

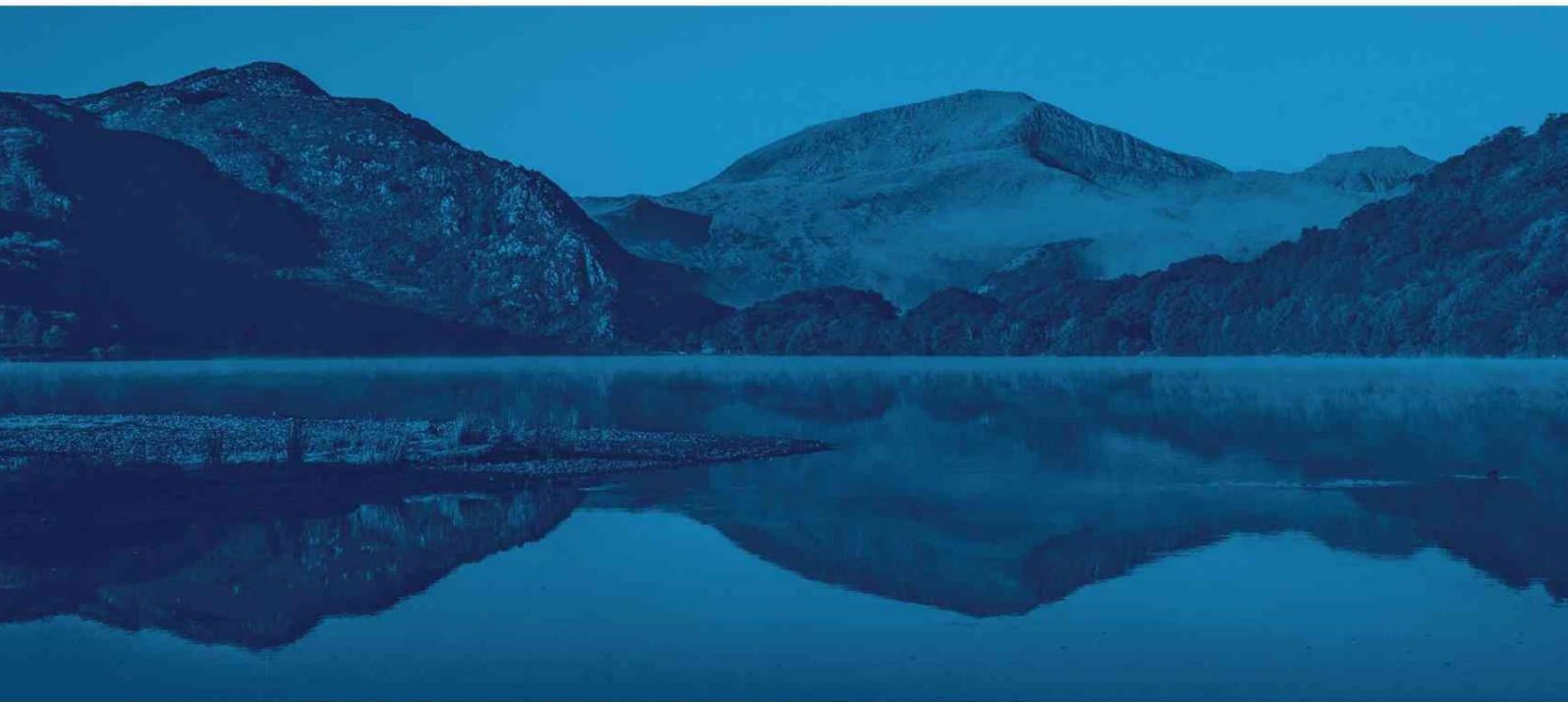


Newark & Sherwood SFRA Project

River Maun Hydraulic Modelling Study

Hydraulic Modelling Report

May 2017



Assessment / Modelling / Design

DOCUMENT VERIFICATION RECORD

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DOCUMENT REVIEW & APPROVAL

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Introduction

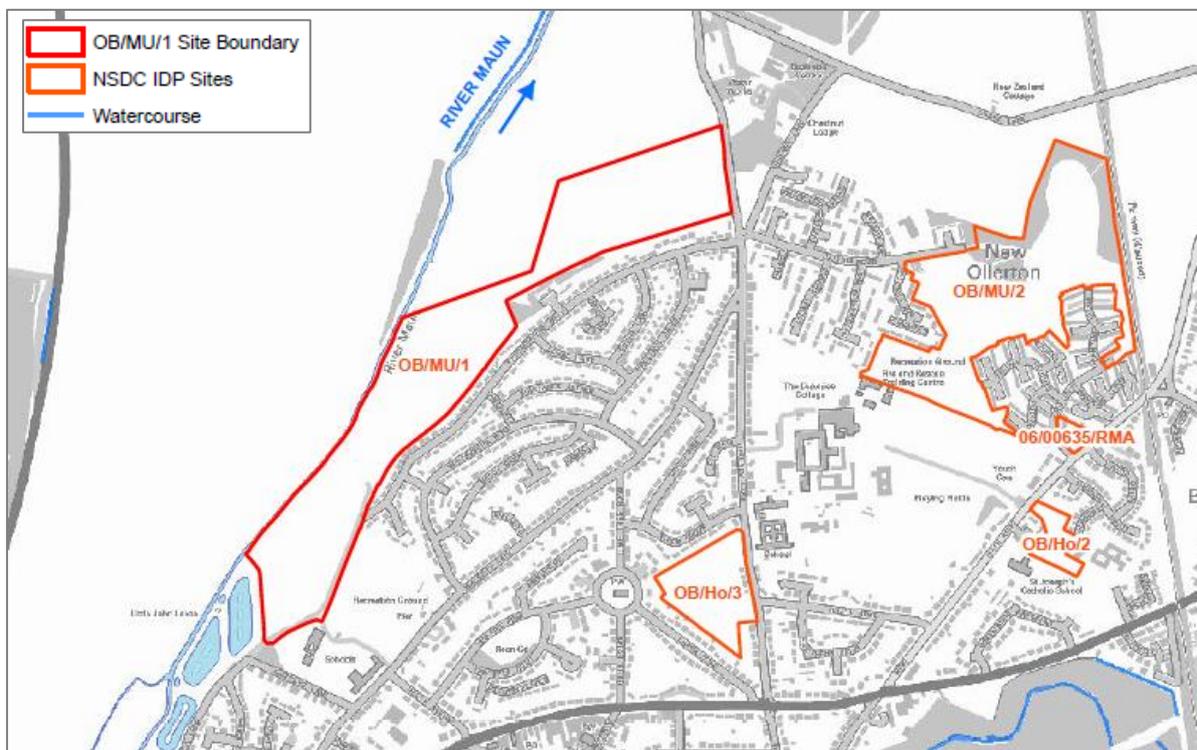
Waterco Consultants, working in partnership with White Young Green (WYG), have been commissioned to undertake a detailed fluvial hydraulic modelling study of the River Maun through the towns of Ollerton, New Ollerton and Boughton, Nottinghamshire to support the review and update of the Newark & Sherwood District Council’s (N&SDC) Strategic Flood Risk Assessment (SFRA) and Water Cycle Study (WCS).

The updated SFRA will provide a detailed evidence base concerning the water environment, support the review of the Council’s Local Development Framework and inform the day-to-day determination of planning applications.

Several site allocations identified in the Development Plan for Newark and Sherwood are located in Ollerton, New Ollerton and Boughton and a more detailed assessment of fluvial flood risk is required to inform the SFRA. Following a review current Environment Agency (EA) Flood Zones, all but one of these sites, Site OB/MU/1, lie in Flood Zone 1 and considered to be at little to no risk of fluvial flooding. Site OB/MU/1, referred to as “the site” hereafter, is situated directly adjacent to the River Maun and shown to be a significant risk of fluvial flooding and so is the main focus of this study.

A location plan and an aerial photograph of the site are included in Appendix A; an extract of the location plan is included in Figure 1 for information. The approximate National Grid Reference (NGR) of the site is SK 66100 68650.

Figure 1 – Key Site Location Plan



OB/MU/1 Site Description

The site is currently entirely “greenfield”, bordered by existing residential development to the south and east, the River Maun to the west, and further greenfield land to the north. The site covers an area of 19.2ha.

Nearby Watercourses and Existing Flood Risk Data

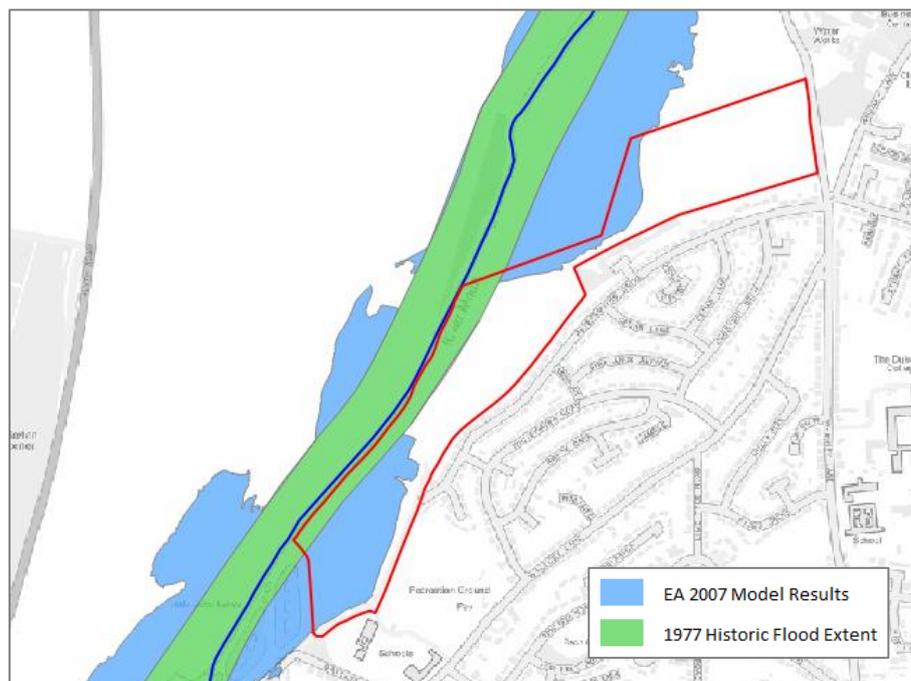
The site is located on the eastern bank of the River Maun – an Environment Agency (EA) designated ‘main river’. The watercourse flows in a northerly direction at this location.

Flooding at the site could occur if water levels are sufficient to overtop local banks during, or following, an extreme fluvial event. The watercourse is considered the primary source of fluvial flood risk at the site and is the main focus of this study.

The current EA Flood Maps for Planning (May 2017) show approximately 17% of the site to be located within Flood Zone 3 – an area considered to be at relatively high risk of fluvial flooding with an annual probability of the flooding greater than 1% (1 in 100) AEP (annual exceedance probability). A further 22% of the site is located within Flood Zone 2 – an area considered to be at medium risk of fluvial flooding with an annual probability of the flooding greater than 0.1% (1 in 1000) AEP. An extract of the current EA Flood Zones is included in Appendix B for reference.

The existing Flood Zone 2 outline through the site is understood to be comprised of data from two sources. Outputs from an EA 1D modelling study completed in 2007 define the flood extent to the north and south of the site. The flood extents through the centre are based on historic information from a flood event that occurred in 1977. The EA have stated that confidence in this historic flood extent is low. An extract of the EA Flood Map for Planning (May 2017) is shown in Figure 2.

Figure 2 – Composition of EA Flood Map for Planning – Flood Zone 2 (May 2017)



A copy of the 1D ISIS model produced by the EA for their 2007 study has been provided for use in this study. It covers a long stretch of the watercourse from its upstream extent in south-west Mansfield (NGR: SK 52380 59820) to its downstream confluence with the River Meden near West Drayton (NGR: SK 70250 75120). Downstream of this confluence, the watercourse becomes the River Idle.

To provide a site-specific assessment of fluvial flood risk from the River Maun, the existing EA 1D hydraulic model has been linked to a new 2D TUFLOW domain through Ollerton, New Ollerton and Boughton.

Hydraulic Modelling

This section provides details of the 1D/2D hydraulic model build and the simulations and scenarios completed as part of this study. The extent of the model is presented in Appendix C.

The latest 64-bit, single precision builds of hydraulic modelling software Flood Modeller Pro (FMP – previously ISIS) and TUFLOW available at the start of the project have been used for all simulations; 4.2 and 2016-03-AC respectively.

Events considered

To fully investigate the fluvial flood risk through Ollerton, New Ollerton and Boughton from the River Maun, a range of fluvial events have been simulated; namely the 4% (1 in 25 or Q25), 1% (Q100) and 0.1% (Q1000) AEP events. The impact of future climate change (CC) has also been investigated during the 1% AEP event by increasing flows by 30% (Q100CC1) and 50% (Q100CC2) in line with current EA guidance.

Model inflows remain unchanged from the existing EA model setup. Given the length of the EA 1D model, each AEP event was run for a range of storm durations; 3.75hrs, 7.5hrs and 15hrs. Initial modelling suggested that the 7.5hrs scenarios produced the most significant flooding through Ollerton, New Ollerton and Boughton. As such, all subsequent simulations completed as part of these works use the 7.5hr duration hydrographs only.

Inflows used in this study were derived in 2007 as part of the EA's 1D hydraulic modelling exercise. During consultation following initial model reviewed, the EA stated that the method of flow estimation used in their previous study remains appropriate, but that there are now an additional ten years of data that could be used to update the flows. Whilst it is accepted that the age of the hydrology suggests recalculation would ordinarily be recommended, in this case it is agreed that the associated costs are disproportionate to the benefits offered. Therefore, no updates to the hydrology have been completed as part of this study.

1D Model Details

Outside of the extent of the new 2D TUFLOW model domain, no changes have been made to the 1D network setup, including cross sections, structures and boundary conditions.

To facilitate linking between the 1D and 2D model domains, the floodplain representation of the cross sections located within the 2D domain have been deactivated, leaving just the channel and bank levels. Such an approach ensures flood plain storage is accurately represented.

Structure sections within the linked reach of the model have been trimmed back to similar widths to the cross sections. In some cases, a 1D spill unit had been used to represent flowpaths over submerged structures. Where the longitudinal length of these structures is equivalent to three 2D cells or more, the spill unit has been removed and the flowpath has instead been modelled within the 2D domain.

To improve model stability through the 1D/2D model area, multiple interpolate units have been inserted into the 1D network reducing each channel segment to between 40-60m.

The River Maun is culverted underneath Ollerton Watermill Tea Shop and Newark Road (NGR: SK 65320 67400). This structure had been modelled within the existing 1D model using a round nosed weir unit “due to model stability issues”. As part of the linking process, the dimensions of this structure have been estimated from online mapping and aerial photography and the structure is now modelled as a culvert. The gradient within the culvert has been set based on upstream and downstream channel bed levels.

At the time of initial site-specific model build, the survey data used to construct the EA 2007 1D model was not available. As such, the dimensions of the Newark Road culvert, not included in detail in the 2007 model, were estimated based on site observations and photographs. Following an additional data request, the original 2007 data for this structure was provided to enable comparison. This comparison showed the assumed dimensions and shape (arch) of the Newark Road culvert to be largely consistent with the height approximately equivalent to the survey data. It was however noted that the modelled width of the structure was larger than reported in the survey. Given this structure is upstream of the study area, this dimension variation presents a worst case for the site (i.e. the upstream structure is able to convey a larger flow) with the consequence that the model is likely to slightly overestimate the flood risk at the site. A conservative approach of leaving the estimated structure dimensions in place has been adopted. A comparison of the modelled and surveyed dimensions is provided in Table 1.

Table 1 – Newark Road Culvert Dimension Comparison - Modelled Vs 2007 Survey

	Shape	Height (m)	Width (m)	Invert Level (mAOD)
Modelled	Arch	1.5	8.0	40.66
Surveyed	Arch	1.78	4.23	40.57

Manning’s n coefficients remain unchanged from the existing EA model setup; typical values provided in Table 2.

Table 2 – Typical 1D Model Manning’s n Roughness Coefficients

Land Use	Manning’s n Roughness Coefficient (s/m ^{1/3})
Channel	0.04
Banks / Floodplain	0.06

2D Model Details

The 2D TUFLOW model has been constructed from 1m LiDAR data. The 2D cell size has been set at 4m. This resolution is adequate to represent the flow paths on site and within the wider floodplain whilst maintaining a reasonable run time.

OS MasterMap data has been used to classify land use and assign Manning’s n roughness coefficients throughout the floodplain. The coefficients used are given in Table 3.

Table 3 – 2D Model Manning’s n Roughness Coefficients

Land Use	Manning’s n Roughness Coefficient (s/m ^{1/3})
Default	0.035
Buildings	1.0
Land (gardens / fields)	0.035
Woodland	0.06
Inland water	0.035
Roads, paths	0.02

Upstream of Old Rufford Road, a side channel splits off from the River Maun (NGR: SK 64900 67270) and flows parallel to the main channel before re-joining at the Little John Lakes (NGR: SK 65550 68000). This side channel has been represented within the 2D domain using a z-shape layer. Elevations have been assumed from existing cross section data, LiDAR coverage and online photography. This channel is also culverted several times underneath roads and a service station. As with the channel geometry, structure dimensions and inverts have been assumed from LiDAR coverage and online photography.

Sensitivity Testing

In the absence of available calibration data, increased significance has been placed on sensitivity testing to improve confidence in the model outputs and assess the sensitivity of the model parameters. Two sensitivity tests have been carried out (ST1-2) with respect to the Q100CC1 fluvial event.

Sensitivity tests “ST1” and “ST2” investigate variation ($\pm 20\%$) of Manning’s roughness coefficients across the floodplain. No changes have been made to the coefficients within the channel as no changes have been made to the existing coefficients in the approved EA model.

Sensitivity testing was not performed on either the 1D or 2D model downstream boundaries given the elevation at these locations relative to site levels. For information, the approximate bank and bed levels adjacent to the site are 36.1mAOD and 34.1mAOD respectively (1D node 13816.001). The 2D domain ends approximately 1.6km downstream of the site. Bank and bed levels at the 2D downstream boundary are around 3-4m lower than site levels at 31.1mAOD and 29.7mAOD respectively. This large drop in elevations means any backwater effects at the site due to the 2D boundary choice will not impact the site.

The River Maun is modelled in 1D-only for another 11km where bank and bed elevations have dropped to 17.5mAOD and 14.5mAOD respectively (node MED000). As with the 2D boundary, backwater effects caused by the choice of boundary condition at this location will not have a measurable effect on results at the site.

Results & Conclusions

This section of the report documents the results obtained from the primary simulations and sensitivity tests.

Calculated maximum water levels were extracted at each node along the 1D network model and compared for each simulation. A table of this data has been provided in Appendix D. Maximum flood depth, velocity and hazard mapping has been provided for each primary simulation in Appendix E.

