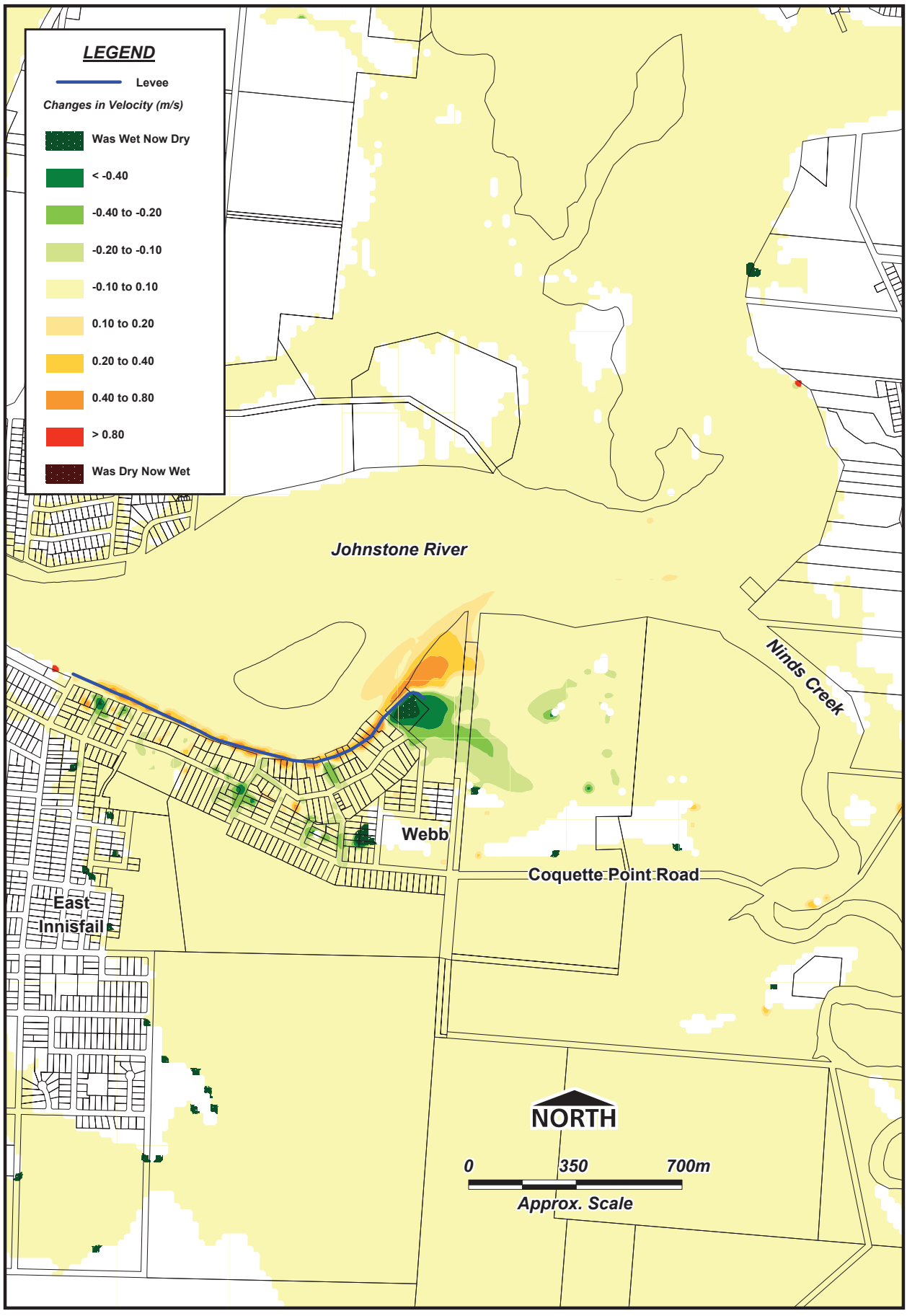
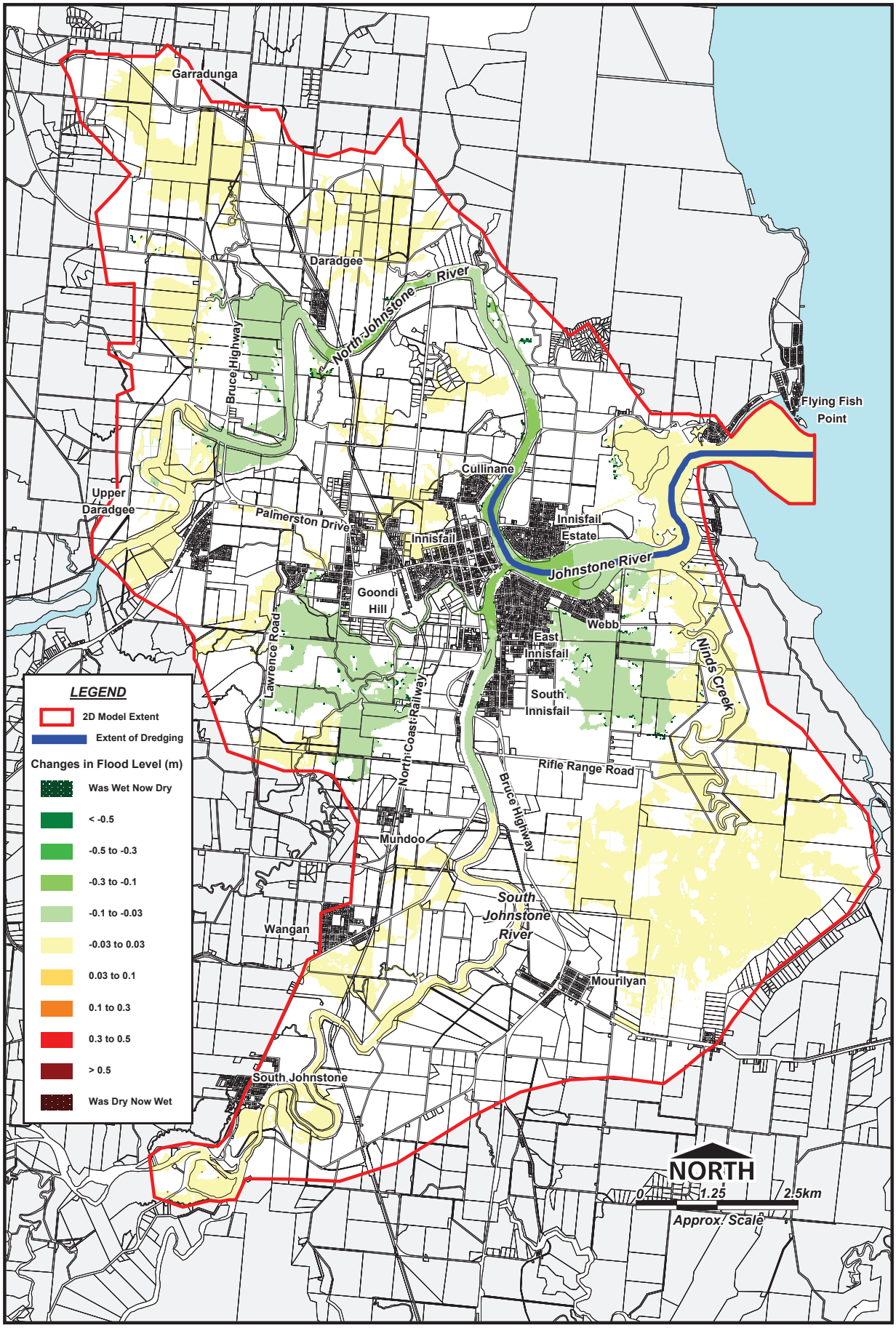


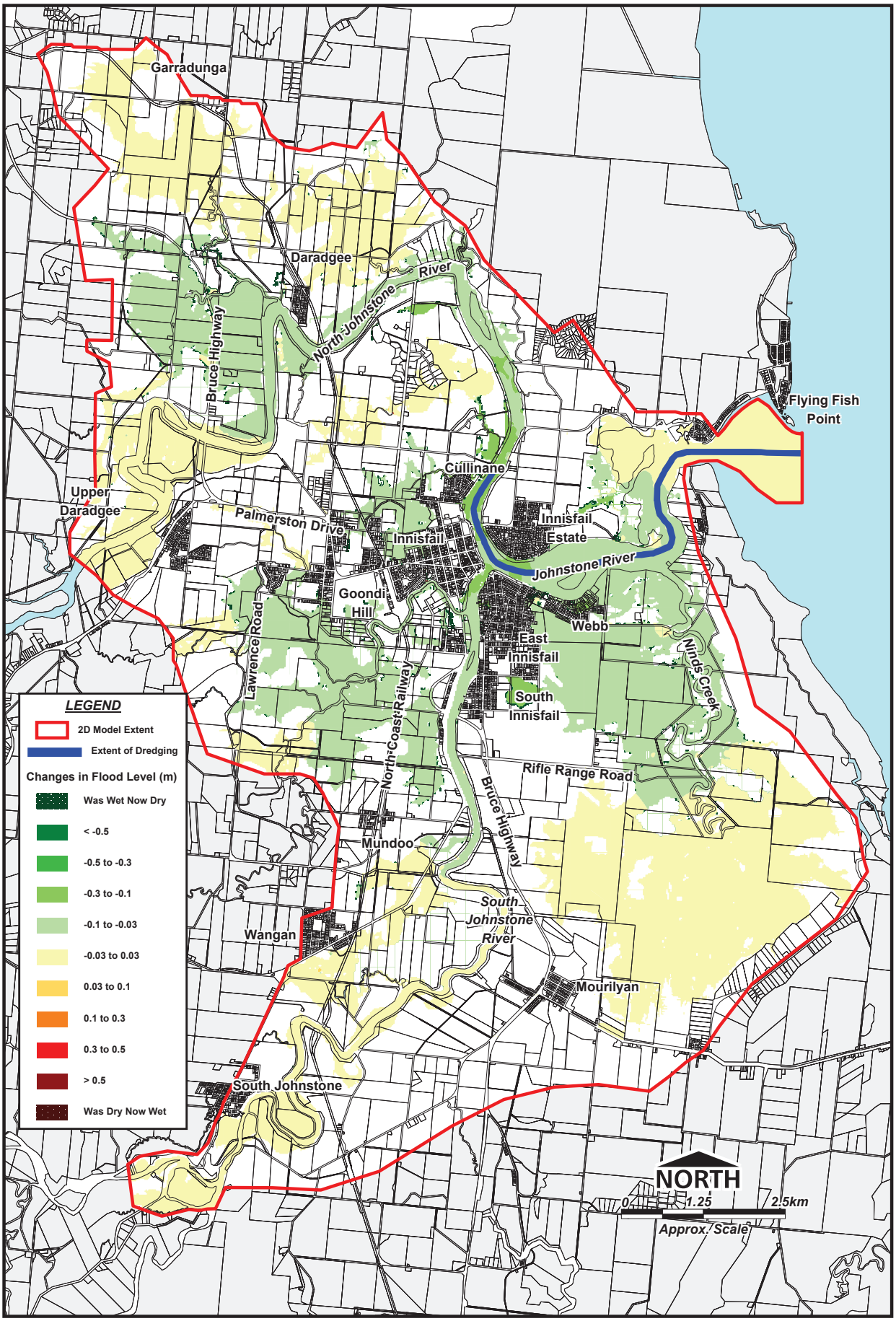
Impact of Webb Levee on 20 Year ARI Velocities at the Flood Peak

