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HAZARDSCRC

FRAMEWORK TO INSPECT FLOODWAYS TOWARDS ESTIMATING DAMAGE

Presenters Name

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FLOODWAYS

- 1) Small road structure
- 2) Meant to be covered with flood water and to be fully functional after flood water recedes
- 3) Mainly in rural access roads, few in rural collector roads
- 4) During the flood and in the recovery stage of it, these rural access and collector roads may be the only access to a community
- 5) Vulnerability of floodway will have an impact on the resilience of the community



FLOODWAYS

Connects regional communities, farmlands and agricultural areas to city centers.

- 48% of total agricultural production in Australia in 2006 had been produced from regional council areas

For day-to-day amenity and social connectedness of rural communities



Ref. 2

IMPACT OF NATURAL DISASTERS BROADER ASPECTS

Natural disasters disrupts

- a) Built environment
- b) Social environment
- c) Economic environment
- d) Natural environment

Degree of impact will depend on

- a) Severity of damage
- b) Interconnectivity of different environments
- c) Resilience of the community



Ref 3:

IMPACT OF NATURAL DISASTERS TO ROAD INFRASTRUCTURES

Road infrastructure damage

- a) Disrupt the mobility of people, goods and services
- b) Cause delays (increased travel time and distance)
- c) Isolate communities (partially/fully)
- d) Delay repair/reconstruction activities
- e) Disturb the general household travel needs

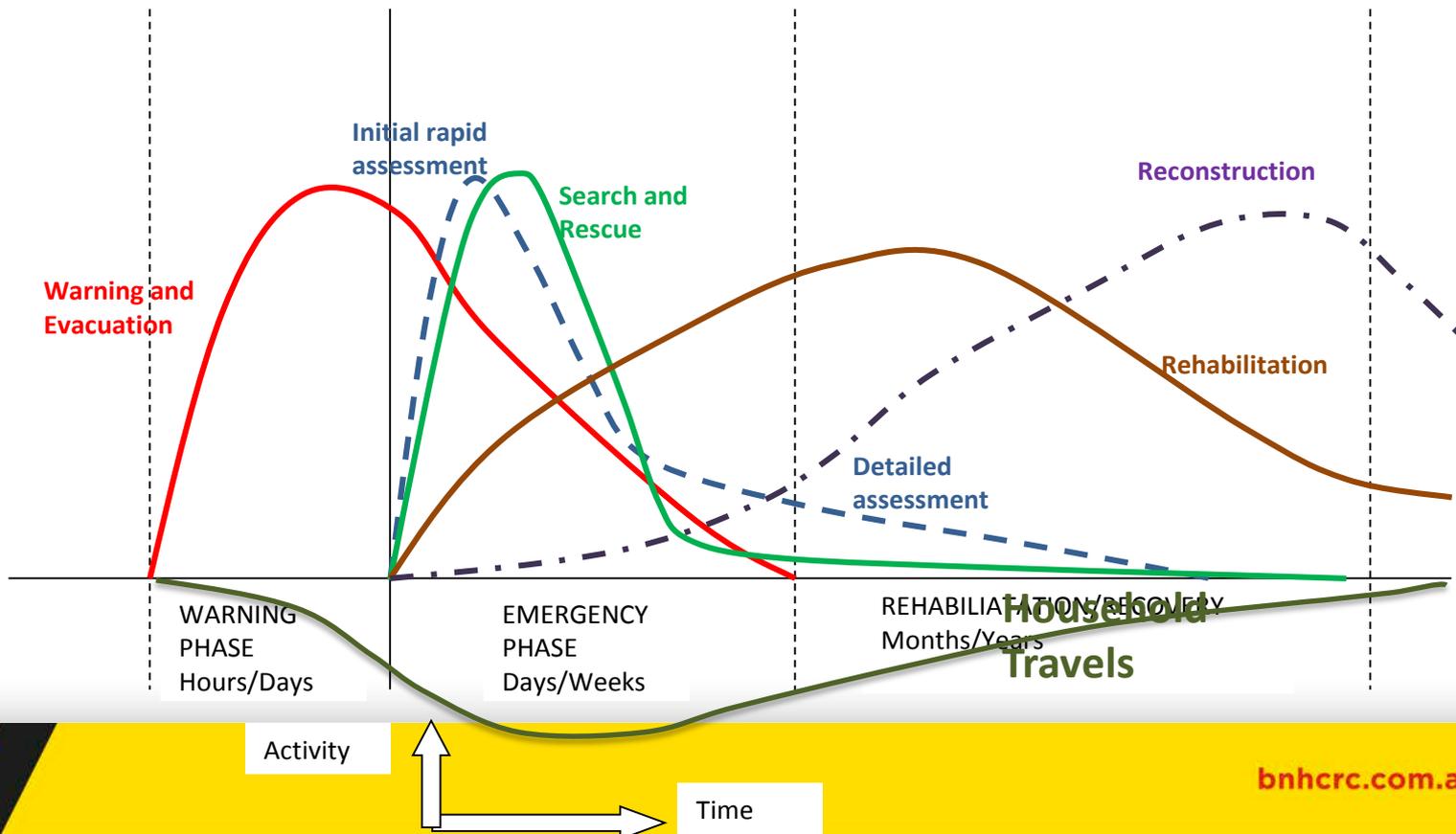
Any reduction in service level is a degree of a damage



