EDDLESTON WATER TRIBUTARY MODELLING

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Project meeting 23/2/12

The Scottish Government

Outline

- Upper catchment interventions – investigation of potential on Middle and Longcote burns
- Linking to hydrometric network
- Future directions

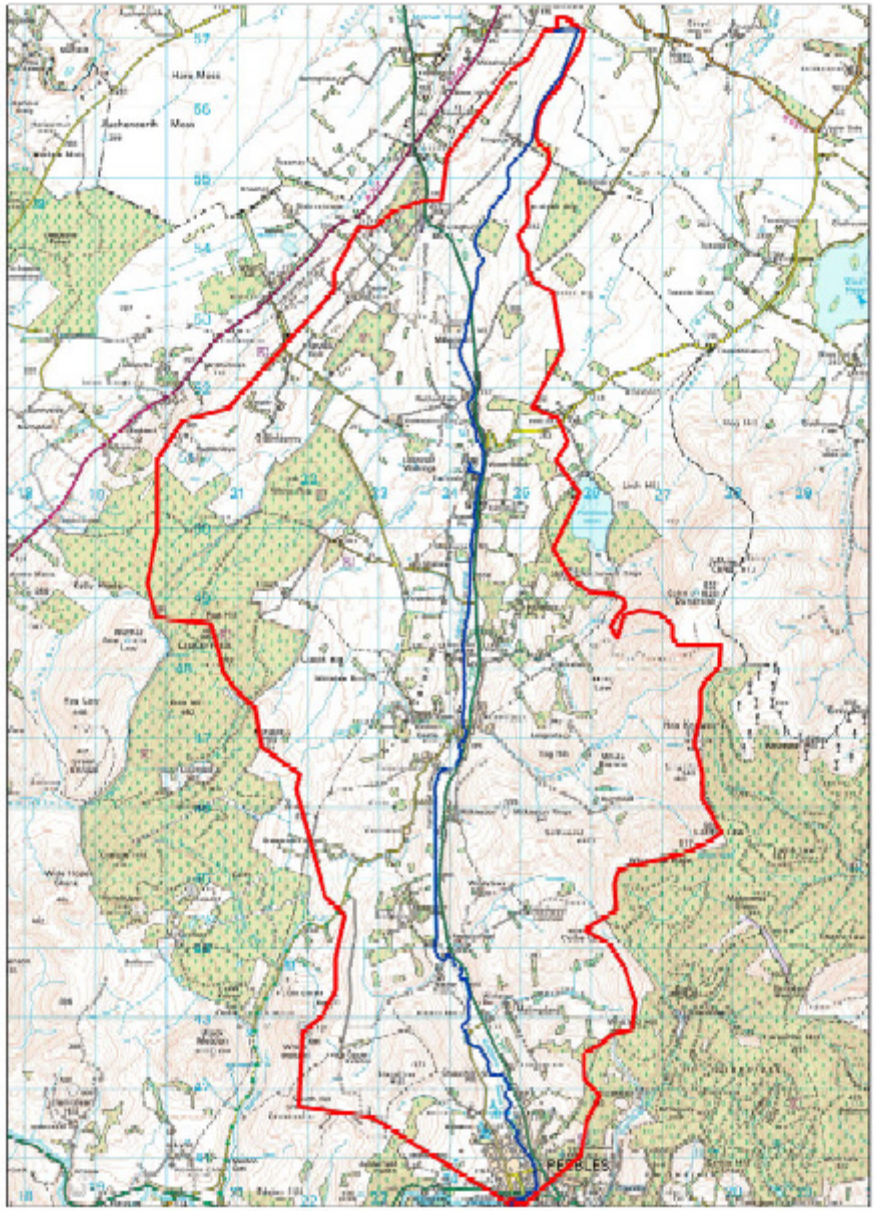
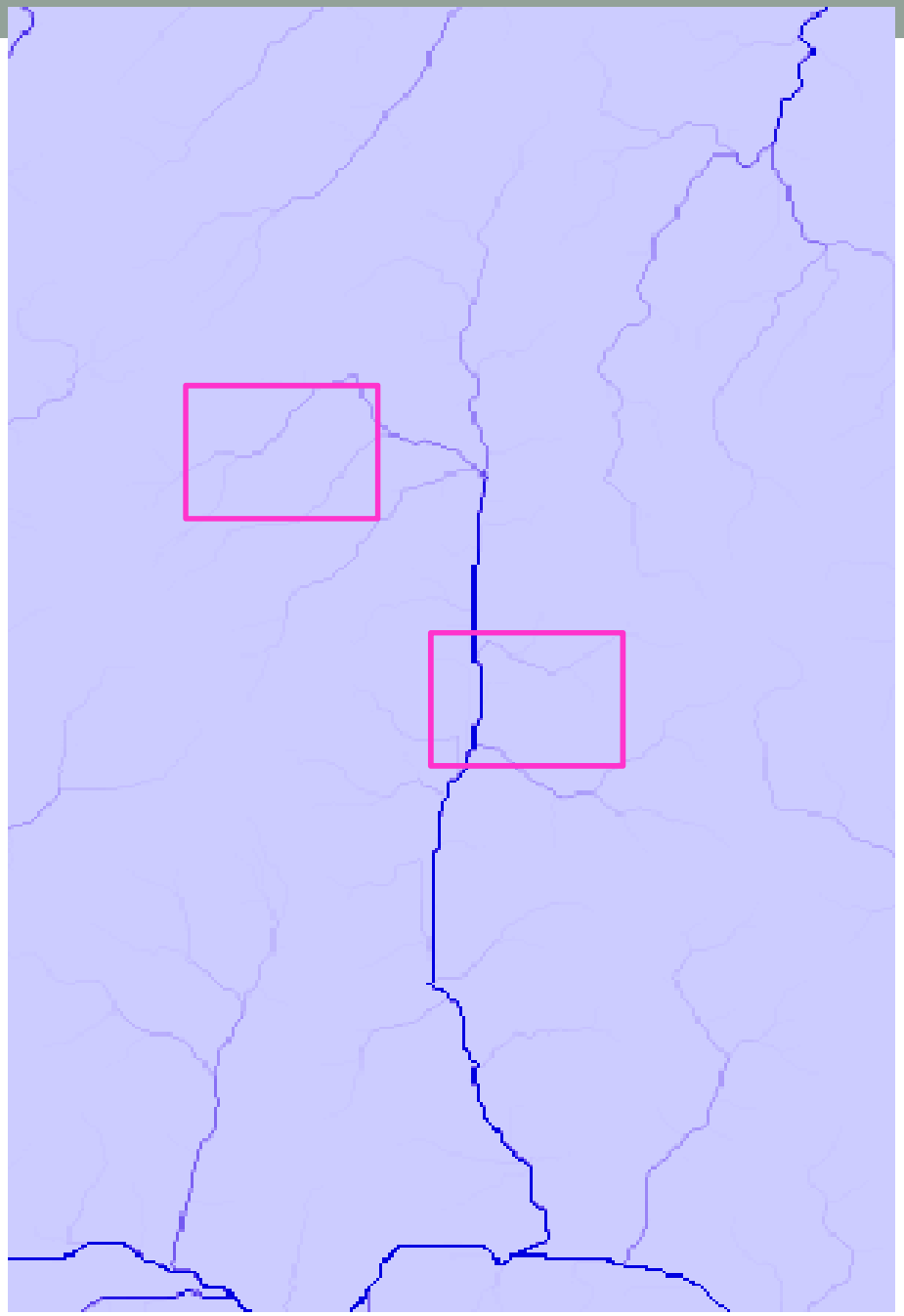
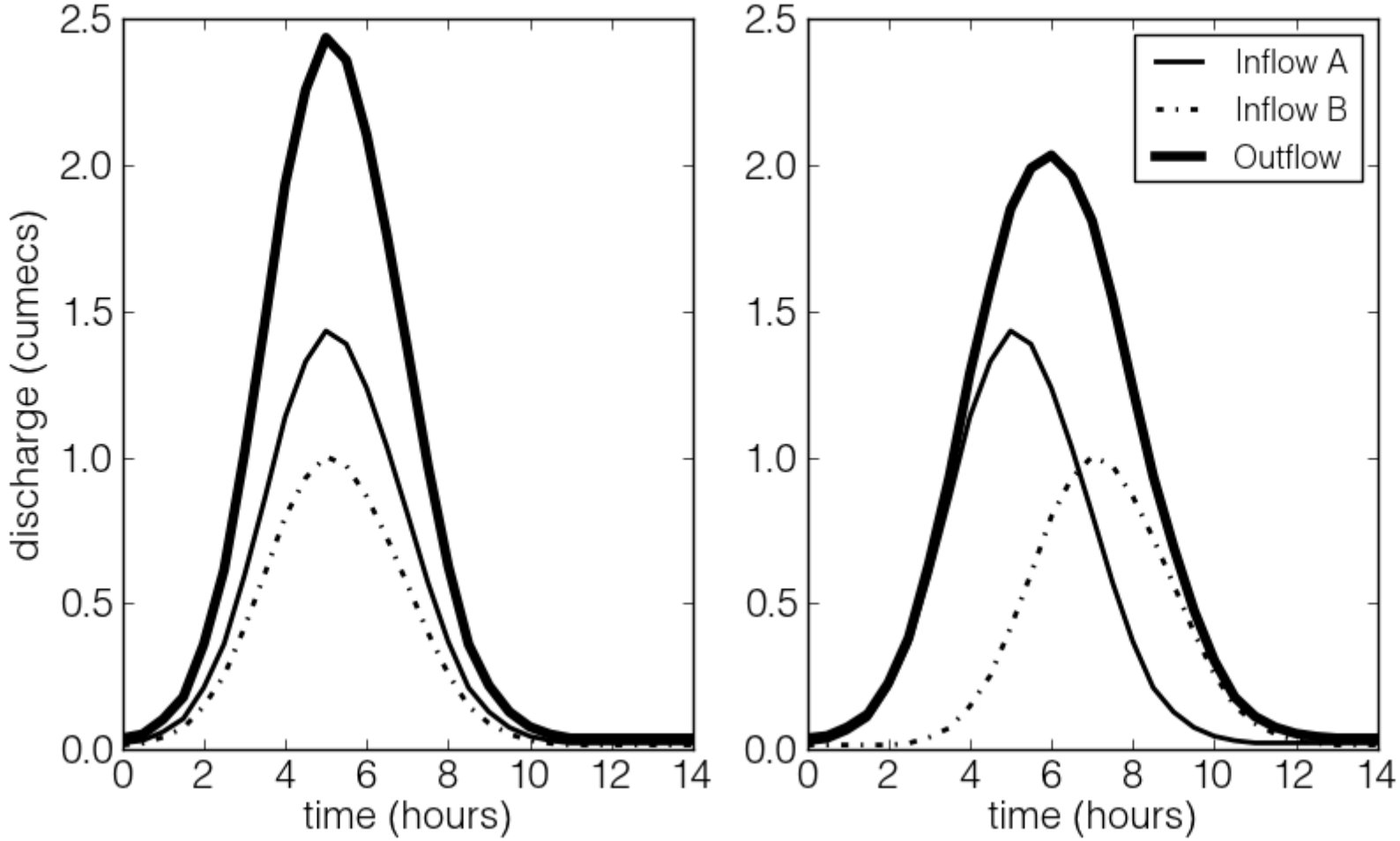