Flood hazard ratings have been calculated in accordance with DEFRA document 'FD2320: Flood Risks to People' and EA guidance document 'Supplementary Note on Flood Hazard Ratings and Thresholds'.

The results of the hydraulic modelling show the entire OB/MU/1 development site to be dry during the 4% AEP event. Although the River Maun overtops its banks in places during this event, flood waters do not reach the site.

During the 1% AEP event, a very small area of the site ($\approx 1\%$) to the north experiences shallow flooding of up to 200mm (max water level (WL) = 33.77m AOD). The remainder of the site remains flood free.

When a climate change allowance of +30% flow is considered during the 1% AEP event (Q100CC1), the flood extent in the northern section of the site is slightly increased to approximately 0.4ha (2% of the site area). Maximum flood depths also increase, reaching up to 500mm (max WL = 34.06m AOD). Again, the remainder of the site remains flood free. An extract of the 1% AEP + CC (+30%) event maximum flood depth map is provided in Figure 3 for information. Maximum flood velocities on site during this event are less than 0.25m/s and the flood hazard rating on site varies between 'Caution' to 'Danger for Some'.

When a +50% climate change allowance (Q100CC2) is considered, flood extents and depths in the northern section of the site increase a small amount relative to the +30% scenario; depths reaching approximately 600mm along the site boundary (max WL = 34.10m AOD). To the south, approximately 3.0ha (16% of the site area) experiences flooding with maximum flood depths varying between 100-600mm (max WL = 37.49m AOD). An extract of the 1% AEP + CC (+50%) event maximum flood depth map is provided in Figure 4 for information. Maximum flood velocities throughout the site reach up to 1.0m/s during this event though are generally less than 0.15m/s. The flood hazard rating on site varies between 'Caution' to 'Danger for Most'. The remainder of the site, approximately 83% of the area, remains flood free.

The extreme 0.1% AEP event results show a similar extent and mechanism to the 1% AEP + 50% climate change scenario, albeit depths and extents are increased, particularly in the southern section. Depths in this area reach up to 850mm (max WL = 37.73m AOD). Maximum flood velocities on site during this event reach up to 1.5m/s and the flood hazard rating on site generally varies between 'Danger for Some' and 'Danger for Most'. The remainder of the site, approximately 77% of the area, remains flood free.

Figure 3 – Maximum Flood Depth – 1% AEP + CC (+30%) event – Existing Site Layout (EXG)

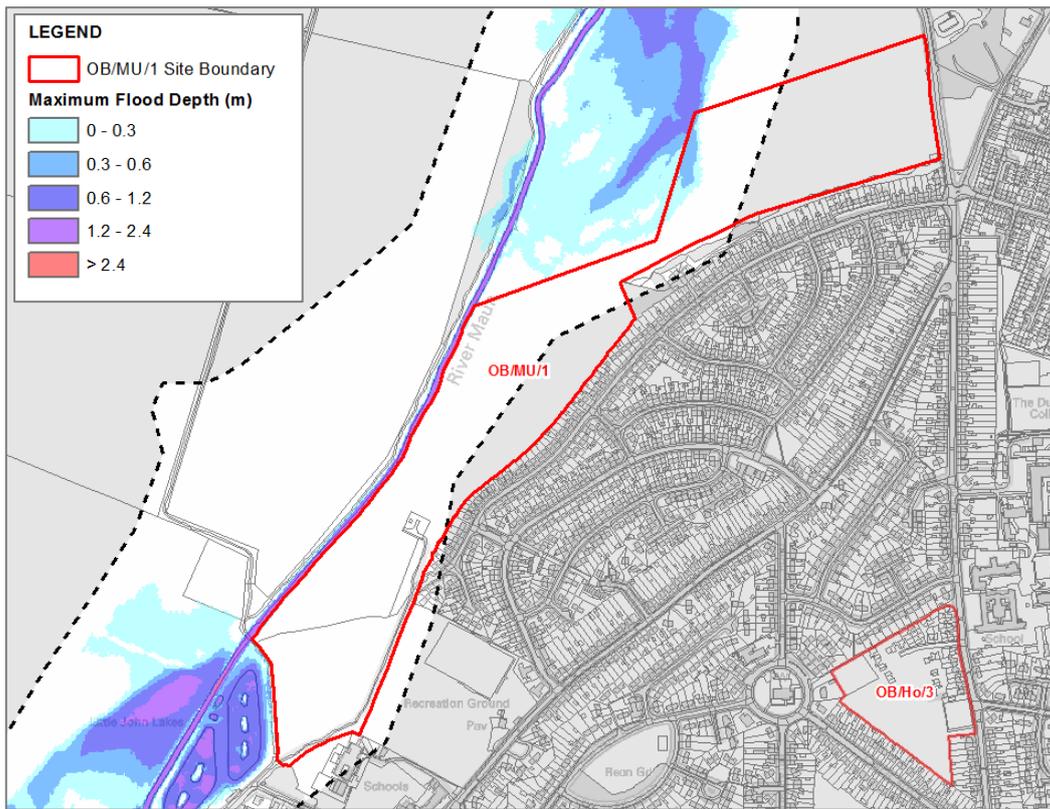
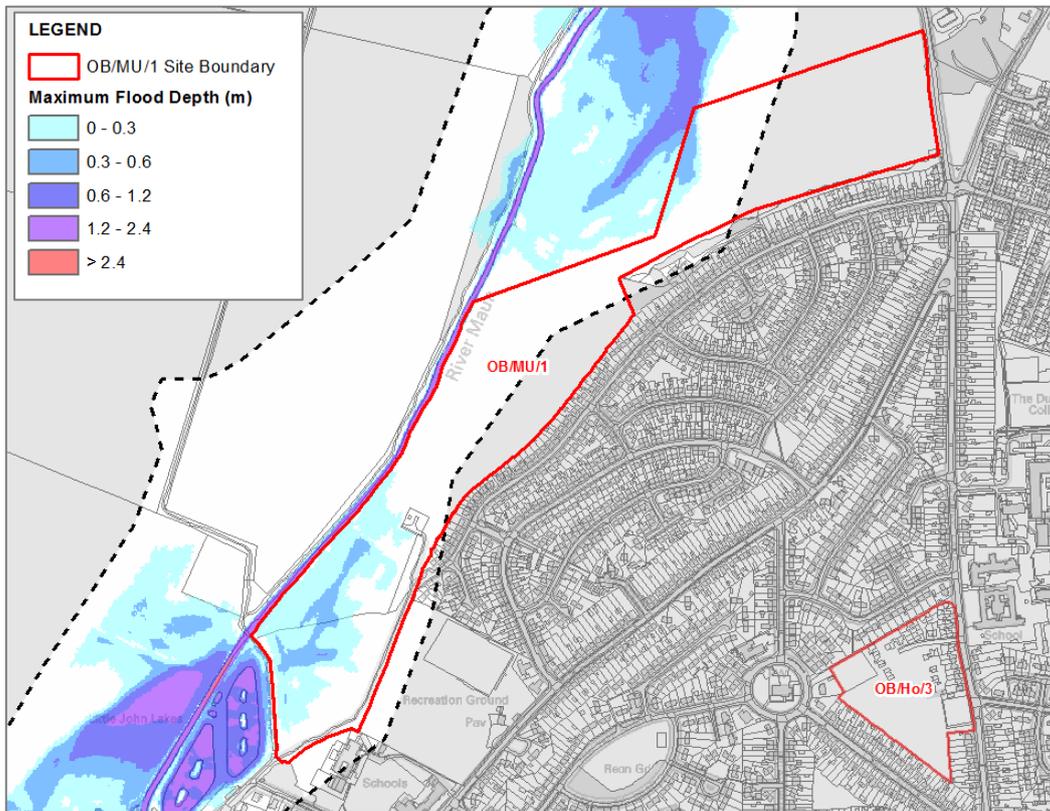


Figure 4 – Maximum Flood Depth – 1% AEP + CC (+50%) event – Existing Site Layout (EXG)



Sensitivity Tests

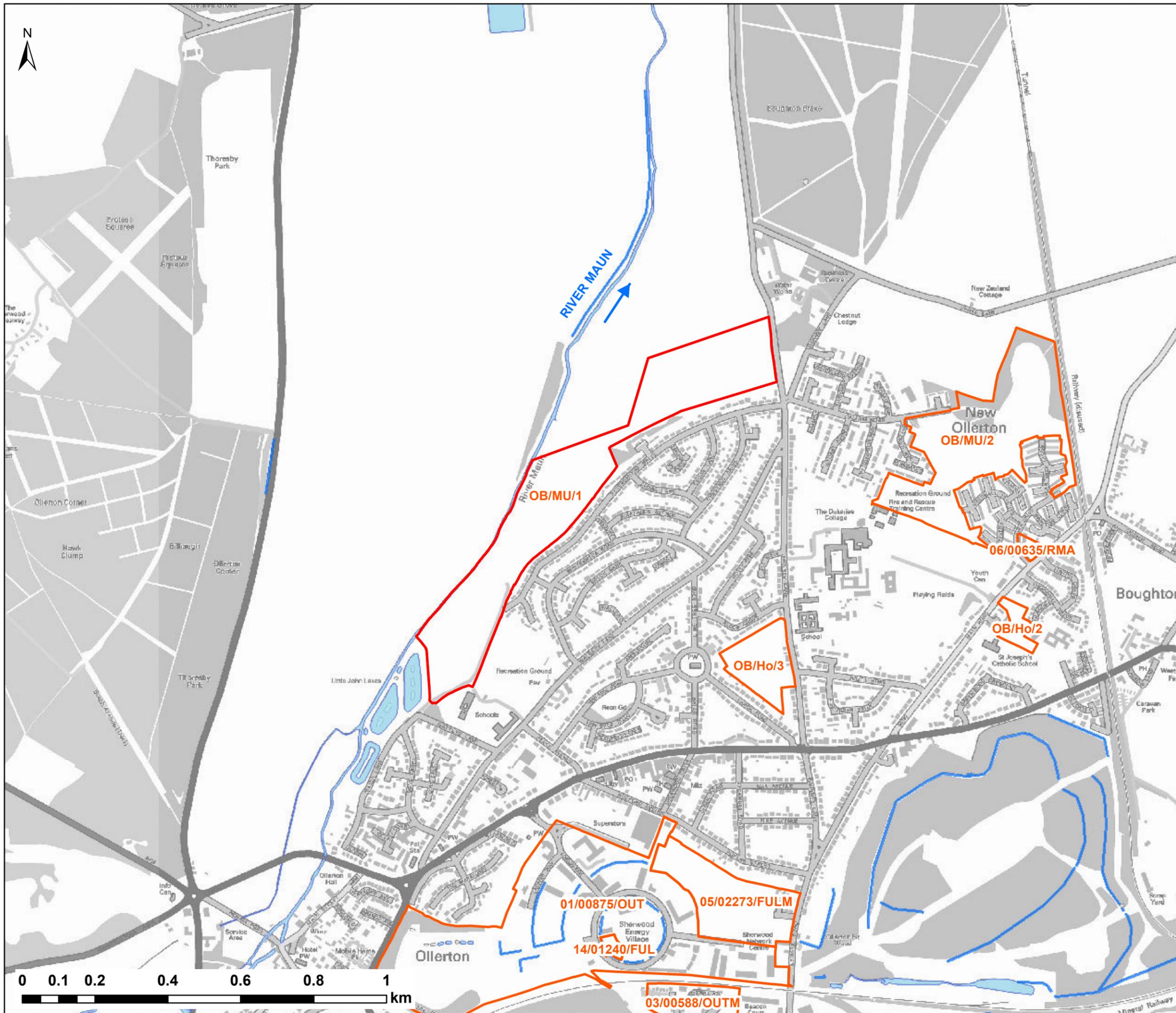
The results of sensitivity tests ST1 and ST2 show that a significant variation ($\pm 20\%$) in the Manning's 'n' coefficients used across the floodplain has negligible effect on maximum water levels throughout the model.

Recommendations

The hydraulic model and associated report should be submitted to the EA for technical review as a reasonable representation of the existing fluvial flood risk at Site OB/MU/1.

Should the site be the subject of detailed studies in the future, the River Maun hydrology should be revised as necessary to make use of the additional ten years of data available.

Appendix A – Location Plan and Aerial Image



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- Watercourse



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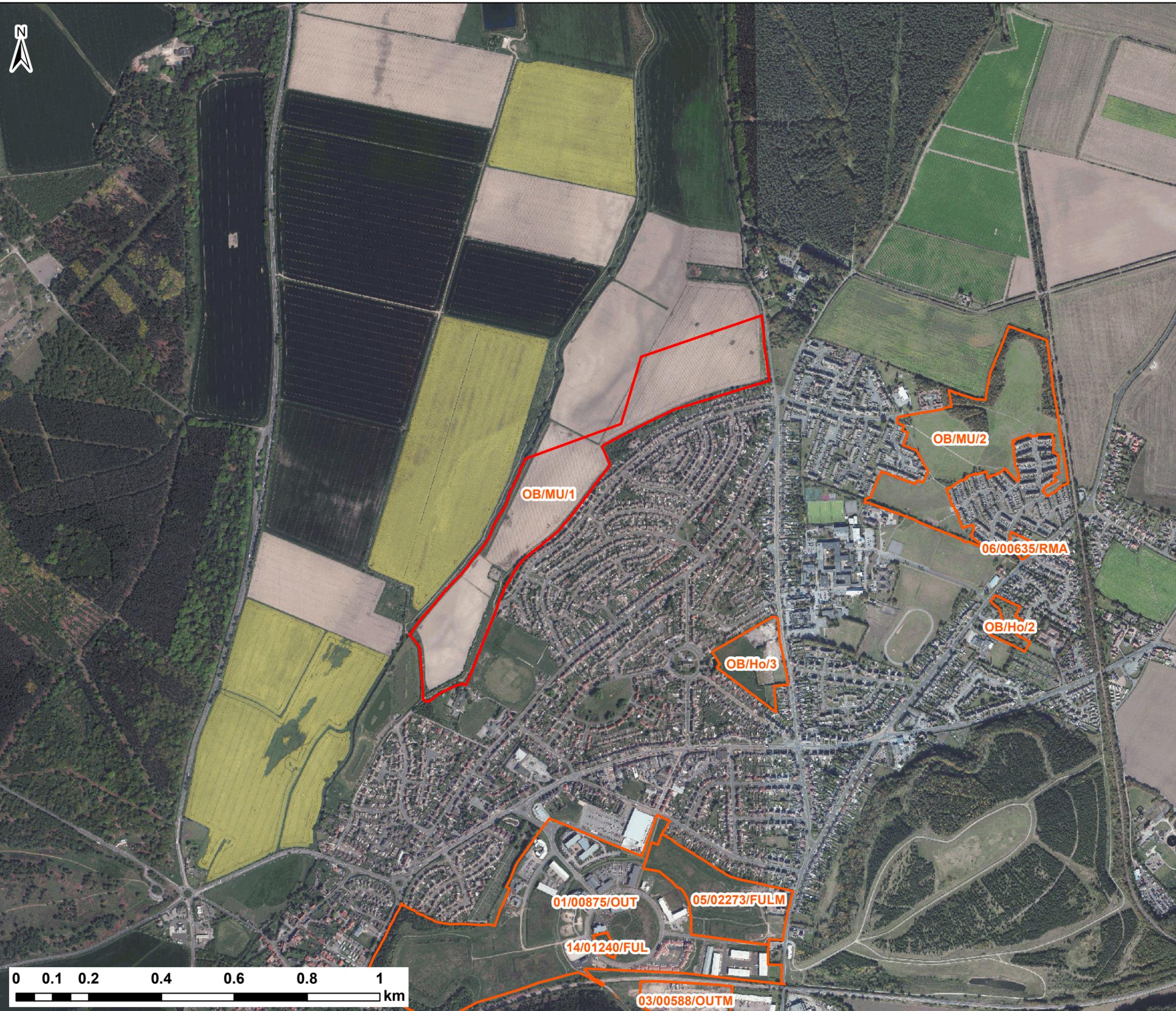
NEWARK & SHERWOOD DISTRICT COUNCIL

 **waterco consultants**

SCHEME:
NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

PLOT TITLE:
LOCATION PLAN

PLOT STATUS: FINAL		DATE: 06/10/2016	
DRAWN: DH	CHECKED: BLJ	APPROVED: RCL	PLOT SCALE @ A3: 1:10,000 (UNLESS STATED OTHERWISE)
PLOT NAME: w3227-Site_Location			REV: -



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites



CLIENT:



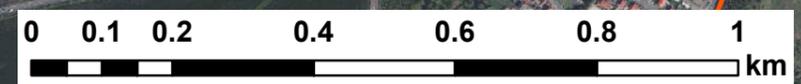
NEWARK & SHERWOOD
DISTRICT COUNCIL



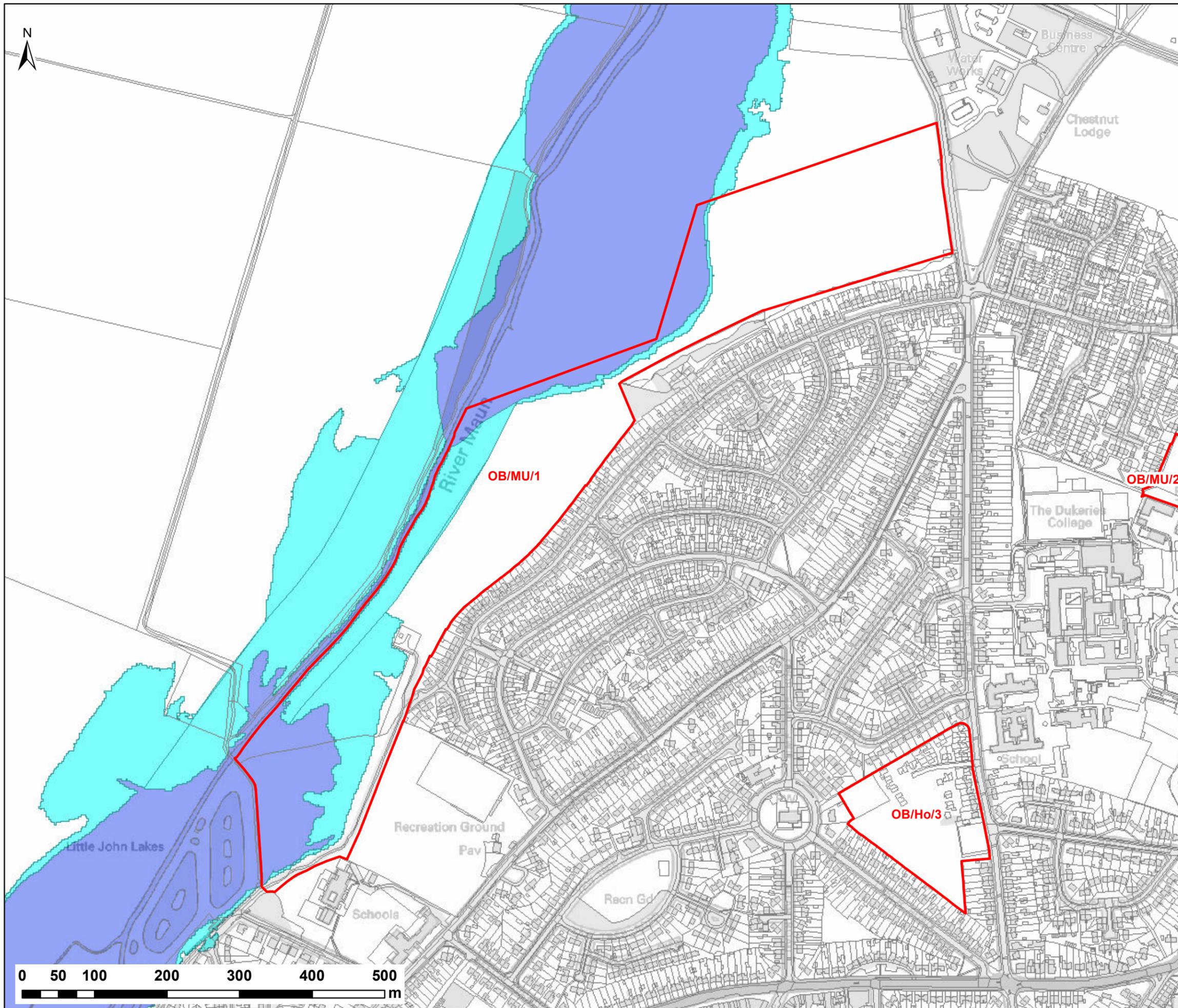
SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
AERIAL IMAGE

