

Blockage management guide

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Preamble

- ➔ Project from the Joint FCERM programme
 - ➔ led by the Environment Agency
- ➔ Starting point to reduce inconsistency across the flood risk management sector
- ➔ Brings a science and evidence-based view to a highly uncertain subject
- ➔ The Guide, published in November 2019, is supported with a scientific report

Acknowledgements

⇒ Theme and Project Manager

- ⇒ Owen Tarrant, Asset Management
- ⇒ Mark Whitling, Evidence Directorate

⇒ Project Board

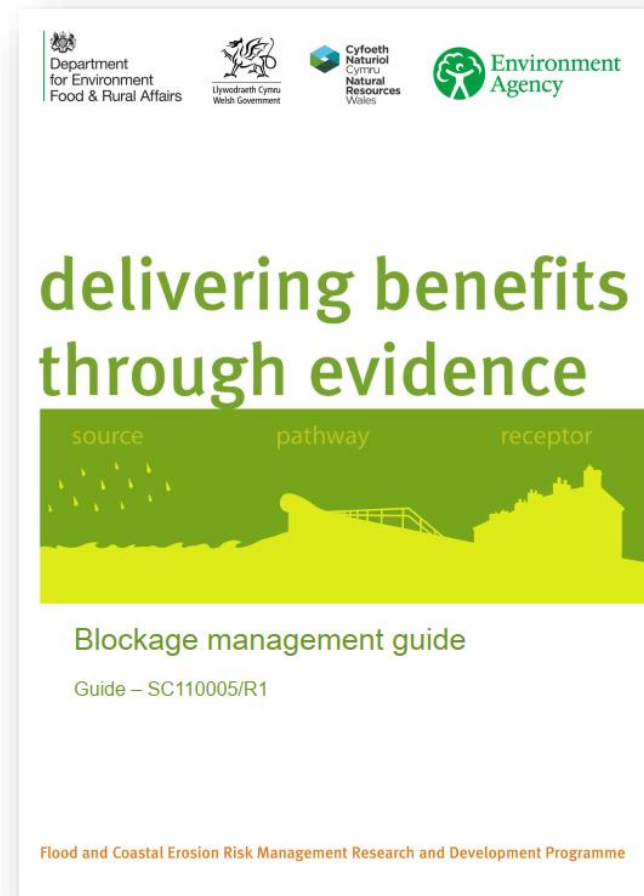
- ⇒ Range of EA staff

⇒ Research team

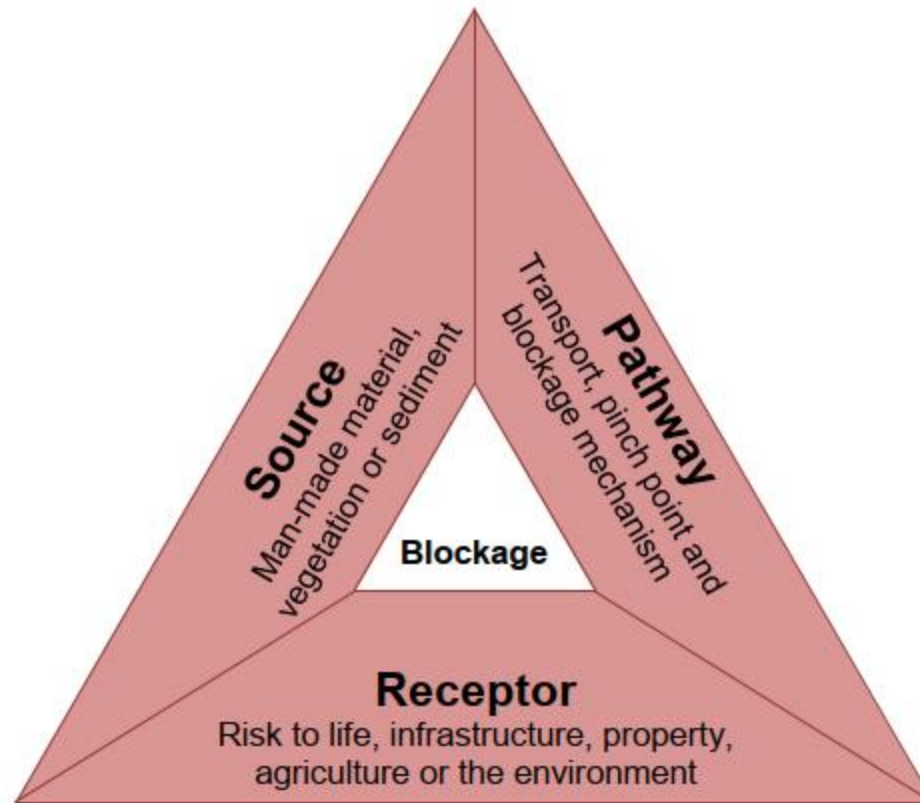
- ⇒ JBA Consulting
- ⇒ Sayers & Partners LLP
- ⇒ Reviewers (EA, JBA Consulting and Mott MacDonald)

Introduction

- ➔ What is blockage?
- ➔ What we did
- ➔ Initial appraisal
- ➔ Detailed assessment
- ➔ Blockage management
- ➔ Limitations
- ➔ Where to find out more



What is blockage?



All 3 elements combine to cause damage

Types of debris

Vegetation (floating)

Mats of weeds, leaves, twigs, cuttings, shrubs, branches, logs and trees.



Man-made (floating or non-floating)

Packaging, containers, pallets, bales, trolleys, furniture, mattresses and carpets.



Sediment (non-floating)

Silt, sand, gravel, cobbles and boulders.



Short-term impacts



- ➔ Flooding
- ➔ Block flap valves and control gates
- ➔ Structural failure
- ➔ Scour
- ➔ Obstruct navigation
- ➔ Hazard to water users
- ➔ Lose public confidence

Top photo: Laura Bullivant

Long-term impacts

- ➔ Infill blockage
- ➔ Sedimentation
- ➔ Flow diversity
- ➔ Habitat
- ➔ Water quality improvements
- ➔ Flood attenuation
- ➔ Management costs



Case study: screen blockage

➔ Surprisingly common!



