813-913 Wallgrove Road, Horsley Park Regional Hydraulic Modelling and Impact Report

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813-913 Wallgrove Road, Horsley Park Regional Hydraulic Modelling and Impact Report

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Synopsis: **Report detailing the methodology and finding of hydraulic modelling of proposed development of 813-819 Wallgrove Road, Horsley Park, New South Wales**

REVISION/CHECKING HISTORY

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1	24/10/2013	DR		JGL	
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DISTRIBUTION

Destination	Revision										
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1 Introduction

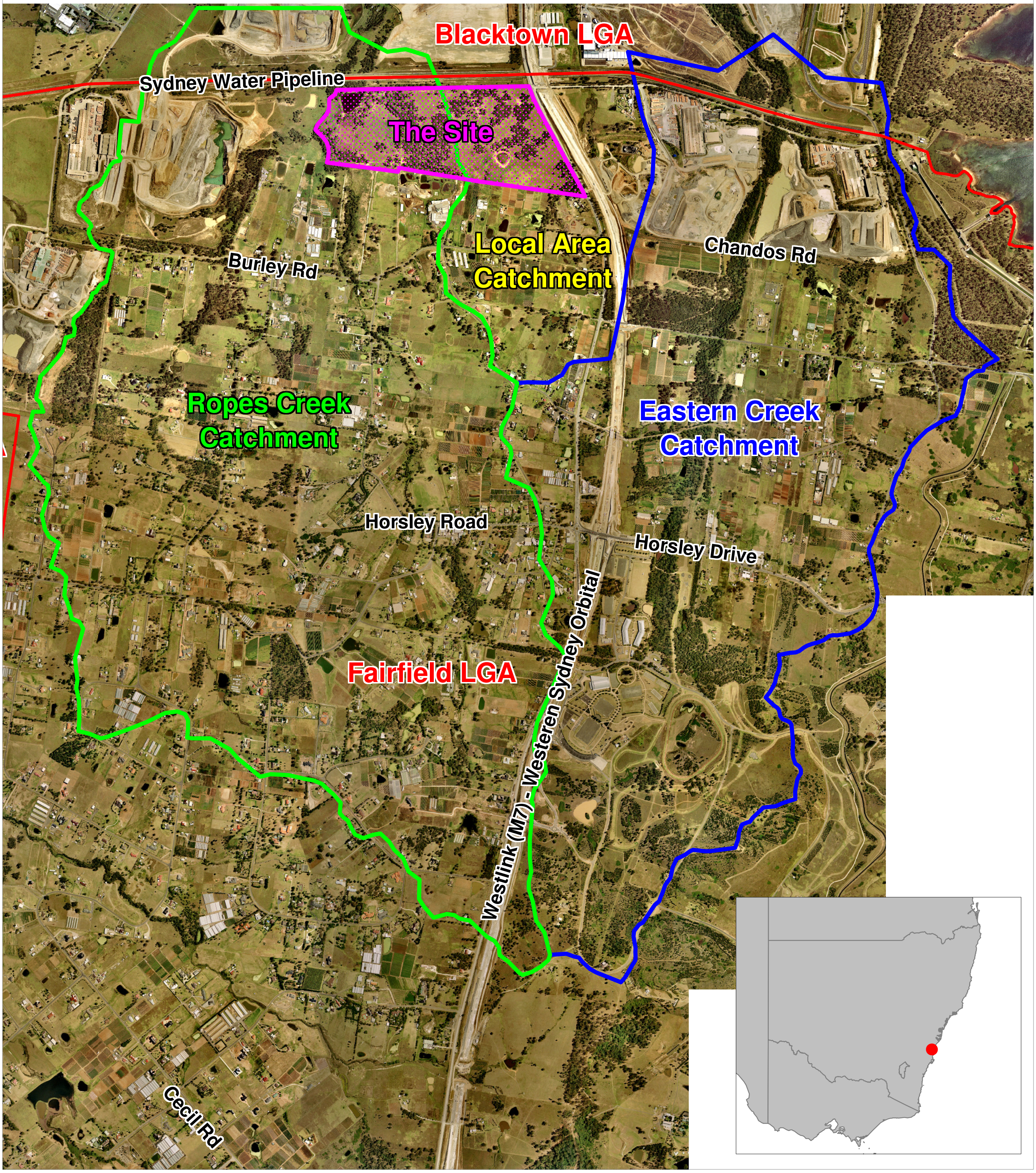
Gazcorp Pty Ltd is seeking approval for an industrial park development in Horsley Park, a suburb approximately 38 km east of the Sydney CBD. The location of the proposed development is 813-913 Wallgrove Road, Horsley Park (the site). The site is bounded to the east by Wallgrove Road, neighbouring properties to the south, Sydney Water's supply pipeline to the north, and Reedy Creek to the west as shown in Figure 1-1. The site straddles a ridge between the Reedy Creek floodplain and a local depression between the Reedy Creek catchment and nearby Eastern Creek catchment. BMT WBM previously prepared flood studies for both the Reedy Creek and Eastern Creek catchments on behalf of Fairfield City Council (BMT WBM, 2013).

The current study involved extending the Reedy Creek catchment flood model to include the neighbouring local catchment covering the eastern portion of the site. The proposed development will drain either to the north under the Sydney Water pipeline or to the east under the West Sydney Orbital (Westlink M7). In order to demonstrate that the development does not adversely impact flood levels on the surrounding properties, BMT WBM has adopted and updated the modelling used in BMT WBM (2013) as follows:

- Extend the regional Reedy Creek catchment two-dimensional (2D) TUFLOW flood model of the existing floodplain for the to provide improved representation of local inflow boundaries to the east in the vicinity of the proposed infill development;
- Updated the developed case model of the proposed development fill platform;
- Assess the impacts of the proposed development upstream and downstream of the development site for the 2000, 500, 100, 50 and 20 year ARI events as well as the Probable Maximum Precipitation (PMP) flood event; and
- Assess the impacts of the proposed development on flood levels upstream and downstream of the development site for the 2000, 500, 100, 50 and 20 year ARI events under a series of climate change scenarios.

This report presents the final modelling results using the latest design, including the infill development.

Although this report is intended to provide sufficient detail on the methodologies of the modelling, this report contains only a summary of the Reedy Creek model development. For further details on the base case model development are document in the Rural Area Flood Study Report (BMT WBM, 2013).



Title:

Fairfield Rural Area Flood Study
Locality Map

Figure: **1 - 1**

Rev: **A**

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Approx. Scale

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2 Data Sets

The study drew upon data sets provided by Council and Gazcorp. The key data sets included:

- Digital aerial photography and cadastral property boundaries provided by Fairfield City Council;
- A catchment digital terrain model (DTM) developed from LiDAR and field survey by Fairfield City Council;
- Detailed feature survey of the existing topography collected by A Allen Consulting Surveyors (2008); and
- A DTM of proposed development site fill supplied by Calibre Consulting (Calibre Consulting, 2014).

3 Hydraulic Model Selection

Fairfield City Council (FCC) commissioned BMT WBM Pty Ltd (BMT WBM) to undertake a flood study of three distinct yet adjoining catchments (Reedy Creek, Ropes Creek and Eastern Creek) as part of the Rural Area Flood Study. The study was undertaken in a manner consistent with the requirements of the NSW Flood Prone Land Policy and the process described in the NSW Government's Floodplain Development Manual (NSW Government, 2005). The findings and models created for these flood study was completed and provided to Council in 2013.

The flood impact assessment of the site has been carried out with an extended version of the Reedy Creek model developed as part of the aforementioned flood study commissioned by FCC.

4 Model Development – Existing Case

This section summarises the development of the Reedy Creek 2D TUFLOW hydraulic model. For further details refer to the final report issued to FCC as part of the Rural Area Flood Study (BMT WBM, 2013).

4.1 Hydrology Inputs

The modelling approach adopted for this study was to apply the rainfall directly to the hydraulic model. Consequently, there is no hydrologic model to provide inflow boundaries for the hydraulic model. With the direct rainfall modelling approach, all the rainfall losses were processed by TUFLOW prior to application of the boundaries to the hydraulic model, and routing was undertaken by the hydraulic model.

Direct rainfall modelling was adopted for the Rural Area Flood study as it would provide detailed flood modelling and flood behaviour mapping for not only the main creeks within the catchment, but also all the tributaries within the study area, including those located in the vicinity of the Site.

Rainfall inputs were determined for the 20, 50, 100, 500 and 2000 year Average Recurrence Interval (ARI) flood events and the Probable Maximum Precipitation (PMP) flood event as modelled for the Rural Area Flood Study (BMT WBM, 2013). Full details of the derivation of the rainfall inputs are provided in BMT WBM (2013).

Three increased rainfall intensity scenarios due to potential future climate change were investigated as part of this study. For the purposes of this study increases of 10, 20 and 30% above the existing levels were undertaken.

4.2 Hydraulic Model Layout and Coverage

A base case hydraulic model of the existing site and surrounds was developed to establish the existing flood behaviour of the study area. The TUFLOW model boundary was extended sufficiently of the site to ensure that the complex distributions of flow in the floodplain upstream of the development were reliably modelled, and also to ensure that any flood impacts resulting from the development could be simulated within the model domain. The model was also extended downstream of the Sydney Orbital tollway to assess impacts of the proposed development on downstream flooding.

The proposed development site and TUFLOW model domains are shown in Figure 4-1.

4.3 Base Case Model Development

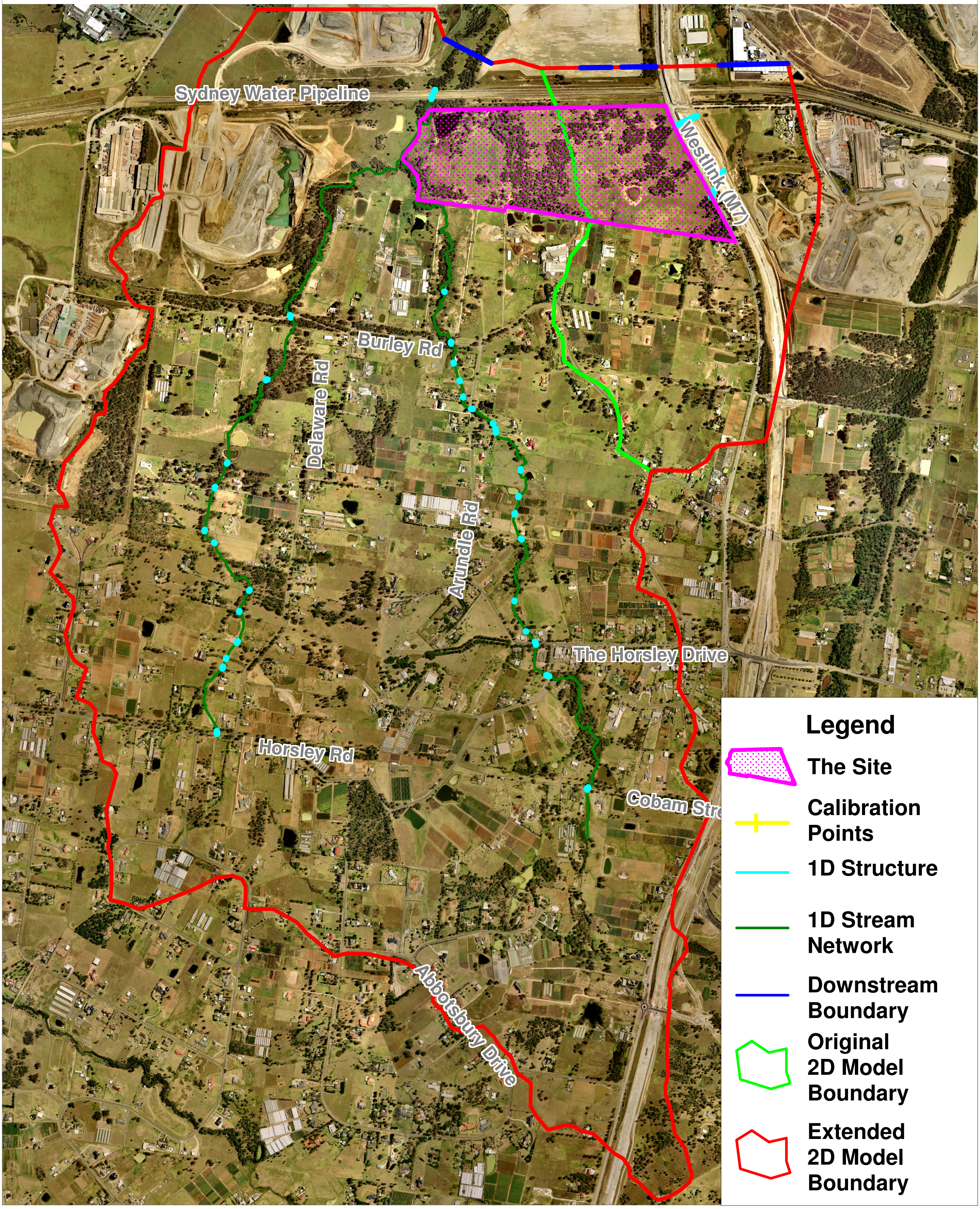
The base case TUFLOW model was developed with a 5 m grid across the study area. The broader floodplain geometry was defined within the model by extracting ground surface elevations from a DTM provided by FCC at each TUFLOW grid point.

1D elements were ‘carved’ through the 2D domain to represent the geometry of open channels and culverts. This process overcomes the limitation of modelling fine detail features with a 5 m fixed grid. Channel geometry was defined by detailed cross section survey of the major creeks alignments, including top of bank survey. Structures within the floodplain mainly comprised culverts and road crossing embankments. Culvert details of were included based upon survey provided by FCC. The 1D elements were dynamically nested within the 2D domain allowing for the interchange of water between the two model domains at every time step.

The direct rainfall modelling approach does not require individual inflow boundaries to be applied at discreet locations throughout the hydraulic model. Rather, a rainfall hyetograph is applied across the entire model domain. The direct rainfall modelling approach allows for different initial loss and continuing loss values to be applied to each different land use type within the hydraulic model. The adopted initial loss and continuing loss values were adjusted as part of the comparison process to ensure that the direct rainfall model was able to replicate the performance of the traditional modelling approach (refer to BMT WBM (2013) for details).

Stage-discharge boundaries (or rating curves) were used as the downstream boundaries for the TUFLOW model. TUFLOW automatically generated the stage-discharge relationship based upon a user defined slope. This calculation is based upon a Manning's flow calculation which uses the underlying model roughness in conjunction with the elevations of the hydraulic model at the location of the downstream boundary to determine the stage-discharge relationship for the defined slope at the boundary location. The adopted slopes were consistent with the ground slopes at the downstream extent of the model.

Boundary condition locations and types are shown in Figure 4-1.



Title:

Base Case Hydraulic Model
Domain Extension and Significant Hydraulic Features

Figure: 4-1

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4.4 Manning’s Roughness Values

The Manning’s roughness values are defined for each land use within the hydraulic model. Due to the nature of a direct rainfall model it is important to vary the Manning’s roughness with water depth. Typically in a rural environment the initial roughness is higher for shallow floodwaters and decreases as the depth increases. For instance, low flood depths through grass are rough, however once flood depths are at a greater height than the grass the roughness drops until the grass is pushed over by the flood waters and the roughness drops even further. The adopted parameters based on the results of the model calibration (BMT WBM, 2013) are listed in Table 4-1.