Figure 8-31



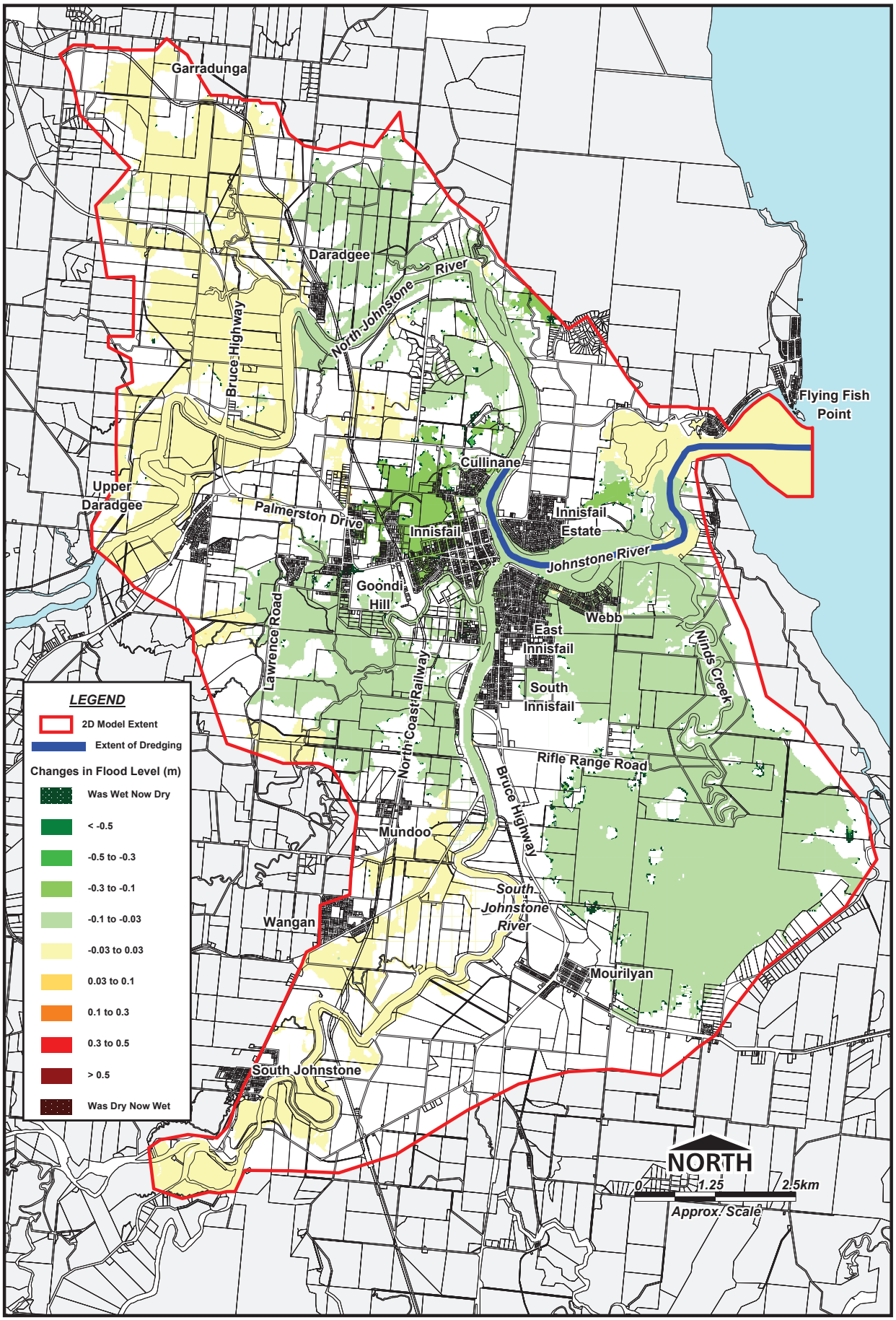
Impact of Scheme 2 Dredging on Peak 2 Year ARI Flood Levels

Figure 8-32



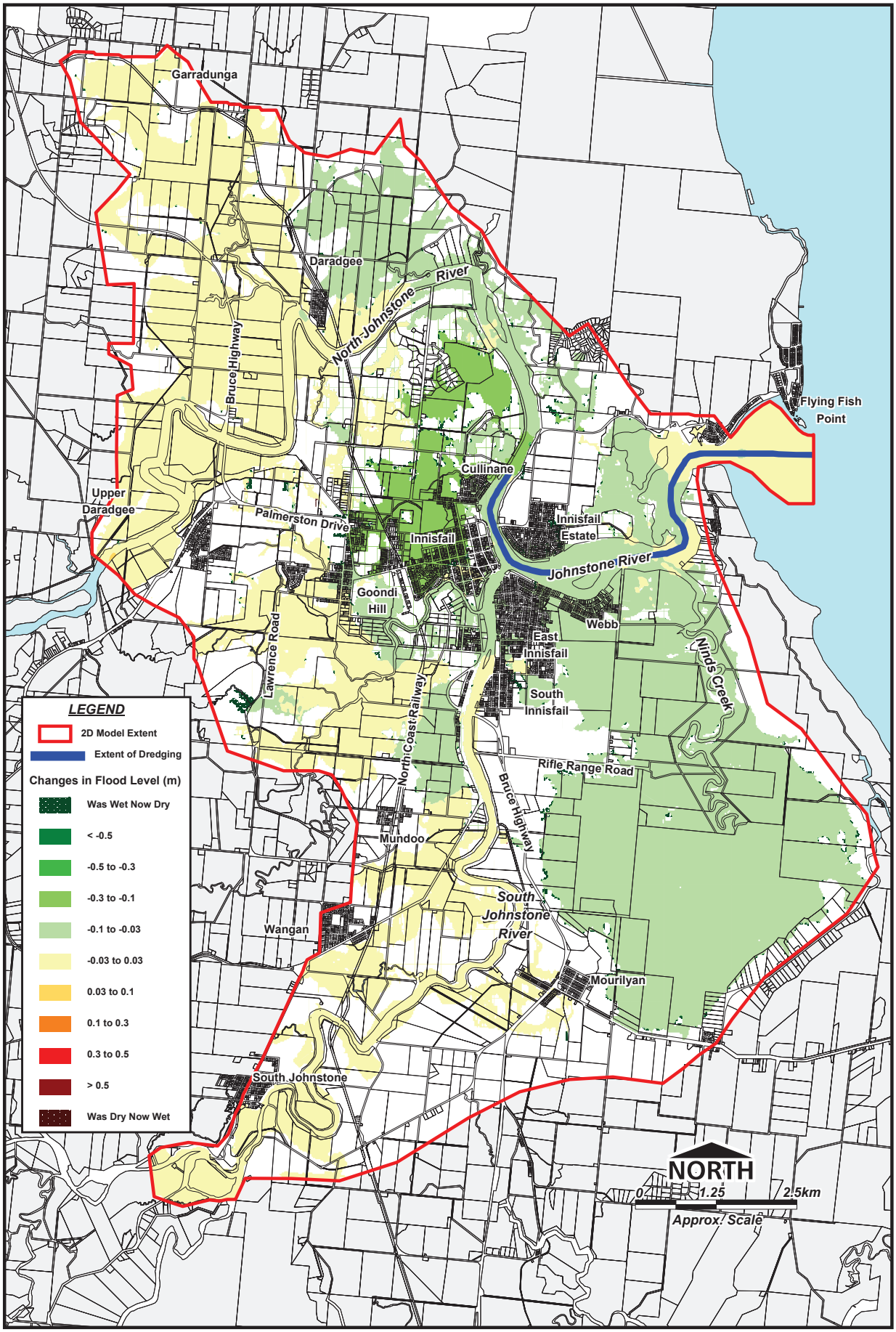
Impact of Scheme 2 Dredging on Peak 5 Year ARI Flood Levels

Figure 8-33



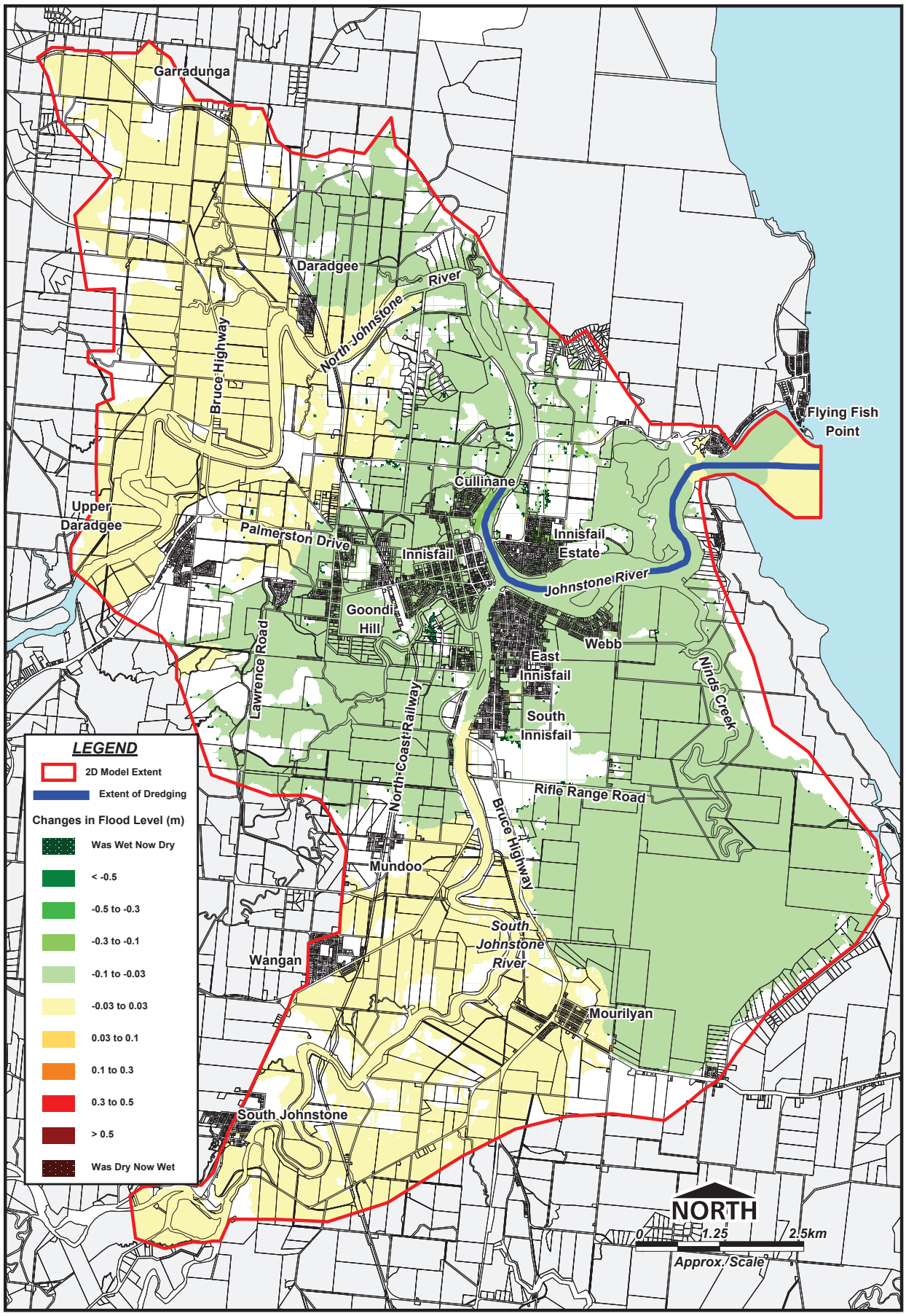
Impact of Scheme 2 Dredging on Peak 10 Year ARI Flood Levels

Figure 8-34



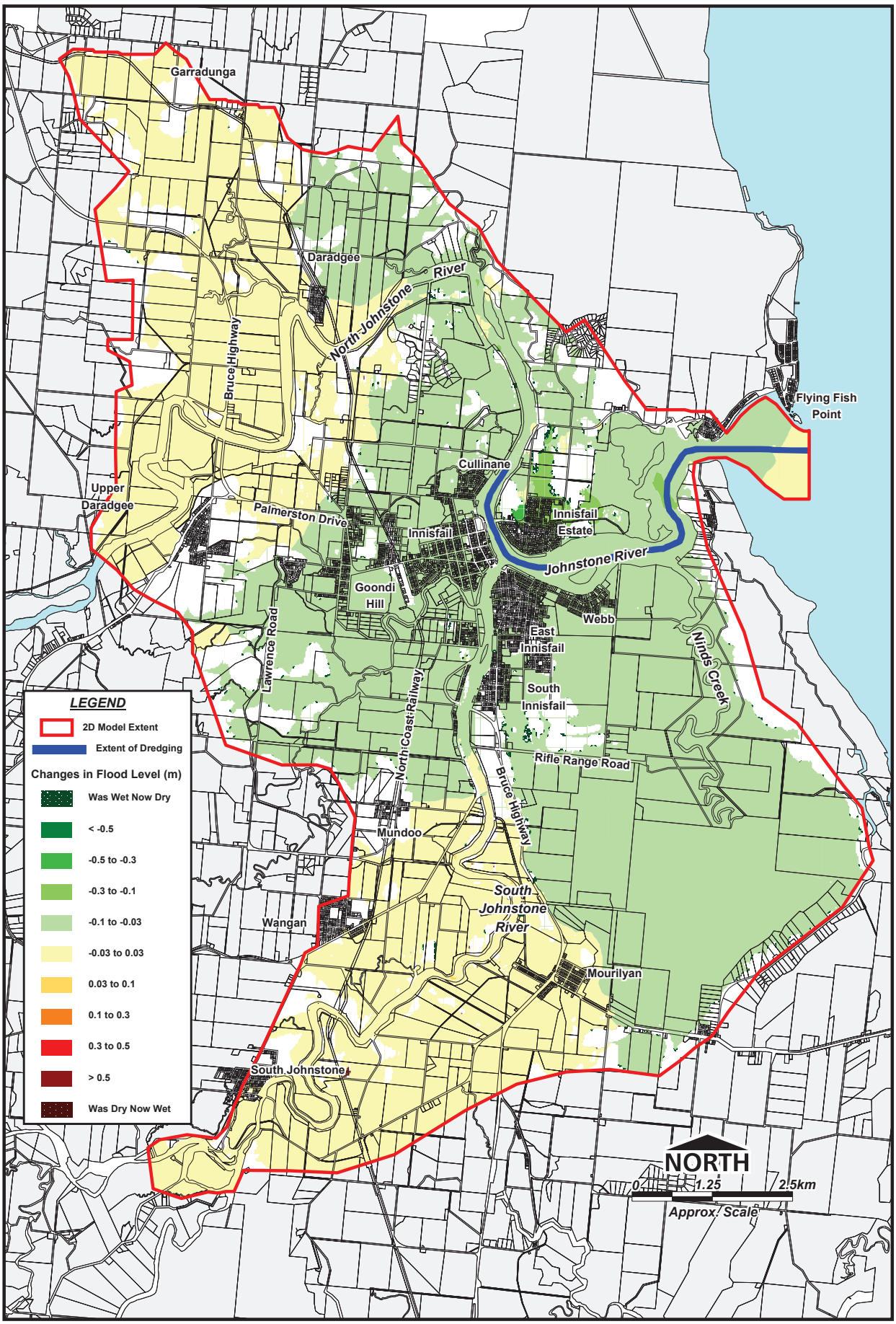
Impact of Scheme 2 Dredging on Peak 20 Year ARI Flood Levels