IMPACT OF NATURAL DISASTERS CHANGES TRAVEL DEMANDS

Community needs and demand varies.

Eg: Travel demand for different activities around a natural disaster (Hypothetical model)



IMPACT OF FLOODS ON FLOODWAYS

Floodways are designed to withstand at low flood levels.

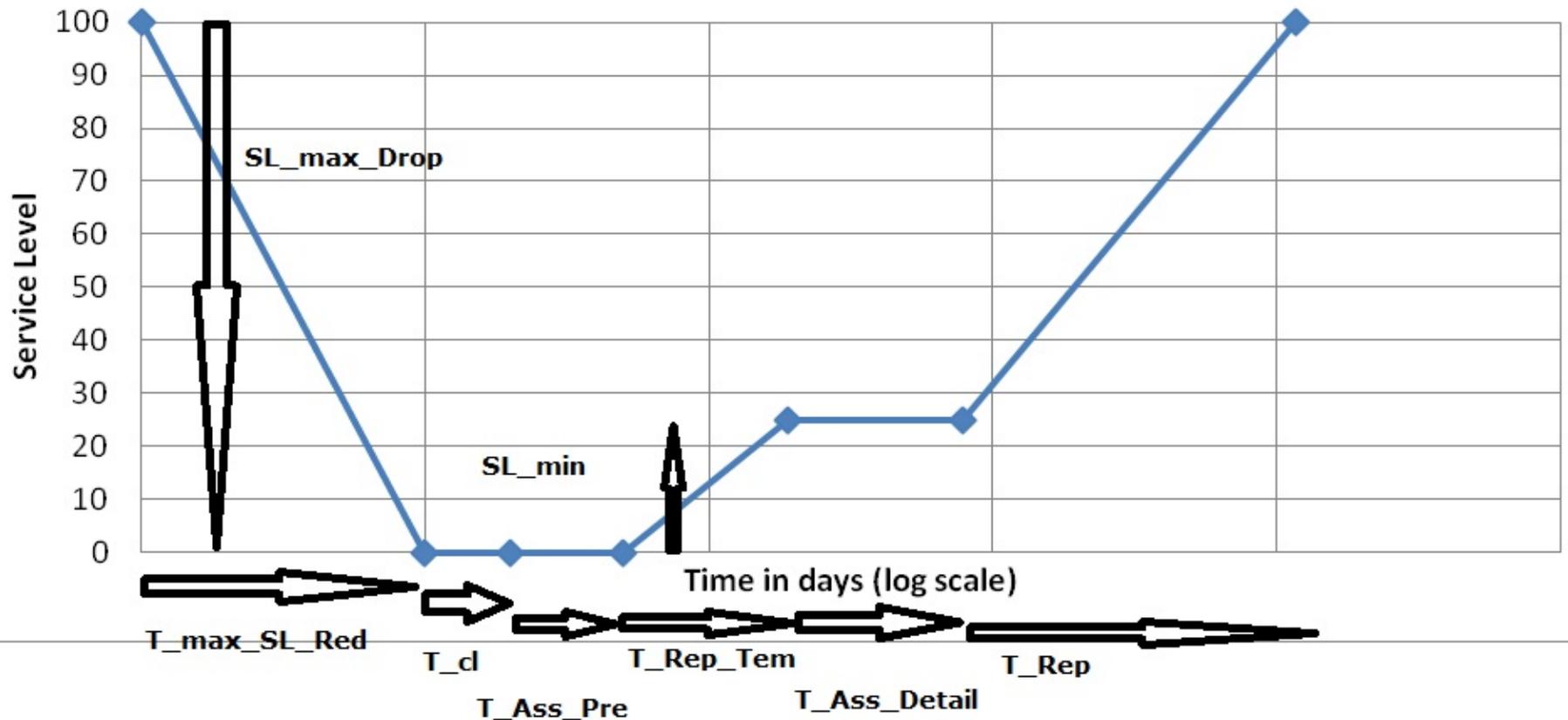
But, extreme flood events can damage floodways.