Case study: temporary structures

➔ Form a variable blockage



Case study: scour



The need for guidance

➔ No consistent guidance on

- ➔ Type of debris

- ➔ Impact of debris

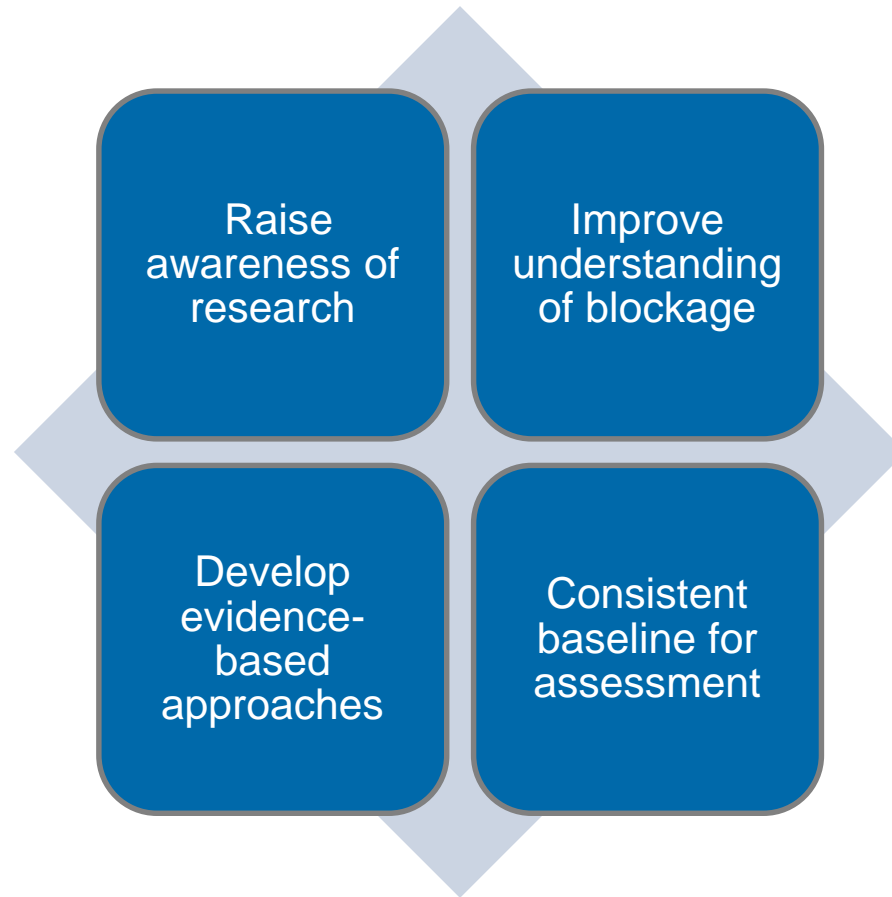
- ➔ Aggregate susceptibility of catchment to blockage at many locations

