

Appendix F – Sensitivity Testing



Legend

Watercourse

Flood Depth (m)

- 0.00 - 0.05
- 0.05 - 0.10
- 0.10 - 0.2
- 0.20 - 0.30
- 0.30 - 0.40
- 0.40 - 0.50
- 0.50 - 1.00
- > 1.00

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Revision Details	By	Date	Suffix

Drawing Status

Job Title
 Llanmaes Flood Alleviation Scheme

Drawing Title
 Flood Depth Sensitivity Proposed Option +20%
 1% AEP + 30% Climate Change

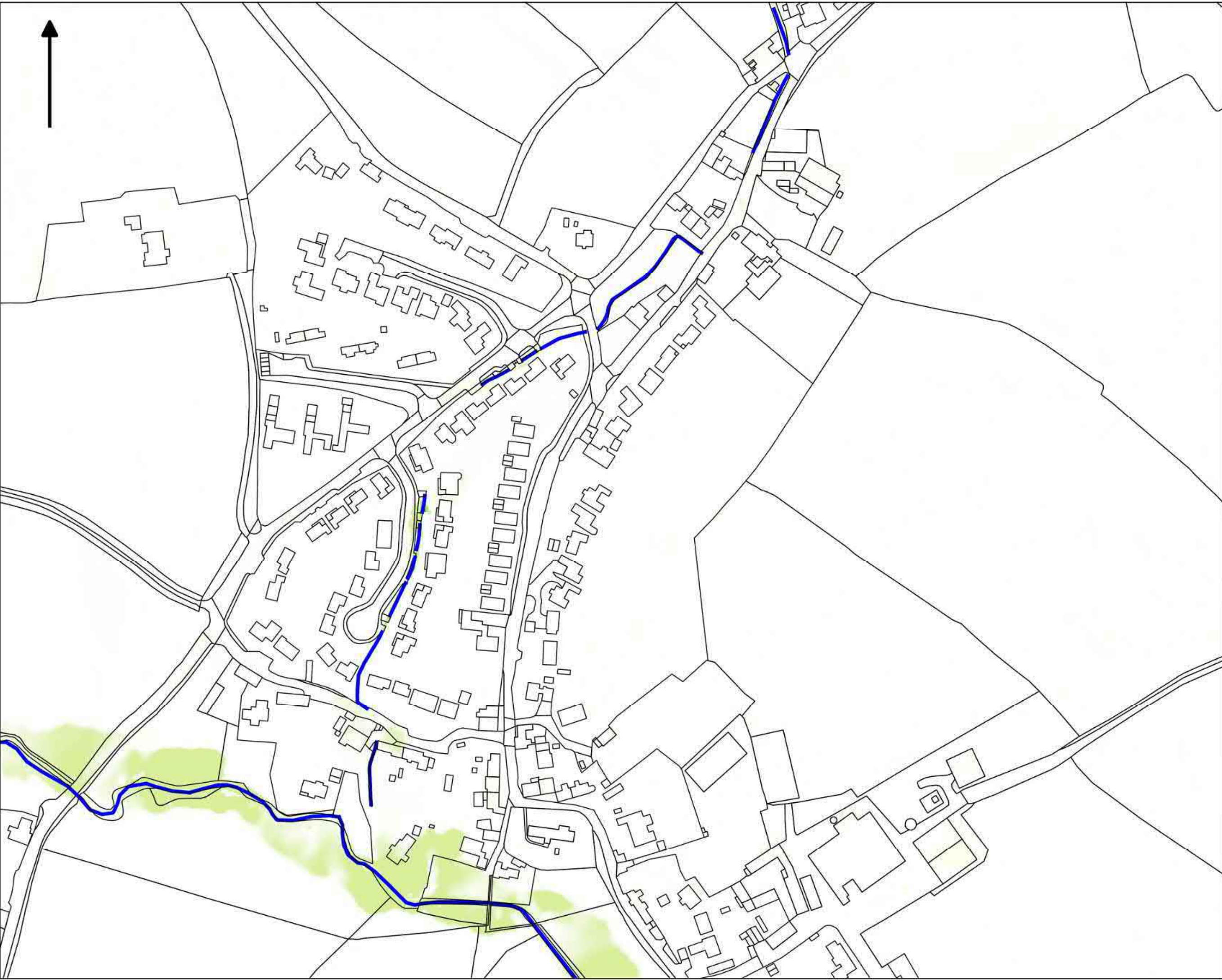
Scale at A3 1:2000

Drawn RC Approved MD

Stage 1 Check Stage 2 Check Originated Date 11/18



Drawing Number F1 Rev



Legend

Watercourse

Depth Difference (m)

- < -0.5
- 0.4 to -0.5
- 0.3 to -0.4
- 0.2 to -0.3
- 0.1 to -0.2
- 0.0 to -0.1
- 0.0
- 0.0 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- > 0.5

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Revised/Drawn:	By:	Drawn:	Scale:
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Drawing Status

Job Title
 Llanmaes Flood Alleviation Scheme

Drawing Title
 Depth Difference Map
 Sensitivity
 +20%*n* vs Proposed Option
 1% AEP + 30% CC

