



JBA
consulting

Fluvial Flood Defence Asset Management Plan

Tuesday 11 January 2011

Angus Pettit



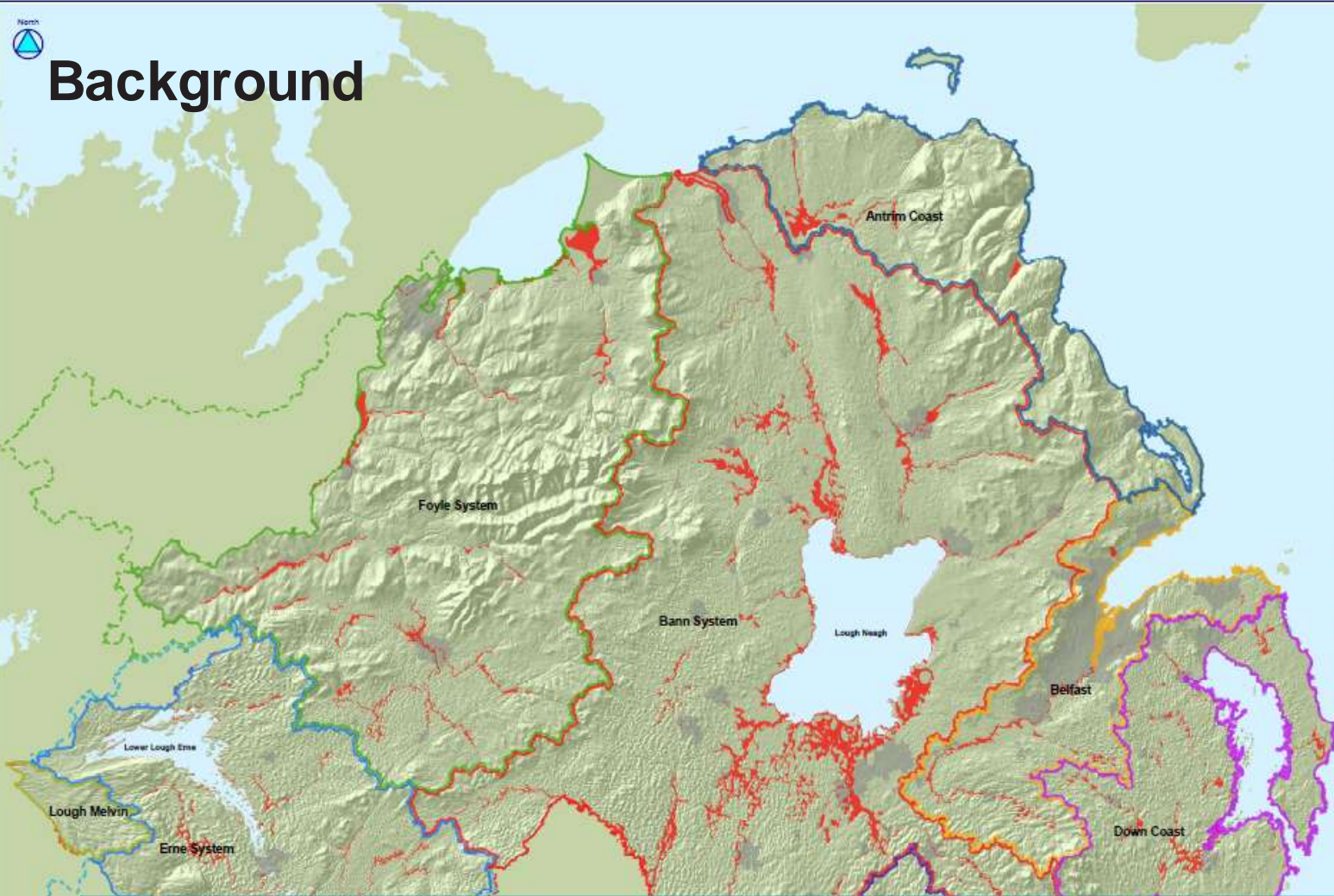
WDR & RT TAGGART



- Overview of the Fluvial Flood Defence Asset Management Plan
- Insight into Whole Life Asset Management, the Challenges and Way Forward



Background



Units of Management

- Antrim Coast
- Bann System
- Belfast
- Down Coast
- Erne System
- Foyle System
- Lough Melvin
- Lough & South Down Coast
- Historical Flood Outlines

Cross-Border Units of Management

- Bann System
- Erne System
- Foyle System
- Lough & South Down Coast

© Crown Copyright
Key map background: www.esri.com

jba
CONSULTING

The Draw House
Wilsnipol Park
Greenhill Avenue
Warrington
Warr, Cheshire

www.jbaconsulting.co.uk
+44 (0)1925 437030
+44 (0)1425 437039
info@jbaconsulting.co.uk

Return period (years)	Number of properties at risk	Number of properties at risk (including climate change)
10	26,000	28,000
100	36,000	38,000
1000	45,000	48,000

Purpose



WDR & RT TAGGART



Background

- Develop link between asset improvement and strategic drivers
 - Previous AMP's
 - Culvert AMP
 - Coastal AMP
 - Link to data from the PFRA
 - Best practice to achieve Agency's service goals
-

Purpose



WDR & RT TAGGART



Drivers

- AMP connects high level strategy to operational decisions
- PFRA
- 'Living with rivers and the sea'
- Holistic approach to risk



Purpose

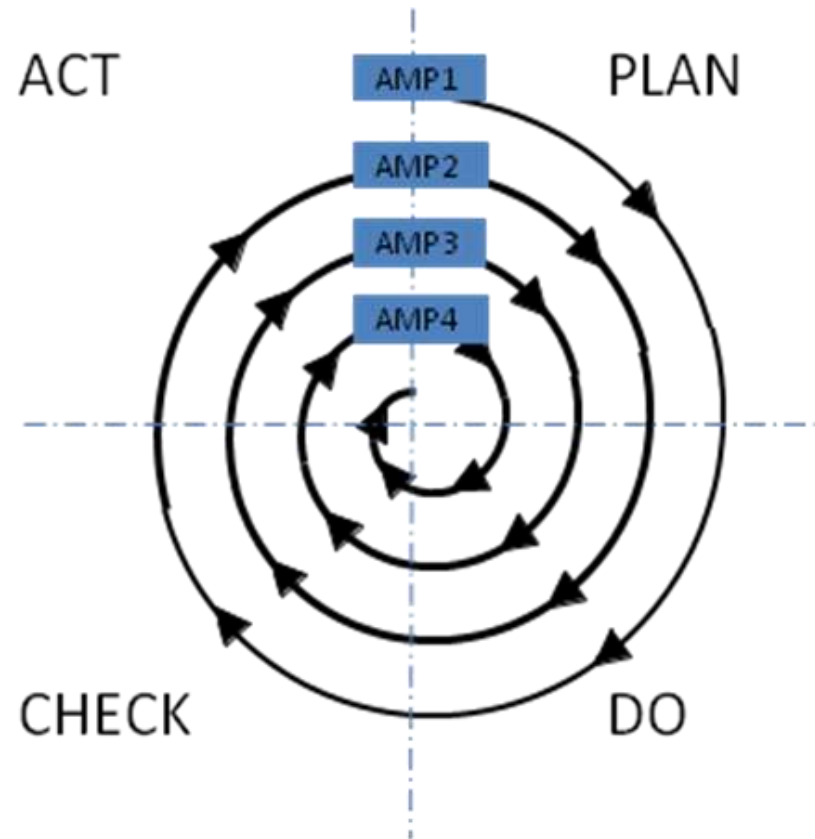


WDR & RT TAGGART



Deliverables

- Plan – establish strategy and objectives
- Do – establish requirements and develop database
- Check – monitor and measure results
- Act – take actions to ensure objectives are achieved



Overview of defences



WDR & RT TAGGART



- Fluvial Flood Defence Database
- EA Condition Assessment Manual
- 1100 assets recorded
- 630 km defence length
- Includes agricultural defences
- 59 systems
- 10,600 properties at risk
- Defence value = £79m
- Annual budget = £6m
- Optimise spend



Overview of defences

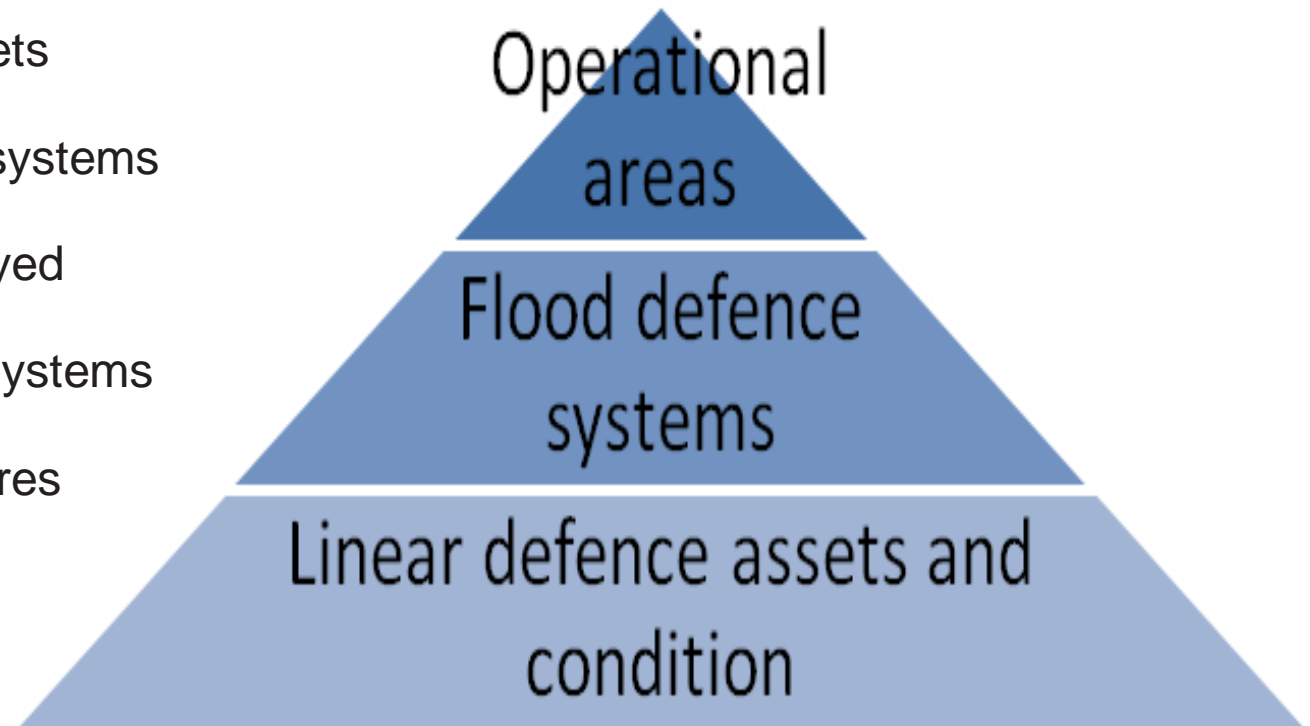


WDR & RT TAGGART



Defence systems

- 6 operational areas
- 1112 defence assets
- 88 flood defence systems
- 59 systems surveyed
- 416 assets in 59 systems
- 284 active structures