Figure 8-35



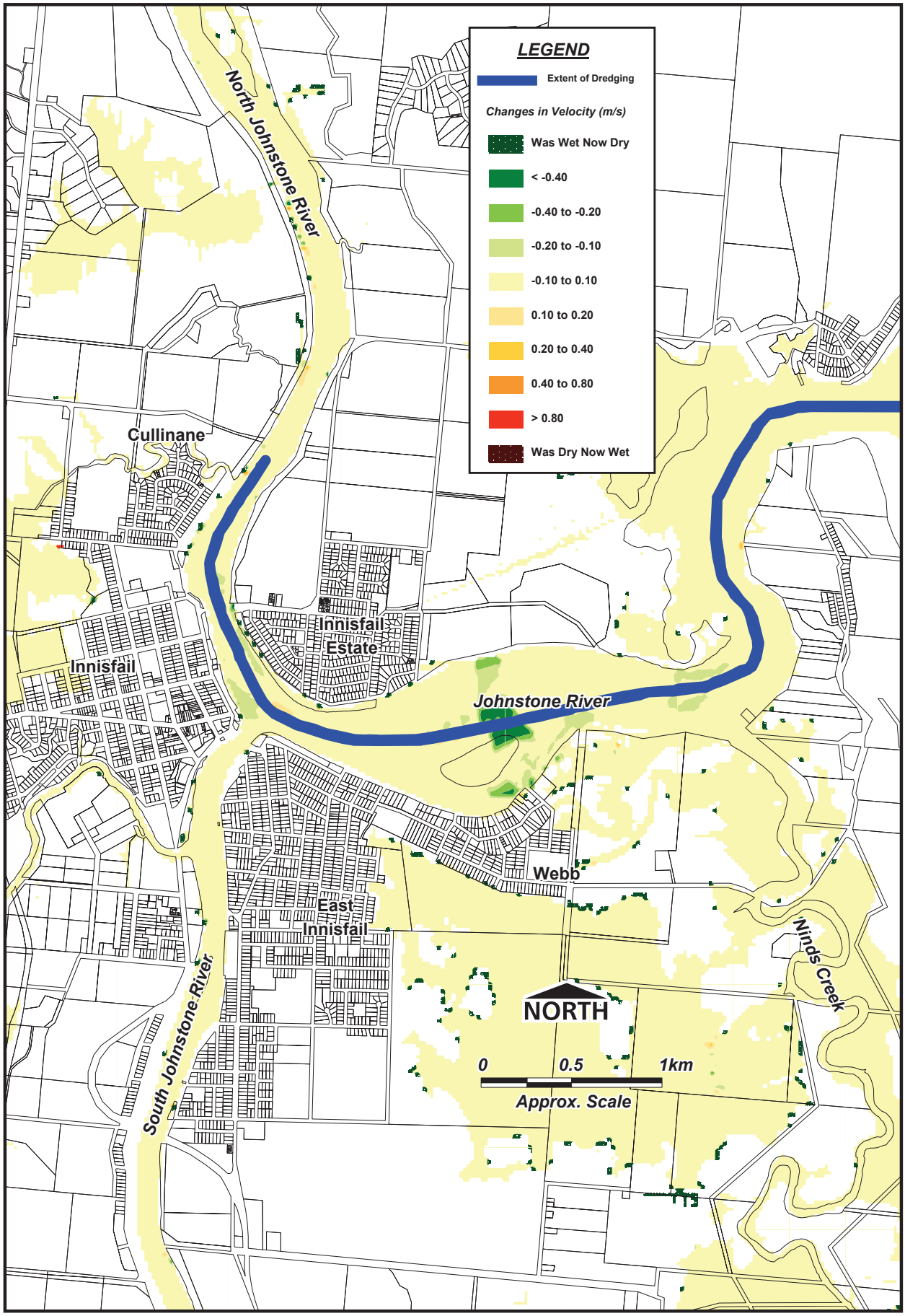
Impact of Scheme 2 Dredging on Peak 50 Year ARI Flood Levels

Figure 8-36



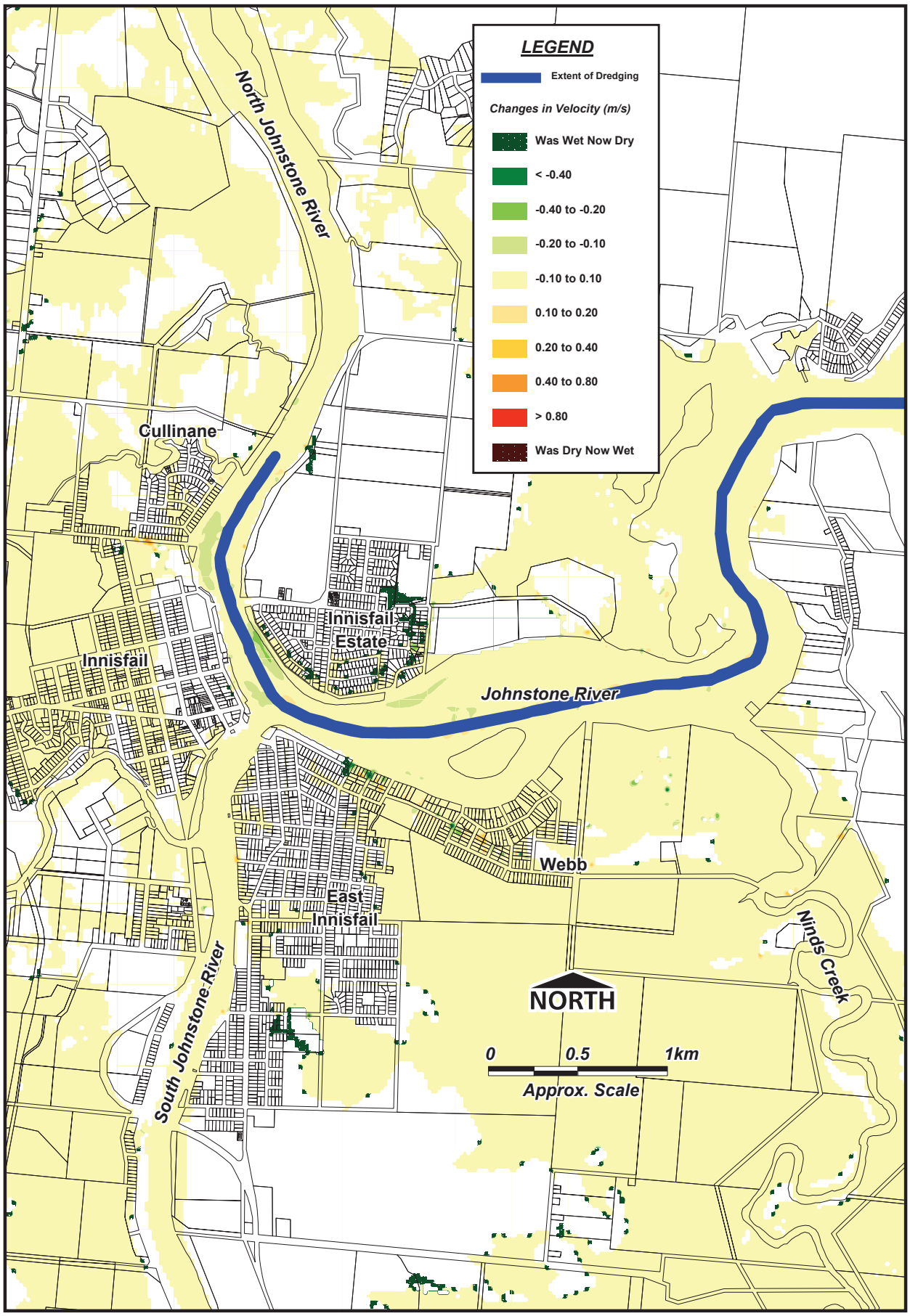
Impact of Scheme 2 Dredging on Peak 100 Year ARI Flood Levels

Figure 8-37



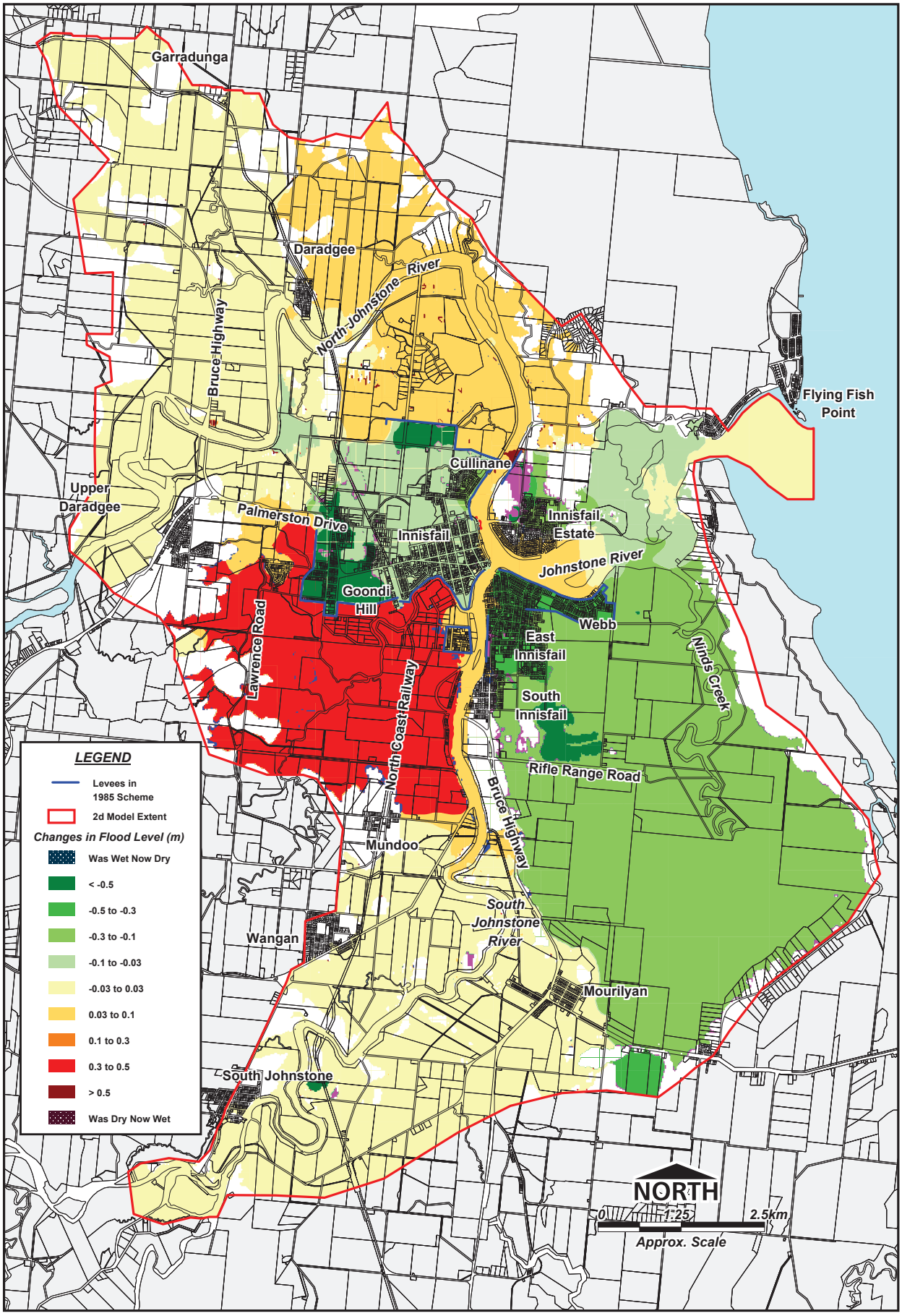
Impact of Scheme 2 Dredging on 2 Year ARI Velocities at the Flood Peak