Scale at A3: 1:2000

Drawn: RC Approved: MD

Stage 1 Check:	Stage 2 Check:	Originated:	Date:
			11/18



Drawing Number: F2 Rev



Legend

Watercourse

Flood Depth (m)

- 0.00 - 0.05
- 0.05 - 0.10
- 0.10 - 0.2
- 0.20 - 0.30
- 0.30 - 0.40
- 0.40 - 0.50
- 0.50 - 1.00
- > 1.00

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Revision Details	By	Date	Suffix

Drawing Status

Job Title
 Llanmaes Flood Alleviation Scheme

Drawing Title
 Flood Depth Sensitivity Proposed Option -10%
 1% AEP + 30% Climate Change

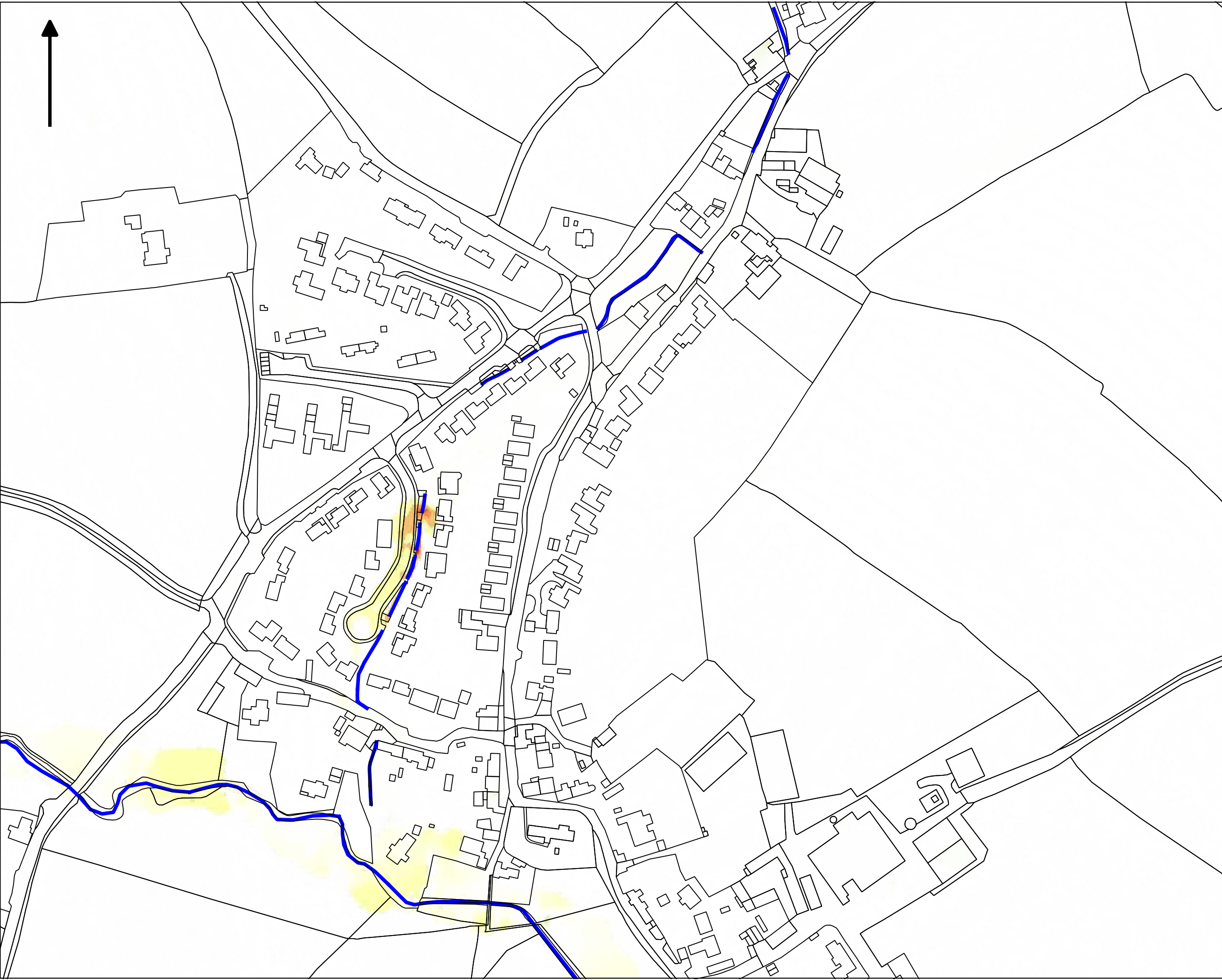
Scale at A3: 1:2000

Drawn: RC Approved: MD

Stage 1 Check: Stage 2 Check: Originated: Date: 11/18



Drawing Number: F3 Rev



Legend

Watercourse

Depth Difference (m)

- < -0.5
- 0.4 to -0.5
- 0.3 to -0.4
- 0.2 to -0.3
- 0.1 to -0.2
- 0.0 to -0.1
- 0.0
- 0.0 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- > 0.5

