Department of Climate Change, Energy, the Environment and Water

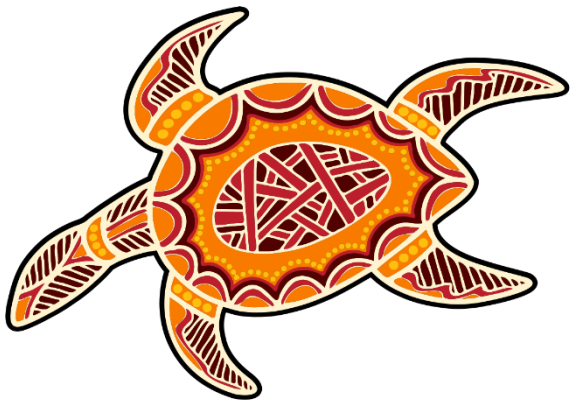
Draft Billabong Creek Floodplain Management Plan

Report to assist Stage 1 public consultation

October 2024

NSW GOVERNMENT

Acknowledgement of Country



Wiradjuri artist and designer Nathan Peckham from Yurana Creative created Guwunggan*.

Department of Climate Change, Energy, the Environment and Water acknowledges the traditional custodians of the land and pays respect to Elders past, present and future.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

**The images in this artwork embody traditional knowledge of the Wiradjuri Nation. Dealing with any part of the images for any purpose that has not been authorised by the custodians is a serious breach of the customary laws of the Wiradjuri Nation and may also breach the Copyright Act 1968 (Cth). For enquiries about permitted reproduction of these images and cultural consents to use the traditional knowledge embodied in this work, contact Yurana Creative Pty Ltd.*

Draft Billabong Creek Floodplain Management Plan - Report to assist Stage 1 public consultation

Published by NSW Department of Climate Change, Energy, the Environment and Water

dcceew.nsw.gov.au

First published: October 2024

Department reference number: PUB23/911

Acknowledgements

Cover image: Billabong Creek at Wanganella October 2024, NSW Department of Climate Change, Energy, the Environment and Water

Copyright and disclaimer

Contents

List of figures

List of tables

1 Summary

The Water Group in the NSW Department of Climate Change, Energy, the Environment and Water (the department) is developing a whole-of-valley floodplain management plan (FMP) under the *Water Management Act 2000* (the WM Act) for the Billabong Creek area. This will replace the historical FMP that was originally developed under the *Water Act 1912*.

We are seeking feedback on the following key elements that will inform the development of the draft *Floodplain Management Plan for the Billabong Creek floodplain* (the draft FMP) through Stage 1 public consultation, including a formal submission process from 8 October until 18 November 2024:

1. proposed **floodplain boundary**
2. proposed flood events to be used in hydraulic flood modelling (**design floods**)
3. proposed **floodway network**, which includes the main floodways, and areas important for the temporary storage of floodwater during the passage of a flood
4. flood-dependent and flood-impacted **Aboriginal cultural assets** and values located within the floodplain
5. flood-dependent and flood-impacted **heritage sites** located within the floodplain
6. flood-dependent **ecological assets** that have been identified within the floodplain
7. **local variances from default rules** for flood work applications in different areas of the floodplain.

The department is seeking feedback on the proposed floodway network and flood-dependent assets to identify and confirm the areas of the floodplain that require protection. FMPs protect these areas by restricting the types of flood works that can be constructed and in doing so allow for floodwater to move freely to and from a river or to assets that rely on it.

FMPs are required under the WM Act to consider the risk to life and property from the effects of flooding. The identification and confirmation of the proposed floodway network informs this consideration. The construction of a flood work in an area which has fast-flowing floodwater (floodways) can significantly increase the risk to life and property; both on the landholding where the flood work is constructed and on neighbouring properties. The draft FMP will limit the types and size of flood works constructed in floodways to minimise the risk to life and property.

2 Introduction

This report has been prepared to assist stakeholders in providing informed feedback during Stage 1 public consultation for the draft FMP. Stage 1 public consultation is intended to provide an early opportunity for community feedback on key elements that will inform the development of the draft FMP prior to formal public exhibition of the draft FMP in early 2025.

The draft FMP will consolidate and update the existing floodplain management arrangements to:

- meet the requirements of the WM Act
- establish consistent rules for flood works across the floodplain
- improve the coordinated regulation of flood works across the southern Murray–Darling Basin.

Flood works are structures that alter the flow of water to/from a river or alter the movement of floodwater during a flood. Examples of flood works are levees, earthworks used to protect houses or infrastructure, and roads.

In NSW all flood works require a flood work approval. Some activities considered low-risk or covered by other legislation may be exempt from an approval. Read more information in the *Understanding exemptions from flood work approvals fact sheet* on the WaterNSW website.

The draft FMP will set the rules for flood work approvals and the criteria that will be used to assess applications. For further information on WaterNSW and flood work approval processes, please see the WaterNSW approvals webpage.

More information on FMPs, including the replacement of the historical FMPs in the southern Murray–Darling Basin, is available on our website.

Floodplain management plans cannot provide a comprehensive response to flooding

The roles and responsibilities of local government and NSW Government agencies in floodplain management and flood risk management are outlined in the *Flood risk management manual — The policy and manual for the management of flood liable land* (2023).

Improvements to flood risk mitigation were considered through the 2022 NSW Flood Inquiry. Read the inquiry report and the NSW Government response.

As part of developing the draft FMP, the department will provide all modelling information to the relevant Commonwealth, state and interstate emergency management agencies so that it may assist in their future flood predictions. The draft FMP will set rules for flood works on the Billabong Creek floodplain. It will not deal with flood mitigation or flood response.

2.1 Background

2.1.1 Billabong Creek and catchment

The Billabong Creek floodplain is in the Murrumbidgee catchment in southern NSW and is bordered by the Great Dividing Range to the east, the Murrumbidgee floodplain to the north, and the Murray catchment to the south.

The majority of the Murrumbidgee catchment is used for agricultural purposes. Major water users include local councils and utilities, forestry, tourism, and agriculture, including cotton, rice, dairy, wool, wheat, beef, lamb, grapes and citrus.

The Murrumbidgee catchment also supports a range of water-dependent ecosystems, including instream aquatic habitats, riparian forests, and floodplain watercourses, woodlands and wetlands.

2.1.2 Existing floodplain management arrangements

Existing floodplain management arrangements within the rural areas of Billabong Creek consist of the following in-force FMP prepared under the *Water Act 1912* (existing localised FMP) and associated floodplain declared under the *Water Act 1912*:

- *Billabong Creek Floodplain Management Plan (2006)* and associated declared floodplain.

Consideration will be given to the existing floodplain management arrangements in the above statutory document when developing the draft FMP. Further, the boundary of the existing declared floodplain has been incorporated into the proposed floodplain boundary.

The existing localised FMP is published on our website.

3 Key elements for development of the floodplain management plan

The information and maps presented in this report have been prepared using the best available information for the Billabong Creek floodplain. The information and maps are subject to change following Stage 1 public consultation.

3.1 Proposed floodplain boundary

The proposed Billabong Creek floodplain boundary, shown in Figure 1, has been mapped to capture the areas that are inundated during large flood events while considering flood works that may influence the way floodwater moves across the landscape.

The proposed floodplain boundary extends downstream from Walbundrie in the east to the junction of Billabong Creek and the proposed NSW Murray Valley Floodplain at Moulamein, and includes the area currently within the existing localised FMP and associated declared floodplain. The proposed floodplain boundary includes the southern end of the Yanco Creek system from Kidman Way. The proposed floodplain boundary is 10,446 square kilometres in area and 27% of this area is already captured in the existing localised FMP.

The proposed floodplain boundary will connect with the floodplain boundaries for the FMPs currently being developed for the NSW Murray and Murrumbidgee valleys, improving the assessment of cumulative impacts from individual flood works across the southern Murray–Darling Basin.

A combination of hydraulic and administrative factors, where appropriate, have been used to develop the proposed floodplain boundary including:

- inundation data within the Billabong Creek floodplain
- hydraulic model development
- existing localised FMP
- water source boundaries, as established in water sharing plans
- local government areas
- major roads and railways which act as barriers to large scale flood movement.

For a higher resolution version of the proposed floodplain boundary please see the Stage 1 Interactive Spatial Map.

To assist with providing feedback on the proposed floodplain boundary as shown in Figure 1, we recommend you take a screenshot of the relevant area/s displayed on the interactive spatial map and use a drawing tool to illustrate feedback or refer to the area shown in written feedback. Please include information about the location on the map, such as an address. The screenshot of the map can be saved as an image file and attached to your submission.

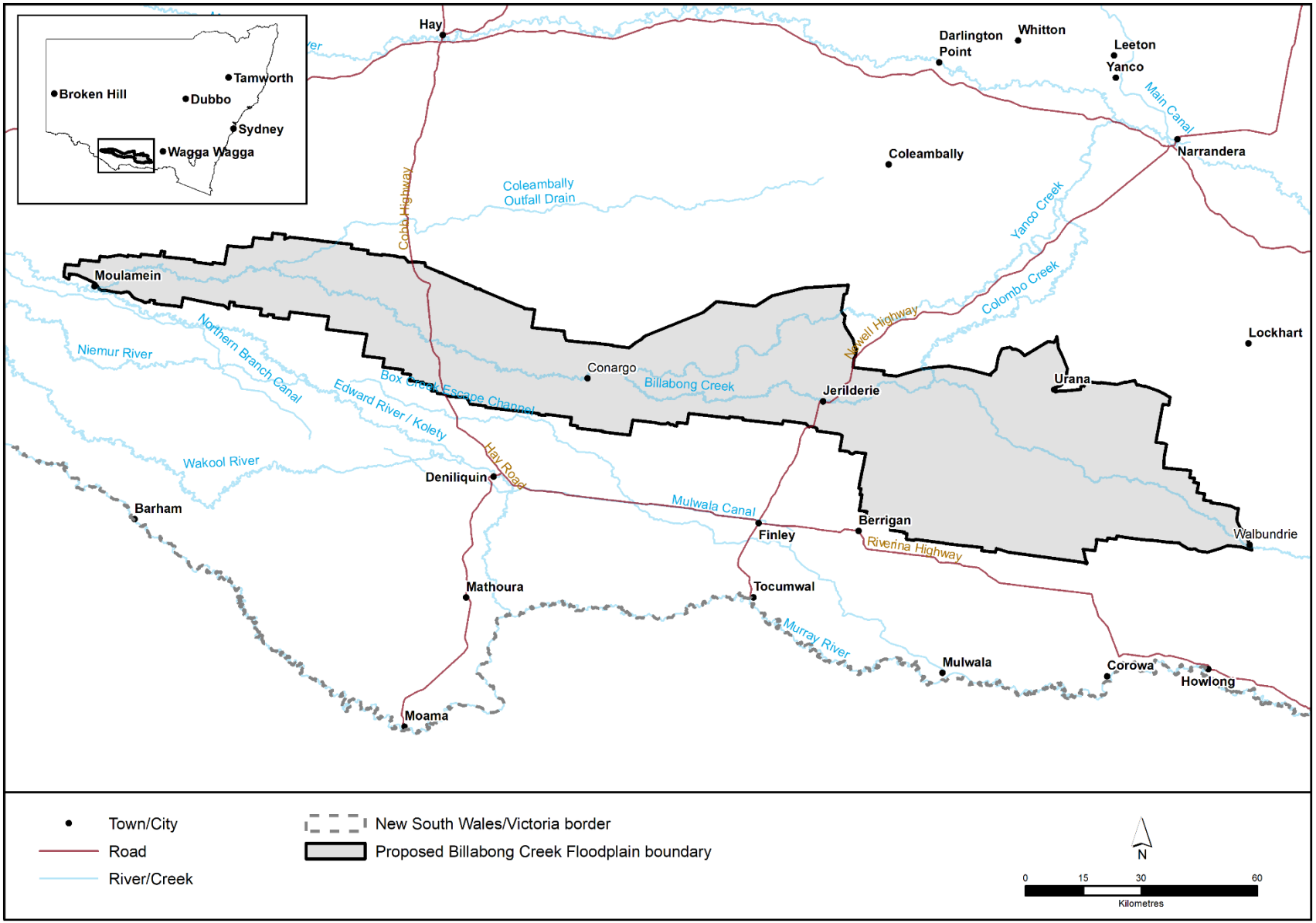
Prompts for feedback

Do you support the proposed boundary of the Billabong Creek floodplain?