Eg: Lockyer Valley Regional Council (LVRC)

- 58% of floodways were damaged during the 2013 Queensland flood event.

IMPACT OF FLOODS

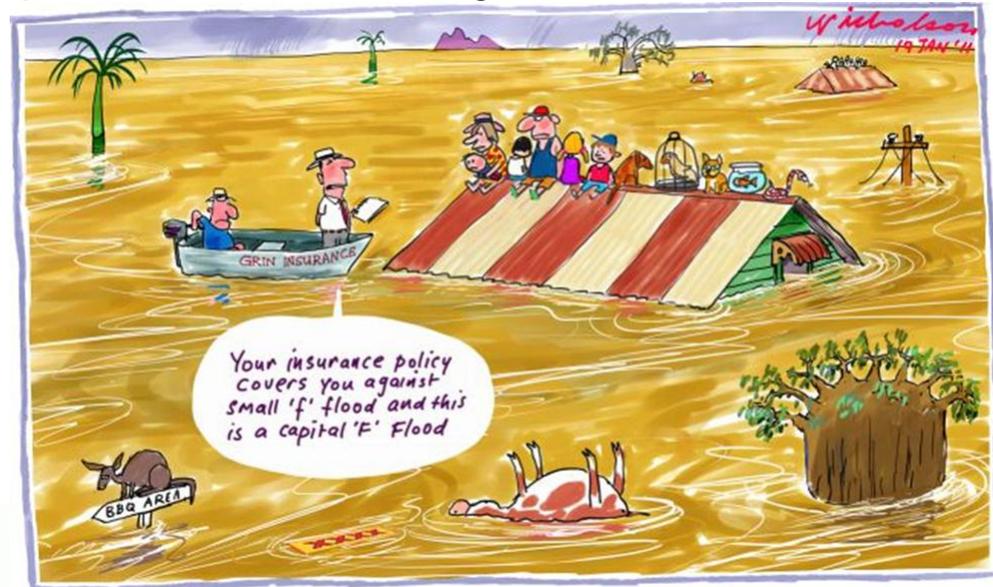
Eg: Service level variation of Floodways during flood