Figure 8-38



Impact of Scheme 2 Dredging on 20 Year ARI Velocities at the Flood Peak

Figure 8-39

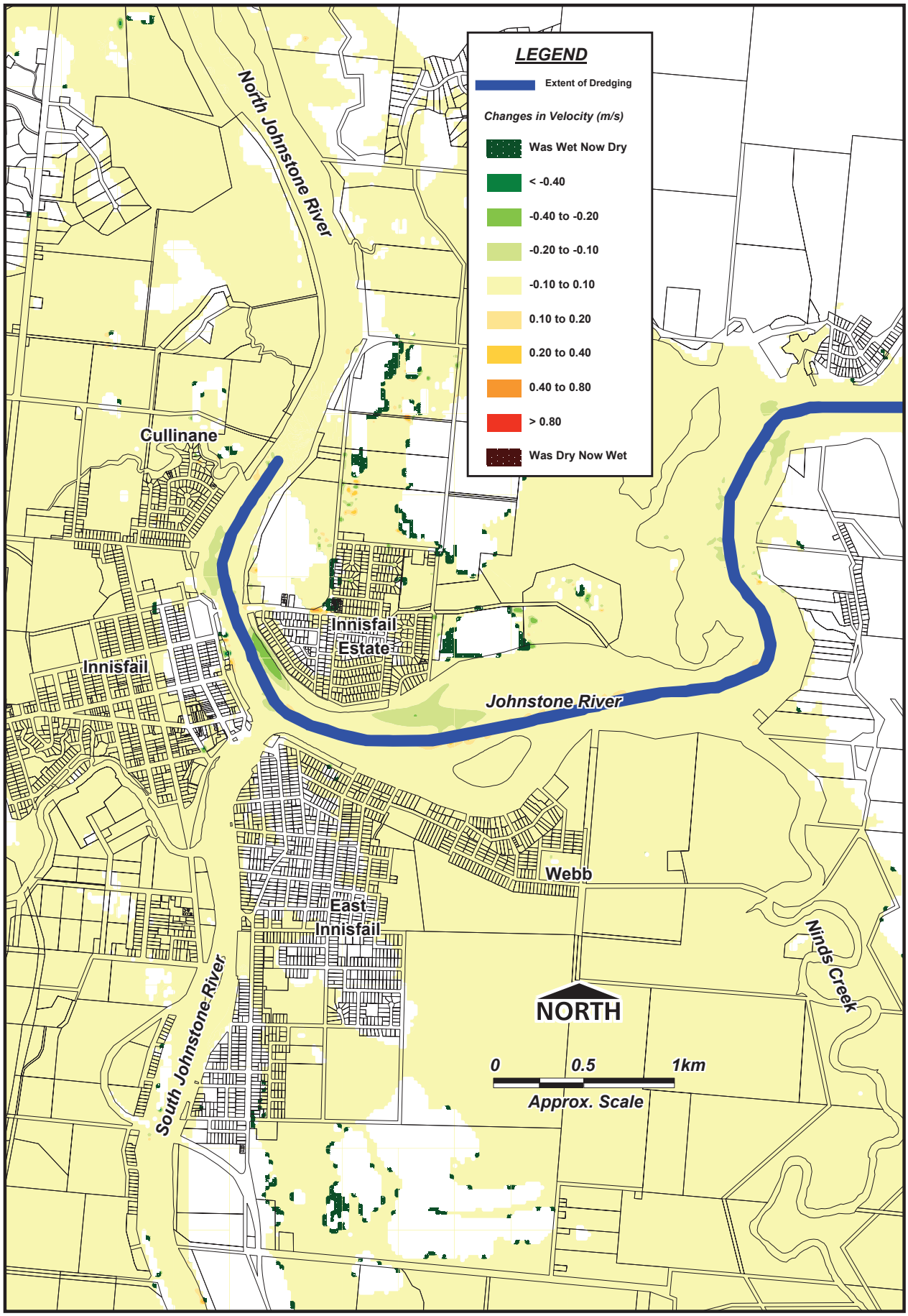


Impact of 1985 Levee Scheme on 100 Year ARI Peak Flood Levels

Figure 8-4

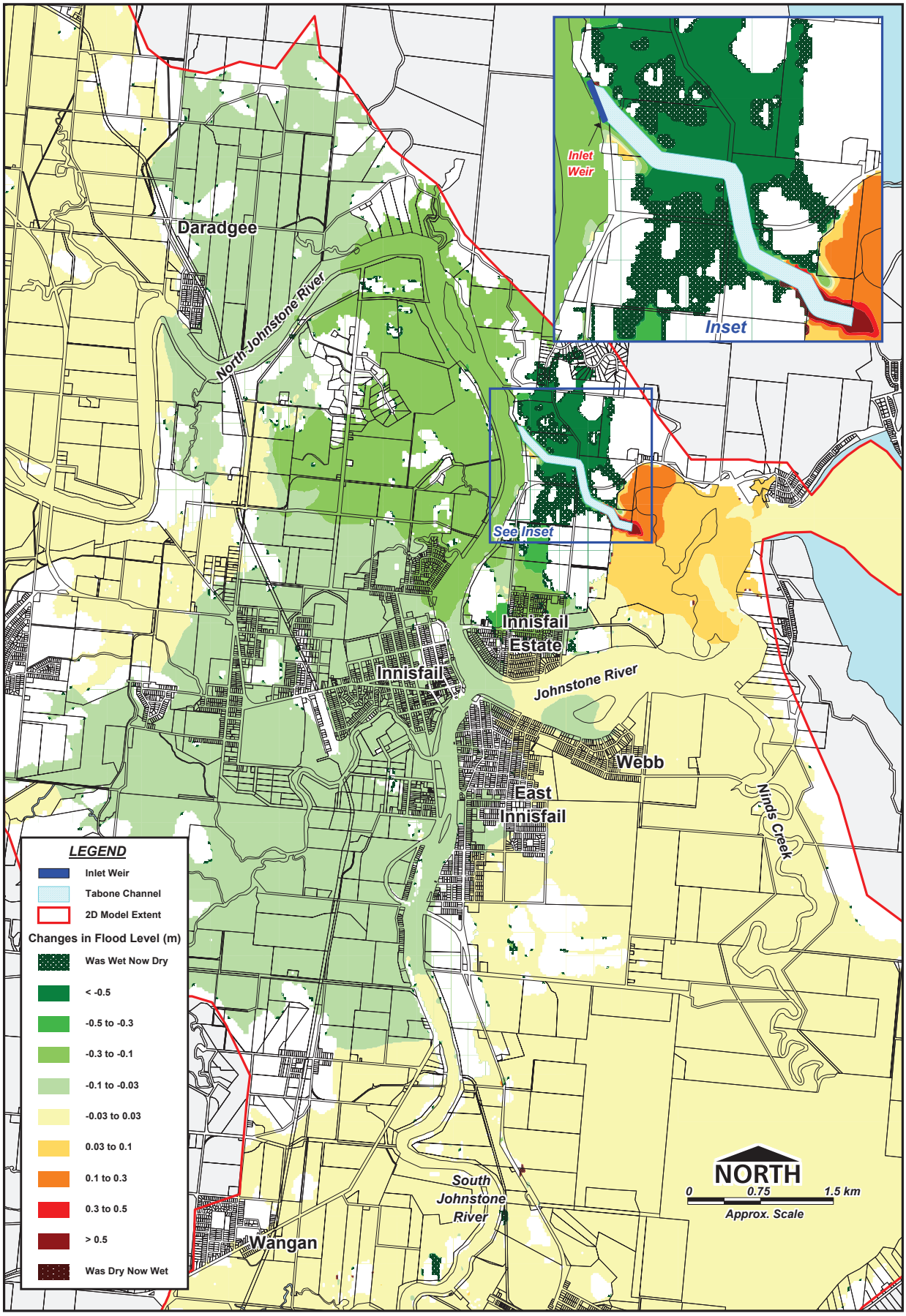
I:\jb12815_l_brh\Drawings\Cameron_85_Levee_100y_Max.wor

WBM OCEANICS AUSTRALIA



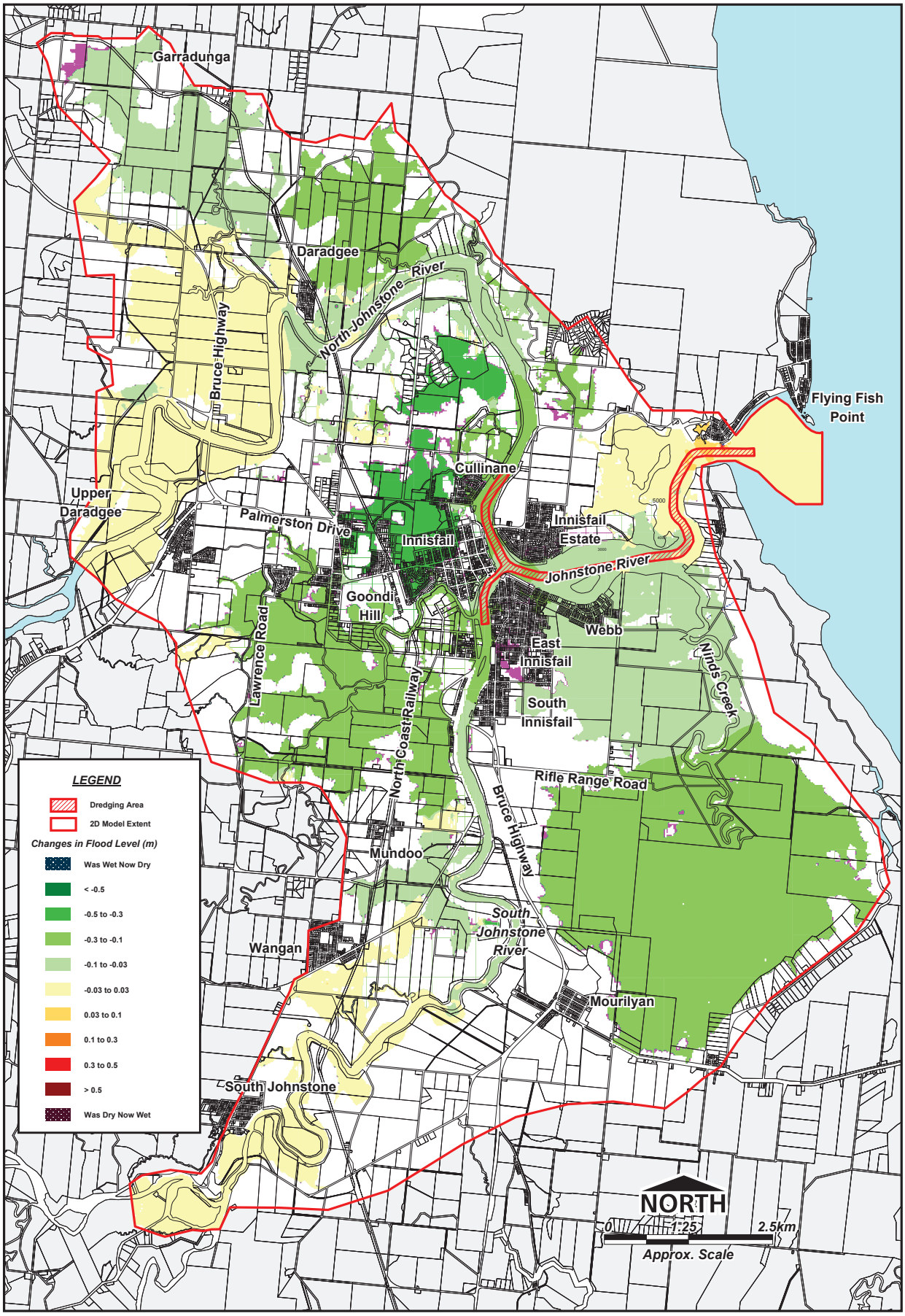
Impact of Scheme 2 Dredging on 100 Year ARI Velocities at the Flood Peak

Figure 8-40



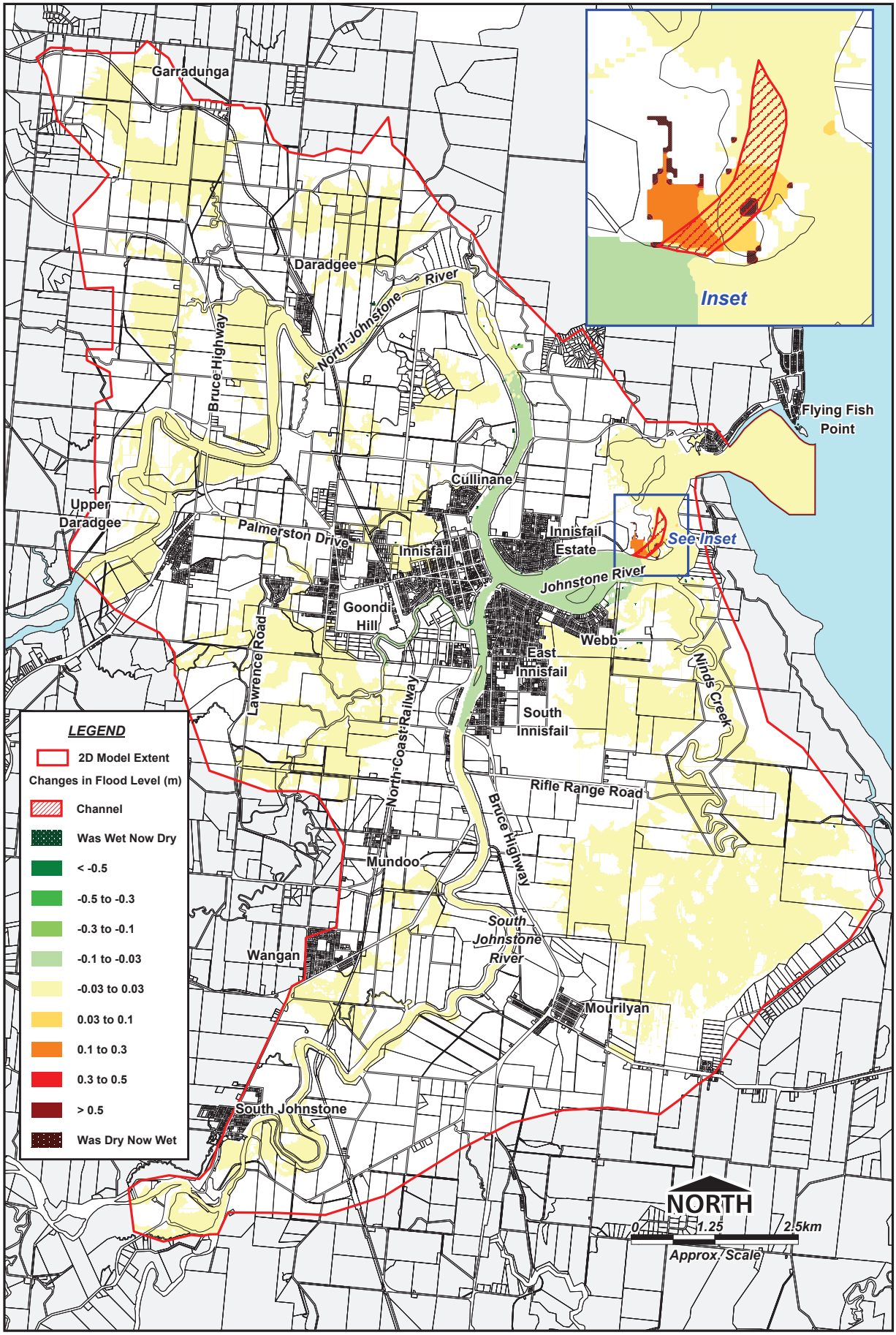
Impact of Tabone Channel on Peak 100 Year ARI Flood Levels