Table 4-1 Adopted Manning’s ‘n’ Coefficients and Hydrological Loss Values

Land use	Lower Depth (m)	Lower ‘n’	Upper Depth (m)	Upper ‘n’	Initial Loss (mm)	Continuing Loss (mm/hr)
Agriculture	0.1	0.300	0.2	0.050	11.5	2.5
Forest / High Density Veg	0.1	0.300	0.2	0.160	11.5	2.5
Forest and Grassland / Medium Veg	0.1	0.300	0.2	0.110	11.5	2.5
Grassland / No Veg	0.1	0.300	0.2	0.050	10.0	2.0
Grazing / Low Veg	0.1	0.300	0.2	0.035	11.5	2.5
Transport	0.1	0.030	0.2	0.025	2.0	0.5
Commercial	0.1	0.075	0.2	0.250	2.0	0.5
Natural Waterway / Lake	0.1	0.025	0.2	0.045	12.0	2.5
Quarry	0.1	0.030	0.2	0.050	5.0	2.5
Waterway – No/Low Veg	0.1	0.300	0.2	0.045	11.5	2.5
Waterway – Med. Veg	0.1	0.300	0.2	0.055	11.5	2.5
Waterway – High Veg	0.1	0.300	0.2	0.080	11.5	2.5
Farm land including farm houses, roads and associated infrastructure (Tag Key from LEP = 1(a))	0.1	0.300	0.2	0.085	11.5	2.5
Quarry (Tag Key from LEP = 1(b))	0.1	0.030	0.2	0.050	5.0	2.5
Commercial (Tag Key from LEP = 1(v))	0.1	0.075	0.2	0.200	2.0	1.0
Pipeline easement and associated infrastructure (Tag Key from LEP = 5(a))	0.1	0.300	0.2	0.050	11.5	2.5
Sealed road and verge (Tag Key from LEP = 5(b), 5(c))	0.1	0.030	0.2	0.025	2.0	0.5
Sports ground (Tag Key from LEP = 6(a))	0.1	0.300	0.2	0.050	11.5	2.5

Land use	Lower Depth (m)	Lower 'n'	Upper Depth (m)	Upper 'n'	Initial Loss (mm)	Continuing Loss (mm/hr)
Farm land including farm houses, roads and associated infrastructure (Tag Key from LEP = 6(d))	0.1	0.300	0.2	0.080	11.5	2.5
Farm land including farm houses, roads and associated infrastructure (Tag Key from LEP = SREP 31)	0.1	0.300	0.2	0.080	11.5	2.5

4.5 Design Event Modelling

The 20, 50 and 100 year ARI design storm events were modelled in TUFLOW for a number of storm durations: 2 hour, 3 hour, 6 hour, 9 hour, 12 hour and 18 hour. The 500 and 2000 year ARI design storm events modelled for the 2 hour, 3 hour, 6 hour and 9 hour durations. The critical storm duration varied across the catchment and hence a variety of storm durations were modelled to ensure the maximum flood heights across the entire catchment are captured. Generally, the 9 hour storm duration was critical across the majority of the Reedy Creek catchment.

A peak flood height envelope was developed from the durations modelled and the peak envelope of flood levels mapped.

4.6 Climate Change Sensitivity

To assess the catchment under future climate conditions, three potential climate change scenarios were investigated. These scenarios were increases in the rainfall intensity of 10, 20 and 30% above those determined for the design event modelling. As there was not a separate hydrologic model, the rainfall depths applied to the hydraulic model were factored. No change to the existing temporal patterns, rainfall loss rates or the infiltration rates were made for these climate change scenarios.

The PMP was not run under increased rainfall intensity scenarios as it already represents the probable maximum precipitation. Whilst the moisture carrying ability may increase there is no guidance on what this increase may be under such a rare event.

4.7 Hydraulic Structures

The collected survey information was used to include various structures (bridges and culverts) in the hydraulic model.

Bridges and culverts were always modelled as 1D elements, and where a roadway was present over the structure, a weir was used representing the flow over the road. The weir was represented using either the available survey information or road levels derived from the DEM. Where bridge railings (either as guard rails or pedestrian hand rails) were present, they included in the representation of the structure within the 1D model. These railing were modelled as a 50%

blockage to the flow (based upon the available survey information for a number of the structures throughout the catchment).

4.8 Modifications to the Base Case from Previous Modelling

The development straddles a ridge whereby a portion of the proposed development is within the Reedy Creek catchment, whilst the remainder of the site is located within a localised catchment to the east. It was therefore necessary to extend the catchment to the east up to and including the area entire local catchment. In addition the following enhancements were incorporated into the base case model:

- Feature survey information of the site was incorporated into the base case model covering the site and the near surrounds.
- Additional outflow locations for localised catchment
- Incorporate Sydney Orbital (M7) toll road; and
- Incorporate drainage asset under Wallgrove Rd.

5 Model Development – Developed Case

The base case TUFLOW model was modified to incorporate the proposed development. The assessment of the development is focussed only on the external flood impacts and not the management of internal stormwater within the development. Internal drainage has been covered by the Stormwater Concept Plan as developed by Calibre Consulting (formally Brown Consulting, 2013).

The DTM of the proposed development provided by Calibre Consulting did not contain provisions for flow from the eastern local catchment to drain to the pipe under Wallgrove Road. To allow the flood waters to reach the culvert a nominal swale with a top width of approximately 15m was incorporated into model. The swale included in the hydraulic model is based upon cross section details provided by Brown (Calibre) Consulting and is not included as part of the provided DTM.

The rainfall was not modified, nor the materials parameters that control runoff from the site. For the assessment on flood impacts it has been assumed that onsite detention will retard onsite runoff back to existing conditions (as detailed in the Stormwater Concept Plan).

The DTM of the developed model showing the modifications as part of the development are illustrated in Figure 5-1.

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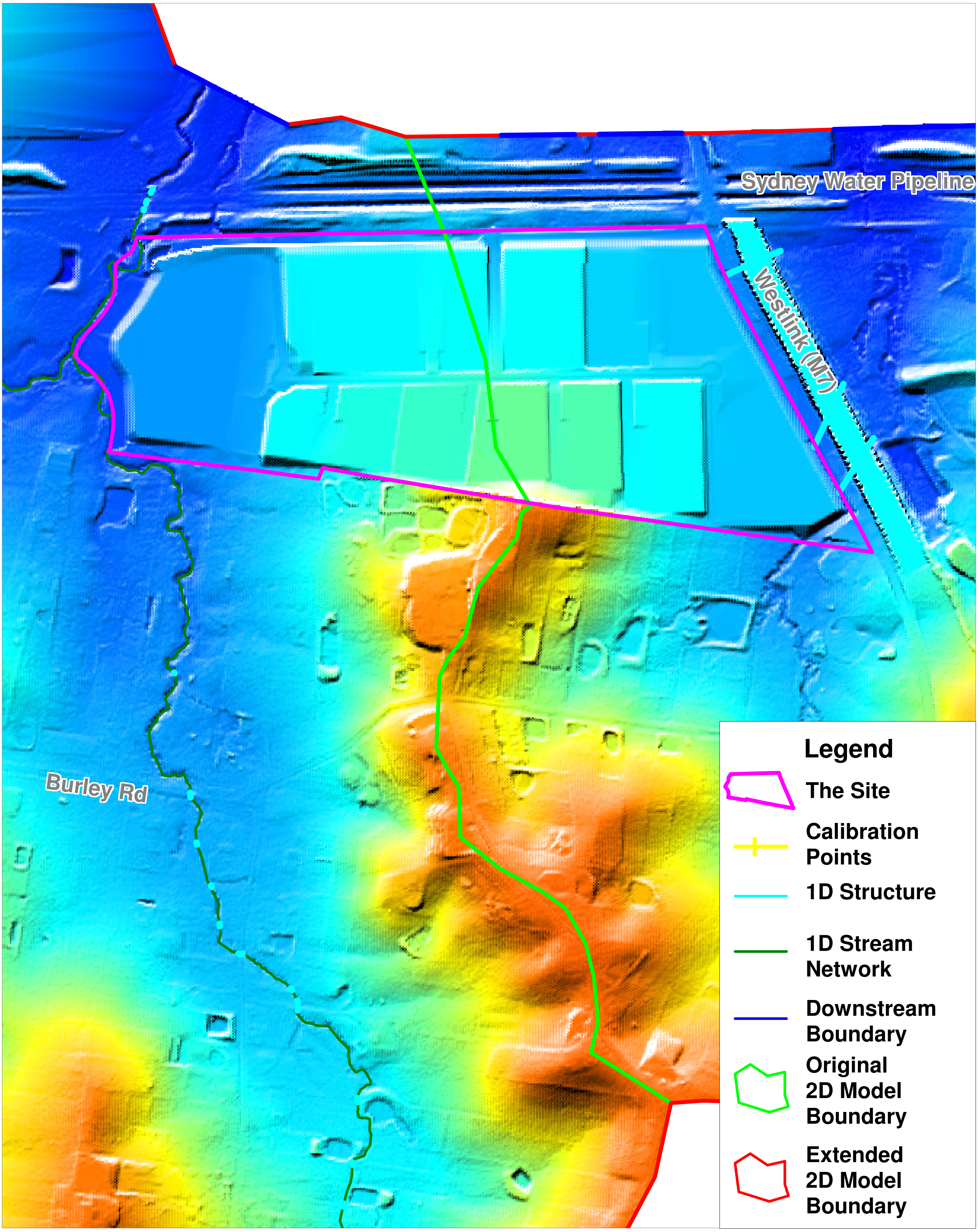

Title:

Developed Case Terrain Modification

Figure: 5-1

Rev: A

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6 Flood Mapping

TUFLOW produces a geo-referenced data set defining peak water levels throughout the model domain at the corners of its computational cells. For the peak flood level from all of the storm durations was selected for each computational cell to generate an envelope of peak flood level. This data were imported into GIS to generate a digital model of the flood surface.

6.1 Flood Depth and Extent Mapping

The TUFLOW flood model was initially used to determine the flood depths for the 100 year ARI flood events for the base case and developed case. These flood extent maps are presented in Figure 6-1 and Figure 6-2 respectively.

6.1.1 Discussion of Flood Depth Mapping

The developed case flood depth modelling (shown in Figure 6-2), shows minimal change in flooding patterns when compared to the existing condition (Figure 6-1). A slight increase in depth is noted along the leading edge of Reedy Creek due to the modifications as set out by development's proposed earthworks. The flow within conceptual swale drain along the south-eastern boundary of the site results is an increase in depth of flooding in the neighbouring property, however, there is a reduction in flood depth across Wallgrove Road.

Beyond the immediate site there is minimal, if any, change to the flood depths.

6.2 Flood Impact Mapping

Digital flood surfaces were created for the base case and developed case, and the changes in peak flood height were calculated by subtracting the base case model peak flood heights from the developed case model flood heights at each TUFLOW grid cell. The change in peak flood height for the 20, 50, 100, 500 and 2000 year ARI flood events and the PMP flood event colour contoured and mapped in Figure 6-3 through Figure 6-8.

6.2.1 Discussion of Flood Impact Mapping

The results from the flood model indicate that the proposed development will not significantly increases in flood levels external to the site. There are reductions in flood level to the west of the site along Reedy Creek as well as at the Sydney Water pipeline. However there are small areas along the western and southern boundaries of the development where there are increases in flood level of up to about 4 cm. The areas where there are increases are currently flood prone and there are no buildings within the area where the increase is shown.

On the local catchment to the east of the proposed development, there are increases in flood levels evident in the adjoining property to the east of the West Sydney Orbital (M7). The modeling of the vegetated swale in the vicinity of these impacts is based upon a cross section shape provided by Brown (Calibre) Consulting (via email, 24/06/2013). Further detailed design of this vegetated swale and the subsequent hydraulic modeling of the design may reduce the currently observed impact downstream of the West Sydney Orbital.

Downstream of the West Sydney Orbital, reductions in flood levels due to the proposed development were observed.

6.3 Flood Velocity Mapping

Digital flood velocity layers were created for the base case and developed case, and the changes in peak flood velocity were calculated by subtracting the base case model peak flood velocity from the developed case model flood velocity at each TUFLOW grid cell. The change in peak flood velocity for the 20, 50 and 100 year ARI flood events colour contoured and mapped in Figure 6-9, Figure 6-10 and Figure 6-11 respectively.

6.3.1 Discussion of Flood Velocity Mapping

The results from the flood model indicate that the proposed development will result in some higher velocities alongside the right bank of Reedy Creek and upstream of the development (at the south east corner and along the west edge of the site). In these locations, velocity increases of greater than 0.5 metres per seconds are noted, though more typically increases of less than 0.25 metres per second. Flood velocities across Wallgrove Road are also increases (although the flood depth has decreased). Such increases may require erosion control measures to be implemented depending on the nature of the underlying soil and its susceptibility to scour.

6.4 Duration of Flood Inundation

The results from the flood impact mapping generally show reductions in flood levels and in general, no significant increases in flood level. The duration of flood inundation is likely to increase in regions where the flood levels have increased and decrease to regions where the flood levels have decreased.

The flood level decreases along Wallgrove Road will result in the duration of flood inundation along Wallgrove Road decreasing as a result of the proposed development. Under existing conditions, Wallgrove Road is likely to be inundated in the vicinity of the site for approximately 9 hours, however, this will be reduced under the proposed development.

6.5 Climate Change Sensitivity Flood Impact Mapping

The flood level impact mapping for the climate change sensitivity scenarios was mapped the exact same way as the previous impact mapping; the digital flood surfaces were created for the base case and developed case, and the changes in peak flood height were calculated by subtracting the base case model peak flood heights from the developed case model flood heights at each TUFLOW grid cell.

The change in peak flood height for the 20, 50, 100, 500 and 2000 year ARI flood events colour contoured and mapped in; Figure 6-12 through Figure 6-16 for the 10% increase in rainfall intentsity; Figure 6-17 through Figure 6-21 for the 20% increase in rainfall intentsity; and Figure 6-22 through Figure 6-26 for the 30% increase in rainfall intentsity.

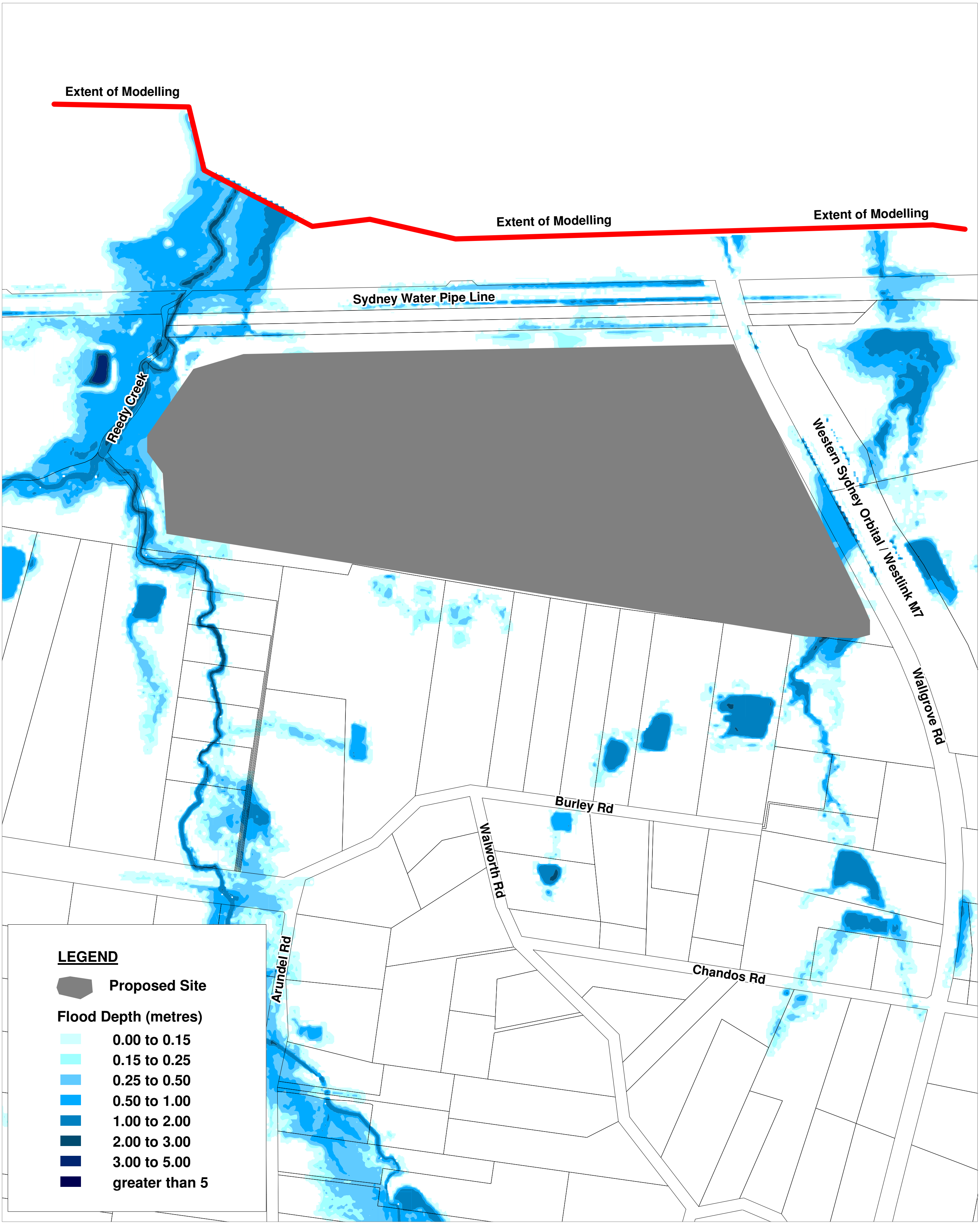
6.5.1 Discussion of Climate Change Scenarios

The results from the flood model indicate that under the three increased rainfall intensity scenarios the flood impacts resulting from the proposed development are not dissimilar to those under the existing rainfall conditions.

As the rainfall intensity increases the flood differences along Reedy Creek typically go from slight reductions (10% increase), through equal (20% increase) and, under the 30% increase scenario, slight increases. Similar behaviour is noted of the flood impacts at the south-west corner of the proposed development.