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Revision Details	By	Date	Suffix

Drawing Status

Job Title
 Llanmaes Flood Alleviation Scheme

Drawing Title
 Depth Difference Map
 Sensitivity
 -10%*n* vs Proposed Option
 1% AEP + 30%CC

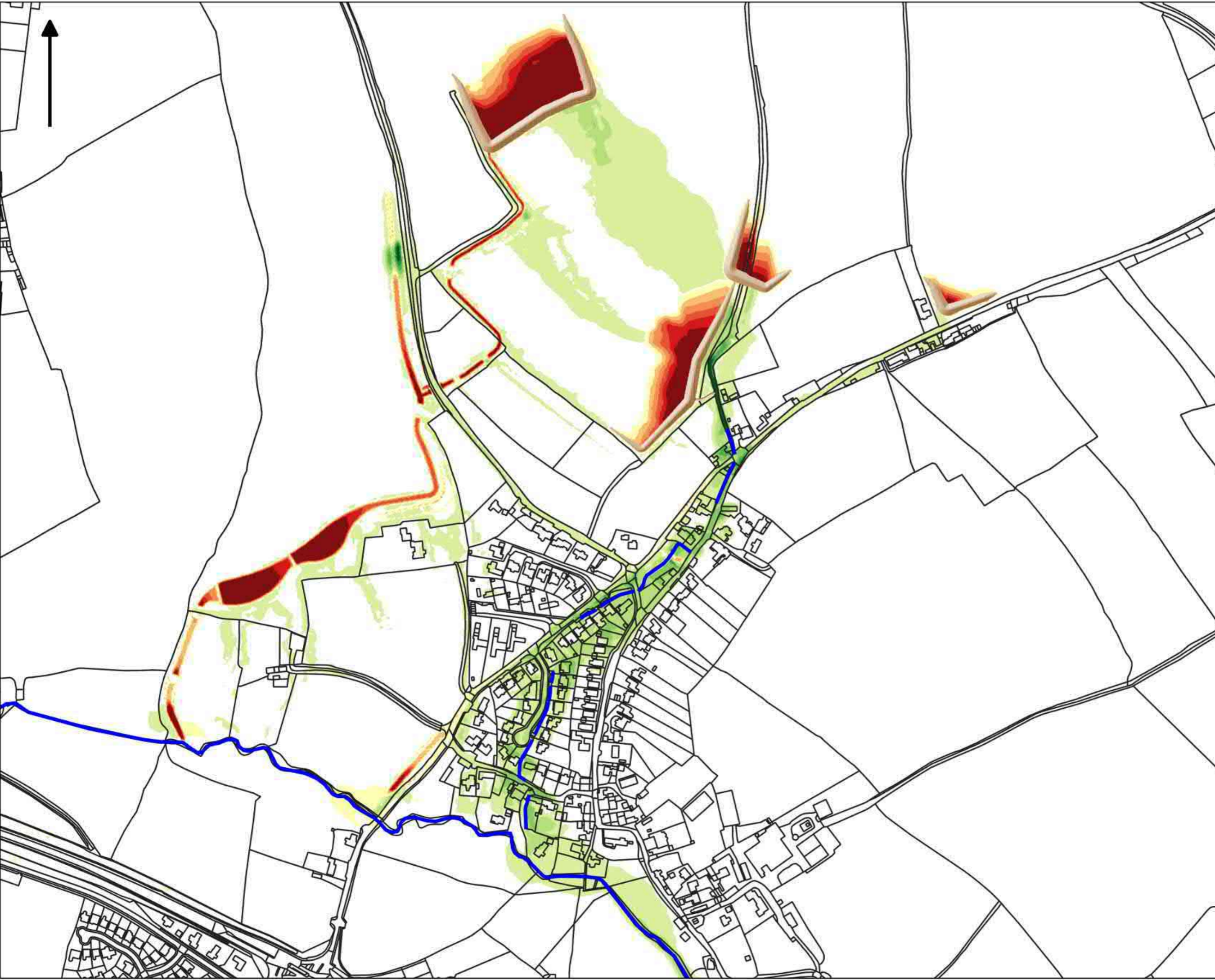
Scale at A3 1:2000

Drawn RC Approved MD

Stage 1 Check Stage 2 Check Originated Date 11/18



Drawing Number F4 Rev



Legend

- Watercourse

Depth Difference (m)

- Less than -0.5
- -0.4 to -0.5
- -0.3 to -0.4
- -0.2 to -0.3
- -0.1 to -0.2
- -0.01 to -0.1
- -0.01 to +0.01
- +0.01 to +0.1
- +0.1 to +0.2
- +0.2 to +0.3
- +0.3 to +0.4
- +0.4 to +0.5
- Greater than +0.5

■ Flood Storage Area

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Revision Details	By	Date	Suffix