Are there areas of the floodplain that should be included or omitted?

Is the proposed boundary correct at a property scale?

Figure 1. Proposed Billabong Creek Floodplain boundary



3.2 Proposed design floods

A design flood is a flood of known magnitude that can be modelled and used for planning or engineering purposes. They are usually based on recorded historical events that are preferably within the living memory of a community.

Selection of a design flood is based on an understanding of flood behaviour and associated flood risk. Multiple design floods are often selected to account for the social, economic, ecological and cultural consequences associated with floods of different magnitudes.

Design flood events that are selected will be described through the following attributes:

- the flood event that it is based on (month, year)
- where the data is taken from, such as a section of river and associated gauge
- the probability of an equivalent (or larger) flood event occurring in any given year, known as the annual exceedance probability (AEP).

A large design flood is a large magnitude flood event that generally has a 5% or less probability of occurring in any given year (AEP) while a small design flood is a smaller magnitude flood event that has at least a 10% probability of occurring in any given year (AEP). There may be some slight variances in the AEP associated with a large or small design flood because of the nature of the flood event that the design flood is based on.

The existing localised FMP used the 1974 and 1983 floods to model the floodway network in that area of the floodplain.

Generally, a FMP will use 2 design floods (one large design flood and one small design flood). However, flood behaviour in the Billabong Creek floodplain is different in the upper reaches (Walbundrie to Jerilderie) compared to the lower reaches (Jerilderie to Moulamein), so 4 design floods are proposed. This is because:

- there is a reduction in peak flood flows in the upper Billabong Creek area caused by the effects of large storage areas, such as Lake Urana
- inflows from the Murrumbidgee system, mainly via Yanco Creek (upstream of Conargo), change flood behaviour in the lower Billabong Creek area.

The following proposed design floods were used to model the floodway network:

- **large design flood of October to December 2022:** 5% AEP at the Billabong Creek at Jerilderie gauge (410016)
- **large design flood of October 2010:** 3.3% AEP at the Billabong Creek at Walbundrie gauge (410091). This flood was selected as an additional large design flood for the upper Billabong Creek area, upstream of Jerilderie

- **small design flood of October to November 2010:** 26% AEP at the Billabong Creek at Conargo (Puckawidgee) gauge (410017). This flood was selected as a small design flood for the lower Billabong Creek area, downstream of Jerilderie.
- **small design flood of March 2011:** 17% AEP at the Billabong Creek at Walbundrie gauge (410091) was selected as the small design flood for the upper Billabong Creek area, upstream of Jerilderie.

One large design flood (October to December 2022) has been selected for the whole floodplain area while the remaining 3 design floods are specific to either the upper or lower Billabong Creek area. Three hydraulic models were created to simulate the movement of these design floods through the river channels and floodplain.

More information on how the proposed design floods were selected, and the associated hydraulic models is available in Appendix 1 Development of the floodway network.

Prompts for feedback

Do you agree with the choice of the proposed design floods?

Do the proposed design floods align with your experience of past flood events?

3.3 Proposed floodway network

A FMP will coordinate flood work development on a floodplain to ensure that floodwater can move freely to and from rivers and creeks. To do this, an understanding of how water moves across the landscape when it floods is required.

Three hydraulic models have been developed to simulate the movement of floodwater through river channels, wetlands and the wider floodplain during the proposed large and small design floods. This modelling process identifies areas of the floodplain that have the deepest and fastest flowing floodwater and pose the greatest risk to life and property. These areas are known as floodways, and together with areas of ponding, they make up the floodway network which is described below.

The proposed floodway network for the Billabong Creek floodplain, shown in Figure 2, has been defined by:

- mapping the outputs of the hydraulic modelling
- considering the floodway networks in the existing localised FMP and historical floodplain development guidelines, and aligning with them where appropriate
- reviewing additional flood photography and satellite imagery.

The proposed floodway network is comprised of **floodways** (approximately 4% of the floodplain) and the **inundation extent** (ponding areas) (approximately 22% of the floodplain).

More information about how the hydraulic models and the floodway network were developed is available in Appendix 1 Development of the floodway network.

For a higher resolution version of the proposed floodway network please see the Stage 1 Interactive Spatial Map.

To assist with providing feedback on the proposed floodplain boundary as shown in Figure 2, we recommend you take a screenshot of the relevant area/s displayed on the interactive spatial map and use a drawing tool to illustrate feedback or refer to the area shown in written feedback. Please include information about the location on the map, such as an address. The screenshot of the map can be saved as an image file and attached to your submission.

3.3.1 Consideration of unapproved flood works

The development of the floodway network includes consideration of existing flood works in the landscape, such as levees, embankments and roads. Each of these features can have a significant impact on the movement of floodwater and must be accounted for in the hydraulic models. Some of these flood works do not have a flood work approval. A process for determining how unapproved flood works are considered in the development of the floodway network is shown in Figure 8 in Appendix 1 Development of the floodway network.

We acknowledge that unapproved flood works are a significant issue for many local landholders. You can report concerns regarding unapproved works to the Natural Resources Access Regulator (NRAR) on their website at www.nrar.nsw.gov.au/suspicious-activites. You can also contact NRAR on 1800 633 362 during business hours or via email nrar.enquiries@nrar.nsw.gov.au.

3.3.2 Floodways

Throughout a floodplain, there will be pathways of fast-flowing floodwater during times of flood. These areas are known as floodways and are part of the floodway network. They are often aligned with naturally defined channels. Floodways are high-risk areas that, even if only partially blocked, would cause significant changes in the movement of floodwater across the floodplain. It is a critical area of the floodplain as it allows water to leave or return to a river or creek during times of flood or deliver floodwater to ecological assets and Aboriginal cultural values that depend on it.

Floodways also pose the greatest risk to life and property during times of flood.

3.3.3 Inundation extent (ponding areas)

Along the floodways there will be areas where floodwater breaks out (flood discharge) and forms ponds. These areas are known as the inundation extent and are also part of the floodway network. The inundation extent is critical to storing floodwater during times of flood. Without these areas, the depth and speed of the floodwater in the floodway would dramatically increase. It is important that

flood works constructed in these areas are coordinated so that they do not block inundation, particularly during large floods.

3.3.4 Other areas of the floodplain

The remaining area of the floodplain can be categorised as **flood fringe areas** or **flood protected areas**. These areas do not form part of the floodway network.

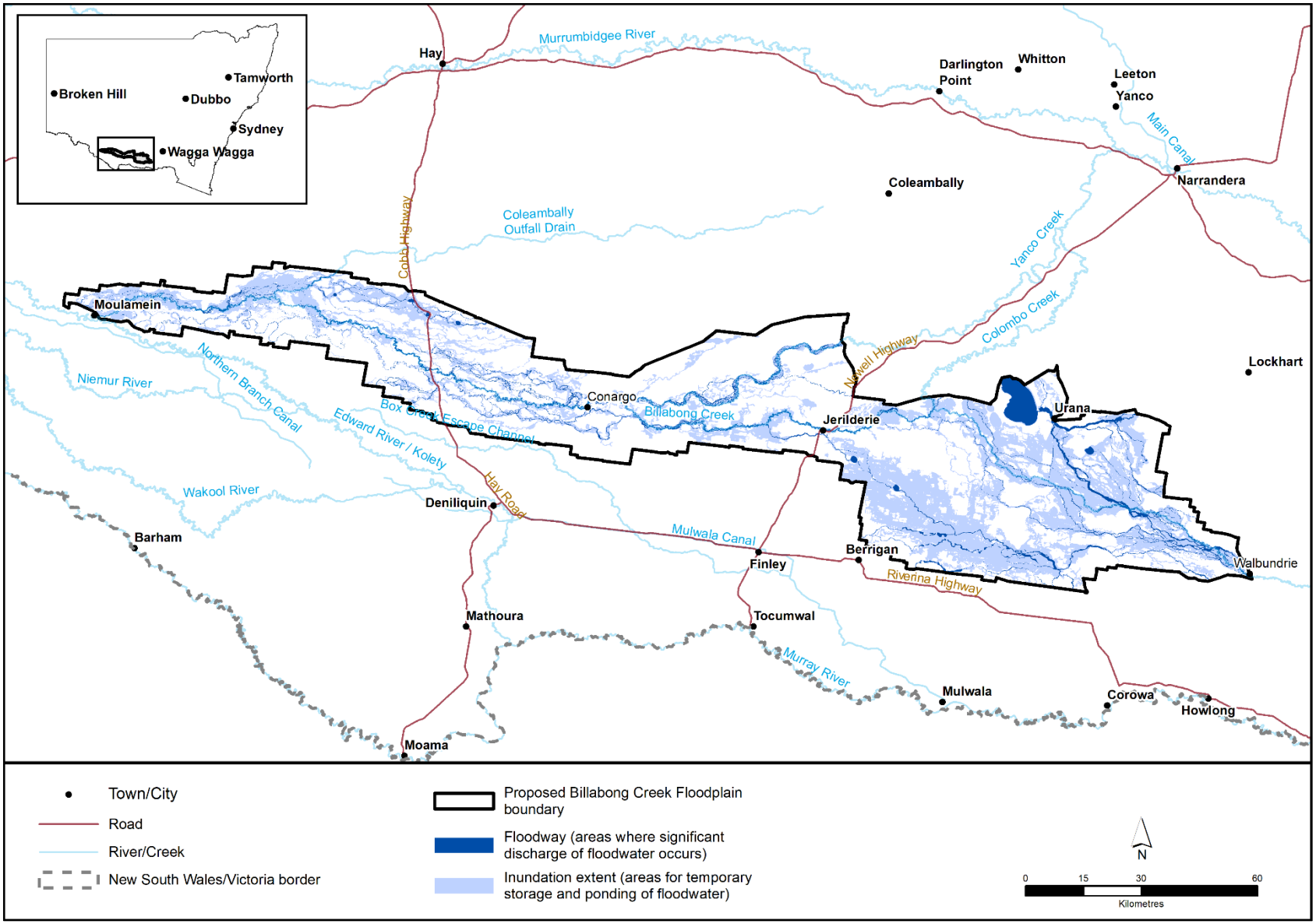
The flood fringe is an area which may be flooded but is not considered critical in the flow of water during times of flood. Flood-protected areas do not receive floodwater. This may be due to the area being higher ground or the presence of existing flood works prevents the passage of floodwater.

Prompts for feedback

Do the proposed floodways and inundation extent align with your experience of past flood events?

What changes should be made to the floodway network?

Figure 2. Proposed Floodway Network for the Billabong Creek floodplain



3.4 Identified flood-dependent and flood-impacted Aboriginal cultural assets and values

Aboriginal cultural assets and values on the floodplain can be:

- flood-dependent, such as waterholes, fish traps or scarred trees that require inundation
- flood-impacted, such as Aboriginal burial grounds or shell middens that can be damaged by scour and erosion caused by flooding or directly during the construction of a flood work.

FMPs contain rules which support the protection and restoration of Aboriginal cultural floodplain assets, which in turn provides social and economic benefits to the community. Healthy waterways and floodplains are critical to the culture and wellbeing of Aboriginal people. Water provides food, kinship, connection, recreation, stories, songlines and healing.

The existing localised FMP requires flood works to be assessed against section 166 of the *Water Act 1912* (repealed) and Part 5 of the *Environmental Planning and Assessment Act 1979* to ensure connectivity and prevent ground disturbance to identified Aboriginal cultural assets and values.

The Aboriginal cultural assets and values currently registered on the Aboriginal Heritage Information Management System (AHIMS) are shown in Figure 3. This information is provided to demonstrate the abundance of Aboriginal cultural sites throughout the Billabong Creek floodplain. Figure 3 is shown at a valley scale, does not show restricted sites and does not have an associated interactive map. First Nations communities in Deniliquin, as well as the NSW Heritage AHIMS team, were consulted on the use of Figure 3 and agreed to its inclusion in this report.

As part of assessing and determining an application for a flood work approval, a search of AHIMS must be conducted. To ensure that Aboriginal cultural assets and values are protected from impacts associated with flood works, the department has been explaining and promoting the use of AHIMS as part of consultation with First Nations communities.