The flood height impacts on the smaller eastern corner remain elevated in all scenarios with only the extent increasing with rainfall intensity.

Under all climate change scenarios, up to and including the 2000 year ARI flood event, the development itself remains flood free and there is no risk to persons or property from flooding at the site of the proposed development.



Title:

813-913 Wallsgrove Rd, Horsley Park
Existing Case - 100 Year ARI Peak Flood Depth

Figure: 6-1

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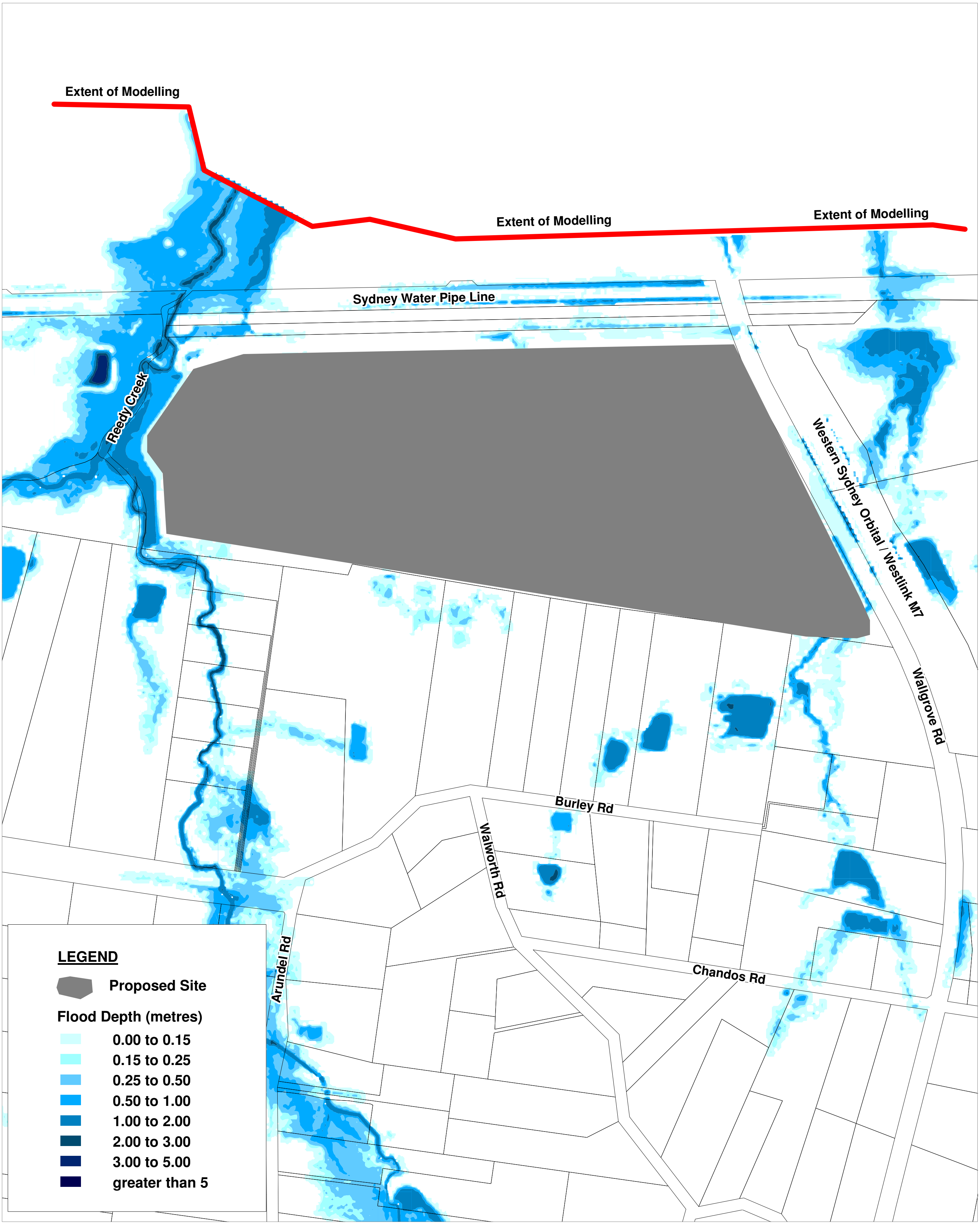

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813-913 Wallsgrove Rd, Horsley Park
Developed Case - 100 Year ARI Peak Flood Depth

Figure: 6-2

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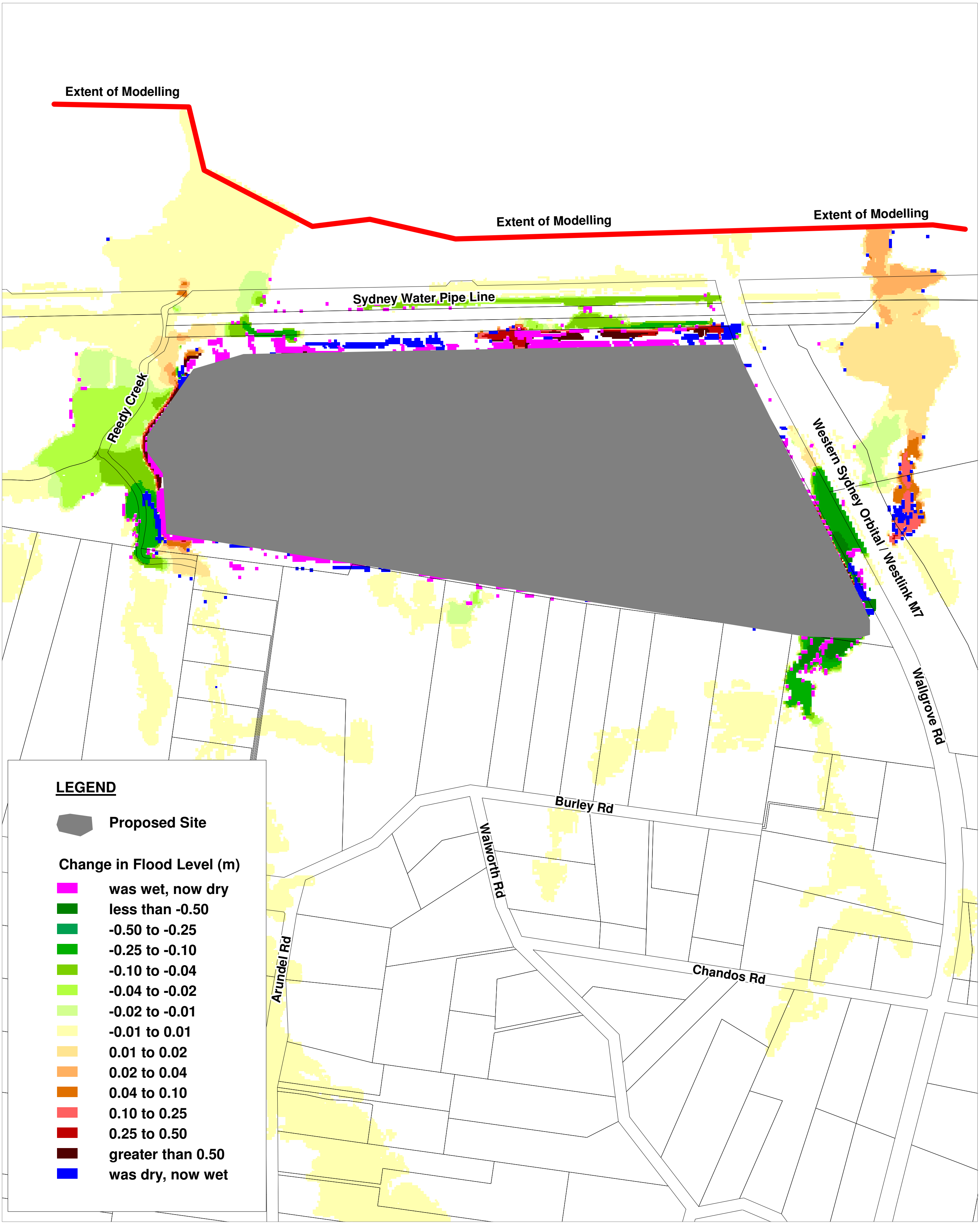

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813-913 Wallsgrove Rd, Horsley Park
20 Year ARI Change in Peak Flood Height

Figure: 6-3

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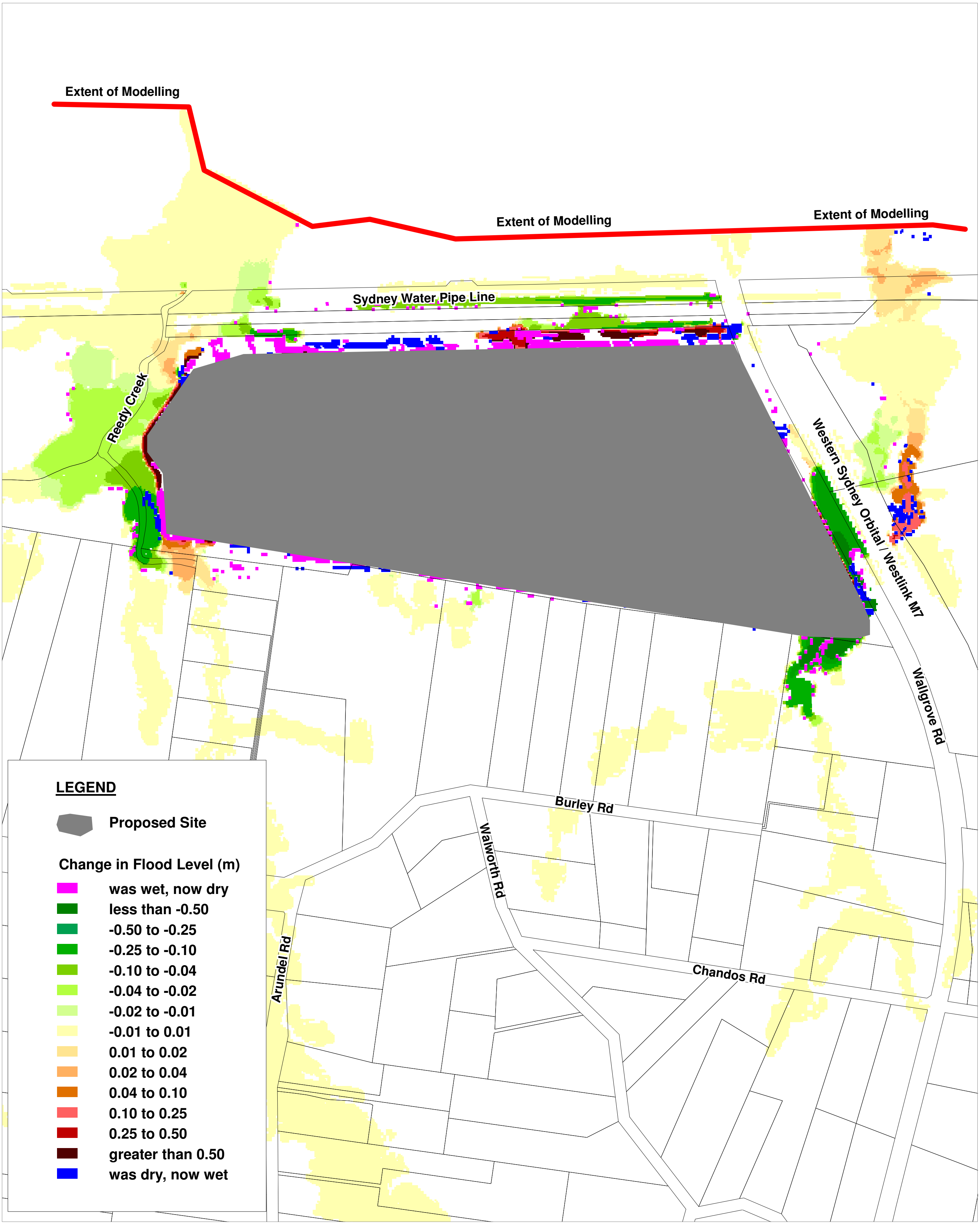

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813-913 Wallsgrove Rd, Horsley Park
50 Year ARI Change in Peak Flood Height

Figure: **6-4**

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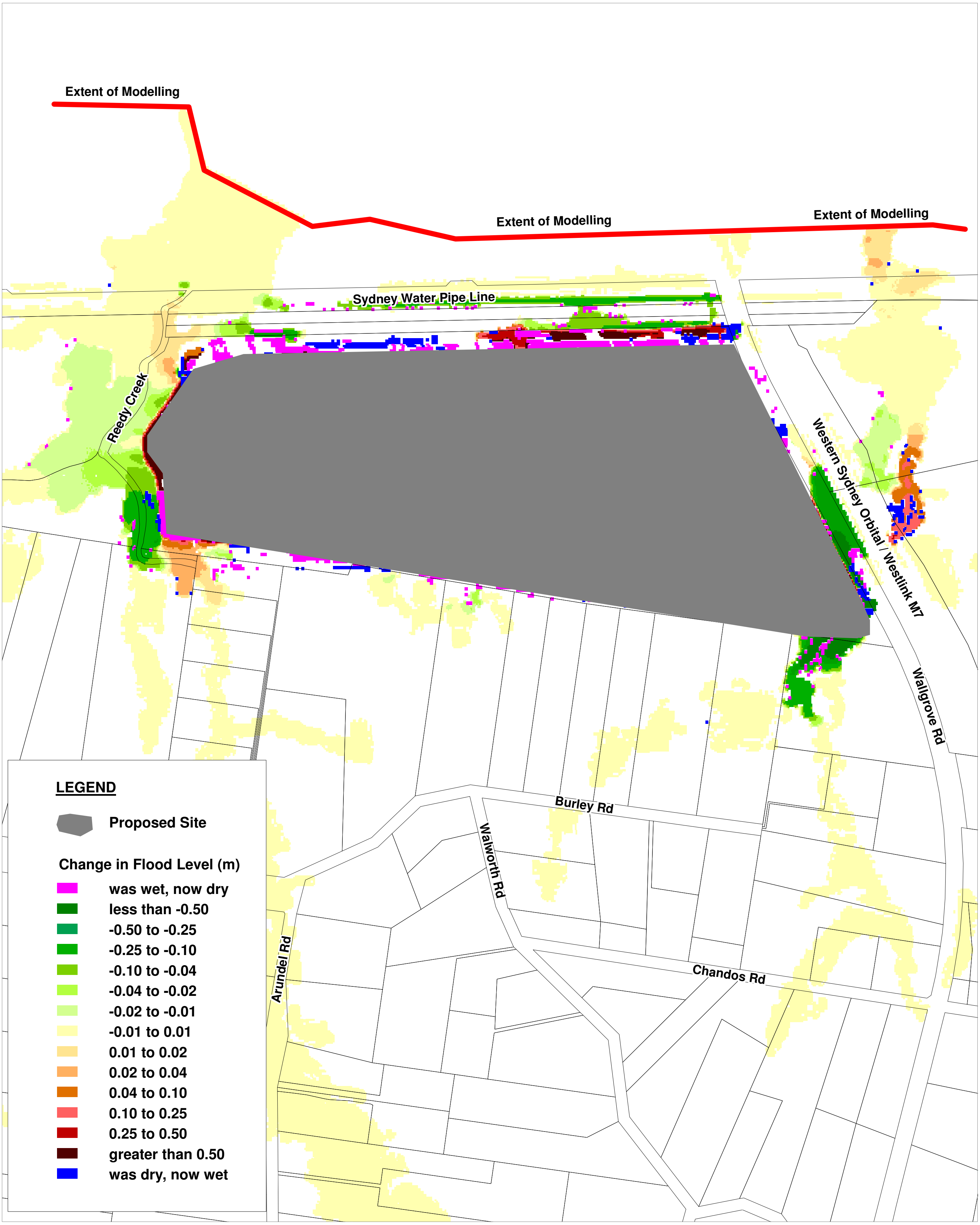

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813-913 Wallsgrove Rd, Horsley Park
100 Year ARI Change in Peak Flood Height