Figure 2.1 Topographical map of the Eddleston Water catchment

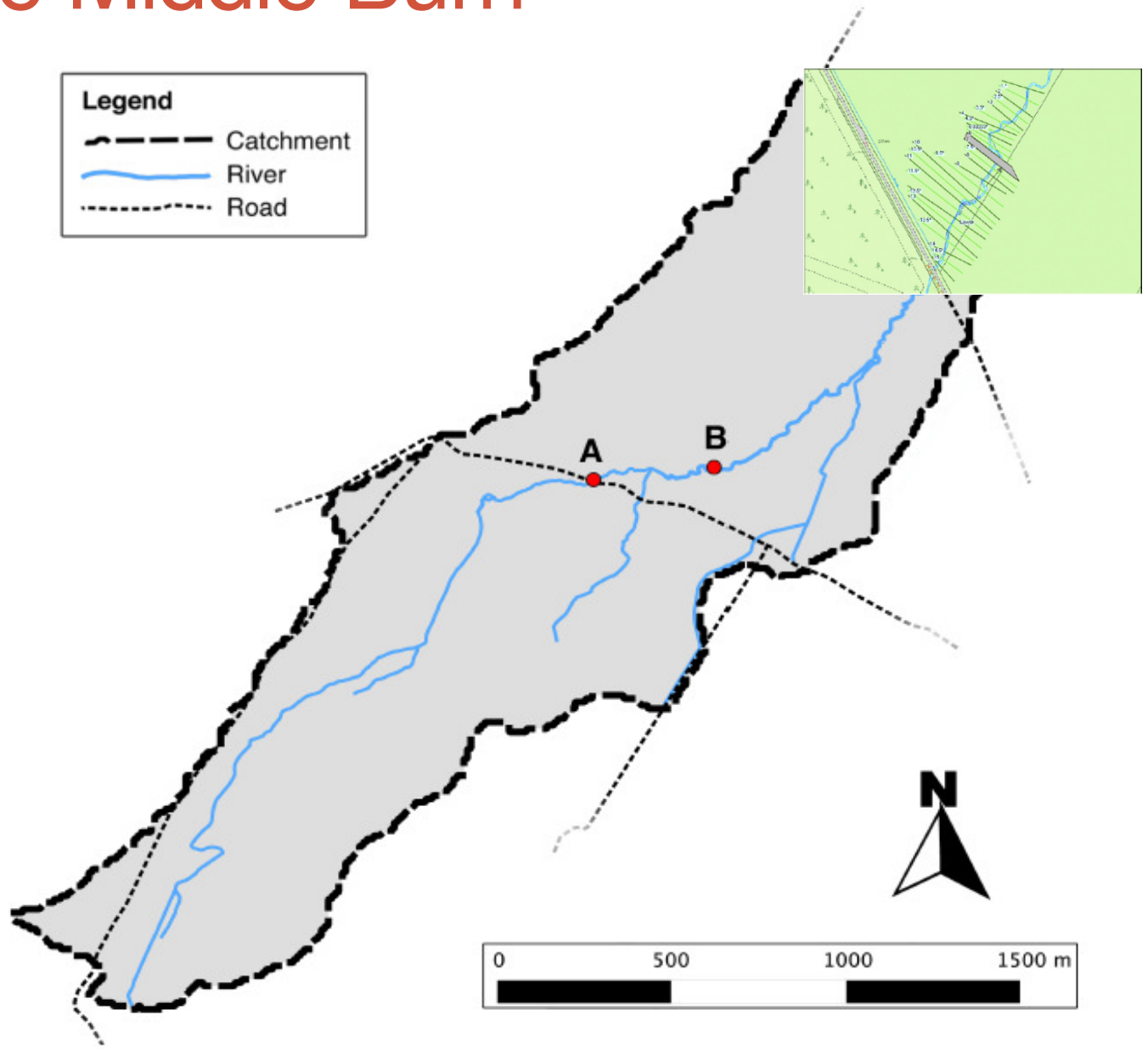


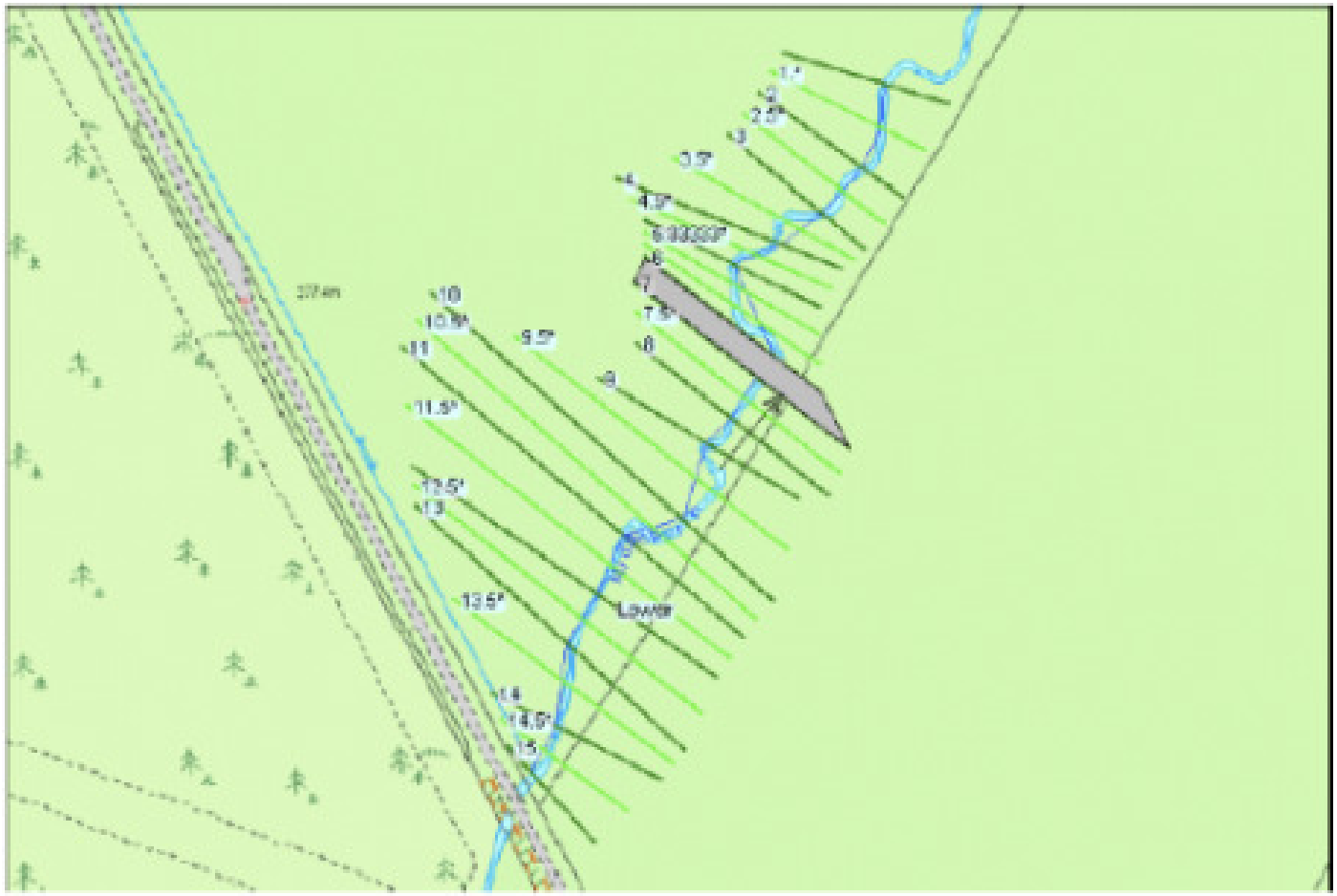
ARC spatial analyst
Flow accumulation
raw output raster