Drawing Status: **FINAL**

Job Title
Llanmaes Flood Alleviation Scheme

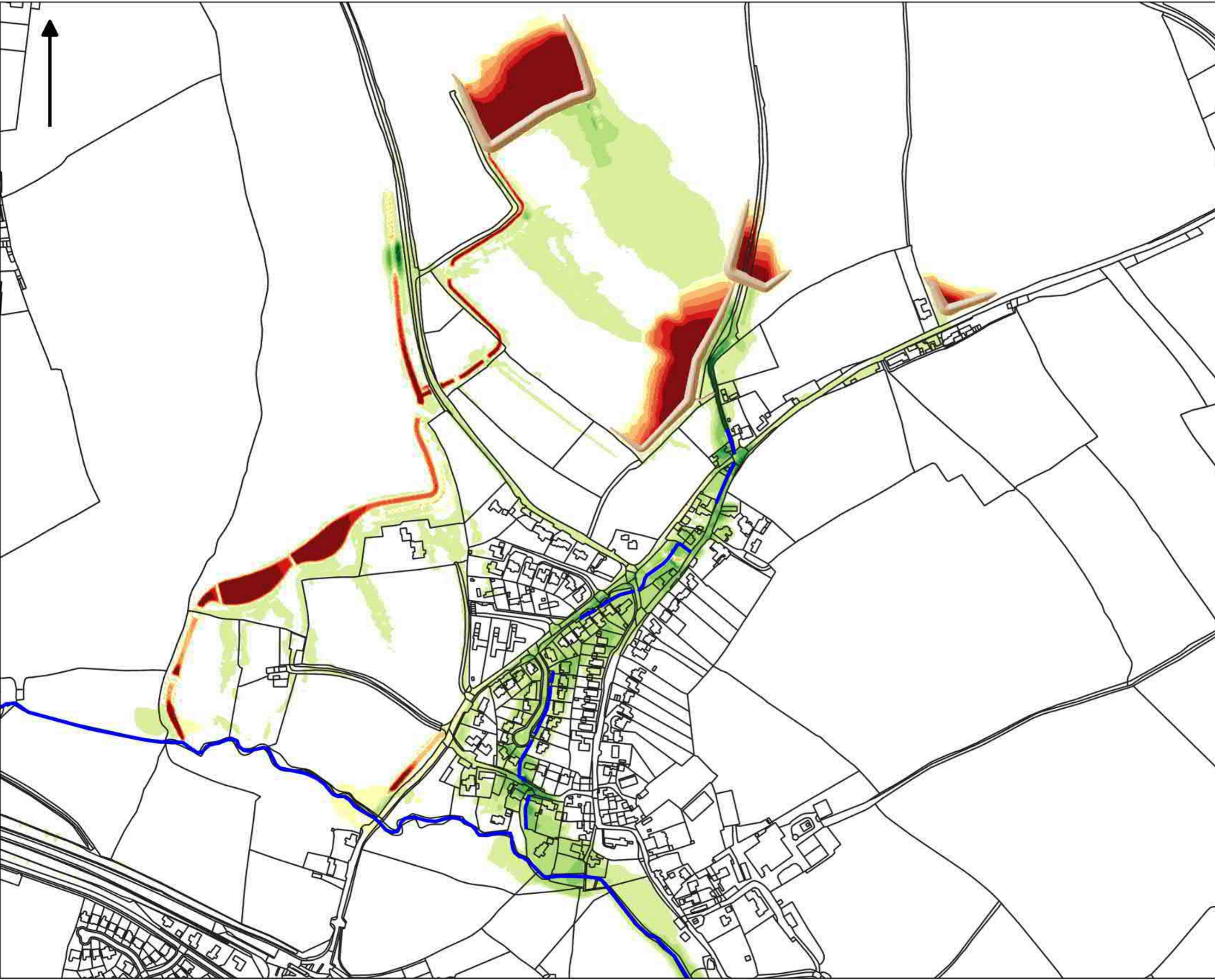
Drawing Title
 Maximum Depth Difference Sensitivity
 40% Surface Percentage Runoff Proposed Option vs. Baseline
 1% AEP + 30% Climate Change

Scale at A3: **1:4000**

Drawn: RC	Approved: RS
Stage 1 Check: RM	Stage 2 Check: AT
Original Date: 04/21	Date: 04/21



Drawing Number: **F5** Rev



Legend

- Watercourse
- Depth Difference (m)**
- Less than -0.5
- -0.4 to -0.5
- -0.3 to -0.4
- -0.2 to -0.3
- -0.1 to -0.2
- -0.01 to -0.1
- -0.01 to +0.01
- +0.01 to +0.1
- +0.1 to +0.2
- +0.2 to +0.3
- +0.3 to +0.4
- +0.4 to +0.5
- Greater than +0.5
- Flood Storage Area

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Revision Details	By	Date	Suffix

Drawing Status: **FINAL**

Job Title
Llanmaes Flood Alleviation Scheme

Drawing Title
 Maximum Depth Difference Sensitivity
 50% Surface Percentage Runoff Proposed Option vs. Baseline
 1% AEP + 30% Climate Change

Scale at A3: **1:4000**

Drawn: RC	Approved: RS
Stage 1 Check: RM	Stage 2 Check: AT
Original Date: 04/21	Date: 04/21



Drawing Number: **F6** Rev



Legend

- Watercourse

Maximum Flood Depths (m)