Figure: **6-5**

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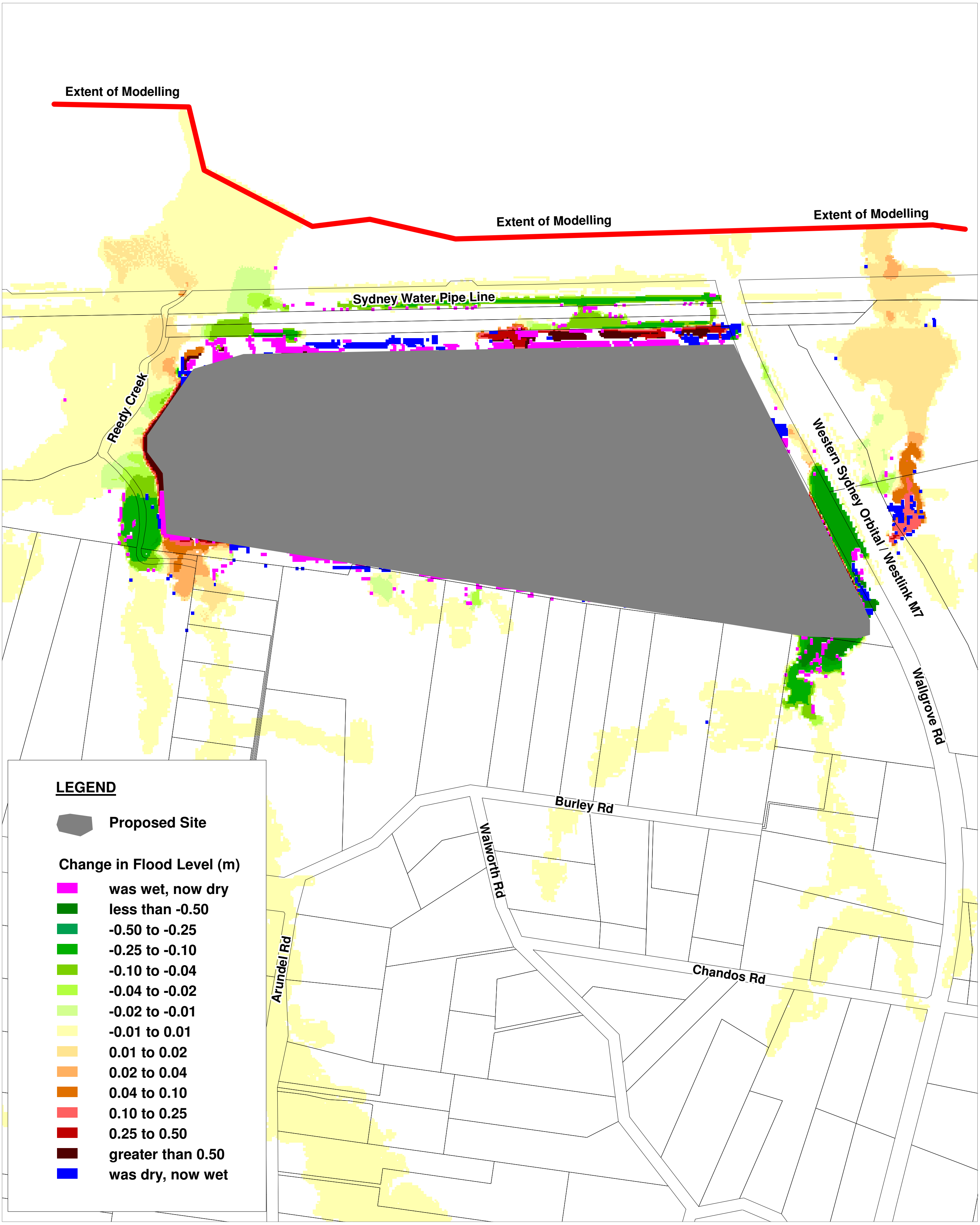

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813-913 Wallsgrove Rd, Horsley Park
500 Year ARI Change in Peak Flood Height

Figure: 6-6

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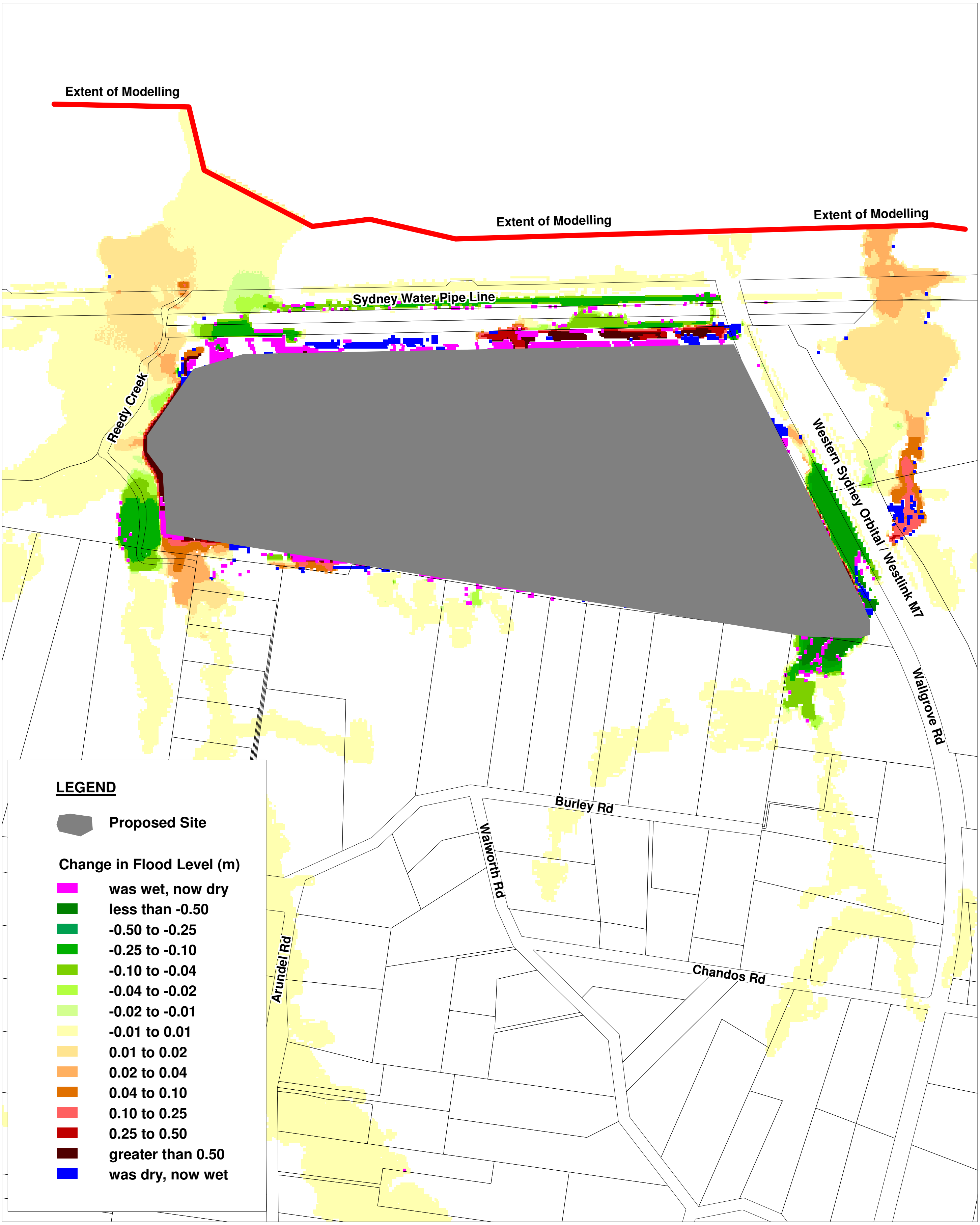

Title:

813-913 Wallsgrove Rd, Horsley Park
2000 Year ARI Change in Peak Flood Height

Figure: 6-7

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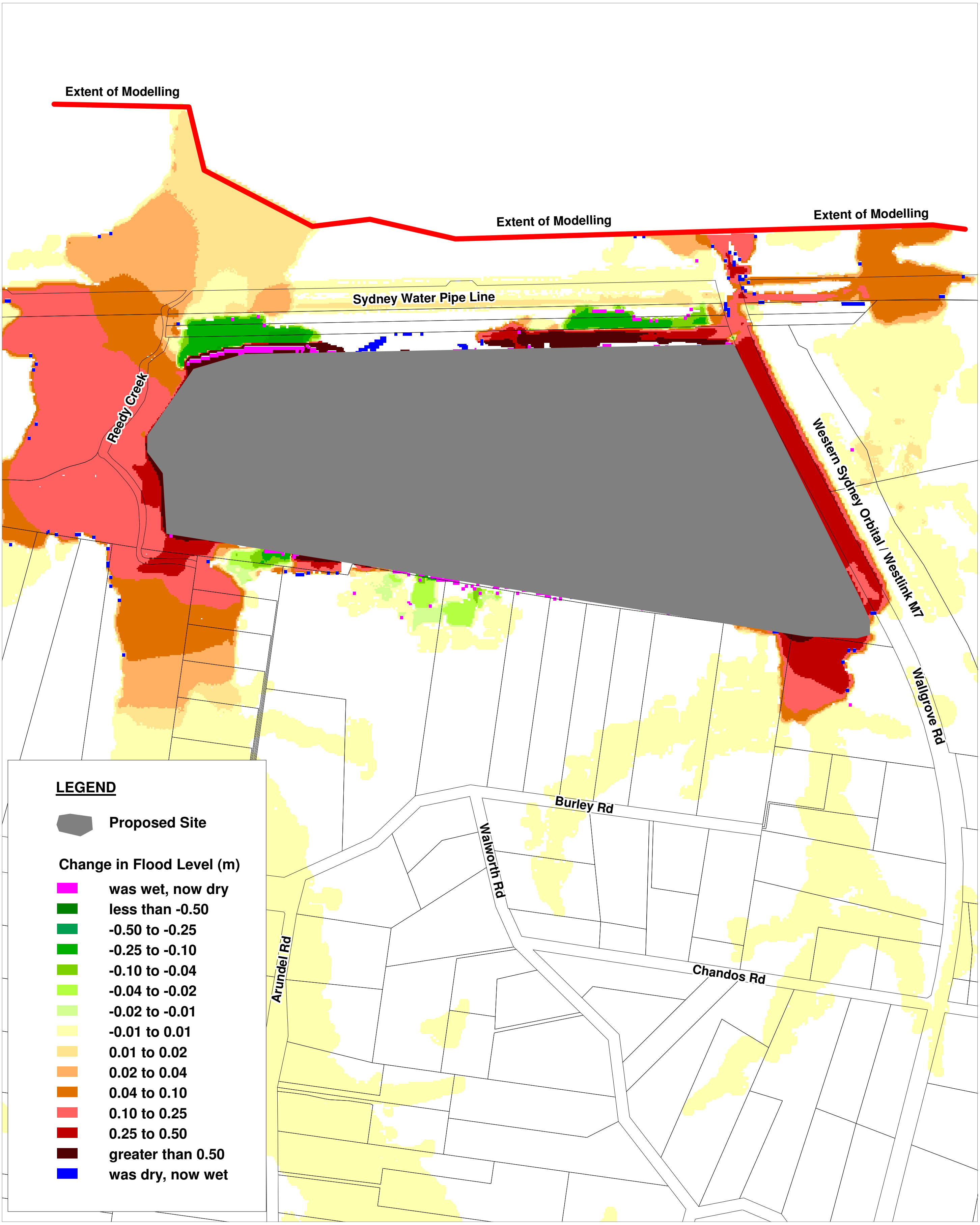

Title:

813-913 Wallsgrove Rd, Horsley Park
Probable Maximum Flood Change in Peak Flood Height

Figure: **6-8**

Rev: **A**

N

0 125 250m
Approx. Scale

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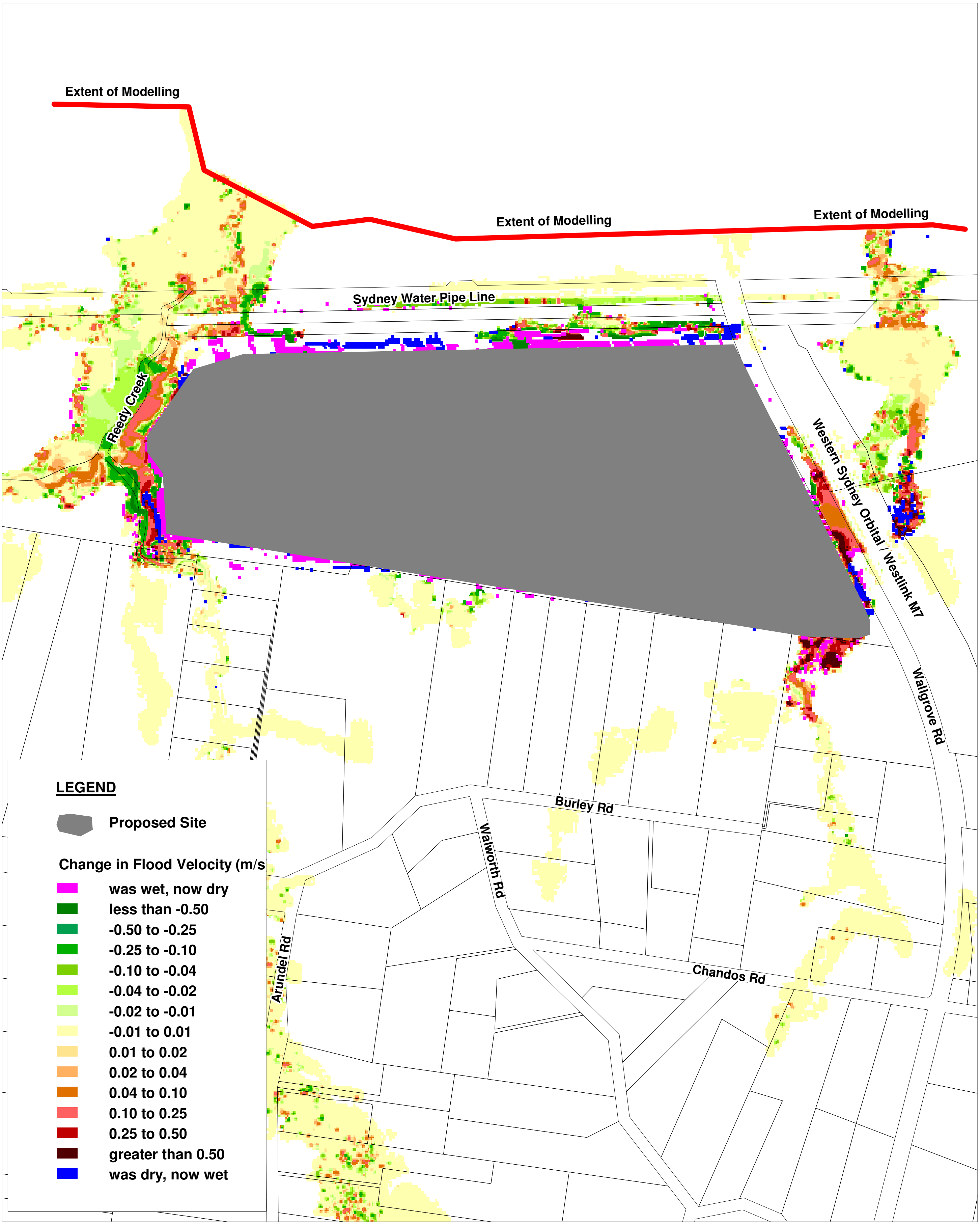
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-8_Dif_D01_012__E01_012_PMP_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park
20 Year ARI Change in Peak Flood Velocity