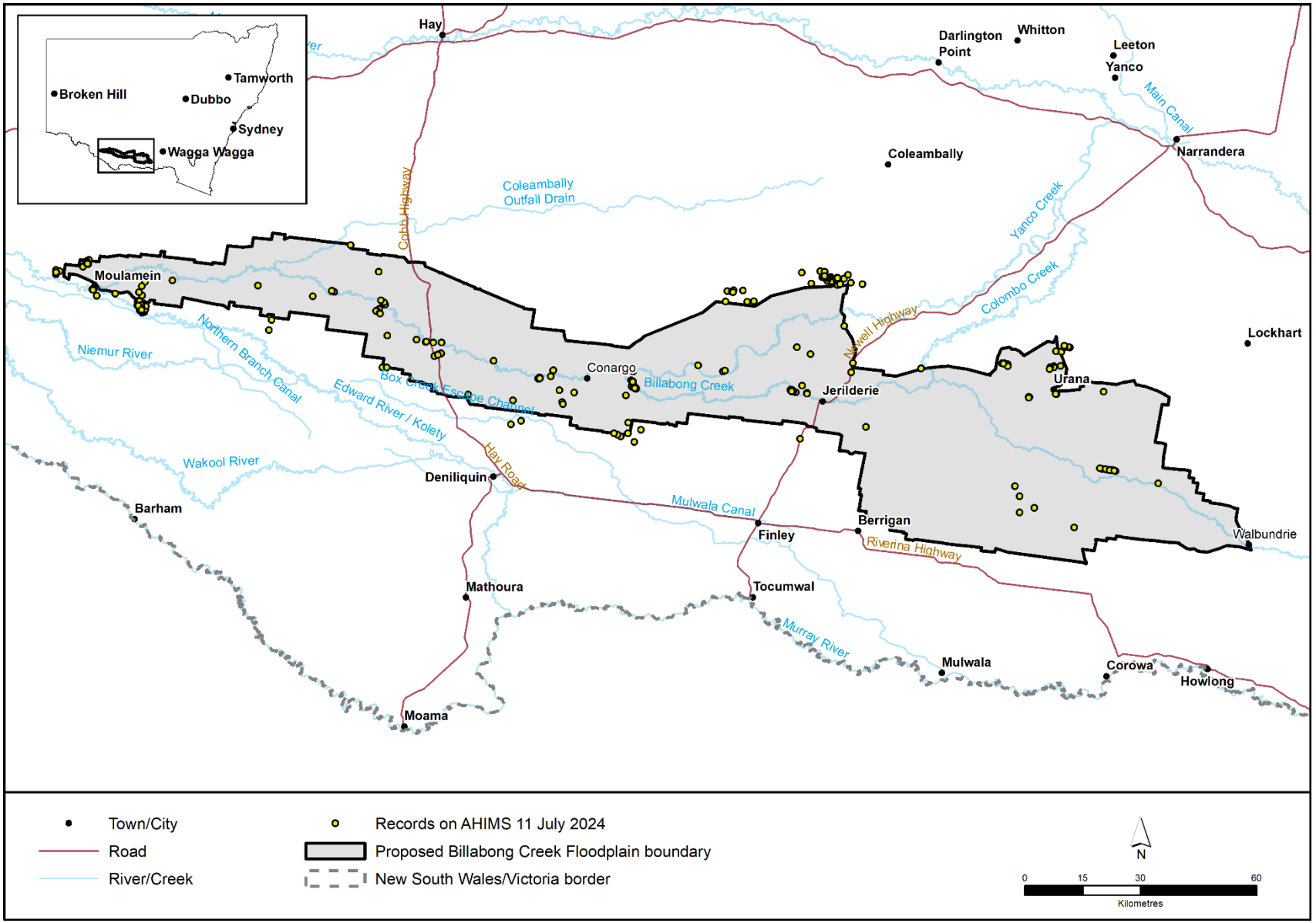
For more information on the First Nations consultation undertaken in the Billabong Creek floodplain, including the feedback received, please see Appendix 2 First Nations consultation.

Information on how FMPs can protect cultural assets is available on our website.

Prompts for feedback

Are there other Aboriginal cultural assets or values on the floodplain that should be considered?

Figure 3. Records on the Aboriginal Heritage Information Management System (as at July 2024) within the Billabong Creek floodplain



3.5 Identified heritage sites

Heritage sites may be sensitive to changes in flood behaviour or disturbance from flood work construction. Heritage sites are cultural heritage objects and places as listed on the following Commonwealth, state and local government heritage registers:

- Australian Heritage Database
- NSW Aboriginal Heritage Information Management System
- NSW Historic Heritage Information Management System
- NSW State Heritage Register.

Some Aboriginal cultural assets and values may also be listed on heritage registers and are discussed in the previous section.

The heritage sites within the Billabong Creek floodplain that are listed on the NSW State Heritage Register are shown in Figure 4. There is one identified heritage site that is dependent upon or connected with flooding known as Black Swamp, which is listed in the *Conargo Local Environment Plan 2013*. Some of the other sites may be flood-impacted as they could be damaged by flooding or directly impacted during the construction of a flood work. This information is provided to demonstrate the array of heritage sites throughout the Billabong Creek floodplain and does not have an associated interactive map.

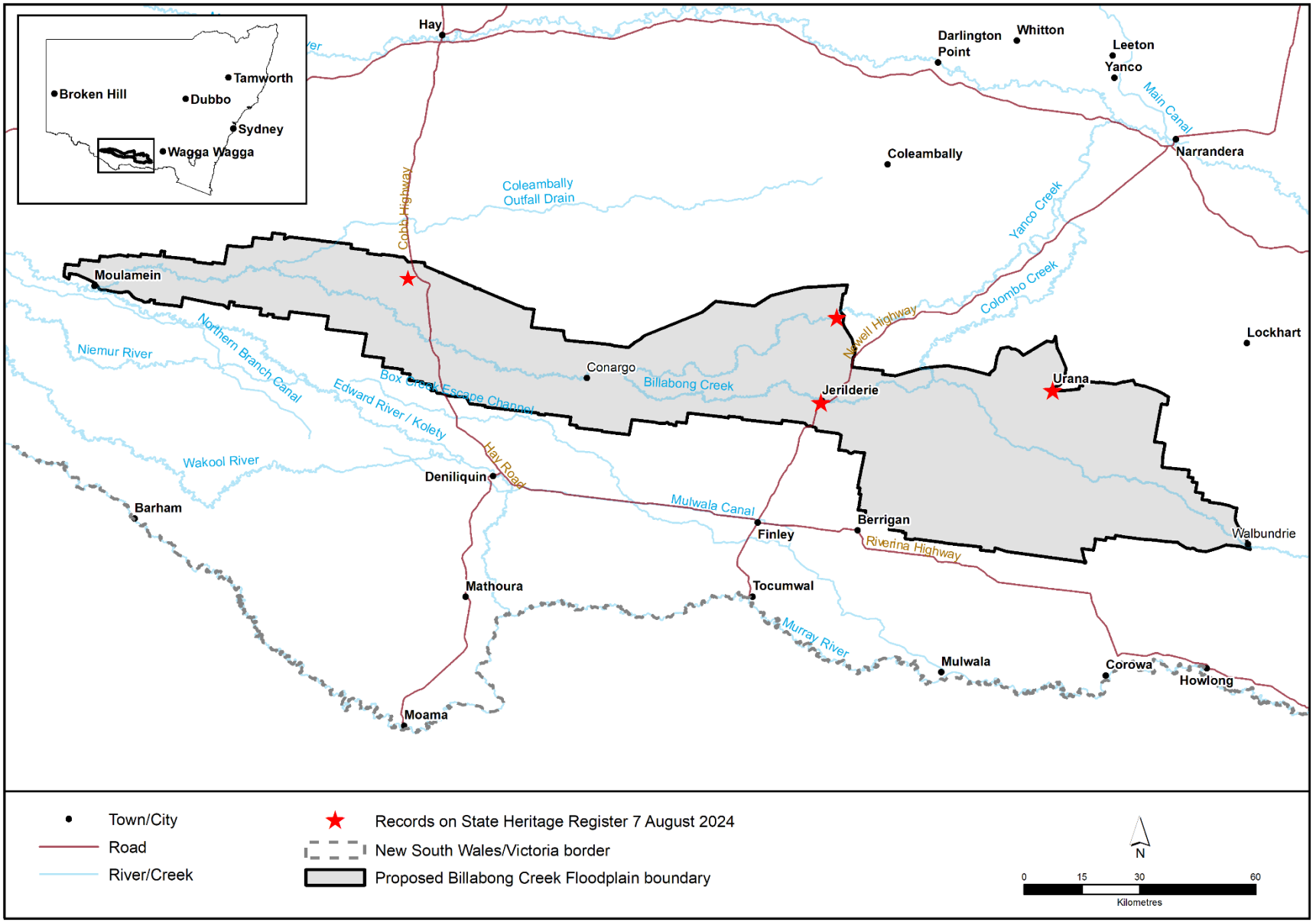
As part of assessing and determining an application for a flood work approval a search of the State Heritage Inventory must be conducted. This online search tool holds information about most statutory protected heritage items in NSW, including the State Heritage Register.

Find out more information about heritage listed items and significant sites in NSW by visiting the Heritage NSW website.

Prompts for feedback

Are there other heritage sites on the floodplain that should be considered?

Figure 4. Records on the State Heritage Register (as at August 2024) within the Billabong Creek floodplain



3.6 Identified flood-dependent ecological assets

A key objective of a FMP is to maintain flood connectivity to flood-dependent ecological assets. This means that flood works should not block the floodways that connect them to floodwaters.

Flood-dependent ecological assets rely on flooding to maintain their ecological character and sustain essential processes. Flood-dependent ecological assets are identified in FMPs to support their protection, which in turn provides social and economic benefits to the community.

A similar process is applied in the existing localised FMP with the identification and inclusion of 'environmentally sensitive areas, including wetlands and watercourses that depend on flooding', and the requirement for flood works to be assessed against section 166 of the *Water Act 1912* (repealed) and Part 5 of the *Environmental Planning and Assessment Act 1979* to ensure connectivity to identified ecological sites and protection of fish passage.

Within the Billabong Creek floodplain, the following types of ecological assets, shown in Figure 5, are being considered in the development of the draft FMP:

- flood dependent forest / woodland (wetlands)
- flood dependent woodland
- floodplain wetland (flood dependent shrubland)
- semi-permanent (non-woody) wetlands.

The ecological assets are categorised according to the flooding requirements of their vegetation communities, which correlates to the degree of connectivity required to the floodway network. For example, wetlands and their associated vegetation communities are highly flood-dependent and therefore will either be located within the floodway network or have a direct connection to the floodway network.

The ecosystems also provide important habitat for native fish, amphibians, reptiles, waterbirds, woodland birds and mammals, and invertebrate and microbial biota. Habitats for fish (and fish passage), waterbirds and other water-dependent fauna have been identified and will be considered in the development of the draft FMP.

The ecological assets are identified using the best available vegetation mapping and survey information, including the NSW State Vegetation Type Map[1] and wetland mapping. More information about how ecological assets have been identified and categorised is available in Appendix 3 Ecological asset identification and categorisation.

[1] Department of Climate Change, Energy, the Environment and Water (2023) NSW State Vegetation Type Map. Current Release C2.0 M2.0 (December 2023)

For a higher resolution version of the proposed flood-dependent ecological assets please see the Stage 1 Interactive Spatial Map.

To assist with providing feedback on the proposed floodplain boundary as shown in Figure 5, we recommend you take a screenshot of the relevant area/s displayed on the interactive spatial map and use a drawing tool to illustrate feedback or refer to the area shown in written feedback. Please include information about the location on the map, such as an address. The screenshot of the map can be saved as an image file and attached to your submission.