Overview of defences



WDR & RT TAGGART



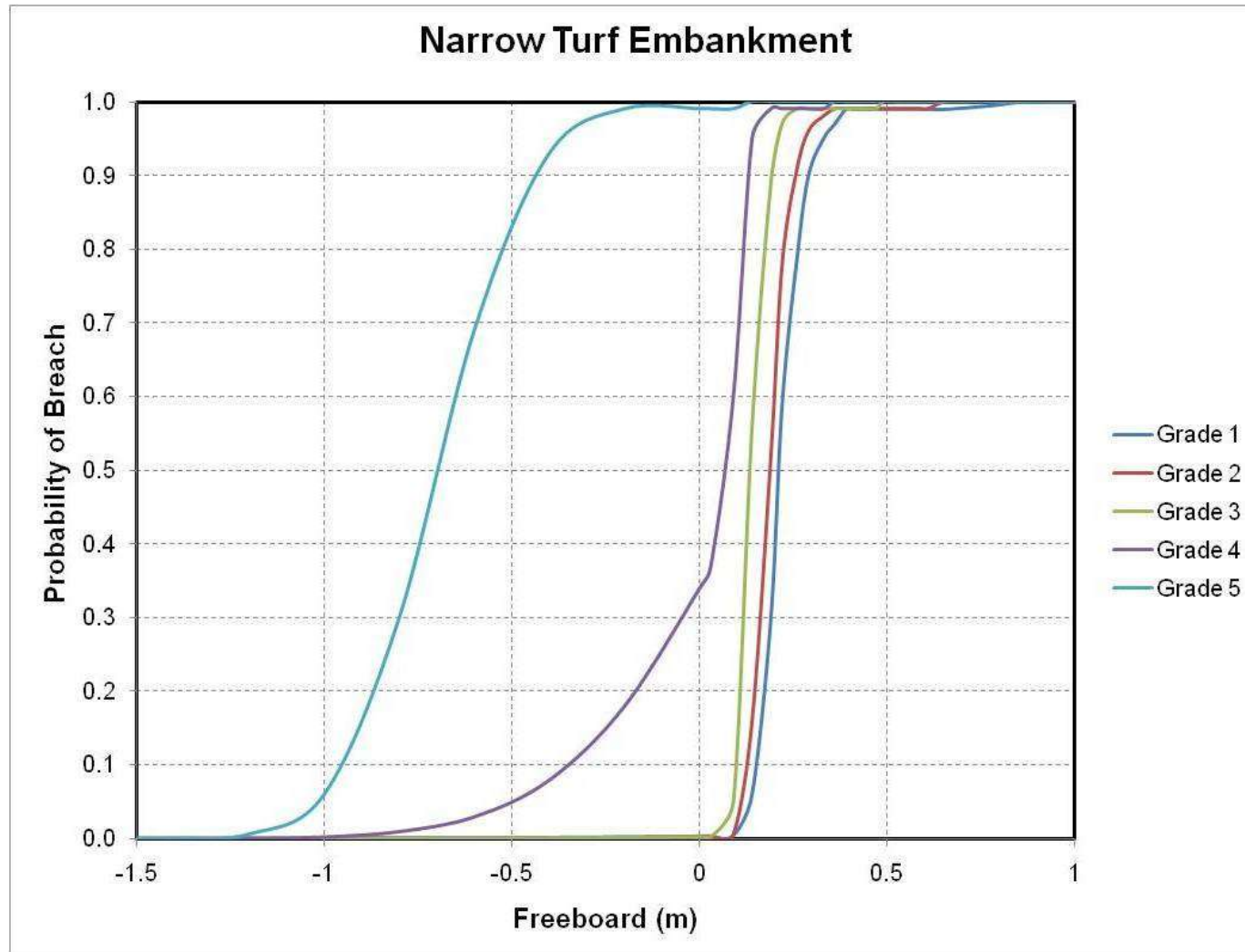
Condition assessment

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset
3	Fair	Minor defects that could reduce the performance of the asset
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation needed
5	Very poor	Severe defects resulting in complete performance failure

Fragility curve – impact of defence condition



WDR & RT TAGGART



Overview of defences



WDR & RT TAGGART



Valuation

- Modern Day Replacement Value
 - Based on Unit Costs
- Net Asset Value
 - Scaled according to condition grade

Asset	Length (km)	MDRV (£k)	NAV (£k)
Rivers Agency	108.4	76,534	65,169
Roads Service	0.2	67	40
Other / Unknown	4.9	1,923	1,194
Total	113.5	78,524	66,404

Risk based prioritisation



WDR & RT TAGGART



Flood Risk Lab Metrics (FRiL)

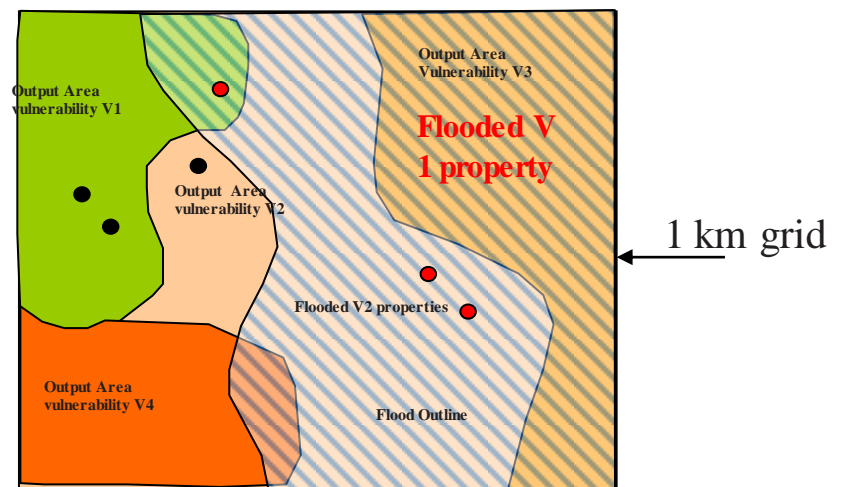
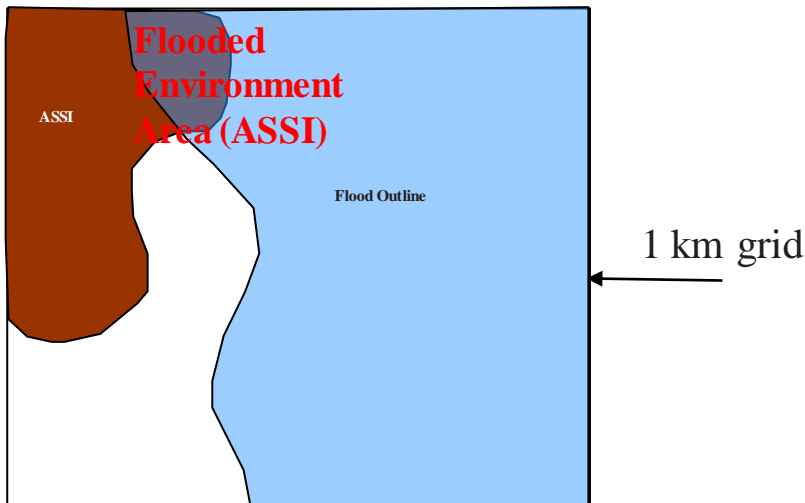
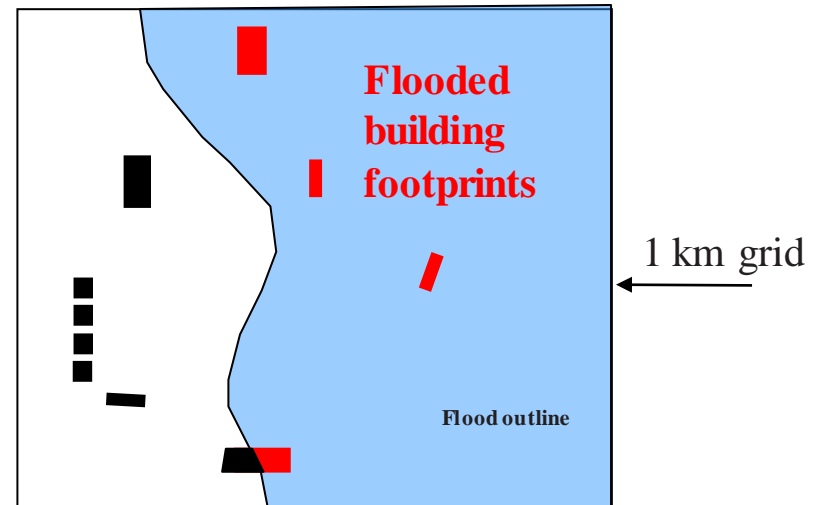
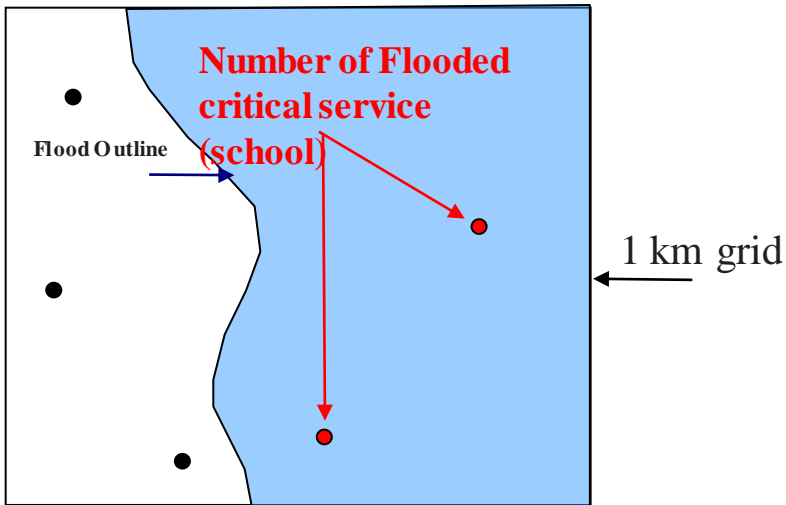
- Risk = consequence x probability
- Based on 100 metrics:
 - Human health,
 - Environment,
 - Cultural heritage and
 - Economic activity
- PFRA = 1km grid scale