Figure: 6-9

Rev: A

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N

0 125 250m
Approx. Scale

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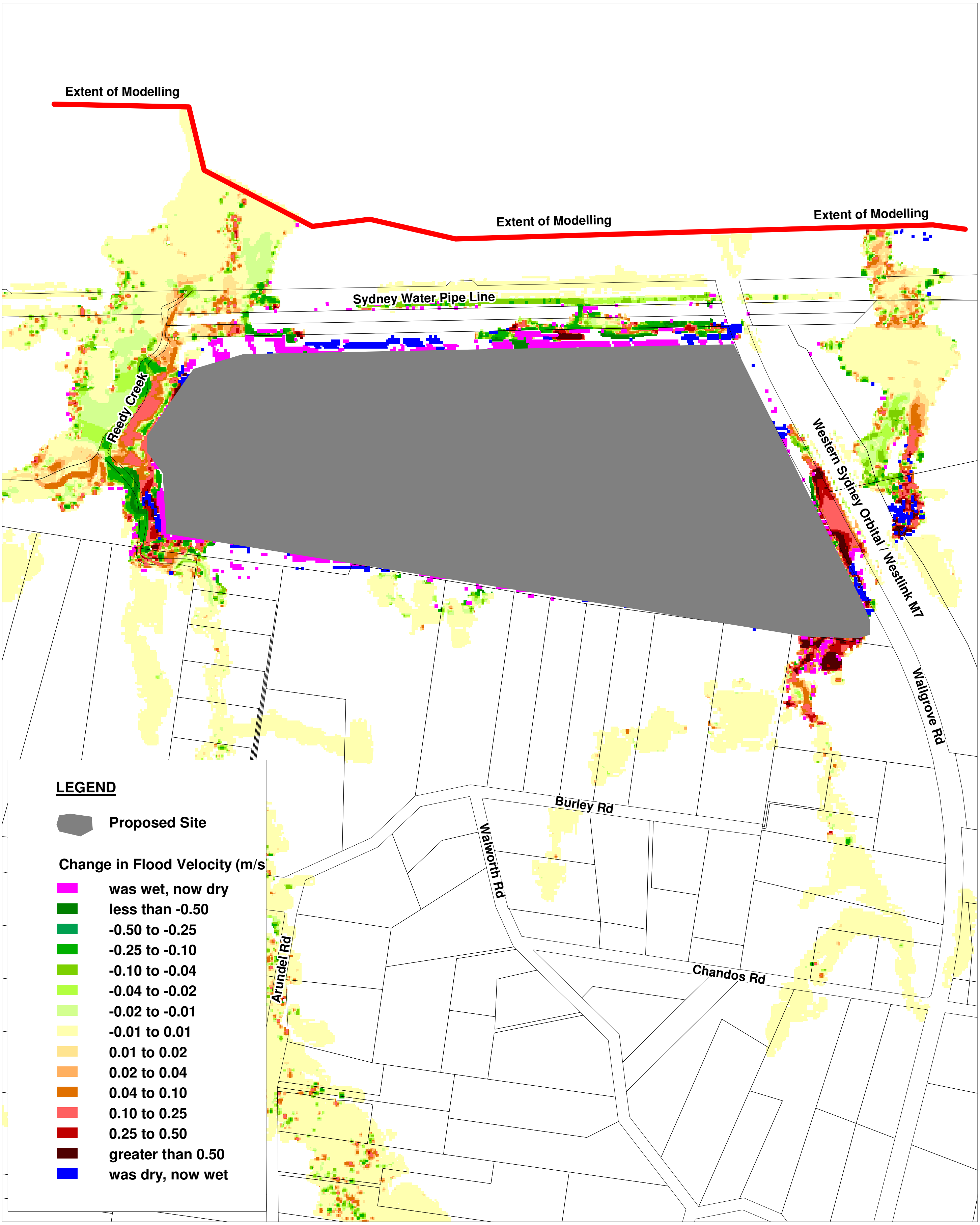
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-9_Dif_D01_012__E01_012_20y_VMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park
50 Year ARI Change in Peak Flood Velocity

Figure: **6-10**

Rev: **A**

N

0 125 250m
Approx. Scale

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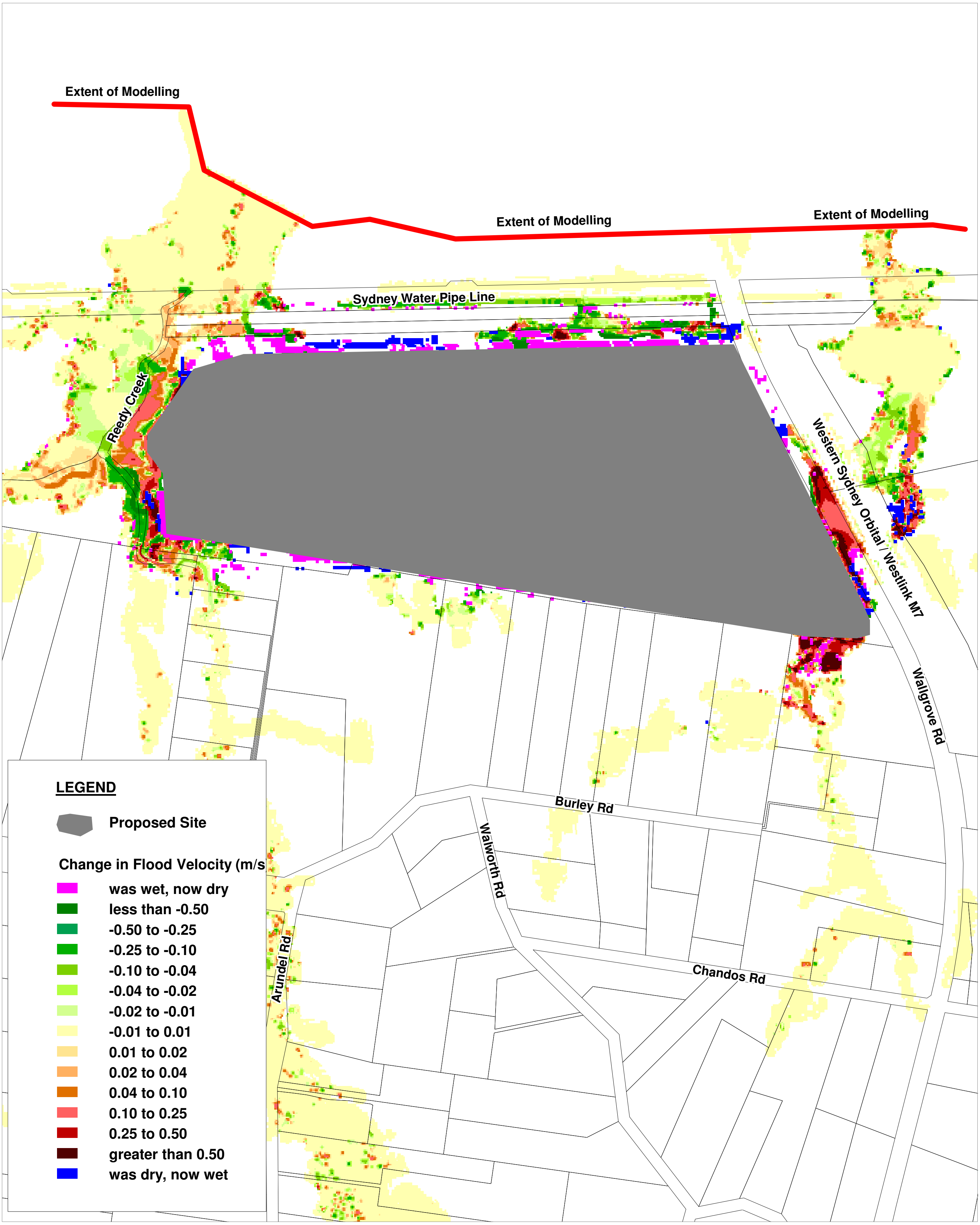
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-10_Dif_D01_012__E01_012_50y_VMax_RevA.WOR



Title:
813-913 Wallsgrove Rd, Horsley Park
100 Year ARI Change in Peak Flood Velocity

Figure: **6-11**

Rev: **A**

N

0 125 250m
Approx. Scale

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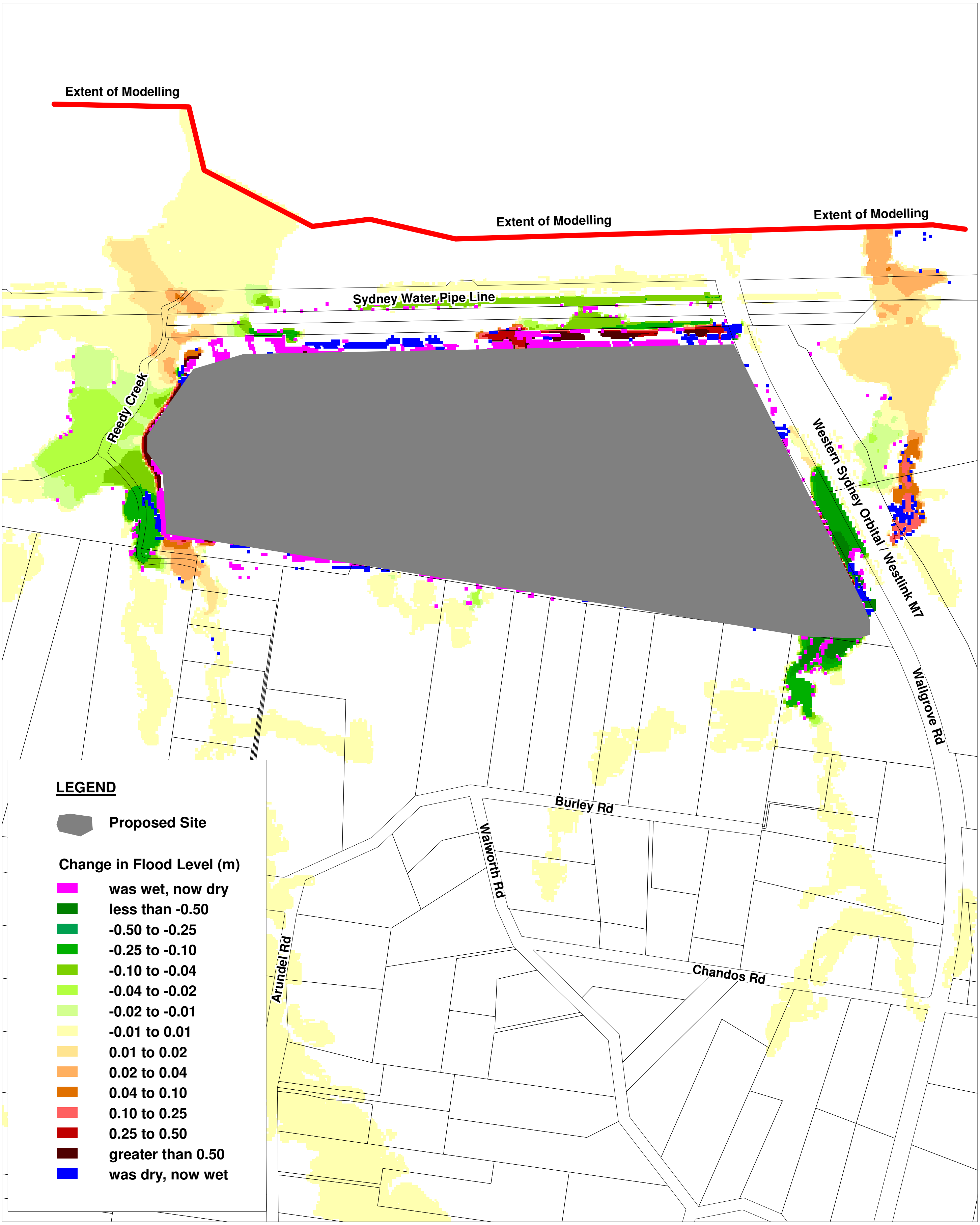
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-11_Dif_D01_012__E01_012_100y_VMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 10% Rainfall Increase 20 Year ARI Change in Peak Flood Height

Figure: 6-12

Rev: A

N

0 125 250m

Approx. Scale

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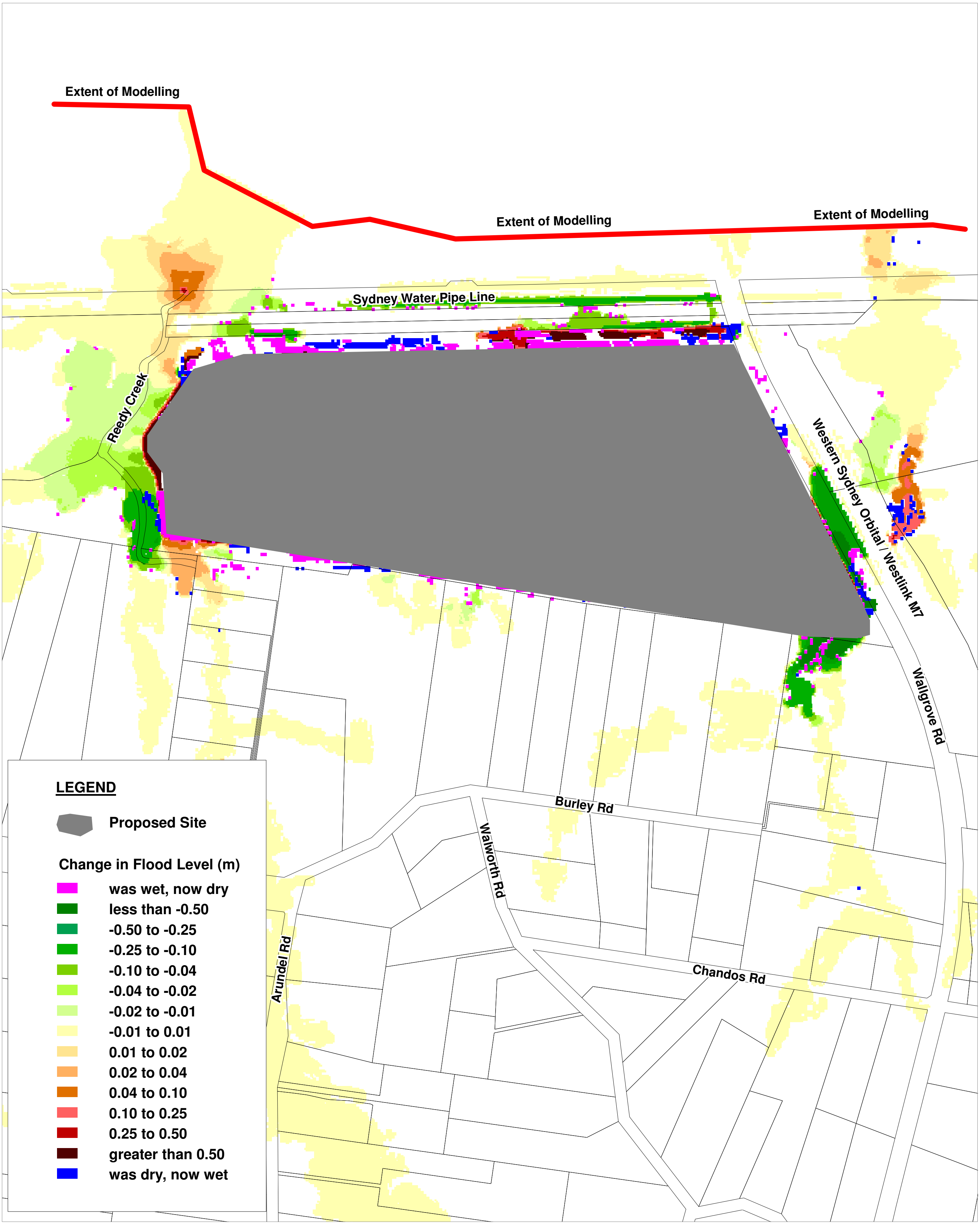
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-12_Dif_D10_012__E10_012_20y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 10% Rainfall Increase 50 Year ARI Change in Peak Flood Height

Figure: 6-13

Rev: A

N

0 125 250m

Approx. Scale

BMT WBM

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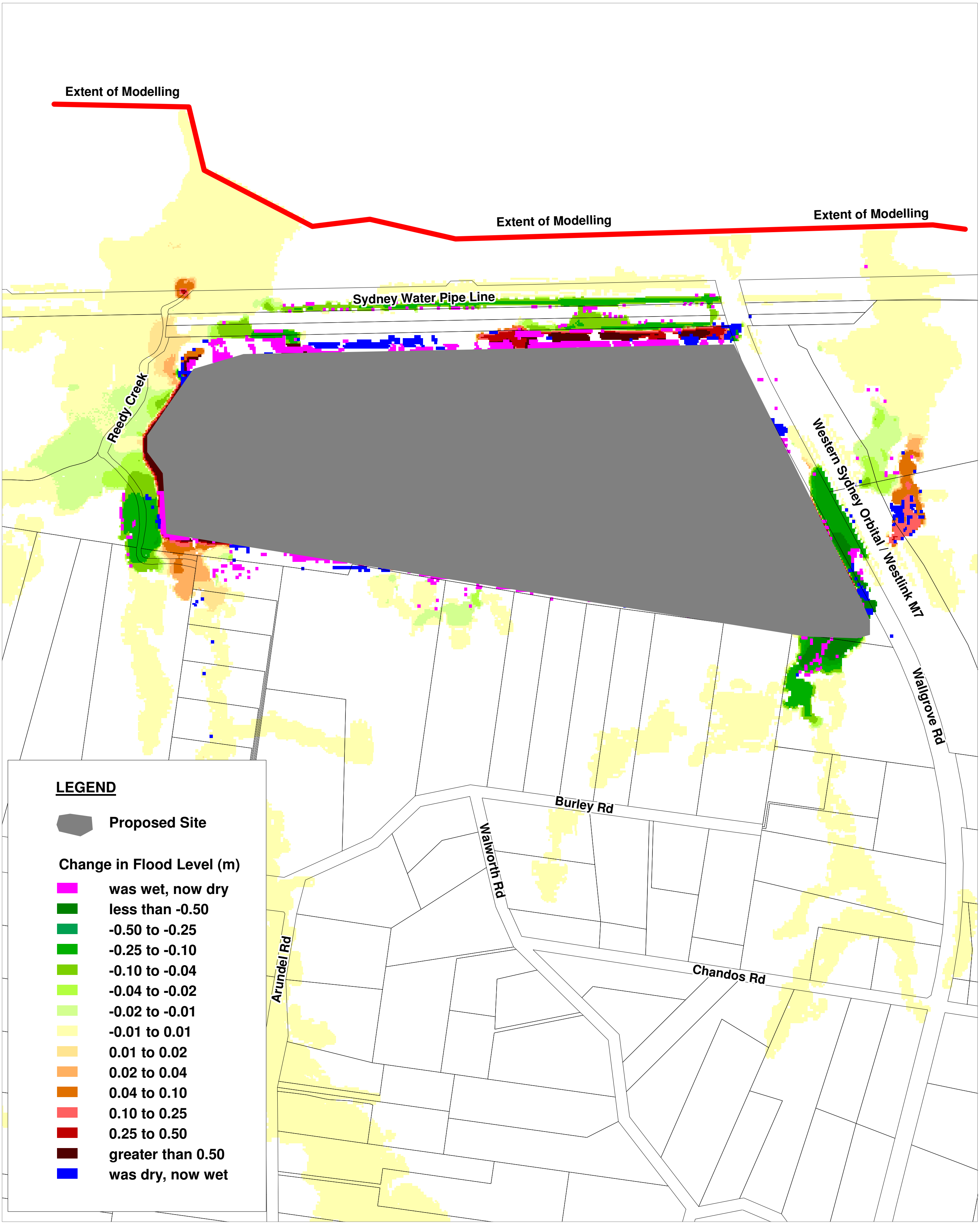
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-13_Dif_D10_012__E10_012_50y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 10% Rainfall Increase 100 Year ARI Change in Peak Flood Height