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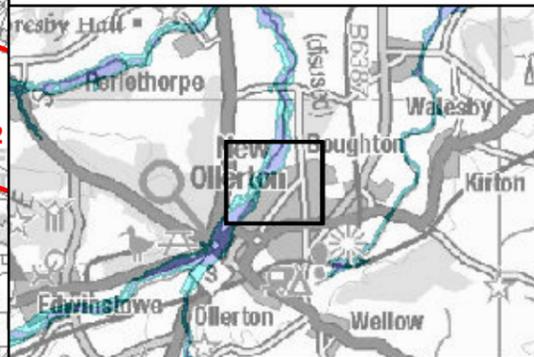
Appendix B – EA Flood Map for Planning



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- NSDC IDP Sites
- EA Flood Zone 2
- EA Flood Zone 3



CLIENT:

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 DISTRICT COUNCIL

 **waterco**
 consultants

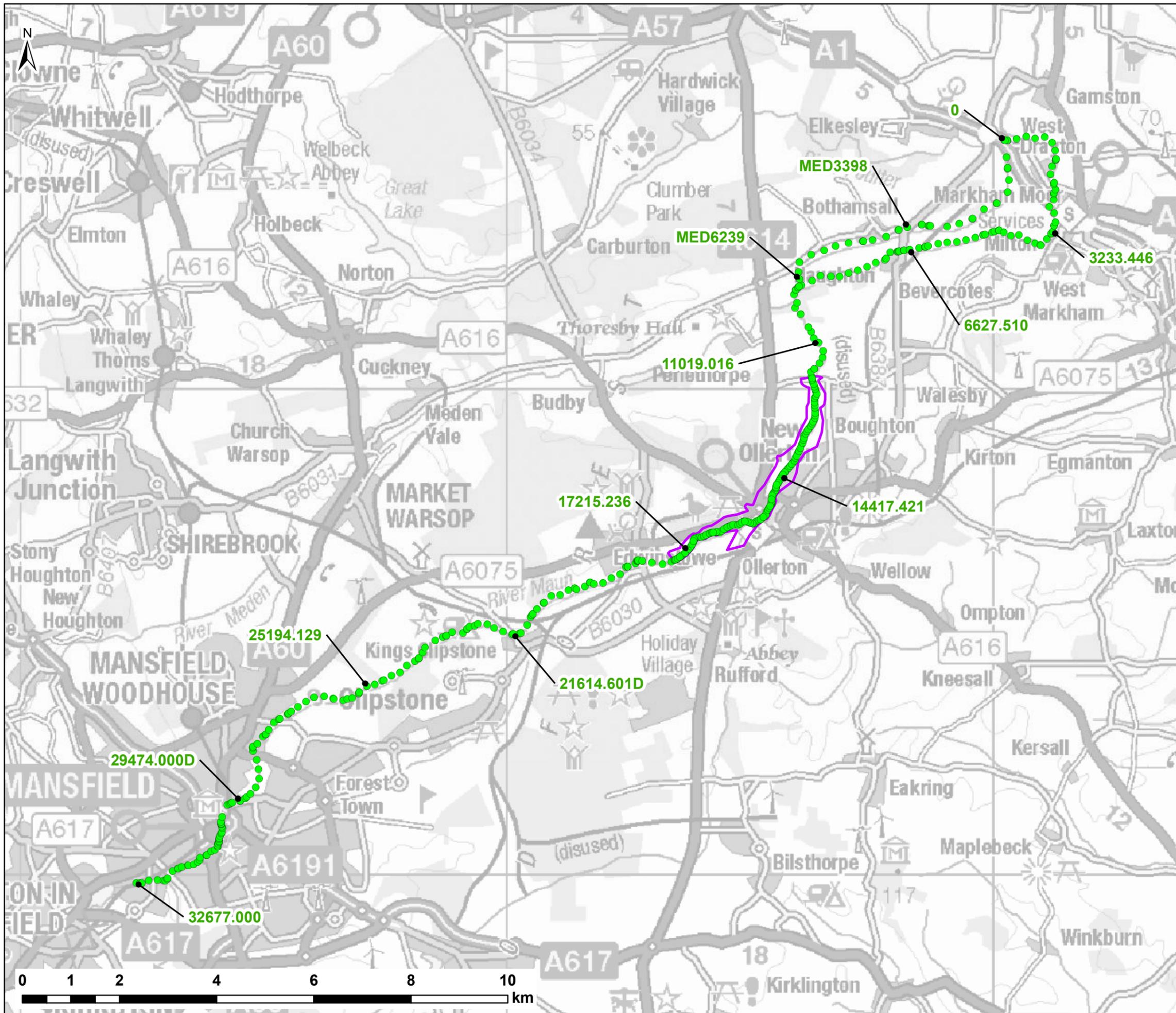
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**NEWARK & SHERWOOD SFRA
 RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**EA FLOOD MAP FOR PLANNING
 OCTOBER 2016**

PLOT STATUS: FINAL		DATE: 04/10/2016	
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Appendix C – 1D/2D Model Extents



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- 1D Model Nodes
 - 2D Model Boundary



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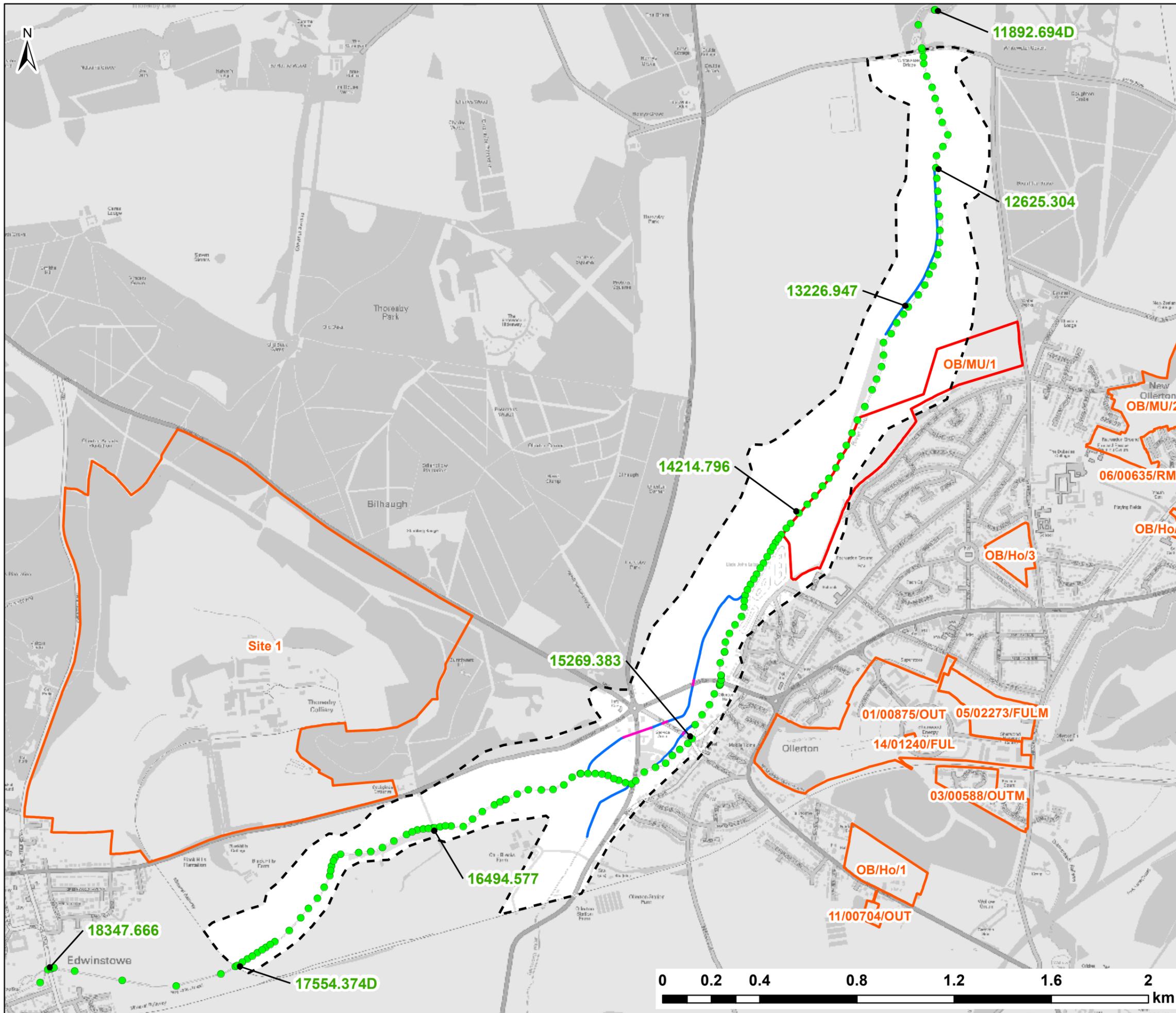
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SCHEME:
NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

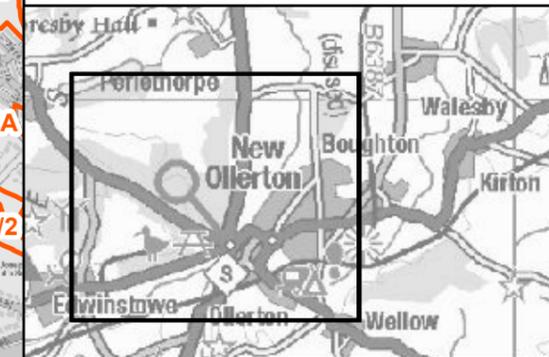
PLOT TITLE:
MODEL EXTENT (PLOT 1 OF 3)

PLOT STATUS: FINAL		DATE: 06/10/2016	
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PLOT NAME: w3227-Model_Extent_pt1			REV: -



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 1D Model Nodes
 - 2D Model Boundary
 - Channels in 2D Domain
 - Structures in 2D Domain



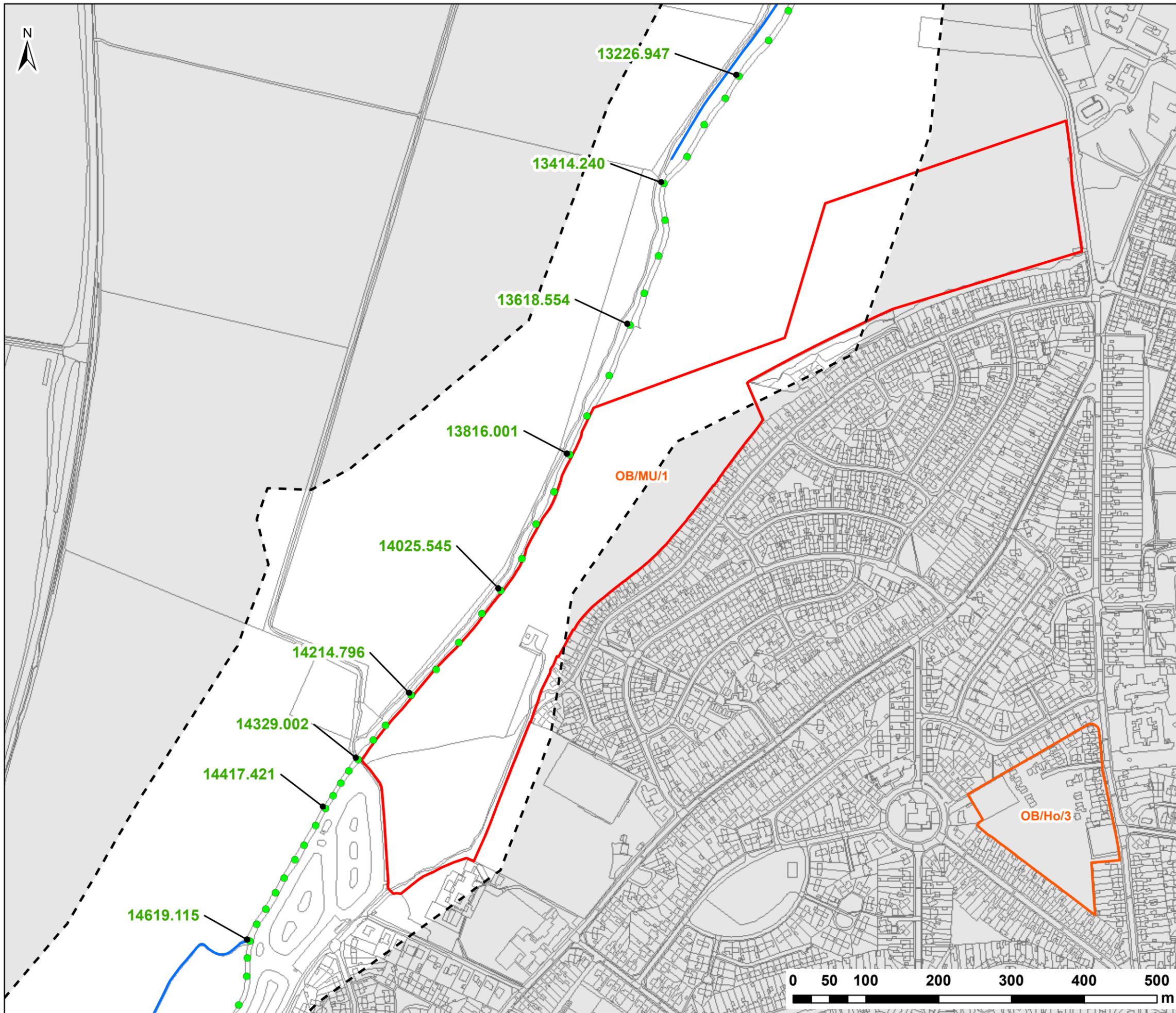
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SCHEME:
NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

PLOT TITLE:
MODEL EXTENT (PLOT 2 OF 3)

PLOT STATUS: FINAL		DATE: 06/10/2016	
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PLOT NAME: w3227-Model_Extent_pt2			REV: -



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 1D Model Nodes
 - 2D Model Boundary
 - Channels in 2D Domain



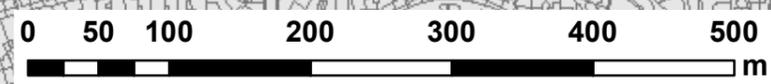
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SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MODEL EXTENT
(PLOT 3 OF 3)**

PLOT STATUS: FINAL		DATE: 06/10/2016	
DRAWN: DH	CHECKED: BLJ	APPROVED: RCL	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
PLOT NAME: w3227-Model_Extent_pt3			REV: -



Appendix D – Tabulated 1D Model Results Data

Newark & Sherwood SFRA - River Maun



Hydraulic Model Results

1D FMP Model Results - Maximum Water Levels (mAOD) and Depths (m)

Primary Simulations

Date: 05/10/16

Model Type: FMP-TUFLOW

FMP Build: 4.2

TUFLOW Build: 2016-03-AC

Notes:

1D/2D model build 005; All simulations completed using 7.5 hour storm duration hydrographs
 Nodes highlighted in yellow are situated adjacent to the OB/MU/1 development site
 EXG - Existing Site Layout; ST1 - +20% Mannings' n Roughness (floodplain); ST2 - -20% Mannings' n Roughness (floodplain)

Node Label	MAXIMUM WATER LEVELS				
	Q25 (4% AEP) EXG	Q100 (1% AEP) EXG	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC2 (1% AEP + 50% CC) EXG	Q1000 (0.1% AEP) EXG
	(mAOD)	(mAOD)	(mAOD)	(mAOD)	(mAOD)
17554.374D	46.70	46.84	46.92	47.01	47.45
17529.374i	46.61	46.76	46.89	47.00	47.44
17504.374i	46.52	46.70	46.88	46.99	47.43
17479.374i	46.43	46.65	46.87	46.99	47.42
17454.374i	46.34	46.58	46.86	46.98	47.42
17429.374i	46.26	46.51	46.85	46.98	47.41
17406.04	46.19	46.43	46.81	46.96	47.40
17386.040i	46.10	46.32	46.67	46.87	47.40
17362.318	45.91	46.11	46.38	46.50	46.92
17292.318i	45.40	45.62	45.89	46.02	46.36
17215.236	45.03	45.26	45.53	45.65	45.89
17165.236i	44.86	45.09	45.34	45.44	45.66
17115.236i	44.72	44.95	45.17	45.26	45.64
17065.236i	44.61	44.84	45.04	45.14	45.64
17004.606	44.53	44.74	45.00	45.13	45.64
16984.606i	44.49	44.71	45.00	45.13	45.64
16964.606i	44.46	44.67	44.99	45.13	45.64
16939.606i	44.41	44.62	44.99	45.13	45.65
16920.4	44.36	44.58	44.89	45.01	45.50
16920.400D	44.21	44.38	44.54	44.62	44.89
16821.826	44.02	44.16	44.25	44.28	44.32
16771.826i	43.90	44.00	44.06	44.09	44.30
16721.826i	43.78	43.86	44.00	44.06	44.29
16671.826i	43.70	43.84	43.99	44.06	44.29
16604.572	43.68	43.83	43.99	44.06	44.28
16579.572i	43.68	43.83	43.99	44.05	44.28
16554.572i	43.65	43.83	43.98	44.05	44.28
16529.572i	43.61	43.80	43.97	44.04	44.27
16504.572i	43.57	43.74	43.88	43.94	44.16
16494.577	43.55	43.70	43.80	43.83	43.91
16494.577D	43.55	43.69	43.78	43.81	43.85
16469.577i	43.52	43.65	43.75	43.79	43.86
16444.577i	43.48	43.60	43.70	43.74	43.82
16417.854	43.44	43.54	43.63	43.66	43.74
16367.854i	43.37	43.45	43.52	43.54	43.59
16317.854i	43.32	43.38	43.42	43.43	43.46
16267.854i	43.28	43.32	43.34	43.35	43.36
16212.58	43.27	43.31	43.33	43.34	43.35
16182.580i	43.27	43.31	43.34	43.34	43.36
16159.643	43.26	43.30	43.33	43.34	43.36
16159.643D	43.01	43.07	43.12	43.14	43.17
16109.643i	42.97	43.02	43.07	43.09	43.13
16059.643i	42.91	42.96	43.02	43.03	43.07
16002.96	42.83	42.88	42.94	42.95	42.99
15952.960i	42.77	42.82	42.87	42.89	42.92
15902.960i	42.71	42.77	42.81	42.83	42.86
15852.960i	42.66	42.72	42.77	42.78	42.81
15820.12	42.63	42.70	42.76	42.78	42.81
15820.120D	42.63	42.70	42.76	42.78	42.81
15790.120i	42.57	42.66	42.73	42.76	42.80
15760.120i	42.53	42.62	42.70	42.72	42.78
15730.120i	42.49	42.59	42.68	42.71	42.77
15700.120i	42.47	42.54	42.62	42.64	42.72