➔ Issues for economic appraisal

- ➔ Defining Do nothing, Do minimum and Do something for capital schemes

- ➔ Attempting to identify benefits of clearance activities

Our objectives



What we did

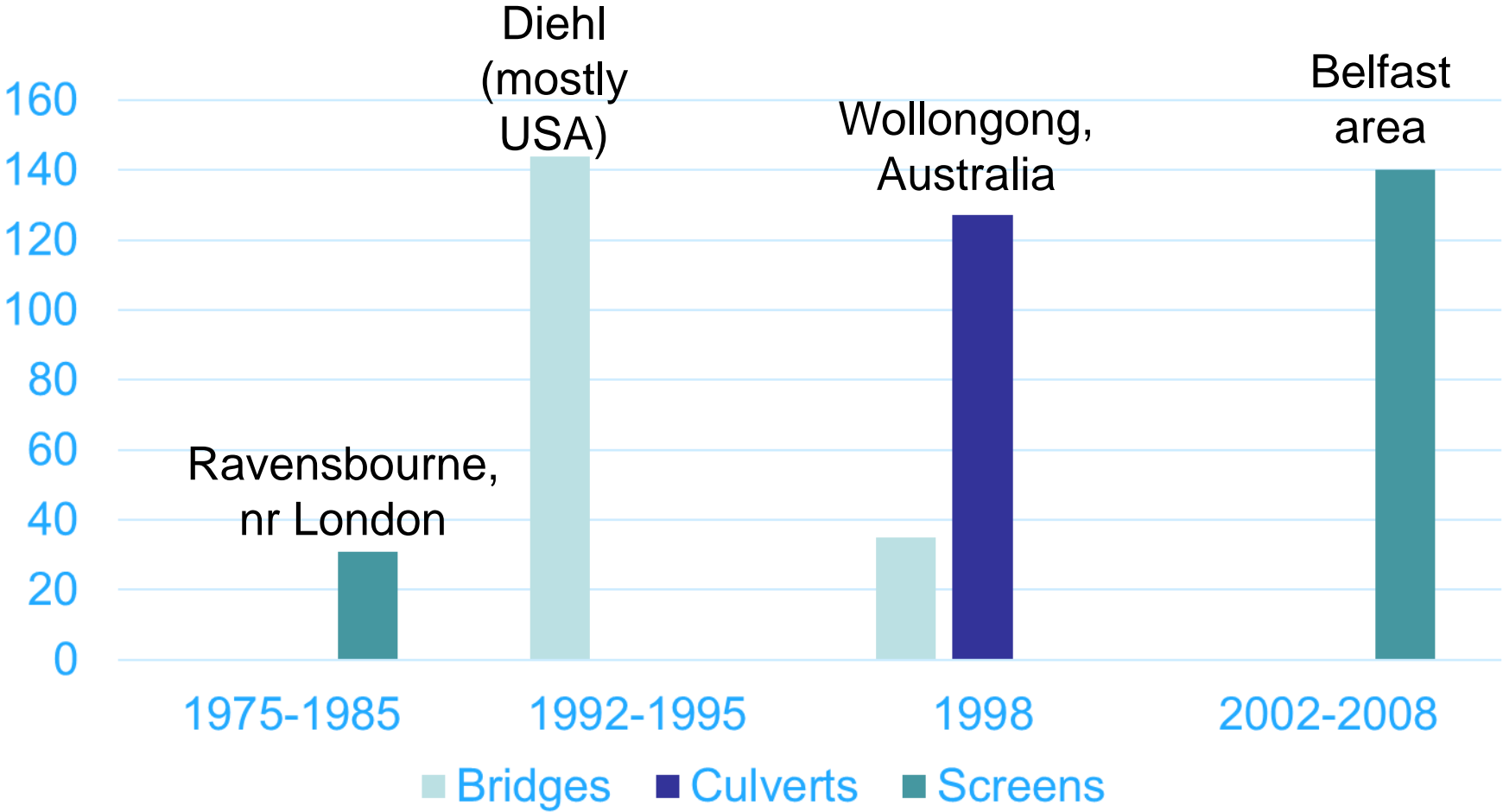


- Literature review
- Consultation

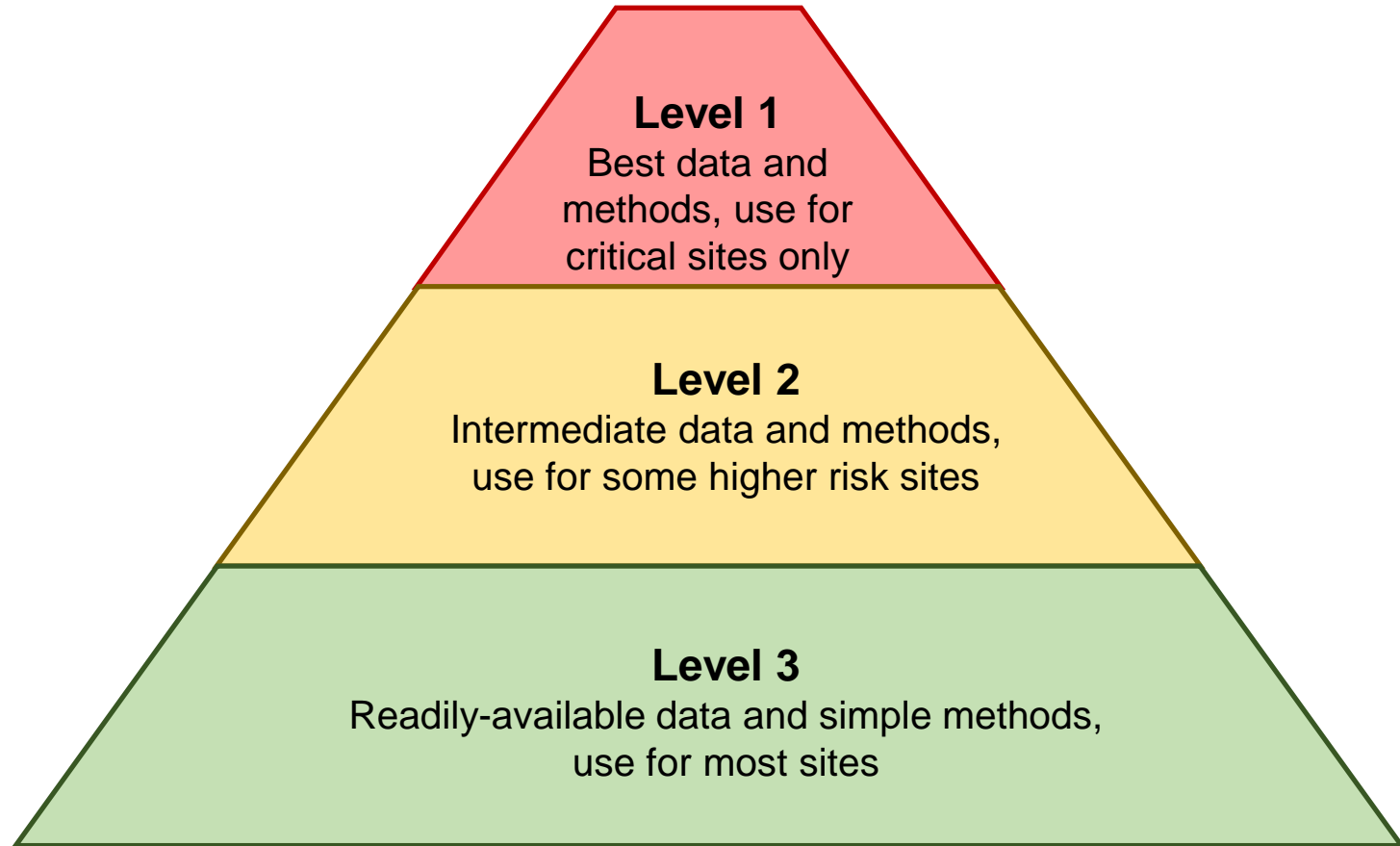
- Identify knowledge gaps
- Validate existing methods

- Blockage management guide
- Science report

The blockage data challenge



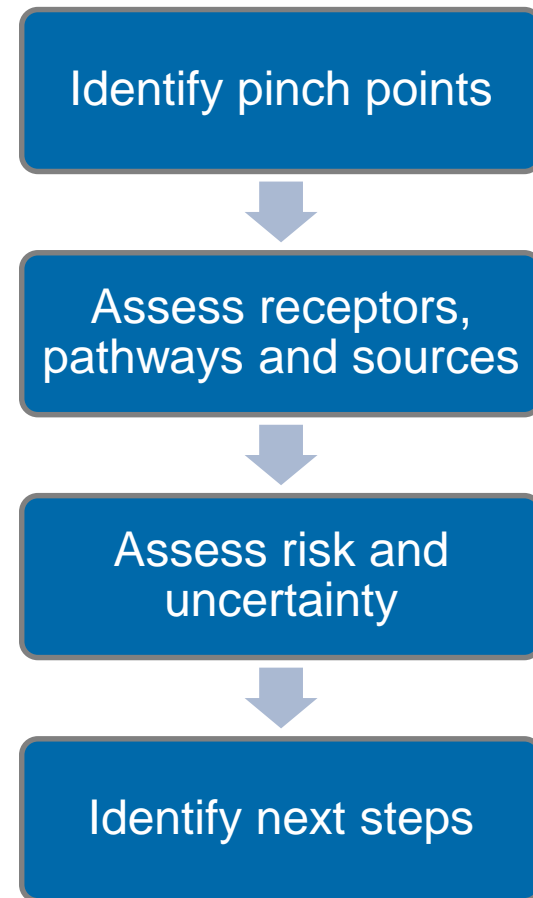
Levels of detail



Initial appraisal

⇒ Use to:

- ⇒ Identify and rank problem sites
- ⇒ Assess risk (single site or portfolio of sites)
- ⇒ Decide whether risk is acceptable
- ⇒ Identify options



Step 1 Pinch points and impact types

Pinch points

- Debris prevents operation
- Central or internal obstruction
- Narrow or low gap
- Low soffit
- Shallow or slow flow

Potential impacts

- Flooding upstream or on relief path
- Structural failure or embankment breach
- Contraction or local scour