Figure: 6-14

Rev: A

N

0 125 250m
Approx. Scale

BMT WBM
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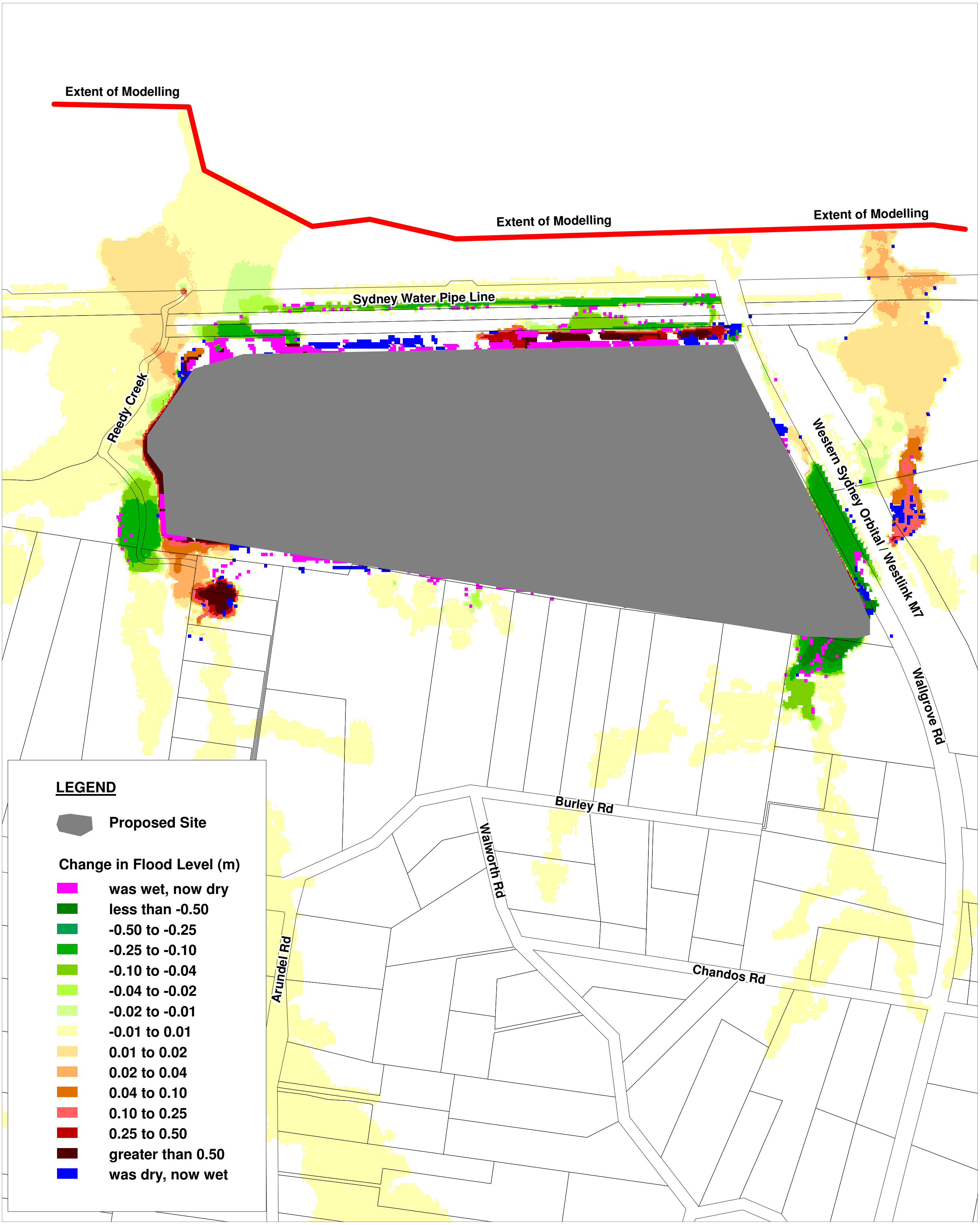
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-14_Dif_D10_012__E10_012_100y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 10% Rainfall Increase 500 Year ARI Change in Peak Flood Height

Figure: 6-15

Rev: A

N

0 125 250m

Approx. Scale

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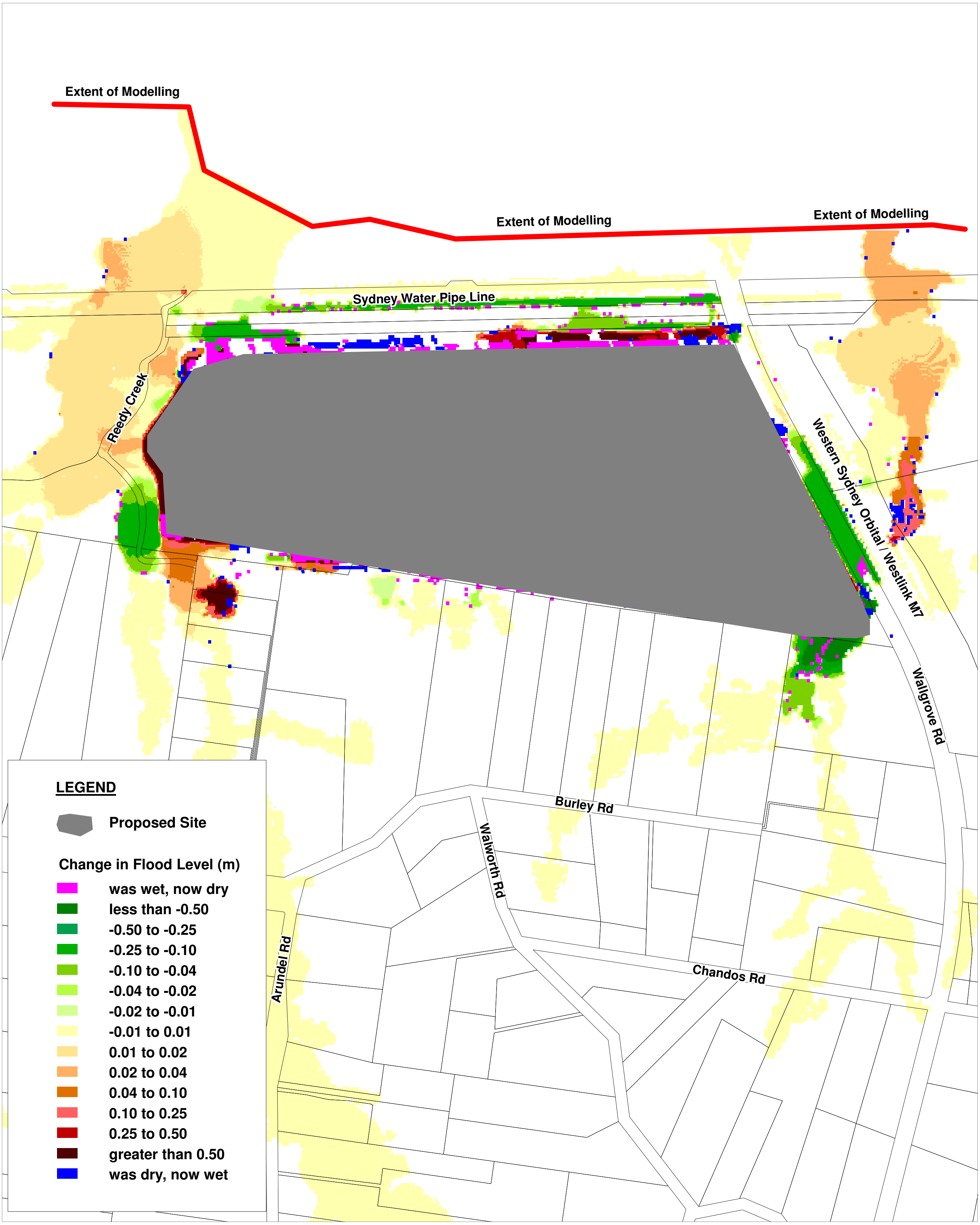
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-15_Dif_D10_012__E10_012_500y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 10% Rainfall Increase 2000 Year ARI Change in Peak Flood Height

Figure: 6-16

Rev: A

N

0 125 250m

Approx. Scale

BMT WBM

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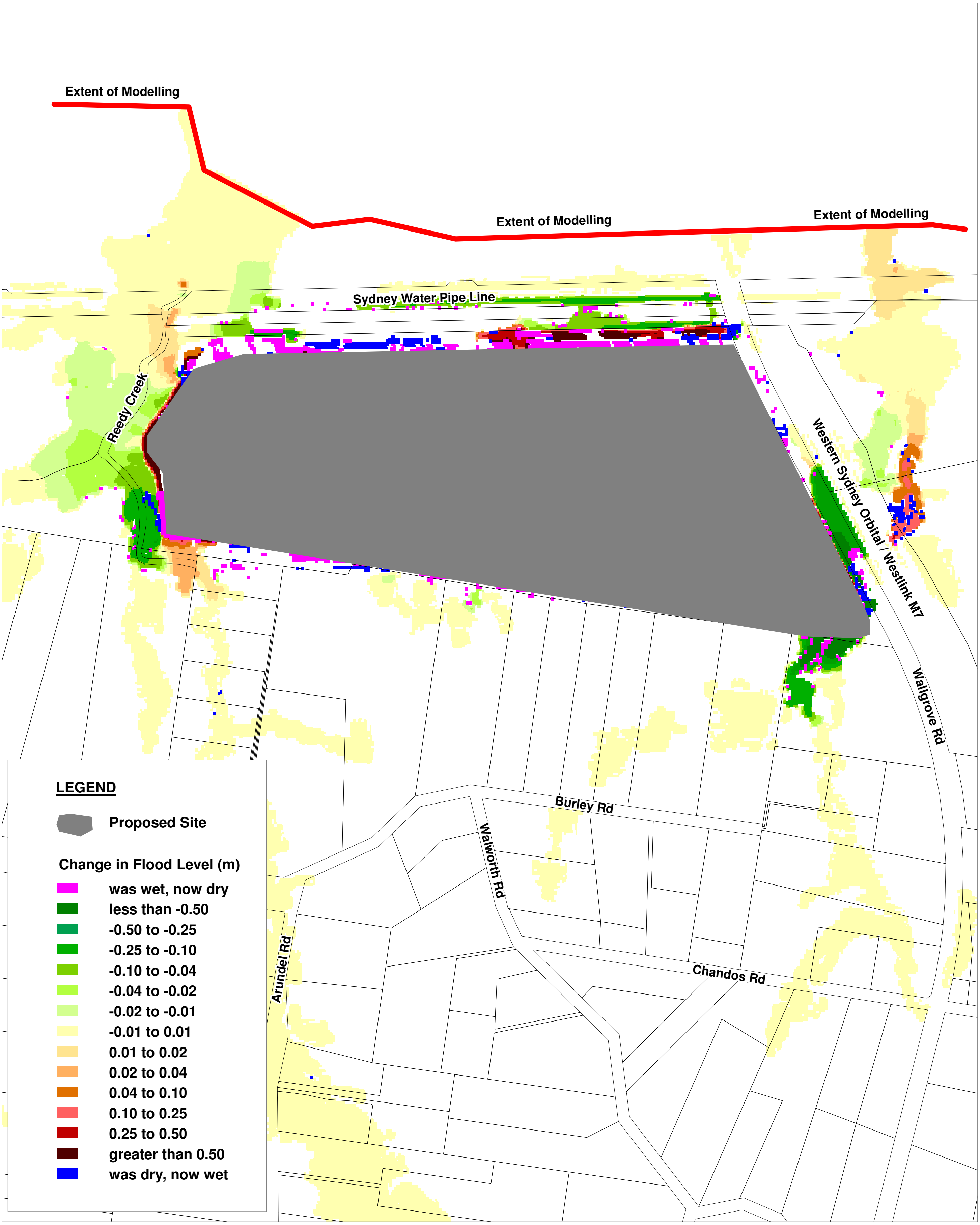
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-16_Dif_D10_012__E10_012_2000y_HMax_RevA.WOR



Title:
813-913 Wallsgrove Rd, Horsley Park - 20% Rainfall Increase
20 Year ARI Change in Peak Flood Height

Figure: **6-17**

Rev: **A**

N

0 125 250m
Approx. Scale

BMT WBM
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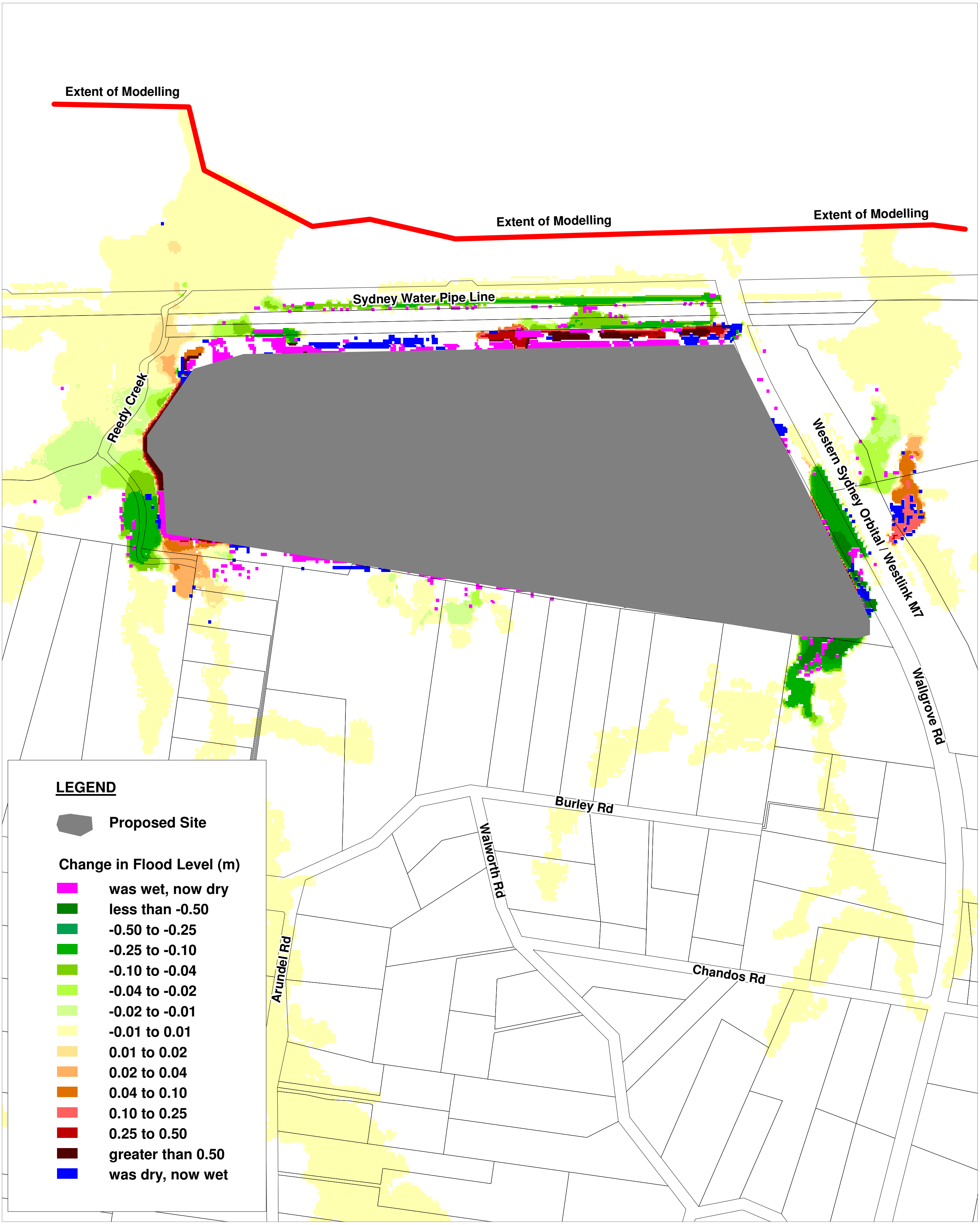
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-17_Dif_D20_012__E20_012_20y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 20% Rainfall Increase
50 Year ARI Change in Peak Flood Height