- 0 - 0.05
- 0.02 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 1.0
- > 1.0

Flood Storage Area

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Revision Details	By	Date	Scale

Drawing Status: **FINAL**

Job Title
Llanmaes Flood Alleviation Scheme

Drawing Title
 Maximum Flood Depth
 Sensitivity
 40% Surface Percentage Runoff
 Proposed Option
 1% AEP + 30% Climate Change

Scale at A3: **1:4000**

Drawn: RC	Approved: RS
Stage 1 Check: RM	Stage 2 Check: AT
Originalled:	Date: 04/21



Drawing Number: **F7** Rev



Legend

- Watercourse

Maximum Flood Depths (m)

- 0 - 0.05
- 0.02 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 1.0
- > 1.0

Flood Storage Area

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Revision No.	By	Date	Scale

Drawing Status: **FINAL**

Job Title
Llanmaes Flood Alleviation Scheme

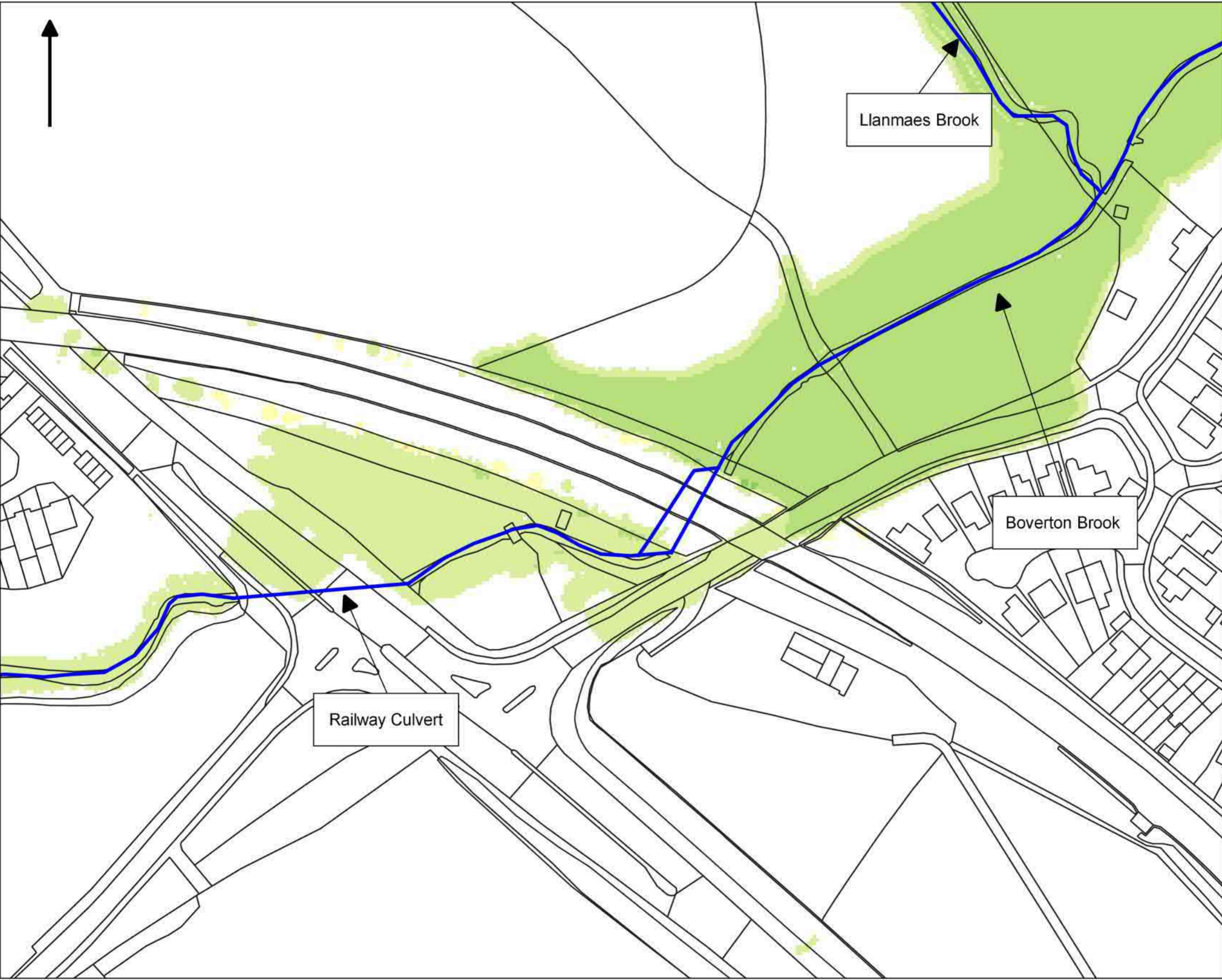
Drawing Title
 Maximum Flood Depth
 Sensitivity
 50% Surface Percentage Runoff
 Proposed Option
 1% AEP + 30% Climate Change

Scale at A3: **1:4000**

Drawn: RC	Approved: RS
Stage 1 Check: RM	Stage 2 Check: AT
Originalled: AT	Date: 04/21