Figure 8-5



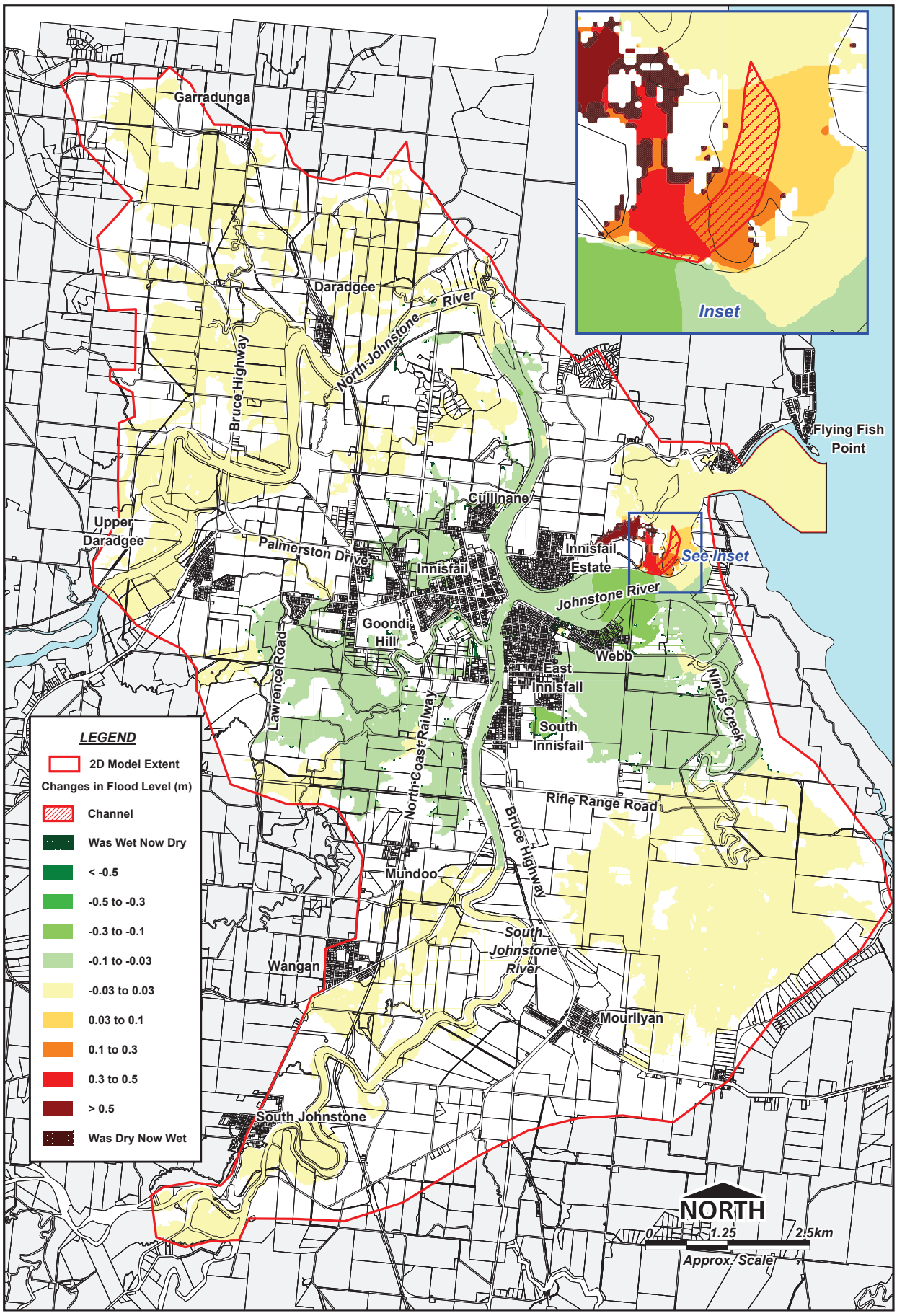
Impact of Scheme 1 Dredging on February 1999 Peak Flood Levels

Figure 8-6



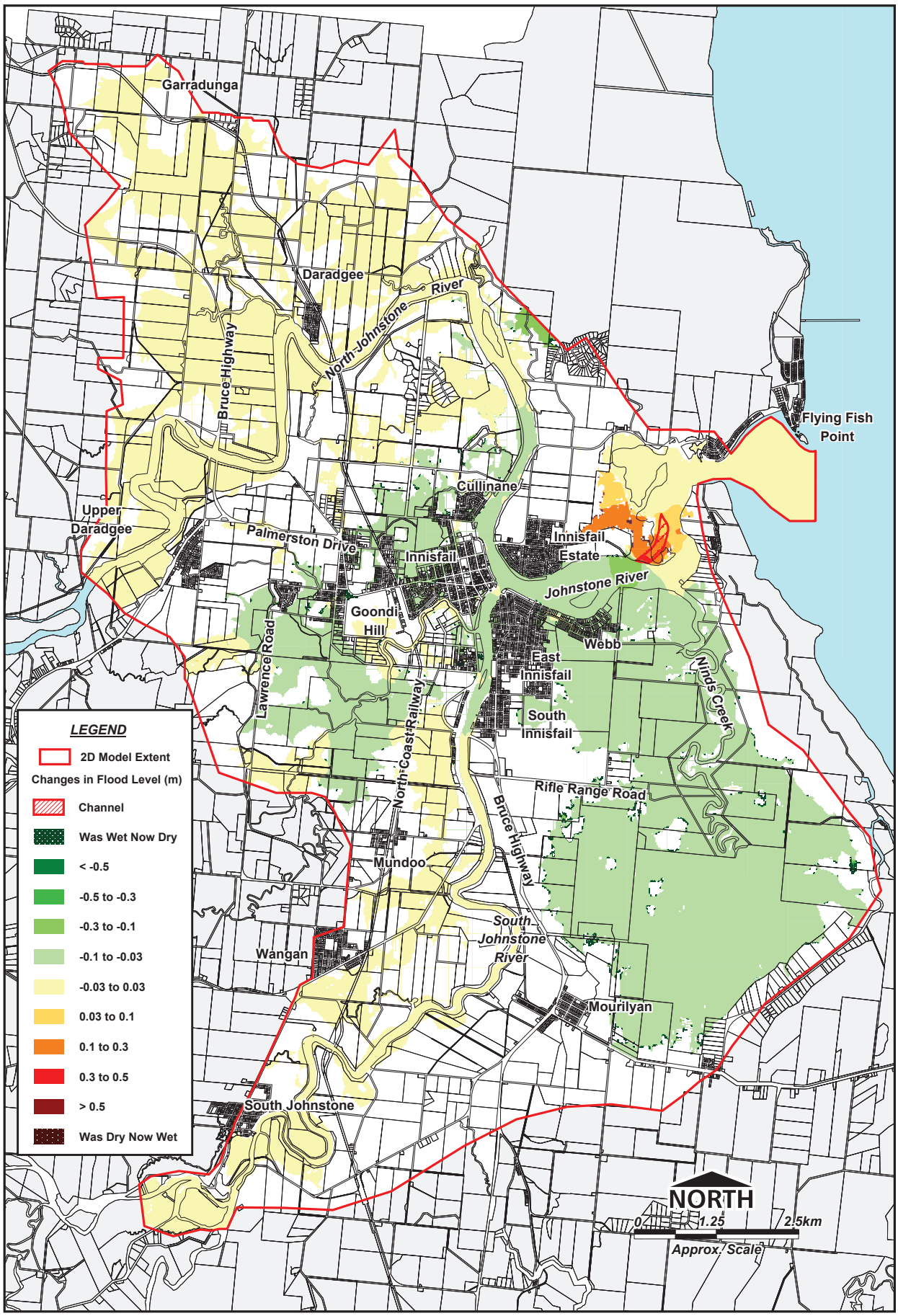
Impact of Carello's Channel on Peak 2 Year ARI Flood Levels