Figure: 6-18

Rev: A

N

0 125 250m
Approx. Scale

BMT WBM
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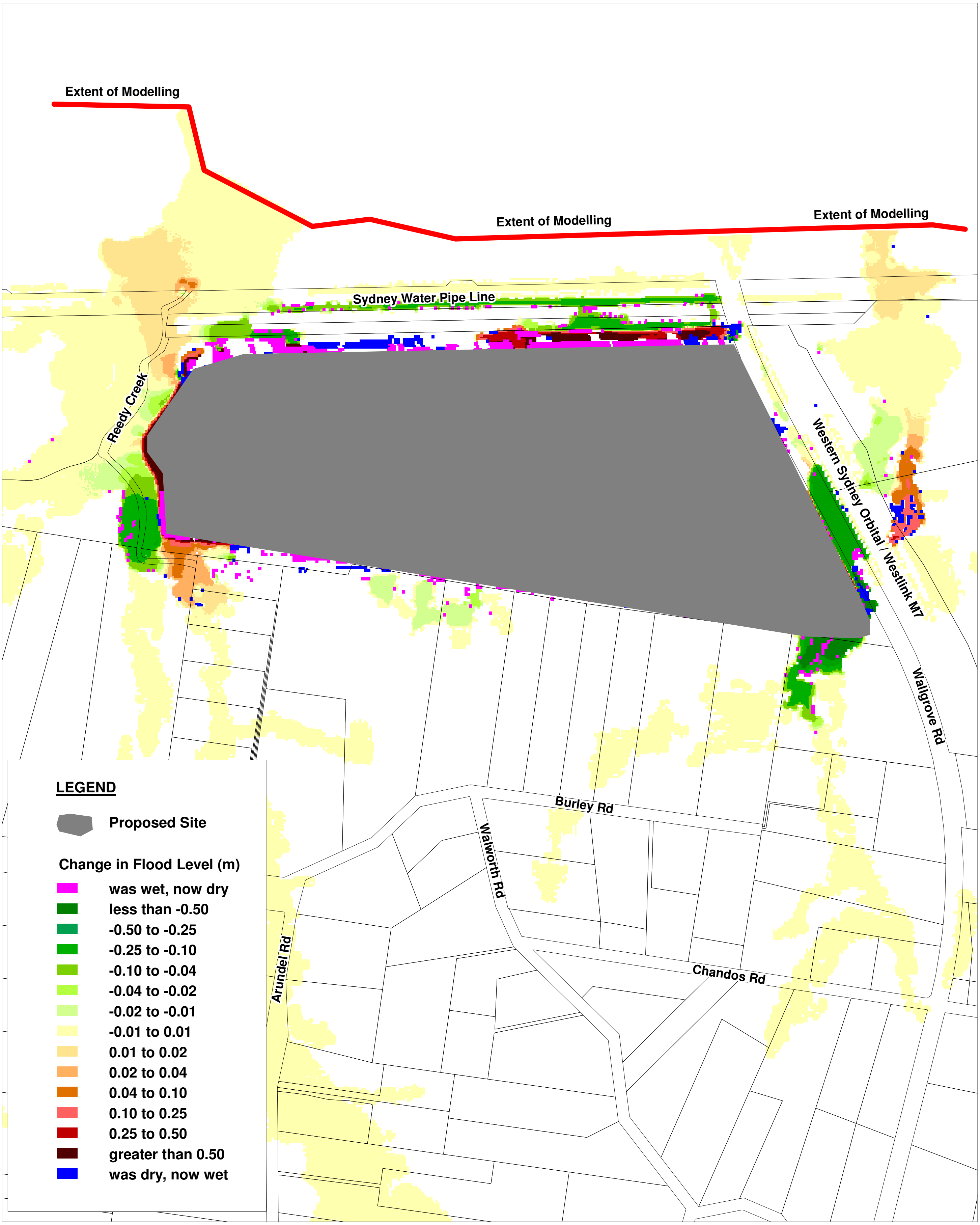
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-18_Dif_D20_012__E20_012_50y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 20% Rainfall Increase 100 Year ARI Change in Peak Flood Height

Figure: 6-19

Rev: A

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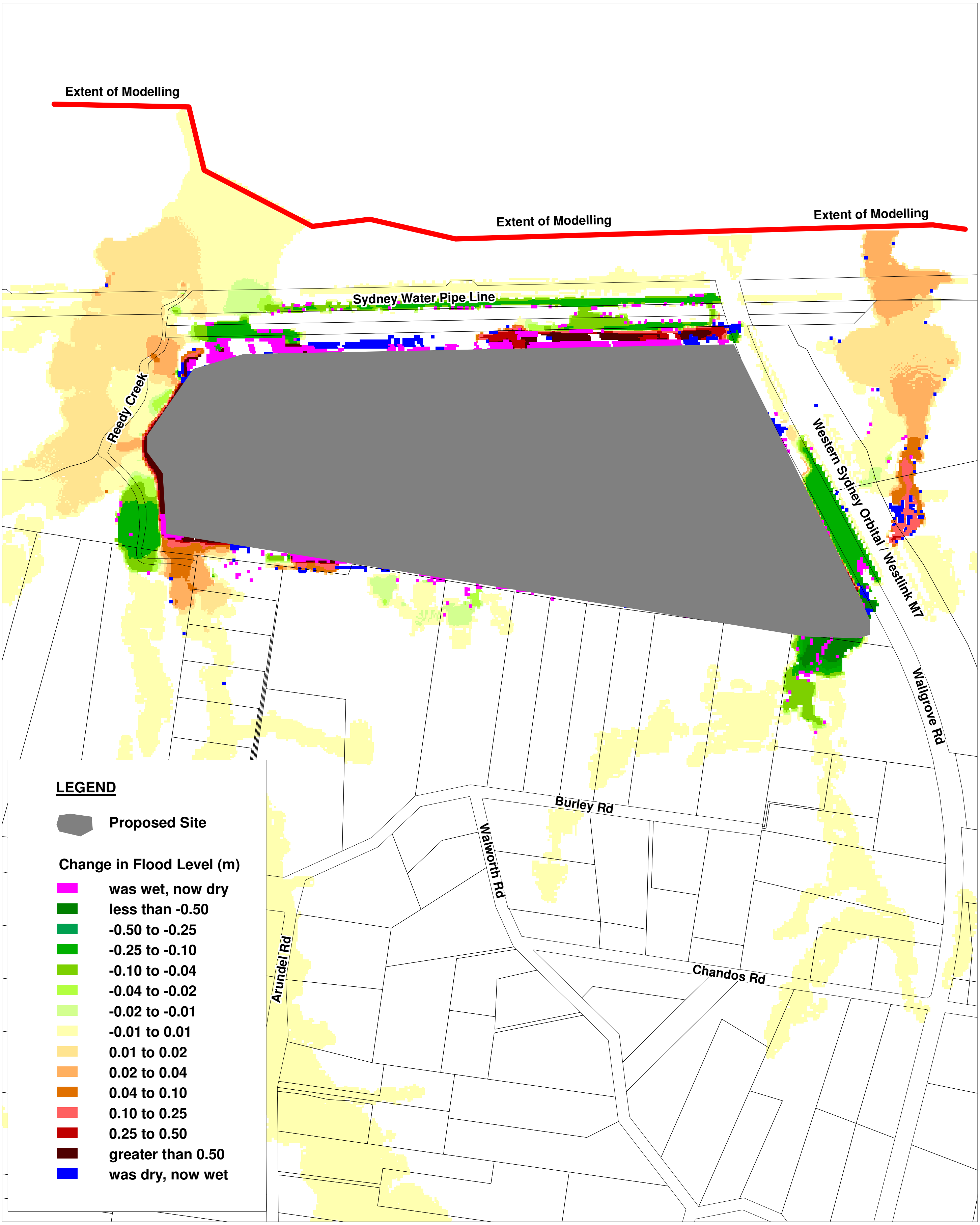
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-19_Dif_D20_012__E20_012_100y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 20% Rainfall Increase 500 Year ARI Change in Peak Flood Height

Figure: 6-20

Rev: A

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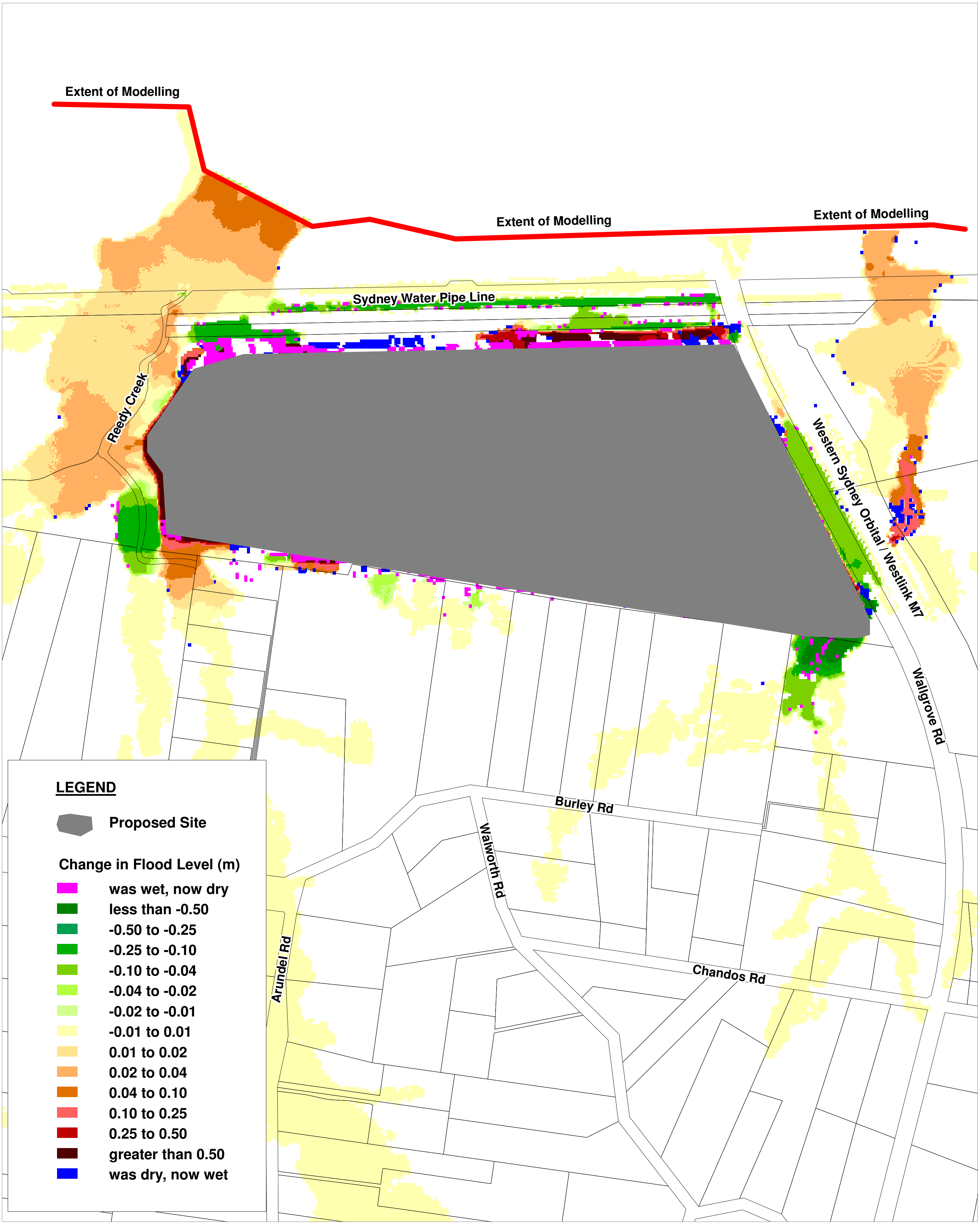

Title:

813-913 Wallsgrove Rd, Horsley Park - 20% Rainfall Increase 2000 Year ARI Change in Peak Flood Height

Figure: 6-21

Rev: A

N

0 125 250m

Approx. Scale

BMT WBM

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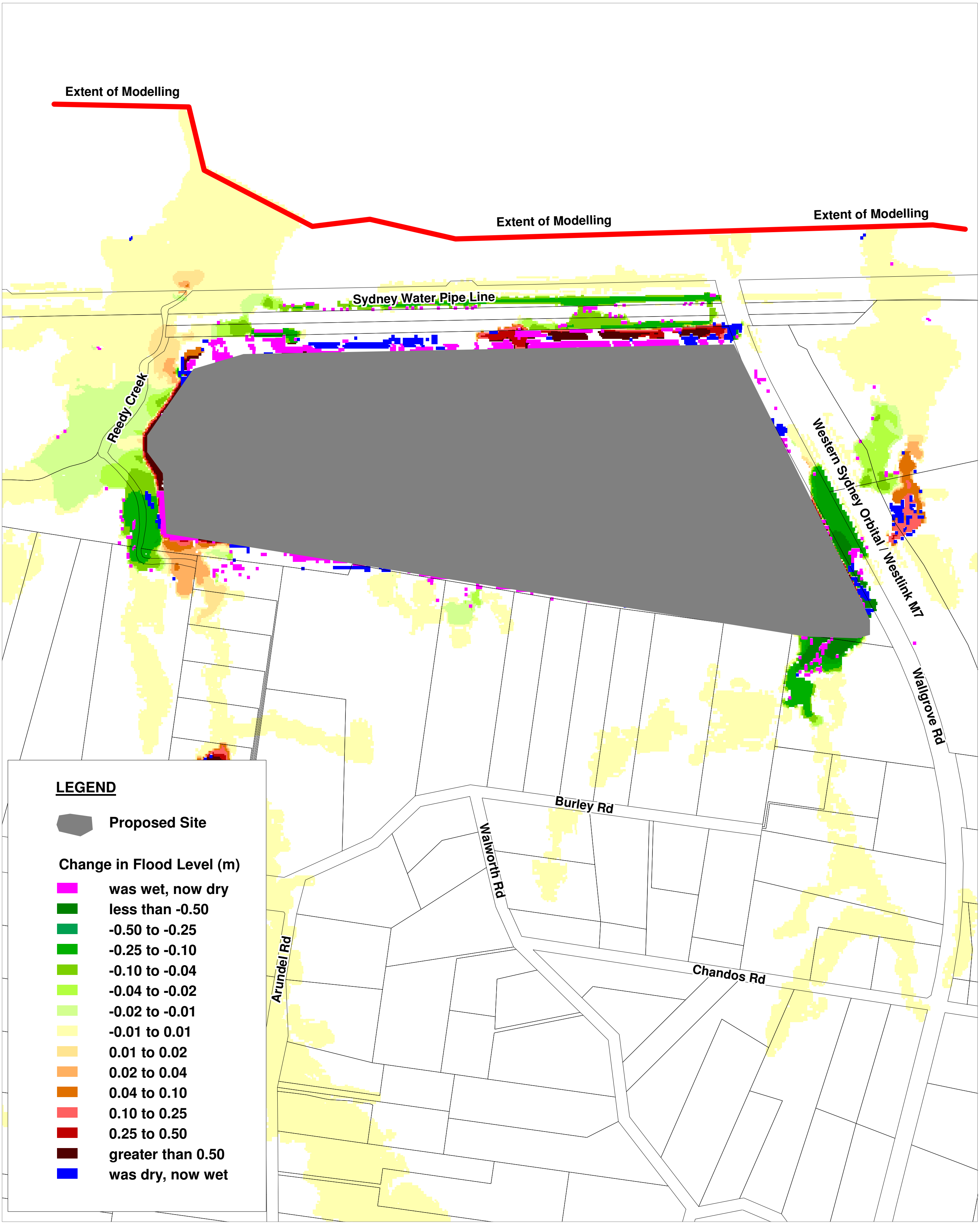
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-21_Dif_D20_012__E20_012_2000y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 30% Rainfall Increase
20 Year ARI Change in Peak Flood Height