Node Label	MAXIMUM WATER LEVELS				
	Q25 (4% AEP) EXG	Q100 (1% AEP) EXG	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC2 (1% AEP + 50% CC) EXG	Q1000 (0.1% AEP) EXG
	(mAOD)	(mAOD)	(mAOD)	(mAOD)	(mAOD)
15015.328U	39.77	39.87	39.96	39.98	40.05
15015.328U	39.77	39.87	39.96	39.98	40.05
14981.362	39.48	39.59	39.69	39.72	39.81
14980.13	39.09	39.22	39.33	39.37	39.44
14930.13i	38.97	39.11	39.23	39.27	39.34
14878.52	38.77	38.91	39.03	39.08	39.16
14877.63i	38.59	38.70	38.80	38.83	38.90
14837.63i	38.34	38.45	38.55	38.59	38.67
14796.344	38.16	38.27	38.38	38.43	38.51
14756.344i	38.01	38.12	38.24	38.29	38.39
14716.344i	37.87	37.99	38.12	38.19	38.30
14676.344i	37.74	37.87	38.03	38.11	38.24
14646.344i	37.66	37.80	37.98	38.08	38.23
14619.115	37.60	37.74	37.97	38.07	38.23
14594.115i	37.55	37.70	37.96	38.07	38.22
14569.115i	37.51	37.67	37.95	38.06	38.22
14544.115i	37.48	37.65	37.95	38.06	38.22
14519.115i	37.45	37.64	37.95	38.06	38.22
14494.115i	37.43	37.64	37.95	38.06	38.22
14469.115i	37.41	37.64	37.95	38.06	38.22
14444.115i	37.39	37.63	37.95	38.06	38.22
14417.421	37.35	37.62	37.95	38.06	38.22
14397.421i	37.32	37.56	37.94	38.06	38.22
14377.421i	37.30	37.52	37.91	38.04	38.21
14352.421i	37.27	37.49	37.83	37.95	38.11
14329.002	37.23	37.45	37.78	37.89	37.98
14299.002i	37.18	37.40	37.73	37.83	37.92
14269.002i	37.12	37.34	37.67	37.77	37.85
14214.796	36.91	37.12	37.43	37.54	37.73
14164.796i	36.70	36.91	37.22	37.34	37.68
14114.796i	36.50	36.71	37.02	37.13	37.49
14064.796i	36.31	36.52	36.82	36.94	37.29
14025.545	36.16	36.37	36.68	36.79	37.09
13975.545i	35.96	36.18	36.49	36.60	36.87
13925.545i	35.77	35.99	36.29	36.40	36.66
13875.545i	35.58	35.79	36.09	36.20	36.46
13816.001	35.33	35.54	35.80	35.90	36.13
13756.001i	35.10	35.31	35.54	35.62	35.85
13696.001i	34.87	35.09	35.28	35.33	35.38
13618.554	34.60	34.82	34.95	34.98	35.05
13568.554i	34.44	34.65	34.82	34.84	34.88
13518.554i	34.29	34.50	34.69	34.71	34.75
13468.554i	34.15	34.36	34.53	34.56	34.61
13414.24	34.03	34.24	34.38	34.41	34.45
13364.240i	33.93	34.13	34.26	34.28	34.32
13314.240i	33.86	34.05	34.15	34.17	34.20
13264.240i	33.80	33.98	34.08	34.11	34.15
13226.947	33.77	33.94	34.07	34.10	34.14
13166.947i	33.71	33.89	34.06	34.10	34.15
13106.947i	33.66	33.84	34.01	34.06	34.12
13056.947i	33.62	33.79	33.95	33.99	34.06
13007.3	33.57	33.75	33.89	33.93	34.01
12957.300i	33.52	33.70	33.80	33.84	33.96

Newark & Sherwood SFRA - River Maun



Hydraulic Model Results

1D FMP Model Results - Maximum Water Levels (mAOD) and Depths (m)

Primary Simulations

Date: 05/10/16

Model Type: FMP-TUFLOW

FMP Build: 4.2

TUFLOW Build: 2016-03-AC

Notes:

1D/2D model build 005; All simulations completed using 7.5 hour storm duration hydrographs
 Nodes highlighted in yellow are situated adjacent to the OB/MU/1 development site
 EXG - Existing Site Layout; ST1 - +20% Mannings' n Roughness (floodplain); ST2 - -20% Mannings' n Roughness (floodplain)

Node Label	MAXIMUM WATER LEVELS				
	Q25 (4% AEP) EXG	Q100 (1% AEP) EXG	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC2 (1% AEP + 50% CC) EXG	Q1000 (0.1% AEP) EXG
	(mAOD)	(mAOD)	(mAOD)	(mAOD)	(mAOD)
15675.120i	42.45	42.51	42.57	42.59	42.67
15650.120i	42.43	42.49	42.55	42.57	42.63
15625.120i	42.42	42.48	42.52	42.54	42.59
15594.841	42.40	42.46	42.50	42.51	42.55
15594.841D	42.40	42.45	42.48	42.50	42.53
15544.841i	42.37	42.42	42.46	42.47	42.50
15494.841i	42.31	42.37	42.41	42.43	42.46
15444.841i	42.21	42.26	42.31	42.32	42.36
15405.629	42.05	42.10	42.14	42.16	42.19
15355.629i	41.88	41.94	41.98	42.00	42.04
15299.383	41.77	41.83	41.88	41.90	41.94
15269.383	41.34	41.37	41.39	41.40	41.42
15214.184	40.69	40.72	40.75	40.77	40.82
15164.184i	40.65	40.69	40.74	40.76	40.81
15114.184i	40.60	40.67	40.74	40.76	40.82
15064.184i	40.52	40.62	40.70	40.73	40.80
15019.854	40.34	40.42	40.49	40.52	40.57
15015.328	39.77	39.87	39.96	39.99	40.05

Node Label	MAXIMUM WATER LEVELS				
	Q25 (4% AEP) EXG	Q100 (1% AEP) EXG	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC2 (1% AEP + 50% CC) EXG	Q1000 (0.1% AEP) EXG
	(mAOD)	(mAOD)	(mAOD)	(mAOD)	(mAOD)
12907.300i	33.45	33.62	33.69	33.73	33.94
12867.300i	33.38	33.55	33.69	33.74	33.94
12826.021	33.28	33.44	33.64	33.72	33.93
12776.021i	33.14	33.31	33.57	33.68	33.92
12726.021i	33.00	33.17	33.52	33.66	33.90
12676.021i	32.86	33.03	33.39	33.60	33.90
12625.304	32.70	32.87	33.17	33.32	33.63
12575.304i	32.55	32.72	33.01	33.14	33.36
12525.304i	32.39	32.55	32.84	32.95	33.13
12475.304i	32.22	32.38	32.65	32.74	32.82
12421.002	32.01	32.15	32.38	32.46	32.54
12371.002i	31.83	31.95	32.10	32.12	32.25
12321.002i	31.69	31.79	31.92	32.03	32.24
12271.002i	31.59	31.69	31.91	32.03	32.24
12220.292	31.58	31.68	31.91	32.03	32.24
12170.292i	31.57	31.68	31.90	32.02	32.23
12140.292i	31.56	31.68	31.90	32.03	32.24
12110.9	31.47	31.54	31.69	31.78	31.99

Newark & Sherwood SFRA - River Maun



Hydraulic Model Results

1D FMP Model Results - Maximum Water Levels (mAOD) and Depths (m)

Sensitivity Tests

Date: 05/10/16

Model Type: FMP-TUFLOW

FMP Build: 4.2

TUFLOW Build: 2016-03-AC

Notes:

1D/2D model build 005; All simulations completed using 7.5 hour storm duration hydrographs
 Nodes highlighted in yellow are situated adjacent to the OB/MU/1 development site
 EXG - Existing Site Layout; ST1 - +20% Mannings' n Roughness (floodplain); ST2 - -20% Mannings' n Roughness (floodplain)

Node Label	MAXIMUM WATER LEVELS				
	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC1 (1% AEP + 30% CC) ST1	Water Level Difference ST1 vs EXG	Q100CC1 (1% AEP + 30% CC) ST2	Water Level Difference ST2 vs EXG
	(mAOD)	(mAOD)	(mm)	(mAOD)	(mm)
17554.374D	46.92	46.93	0.01	46.91	-0.01
17529.374i	46.89	46.89	0.00	46.89	0.00
17504.374i	46.88	46.88	0.00	46.88	0.00
17479.374i	46.87	46.87	0.00	46.87	0.00
17454.374i	46.86	46.86	0.00	46.87	0.00
17429.374i	46.85	46.84	-0.01	46.86	0.01
17406.04	46.81	46.80	-0.01	46.83	0.02
17386.040i	46.67	46.65	-0.01	46.69	0.02
17362.318	46.38	46.37	-0.01	46.39	0.01
17292.318i	45.89	45.89	0.00	45.90	0.01
17215.236	45.53	45.53	0.00	45.54	0.01
17165.236i	45.34	45.34	0.00	45.34	0.00
17115.236i	45.17	45.17	0.00	45.18	0.00
17065.236i	45.04	45.04	0.00	45.04	0.00
17004.606	45.00	44.99	0.00	45.01	0.01
16984.606i	45.00	44.99	0.00	45.01	0.01
16964.606i	44.99	44.99	-0.01	45.00	0.01
16939.606i	44.99	44.99	-0.01	45.01	0.01
16920.4	44.89	44.88	0.00	44.89	0.01
16920.400D	44.54	44.54	0.00	44.54	0.00
16821.826	44.25	44.25	0.00	44.25	0.00
16771.826i	44.06	44.06	0.01	44.05	-0.01
16721.826i	44.00	44.00	0.01	43.99	0.00
16671.826i	43.99	44.00	0.00	43.99	0.00
16604.572	43.99	43.99	0.00	43.99	0.00
16579.572i	43.99	43.99	0.00	43.98	0.00
16554.572i	43.98	43.98	0.00	43.98	0.00
16529.572i	43.97	43.97	0.00	43.97	0.00
16504.572i	43.88	43.88	0.00	43.88	0.00
16494.577	43.80	43.80	0.00	43.80	0.00
16494.577D	43.78	43.79	0.00	43.78	0.00
16469.577i	43.75	43.76	0.00	43.75	0.00
16444.577i	43.70	43.70	0.00	43.70	0.00
16417.854	43.63	43.63	0.00	43.63	0.00
16367.854i	43.52	43.52	0.00	43.52	0.00
16317.854i	43.42	43.42	0.00	43.41	0.00
16267.854i	43.34	43.35	0.01	43.33	-0.01
16212.58	43.33	43.34	0.01	43.32	-0.01
16182.580i	43.34	43.34	0.01	43.33	-0.01
16159.643	43.33	43.33	0.01	43.32	-0.01
16159.643D	43.12	43.13	0.01	43.11	-0.01
16109.643i	43.07	43.08	0.01	43.06	-0.01
16059.643i	43.02	43.03	0.01	43.01	-0.01
16002.96	42.94	42.94	0.01	42.93	-0.01
15952.960i	42.87	42.88	0.01	42.86	-0.01
15902.960i	42.81	42.82	0.01	42.80	-0.01
15852.960i	42.77	42.77	0.01	42.76	-0.01
15820.12	42.76	42.77	0.01	42.75	-0.01
15820.120D	42.76	42.77	0.01	42.75	-0.01
15790.120i	42.73	42.74	0.01	42.73	-0.01
15760.120i	42.70	42.70	0.01	42.69	-0.01
15730.120i	42.68	42.69	0.01	42.68	0.00
15700.120i	42.62	42.62	0.01	42.61	-0.01

Node Label	MAXIMUM WATER LEVELS				
	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC1 (1% AEP + 30% CC) ST1	Water Level Difference ST1 vs EXG	Q100CC1 (1% AEP + 30% CC) ST2	Water Level Difference ST2 vs EXG
	(mAOD)	(mAOD)	(mm)	(mAOD)	(mm)
15015.328U	39.96	39.96	0.00	39.95	0.00
15015.328U	39.96	39.96	0.00	39.95	0.00
14981.362	39.69	39.69	0.01	39.68	0.00
14980.13	39.33	39.34	0.01	39.33	0.00
14930.13i	39.23	39.23	0.00	39.22	-0.01
14878.52	39.03	39.03	0.00	39.02	-0.01
14877.63i	38.80	38.80	0.00	38.79	0.00
14837.63i	38.55	38.56	0.00	38.55	0.00
14796.344	38.38	38.38	0.00	38.37	0.00
14756.344i	38.24	38.24	0.01	38.23	0.00
14716.344i	38.12	38.13	0.01	38.12	0.00
14676.344i	38.03	38.04	0.00	38.03	0.00
14646.344i	37.98	37.99	0.01	37.98	0.00
14619.115	37.97	37.97	0.01	37.97	0.00
14594.115i	37.96	37.96	0.00	37.96	0.00
14569.115i	37.95	37.95	0.00	37.96	0.00
14544.115i	37.95	37.95	0.00	37.96	0.00
14519.115i	37.95	37.95	0.00	37.95	0.00
14494.115i	37.95	37.95	0.00	37.95	0.00
14469.115i	37.95	37.95	0.00	37.95	0.00
14444.115i	37.95	37.95	0.00	37.95	0.01
14417.421	37.95	37.95	0.00	37.95	0.01
14397.421i	37.94	37.94	0.00	37.95	0.01
14377.421i	37.91	37.91	0.00	37.92	0.01
14352.421i	37.83	37.82	0.00	37.84	0.01
14329.002	37.78	37.78	0.00	37.79	0.01
14299.002i	37.73	37.73	0.00	37.74	0.01
14269.002i	37.67	37.66	0.00	37.67	0.01
14214.796	37.43	37.43	0.00	37.44	0.01
14164.796i	37.22	37.22	0.00	37.23	0.01
14114.796i	37.02	37.02	0.00	37.02	0.01
14064.796i	36.82	36.82	0.00	36.83	0.01
14025.545	36.68	36.67	0.00	36.68	0.01
13975.545i	36.49	36.48	0.00	36.49	0.01
13925.545i	36.29	36.29	0.00	36.30	0.01
13875.545i	36.09	36.09	0.00	36.09	0.01
13816.001	35.80	35.80	0.00	35.81	0.00
13756.001i	35.54	35.54	0.00	35.54	0.00
13696.001i	35.28	35.28	0.00	35.28	0.00
13618.554	34.95	34.96	0.01	34.94	-0.01
13568.554i	34.82	34.82	0.00	34.82	0.00
13518.554i	34.69	34.68	0.00	34.69	0.00
13468.554i	34.53	34.53	0.00	34.53	0.00
13414.24	34.38	34.39	0.00	34.38	0.00
13364.240i	34.26	34.26	0.00	34.26	0.00
13314.240i	34.15	34.15	0.00	34.15	0.00
13264.240i	34.08	34.08	0.00	34.08	-0.01
13226.947	34.07	34.07	0.00	34.06	0.00
13166.947i	34.06	34.06	0.00	34.06	0.00
13106.947i	34.01	34.01	0.00	34.01	0.00
13056.947i	33.95	33.95	0.00	33.95	0.00
13007.3	33.89	33.89	0.00	33.88	0.00
12957.300i	33.80	33.81	0.00	33.80	-0.01

Newark & Sherwood SFRA - River Maun



Hydraulic Model Results

1D FMP Model Results - Maximum Water Levels (mAOD) and Depths (m)

Sensitivity Tests

Date: 05/10/16

Model Type: FMP-TUFLOW

FMP Build: 4.2

TUFLOW Build: 2016-03-AC

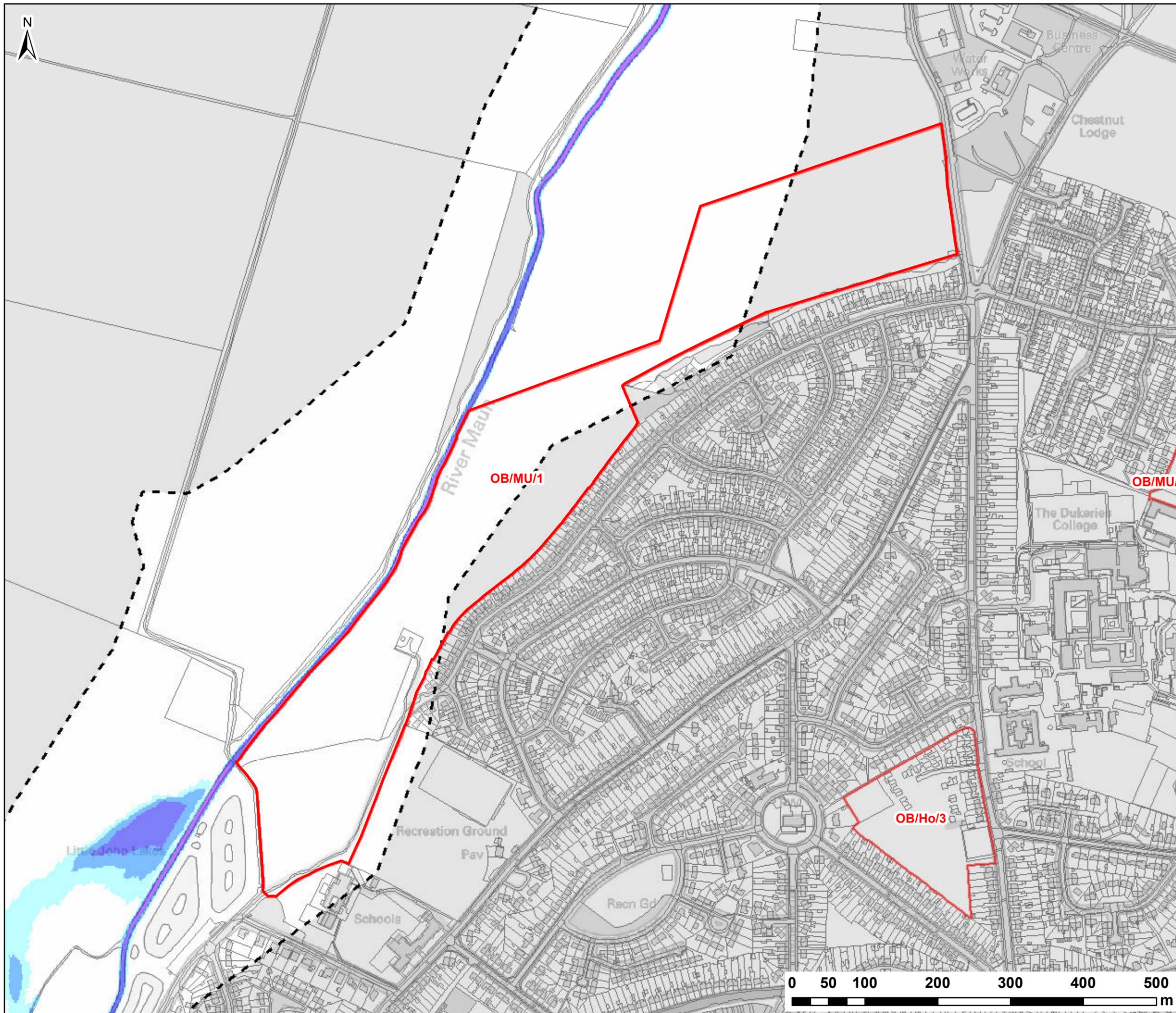
Notes:

1D/2D model build 005; All simulations completed using 7.5 hour storm duration hydrographs
 Nodes highlighted in yellow are situated adjacent to the OB/MU/1 development site
 EXG - Existing Site Layout; ST1 - +20% Mannings' n Roughness (floodplain); ST2 - -20% Mannings' n Roughness (floodplain)

Node Label	MAXIMUM WATER LEVELS				
	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC1 (1% AEP + 30% CC) ST1	Water Level Difference ST1 vs EXG	Q100CC1 (1% AEP + 30% CC) ST2	Water Level Difference ST2 vs EXG
	(mAOD)	(mAOD)	(mm)	(mAOD)	(mm)
15675.120i	42.57	42.58	0.01	42.57	-0.01
15650.120i	42.55	42.55	0.01	42.54	-0.01
15625.120i	42.52	42.53	0.01	42.52	-0.01
15594.841	42.50	42.50	0.00	42.49	-0.01
15594.841D	42.48	42.49	0.00	42.48	-0.01
15544.841i	42.46	42.46	0.00	42.45	-0.01
15494.841i	42.41	42.42	0.00	42.41	-0.01
15444.841i	42.31	42.31	0.00	42.30	-0.01
15405.629	42.14	42.15	0.00	42.14	-0.01
15355.629i	41.98	41.99	0.00	41.98	-0.01
15299.383	41.88	41.89	0.00	41.88	-0.01
15269.383	41.39	41.39	0.00	41.39	0.00
15214.184	40.75	40.76	0.01	40.75	-0.01
15164.184i	40.74	40.75	0.01	40.73	-0.01
15114.184i	40.74	40.74	0.01	40.73	-0.01
15064.184i	40.70	40.70	0.00	40.70	0.00
15019.854	40.49	40.49	0.00	40.49	0.00
15015.328	39.96	39.96	0.00	39.96	0.00

Node Label	MAXIMUM WATER LEVELS				
	Q100CC1 (1% AEP + 30% CC) EXG	Q100CC1 (1% AEP + 30% CC) ST1	Water Level Difference ST1 vs EXG	Q100CC1 (1% AEP + 30% CC) ST2	Water Level Difference ST2 vs EXG
	(mAOD)	(mAOD)	(mm)	(mAOD)	(mm)
12907.300i	33.69	33.70	0.01	33.68	-0.01
12867.300i	33.69	33.69	0.00	33.69	0.00
12826.021	33.64	33.63	0.00	33.63	0.00
12776.021i	33.57	33.57	-0.01	33.58	0.00
12726.021i	33.52	33.51	-0.01	33.53	0.01
12676.021i	33.39	33.38	-0.01	33.40	0.01
12625.304	33.17	33.16	-0.01	33.18	0.00
12575.304i	33.01	33.00	-0.01	33.01	0.00
12525.304i	32.84	32.83	-0.01	32.84	0.00
12475.304i	32.65	32.64	-0.01	32.65	0.00
12421.002	32.38	32.38	-0.01	32.38	0.00
12371.002i	32.10	32.10	0.00	32.10	0.00
12321.002i	31.92	31.91	0.00	31.91	0.00
12271.002i	31.91	31.90	-0.01	31.91	0.00
12220.292	31.91	31.90	-0.01	31.91	0.00
12170.292i	31.90	31.89	-0.01	31.90	0.00
12140.292i	31.90	31.89	-0.01	31.91	0.01
12110.9	31.69	31.68	-0.01	31.69	0.00

Appendix E – Flood Mapping



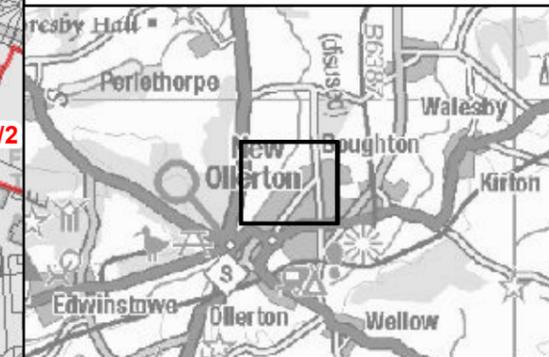
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:



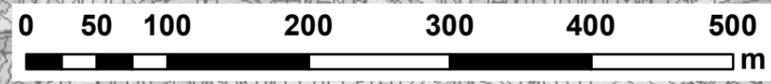
NEWARK & SHERWOOD
DISTRICT COUNCIL

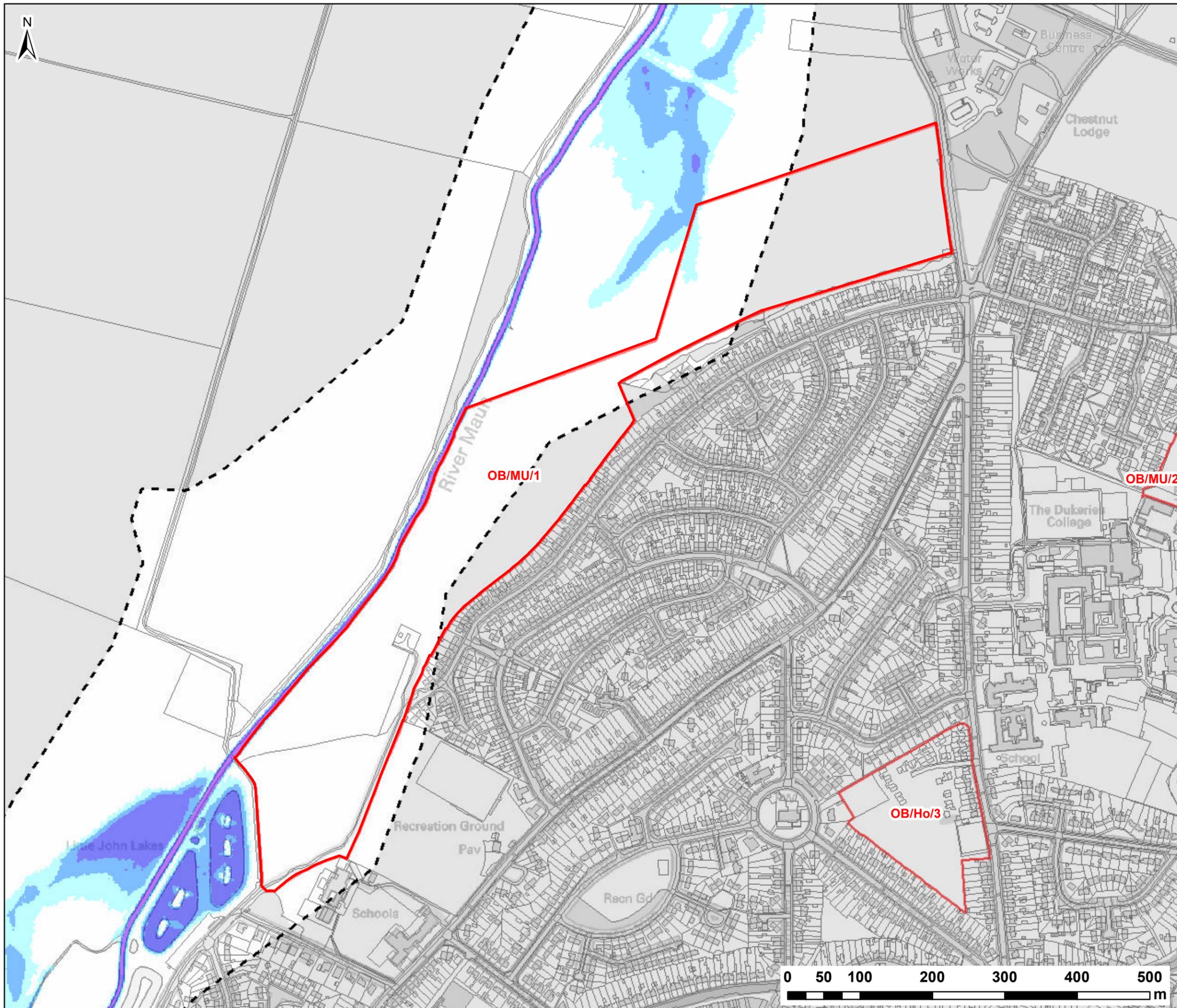



SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD DEPTH
4% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)		REV: A
PLOT NAME: w3227-Q25_EXG_D		





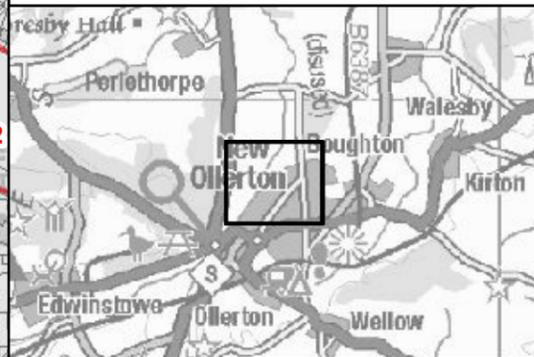
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:



NEWARK & SHERWOOD
DISTRICT COUNCIL

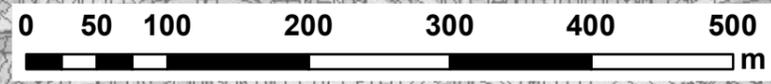


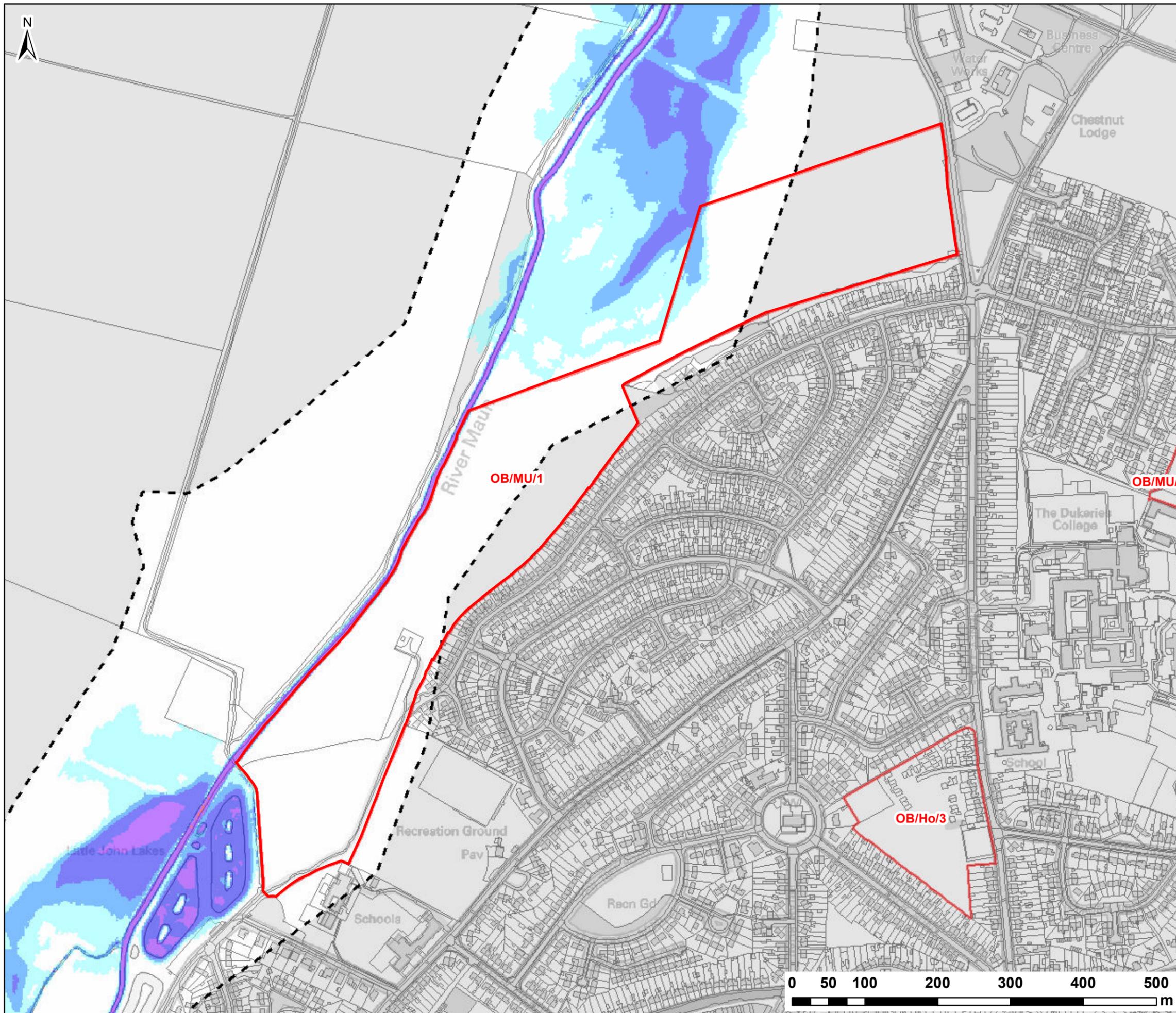
waterco
consultants

SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD DEPTH
1% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)		REV: A
PLOT NAME: w3227-Q100_EXG_D		

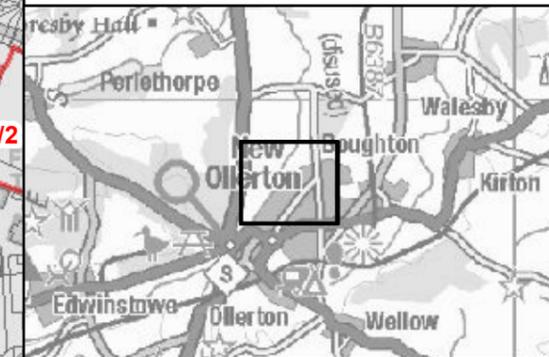




NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 2D Model Boundary

- Maximum Flood Depth (m)**
- 0 - 0.3
 - 0.3 - 0.6
 - 0.6 - 1.2
 - 1.2 - 2.4
 - > 2.4



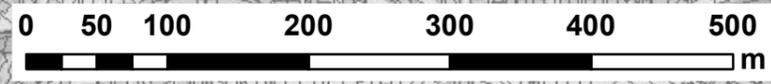
CLIENT: **NEWARK & SHERWOOD DISTRICT COUNCIL**

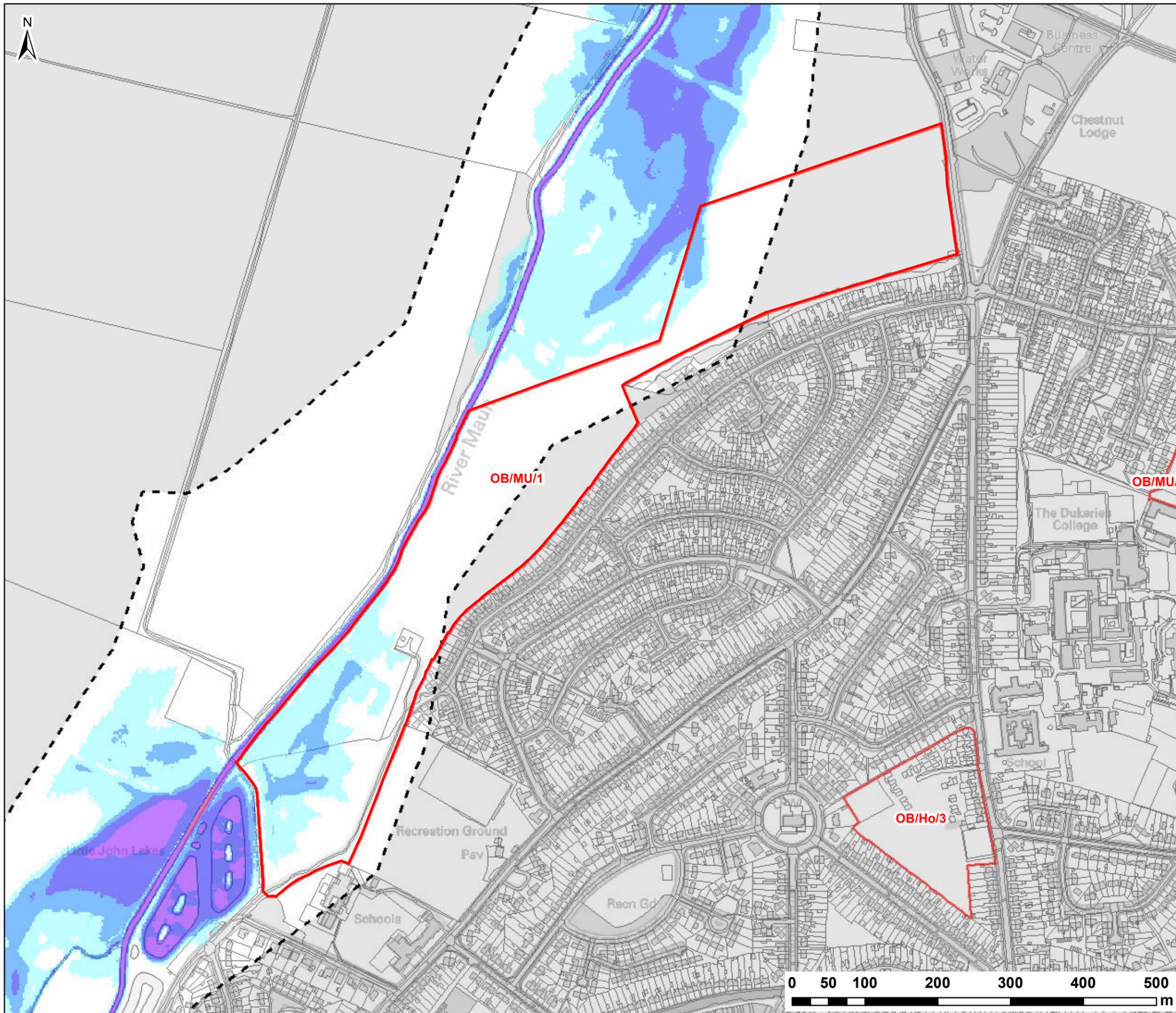
waterco consultants

SCHEME:
NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

PLOT TITLE:
**MAXIMUM FLOOD DEPTH
1% AEP + CC (+30%) FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
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PLOT NAME: w3227-Q100CC1_EXG_D		