Figure 8-7



Impact of Carello's Channel on Peak 5 Year ARI Flood Levels

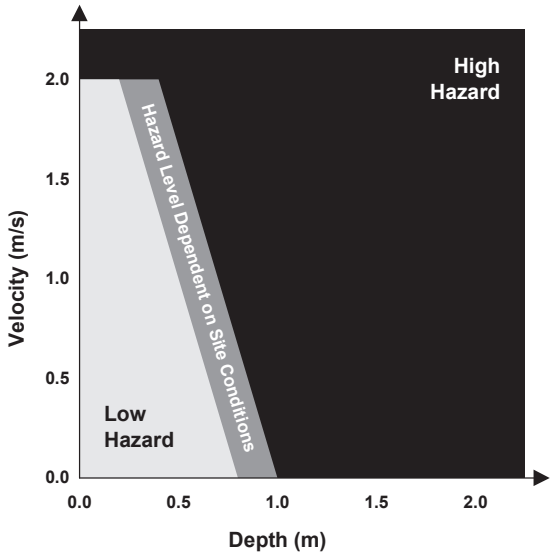
Figure 8-8



Impact of Carello's Channel on Peak 10 Year ARI Flood Levels

Figure 8-9

9 PROPERTY MODIFICATION MEASURES



Provisional Hazard Categories

Figure 9.1 DLWC (2001) Hazard Categories

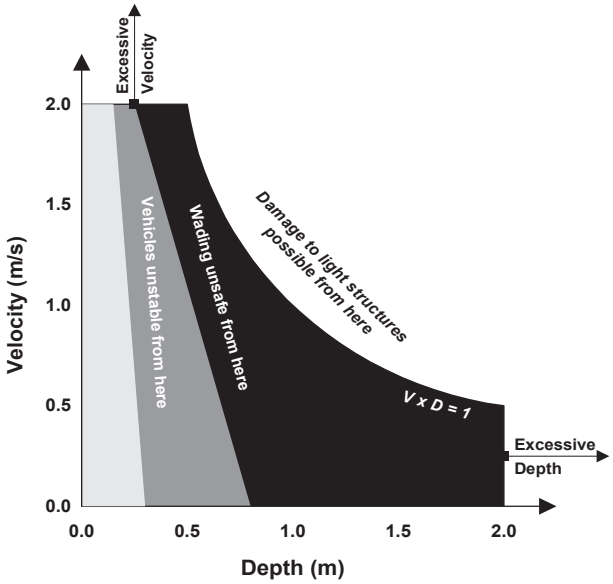


Figure 9.2 DLWC (2001) Velocity and Depth Relationships

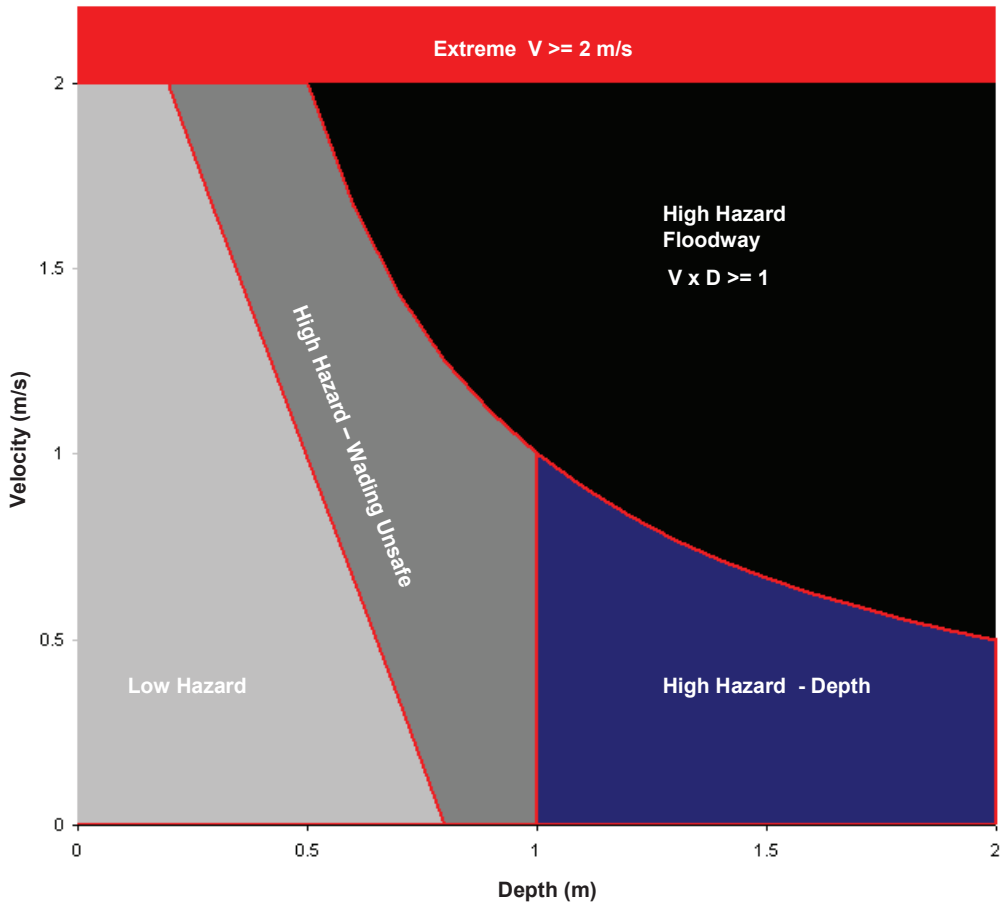
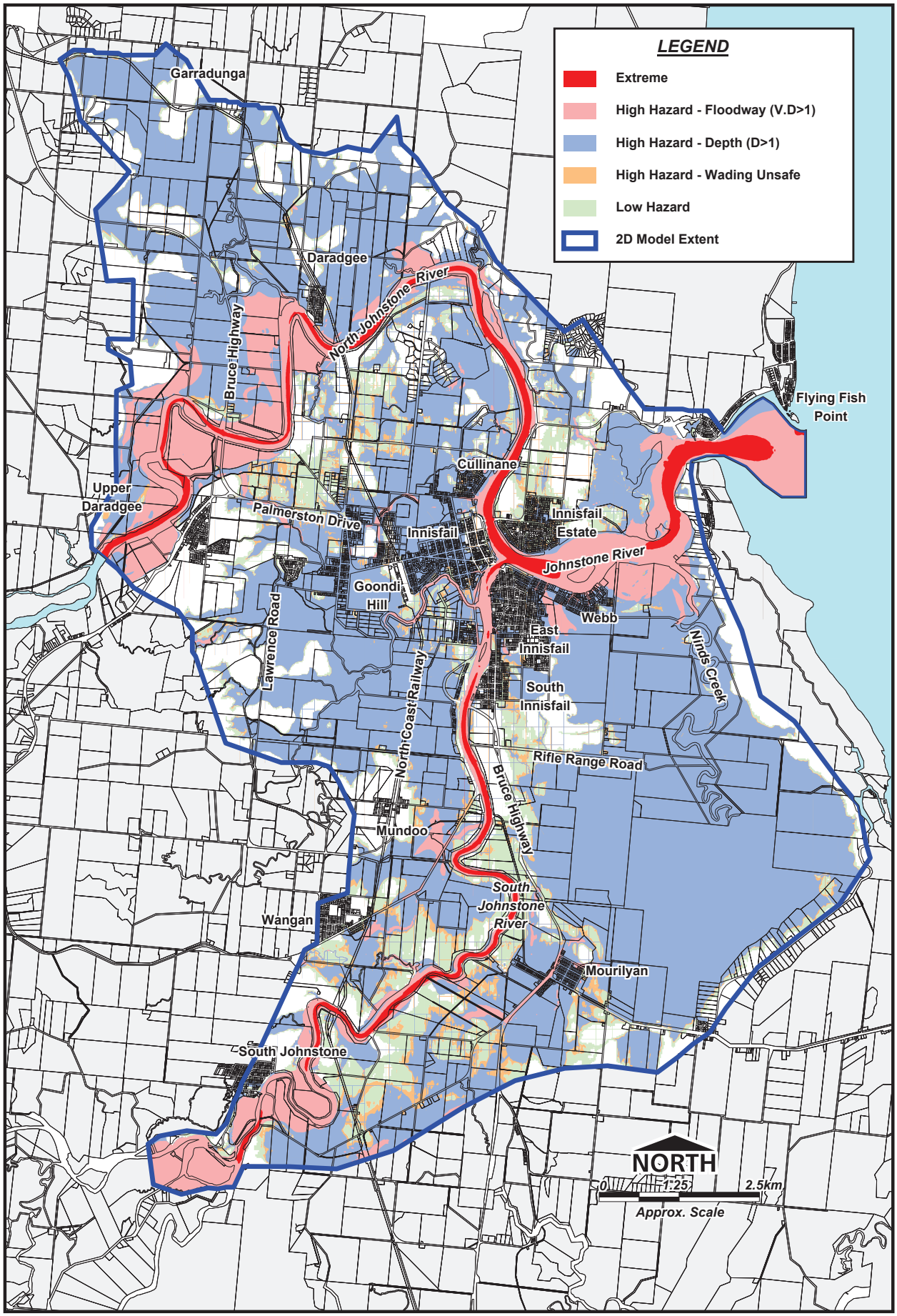


Figure 9.3 Definition of Recommended Flood Hazard Categories



100 Year ARI Flood Hazard Mapping

Figure 9-4

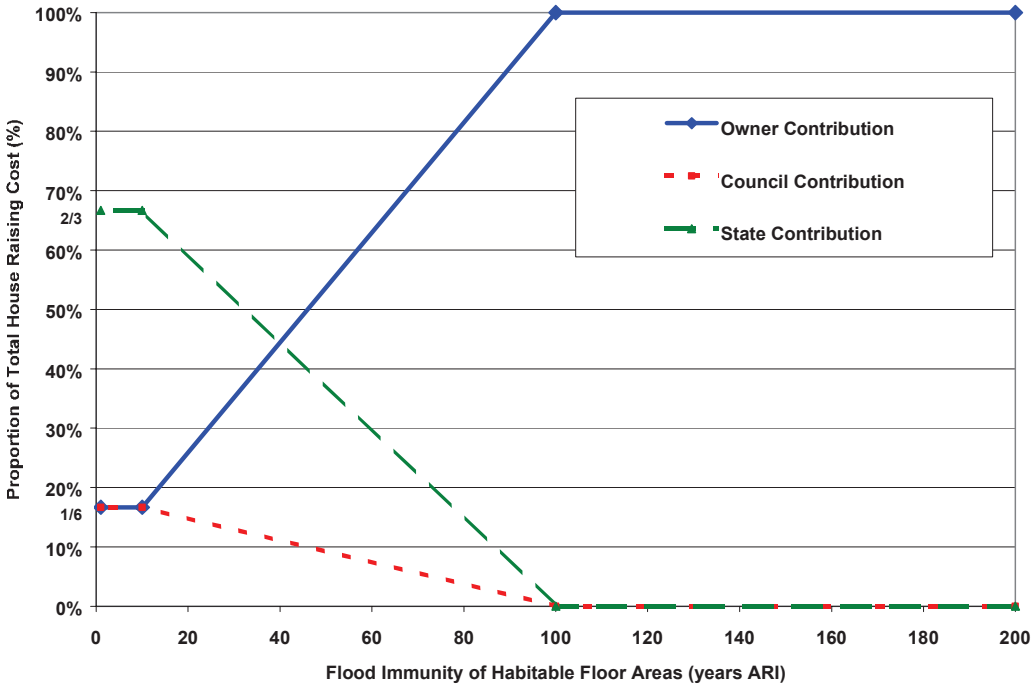


Figure 9.5 Example of Sliding Rule Funding Arrangement for House Raising

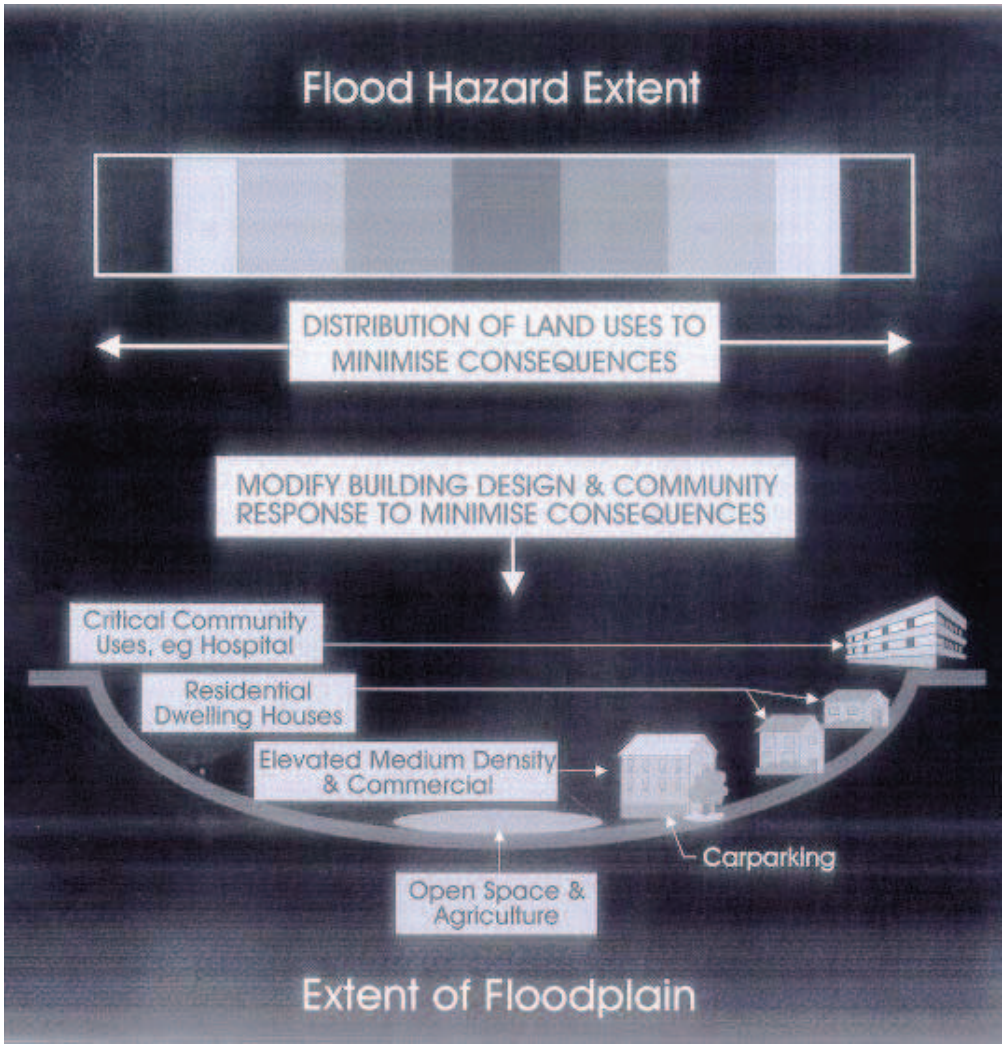


Figure 9.6 Flood Hazard Extent – NSW Floodplain Management Manual (DLWC, 2001)

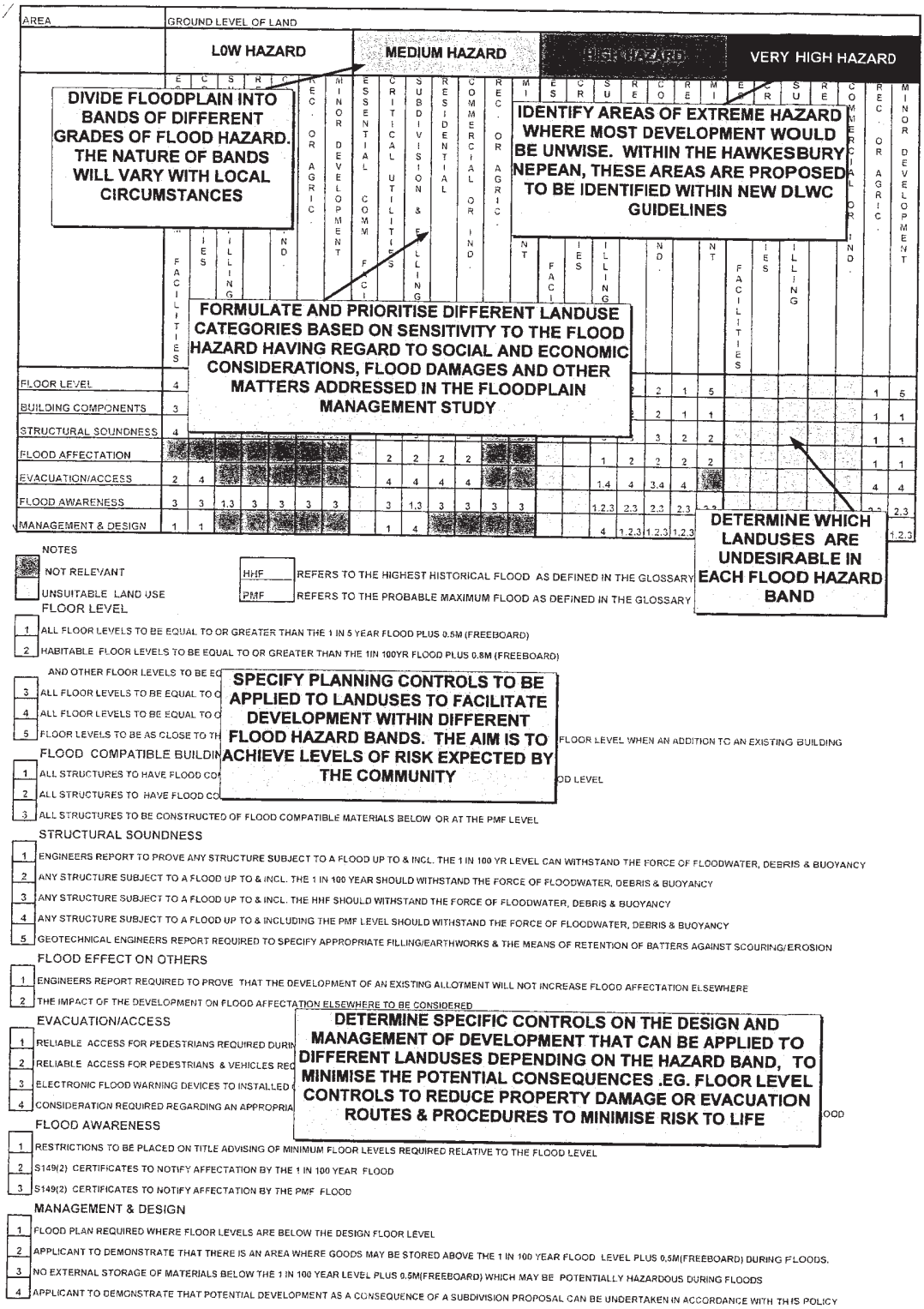


Figure 9.7 Planning Matrix

EXAMPLE FLOOD PLANNING MATRIX (Version 3)