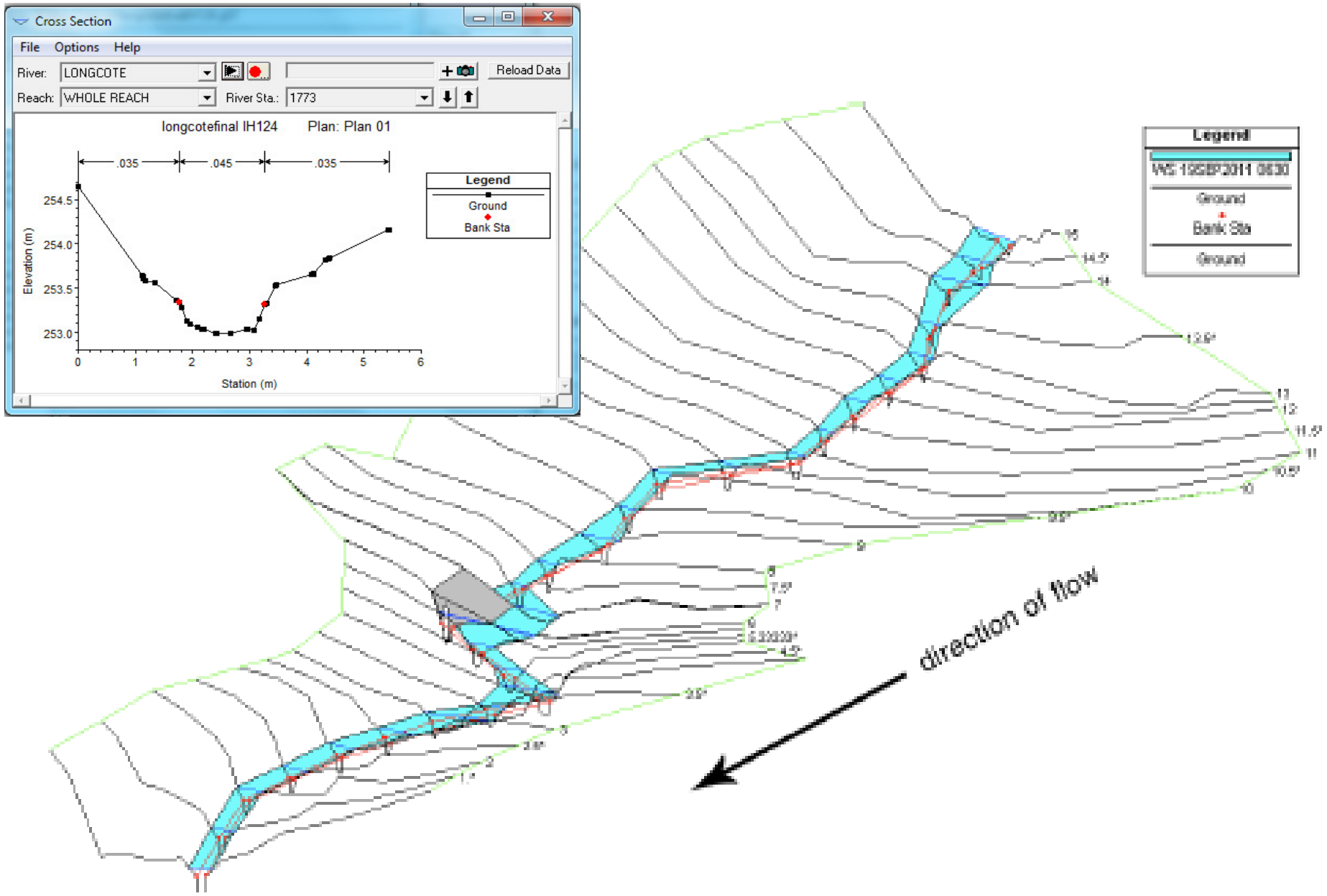
Shows ‘theoretical maximum’ accumulation over whole catchment (ie a unit hydrograph type situation)

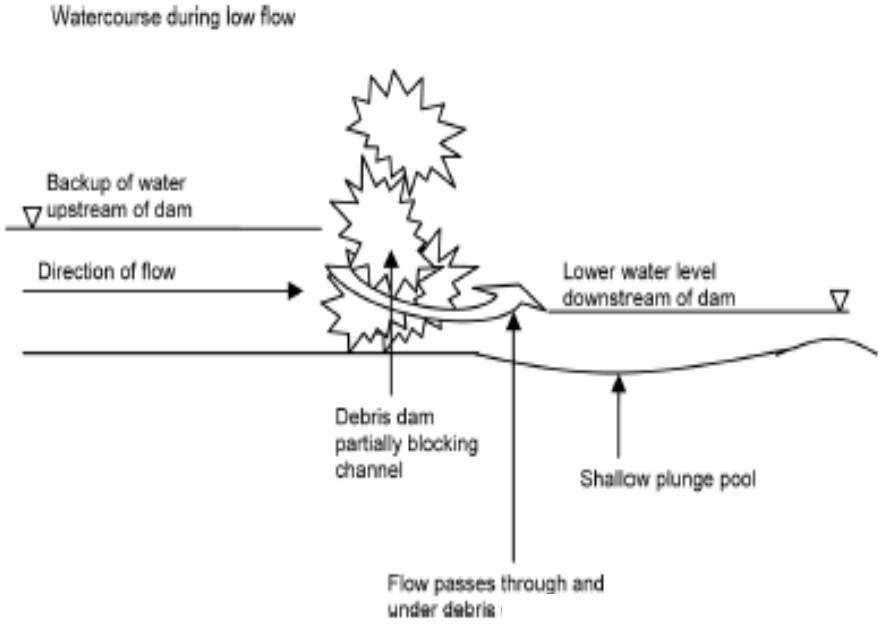

discharge (cumecs)
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
time (hours)
Inflow A
Inflow B
Outflow