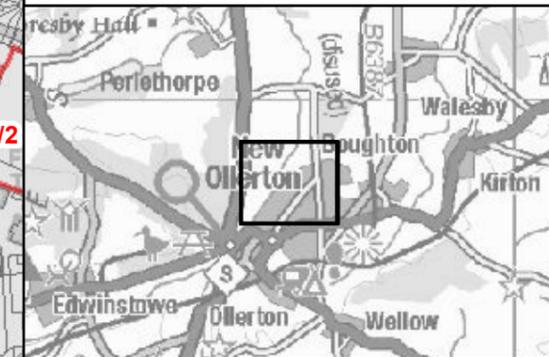
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:



NEWARK & SHERWOOD
DISTRICT COUNCIL

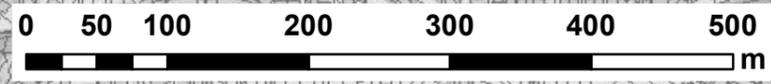


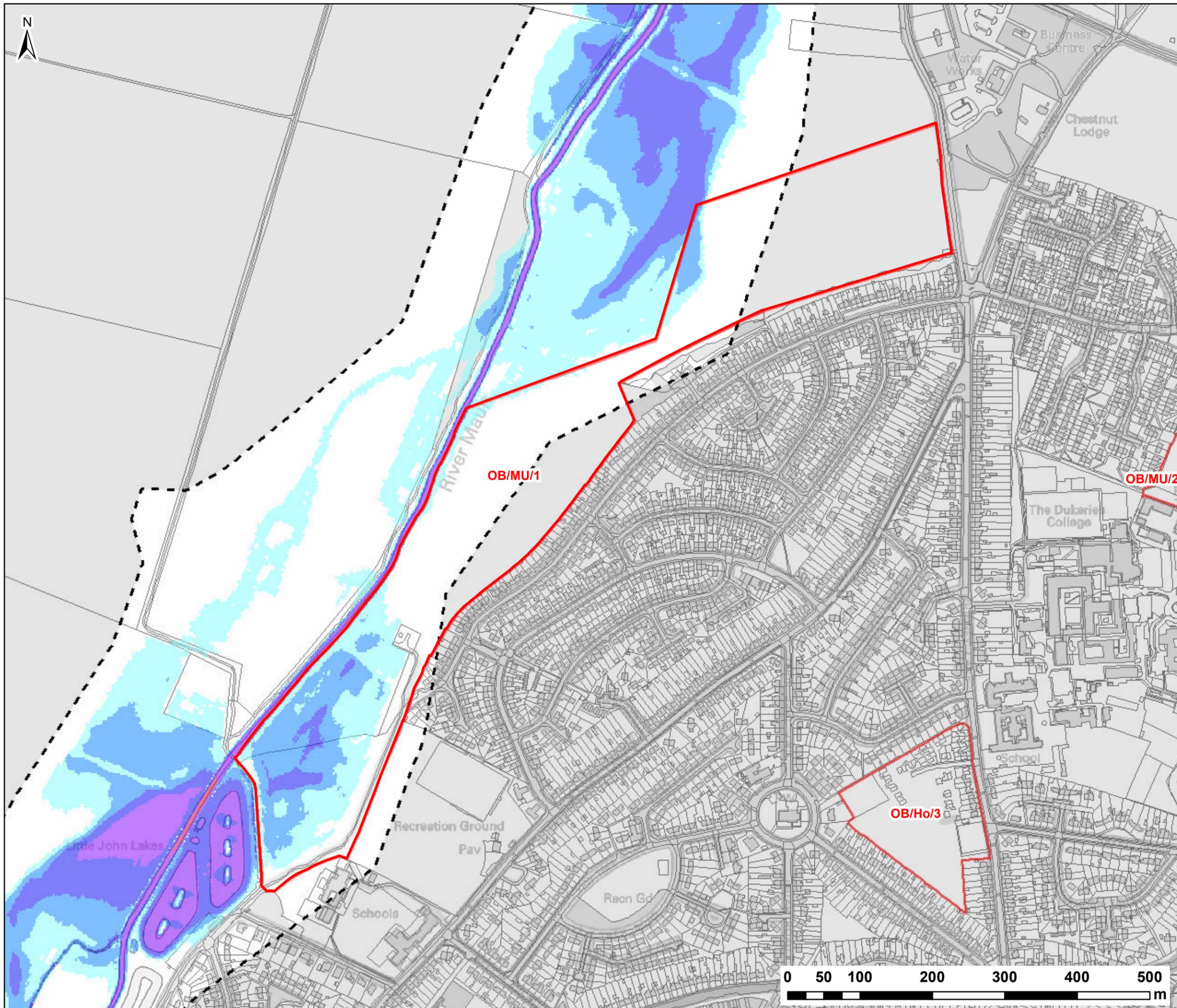
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consultants

SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD DEPTH
1% AEP + CC (+50%) FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)		REV: A
PLOT NAME: w3227-Q100CC2_EXG_D		



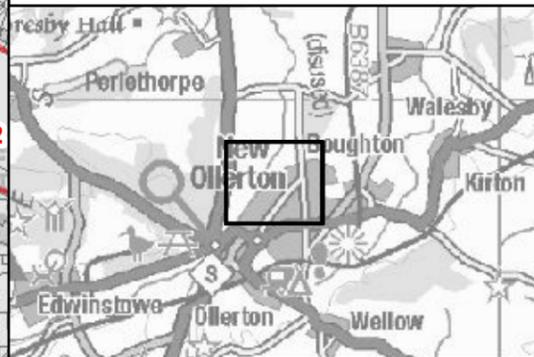


NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 2D Model Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT: **NEWARK & SHERWOOD DISTRICT COUNCIL**

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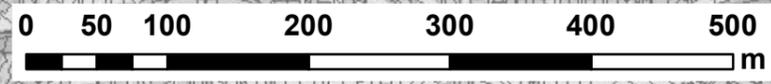
SCHEME:
NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

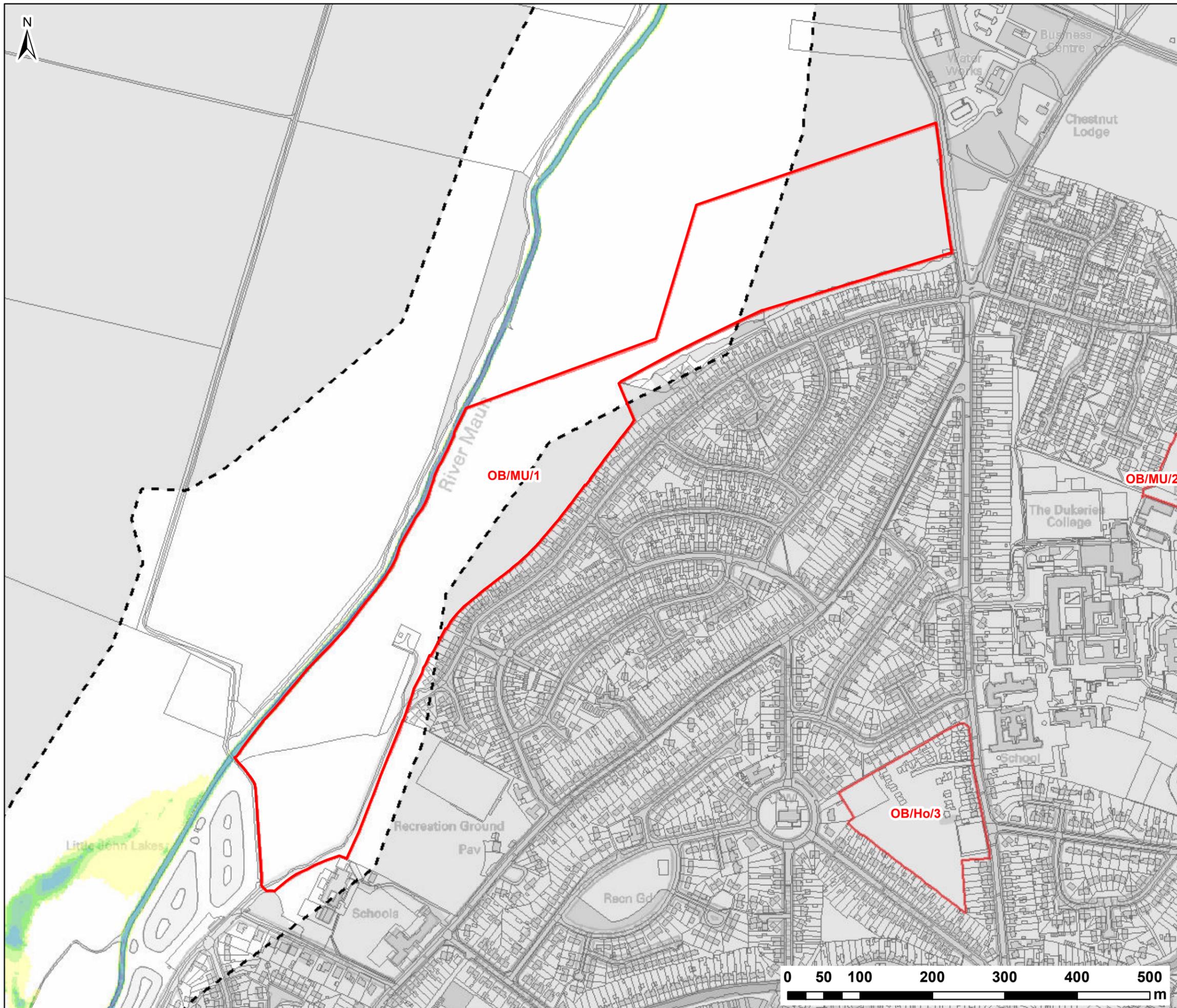
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MAXIMUM FLOOD DEPTH 0.1% AEP FLUVIAL (7.5HR DUR) EXISTING SITE LEVELS

PLOT STATUS: **FINAL** DATE: 06/10/2016

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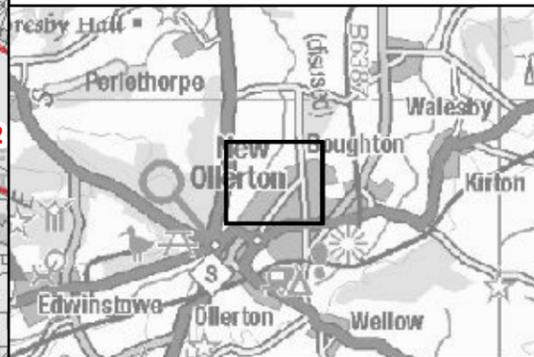
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Velocity (m/s)

- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.45
- 0.45 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:



NEWARK & SHERWOOD
DISTRICT COUNCIL



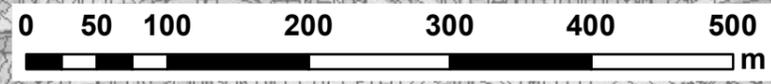

SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

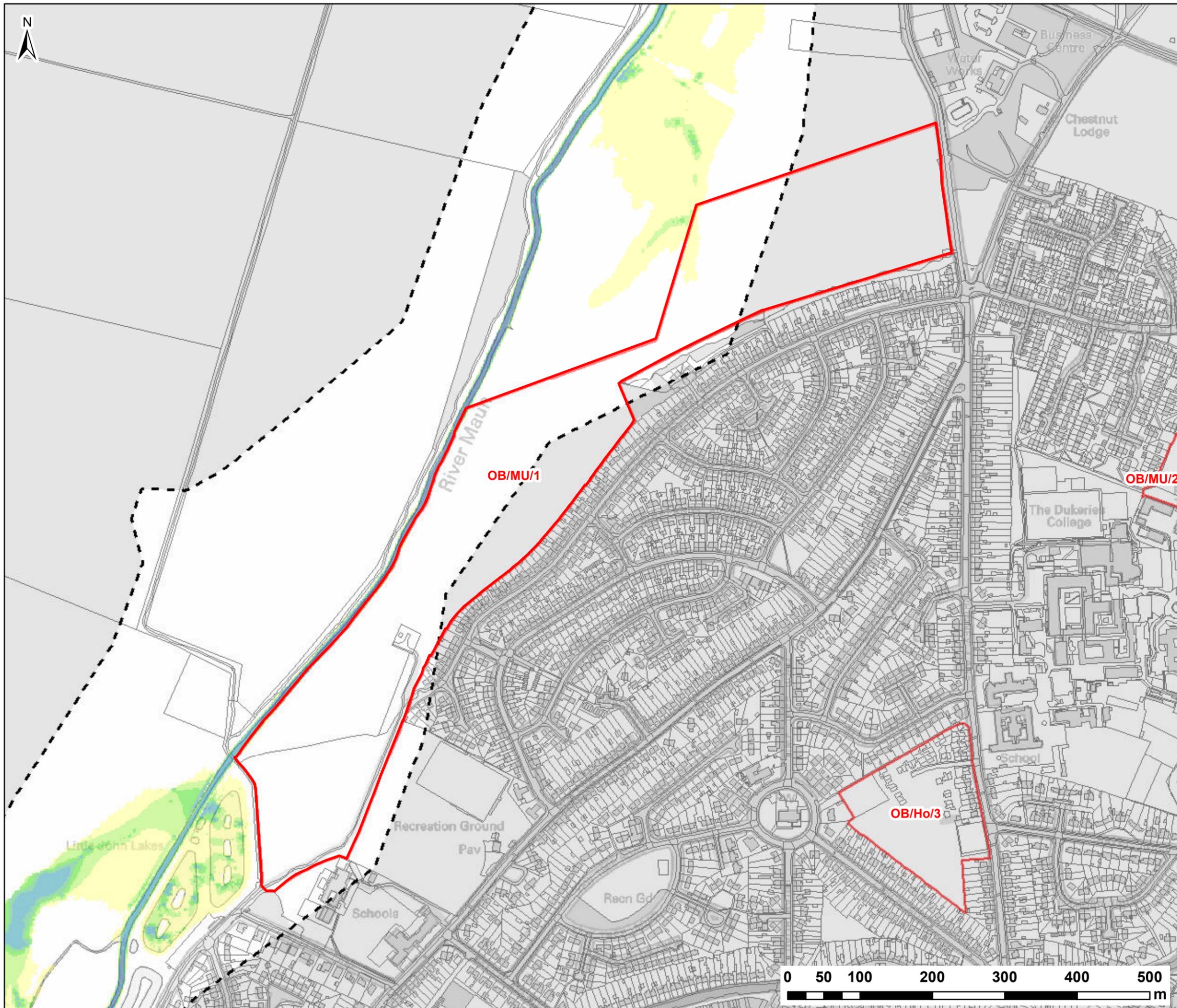
PLOT TITLE:
**MAXIMUM VELOCITY
4% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: **FINAL** DATE: 06/10/2016

DRAWN: DH	CHECKED: RCL	APPROVED: RAF	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
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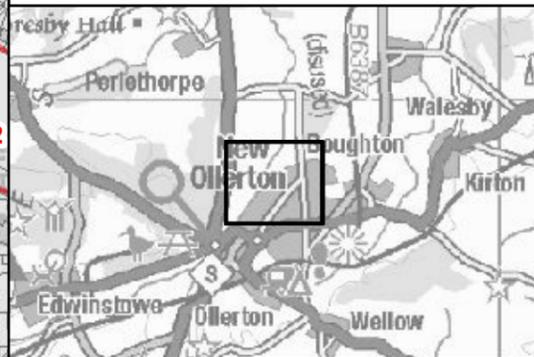


NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 2D Model Boundary

Maximum Velocity (m/s)

- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.45
- 0.45 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:



NEWARK & SHERWOOD
DISTRICT COUNCIL

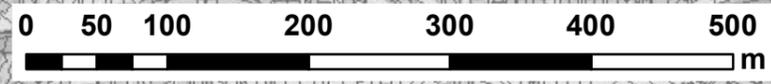


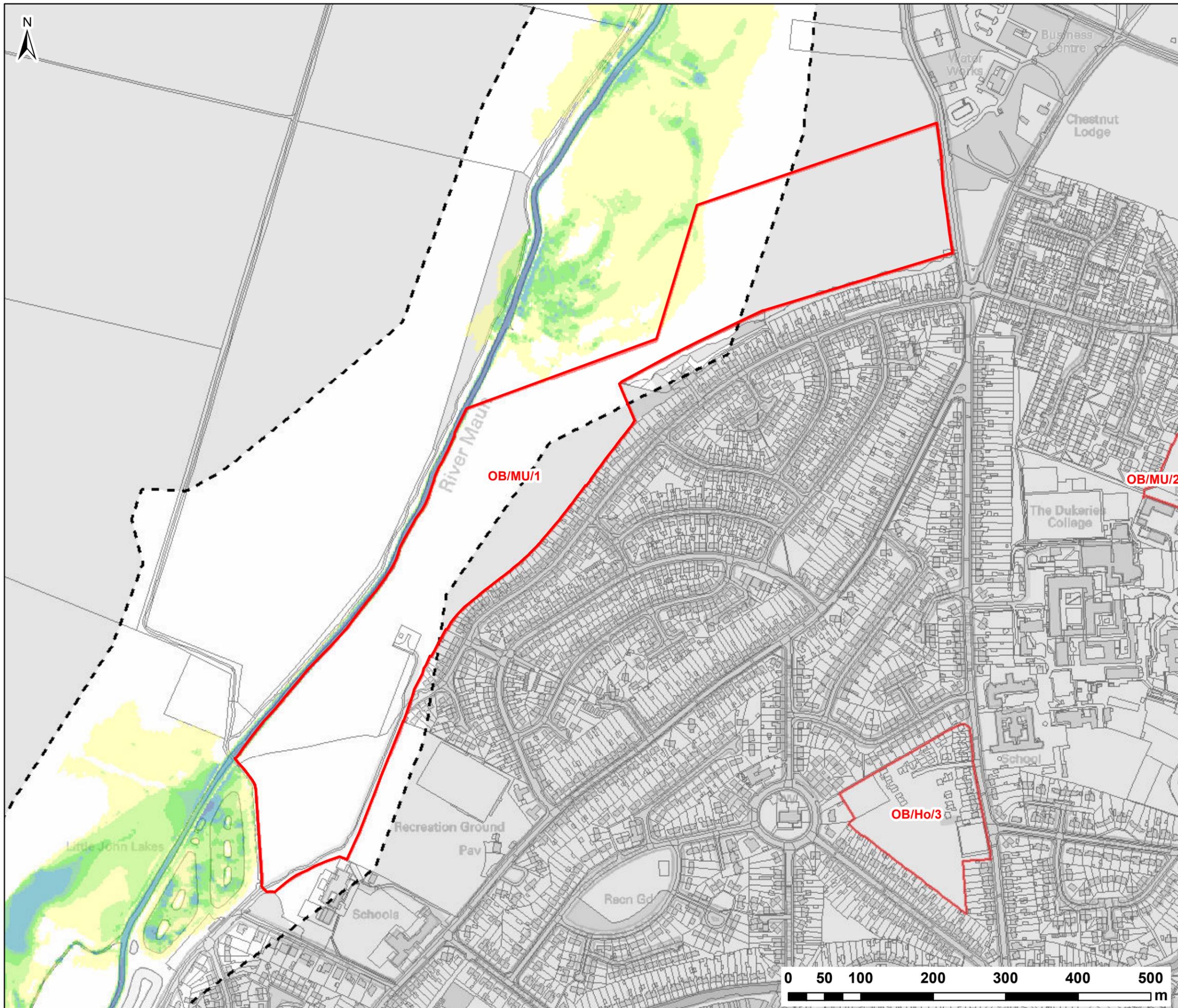
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SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM VELOCITY
1% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
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PLOT NAME: w3227-Q100_EXG_V		