COMMUNITY RESILIENCE

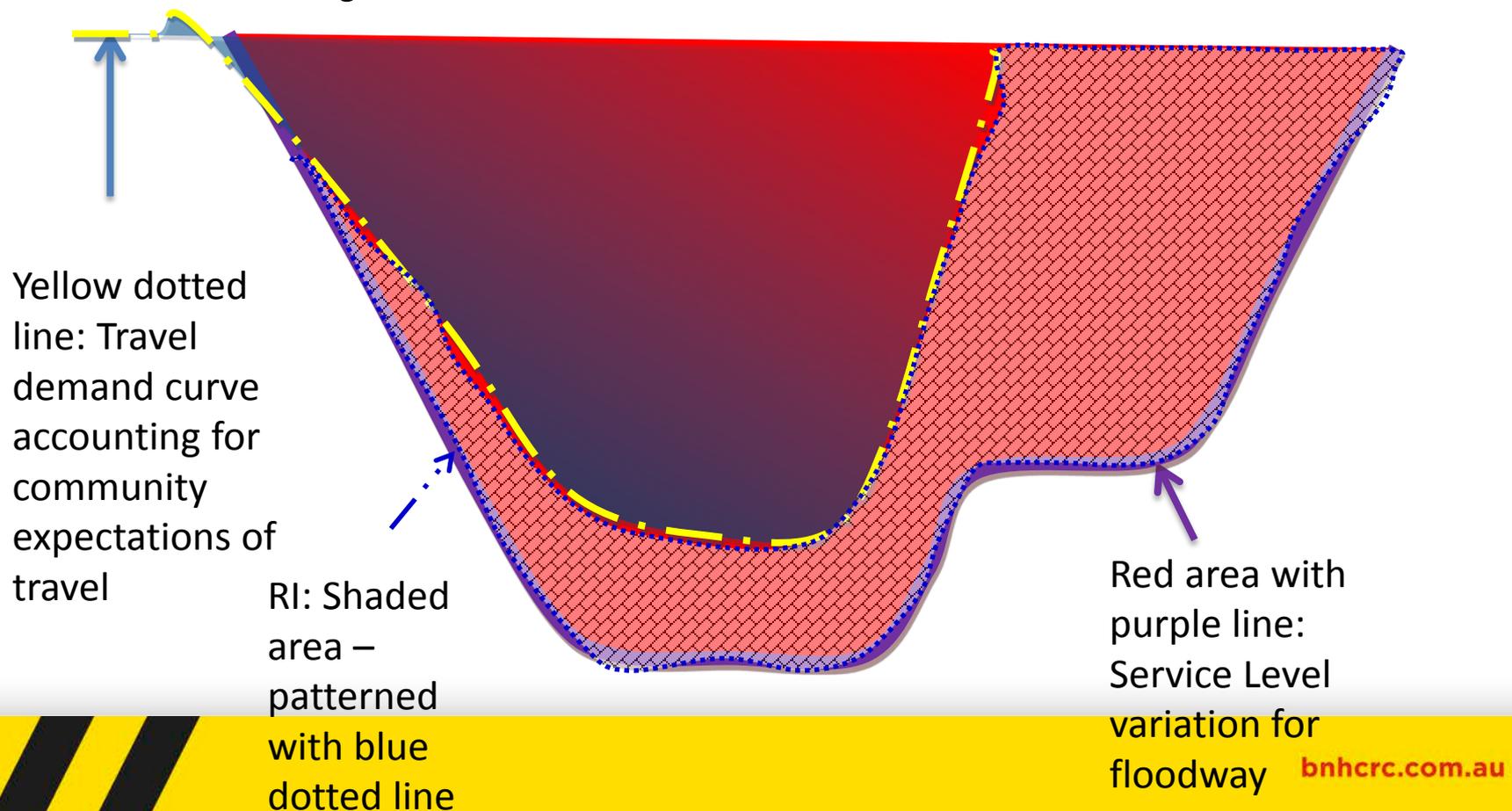
Community resilience depends on many factors such as:

- Preparedness
- Reliability of the system
- Past experience
- Infrastructures
- Level of communication
- Social connectivity



COMMUNITY RESILIENCE VS FLOODWAY FAILURE

Shaded area indicates the deficiency in service level compared to the travel demand of the community