Step 2 Assess receptors

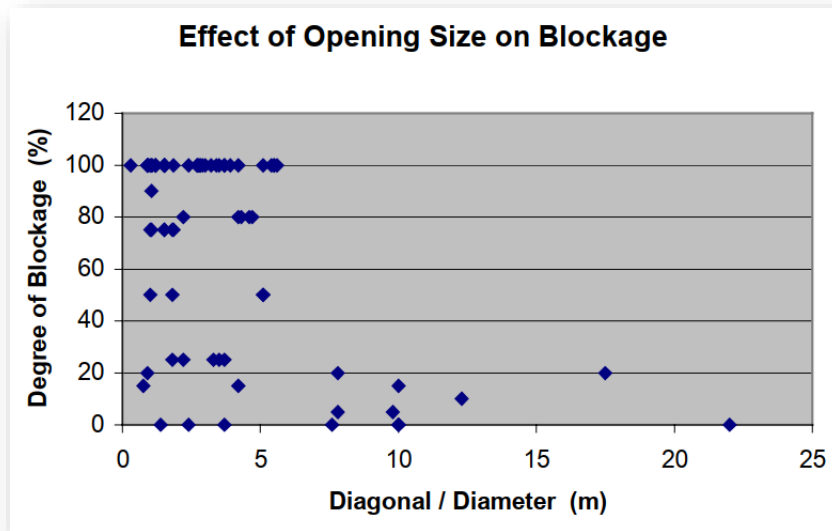


- ➔ Property
- ➔ Infrastructure
- ➔ Risk to life
- ➔ Environment

HIGH RISK FACTORS
Blockage would cause
flooding upstream or downstream
Risk of embankment breach

Step 3 Assess pathways

- ➔ Debris transport +
- ➔ Pinch point/s +
- ➔ Blockage mechanism



HIGH RISK FACTORS
Rapid response catchment
Small openings



Step 4 Assess sources

⇒ Consider:

- ⇒ Land use
- ⇒ Riverside vegetation
- ⇒ Fly-tipping
- ⇒ Storage of materials
- ⇒ River type, sediment sources or deposition
- ⇒ Length of contributing watercourse
- ⇒ Debris accumulation

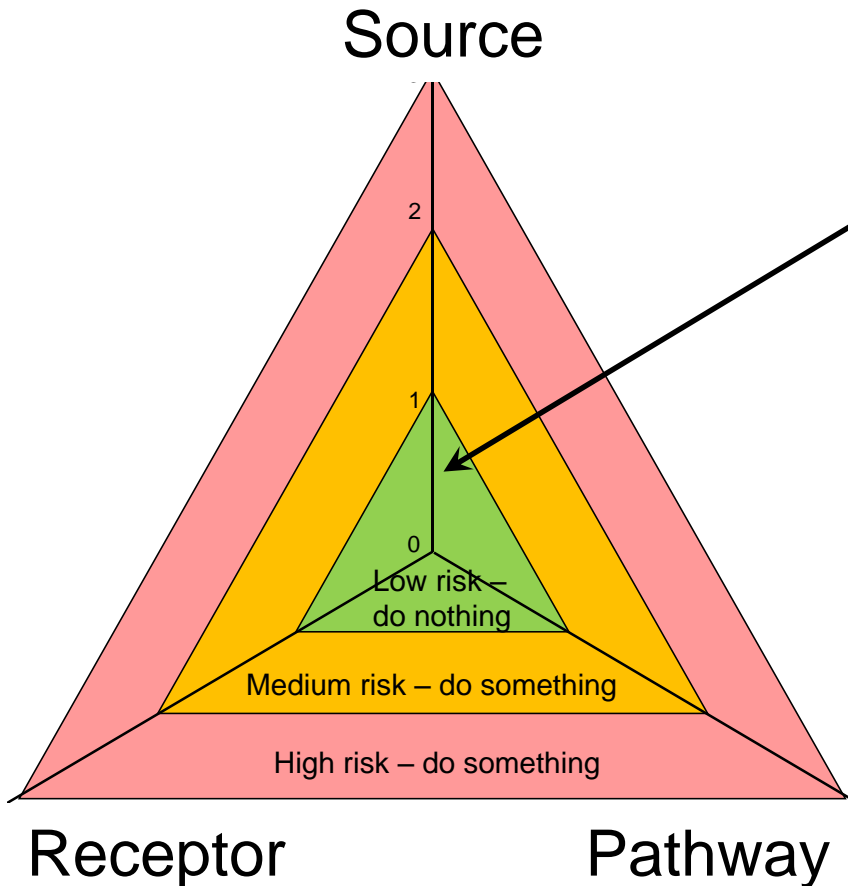


HIGH RISK FACTORS

- Woodland or riverside trees
- Timber operations
- Urban area, history of fly-tipping
- Debris within channel upstream