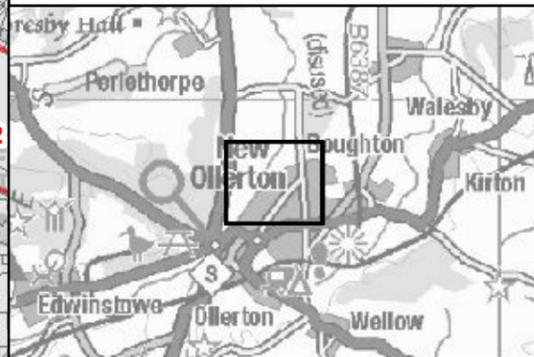


NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 2D Model Boundary

Maximum Velocity (m/s)

- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.45
- 0.45 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT: **NEWARK & SHERWOOD DISTRICT COUNCIL**

waterco consultants

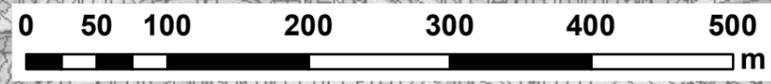
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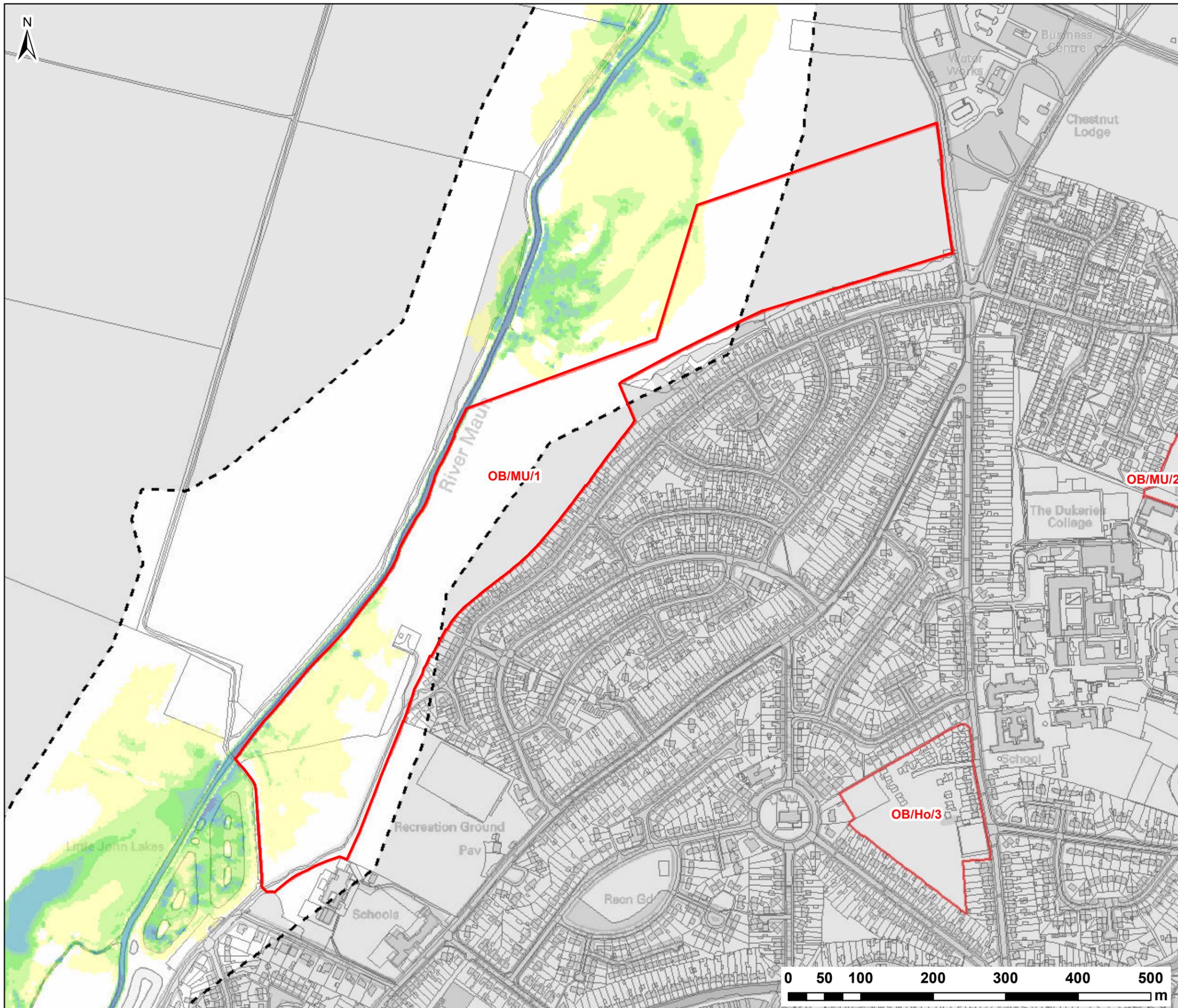
PLOT TITLE: **MAXIMUM VELOCITY
1% AEP + CC (+30%) FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: **FINAL** DATE: 06/10/2016

DRAWN: DH	CHECKED: RCL	APPROVED: RAF	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
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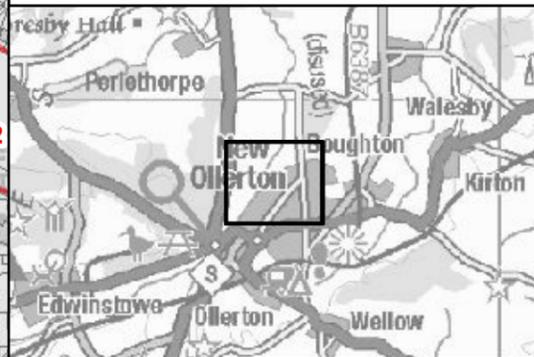
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Velocity (m/s)

- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.45
- 0.45 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT: **NEWARK & SHERWOOD DISTRICT COUNCIL**

waterco consultants

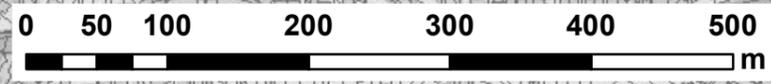
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NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

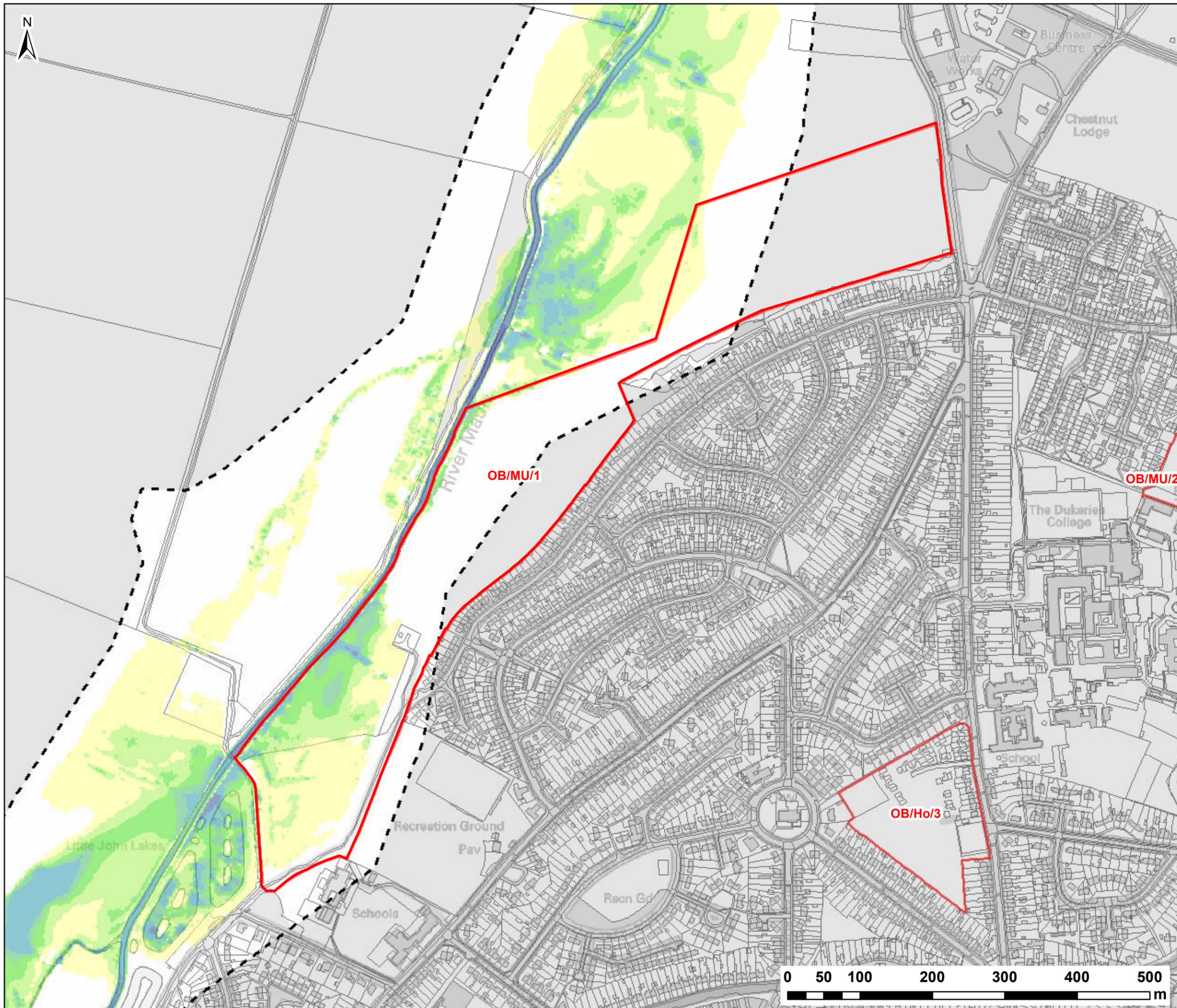
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**MAXIMUM VELOCITY
1% AEP + CC (+50%) FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: **FINAL** DATE: 06/10/2016

DRAWN: DH	CHECKED: RCL	APPROVED: RAF	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
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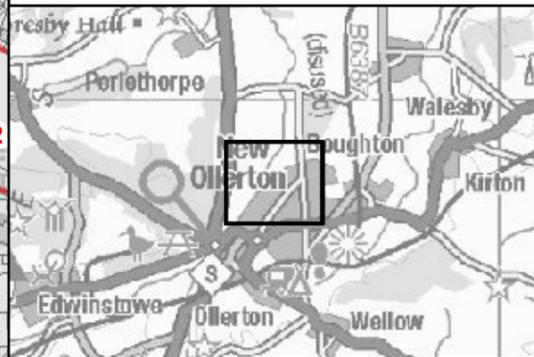


NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

- LEGEND**
- OB/MU/1 Site Boundary
 - NSDC IDP Sites
 - 2D Model Boundary

Maximum Velocity (m/s)

- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.45
- 0.45 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT: **NEWARK & SHERWOOD DISTRICT COUNCIL**

waterco consultants

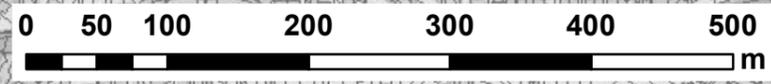
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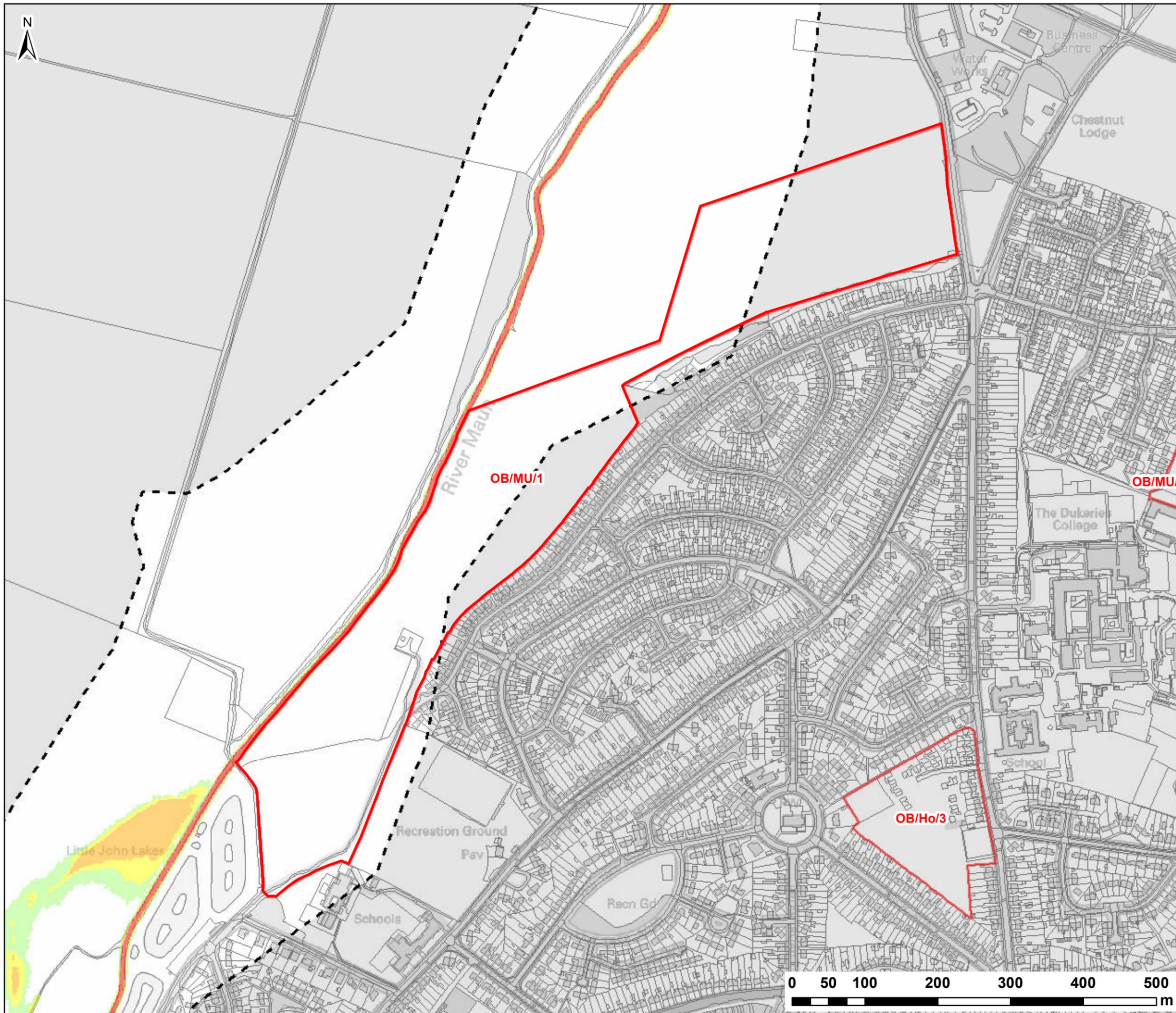
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0.1% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: **FINAL** DATE: 06/10/2016

DRAWN: DH	CHECKED: RCL	APPROVED: RAF	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
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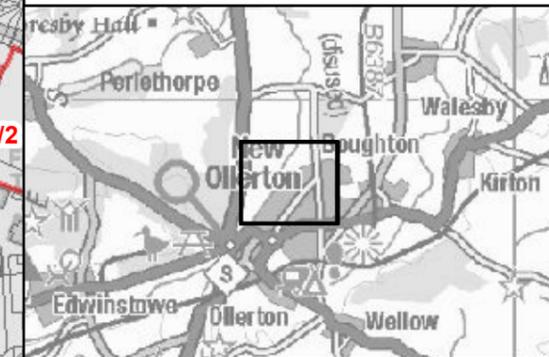
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)



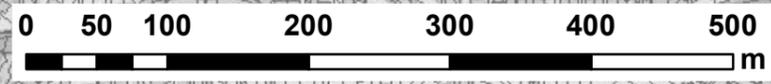
CLIENT: **NEWARK & SHERWOOD DISTRICT COUNCIL**