Flood risk metric spatial queries: example metrics



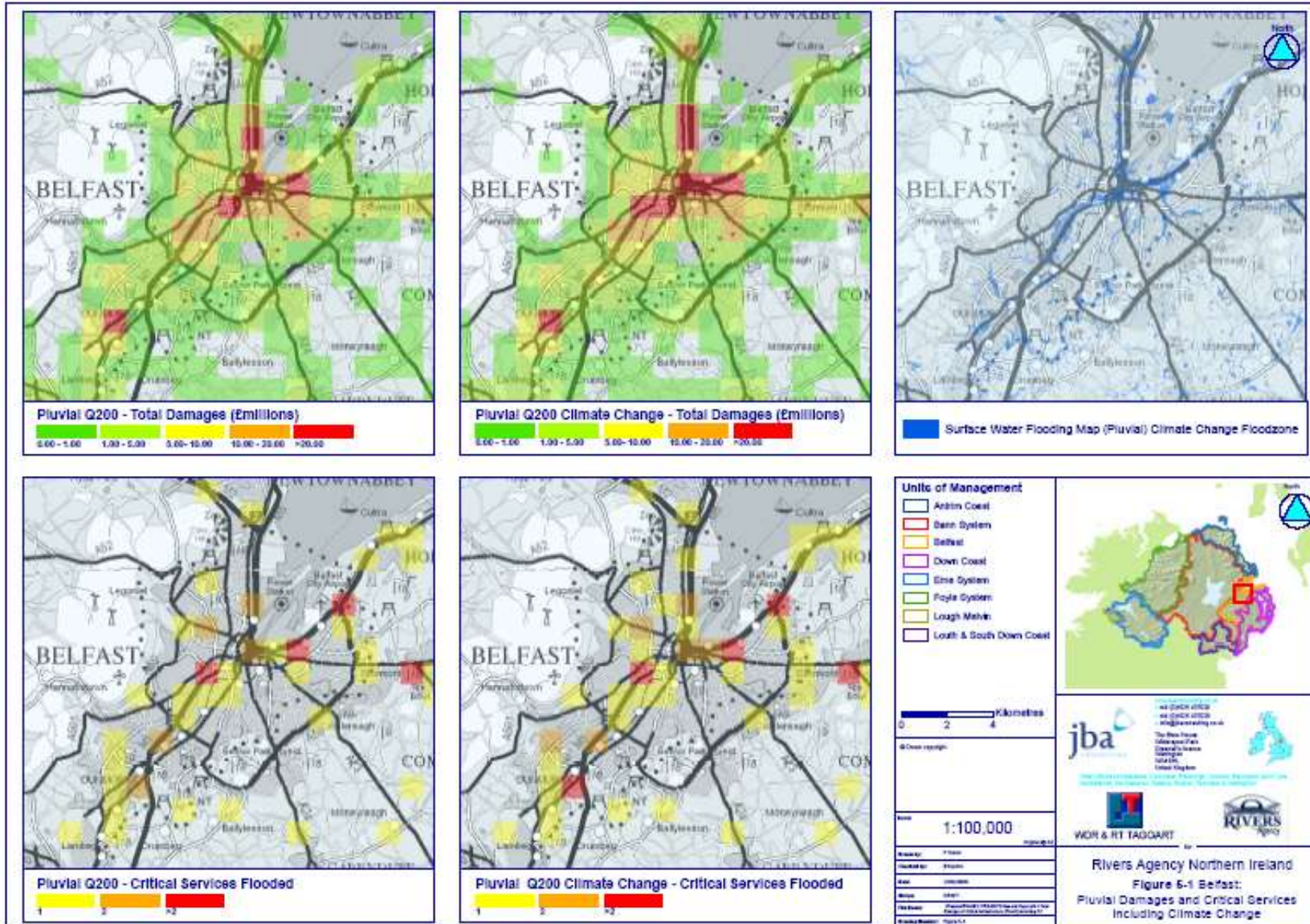
WDR & RT TAGGART



Visualisation of flood risk indicators



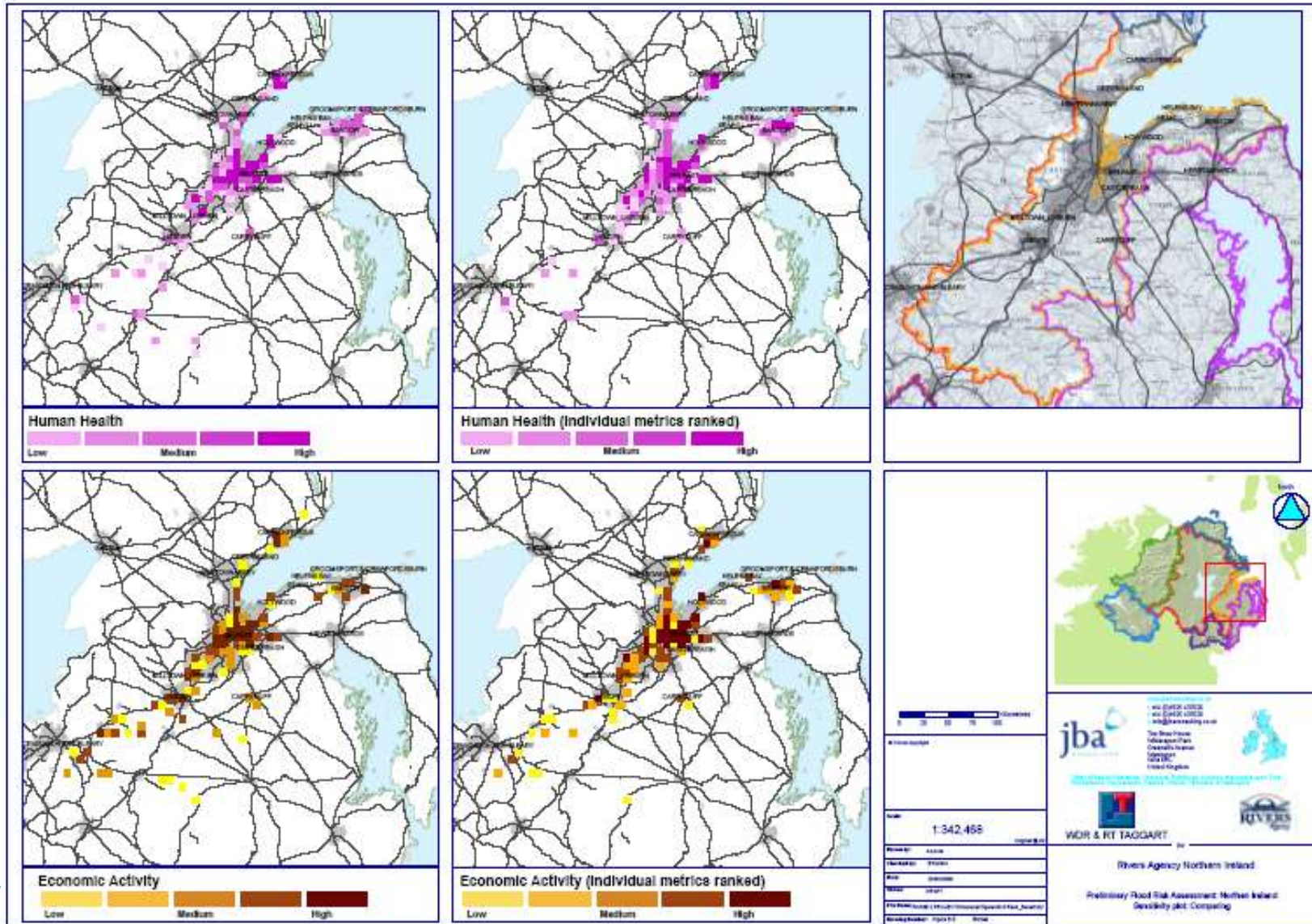
WDR & RT TAGGART



Visualisation of flood risk indicators



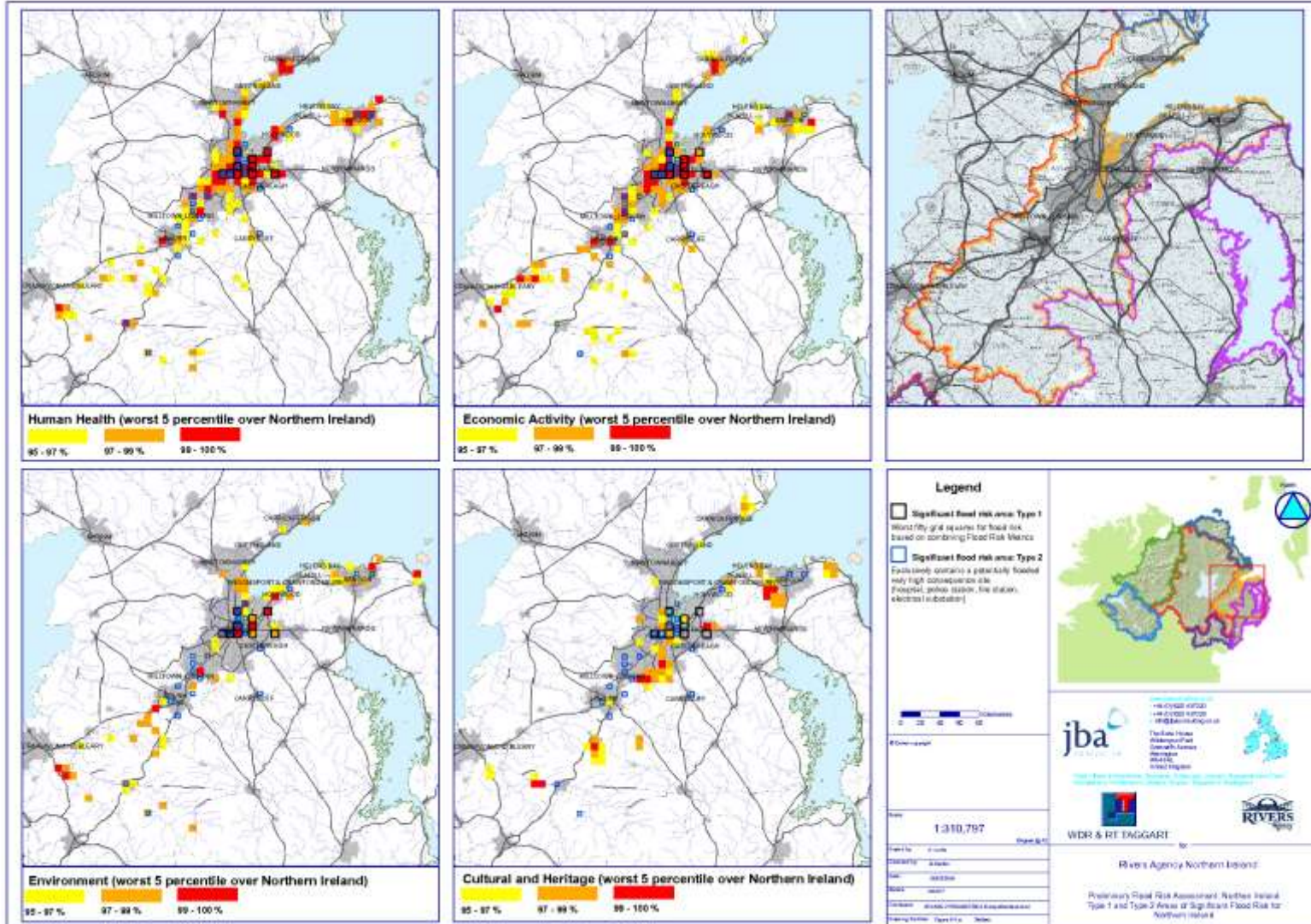
WDR & RT TAGGART



Areas of Significant risk