Drawing Number: **F8** Rev:



Legend

Watercourse

Depth Difference (m)

- Less than -0.5
- 0.4 to -0.5
- 0.3 to -0.4
- 0.2 to -0.3
- 0.1 to -0.2
- 0.01 to -0.1
- 0.01 to +0.01
- +0.01 to +0.1
- +0.1 to +0.2
- +0.2 to +0.3
- +0.3 to +0.4
- +0.4 to +0.5
- Greater than +0.5

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Revision Details	By	Date	Author

Drawing Status: **FINAL**

Job Title
Llanmaes Flood Alleviation Scheme

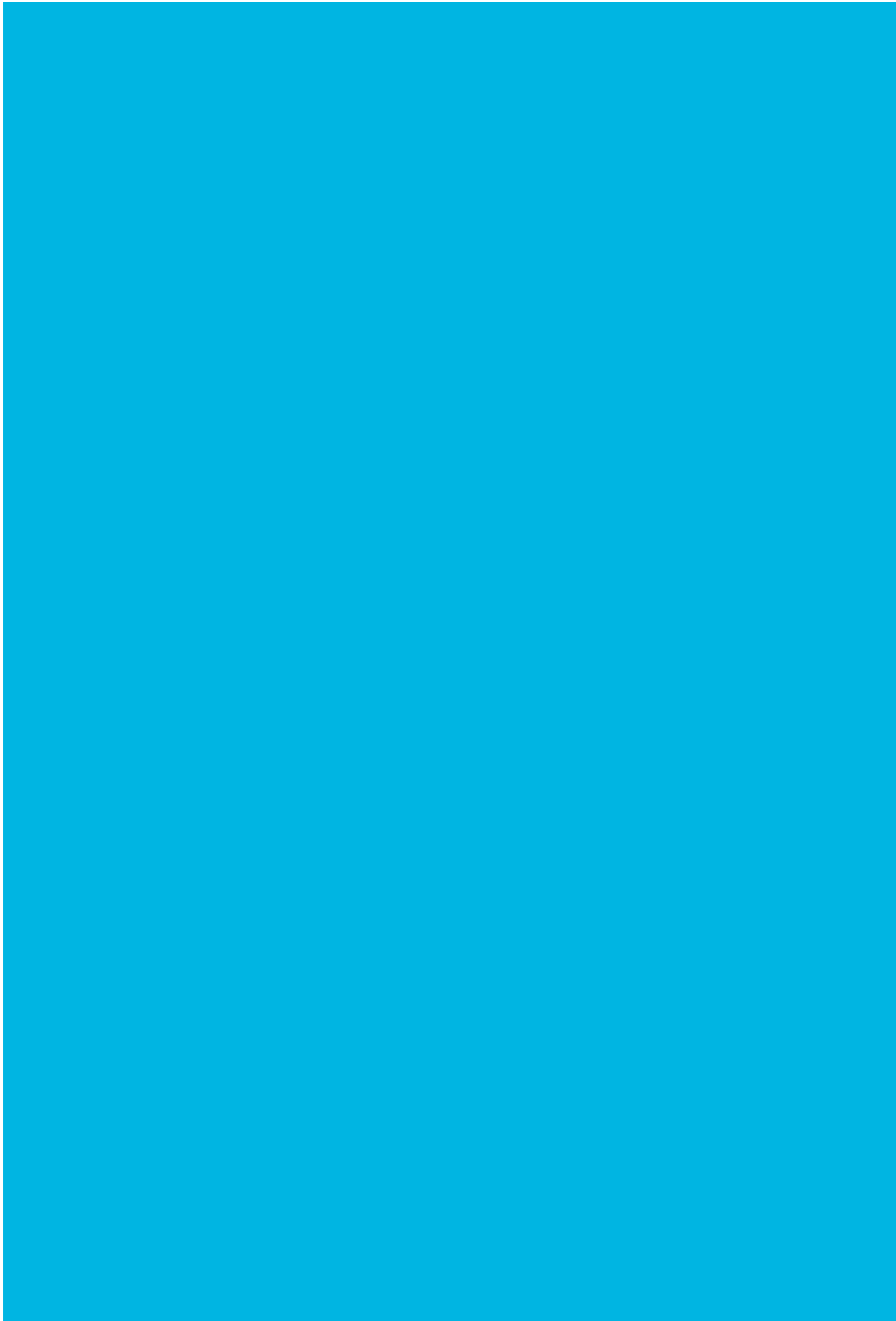
Drawing Title
 Maximum Depth Difference Sensitivity
 Boverton Brook Catchment
 Proposed Option vs. Baseline
 1% AEP + 30% Climate Change

Scale at A3: **1:1000**

Drawn: RC	Approved: RS
Stage 1 Check: RM	Stage 2 Check: AT
Original: 	Date: 04/21



Drawing Number: **F9** Rev:



Appendix D – Safety in Design Risk Assessment



Detailed Design - SiD Assessment

AECOM Project Name: Llanmaes FAS
 AECOM Project No: 60160078



Hazard and Risk Identification						Pre-mitigation assessment			Mitigation			Post-mitigation assessment			Output			
Item No.	Feature, element, structures, process or activity considered	Client's or other H&S information used	Significant Design Hazards Identified	Design Risks Identified	Environment/Persons at Risk?	Severity	Probability	Risk Factor	Design input Control to Eliminate or Reduce Hazard and/or Reduce Risk	Has Selected Control created a new Hazard? (Y/N)*	Severity	Probability	Risk Factor	Output Residual Hazard to Residual Hazard Log	Output Residual Risk to Residual Hazard Log	Ownership	Output Residual Design Hazard Feedback Location	Closeout date for Output
1	Design/Construction		Earthworks	Localised deep excavations. Depth of ditch to be excavated varies		3	4	12	Ditch to follow land boundaries and be close to hedges. The ditch will be located away from landfields that are used for crops, and on private land. Localised false cuts were utilised to secure ditch in the design. Contractor to prepare appropriate working methods prior any works. Temporary fence to be considered		3	3	9	Landowners to acknowledge. Contractor to undertake an excavation Risk Assessment prior any works		Contractor /Client		
2	Design/Construction	VoGC provided some trial pits cross section showing some approx depths	Statutory Undertakers (existing utilities)	There are existing services mainly BT and Gas that passing through the village at unknown depth.		4	3	12	The design mainly consists of pavement overlay and but on a targeted location excavations to 400mm may be required on the West road. AECOM undertook utility services check and consulted VoGC to get all available information for Utilities and provided to the contractor. The contractor to liaise with each utility provider to identify potential mitigations. STAS clash implemented and utility provider plan to be provided under. Current STAS advise is that Gas is approx 700mm from surface		3	3	9			Contractor		
3	Design		Residual flooding on village	Residual flooding under the 1%AEP+ 30% CC scenario, Village Green is from 0.5m to 1.0m within the watercourse channel and rest of village is from 0.2m to 0.3m		4	4	16	Residual flooding within the village was reduced 0.2m to 0.3m, by utilising ditches, flood bunds and road reprofiling. Village green residual flooding is 0.5m to 1.0m (primarily within watercourse channel).		3	3	9	This flooding is considered to be residual risk and flood depths of this magnitude can be mitigated through Property Level Resilience (PLR) measures such as flood doors, smart airbricks etc. This approach is recommended from a constructability and feasibility perspective to allow the Proposed Option to be considered in earnest, providing a wider benefit to the community. Communication to residents of risks, parking restrictions, road signage and rainfall gauge warning systems could be implemented to help reduce the risk to these areas. Provide signage in areas of elevated flood hazard and communicate to residents the risk during large flood events		Client		
4	Design		Formalisation of Overland Flow Paths and Flood Hazard	The West Road and Gadlys Lane highway is designed to become a formalised overland flow route. Residual hazard in the highway across all events >20% AEP. Residual flood hazard of 'Danger to Some' at the Village Green for all events > 20% AEP. For larger magnitude events there is 'Danger to Some' on West Rd and around the Village Green and within the West Rd highway.		4	3	12	the residual flooding flow path was mitigated by Road re-grading, road cross fall away from residences and footways, installation of Bus stop kerbs and HB2 kerbs allow the water to flow downstream through West Road. Public to be informed on this through planning consultation. Water level to be significantly reduced from existing events and therefore water depth s within road are reduced		3	3	9	Provide signage in areas of elevated flood hazard and communicate to residents the risk during large flood events		Client		
5	Construction		Dust, noise	Debris, noise, dust. Breathing Dust, exhaust fumes. Dust causing road traffic collision or harm to operatives. Dust/noise causing disturbance to public. Debris dropping onto the water causing harm to the environment		3	3	9	Water to suppress dust. Wear appropriate PPE at all times. Ensure noise and dust protection measures are deployed from contractor while construction particularly within Llanmaes village. Keep safe distance away from fumes and always comply with the provided and agreed method statement. Contractor to consider dust and noise mitigation measures, prepare appropriate method statements an inform public on works timing and duration		3	2	6	Contractor to consider dust and noise mitigation measures, prepare appropriate method statements an inform public on works timing and duration		Contractor		
7	Construction		working near water	Dermal and internal exposure to site specific contaminants sediments or substances known to be toxic- Dermal irritation or infection from exposed skin cuts or abrasions. Ingestion of contaminants		3	3	9	The level of protective equipment should be upgraded if there is a like hood of exposure to unknown contaminants. Gloves should be worn whenever it is necessary to contact or handle waste, wet soil, groundwater or any other potentially contaminated implements material or samples. Wash hands thoroughly before eating, drinking and leaving site. If necessary destroy contaminated PPE after use to avoid cross contamination		3	1	3					
8	Construction		Site access for construction /Construction plant	Site access (Heavy Plant and Equipment- Working adjacent to Heavy Plant and machinery including excavation plant and lifting appliances) /Traffic Management or special arrangements with land owners		3	4	12	Ensure adequate traffic management arrangements are in place to gain access to works areas where construction traffic and personnel have to interact with the travelling public. Specific routes for work personnel and construction equipment to be determined for accessing work areas. Contractor to prepare TM phasing plan and achieve TM proposals approval from overseeing organisation. Contractor to inform public in advance of any TM		3	2	6	Contractor to liaise with land owners and Highway authority to ensure adequate and safe access is provided. Temporary access works to be completed as required		Contractor		
9	Design		Increased peak flows on Llanmaes Brook between North ditch Outfall and Tara House	Increase in Peak flows and floodplain levels on Llanmaes Brook between Ditch 1 outfall and unammed watercourse outfall at Tara House.		5	3	15	Increased peak flows in already flooded agricultural area with no residences near by. This was selected to reduce the overall volumes and peak flows in the village. VoGC liaise with the relevant landowners to ensure that this part of the FAS can function as intended. A change in the flow regime of Llanmaes Brook for this length of Main River may require a Flood Risk Activity Permit agreement with NRW.		3	3	9	This increased peak flows represent a redirection of flood risk away from properties to an area of lower risk. VoGC liaise with the relevant landowners to ensure that this part of the FAS can function as intended. A change in the flow regime of Llanmaes Brook for this length of Main River may require a Flood Risk Activity Permit agreement with NRW.		Client		
10	Design/Construction		Land acquisition	Private land permission is needed to allow the construction of flood alleviation assets		5	3	15	Client State department and Land agent to accommodate land access agreements. Client informed agreement in principal with majority of land owners. Site meeting implemented with land owners to discuss scheme		2	3	6	Land acquisition compensations		Client		