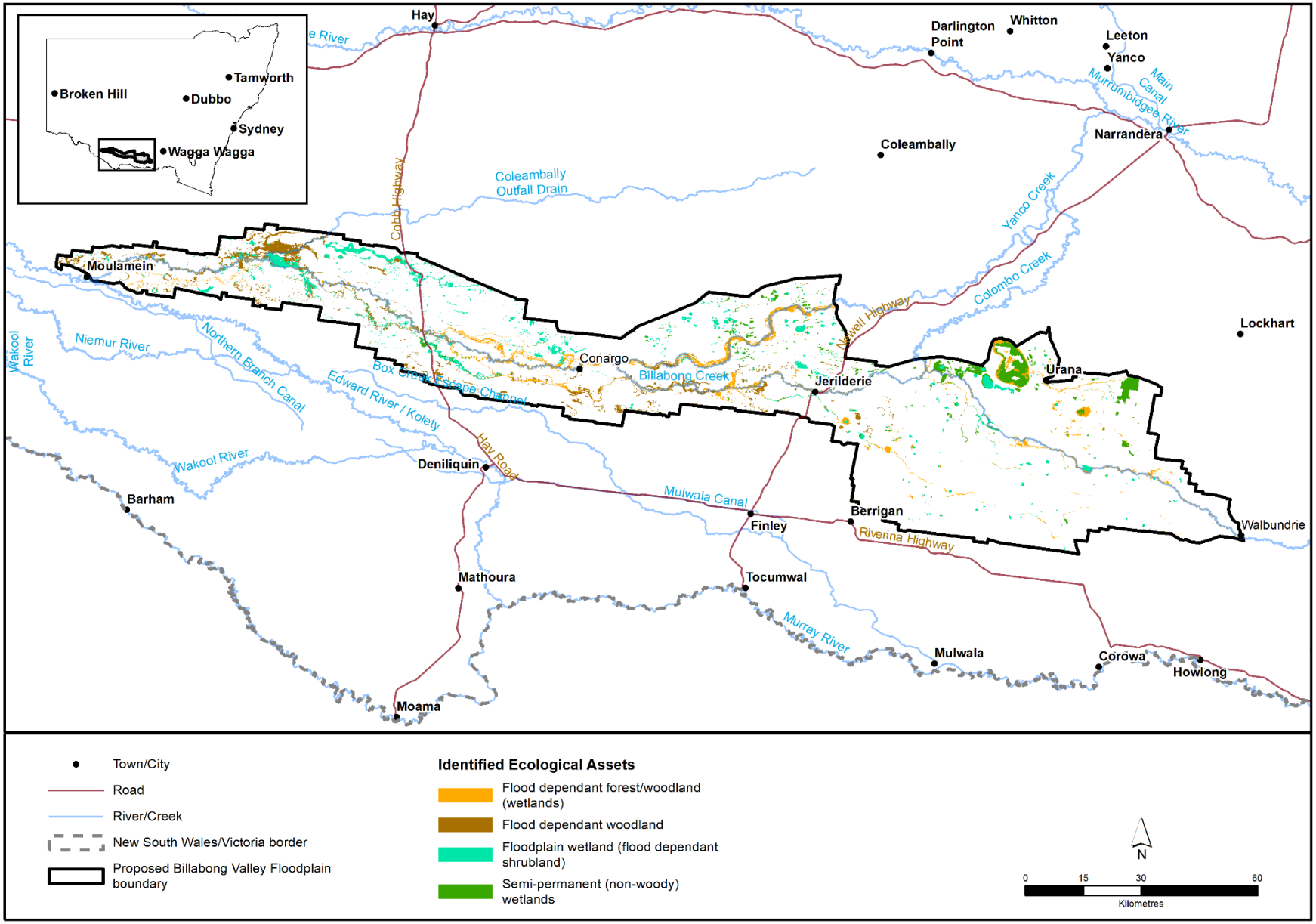
Prompts for feedback

Do you agree with the types of flood-dependent ecological assets that have been identified?

Are there other ecological assets on the floodplain that should be considered?

Are there any areas of ecological significance that are highly flood-dependent, which are not shown on Figure 5?

Figure 5. Identified flood-dependent ecological assets in the proposed Billabong Creek floodplain



3.7 Localised variances to some rules for flood work applications

FMPs follow a default rule set, which determines what can be assessed and approved as a flood work. These rule sets fall into 2 main categories depending on the location of the work:

- **Floodways and areas of ecological, heritage or Aboriginal cultural significance** – flood works in these areas will be restricted to specific types that are essential for the protection of life and property, or improvement of the floodplain.
- **Inundation extent and flood fringe** – all types of flood works are permitted, subject to conditions and assessment criteria.

There are some specific aspects of the rule set that can be tailored to account for local conditions and needs. These aspects are detailed below and are subject to consultation outcomes.

For examples of existing FMP rules, please refer to the rule summary sheets for FMPs in the northern Murray–Darling Basin on the department's website.

3.7.1 Types of works permitted in floodways

The proposed floodways for the Billabong Creek floodplain are shown in Figure 2. The granting of flood work approvals in floodways will be limited to specific types of flood works.

This is a change from the current planning arrangements in the existing localised FMP. Under existing planning arrangements any type of flood work within floodways may be applied for, subject to comprehensive assessment processes and advertising requirements for most types of flood works.

The difference in approaches between the existing localised FMP and the draft FMP relates to the requirement under the WM Act for the draft FMP to consider the risk to life and property from the effects of flooding. The construction of a flood work in a floodway can significantly increase the risk to life and property; both on the landholding where the flood work is constructed and on neighbouring properties.

Hence, the default types of flood works permitted in floodways will be limited to those that are critical for domestic or farm operations, such as those designed to protect life, infrastructure or provide refuge for stock, and will be restricted to a specified size or enclosing a specified area. The assessment process will be streamlined and, in most circumstances, advertising will not be required.

Table 1 lists the default types of flood works, and their purpose, that are typically permitted in floodways. Landholders will be required to lodge an application for a flood work approval for these types of works.

Table 1. Flood work types that are typically permitted in floodways

Flood work type	Purpose
Access roads (roads within private property)	To ensure landholders have basic provisions to access property.
Primary access roads (private road leading directly to a permanently occupied fixed dwelling)	To further ensure landholders have basic provisions to access property or evacuate during a major flood event by permitting higher level roads that directly service homes.
Supply channels (below ground)	To ensure landholders can access water rights from water sources.
Stock refuges	To account for animal welfare and to minimise a landholder's potential to lose stock to floodwaters.
Infrastructure protection works	For protecting high value infrastructure such as homes and sheds. To minimise the risk to life and property from flooding.
Ecological enhancement works	To improve flood connectivity to a recognised flood-dependent ecological asset, such as a wetland or lagoon.
Aboriginal cultural value enhancement flood works	To improve flood connectivity to a recognised flood-dependent Aboriginal cultural asset or value, such as a waterhole or lagoon that holds significance to Aboriginal people.
Heritage site enhancement flood works	To improve flood connectivity to a recognised flood-dependent heritage site, such as a colonial era waterhole or lagoon.
Aboriginal cultural value protection work	For protecting flood-impacted cultural sites such as burial grounds and shell midden sites that may be damaged by scour and erosion.
Heritage site protection work	For protecting heritage listed sites such as cemeteries, buildings or other places that may be damaged by inundation or scour and erosion.

Prompts for feedback

Do you agree with the proposed types of flood works that may be considered for approval in floodways?

Are there any other essential work types that should also be considered for approval in floodways?

3.7.2 Maximum height of access roads

Access roads are an essential flood work that allows for the protection of life and property. When located in a floodway, they need to be constructed to allow for appropriate flood connectivity.

A key objective of the maximum height of an access road is to balance the impacts of the flood work with the need for adequate access during times of flood.

FMPs allow for both standard access roads (including farm tracks) and primary access roads (roads leading directly to a permanently occupied fixed dwelling) to be constructed within floodways. Primary access roads will have a greater height to help protect lives during a flood.

The maximum height of an access road may vary in response to local conditions and consultation outcomes.

We are seeking feedback on a maximum height value for access roads located in a floodway with 10 cm (above the natural surface level) being the lower end of the threshold and 50 cm being the upper end of the threshold. All access roads will also be required to include causeways and manage borrow pits related to construction and maintenance.

Prompts for feedback

What is an appropriate maximum height for a standard access road located within a floodway?

What is an appropriate maximum height for a primary access road located within a floodway?

3.8 Submission process

We are seeking feedback on key elements that will be used to inform the development of the draft FMP through a public submission process from **8 October until 18 November 2024.**

Have your say by:

Completing the online submission form OR

Downloading and completing a submission form and:

- Email the form to: floodplain.planning@dpie.nsw.gov.au
- Post the form to:

  Billabong Creek FMP
  Water Group - NSW DCCEEW
  PO Box 189
  Queanbeyan, NSW 2620

A pre-recorded presentation is available on the department's website. It details an overview of the planning process and the feedback we are seeking.

During the Stage 1 consultation period, landholders and other stakeholders are invited to book individual appointments with departmental staff to ask questions about the key elements being proposed and how to make a submission. Table 2 lists the dates and locations available. Register for an appointment here.

Table 2. Available dates and times for individual appointments

Date	Location	Time
Monday 21 October	Online	9.00 am to 1.00 pm
Tuesday 22 October	Ian Gilbert Room, Jerilderie Civic Hall 33 Jerilderie Street, Jerilderie	2.00 pm to 6.00 pm
Wednesday 23 October	Moulamein Bowling Club Endeavour Drive, Moulamein	10.00 am to 2.00 pm
Thursday 24 October	Wanganella Hall Lang Street, Wanganella	10.00 am to 2.00 pm
Monday 28 October	Online	1.00 pm to 5.00 pm
Tuesday 29 October	Online	9.00 am to 1.00 pm

To assist with providing feedback on the maps shown in Figures 1 – 5, we recommend taking a screenshot of the relevant area/s displayed on the interactive spatial map and either using a drawing function for illustrating feedback or referring to the area shown in your written feedback. Please include information about the location on the map, such as an address. The screenshot of the map can then be saved as an image file and attached to your submission.

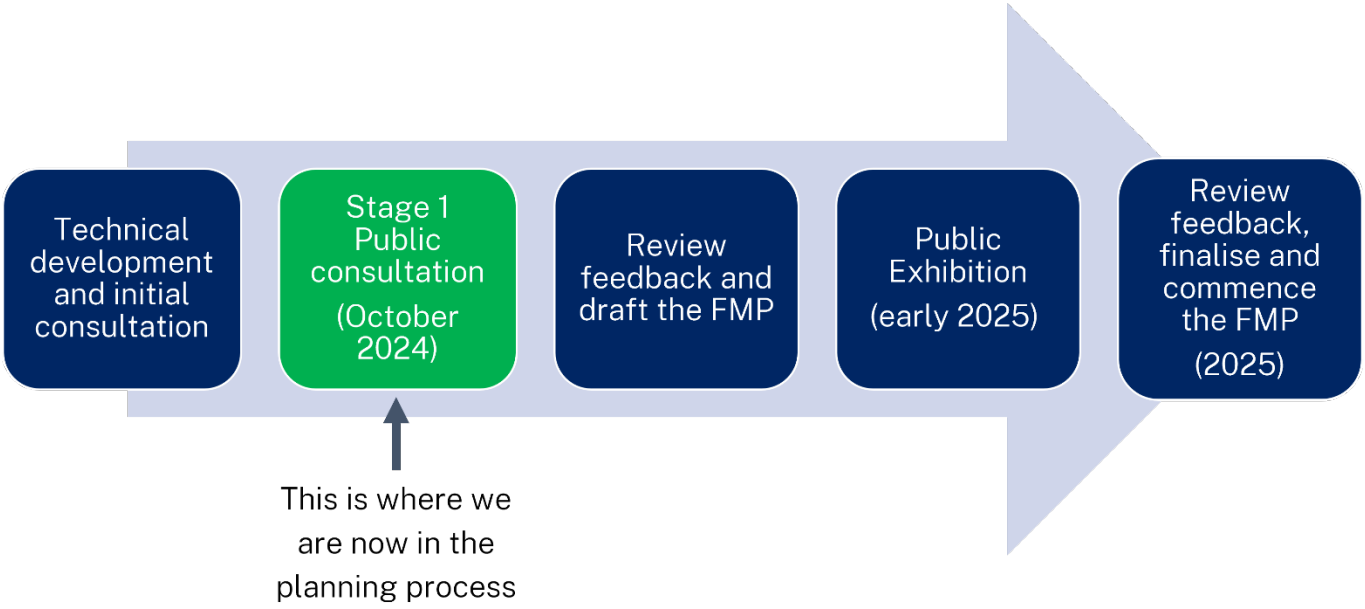
3.9 Next steps

All feedback is important and will be reviewed and considered when preparing the draft FMP for public exhibition (Figure 6). Submissions, including maps, will be published in line with the department's privacy policy, and a consultation outcomes report will be published summarising the feedback received.