The Middle Burn

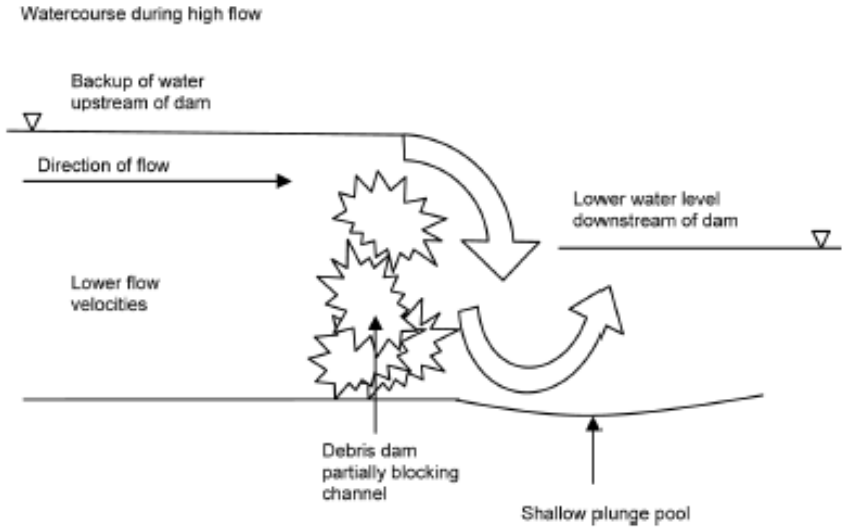





Cross Section
File Options Help
River: LONGCOTE
Reach: WHOLE REACH
River Sta.: 1773
Reload Data
longcotefinal IH124 Plan: Plan 01
.035
.045
.035
Legend
Ground
Bank Sta
Elevation (m)
254.5
254.0
253.5
253.0
0
1
2
3
4
5
6
Station (m)
Legend
Ground
Bank Sta
Ground
direction of flow



Theory of Dam operation (Thomas And Nisbet, 2007 WEJ 21)



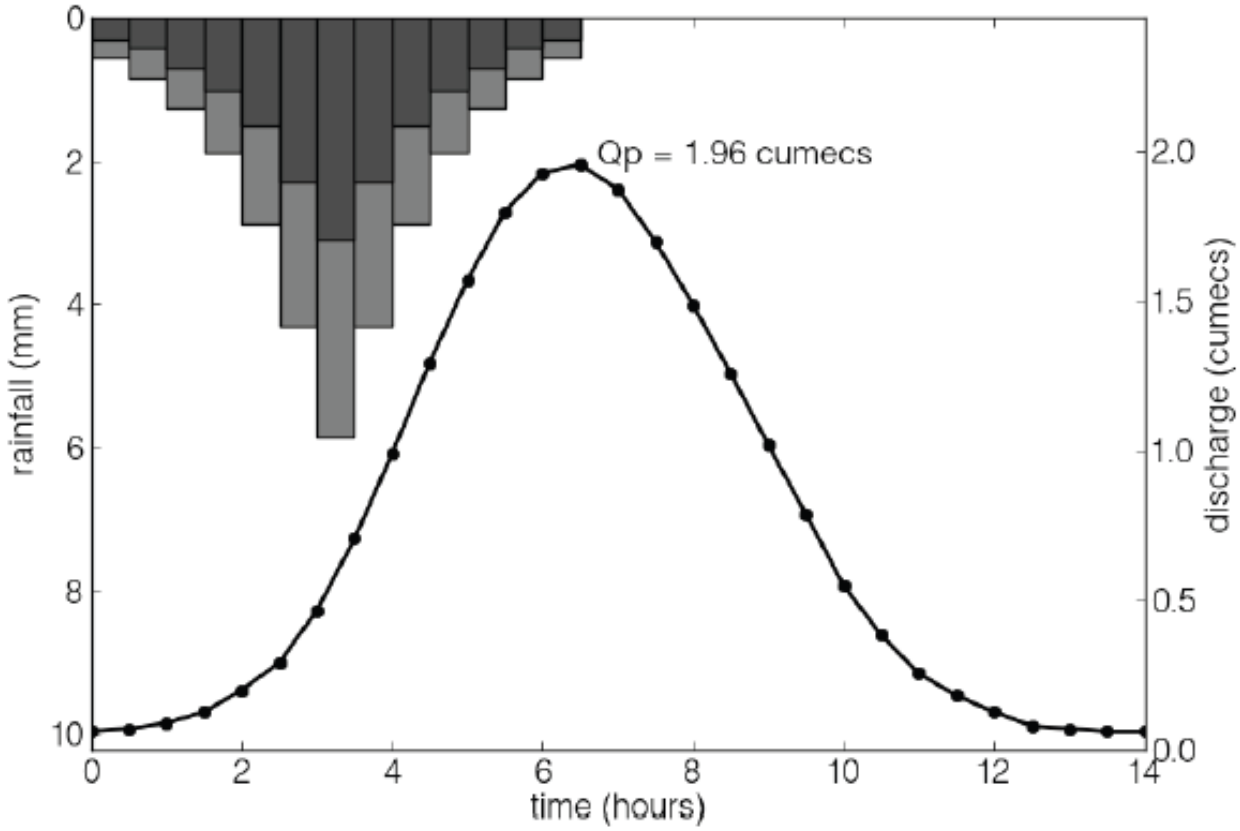
Putting the theory into the models

- Introduction of LWD into the channel represented as global increase in roughness (Mannings n), based on values suggested by Odoni and Lane (2010)

- Increase in floodplain roughness from rip. woodland represented by increase in n based on Chow (1959).