WDR & RT TAGGART



Consequence prioritisation



WDR & RT TAGGART



Consequence

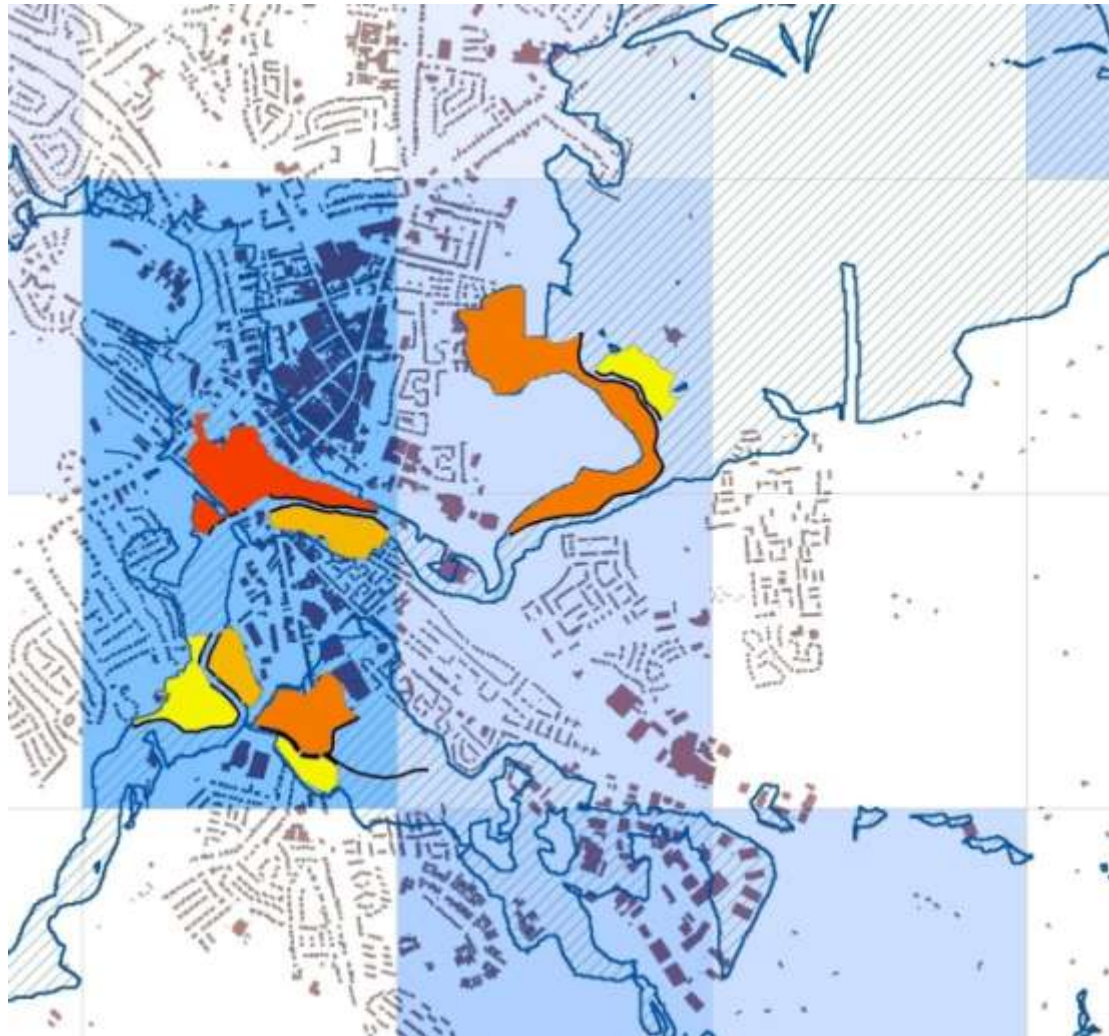
- Areas of benefit
- Indicators of consequence
- Scoring and weighting approach
- Data issues

Criteria	Weighting
Property Damages	30%
Agricultural Damages	10%
People at Risk	20%
Vulnerability Index	20%
Flooded Roads	10%
Critical Services	10%