The draft FMP will be released for formal public exhibition in early 2025, during which we will seek feedback on all elements of the draft FMP. This will include proposed management zones, rules and assessment criteria.

The final FMP is anticipated to commence in 2025 following approval from the Minister for Water and concurrence from the Minister for Environment.

Figure 6. Status of the draft Billabong Creek Floodplain Management Plan



4 Appendices

4.1 Appendix 1 Development of the floodway network

Computer-based hydraulic models are used to simulate the movement of floodwater across the landscape for the large and small design floods. Modelling data, as well as additional information such as flood imagery and topographical information, is used to map the floodway network. This appendix describes the design floods and the hydrologic and hydraulic modelling that has been used to develop the proposed floodway network for the Billabong Creek floodplain.

4.1.1 Design floods

A design flood is a flood of known magnitude or annual exceedance probability (AEP) that can be modelled. A design flood forms the basis of the floodway network, and this information is used as the hydraulic basis when developing the management zones in a FMP. Selection of a design flood is based on an understanding of flood behaviour and associated flood risk. Multiple design floods may be selected to account for the social, economic and ecological consequences associated with floods of different magnitudes.

AEP is the chance of a flood of a given or larger size occurring in any given year, usually expressed as a percentage (%) or a likelihood of 1 flood in x years. For example, a flood with an AEP of 5% means there is a 5% chance that a flood of the same size or larger will occur in any given year.

A flood frequency analysis was undertaken to assist with the selection of the design floods, shown in Table 3. The flood frequency analysis was used to determine the relationship between peak flood discharge at a location of interest and the likelihood that a flood event of that size or greater would occur.

The analysis for Billabong Creek (Table 3) suggests that flood behaviour in the upper reaches of Billabong Creek (Walbundrie to Jerilderie) is different to the lower reaches (Jerilderie to Moulamein). This is because of the influence of large storage areas, including Lake Urana in the upper Billabong Creek area, and inflows from Yanco Creek in the lower Billabong Creek area.

Consequently, 4 design floods were selected for the proposed Billabong Creek floodplain:

- **large design flood (whole floodplain)** – the October to December 2022 flood was selected as the large design flood for the whole study area (2.9% AEP at the Billabong Creek at Conargo (Puckawidgee) gauge (410017))
- **additional large design flood (upper floodplain)** – October to November 2010 flood was selected as an additional large design flood for the upper Billabong Creek area as it is the

largest recorded flood at Walbundrie gauge (410091) (3.3% AEP at the Billabong Creek at Walbundrie gauge (410091))

- **small design flood (lower floodplain)** – October to November 2010 flood was selected as the small design event for the lower Billabong Creek area (downstream of Jerilderie) (26% AEP at the Billabong Creek at Conargo (Puckawidgee) gauge (410017))
- **small design flood (upper floodplain)** – March 2011 flood was selected as the small design flood for the upper Billabong Creek area (upstream of Jerilderie) (17% AEP at the Billabong Creek at Walbundrie gauge (410091)).

The October to December 2022 flood event was selected as the large design flood for the whole valley because of the consistent AEP values throughout the floodplain (from 7.7% AEP at the Walbundrie gauge to 2.9% AEP at the Conargo gauge) compared to other large flood events, such as the 2010 or 2012 flood events.

The October 2010 flood event was selected as an additional large design flood in the upper Billabong Creek area as it is the largest flood on record for that area, with a 3.3% AEP at the Billabong Creek at Walbundrie gauge. The October 2010 flood event was not selected for the whole floodplain, as in the lower Billabong Creek area it is more consistent with the scale of a small design flood with a 26% AEP at the Billabong Creek at Conargo (Puckawidgee) gauge.

The October 2010 flood event was selected as the small design flood in the lower Billabong Creek area as there is a significant amount of information available (for example, gauge data, aerial photography and satellite imagery) to calibrate the hydraulic models.

The March 2011 flood event was selected as the small design flood event for the upper Billabong Creek area as it has an AEP of 17% at the Billabong Creek at Walbundrie gauge, as compared to the larger floods of 2010, 2012 and 2022.

Table 3. AEP for historic flood events at selected locations in the Billabong Creek floodplain

Location (gauge number)	Reason for gauge selection	1983 flood event AEP (%)	2010 flood event AEP (%)	2011 flood event AEP (%)	2012 flood event AEP (%)	2022 flood event AEP (%)
Billabong Creek at Walbundrie (410091)	Has a long-term flow record and a reliable high flow estimate.	5.6	3.3	17	6.3	7.7
Billabong Creek at Jerilderie (410016)	Has a long-term flow record but according to WaterNSW records at	12	> 20	> 20	> 20	5

Location (gauge number)	Reason for gauge selection	1983 flood event AEP (%)	2010 flood event AEP (%)	2011 flood event AEP (%)	2012 flood event AEP (%)	2022 flood event AEP (%)
	this site may be affected by upstream dams or backwater effects.					
Billabong Creek at Conargo (Puckawidgee) (410017)	Has a long-term flow record and a reliable high flow estimate.	21.4	26	23.8	5	2.9

The October to December 2022 large design flood was used to delineate floodways across the whole floodplain and to determine the extent of the floodway network. In the upper Billabong Creek area, the October 2010 flood event was also used to delineate the floodways and confirm the inundation extent as it is the largest flood on record for this area.

Smaller flood events (in the upper and lower areas respectively) were selected to ensure that critical flow paths were identified in the floodway network, where the modelled inundation extent of this event is compared to the identified floodways to ensure the accuracy of the network.

4.1.2 Hydraulic modelling

The proposed Billabong Creek floodplain was divided into 3 reaches for hydraulic modelling purposes. These reaches are described in

Table 4 and shown in Figure 7.

A suite of advanced one- and two-dimensional computer simulation software for hydraulic modelling of flood behaviour in rural and urban settings, known as TUFLOW, was used for each of the 3 reaches. The study area was modelled in the two-dimensional (2D) domain with key structures, such as culverts, incorporated as one-dimensional (1D) elements. Successful calibration and validation of the hydraulic models allowed historical flood events, including design flood events, to be replicated with an acceptable degree of accuracy.

For the purpose of defining acceptable degrees of accuracy, a hydraulic modelling standard specification was developed. It stipulates that all models need to be within 200 mm of inundation depths (based on gauge data and spot elevations) and 5% of the inundation width (based on aerial photography and satellite imagery).

4.1.2.1 Hydraulic model data and parameters

Hydraulic models have several parameters that need to be calibrated to correctly represent how floodwater behaves across the floodplain. The choice of values for these parameters can significantly affect the accuracy of the model outputs and lead to incorrect delineation of the floodway network. Some of these parameters include:

- **Hydrometric and hydrologic model data**: Recorded (gauged) hydrograph data was used as boundary inflows for the hydraulic models.
- **Boundary conditions:** Each model identifies the inflow conditions at the upstream start of the project area and outflow conditions at the downstream finish of the project area. Representation of inflows is critical so that the model has the appropriate volumes and flow rates within the study area. Similarly, at the downstream boundary, water needs to be removed from the model at the correct rates to avoid artificially increasing or decreasing flooding.
- **Topographic information:** A digital elevation model of the existing floodplain topography was developed using a range of topographic datasets acquired from available bathymetry, river cross sectional surveys and Light Detection and Ranging (LiDAR) laser surveying.

Grid size: The model grid size, which is the spatial distance between calculation points, can have a significant impact on the accuracy of results. In particular, if areas with a high variation in topography are represented too coarsely, the flow distribution between different flow paths will be impacted. Grid sizes used in the hydraulic models for the proposed Billabong Creek floodplain are presented in

- Table 4.
- **Hydraulic structures:** All bridges, culverts, weirs, and regulators likely to impact flow along key watercourses and across adjoining floodplain areas were also included in the models as either 1D or 2D structures. In general, structures that were less than the model grid cell size wide (for example, smaller floodplain culverts) were represented as 1D structures.

  It is important that all structures on the floodplain are represented in the model with a high level of accuracy. If structures are not represented correctly, they will behave differently. For example, water may overtop a levee sooner in the model than it does in reality, or water may be constricted by a bridge to a greater degree in the model than in reality.

  Data for majority of significant structures in the model area were captured by ground survey in previous studies (such as the Reconnecting River Country Program) and many remaining structures were measured during field inspections.
- **Existing hydraulic models:** Specific information such as surveyed topographical data and hydraulic structures information from previous developed hydraulic models within the study area were extracted and used in the hydraulic models developed for the Billabong Creek floodplain.

- **Land use/vegetation:** Available land use and vegetation layers covering the study area were used to inform the “roughness" of the ground surface. Floodwater moves more slowly through dense vegetation compared to a cleared field. As part of the calibration process, flood observations, such as gauge data, satellite imagery, flood images, or footage, are compared to the model results, and the parameters like roughness are modified if the model is not aligning with the observed information.
- **Satellite imagery - Sentinel and Landsat:** Available satellite (Sentinel and Landsat 8) imagery of various dates during selected flood events were used for hydraulic model calibration and validation.
- **Data collected during previous flood events**: Flood information such as local flood levels, flow directions, flood extents and inundation duration collected during previous community consultation has been used for hydraulic model calibration and validation. Throughout June, July and August 2023 landholders and local councils, provided a range of data including ground and aerial flood level imagery and identification of areas where flood flow connectivity was compromised. To date, the department has collected an abundance of flood images, some drone footage and a significant number of verbal accounts of the 2022 flood event across all 4 valleys. There was also an abundance of historical flood information provided such as historical flood photos and descriptions of floodplain behaviour during past events.
- **Existing flood works:** A range of natural and constructed embankments extending across the floodplain, such as levees, rail, and road embankments, were included in the hydraulic models. Each of these features can have a significant impact on the movement of floodwater. Some of these flood works do not have a flood work approval.

A process for determining how unapproved flood works are considered in the development of the floodway network is shown in Figure 8. This process considers the potential flooding impacts of the unapproved work, whether the impact is contained within the landholding or if it impacts on other neighbouring properties and whether the impacted area is recognised as a floodway within the existing planning arrangements. Existing planning arrangements in the Billabong Creek floodplain are described in the Background section of this report.

Unapproved flood works are a significant issue for many local landholders. To report concerns regarding unapproved works, please visit the NRAR website at www.nrar.nsw.gov.au/suspicious-activites.

You can also contact NRAR on 1800 633 362 during business hours or via email nrar.enquiries@nrar.nsw.gov.au.

Table 4. Hydraulic models in each reach of the Billabong Creek floodplain

Floodplain model reach	Model grid cell size	Model description
Walbundrie to Jerilderie	30 m across floodplain and 15 m for main waterways	A TUFLOW 1D/2D grid model was built from upstream of Billabong Street Bridge at Walbundrie to 20 km downstream of the Newell Highway bridge at Jerilderie. The major watercourses within this reach include Colombo Creek, Wangamong Creek and Urangeline Creek.
Jerilderie to Wanganella	32 m across floodplain and 16 m for main waterways	A TUFLOW 1D/2D grid model was built from the Bolton Street bridge at Jerilderie to downstream of the Cobb Highway bridge at Wanganella. The major watercourses within this reach include Yanco Creek.
Wanganella to Moulamein	32 m across floodplain and 16 m for main waterways	A TUFLOW 1D/2D grid model was built from about 2.5 km downstream of the Cobb Highway bridge at Wanganella to about 7.8 km downstream of the Moulamein Road Bridge on Edward River at Moulamein.

