5.09	2.23	7.43	2.97
macclesfield rd	134.1	PF 1	11.37	297.37	298.48	298.13	298.58	0.004257	1.46	7.81	10.73	0.54
macclesfield rd	127	PF 1	11.37	297.29	298.47		298.55	0.003234	1.21	9.42	14.36	0.48
macclesfield rd	110.6	PF 1	11.37	297.28	298.13	298.13	298.43	0.015296	2.43	4.69	7.93	1.01
macclesfield rd	87.2	PF 1	11.37	297.00	297.75	297.51	297.81	0.003375	1.08	10.56	20.00	0.47
macclesfield rd	78	PF 1	11.37	297.02	297.57	297.57	297.74	0.017715	1.84	6.17	18.20	1.01
macclesfield rd	67.9	PF 1	11.37	296.48	297.31	297.33	297.55	0.018351	2.17	5.24	12.28	1.06
macclesfield rd	49.6	PF 1	11.37	296.15	296.93	296.97	297.20	0.020086	2.31	4.92	11.25	1.12
macclesfield rd	43.3	PF 1	11.37	295.66	296.46	296.64	296.99	0.044270	3.23	3.52	8.72	1.62
macclesfield rd	30.3	PF 1	11.37	295.10	296.50	296.12	296.55	0.002592	1.05	10.83	17.19	0.42
macclesfield rd	22.2	PF 1	11.37	295.40	296.36		296.51	0.008941	1.68	6.75	13.47	0.76
macclesfield rd	9	PF 1	11.37	295.30	296.39		296.43	0.001690	0.89	12.72	18.33	0.34
macclesfield rd	0	PF 1	11.37	295.23	296.10	296.10	296.38	0.015621	2.32	4.90	8.89	1.00

1000 year flood

HEC-RAS Plan: extg 1000yr River: river wye Reach: macclesfield rd Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
macclesfield rd	158.4	PF 1	13.80	298.19	299.38	299.42	299.85	0.018010	3.05	4.53	5.61	1.08
macclesfield rd	146.1	PF 1	13.80	297.43	297.84	298.19	299.26	0.150626	5.29	2.61	7.78	2.92
macclesfield rd	134.1	PF 1	13.80	297.37	298.59	298.22	298.70	0.004945	1.50	9.19	13.59	0.58
macclesfield rd	127	PF 1	13.80	297.29	298.59		298.67	0.003068	1.24	11.13	15.64	0.47
macclesfield rd	110.6	PF 1	13.80	297.28	298.22	298.22	298.55	0.014885	2.53	5.45	8.46	1.01
macclesfield rd	87.2	PF 1	13.80	297.00	297.81	297.56	297.88	0.003607	1.17	11.80	20.71	0.49
macclesfield rd	78	PF 1	13.80	297.02	297.62	297.62	297.81	0.016685	1.92	7.20	19.14	1.00
macclesfield rd	67.9	PF 1	13.80	296.48	297.40	297.40	297.64	0.016304	2.15	6.43	14.01	1.01
macclesfield rd	49.6	PF 1	13.80	296.15	297.00	297.06	297.29	0.021533	2.41	5.73	12.98	1.16
macclesfield rd	43.3	PF 1	13.80	295.66	296.54	296.72	297.08	0.041386	3.26	4.23	9.78	1.59
macclesfield rd	30.3	PF 1	13.80	295.10	296.59	296.19	296.65	0.002659	1.11	12.42	18.46	0.43
macclesfield rd	22.2	PF 1	13.80	295.40	296.45		296.60	0.008010	1.73	7.96	13.94	0.73
macclesfield rd	9	PF 1	13.80	295.30	296.48		296.53	0.001682	0.96	14.40	18.53	0.35
macclesfield rd	0	PF 1	13.80	295.23	296.22	296.22	296.47	0.015768	2.25	6.14	11.84	1.00