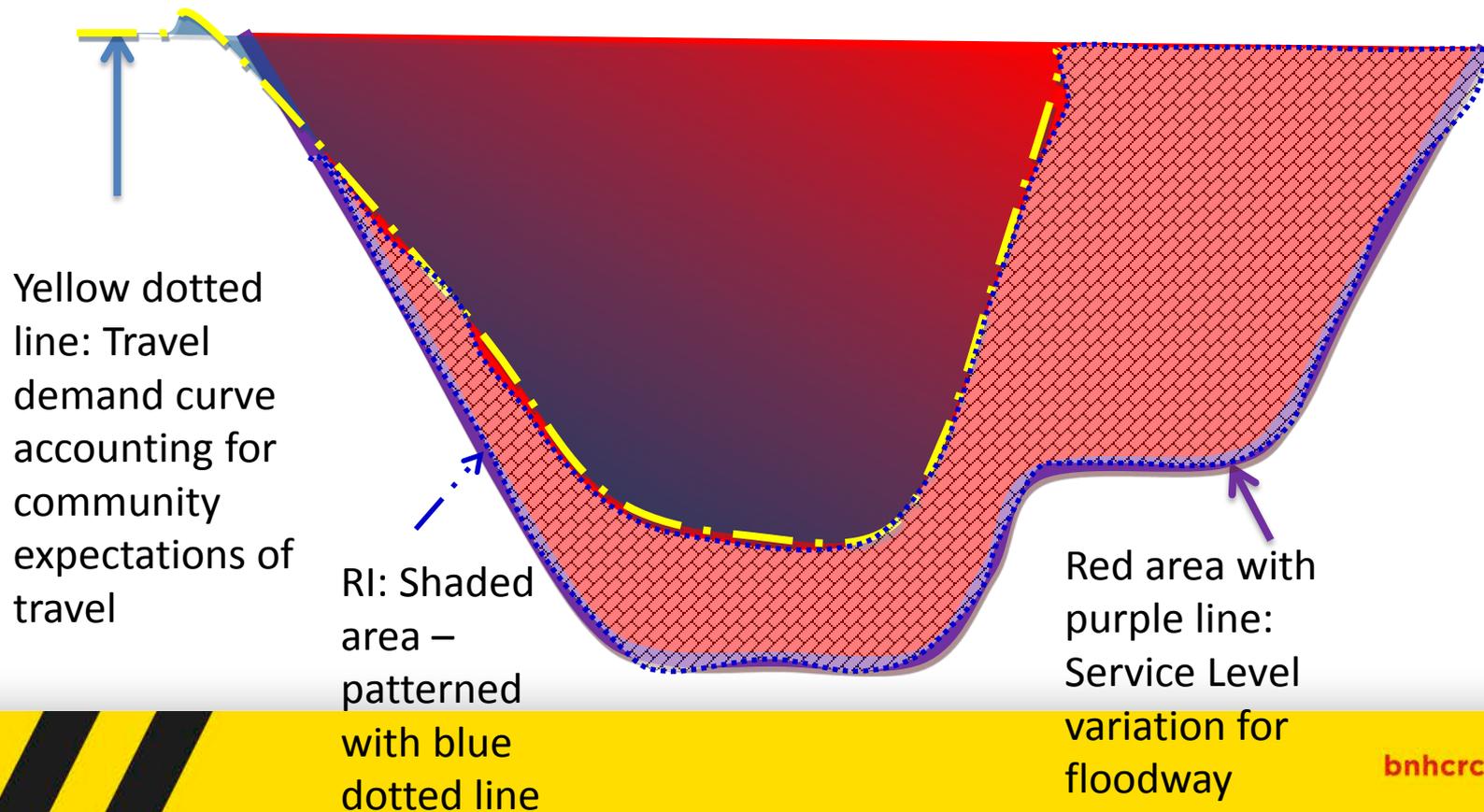


ENHANCING THE COMMUNITY RESILIENCE AROUND A FLOODWAY DAMAGE

Aim is to reduce the shaded area

Build stronger structures

Reduce the repair/reconstruction time frame



REPAIR/RECONSTRUCTION ACTIVITIES

- 1) Preliminary assessment
- 2) Detailed evaluation
- 3) Design
- 4) Tendering
- 5) Repair/reconstruction
- 6) Operation

FLOODWAY INSPECTION FRAMEWORK

To enhance the damage identification process

To reduce the time required for the assessment

To increase the accuracy of estimating the repair/reconstruction needs

To increase the accuracy of budget estimation

To provide more information to the inspector

FLOODWAY INSPECTION FRAMEWORK

Consists of five main components:

- A. Basic information
- B. Notes from previous inspection, repair or maintenance work
- C. Basic details of current inspection
- D. Inspection records
- E. Condition report

A. BASIC INFORMATION

Floodways are inspected infrequently or only after a major natural disaster

This section provides a quick glimpse of the floodway

A. BASIC INFORMATION

Basic information section includes:

Asset identification

1. Asset ID
2. Asset locality – suburb and road name
3. Local authority

Technical details

1. Type of floodway
2. Constructed year
3. Design life
4. Number of lanes and load limit
5. Construction material

A. BASIC INFORMATION

Basic information section includes:

Design flood

1. Trafficable flood
2. Maximum flood

Survey details

1. Start Chainage / latitude and longitude
2. End chainage / latitude and longitude

Drawings & other details

B. NOTES FROM PREVIOUS INSPECTION, REPAIR OR MAINTENANCE WORK

This section informs the last known state of the floodway

Helps to identify the real extent of the floodway damage caused by the event

Helps to identify reasons that may have caused to increase the level of damage

B. NOTES FROM PREVIOUS INSPECTION, REPAIR OR MAINTENANCE WORK

Details should include:

Date of last inspection

Inspected by

Reason

Recommendations

Repair/reconstruction work

Pictures/sketches

C. BASIC DETAILS OF CURRENT INSPECTION

This section provides details of current inspection.

Date of current inspection

Time

Inspected by

Reason

Nature of the incident

Pictures/sketches

D. INSPECTION RECORDS

Includes a detailed and methodological approach outlining:

- state of floodway components
- failure mechanisms
- extent of the damage

Information is used to estimate the repair/reconstruction needs

Quantitative assessment should be performed at all possible instances

D. INSPECTION RECORDS

Floodway is divided into four main zones

1. Upstream zone
2. Downstream zone
3. Roadway zone
4. Peripheral zone

Floodway components in each zone are listed and assessed on individual basis.

D. INSPECTION RECORDS

Floodway components in each zone

1. Upstream zone
Apron, Rock protection, Cut-off wall, Culvert entry, Stream banks
2. Downstream zone
Apron, Rock protection, Cut-off wall, Culvert exit, Stream banks
3. Roadway zone
Road crossing, Sub-base, Sub-grade, Culvert, Road signs, Flood level indicators
4. Peripheral zone
Approaches, Approach signs, Flooded area beyond the floodway extent, Vegetation-upstream, Vegetation-downstream, Evidence of creek changes

D. INSPECTION RECORDS

Quantitative assessment

When possible measurements should be taken to quantify the extent of damage

Damage extent for each component should be recorded

Failure modes, source of damage should also be informed

D. INSPECTION RECORDS

Qualitative assessment

A qualitative assessment can be performed when it is not possible to take measurements.

Previous state should be referred when assessing the current condition and the level of damage caused by the event under consideration

Ranking system assigns a value in the range of 1-5

- Critical – 5
- Poor – 4
- Fair – 3
- Satisfactory – 2
- Good - 1

E. CONDITION REPORT

This section includes:

1. Estimating percentage of repair needs
2. Estimating the contribution factors
3. Calculating the Damage Index (DI)
4. Identifying level of damage using the DI method
5. Recommendation based on the DI
6. Other recommendations
7. Asset Number
8. Date of inspection
9. Details of person/s who prepared the condition report

E. CONDITION REPORT

Damage Index: measures the monetary requirements for repair needs with respect to fully replacement condition

$$\text{Damage Index (DI)} = \frac{\text{Repair Cost}}{\text{Estimated Replacement Cost}}$$

$$\text{Contributing Factor for item 'i'} = \frac{\text{Repair Cost for item 'i'}}{\text{Estimated replacement cost}}$$

$$DI = \sum \text{Contributing Factors for items 'i'}$$

E. CONDITION REPORT

Contribution factors for floodways

Item No	Item	Maximum fractional Contribution Factor
A	Construction of temporary road	0.05
B	Partial/ fully demolishing and removing existing culverts, pipes, and concrete structures	0.10
C	Repair / Reconstruction of concrete floodway including culverts if any	0.25
D	Repair / Reconstruction of apron	0.50
E	Placing geotextile fabric in conjunction with rock fill	0.01
F	Construction of rock protection	0.05
G	Replacing sign posts and standard road signs	0.02
H	Clearing debris material	0.02

FUTURE WORK

Consultation with road authorities who owns floodways

Applying the framework for few case studies

Incorporating their feedback

Developing a nationally accepted framework

- Acknowledgement
 - Bushfire and Natural Hazards CRC
 - Lockyer Valley Regional Council

Thank you