Step 5 Assess risk and uncertainty



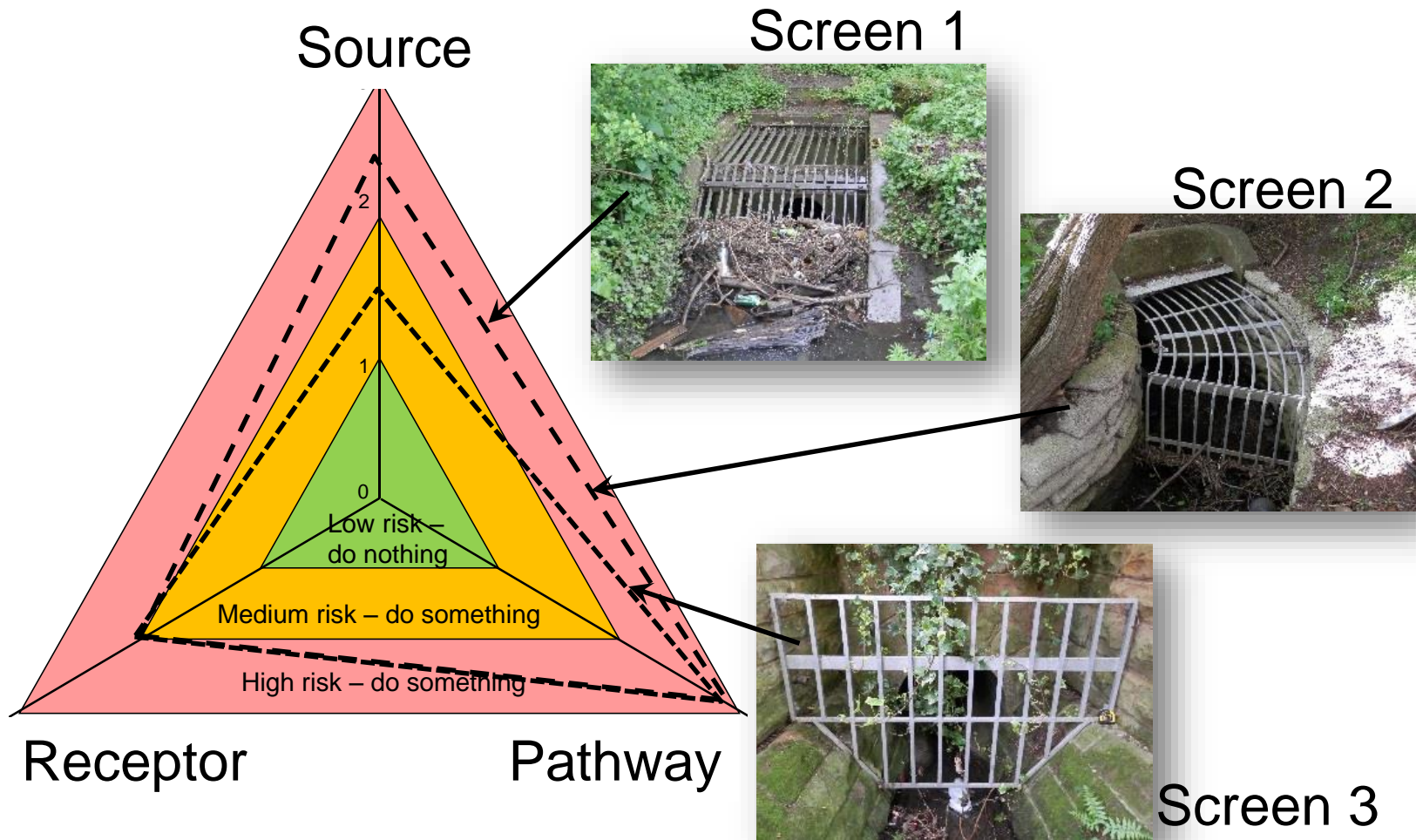
Step 6 Identify next steps

Low risk → do nothing

Medium or high risk → do something

High uncertainty?
More data
gathering or
detailed
assessment

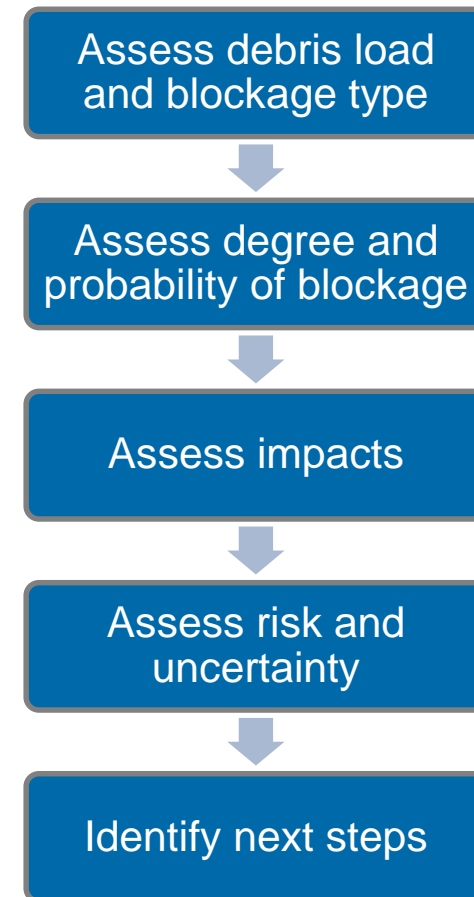
Example: three screens



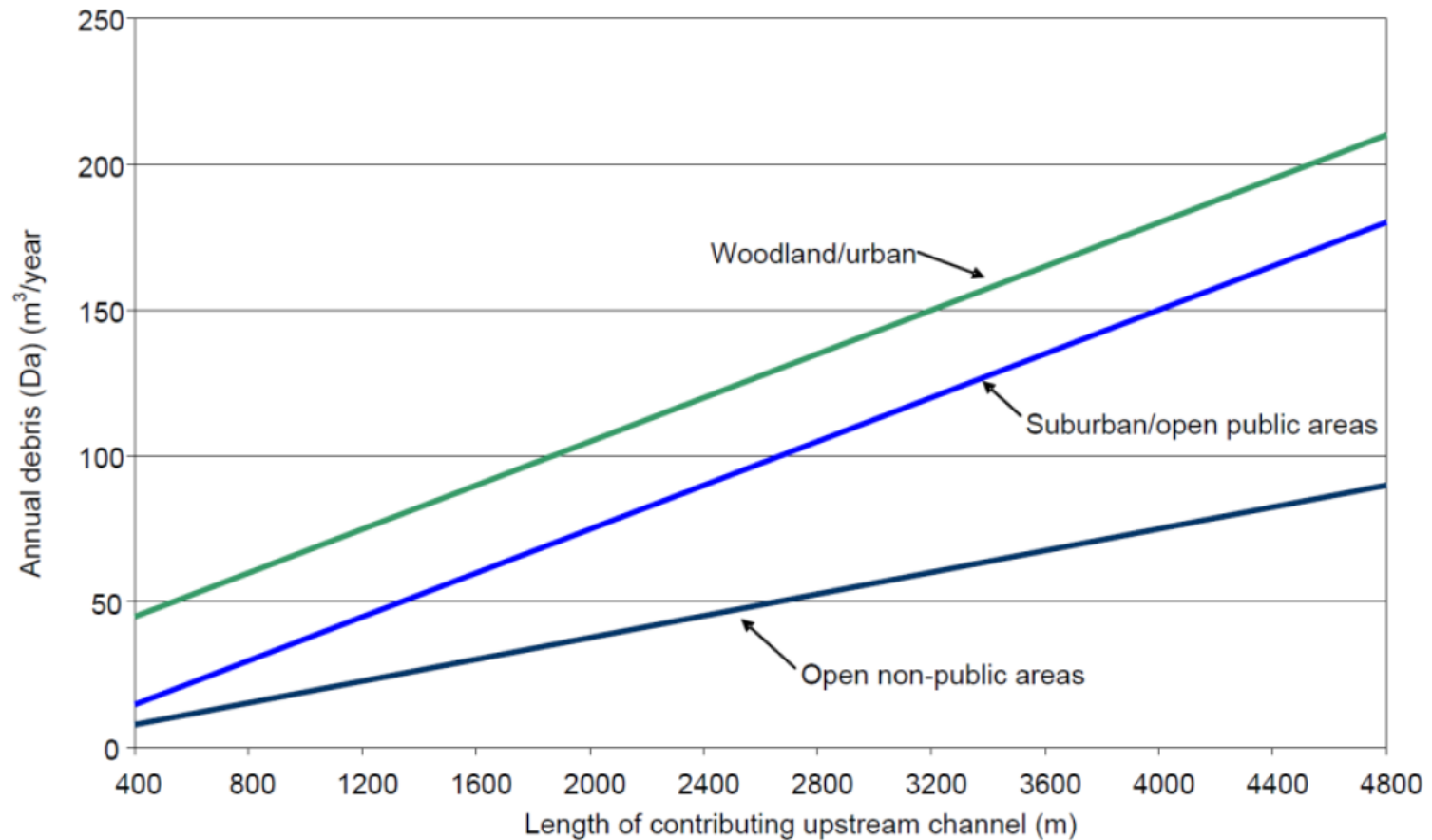
Detailed assessment

⇒ Use to:

- ⇒ Assess risk at high risk or uncertain sites
- ⇒ Plan inspection and maintenance
- ⇒ Inform modelling and mapping of risks
- ⇒ Inform economic appraisal and design



Step 1 Assess debris load



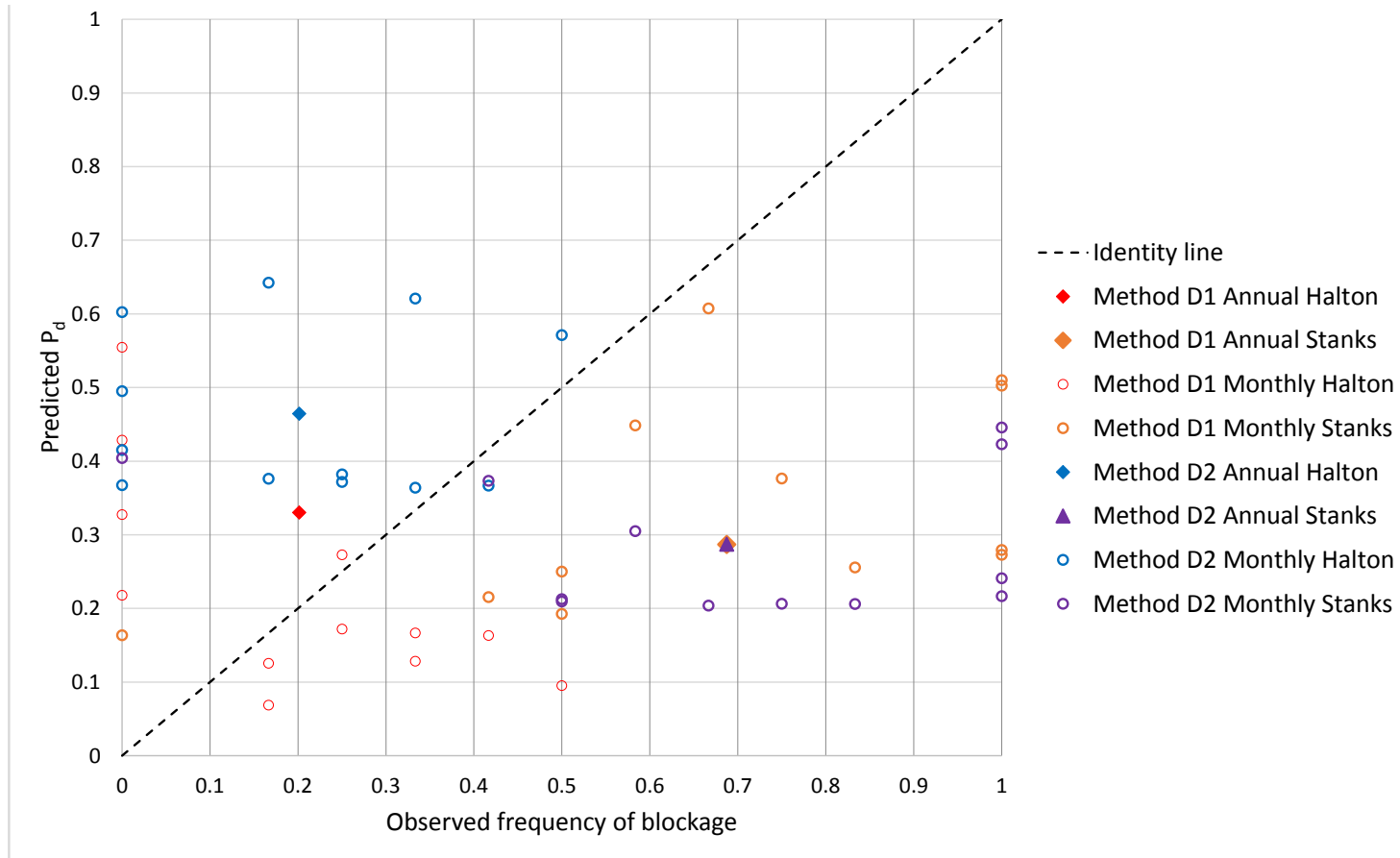
Step 2 Assess blockage type



Step 3 Assess degree of blockage

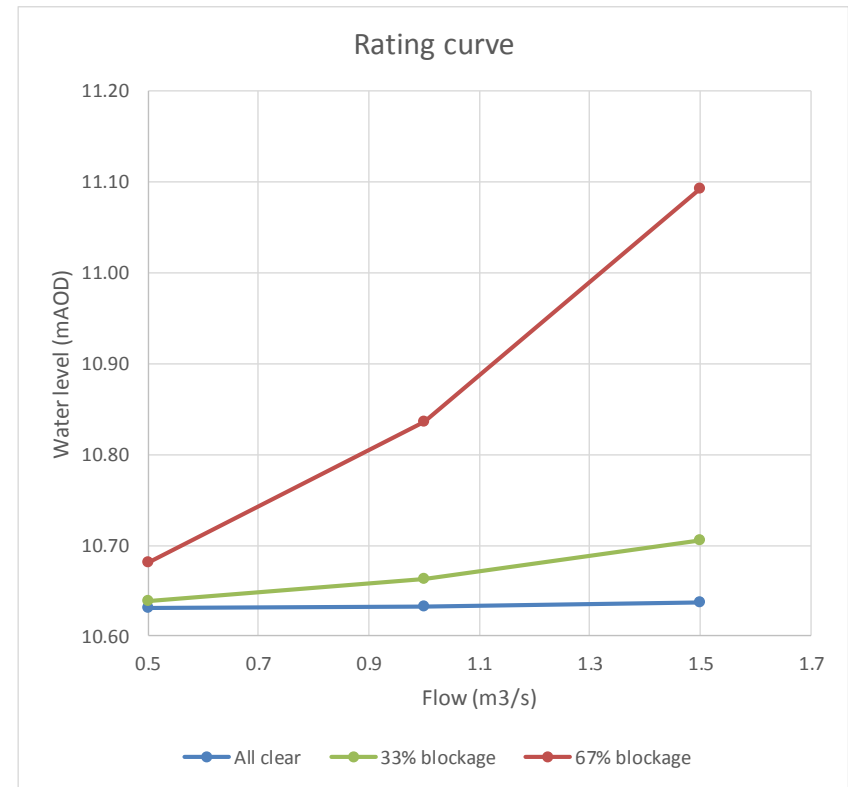


Step 4 Assess probability



Step 5 Assess impacts