Odoni and Lane (2010). Assessment of the impact of upstream land management measures on flood flows in Pickering Beck using OVERFLOW. – Forestry Comm

Middleburn design flow 1 in 10 year



1 in 10 year

Upper Reach *1 in 10 return*	Floodplain roughness 0.03	0.05	0.10	0.15
Channel roughness 0.04	–	0 (0.000)	4 (-0.006)	3 (-0.006)
0.10	–	1 (0.001)	3 (-0.006)	6 (-0.013)
0.14	–	1 (0.001)	3 (-0.006)	6 (-0.013)
0.18	–	1 (0.001)	3 (-0.006)	10 (-0.019)

1 in 10 year

Lower Reach / *1 in 10 return*	Floodplain roughness 0.03	0.05	0.10	0.15
Channel roughness 0.04	0 (0.000)	-1 (0.001)	2 (-0.002)	3 (-0.014)
0.10	-1 (0.001)	0 (-0.01)	7 (-0.015)	9 (-0.016)
0.14	0 (0.000)	4 (-0.014)	6 (-0.015)	11 (-0.026)
0.18	-1 (0.001)	4 (-0.014)	4 (-0.014)	8 (-0.026)

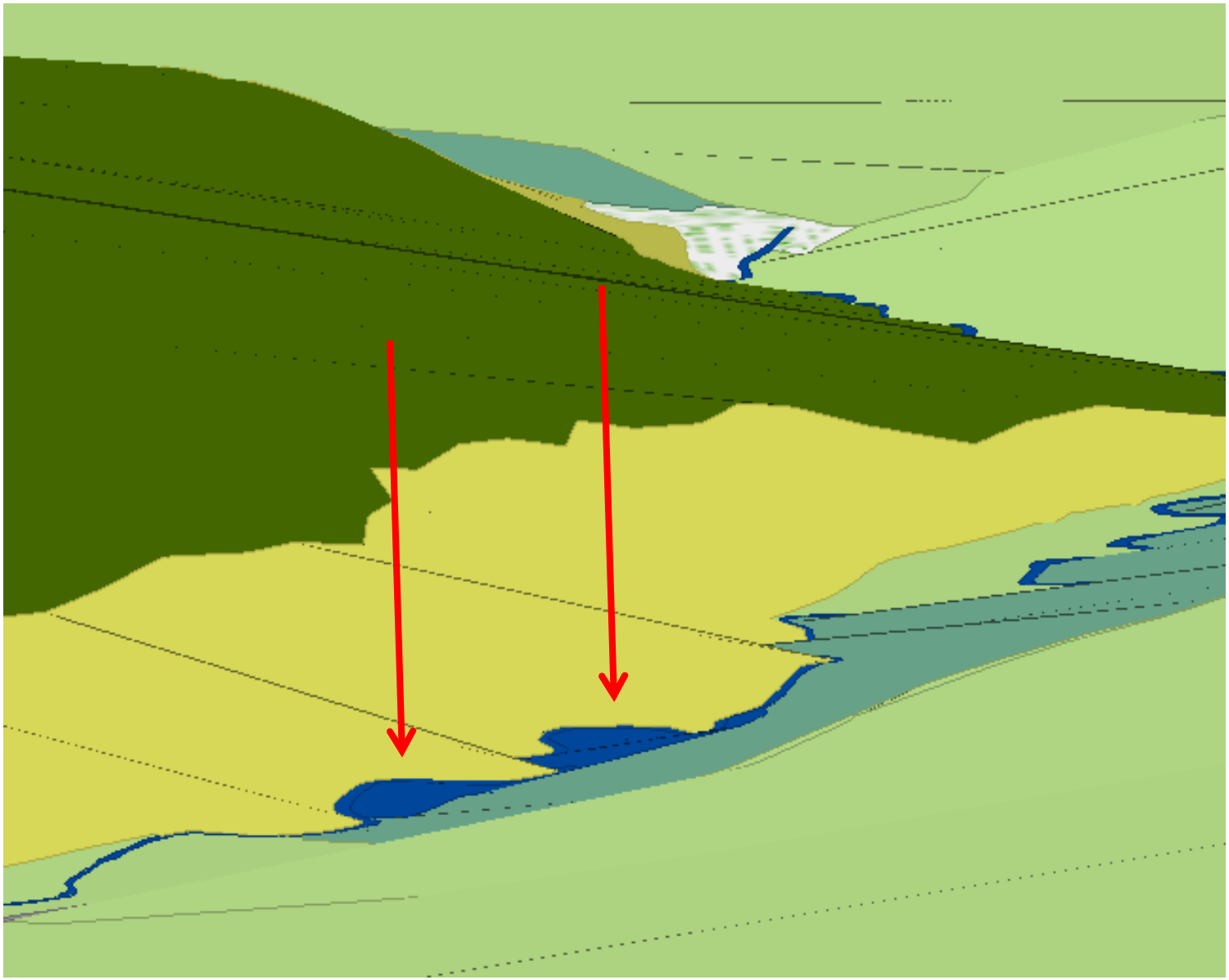
1 in 100 year

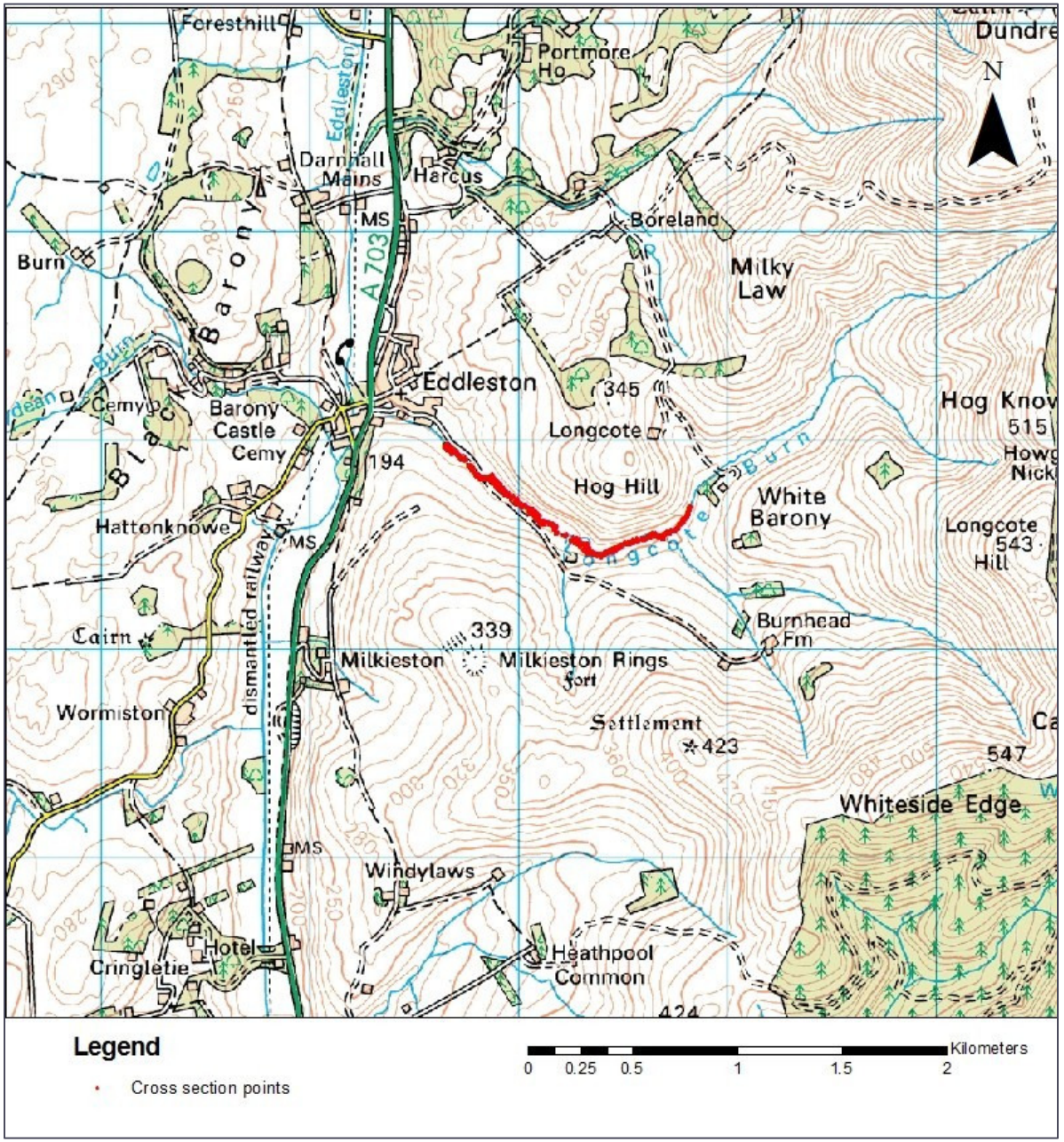
Upper Reach / *1 in 100 return*	Floodplain roughness 0.03	0.05	0.10	0.15
Channel roughness 0.04	–	0 (0.000)	4 (-0.005)	5 (-0.013)
0.10	–	5 (-0.013)	5 (-0.014)	7 (-0.018)
0.14	–	0 (0.000)	5 (-0.014)	7 (-0.02)
0.18	–	0 (0.000)	5 (-0.013)	6 (-0.021)

1 in 100 year

Lower Reach / *1 in 100 return*	Floodplain roughness: **0.03**	**0.05**	**0.10**	**0.15**
Channel roughness: **0.04**	0 (0.000)	2 (-0.003)	5 (-0.020)	7 (-0.022)
0.10	2 (-0.004)	3 (-0.007)	6 (-0.021)	9 (-0.024)
0.14	2 (-0.004)	3 (-0.007)	5 (-0.020)	9 (-0.024)
0.18	2 (-0.004)	5 (-0.008)	7 (-0.022)	9 (-0.024)