System consequence / PFRA 1km resolution



WDR & RT TAGGART



Legend

— Flood Defence Assets

▨ Fluvial_Q100

■ Buildings

PFRA 1km Analysis

Annualised Property Damages

□ 0 - 265,000

□ 265,000 - 1,123,000

□ 1,123,000 - 2,660,000

□ 2,660,000 - 7,016,000

□ 7,016,000 - 22,800,000

Flood Risk Management Systems

Annualised Property Damages

■ 0 - 671,000

■ 671,000 - 1,326,000

■ 1,326,000 - 2,881,000

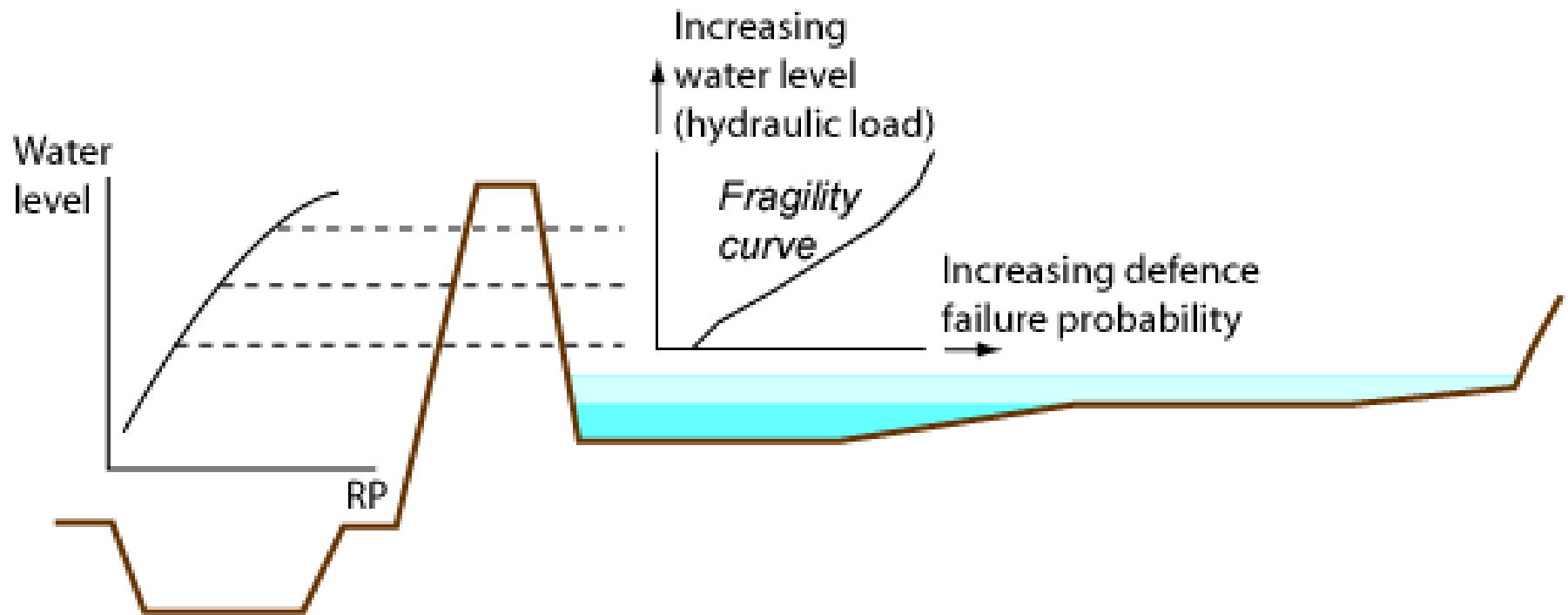
■ 2,881,000 - 6,062,000

■ 6,062,000 - 10,264,000

System probability



WDR & RT TAGGART



Probability prioritisation



WDR & RT TAGGART



Probability

- Flood defences:
 - Reduction in probability of inundation
 - Defence failure is a risk
- Embody parameters of source-pathway model
- Influence defence failure & overtopping
- Simple, consistent method to represent asset performance

Criteria	Weighting
Average condition grade	40%
Average defence type	30%
Presence of third party assets	10%
Climate change increase in damages	10%
Average grade of active structures	10%



Identification of failing assets

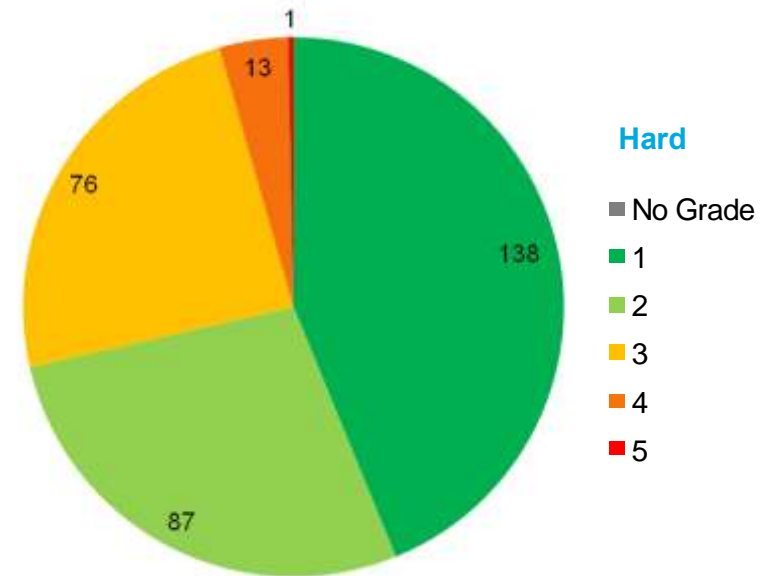


WDR & RT TAGGAR



Target Condition

- Target Condition = Grade 3 (Fair)
- 10% of assets are below target (grade 4-5)
- Failing assets spread over 25 systems
- Generally in rural, soft defence systems
- Action required on failing assets



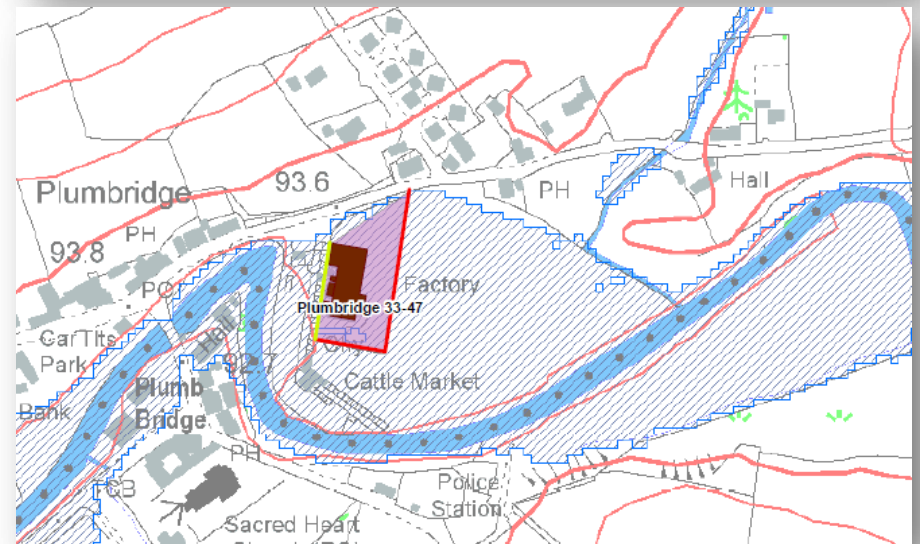
System prioritisation



WDR & RT TAGGART



- Risk = consequence x probability
- Prioritised list of systems
- List used to prioritise:
 - Hydraulic performance reviews
 - Hazard mapping / risk studies
 - Inspection and maintenance
 - Improvement works



Risk based / Frequencies



WDR & RT TAGGART



- Unable to maintain all assets in excellent condition and expand network
- Focus funds where benefits are greatest
- Reduce inspection and maintenance where risk is low
- AMP aims for planned maintenance

Monthly frequency for asset inspection regime					
Consequence of failure	Very High	12	6	6	6
	High	18	12	12	12
	Medium	36	24	12	12
	Low	60	36	18	18
		Low	Medium	High	Very High
	Probability of failure				

Operations



WDR & RT TAGGART



Operational inspections

- Proactive and regular inspection
- Post flood may also be required

Inspection frequencies (months)			
Consequence of failure	Very High	-	1
	High	-	1
	Medium	6	3
	Low	12	6
		Maintained	Raised
Defence type			