Hazard and Risk Identification						Pre-mitigation assessment			Mitigation	Post-mitigation assessment			Output					
Item No.	Feature, element, structures, process or activity considered	Client's or other H&S information used	Significant Design Hazards Identified	Design Risks Identified	Environment/Persons at Risk?	Severity	Probability	Risk Factor	Design Input Control to Eliminate or Reduce Hazard and/or Reduce Risk	Has Selected Control created a new Hazard? (Y/N)	Severity	Probability	Risk Factor	Output Residual Hazard to Residual Hazard Log	Output Residual Risk to Residual Hazard Log	Ownership	Output Residual Design Hazard Feedback Location	Closeout date for Output
11	Design/Maintenance		Maintenance of Flood Storage Area Outfalls and Ditch Culverts /inspectio and maintenance of all SUDs assets	Residual risk of blockage of storage area outfalls. Maintenance and regular inspection is needed		4	3	12	Sensitivity on hydraulic model to understand if blockage of storage area would increase storage volumes over 10,00 cubic metres. Two grated headwalls one with primary 300mm outfall to reduce risk of blockage and secondary overflow pipe 1.3m above the primary outfall invert level. This will provide overflow in the event of a blockage within the primary outfall. Identification of maintenance regime required for all outfalls and ditch culverts.		3	3	9			Client		
12	Construction/Maintenance		Construction project interface with the existing road network during tie-ins with local roads - traffic risk to construction workers and members of the public.	traffic risk to construction workers and members of the public.		3	4	12	Chapter 8 traffic management arrangements to be considered. Design stage identified phases of works that can be utilised to reduce disruption to public. Traffic notices to be erected in advance of any temporary road closures. Contractor to prepare phasing of works plans		3	3	9			Contractor		
13	Construction		Roaming livestock and ongoing farming activities during construction - risk to operatives.	risk of injury to operatives.		3	3	9	Appropriate fencing to be maintained for duration of the works.		3	2	6			Contractor		
14	Construction		Ground Conditions	earthworks stability		3	3	9	1:3 slopes of all SUDs assets designed to reduce any risk. Appropriate working methods to be considered from the Contractor, in particular around agricultural crossings		3	1	3			Contractor		
15	Construction		Manual handling risks			3	3	9	Contractor to ensure appropriate construction methodology and avoid manual handling wherever possible.		3	2	6			Contractor		
16	Construction		Construction of culverts	risk of injury to operatives and livestock perhaps		3	3	9	Contractor to establish appropriate safe method of work when working. Temporary fencing to consider is required during construction		3	2	6			Contractor		
17	Construction/Maintenance		Attenuation storage areas	-drowning risk to persons approaching these ponds when they are retaining water - Drowning risk to members of the public and maintenance staff.		3	3	9	attenuation storage areas deigned to 1:3 slopes to 1.5 side slopes so can be easily accesseble if required. Max depth within attenuation areas is 1m, at 100yrs +30% CC scenarios. Also areas have low flow outfall pipes to ensure no water is stored after the event is completed. Swales and ditch should dry out at dry conditions		3	2	6			Client		
18	Construction		New drainage runs on West Road, Sigingstone Lane and Village Green road	Potential clash with hard ground or other utilities		3	4	12	Contractor to review STATS utilities drawings provided and develop appropriate working methodology		3	2	6	Programme delays		Contractor /Client		
19	Construction		Works adjacent to third party assets	risk of damages and reinstatements		3	3	9	Contractor to develop appropriate working methods, to mitigate third party damages. Temprary protective works may be required with pre-works survey to identify and record existing site conditions prior any works commence		3	3	9			Contractor /Client		