TABLE 1: RESIDENTIAL, COMMERCIAL AND INDUSTRIAL DEVELOPMENT WITHIN AN URBAN AREA

Controls	Development / Building Type	No Hazard[1]	Flood Hazard Category		
			Low Hazard	High Depth Hazard	High Floodway Hazard
Land Use Suitability & Fill Level	Existing Lot - including infill subdivision	N/A	SF1	SF1	
	(this line not used)				
	Subdivision - en globo	N/A	SF2	SF2	
	Emergency Services Site (Hospitals, etc.)	N/A	SF3a		
	Other Community Service Building (School, etc.)	N/A	SF3b		
Floor Level	New Habitable Building	N/A	FL2c	FL2c	
	New Commercial or Industrial Building	N/A	FL2a	FL2a	
	New Emergency Service Building (Hospitals, etc.)	FL3a	FL3a		
	New Other Community Service Building (School, etc.)	FL3b	FL3b		
	New Ancillary Building (eg shed, carport)	N/A	FL1	FL1	
	Building Extension	N/A	FL4a	FL4b	
	(this line not used)				
Building Components		N/A	BC1	BC1	
Structural Soundness	Ancillary Building (eg. shed, carport)	N/A	SS1	SS1	
	Other Building	N/A	SS1	SS2	
Flood Effect	Existing Lot - including infill subdivision	N/A	FE2	FE2	
	Subdivision - en globo	N/A	FE2	FE2	
	New Ancillary Building (eg shed, carport)	N/A	FE2	FE2	
	Building Extension	N/A	FE1	FE2	
	Other Developments (road raising, etc)	N/A	FE2	FE2	FE3
Evacuation & Access	Existing Lot - including infill subdivision	N/A	EA1	EA1	
	Subdivision - en globo	N/A	EA3	EA3	
	Emergency Service Site (Hospitals, etc.)	N/A	EA4a		
	Other Community Service Site (Schools, etc.)	N/A	EA4b		
Flood Awareness, etc		N/A	FA2	FA2	FA2

Note 1: **An explanation of the criteria used to define the hazard categories is contained in the Johnstone River Flood Study (WBM Oceanics Australia, 2002)**

Note 2: **Small-scale development implies development on rural land that is small relative to the width of the floodplain and is not part of a planned large-sca development.**

Note 3: **Weatherproof Area Definition - Enclosed areas excluding garages / carports / open verandahs**

N/A	Controls Not Applicable
	Unsuitable Land Use - Not considered suitable for development
	LAND USE SUITABILITY & MINIMUM FILL LEVEL
SF1	Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For residential and commercial areas, the minimum fill level to be greater than or equal to the 100 year flood level. For industrial areas, the minimum fill level to be greater than or equal to the 10 year flood level.
SF3a	Consider for development subject to the controls below. Minimum fill level greater than or equal to the PMF flood level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood emergency. If the site is to be used for a flood emergency, the minimum fill level should preferably be greater than or equal to the PMF flood level.
	MINIMUM FLOOR LEVEL
FL1	No minimum floor level required (Council to advise developer of flood risk and potential damage to building & contents. Flood levels available on request)
FL2a	All floor levels to be greater than or equal to the 100 year flood level
FL2b	For permissible uses other than residential, it is preferable to have all floor levels greater than or equal to the 100 year flood level subject to industry standards and individual site assessment.
FL2c	All habitable floor levels to be greater than or equal to the 100 year flood level plus 0.3m
FL3a	All floor levels to be greater than or equal to the PMF flood level.
FL3b	If practical, some or all floor levels to be greater than or equal to the PMF flood level, so that these buildings will be available for accommodation / storage during and after a flood emergency.
FL4a	Habitable, commercial or industrial floor levels to be as close to the *minimum floor level* above as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area3 exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. If building is idenitified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
FL4b	As for FL4a with the maximum percentage increase in extended weatherproof area[3] to be: (a) 50% if the extension's floor level is less than one (1) metre below the 100 year flood level; (b) 25% if the extension's floor level is greater than two (2) metres below the 100 year flood level; or (c) pro-rata between 50% and 25% for floor levels from one (1) metre to two (2) metres below the 100 year flood level.
	BUILDING COMPONENTS
BC1	Buildings to have flood compatible material below the higher of (a) the minimum floor level or (b) the 1 in 100 year flood level plus 0.3m.
	STRUCTURAL SOUNDNESS
SS1	No structural soundness requirements for the force of floodwater, debris & buoyancy. Must still comply with BCA requirements.
SS2	Engineers report to prove that structures subject to a flood up to the 100 year event can withstand the force of floodwater, debris & buoyancy.
SS3	Engineers report to prove that structures subject to a flood up to the 500 year event can withstand the force of floodwater, debris & buoyancy.
	FLOOD EFFECT
FE1	No action required
FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below)
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere
	EVACUATION/ACCESS
EA1	Council to provide information on flood evacuation strategy
EA2	Not used
EA3	Site specific Flood Evacuation Strategy be developed consistent with Council / SES overall Flood Evacuation Strategy.
EA4a	Emergency service site - should have good access up to the PMF and preferably not cut-off from the main residential area(s). Council to evaluate suitablility of site in this respect.
EA4b	If site to be used during and after a flood emergency (see FL3b above), should have good access up to the PMF and preferably not cut-off from the main residential area(s).
	FLOOD AWARENESS
FA1	Not used
FA2	Not used

Figure 9-8 Example Planning Matrix - Residential, Commercial, Industrial Land Use k:\jb12815.clb\Management Measures\DCPDCP Version 3.xls

EXAMPLE FLOOD PLANNING MATRIX (Version 3)

TABLE 2: DEVELOPMENT IN RURAL AREAS

			Flood Hazard Category		
Controls	**Development / Building Type**	**No Hazard[1]**	**Low Hazard**	**High Depth Hazard**	**High Floodway Hazard**
Land Use Suitability & Fill Level	Habitable Building	N/A	SF1	SF1	
	Ancillary Building (eg. shed)	N/A	SF1	SF1	SF1
	Other Developments (eg. levees, roads, dams, etc)	N/A	SF1	SF1	SF1
	Emergency Services Site (Hospitals, etc.)	N/A	SF3a		
	Other Community Service Building (School, etc.)	N/A	SF3b	SF3b	
Floor Level	New Habitable Building	N/A	FL2c	FL2c	
	(this line not used)				
	New Emergency Service Building (Hospitals, etc.)	FL3a	FL3a		
	New Other Community Service Building (School, etc.)	FL3b	FL3b		
	New Ancillary Building (eg shed, carport)	N/A	FL1	FL1	FL1
	Building Extension	N/A	FL4a	FL4b	
	New Rural Industry	N/A	FL2b	FL2b	
Building Components		N/A	BC1	BC1	BC1
Structural Soundness	Small-scale[2] Development (eg. shed, small dam)	N/A	SS1	SS1	SS2
	Large-scale Development (eg. levee, raised road)	N/A	SS1	SS2	SS2
Flood Effect	Small-scale[2] Development (eg. shed, small dam)	N/A	FE1	FE2	FE2
	Large-scale Development (eg. levee, raised road)	N/A	FE2	FE3	FE3
	(this line not used)				
	(this line not used)				
	(this line not used)				
Evacuation & Access	Habitable Building	N/A	EA1	EA1	
	(this line not used)				
	Emergency Service Site (Hospitals, etc.)	N/A	EA4a		
	Other Community Service Site (Schools, etc.)	N/A	EA4b		
Flood Awareness, etc		N/A	FA2	FA2	FA2

Note 1: **An explanation of the criteria used to define the hazard categories is contained in the Johnstone River Flood Study (WBM Oceanics Australia, 2002)**

Note 2: **Small-scale development implies development on rural land that is small relative to the width of the floodplain and is not part of a planned large-scale development.**

Note 3: **Weatherproof Area Definition - Enclosed areas excluding garages / carports / open verandahs**

Control Measures

N/A	Controls Not Applicable
	Unsuitable Land Use - Not considered suitable for development
	LAND USE SUITABILITY & MINIMUM FILL LEVEL
SF1	Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For residential and commercial areas, the minimum fill level to be greater than or equal to the 100 year flood level. For industrial areas, the minimum fill level to be greater than or equal to the 10 year flood level.
SF3a	Consider for development subject to the controls below. Minimum fill level greater than or equal to the PMF flood level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood emergency. If the site is to be used for a flood emergency, the minimum fill level should preferably be greater than or equal to the PMF flood level.
	MINIMUM FLOOR LEVEL
FL1	No minimum floor level required (Council to advise developer of flood risk and potential damage to building & contents. Flood levels available on request)
FL2a	All floor levels to be greater than or equal to the 100 year flood level
FL2b	For permissible uses other than residential, it is preferable to have all floor levels greater than or equal to the 100 year flood level subject to industry standards and individual site assessment.
FL2c	All habitable floor levels to be greater than or equal to the 100 year flood level plus 0.3m
FL3a	All floor levels to be greater than or equal to the PMF flood level.
FL3b	If practical, some or all floor levels to be greater than or equal to the PMF flood level, so that these buildings will be available for accommodation / storage during and after a flood emergency.
FL4a	Habitable, commercial or industrial floor levels to be as close to the *minimum floor level* above as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area[3] exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. If building is idenitified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
FL4b	As for FL4a with the maximum percentage increase in extended weatherproof area[3] to be: (a) 50% if the extension's floor level is less than one (1) metre below the 100 year flood level; (b) 25% if the extension's floor level is greater than two (2) metres below the 100 year flood level; or (c) pro-rata between 50% and 25% for floor levels from one (1) metre to two (2) metres below the 100 year flood level.
	BUILDING COMPONENTS
BC1	Buildings to have flood compatible material below the higher of (a) the minimum floor level or (b) the 1 in 100 year flood level plus 0.3m.
	STRUCTURAL SOUNDNESS
SS1	No structural soundness requirements for the force of floodwater, debris & buoyancy. Must still comply with BCA requirements.
SS2	Engineers report to prove that structures subject to a flood up to the 100 year event can withstand the force of floodwater, debris & buoyancy.
SS3	Engineers report to prove that structures subject to a flood up to the 500 year event can withstand the force of floodwater, debris & buoyancy.
	FLOOD EFFECT
FE1	No action required
FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below)
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere
	EVACUATION/ACCESS
EA1	Council to provide information on flood evacuation strategy
EA2	Not used
EA3	Site specific Flood Evacuation Strategy be developed consistent with Council / SES overall Flood Evacuation Strategy.
EA4a	Emergency service site - should have good access up to the PMF and preferably not cut-off from the main residential area(s). Council to evaluate suitablility of site in this respect.
EA4b	If site to be used during and after a flood emergency (see FL3b above), should have good access up to the PMF and preferably not cut-off from the main residential area(s).
	FLOOD AWARENESS
FA1	Not used
FA2	Not used

Figure 9-9 Example Planning Matrix - Rural Land Uses

EXAMPLE FLOOD PLANNING MATRIX (Version 3)

TABLE 3: OTHER

Controls	Development / Building Type	Flood Hazard Category			
		No Hazard[1]	Low Hazard	High Depth Hazard	High Floodway Hazard
Land Use Suitability & Fill Level	Non-Habitable Building (shed, toilets, shelter, etc)	N/A	SF1	SF1	SF1
	(this line not used)				
	Other Developments (eg. levees, roads, dams, etc)	N/A	SF1	SF1	SF1
	(this line not used)				
	(this line not used)				
Floor Level	(this line not used)	N/A	N/A	N/A	N/A
	(this line not used)				
	(this line not used)				
	(this line not used)				
	(this line not used)				
	(this line not used)				
	(this line not used)				
Building Components		N/A	BC1	BC1	BC1
Structural	Small-scale[2] Development (eg. shed, small dam)	N/A	SS1	SS1	SS2
Soundness	Large-scale Development (eg. levee, raised road)	N/A	SS1	SS2	SS2
Flood Effect	Small-scale Development (eg. shed, small dam)	N/A	FE1	FE2	FE2
	Large-scale Development (eg. levee, raised road)	N/A	FE2	FE3	FE3
	(this line not used)				
	(this line not used)				
	(this line not used)				
Evacuation & Access	Not Applicable				
	(this line not used)				
	(this line not used)				
	(this line not used)				
Flood Awareness, etc	Not Applicable				