Inspection requirements

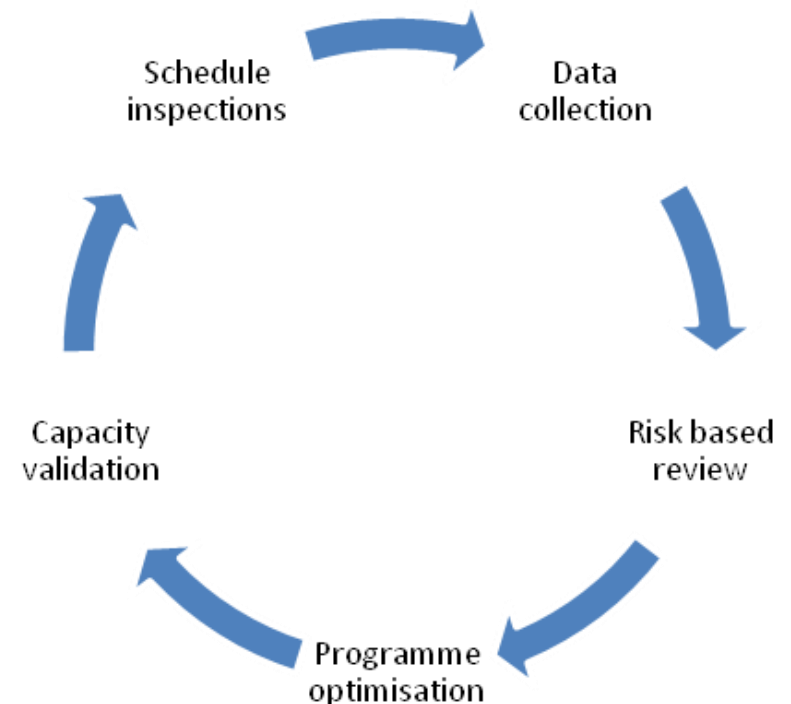


WDR & RT TAGGART



Resource requirements

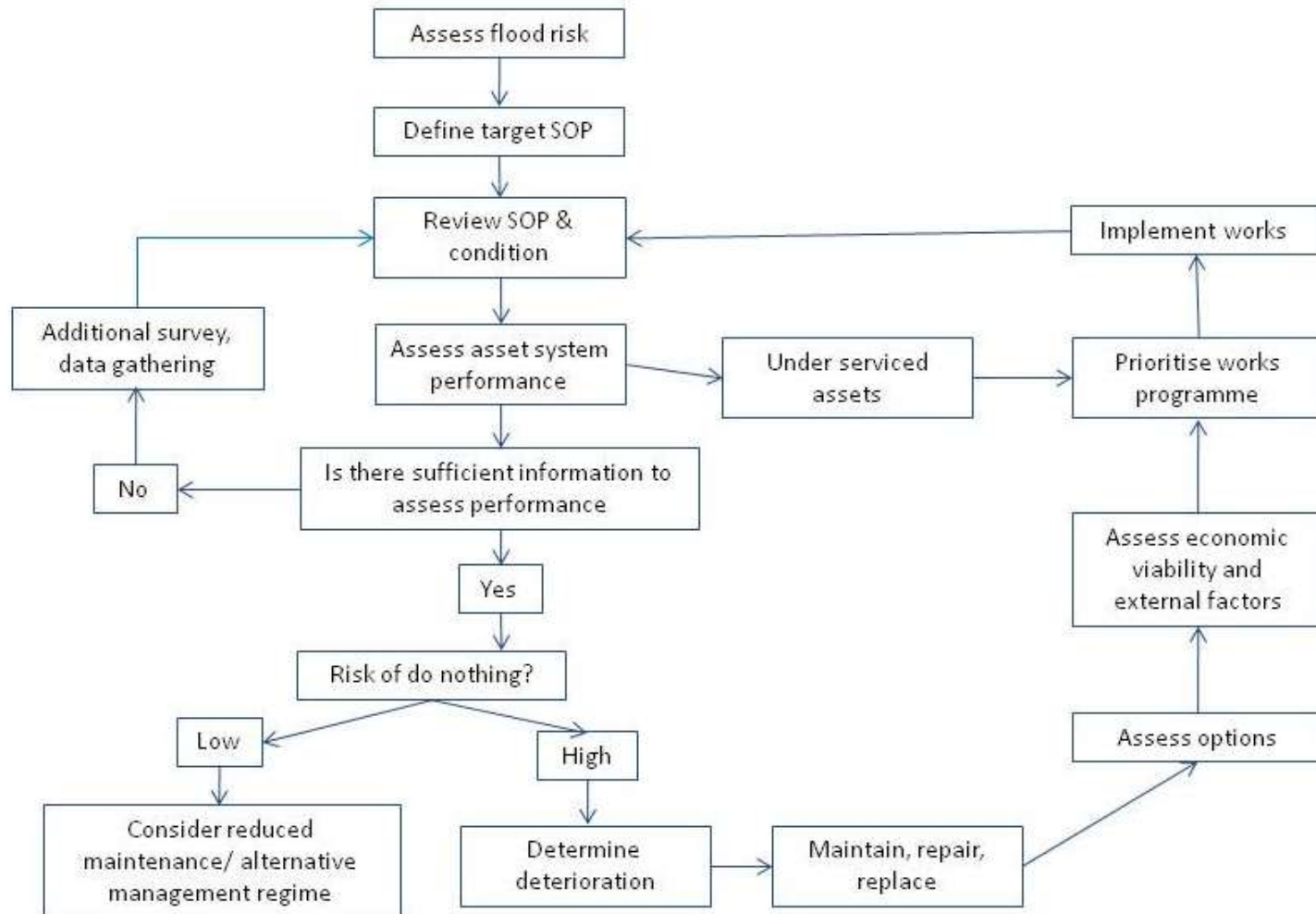
- Asset inspection = 154 days
- Operational inspection = 1,041 days
- Asset inspection = £77,000
- Operational inspection = £316,000



Planning



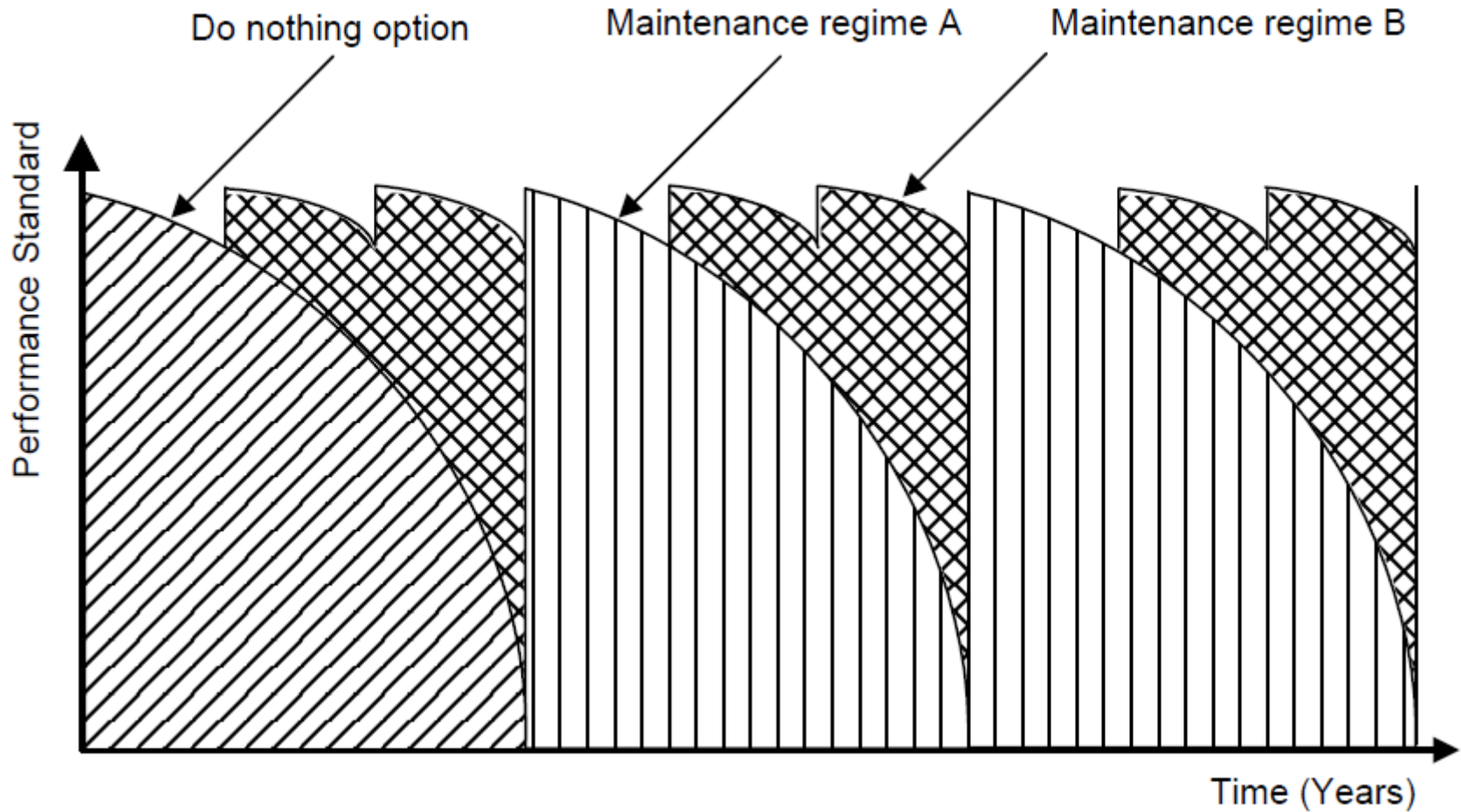
WDR & RT TAGGART



Planning and maintenance regimes

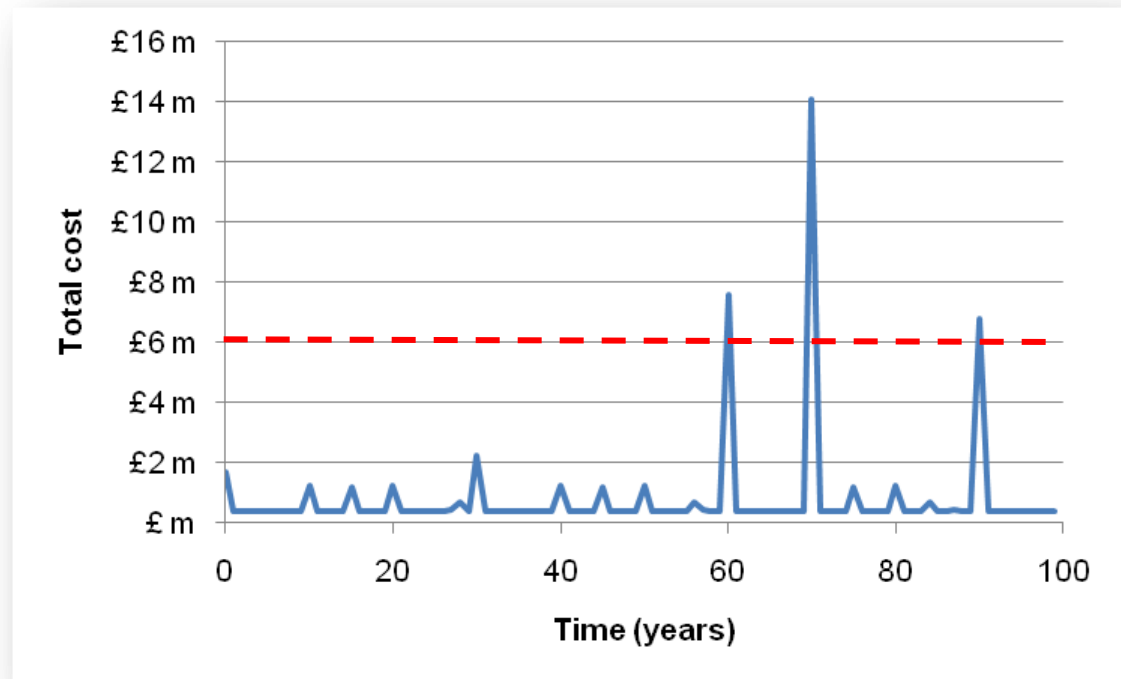


WDR & RT TAGGART

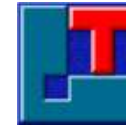


Whole life costs / cost profiles

- Need to budget future works
- Compare costs against benefits of maintaining
- Whole life asset costs:
 - Inspection (risk based)
 - Frequent maintenance
 - Intermittent
 - Replacement



Deterioration and residual life



WDR & RT TAGGART



Deterioration curves

- Expenditure extends asset life and reduces rate of deterioration
- Benefit of intervention measured by extension of the residual life

Defence Type	Narrow / Wide	Maintenance	Grade1	Grade 2	Grade 3	Grade 4	Grade 5
Gabion	N/A	N/A	0	5	10	22	28
Wall	N/A	No	0	20	50	70	90
		Yes	0	20	50	100	120
Embankment	Narrow	No	0	3	6	25	40
		Yes	0	15	30	130	150
	Wide	No	0	3	6	25	40
		Yes	0	15	30	130	150