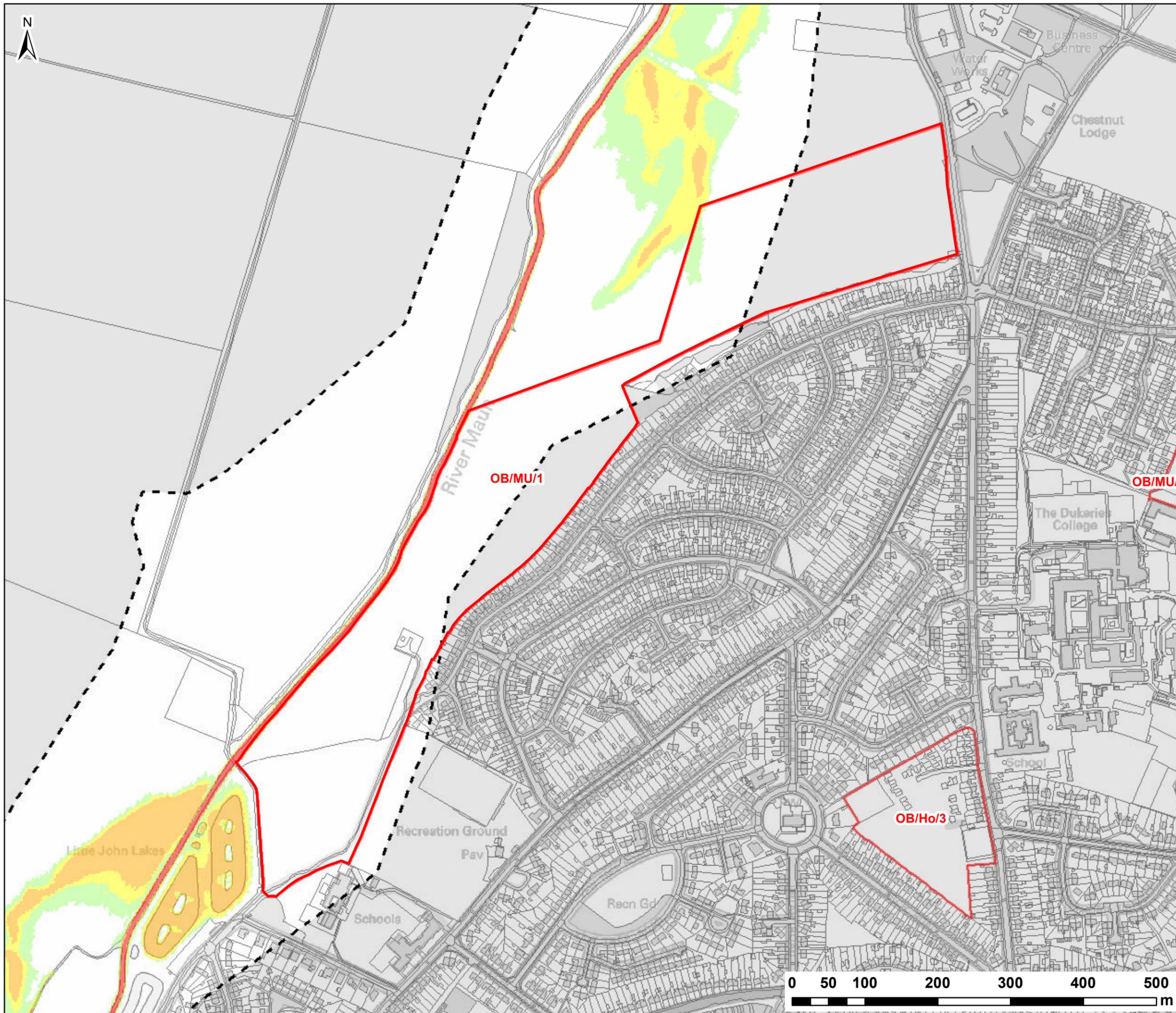
waterco consultants

SCHEME:
NEWARK & SHERWOOD SFRA RIVER MAUN HYDRAULIC MODEL

PLOT TITLE:
**MAXIMUM FLOOD HAZARD
4% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016	
DRAWN: DH	CHECKED: RCL	APPROVED: RAF	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
PLOT NAME: w3227-Q25_EXG_H			REV: A





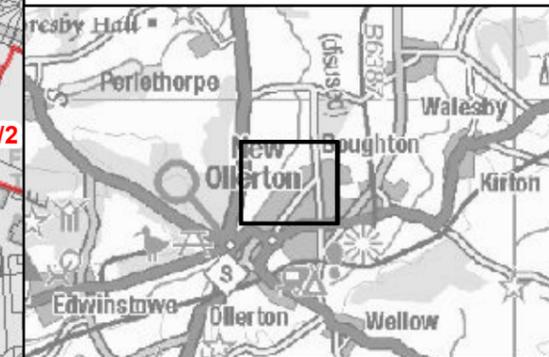
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)



CLIENT:



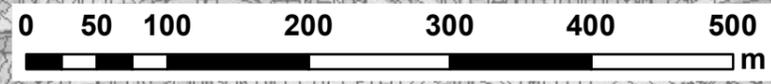
NEWARK & SHERWOOD
DISTRICT COUNCIL

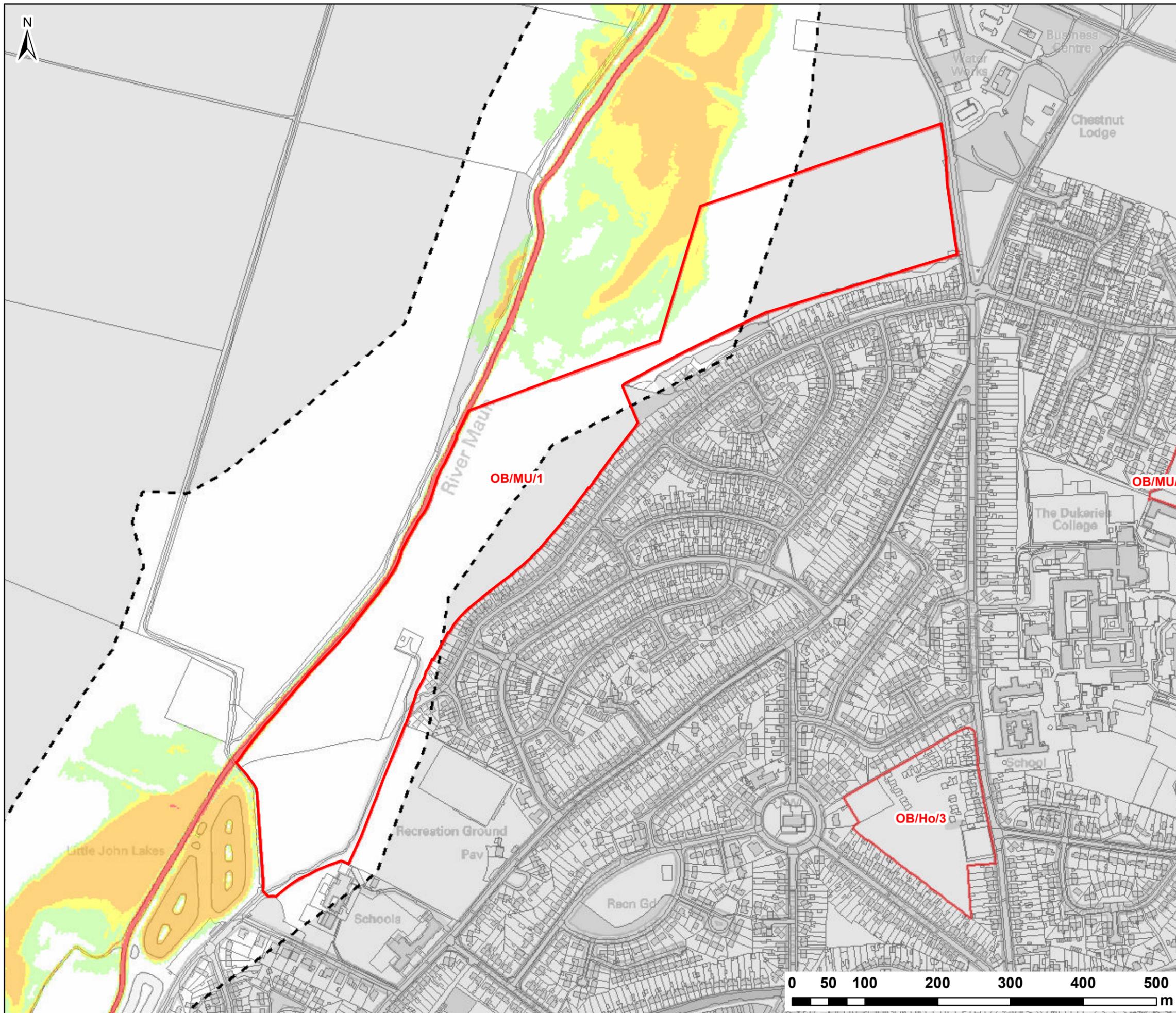



SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD HAZARD
1% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
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PLOT NAME: w3227-Q100_EXG_H		





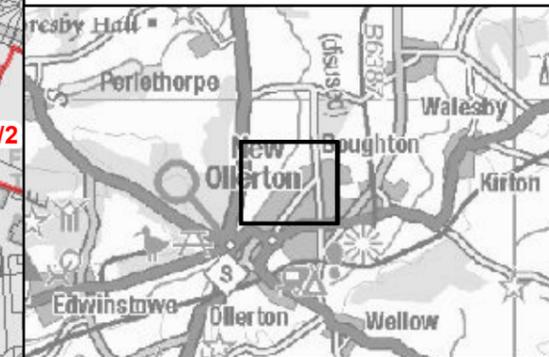
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)



CLIENT:



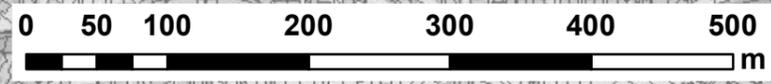
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DISTRICT COUNCIL

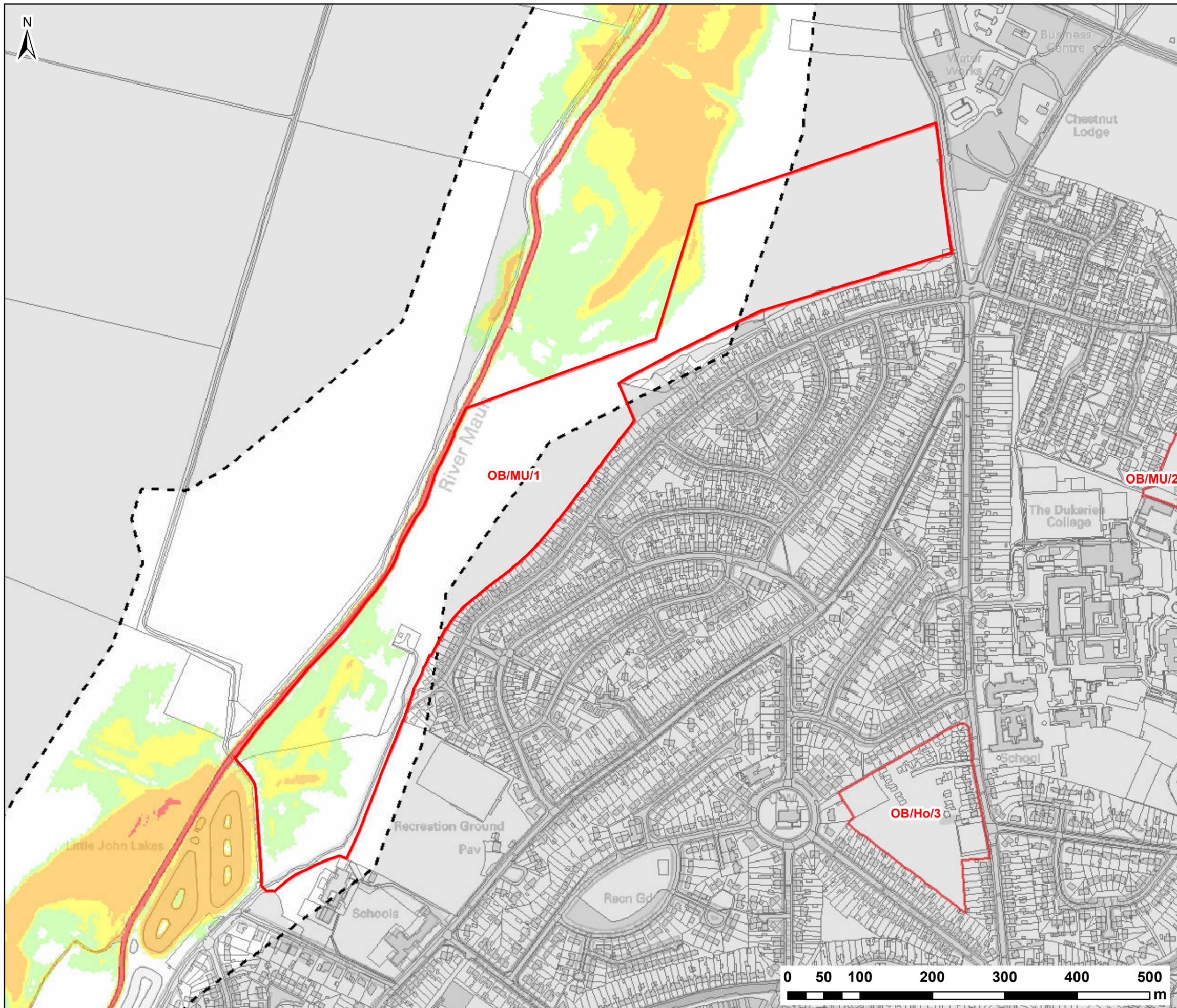



SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD HAZARD
1% AEP + CC (+30%) FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)		REV: A
PLOT NAME: w3227-Q100CC1_EXG_H		





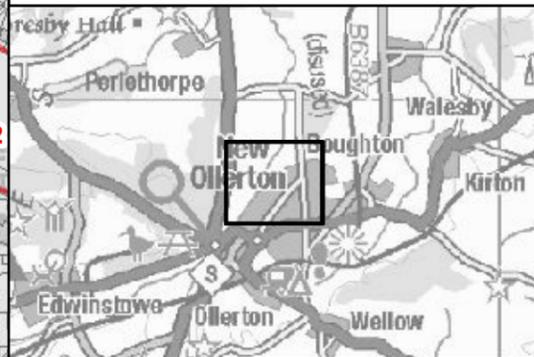
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)



CLIENT:



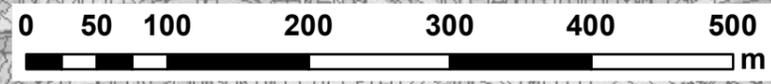
NEWARK & SHERWOOD
DISTRICT COUNCIL

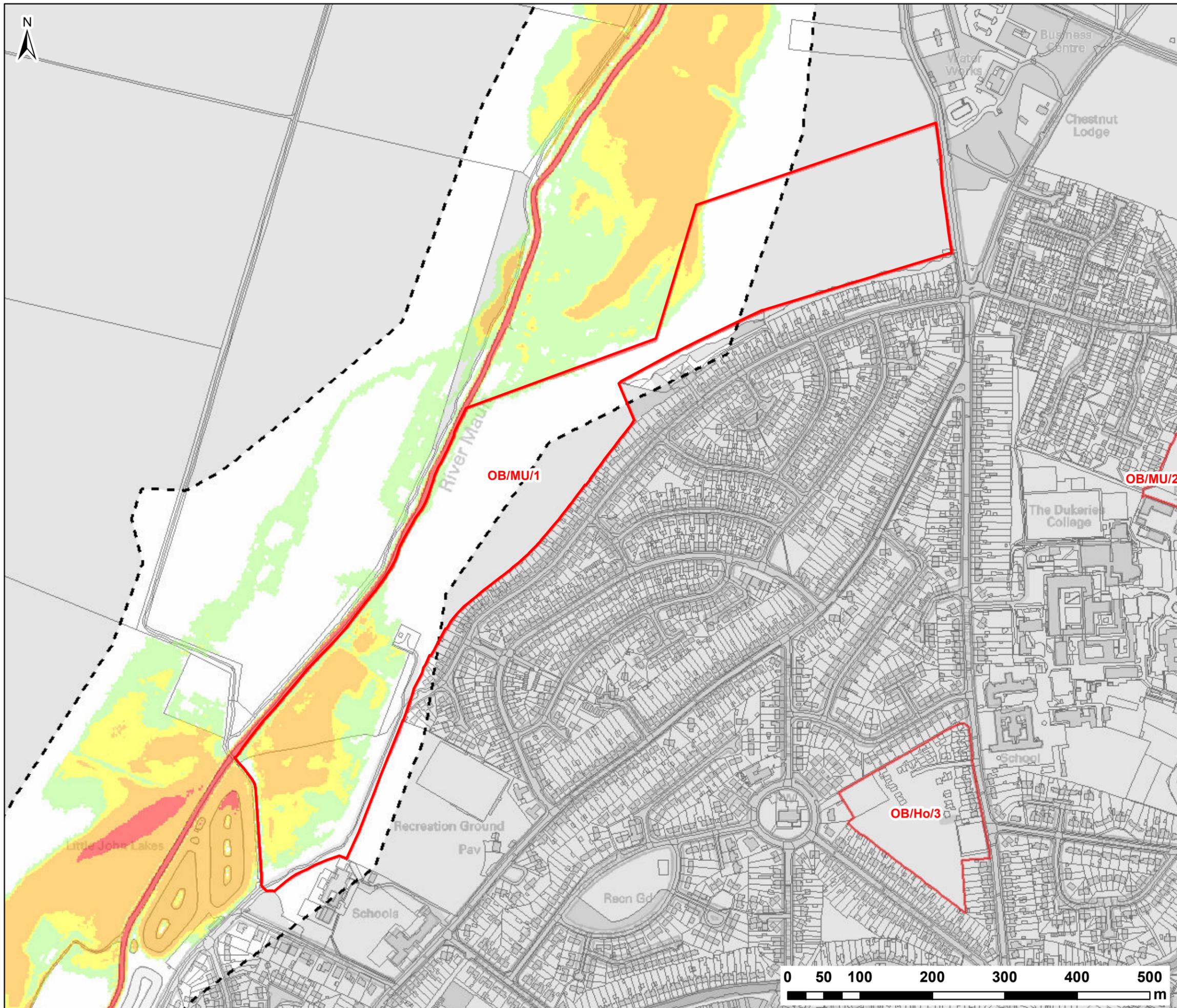



SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD HAZARD
1% AEP + CC (+50%) FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)		REV: A
PLOT NAME: w3227-Q100CC2_EXG_H		





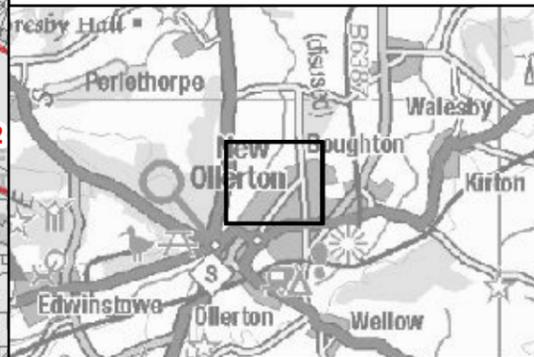
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- OB/MU/1 Site Boundary
- NSDC IDP Sites
- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)



CLIENT:



NEWARK & SHERWOOD
DISTRICT COUNCIL



waterco
consultants

SCHEME:
**NEWARK & SHERWOOD SFRA
RIVER MAUN HYDRAULIC MODEL**

PLOT TITLE:
**MAXIMUM FLOOD HAZARD
0.1% AEP FLUVIAL (7.5HR DUR)
EXISTING SITE LEVELS**

PLOT STATUS: FINAL		DATE: 06/10/2016
DRAWN: DH	CHECKED: RCL	APPROVED: RAF
PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)		REV: A
PLOT NAME: w3227-Q1000_EXG_H		