- ➔ Water level
- ➔ Receptors
- ➔ Damages



Step 6 Assess risk and uncertainty

⇒ Calculate blockage risk

⇒ Impact on water level

⇒ Nature of impacts

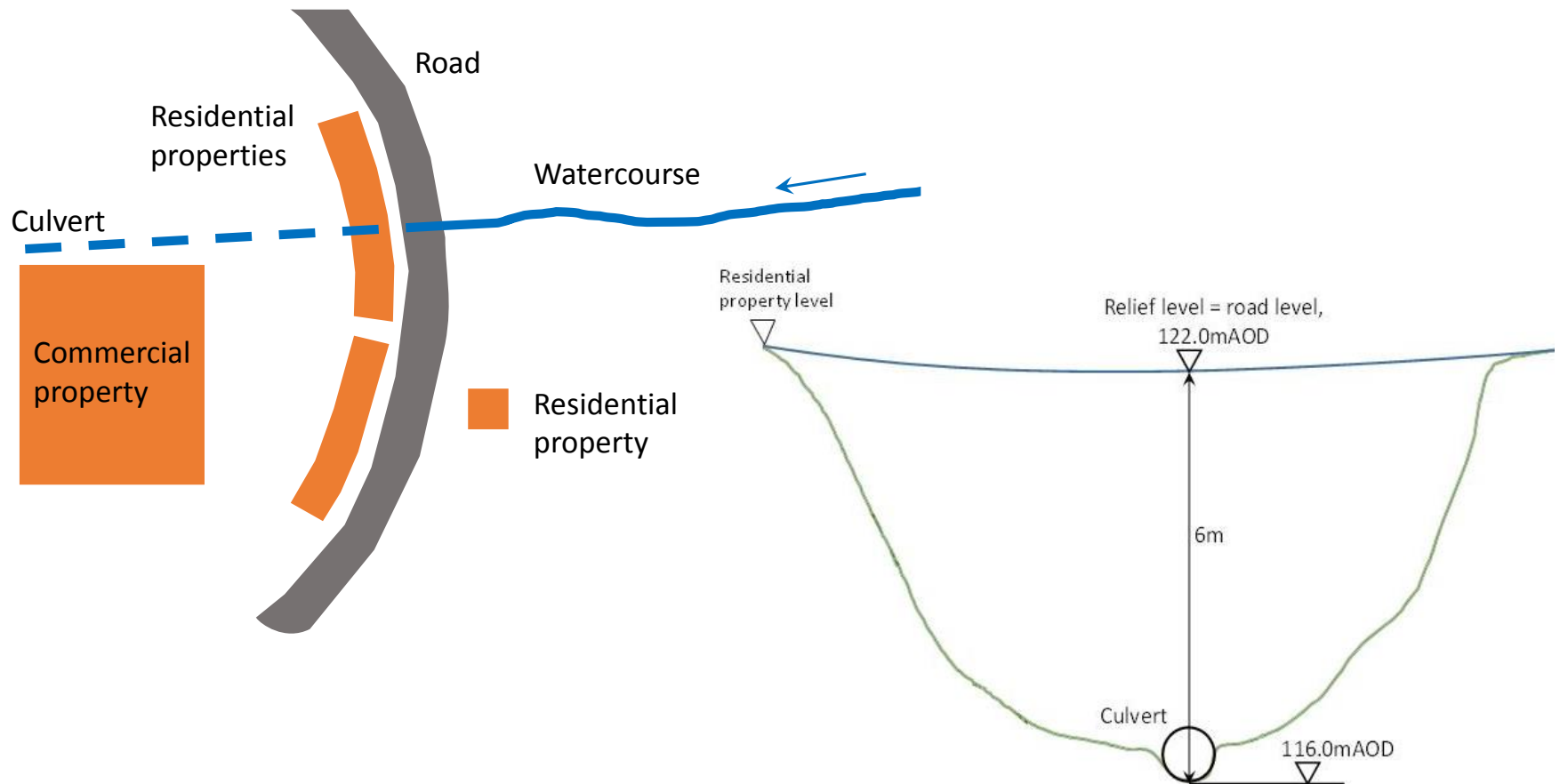
⇒ Impacts in £ for 'all clear' and 'with blockage'

⇒ Uncertainty, sensitivity testing and verification

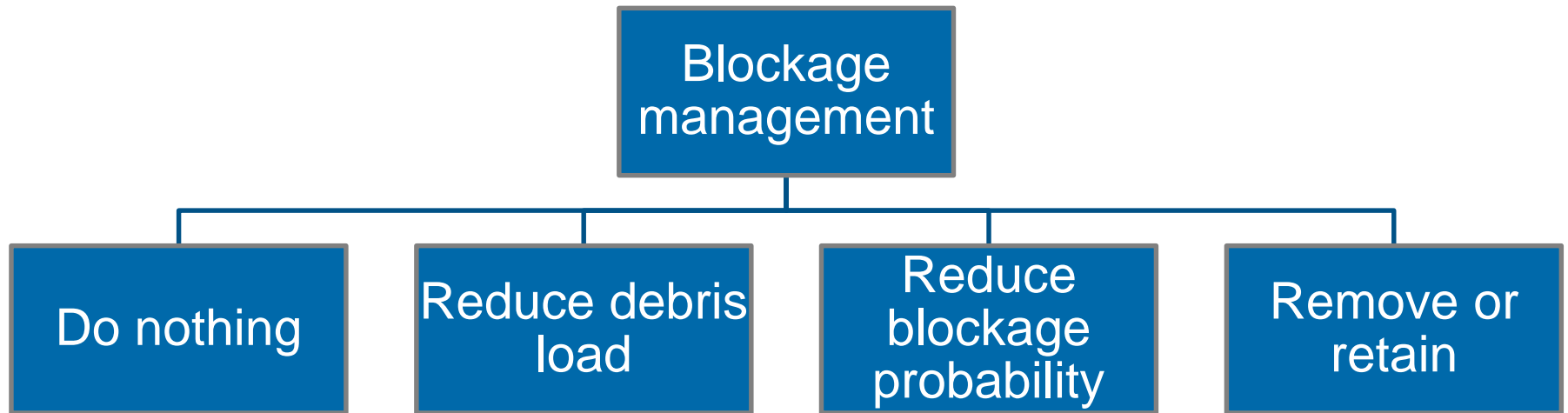
⇒ Step 7 Plan next steps

⇒ Do something?