Planning

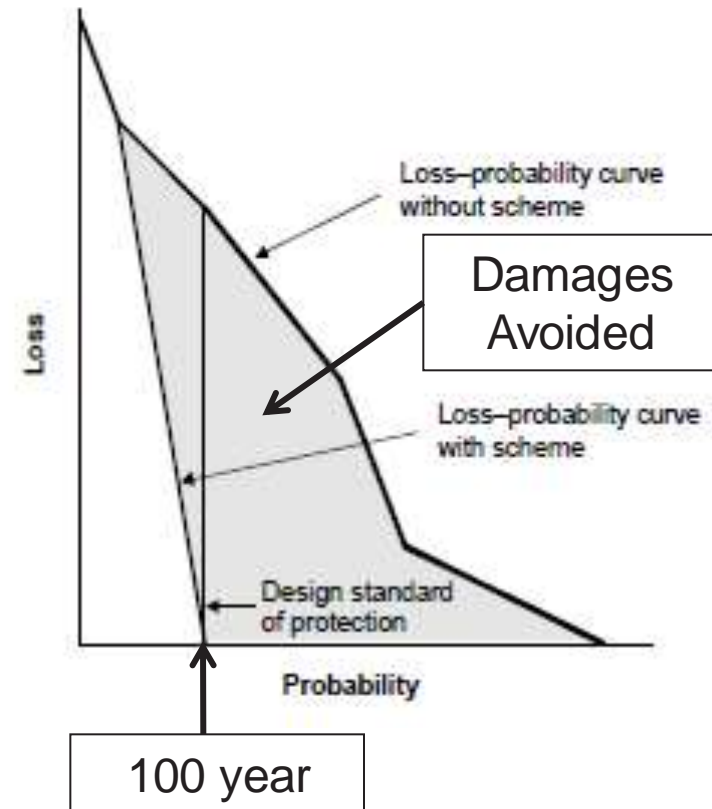


WDR & RT TAGGART



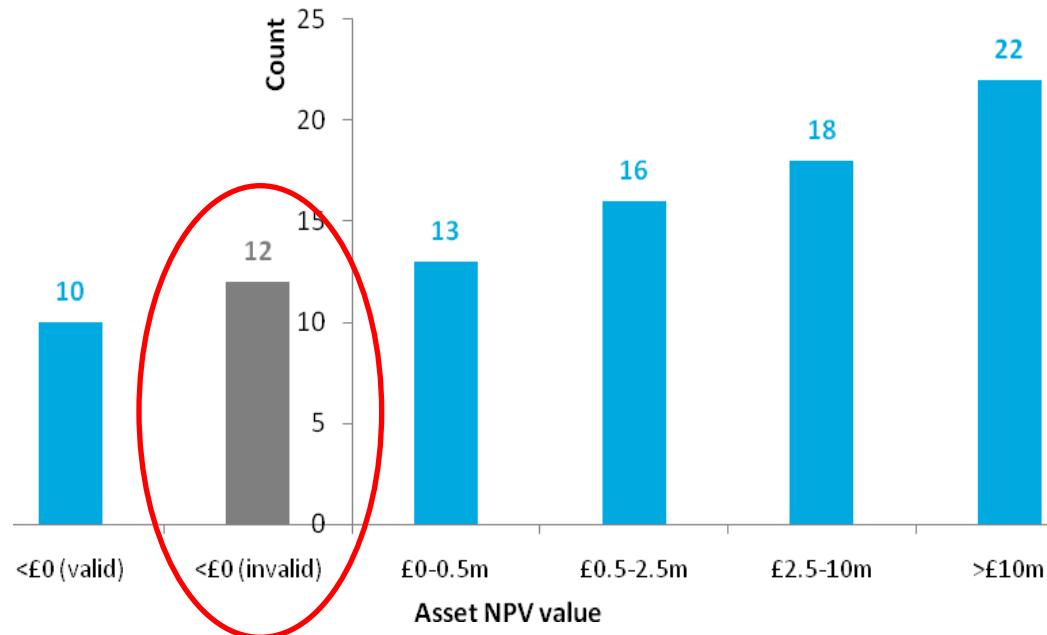
Benefits

- Benefits of maintaining assets in good condition and retained standard
- Benefits of long term maintenance
 - Do Nothing (no costs)
 - Continued maintenance and replacement
- Assumes target condition grade
- Damages assume 1 in 100 year standard



Net Present Value

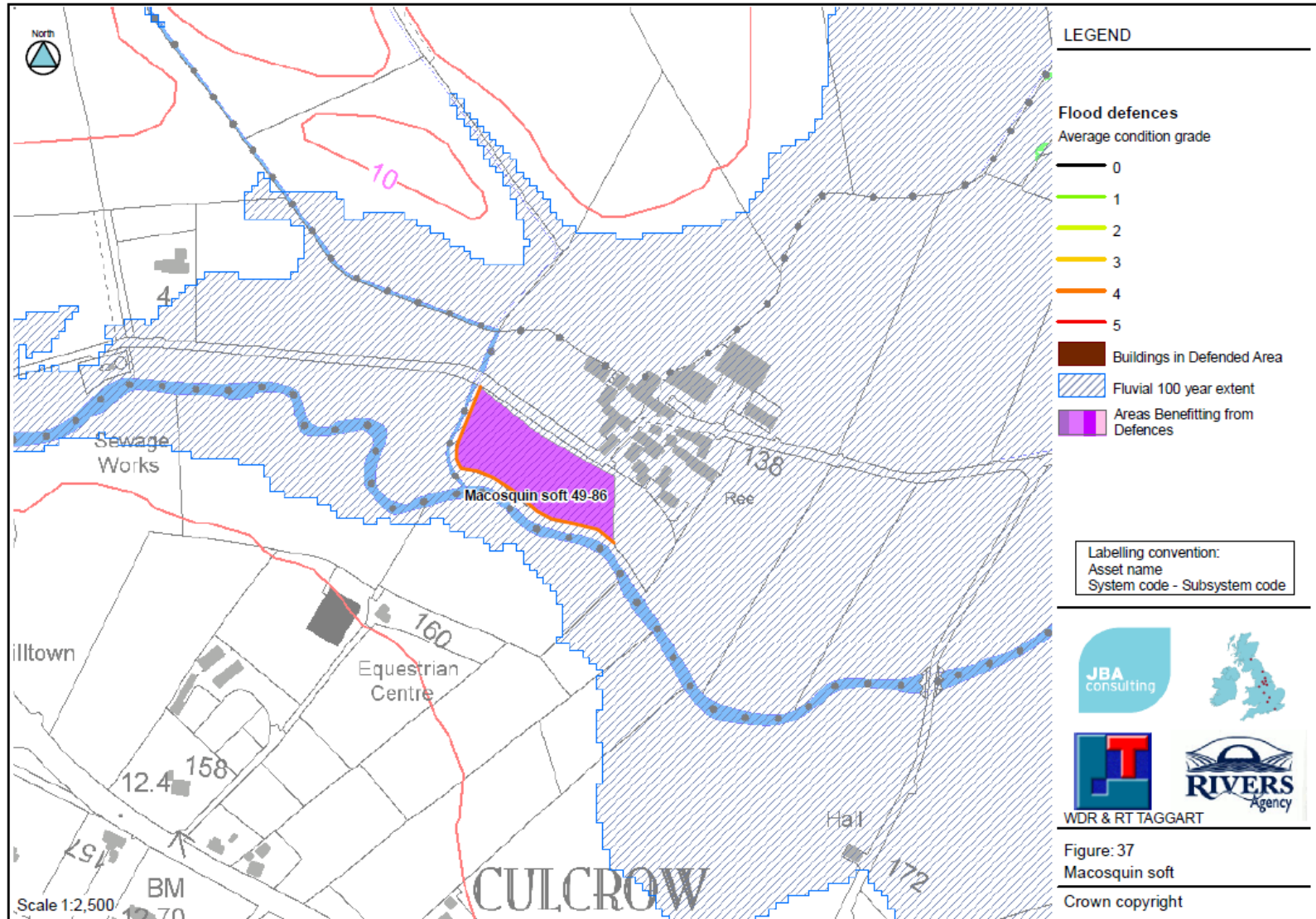
- Costs and benefits compared
- Net Present Value for each system / sub-system
- Positive NPV suggests long term benefits outweigh long term costs