Figure 7. The 3 reaches of the hydraulic models within the proposed Billabong Creek floodplain

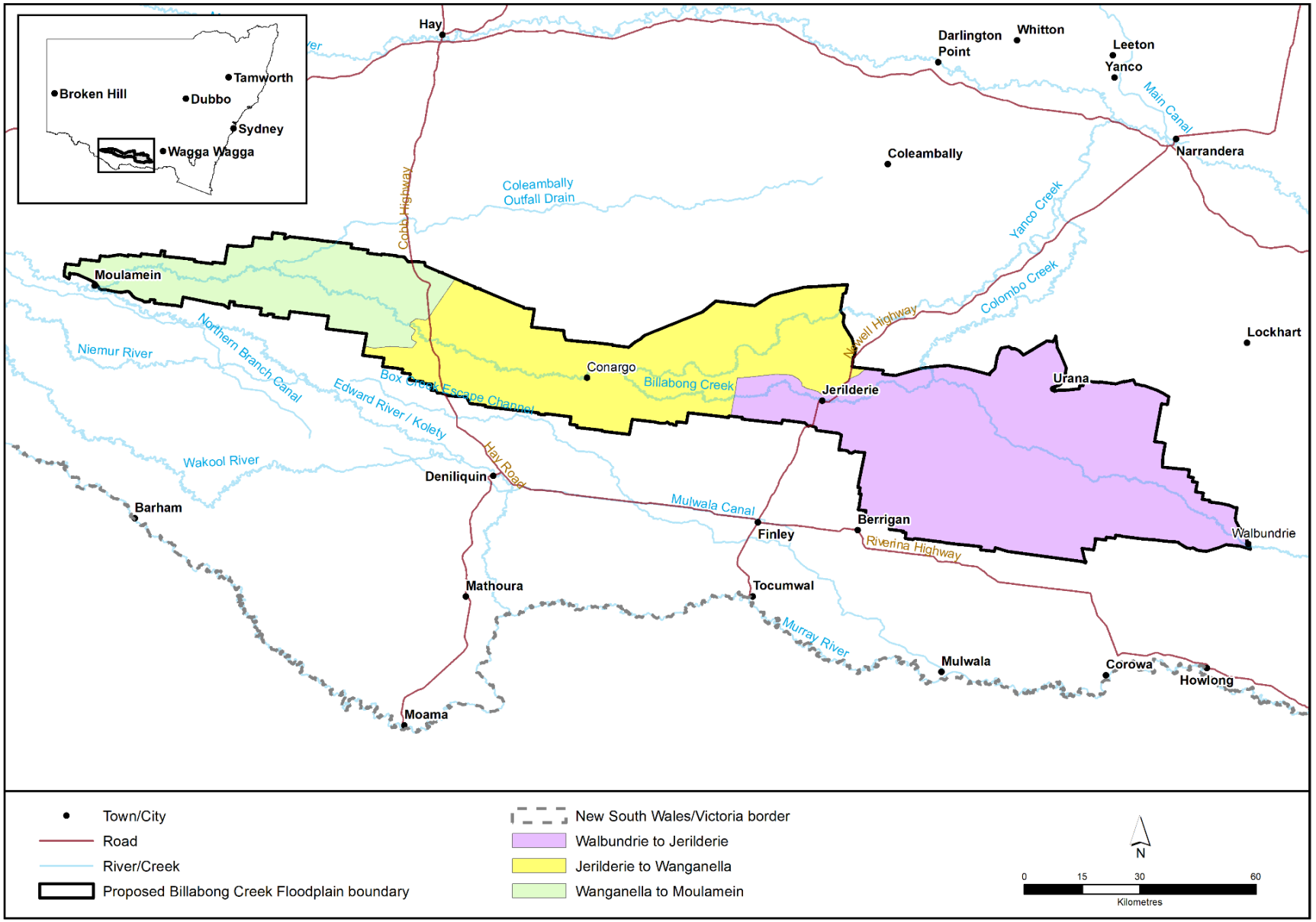
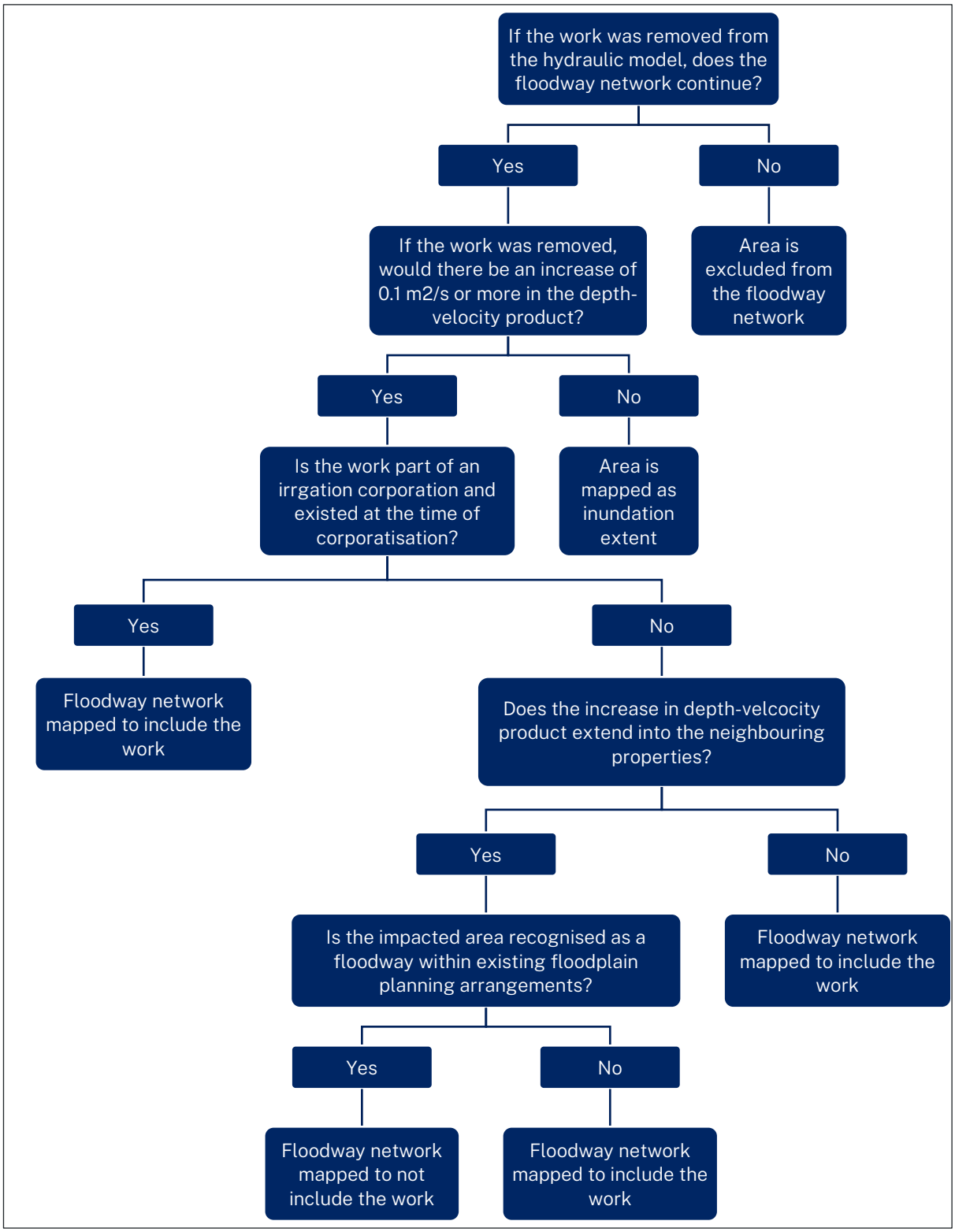


Figure 8. Process for determining how an unapproved work is considered in the development of the floodway network



4.1.3 Hydrology

Flood flow data at various points across the floodplain is a key input in the hydraulic models that are used to map the floodway network. Within the proposed Billabong Creek floodplain, flood flows were derived from mainstream and tributary streamflow gauges, while flows for ungauged tributaries were estimated using hydrologic models simulating rainfall-runoff on a catchment by converting storm rainfall to flow hydrographs.

Hydrologic models were developed for the following ungauged tributaries:

- Wangamong Creek
- Urangeline Creek
- Coleambally Outfall Drain catchment.

The Watershed Bounded Network Model (WBNM) software was used to develop hydrologic models of the Wangamong Creek and Urangeline Creek catchments. WBNM was also intended for application to the Coleambally Outfall Drain catchment. However, the nondendritic nature of the catchment, considerable storages, and many drainage modifications associated with the Coleambally irrigation district made a lumped hydrologic software like WBNM unsuitable. Therefore, a full two-dimensional 'direct rainfall' model of the catchment was developed using the TUFLOW software.

CatchmentSIM was used to automatically calculate key hydrologic properties for each sub-catchment in WBNM. WBNM incorporates a non-linear routing calculation to account for routing of flows along watercourses within each sub-catchment.

Historic rainfall for each event was assigned based on all active daily and sub-daily gauges in the vicinity of each catchment – gauges are listed below. All rainfall data was extracted from the Bureau of Meteorology's Water Data Online website.

- Bowna Creek at Yambla (401015)
- Brookong Creek at Hollies Road (41000279)
- Burkes Creek at Mangoplah (41000280)
- Beavers Creek at Mundowey (410137)
- Colleambley Irrigation (Daily)
- Murray River downstream Hume Dam (Heywoods Bridge) (409016)

As there are no stream gauges located within the WBNM model areas, it was not possible to complete a direct calibration of the WBNM models against historic stream flow records. Therefore, a joint validation was performed with the TUFLOW hydraulic model using the gauge inflows only and gauge inflows plus hydrologic model inflows. Then, the simulated flow and water level hydrographs at the Billabong Creek at upstream Innes Bridge, Jerilderie and Darlot stream gauges were

compared with and without the hydrologic models flows to understand whether the hydrologic models' inflows provided an improved reproduction of the recorded water level information.

The simulated inundation extents for each of the hydrologic models' tributaries were compared against Sentinel and Landsat flood imagery to confirm the inflows, and when combined with the TUFLOW model results, were providing reasonable reproduction of the observed inundation extents. This comparison was limited by the availability of flood imagery for these tributaries.

4.1.4 Hydraulic model calibration and validation

The hydraulic models were calibrated and validated using selected historic flood events that are around the design flood magnitude and are likely to activate all flood flow paths.

The following flood events were used for calibration and validation:

- October to December 2022 flood event as the large calibration event (the large design flood - whole floodplain)
- October to November 2010 and March 2011 flood events as the small calibration events (the small design floods)
- March 2012 flood event as the validation event.

The models were calibrated against a range of data sources, particularly:

- peak flood heights at streamflow gauge locations
- available flow distribution calculations for the existing non-statutory floodplain development guidelines
- the peak discharge magnitude and timing at streamflow gauge locations
- flood extents from satellite imagery and aerial photography.

A summary of the peak recorded flows and water levels during the 2010, 2011, 2012 and 2022 flood events for calibration and validation of the hydraulic models is presented in Table 5.

Table 5. Peak recorded flows and water levels during selected flood events for calibration and validation of hydraulic models

Gauge	2022 flood water level (mAHD*)	2022 flood flow (ML/day)	2012 flood water level (mAHD)	2012 flood flow (ML/day)	2010 or 2011 flood water level (mAHD)	2010 or 2011 flood flow (ML/day)
Billabong Creek at Walbundrie (410091)	175.72	35,908	175.77	35,476	**174.72	**22,784
Billabong Creek at upstream Innes Bridge (410170)	112.47	6,786	111.63	4,238	**111.63	**4,230

Gauge	2022 flood water level (mAHD*)	2022 flood flow (ML/day)	2012 flood water level (mAHD)	2012 flood flow (ML/day)	2010 or 2011 flood water level (mAHD)	2010 or 2011 flood flow (ML/day)
Billabong Creek at Jerilderie (410016)	107.88	7,313	107.14	4,070	**107.10	**3,890
Billabong Creek at Conargo (Puckawidgee) (410017)	95.25	13,253	94.93	9,774	93.92	3,858
Billabong Creek at Wanganella (41010810)	85.46	11,640	84.343	7,321	83.023	2,990
Billabong Creek at Darlot (410134)	77.67	9,376	77.155	6,700	75.805	3,000
Coleambally outfall drain at Near Bundy (410133)	78.11	Not available	77.445	Not available	76.105	Not available

* mAHD means elevation in metres with respect to the Australian Height Datum.

** This information is from March 2011 flood event as the October 2010 flood event was considered a large flood event in the upper Billabong Creek area.

A summary of the hydraulic models' calibration results is presented in Table 6.

Table 6. Summary of hydraulic models' calibration results for peak inundation depth differences (metres)

Gauge	Small calibration event	Large calibration event
Billabong Creek at Walbundrie	-0.10	-0.18
Billabong Creek at upstream Innes Bridge	-0.10	-0.18
Billabong Creek at Jerilderie	0.05	0.00
Billabong Creek at Conargo	+0.18	-0.19
Billabong Creek at Wanganella	+0.32	-0.29
Billabong Creek at Darlot	-0.06	-0.11
Coleambally outfall drain at near Bundy	-0.2	-0.19

Overall, the TUFLOW model results agreed well with recorded in-bank flow estimates and agreed with documented flood extents.