Example: highway culvert



Management options



Choice of management option

Blockage type	Proactive → → →			Reactive	
	Load	Probability		Consequences	
	Source control	Design or retrofit	Inspect or monitor	Remove debris	Retain debris
High risk	Y	Y	Y	N	N
Low risk	Y	Y	Y	Y	Y
Refuse	Y	Y	Y	Y	N
Vegetation	Y	Y	Y	Y	Y
Sediment	Y	Y	Y	Y	Y
High volume	Y	Y	N	N	N
Low volume	Y	Y	Y	Y	Y
Rapid blockage	Y	Y	N	N	N
Slow blockage	Y	Y	Y	Y	Y
Difficult to intervene	Y	Y	N	N	N
Easy to intervene	Y	Y	Y	Y	Y
Remote disposal	N	Y	N	N	Y
Local disposal	Y	Y	Y	Y	Y

Environmental impact

Impact	Reduce debris load	Reduce blockage probability	Remove or retain
Red (greatest impact)	<ul style="list-style-type: none"> Remove all debris from channel and floodplain upstream 	<ul style="list-style-type: none"> Inspect or monitor to allow timely intervention 	<ul style="list-style-type: none"> Retain refuse Remove debris or sediment and use off-site or dispose to landfill
Amber	<ul style="list-style-type: none"> Remove selective debris and re-align remainder to improve flow 	<ul style="list-style-type: none"> Modify or replace structure 	<ul style="list-style-type: none"> Remove debris or sediment and return to river downstream
Green (least impact)	<ul style="list-style-type: none"> Identify debris sources and control at source 	<ul style="list-style-type: none"> Remove structure and restore natural channel 	<ul style="list-style-type: none"> Remove refuse Retain woody debris or sediment

Reduce debris load at source



Reduce probability



Remove debris

Photo John Riddell

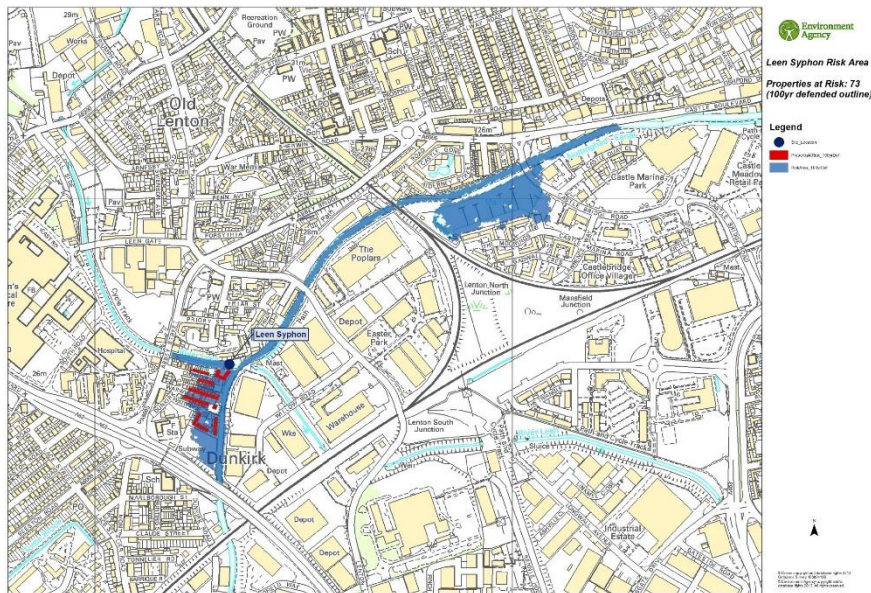


Case study: screens

- ➔ Assessment of probability of blockage
 - ➔ Type of screen
 - ➔ Source and type of debris
 - ➔ Hydraulic performance assessment
 - ➔ Operational experience

Case study: screens

➔ Assessment of consequence of blockage



➔ Categorise (eg High Priority / Lower Priority)

Case study: screens

- ➔ Plan
- ➔ Monitor
- ➔ Review

Grille Inspection 7

Select Area Office: *

- Greater Belfast
- Lisburn
- Armagh
- Omagh
- Coleraine
- Ballinamallard

Select Squad: *

- D10
- D14
- D36
- D40
- D41
- D42

Grille Number *

999-999

161-013

Category (select A or B) *

- A
- B

Location *

54.497°N 6.052°W ± 48 m

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Date & Time On Site *

Thursday, 18 April 2019 08:06

Photo (on arrival) *

Extent of Grille Debris on front of grille ON ARRIVAL *

0

Site Debris Management (tick any that apply)

- Stockpiled on Site
- Removed from Site

Inspection/Works Comments

Debris removed from grille

Photo (on departure)

Extent of Grille Debris on front of grille ON DEPARTURE *

0

Length of Time On Site (minutes) *

35

Date & Time Off Site *

Date Time

Additional Works Required ? *

- Yes
- No

Inspector (type name) *

Mr Smith

GRILLE MAINTENANCE RECORD SHEET

SUB DISTRICT	Area Covered :-		{Supervisor or Deputy Supervisor}		{District Foreman}		OBSERVATION ON ARRIVAL AT SITE (tick all that apply)						
	Antrim, Parkgate, Mallusk, Ballyclare, Straid, Mossley, Doagh, Templepatrick.		Name:-	Signed:-	Name:-	Signed:-	TIME ARRIVE AT SITE	GRILLE DEBRIS (See guidance)	Damage to fence √	Damage to Grille √	Access Refusal √	SITE DEBRIS √	
GRILLE Ref. (from GIS)	WATERCOURSE	CAT	LOCATION	Date: / /	Date: / /	Band 1-4 (Clear - 0)						Stockpile on Site	Removed from Site
	NUMBER	NAME											
	U3 728	HOLYWELL BURN	B	Outlet grille at Niblock Road (near Argyll Street) ANTRIM									
	U3 728	HOLYWELL BURN (side inlet)	A	Small inlet grille at downstream side of Niblock Road (near Argyll Street) ANTRIM									

Conclusions

- ➔ Blockage can have short- and long-term, positive or adverse impacts
- ➔ But it's highly uncertain
 - ➔ Stochastic process with many influential factors
 - ➔ Limited data
- ➔ Assess and manage the risk
 - ➔ Professional judgement
 - ➔ Sensitivity testing
 - ➔ Systematic data gathering

Conclusions

➔ But don't ignore it



Where to find out more

- ➔ Blockage management guide (SC110005)
- ➔ Blockage management guide - science report
- ➔ Project summary
- ➔ Go to:
<http://evidence.environment-agency.gov.uk>