Discussion example



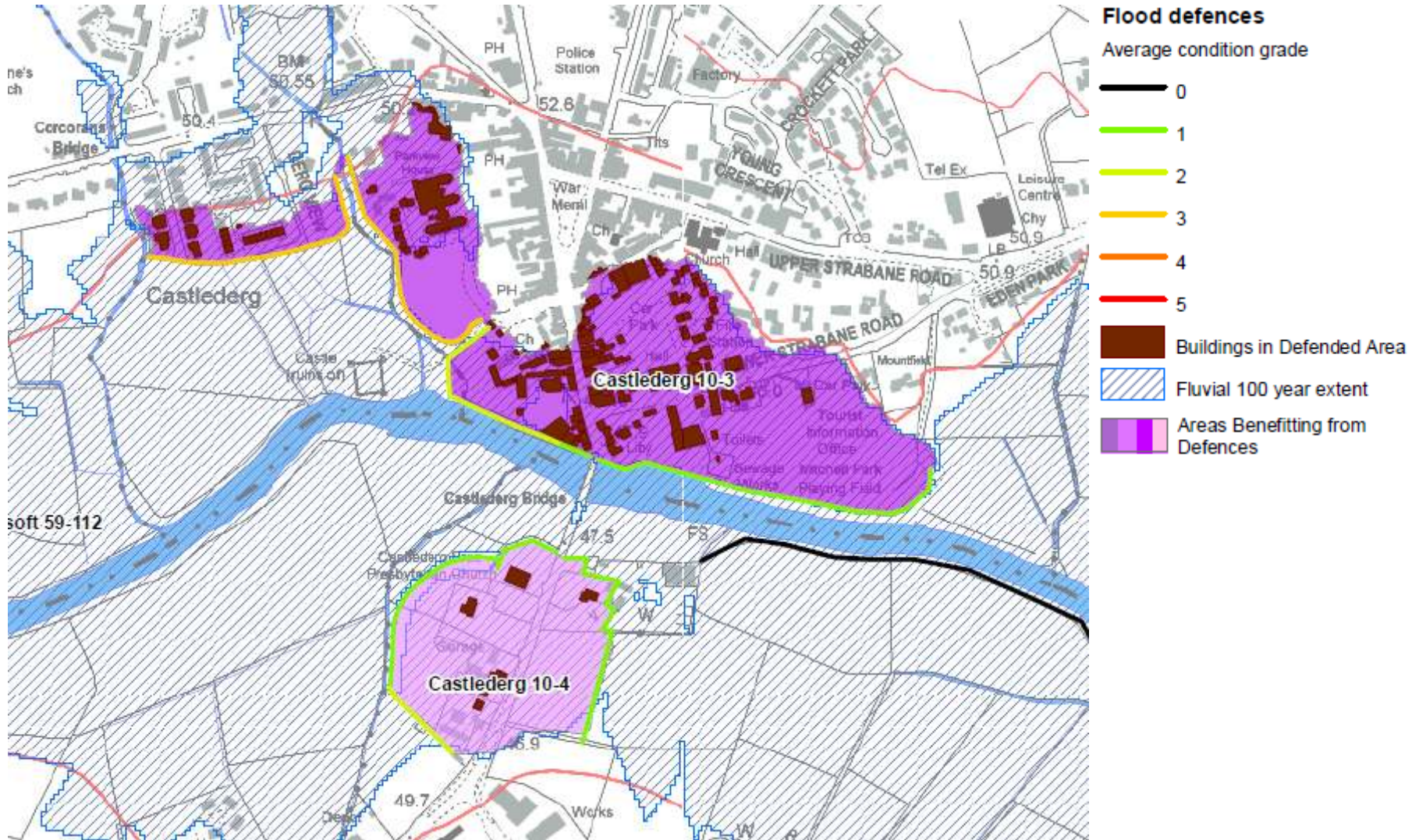
WDR & RT TAGGART



Discussion example



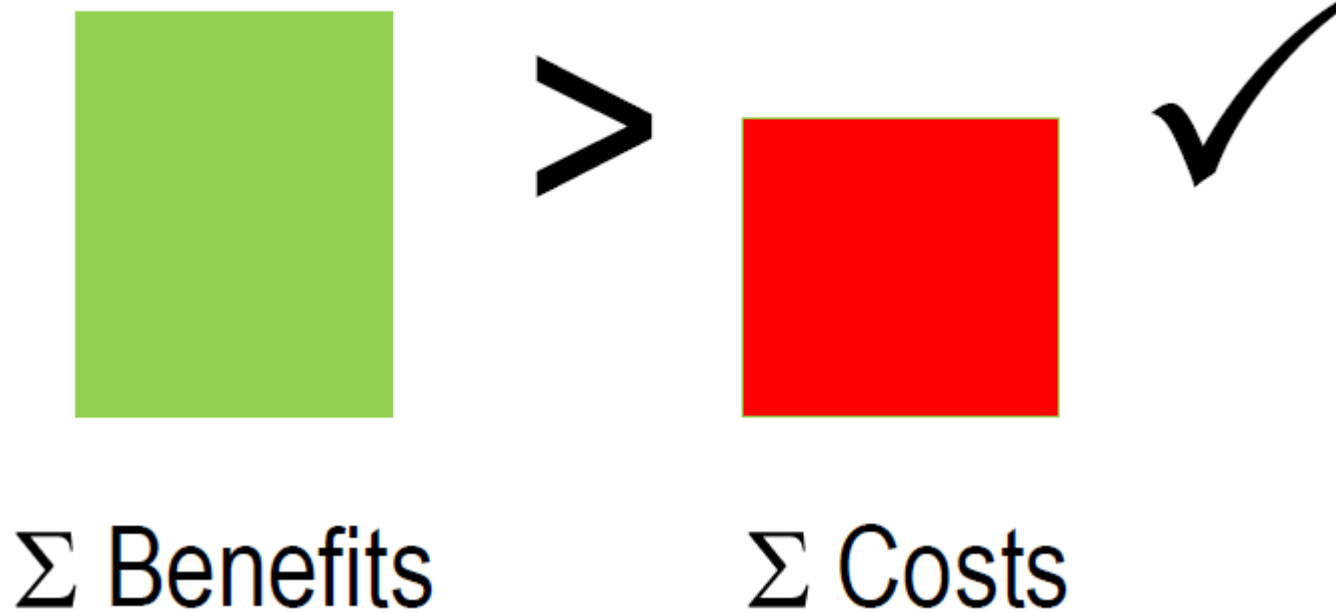
WDR & RT TAGGART



Uncertainty



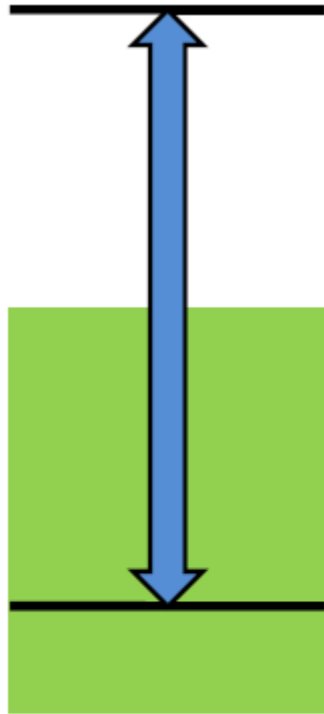
WDR & RT TAGGART



Uncertainty

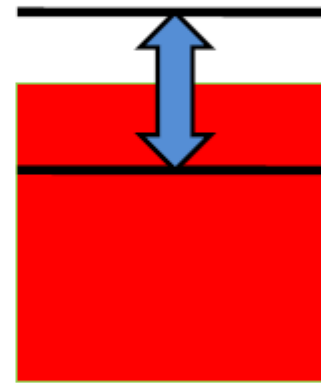


WDR & RT TAGGART



Σ Benefits

-



Σ Costs

= ?

Intervention



WDR & RT TAGGART



Alternative management regime

- Suggests policy decision is required for future management of sites
 - Continue to maintain
 - Minimum needs
 - Consider flood resistance/resilience measures
 - Consider flood warning
 - Consider stakeholder self management
 - Re-instate a 100 year standard scheme (if cost effective)
-

Key findings



WDR & RT TAGGART



- 10% of assets below target grade
- Investment needs:
 - £1.3m - costs to correct failing assets
 - £0.4m - annual maintenance and inspection costs
- 9 systems uneconomic
- Ongoing risk and performance modelling
- Update asset database and condition surveys

	Failing systems	Systems with assets in target condition	Total
Maintain & replace	25	34	59
Minimum needs	6	3 (suggests cost savings may be available)	9

Recommendations of AMP



WDR & RT TAGGART



Strategic

- Future AMP Policy
- Future AMP cycles
- Management of failing assets

Data

- Additional data gathering
- Improvements in flood outlines
- Understanding SOP
- Rural soft defences

System

- Maintain and replace
- Minimum needs
 - Consider lowering or removing management responsibilities
 - Consider alternative measures (resistance, resilience, warning)

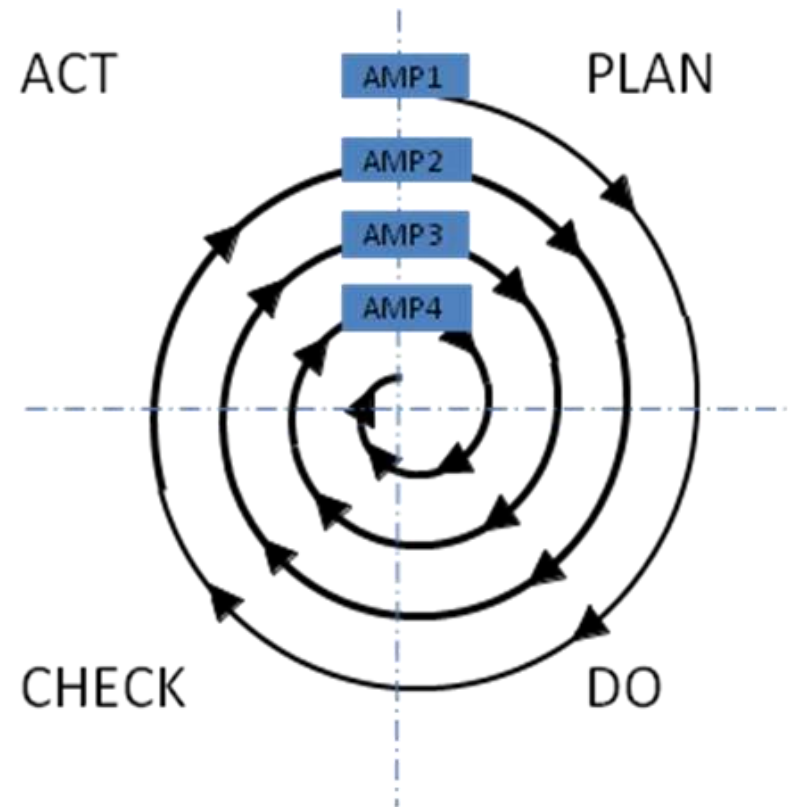
Conclusions of AMP



WDR & RT TAGGART



- AMP links policy to delivery
- AMP targets resources
- Future AMP revisions are required
- Role out to other areas assets
- An integrated assessment is required
- AM Policy is required



Comparison with Scotland



WDR & RT TAGGART



- SFDAD – 2004-2006
- Determination of SOP
- Detailed modelling
- No AMP
- Asset condition not updated
- 2006 – AAD avoided - £12m





JBA
consulting

JBA: David Bassett, Marion McMillan

WDR & RT Taggart: Simon Wells

John Chatterton

Rivers Agency: Brian Doyle, William Kingham, Michael McLean, Stephen Lancaster and Malcolm Calvert



WDR & RT TAGGART



JBA
consulting

Questions

angus.pettit@jbaconsulting.co.uk



WDR & RT TAGGART