4.1.5 Hydraulic model outputs

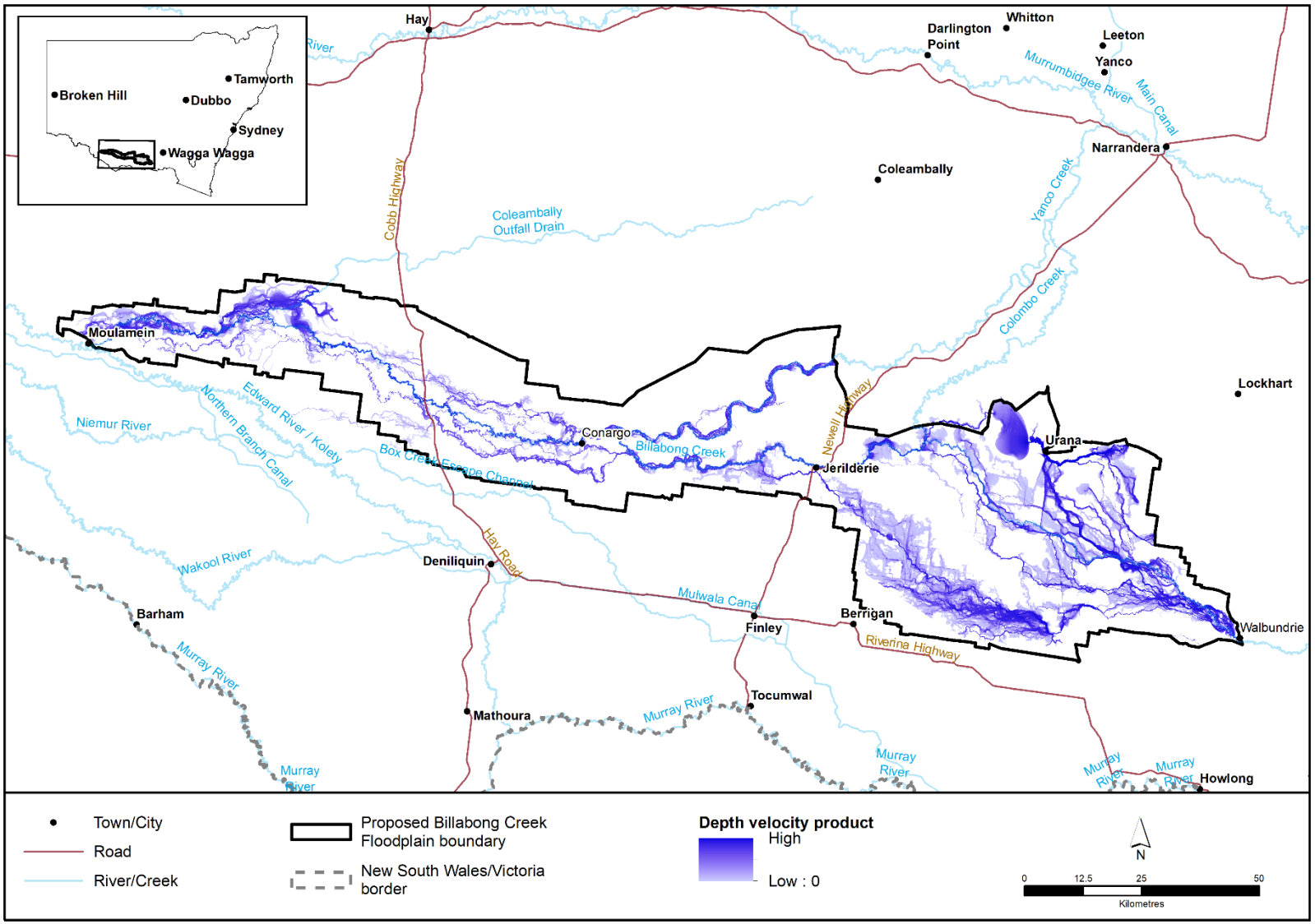
The hydraulic model outputs used to develop the floodway network included:

- depth-velocity product maps for the large design flood (October to December 2022 for the whole Billabong Creek floodplain area, Figure 9, and October 2010 flood event for the upper Billabong Creek floodplain area).
- inundation extents for the small design flood (October to November 2010 flood for lower Billabong Creek floodplain area - downstream of Jerilderie and March 2011 flood event for upper Billabong Creek floodplain area – from Walbundrie to Jerilderie) and the large design flood (October to December 2022).

A depth-velocity product is derived by multiplying the modelled depth and velocity results at each calculation point. This is used to indicate areas of high flow (deep and fast flowing) throughout the floodplain.

These outputs were used to determine the appropriate size of each floodway and the overall floodway network. In areas where hydraulic data was not sufficient to accurately map the flood extents, the limits to the floodway networks were determined by using aerial and satellite flood imagery captured for the design flood events.

Figure 9. Hydraulic modelling results (depth-velocity product) map from all 3 models for the large design flood event (October to November 2022 – 5% AEP at the Billabong Creek at Jerilderie gauge)



4.1.6 Mapping the floodway network

4.1.6.1 Hydraulic criteria

The small and large design floods provide the hydraulic basis for delineating the floodway network. The hydraulic criteria that were used to delineate the floodway network are described in Table 7.

Table 7. Summary of the criteria used to delineate the hydraulic categories in the floodway network

Hydraulic category	Criteria
Floodways	• Areas that have a depth-velocity product of greater than or equal to 0.1 m^2/s for the large design flood (October to November 2022). • Parts of the small design flood extent (October to November 2010 and March 2011 floods) that ensure continuity of floodways.
Inundation extent	• Flood extent of the small design flood (October to November 2010 and March 2011 floods) and the large design flood (October to November 2022). • In areas outside the hydraulic model extent flood imagery from the 2022 flood event derived from Sentinel and Landsat imagery.
Areas outside of the floodway network	• Flood fringe areas outside the large design flood (October to November 2022 and October 2010 flood for the upper Billabong area) extent. • Floodplain area enclosed by existing flood works that were not designed to be overtopped by floodwater.

Hydraulic modelling outputs may not always account for all the important floodways. As such, additional data is used to ensure that the floodway network represents on-ground conditions. The following information was used to validate the floodway network:

- flood aerial photography and satellite imagery
- spatial watercourse layers
- non-statutory rural floodplain development guidelines
- local knowledge from floodplain communities, and floodplain and environmental managers
- existing flood work development.

4.1.6.2 Floodways

Floodways in the proposed Billabong Creek floodplain were mapped using the outputs of the hydraulic models, in particular the depth-velocity products from the large design flood (October to November 2022).

Floodways derived from the target depth-velocity threshold were compared with the inundation extent of the small design flood (October to November 2010 and March 2011). This comparison was undertaken to ensure that areas of the floodplain activated during small floods were identified as floodways, irrespective of whether they reached the selected depth-velocity threshold. Such areas are also likely to be the first floodways activated during large flood events and may be important for

connecting flood-dependent ecological and Aboriginal cultural assets to floodwater during smaller floods.

4.1.6.3 Inundation extent

The hydraulic modelling also produced the inundation extent of the large design flood (October to November 2022) across the floodplain. Where the flood extent was reliable via confirmation with observed data, its outer limits were used to determine the extent of the floodway network.

Areas within the extent of the large design flood are considered important for providing temporary pondage during large floods. Areas beyond the extent of the design flood may also be flood-prone but would only become inundated during larger floods including extreme events and would generally have low conveyance or pondage capacity.

4.2 Appendix 2 First Nations consultation

The department held several information sessions with First Nations communities within the Billabong Creek floodplain between November 2023 and August 2024. An overview of the engagement activities completed to-date is provided in Table 8.

The purpose of this targeted engagement was to identify or confirm Aboriginal cultural assets and values on the floodplain, which is a key step in the development of the draft FMP, and to raise awareness about how FMPs can protect Aboriginal cultural assets and values. The Heritage NSW division also provided information on AHIMS that is used to support the development and implementation of a FMP.

The department will continue to liaise with First Nations communities in the Billabong Creek floodplain throughout the development of the draft FMP. This will include updates via the department's Southern Regional Aboriginal Water Committees.

Table 8. Overview of First Nations engagement sessions to-date

Date	Location	Who	Nation	Number of people
21 November 2023	Wagga Wagga	Southern Regional Aboriginal Water Committees (introduction)	Multiple	25
24 July 2024 16 August 2024	Deniliquin and online	Deniliquin Local Aboriginal Land Council and community	Wamba Wamba Perrepa Perrepa	5
27 August 2024	Online	Yarkuwa Indigenous Knowledge Centre	Wamba Wamba Perrepa Perrepa	2

Feedback received

A summary of the feedback received from First Nations communities in the Billabong Creek floodplain is provided in Table 9. First Nations communities in Deniliquin, as well as the NSW Heritage AHIMS team, were consulted on the feedback summarised in Table 9 and agreed to its inclusion in this report.

Table 9. Summary of feedback received from First Nations communities in the Billabong Creek floodplain and the department's response

Feedback received	Response from the department
All effort must be made to consult with Traditional Owners as well as members of the Local Aboriginal Land Councils.	The department will continue to identify and contact Traditional Owners to ensure they are included in all consultation as part of developing floodplain management plans in the southern Murray–Darling Basin.
There is a common desire amongst First Nations communities to protect and care for Aboriginal cultural assets and values that are located on private properties. However, this cannot be done due to a lack of access.	While floodplain management plans do not deal with access, they can raise awareness of the value of Aboriginal cultural assets to First Nations people and the broader community. The department acknowledges that healthy waterways and floodplains are critical to the culture and wellbeing of Aboriginal people. Where possible, the department will encourage local landholders to build relationships with local First Nations communities to work together to care for cultural assets and values on the floodplain that, in turn, can provide social and economic benefits to the community.
Aboriginal cultural assets recorded in AHIMS are being damaged or destroyed during development processes. Communities are concerned about being involved in the development process.	The *National Parks and Wildlife Act 1974* protects Aboriginal cultural heritage in NSW. An Aboriginal Heritage Impact Permit is required for any activity or works where harm to an Aboriginal object or place cannot be avoided. This means that development proposals must consider impacts on Aboriginal cultural heritage. For further information about current development applications, please contact the local council in your area. To report damage or harm to an Aboriginal cultural asset contact the Environment Line: By phone: 131 555 (24 hours a day, 7 days a week) By email: info@epa.nsw.gov.au In relation to floodplain management, as part of assessing and determining an application for a flood work approval, a search of AHIMS must be conducted. In AHIMS, site information can be restricted so that culturally sensitive information is not shared publicly. Heritage NSW can provide assistance to facilitate communication between a landholder and the relevant

Feedback received	Response from the department
	knowledge holder/Elders in the event that a restricted Aboriginal cultural site is identified within or near a proposed flood work. Floodplain management plans provide an opportunity to improve public awareness of the value of Aboriginal cultural assets on the floodplain as it relates to the health and wellbeing of First Nations people, and in turn foster greater stewardship of these cultural assets.
Earth works such as levee banks in some locations are restricting flows during flood events preventing wetlands from receiving the water they need to thrive.	The Natural Resources Access Regulator (NRAR) is responsible for compliance and enforcement of flood works. As part of developing the draft FMP, all flood works are being identified and their approval status reviewed. This information will be provided to NRAR when complete. More information is available in the June 2023 consultation outcomes report that is published on the department's website.
A lot of First Nations people are aware of AHIMS but were unsure on how to use it, including how to use the mobile app. Consequently, many sites are not yet recorded in AHIMS.	Heritage NSW will continue to provide support to individual communities where required to add objects or places to AHIMS. For further information, please contact heritageinbox@environment.nsw.gov.au or phone (02) 9873 8500.
Poor mobile phone coverage when out on Country makes it difficult to record the location of Aboriginal cultural assets and values in AHIMS.	Heritage NSW will provide support to individual communities to supply a GPS unit to allow recording in areas with poor mobile phone coverage. For further information, please contact heritageinbox@environment.nsw.gov.au or phone (02) 9873 8500.
It is difficult for many First Nations people, including Elders, to attend information sessions and meetings that are held during regular business hours due to work commitments.	Where possible, the department will host future events later in the afternoon or early evening to ensure that more people can attend information sessions and have their say.