Figure: **6-22**

Rev: **A**

N

0 125 250m
Approx. Scale

BMT WBM
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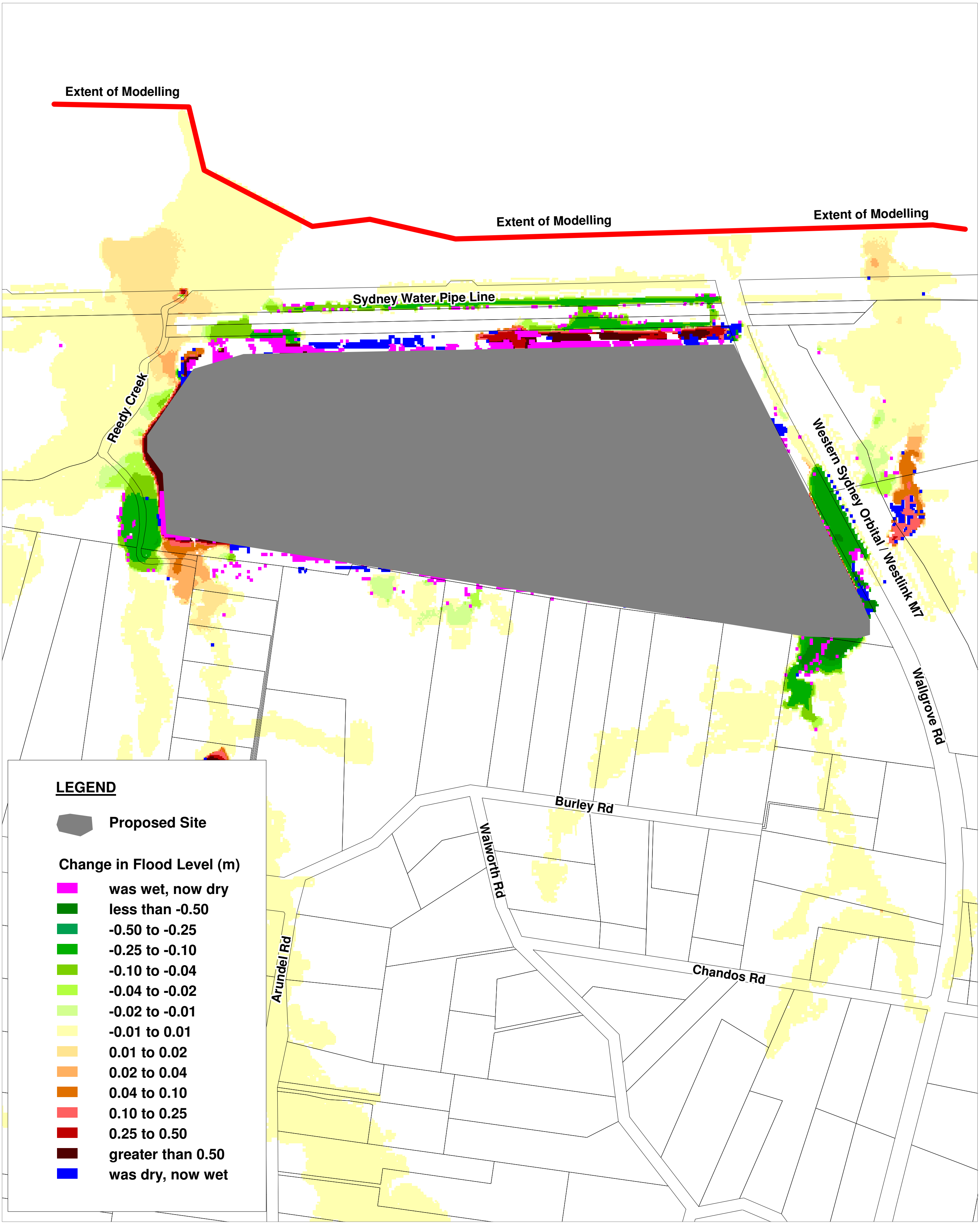
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-22_Dif_D30_012__E30_012_20y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 30% Rainfall Increase 50 Year ARI Change in Peak Flood Height

Figure: 6-23

Rev: A

N

0 125 250m

Approx. Scale

BMT WBM

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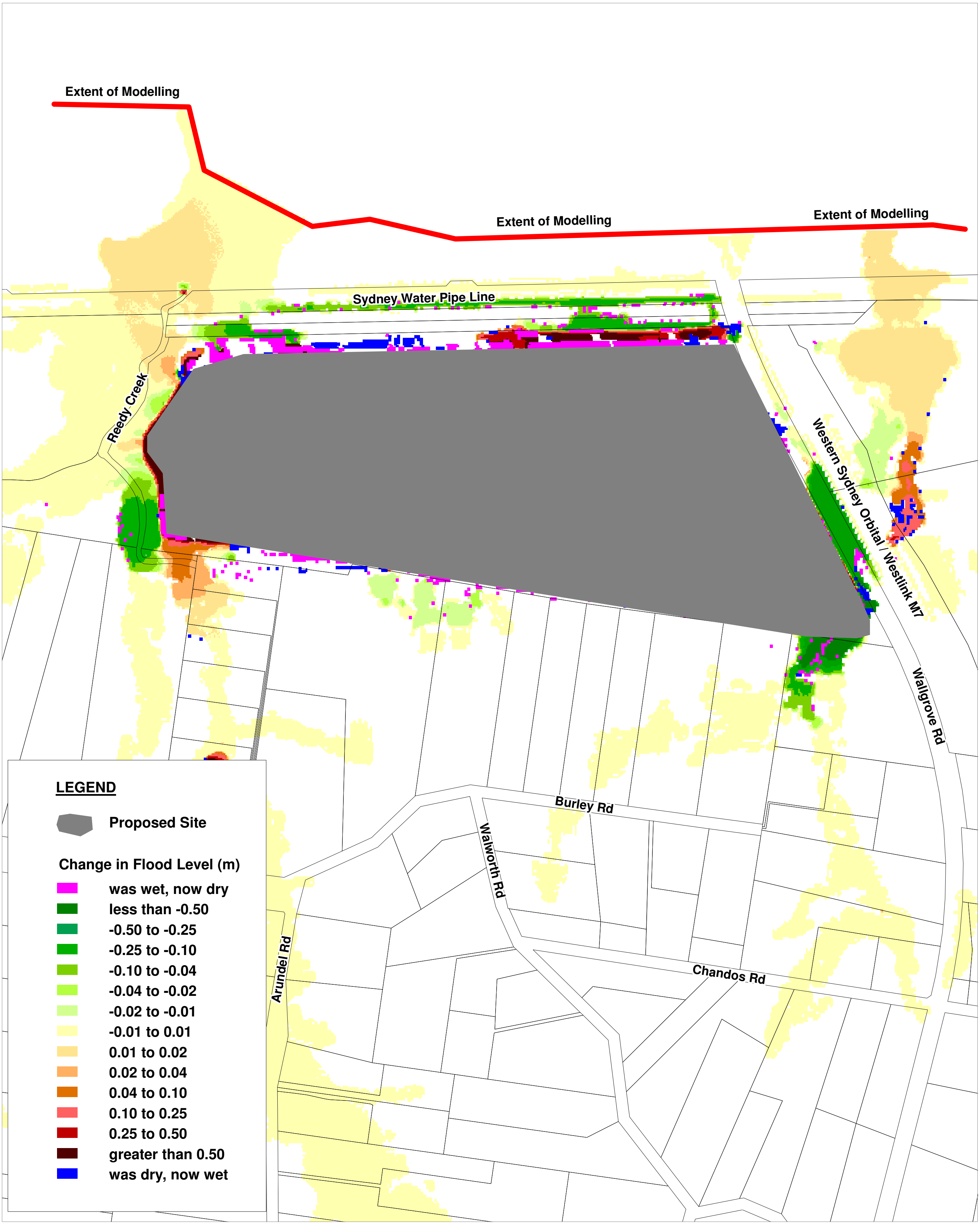
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-23_Dif_D30_012__E30_012_50y_HMax_RevA.WOR



Title:
813-913 Wallsgrove Rd, Horsley Park - 30% Rainfall Increase
100 Year ARI Change in Peak Flood Height

Figure: **6-24**

Rev: **A**

N

0 125 250m
Approx. Scale

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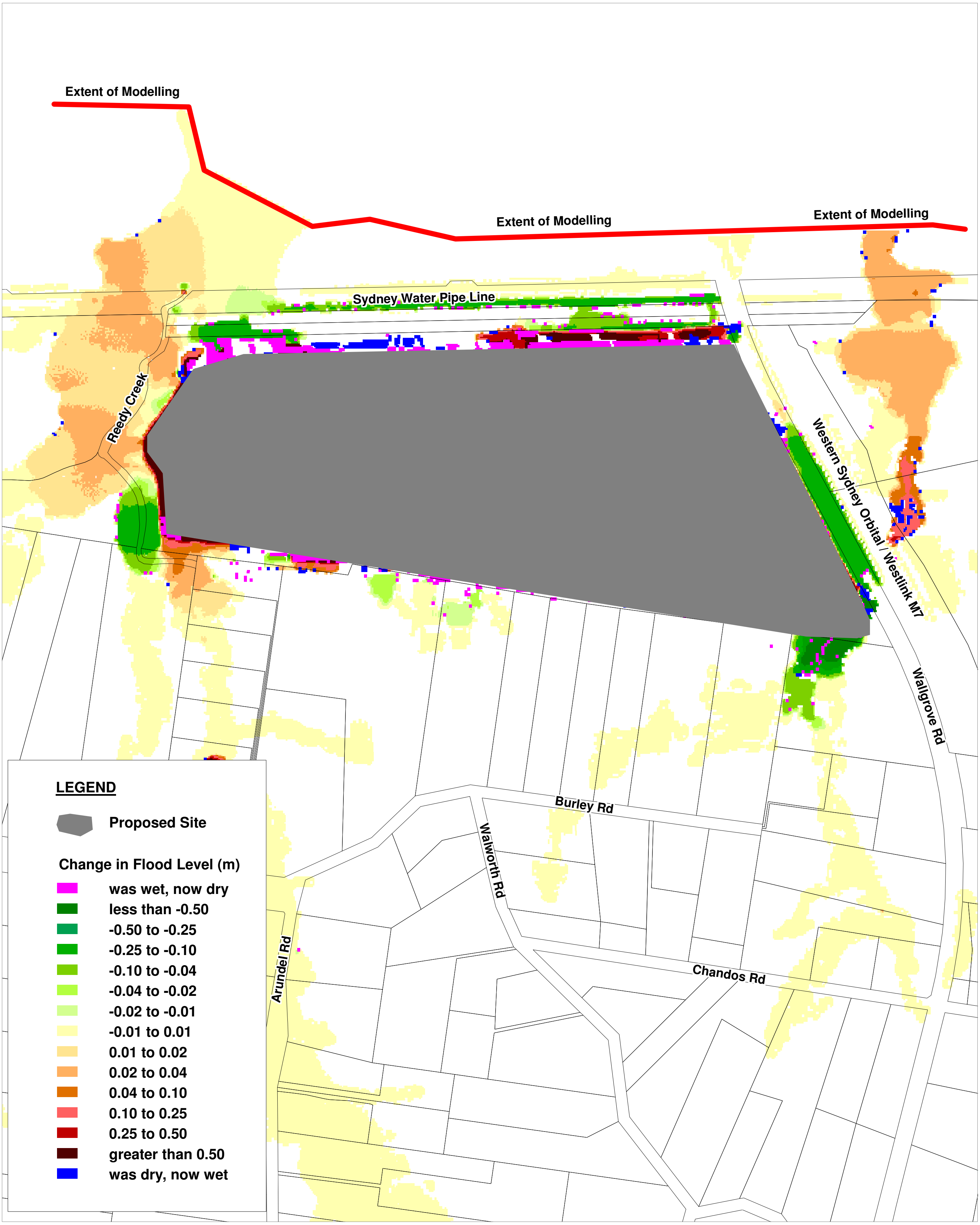
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-24_Dif_D30_012__E30_012_100y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 30% Rainfall Increase
500 Year ARI Change in Peak Flood Height

Figure: **6-25**

Rev: **A**

N

0 125 250m
Approx. Scale

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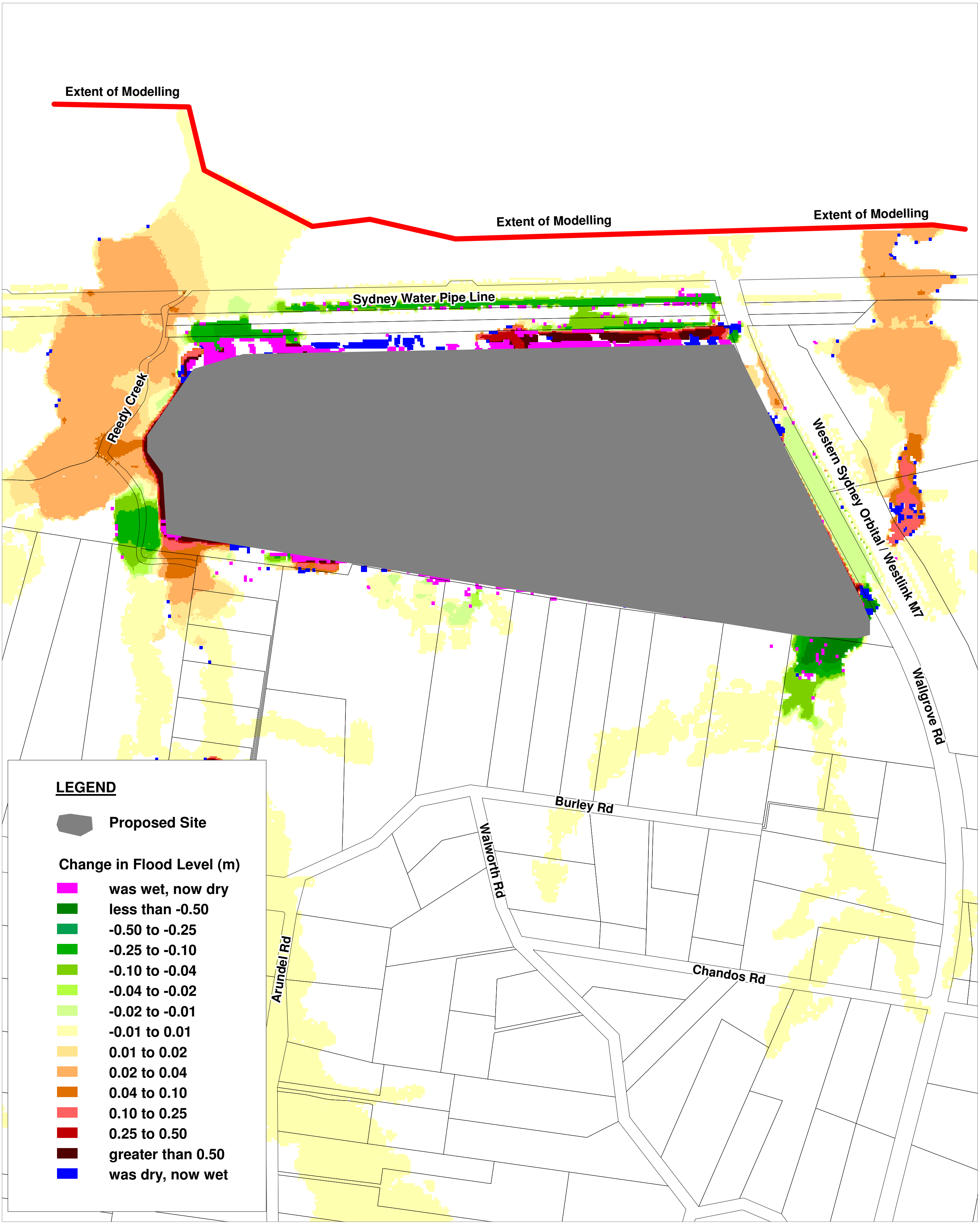
Filepath : T:\M20101.JL.WallgroveRd_FIA\MapInfo\Drawings\R.M20101.001.03.ModellingReport\WgR_Fig6-25_Dif_D30_012__E30_012_500y_HMax_RevA.WOR



Title:

813-913 Wallsgrove Rd, Horsley Park - 30% Rainfall Increase 2000 Year ARI Change in Peak Flood Height

Figure: 6-26

Rev: A

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N

0 125 250m

Approx. Scale

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7 Summary

A fully two-dimensional TUFLOW flood models have been adapted from the Reedy Creek TUFLOW model developed as part of the Rural Area Flood Study (BMT WBM, 2013) to assess the flood impacts of the proposed development at 813-913 Wallgrove Road, Horsley Park.

The modelling has demonstrated that the proposed development can be constructed without significant flood impact on the neighbouring properties. Although, it is noted that localised flood impacts are evident. However, these flood impacts can likely be reduced during the detailed design of the proposed development.

8 References

BMT WBM (2013), Rural Area Flood Study - Ropes, Reedy & Eastern Creeks - Final Report, BMT WBM Pty Ltd, August 2013, Report No. R.M7198.004.02.Final.pdf

Brown Consulting (2013), Stormwater Concept Plan – Proposed for Industrial Development, 813-913 Wallgrove Road, Horsley Park, August 2013, Report No. X12254-01.pdf

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