Note 1: **An explanation of the criteria used to define the hazard categories is contained in the Johnstone River Flood Study (WBM Oceanics Australia, 2002)**

Note 2: **Small-scale development implies development on rural land that is small relative to the width of the floodplain and is not part of a planned large-scale development.**

Note 3: **Weatherproof Area Definition - Enclosed areas excluding garages / carports / open verandahs**

Control Measures

N/A	Controls Not Applicable
	Unsuitable Land Use - Not considered suitable for development
	LAND USE SUITABILITY & MINIMUM FILL LEVEL
SF1	Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For residential and commercial areas, the minimum fill level to be greater than or equal to the 100 year flood level. For industrial areas, the minimum fill level to be greater than or equal to the 10 year flood level.
SF3a	Consider for development subject to the controls below. Minimum fill level greater than or equal to the PMF flood level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood emergency. If the site is to be used for a flood emergency, the minimum fill level should preferably be greater than or equal to the PMF flood level.
	MINIMUM FLOOR LEVEL
FL1	No minimum floor level required (Council to advise developer of flood risk and potential damage to building & contents. Flood levels available on request)
FL2a	All floor levels to be greater than or equal to the 100 year flood level
FL2b	For permissible uses other than residential, it is preferable to have all floor levels greater than or equal to the 100 year flood level subject to industry standards and individual site assessment.
FL2c	All habitable floor levels to be greater than or equal to the 100 year flood level plus 0.3m
FL3a	All floor levels to be greater than or equal to the PMF flood level.
FL3b	If practical, some or all floor levels to be greater than or equal to the PMF flood level, so that these buildings will be available for accommodation / storage during and after a flood emergency.
FL4a	Habitable, commercial or industrial floor levels to be as close to the *minimum floor level* above as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area[3] exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. If building is idenitified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
FL4b	As for FL4a with the maximum percentage increase in extended weatherproof area[3] to be: (a) 50% if the extension's floor level is less than one (1) metre below the 100 year flood level; (b) 25% if the extension's floor level is greater than two (2) metres below the 100 year flood level; or (c) pro-rata between 50% and 25% for floor levels from one (1) metre to two (2) metres below the 100 year flood level.
	BUILDING COMPONENTS
BC1	Buildings to have flood compatible material below the higher of (a) the minimum floor level or (b) the 1 in 100 year flood level plus 0.3m.
	STRUCTURAL SOUNDNESS
SS1	No structural soundness requirements for the force of floodwater, debris & buoyancy. Must still comply with BCA requirements.
SS2	Engineers report to prove that structures subject to a flood up to the 100 year event can withstand the force of floodwater, debris & buoyancy.
SS3	Engineers report to prove that structures subject to a flood up to the 500 year event can withstand the force of floodwater, debris & buoyancy.
	FLOOD EFFECT
FE1	No action required
FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below)
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere
	EVACUATION/ACCESS
EA1	Council to provide information on flood evacuation strategy
EA2	Not used
EA3	Site specific Flood Evacuation Strategy be developed consistent with Council / SES overall Flood Evacuation Strategy.
EA4a	Emergency service site - should have good access up to the PMF and preferably not cut-off from the main residential area(s). Council to evaluate suitablility of site in this respect.
EA4b	If site to be used during and after a flood emergency (see FL3b above), should have good access up to the PMF and preferably not cut-off from the main residential area(s).
	FLOOD AWARENESS
FA1	Not used
FA2	Not used

Figure 9-10 Example Planning Matrix - Other Land Uses

10 RESPONSE MODIFICATION MEASURES

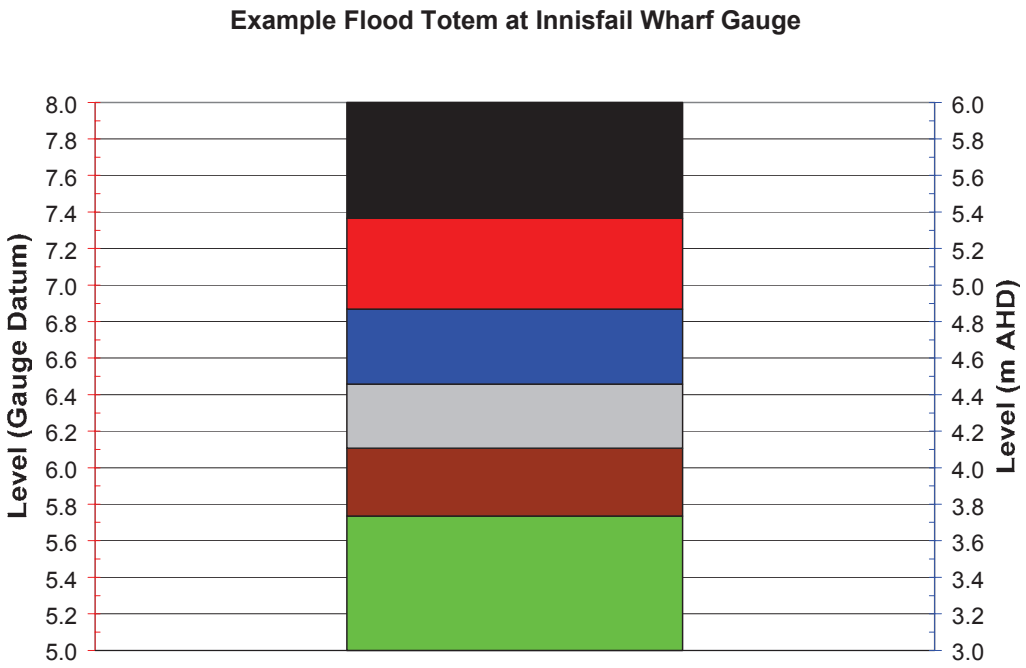


Figure 10.1 Flood Classification at Johnstone River Gauge at Innisfail Wharf

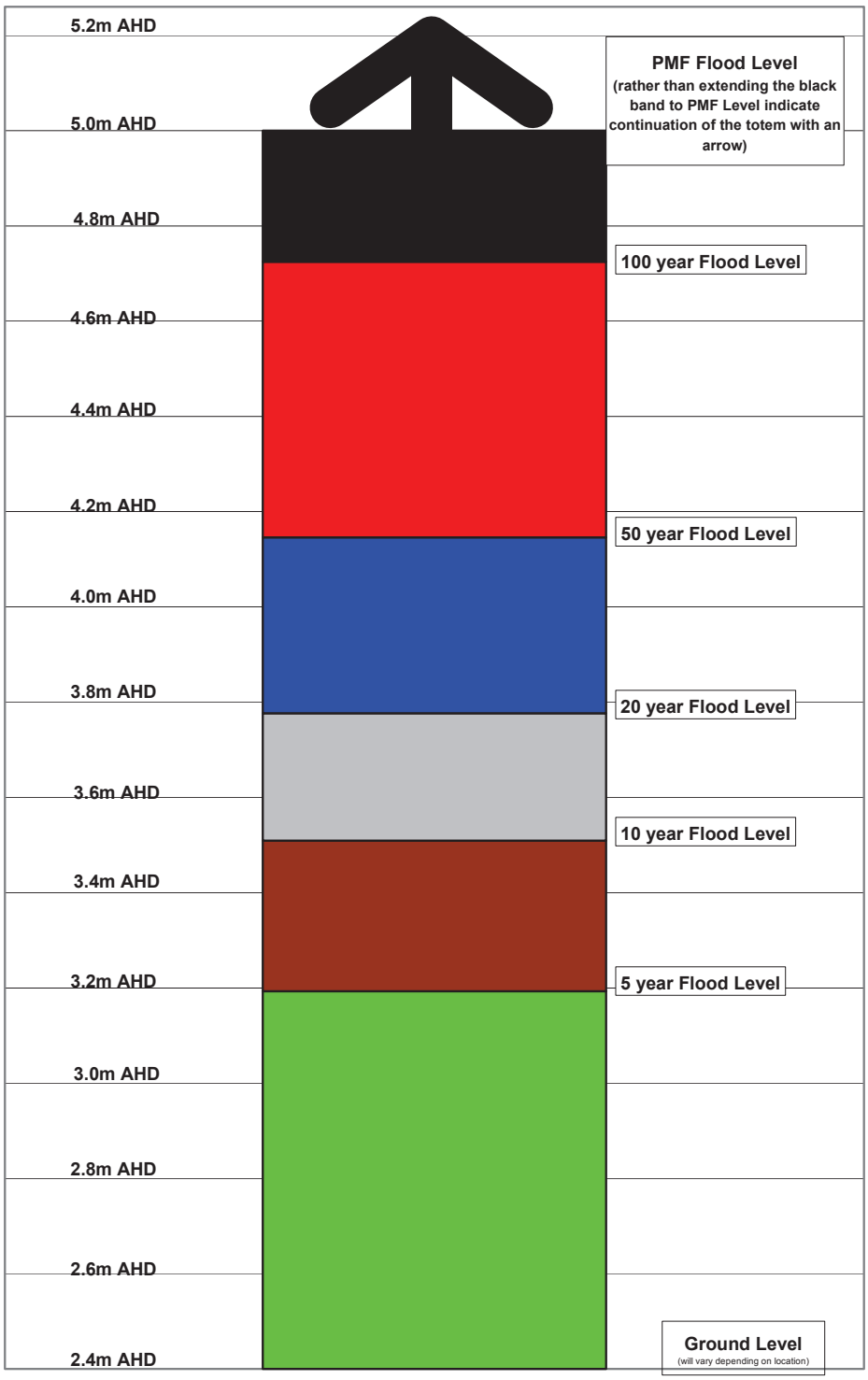


Figure 10.2 Example Flood Totem cnr Jodrell and Marjorie Streets

Note that the actual totem would only show colours, not flood levels or flood ARI.

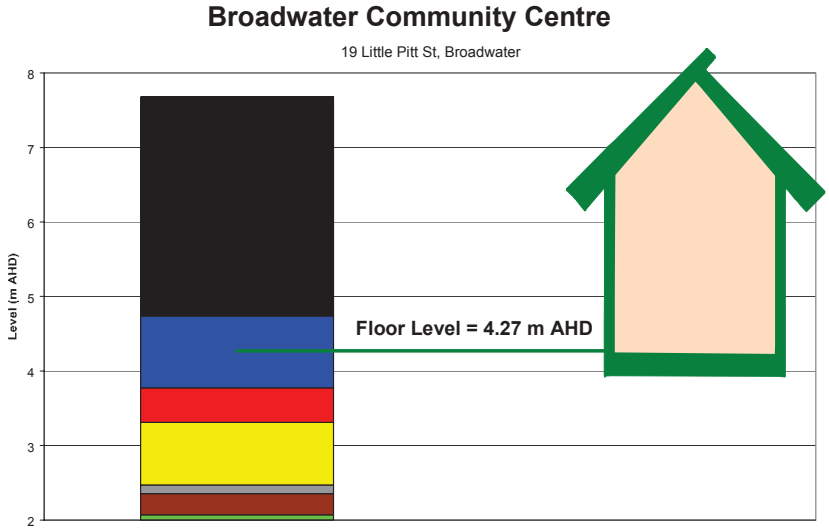


Figure 10.3 Example of Classification of Evacuation Centre

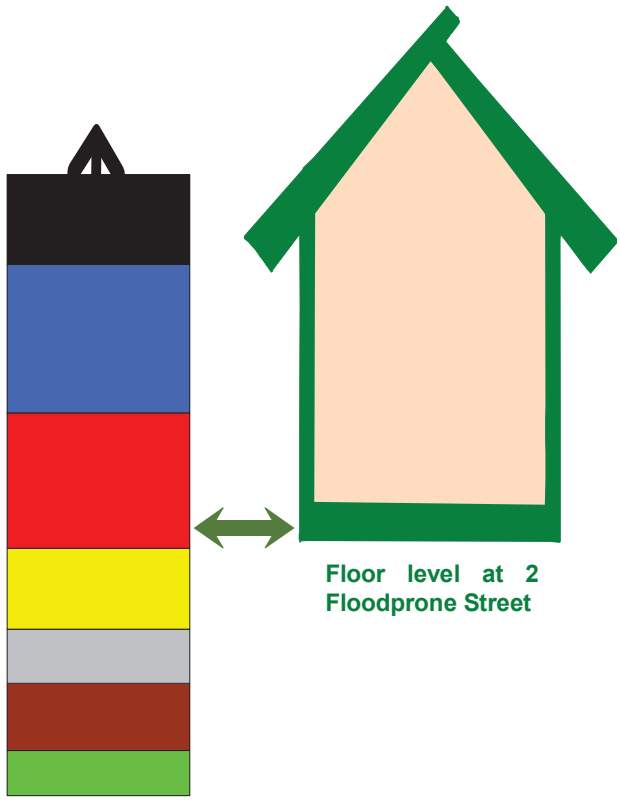


Figure 10.4 Example of a Household Flood Diagram

11 REFERENCES