Feedback received	Response from the department
First Nations communities are concerned about how water is managed, including the ownership of cultural access licences.	Floodplain management plans do not deal with the take of floodplain water. That is dealt with in water sharing plans. The department is committed to improving water management in NSW by giving greater recognition to Aboriginal water rights and interests as well as improving access to and ownership of water for cultural, spiritual, social, environmental and economic benefit to communities. This work is happening through the Aboriginal Water Program and the development of an Aboriginal Water Strategy. Information about cultural water access for Aboriginal people is available on the department's website. Support is also available from the department's Regional Aboriginal Engagement team by emailing awp.engagementteam@dpie.nsw.gov.au
First Nations community members are updating the AHIMS data base with more cultural assets due to gaining access to private property.	This is a great outcome for First Nations peoples and the broader community. The identification and protection of cultural assets is beneficial to everyone. Heritage NSW will continue to provide support to individual communities where required to add objects or places to AHIMS. For further information, please contact heritageinbox@environment.nsw.gov.au or phone (02) 9873 8500. Cultural assets registered through AHIMS can be protected from the impacts of floodplain development through the rules in the draft FMP.
Vegetation needs to be monitored and supported so the right species can grow in the right places for food, fibre and medicine. There are currently issues in the area where Red Gums grow in places they shouldn't have grown because of the changes in watering patterns and flood behaviours.	Noted. This feedback has been shared with the department's Surface Water Science team. The department uses monitoring and research projects to track if changes in water management protect and improve water-dependent environments, including inland floodplains. The encroachment of River Red Gum trees is recognised as a problem in many inland areas where the flooding regime has changed or where watering does not persist for long enough to drown out Red Gum seedlings. No specific floodplain vegetation monitoring is currently happening in the Billabong Creek floodplain, but it will be considered as part of future programs if funding is available.

Feedback received	Response from the department
	More information about the Environmental Outcomes Monitoring and Research Program is available on the department's website.
Places with dual naming should be listed as the dual name, such as Edward River / Kolety.	Places with dual Aboriginal names will be used as required by the NSW Dual Naming Policy. More information is available on the NSW Planning Portal. Edward River / Kolety has been labelled on the maps used in this document and will be used in the draft FMP.
Past tense tends to be the language used when referring to Aboriginal cultural assets. Aboriginal cultural assets are all current assets. We do not need to just protect assets because they were used by previous First Nations generations. We need to preserve assets, such as food, fibre and medicines, for current and future generations to use. We also recommend using place-based stories when describing the Aboriginal cultural assets in the area.	Noted. Where relevant, references to Aboriginal cultural assets and values will use current tense. Floodplain management plans provide an opportunity to improve public awareness of the value of Aboriginal cultural assets on the floodplain as it relates to the health and wellbeing of First Nations people, and in turn foster greater stewardship of these cultural assets.
Not all Aboriginal cultural assets are recorded in AHIMS. Preference for occupancy mapping to help promote connection to Country and connecting communities together along the river.	Noted. As part of assessing and determining an application for a flood work approval, a search of AHIMS must be conducted. This search is consistent with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW. Heritage NSW will continue to provide support to individual communities where required to add objects or places to AHIMS. For further information, please contact heritageinbox@environment.nsw.gov.au or phone (02) 9873 8500. Cultural assets registered through AHIMS can be protected from the impacts of floodplain development through the rules in the draft FMP. The department will investigate how other tools such as the Aboriginal Sites Decision Support Tool and occupancy mapping may be used to inform the development of the draft FMP. The Aboriginal Sites Decision Support Tool is a spatial dataset published on the department's SEED Portal that illustrates the potential distribution of site features recorded in AHIMS.

4.3 Appendix 3 Ecological asset identification and categorisation

4.3.1 Identifying ecological assets

Two types of flood-dependent ecological assets have been identified in the Billabong Creek floodplain: wetlands and other floodplain ecosystems.

Wetlands and other floodplain ecosystems include the flood-dependent vegetation communities that were identified and categorised into hydro-ecological functional groups according to the surface water requirements of the dominant or canopy species in the floodplain vegetation community, including:

- semi-permanent (non-woody) wetlands
- floodplain wetlands (flood-dependent shrubland wetlands)
- flood-dependent forest/woodland (wetlands)
- flood-dependent woodlands.

4.3.2 Ecological asset type – wetlands

Vegetation mapping including the State Vegetation Type Map[2] of plant community types (PCTs) and several wetland studies were predominantly used to identify wetlands. PCTs identify recurring patterns of native plant species assemblages in relation to environmental conditions. More information about NSW plant community type classification is available on the department's website.

The following previous wetland studies and datasets have been identified:

- Billabong Creek wetlands[3]
- Wetlands of West Hume – Corowa[4]
- Yanco Creek Wetlands[5]

[2] Department of Climate Change, Energy, the Environment and Water (2023) NSW State Vegetation Type Map. Current Release C2.0 M2.0 (December 2023)

[3] Leslie, D and Maher, P (2000) An inventory of wetlands in the Billabong Creek catchment between Walbundrie and Jerilderie. Unpublished report for the Murray Wetlands Working Group by Absolutely Native, Deniliquin

[4] Webster, R & Davidson I (2003) Inventory of wetlands within the Riverina Highland regional vegetation region. Ecosurveys Pty Ltd, Deniliquin.

[5] Webster, R (2007) Investigation into potential water savings from the Yanco Creek System (Off-take to Yanco Bridge) Wetlands by Rick Webster 2007Webster 2007

- Yanco-Billabong Creek Broad-scale Wetland Monitoring Project[6]
- Directory of Important Wetlands in Australia[7]
- NSW Hydro Area dataset which contains delineations of named wetlands
- Mitchell Landscapes version 3.1[8] identifies Murrumbidgee Lakes, Swamps and Lunettes.

The State Vegetation Type Map mapping of PCTs supersedes the vegetation mapping that was used to identify flood dependent ecosystems as a part of the design process for the floodway network for the existing localised FMP. More information about the reliability and spatial precision of the State Vegetation Type Map is available on the department's website.

The department is committed to using the best available information in the development of the draft FMP. When newer ecological asset data becomes available in the short-term, this will be considered in the development of the draft FMP and further community feedback will be sought during Stage 2 public exhibition.

4.3.2.1 Wetlands of national importance

The following wetlands within the proposed Billabong Creek Floodplain are listed in the Directory of Important Wetlands in Australia:

- Black Swamp and Coopers Swamp (NSW042).

4.3.2.2 Wetland plant communities

Wetlands within the Billabong Creek floodplain include semi-permanent (non-woody) wetlands and floodplain (flood-dependent shrubland) wetlands. The plant community types that make up this group and their watering requirements are shown in Table 10.

Lignum swamps are a priority for the NSW and Commonwealth Governments outlined in the Murrumbidgee Long Term Water Plan[9], the Murrumbidgee Valley Water Plan 2023-24[10] and the Basin-wide environmental watering strategy[11].

---

[6] Walcott A, Wolfenden B, Hall A & Wassens S (2018) 'Yanco-Billabong Creek Broad-scale Wetland Monitoring Project: Frog communities of the Yanco-Billabong creek system', Final Report prepared for Murray Local Land Services. Institute of Land Water and Society, Charles Sturt University, Albury

[7] Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2016) Directory of Important Wetlands in Australia.

[8] Department of Environment and Climate Change (DECC) (2002) Descriptions for NSW (Micthell) Landscapes Version 2

[9] Department of Planning, Industry and Environment (DPIE) (2020) Murrumbidgee Long Term Water Plan. Part A: Murrumbidgee catchment. ISBN 978-1-922317-79-7 EES 2020/0078 July 2020

[10] Commonwealth of Australia 2023, Commonwealth Environmental Water Holder Water Management Plan 2023–24, Canberra. CC BY 4.0. ISBN 978-1-76003-434-4

[11] Murray-Darling Basin Authority (MDBA) (2019) Basin-wide environmental watering strategy. Second Edition. 22 November 2019. Published by the Murray-Darling Basin Authority. MDBA publication no: 42/19. ISBN (online): 978-1-925762-47-1

Table 10. Wetlands – Plant community types in the Billabong Creek floodplain and their watering requirements

Wetlands by sub-type	Plant community type name (ID)	Ideal watering frequency (average recurrence interval)*
Semi-permanent (non-woody) wetlands	• Shallow marsh wetland of regularly flooded depressions on floodplains mainly in the semi-arid (warm) climatic zone (mainly Riverina Bioregion & Murray Darling Depression Bioregion; PCT 12) • Swamp grassland wetland of the Riverine Plain (PCT 47) • Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains (PCT 53) • Common Reed - Bushy Groundsel aquatic tall reedland grassland wetland of inland river systems (PCT 181) • Cumbungi rushland wetland of shallow semi-permanent water bodies & inland watercourses (PCT 182) • Rush - Sedge - Common Reed mainly lentic channel wetland of the Upper Murray and mid-Murrumbidgee River floodplains in the NSW South Western Slopes Bioregion (PCT 336)	Once every 1-2 years
Floodplain wetland (flood-dependent shrubland) wetland	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion; PCT 17)	From once every 1–3 years to once every 7–10 years
Floodplain wetland (flood-dependent shrubland) wetland	Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains (PCT 24)	From once every 2-3 years to once every 5-7 years
Floodplain wetland (flood-dependent shrubland) wetland	Nitre Goosefoot shrubland wetland on clays of the inland floodplains (PCT 160)	From once every 1–2 years to once every 2–7 years

*Refers to the frequency at which a flow event is required to maintain the ecological character of the wetland, expressed as an average recurrence interval (the long-term average number of years between a flood event). Adapted from the Murrumbidgee Long Term Water Plan.

4.3.3 Other floodplain ecosystems

The State Vegetation Type Map mapping of plant community types (PCTs) and several wetland studies was predominantly used to identify other floodplain ecosystems.

Other floodplain ecosystems within the Billabong Creek floodplain include flood-dependent forest/woodland (wetlands) and flood-dependent woodlands. The plant community types that make up these hydro-ecological functional groups and their watering requirements are shown in Table 11.

River Red Gum woodlands and Black Box woodlands are target ecological populations in the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* and are a priority for the NSW and Commonwealth Governments outlined in the Murrumbidgee Long Term Water Plan and the Basin-wide environmental watering strategy.

Table 11. Other floodplain ecosystems - Plant community types in the Billabong Creek floodplain and their watering requirements

Other floodplain ecosystems by sub-type	Plant community type name (ID)	Ideal watering frequency (average recurrence interval)*
Flood-dependent forest/woodland (wetland)	• River Red Gum-sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW (PCT 2) • River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) • River Red Gum - Warrego Grass - herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion (PCT 7) • River Red Gum - Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion; PCT 11)	Once every 1–3 years
Flood-dependent forest/woodland (wetland)	• River Red Gum - Warrego Grass - Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion; PCT 8) • River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion (PCT 9) • River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion; PCT 10)	Once every 2–4 years

Other floodplain ecosystems by sub-type	Plant community type name (ID)	Ideal watering frequency (average recurrence interval)*
	• Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 74) • River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW (PCT 249)	
Flood-dependent woodlands	• Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion; PCT 13) • Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion; PCT 15) • Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion; PCT 16)	From once every 3–7 years to once every 5–10 years, depending on the plant community type

*Refers to the frequency at which a flow event is required to maintain the ecological character of the wetland, expressed as an average recurrence interval (the long-term average number of years between a flood event). Adapted from the Murrumbidgee Long Term Water Plan.

4.3.4 Consideration of water-dependent fauna and habitat in the identification of the flood-dependent ecological assets on the floodplain

The identification of the flood-dependent ecological assets within the Billabong Creek floodplain includes consideration of key habitat features for water-dependent fauna including areas of native fish passage[12], observed waterbird breeding habitat sites and drought refugia. The proposed floodway network aims to provide for the adequate passage of floodwater to these areas to maintain their ecological value.

[12] Fish passage refers to connectivity that allows native fish species to move between upstream and downstream habitats as well as adjacent riparian and floodplain areas. Areas of key fish habitat include rivers, creeks and flood flow paths and are available on the Fisheries NSW website.