The Longcote Burn

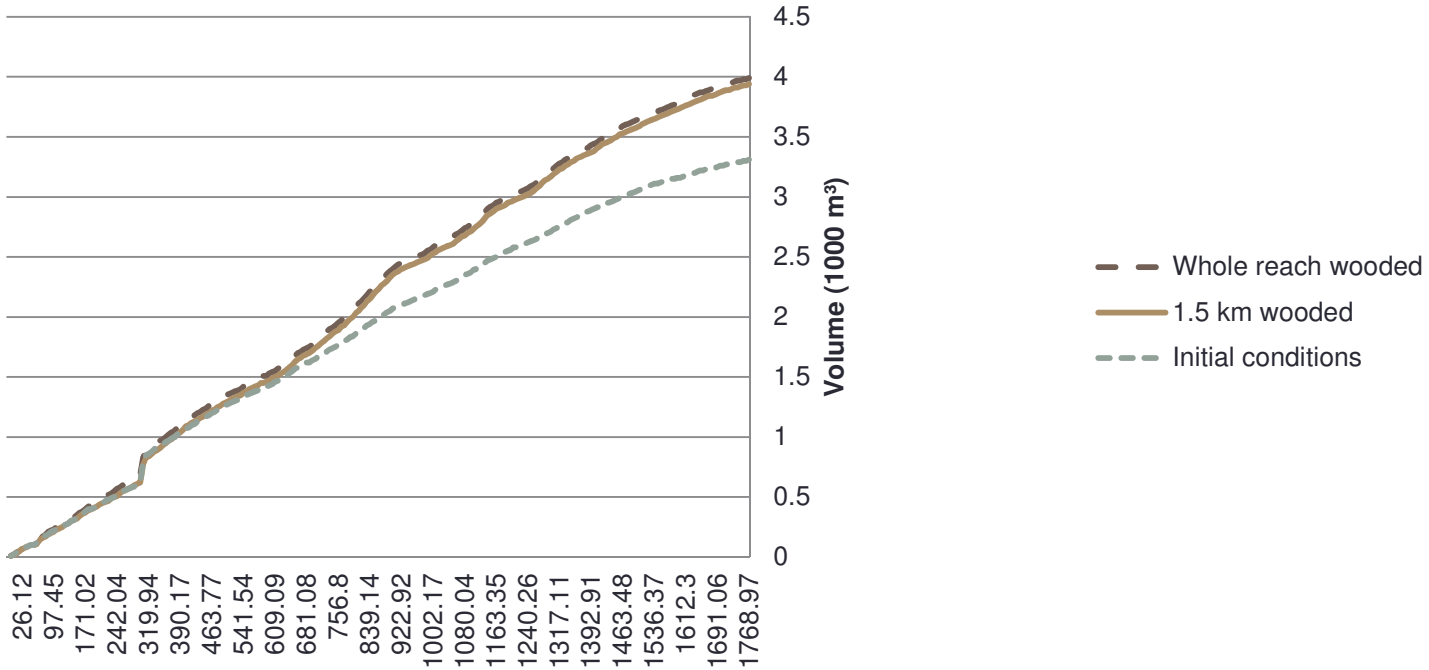


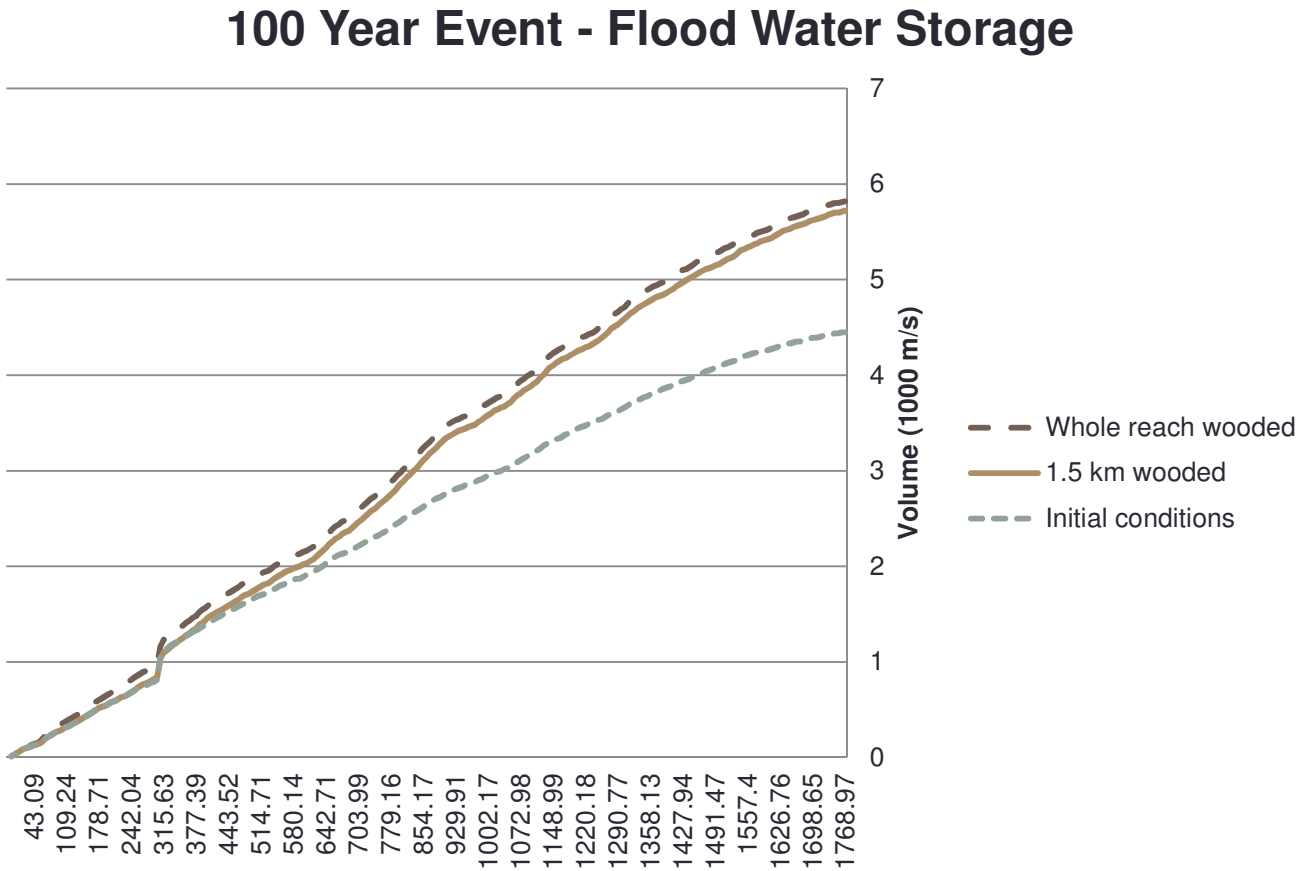

Foresthill
Portmore Ho
Dundre
N
Darnhall Mains
Harcus
Eddleston
A 703
MS
Boreland
Burn
Barony
Milky Law
Eddleston
345
Hog Knov
515
Cemy
Barony Castle Cemy
Longcote
194
Hog Hill
White Barony
Longcote Burn
Hattonknowe
MS
Longcote 543 Hill
Cairn
339
Burnhead Fm
Milkieston
Milkieston Rings fort
dismantled railway
Wormiston
Settlement
423
547
Whiteside Edge
MS
Windylaws
Hotel
Cringletie
Heathpool Common
424
Legend
Cross section points
0 0.25 0.5 1 1.5 2
Kilometers

The Longcote Burn

- At the Longcote Burn, storage potential for water on the floodplain in a 1 in 25 year event increased by 12.9% over the baseline condition when1.5km of floodplain was afforested.
- This storage increased by only 1.6%, to 14.5%, when the **entire** floodplain was afforested.

Longcote 25 Year Event - Flood Water Storage




100 Year Event - Flood Water Storage
Volume (1000 m/s)
0
1
2
3
4
5
6
7
43.09
109.24
178.71
242.04
315.63
377.39
443.52
514.71
580.14
642.71
703.99
779.16
854.17
929.91
1002.17
1072.98
1148.99
1220.18
1290.77
1358.13
1427.94
1491.47
1557.4
1626.76
1698.65
1768.97
Whole reach wooded
1.5 km wooded
Initial conditions

Future Directions

- Flow calibration and ratings of hydrometric network – ongoing
- --> Use of the calibration for model calibration and refinement
- Survey and model the Shiplaw burn in a similar way – possibly the upper main stem
- Actual planting! (SRDP) and debris/ other management