AGENDA

FLOODPLAIN MANAGEMENT COMMITTEE
TO BE HELD IN THE COUNCIL CHAMBERS ON
THURSDAY, 9 OCTOBER 2025 AT 2:00 PM

Items of Business

DISTRIBUTION LIST
Councillor Scott Groat (Chair), Laurie Testoni (Councillor - Alternate), Steve Manwaring (DCCEEW), Craig Ronan (NSW SES), Michael Borg (NSW SES), Ian Parisotto (Community Representative), Paul Rossetto (Community Representative), Ema Munro (Community Representative), John Kerrigan (Community Representative), Steve Mortlock (Community Representative), Joseph Dal Broi (Community Representative)

General Manager, Scott Grant; Director Utilities, Graham Gordon; Water & Wastewater Manager, Durgananda Chaudhary and Minute Secretary, Joanne Bollen

Quorum = 3

If you are unable to attend this meeting please notify the Minute Secretary prior to commencement of the meeting by email or by telephoning Council on 1300 176 077.

This Committee meeting may be attended remotely and recorded by audio or audio-visual means for administrative purposes. No other recording is permitted.

Acknowledgement of Country

Griffith City Council acknowledges the Wiradjuri people as the traditional owners and custodians of the land and waters, and their deep knowledge embedded within the Aboriginal community.

Council further pays respect to the local Wiradjuri Elders, past, present and those emerging, for whom we acknowledge have responsibilities for the continuation of cultural, spiritual and educational practices of the local Wiradjuri people.

CLAUSE **CL06**

TITLE **Additional Information - Agenda Items Received from Committee Members**

FROM **Joanne Bollen, Governance Officer**

TRIM REF **25/117003**

SUMMARY

Additional information is available for CL04 – Agenda Items Received from Committee Members – Item 1.

RECOMMENDATION

The Committee note the report.

REPORT

The additional information is in reference to CL04 – Agenda Items Received from Committee Members – Item 1.

LINK TO STRATEGIC PLAN

This item links to Council's Strategic Plan item 1.1 Provide clear, accessible, relevant information.

ATTACHMENTS

Griffith City Council Floodplain Management Committee Meeting 9/10/25

Required reading by committee members foreshadowing a Motion (12/6/25)

Upgrade Flood Gates Option as per consultants BMT WBM Griffith Main Drain J and Mirrool Creek Risk Management Study and Plan August 2015 **report pages 51 – 78** Yenda Structural Options and Appendix C Structural Option Concept Designs C-2 EMR Flood Escape Upgrade **pages C-5 to C-7 including Figure C-2** to be emailed to the Floodplain Management Committee and added as an Agenda item before the next FMC meeting on October 9 2025.

Overview

The agenda item focuses on the evaluation and proposed upgrade of flood gates as part of Griffith City Council's floodplain management initiatives. The upgrade intends to enhance Yenda and District resilience to flooding and improve the operational efficiency of flood management systems controlling cross flow of flood water into Mid to Lower Mirrool Creek with minimal disruption to Main Canal Irrigation water supplies, the lifeblood of downstream irrigators.

History

The Pioneers of our irrigation system built the Main Canal across Mirrool Creek and then devised an under-canal siphon to transfer Mirrool Creek Floods at 5%AEP or 1:20 ARI Design Capacity. 2 major floods later 1931 & 1939 they were forced to build flood gates into the banks of the Main Canal bringing Flood Design capacity up to 2% AEP or 1:50 ARI. This system was successful for several major floods 1955, 1956, 1974, 1984 & 1989 the largest to date: as measured at Barren Box Swamp, scouring the base of the 8 drop board gate structures in the southern bank. Consequently, the drop board gates were decommissioned and the north bank 5 gates were replaced with 3 irrigation lay back doors reducing flood design capacity to 5%AEP or 1:20ARI. (3400ML per day)

5th March 2012, approximately 1500 Yenda & District residents witnessed the biggest flood in their lifetimes causing an estimated $90 Million dollars damage to 450 homes, a dozen businesses and 100 farms as a greater than 1% AEP or 1:100 ARI rainfall event inundated the entire Upper Mirrool Creek catchment with falls of daily rainfall exceeding 130mm causing extensive run off after several days of less but still saturating rain. The Decommissioned Flood Gates and failure of the newly constructed Murrumbidgee Irrigation Northern Bank lay-back doors that lifted during the flood preventing Mirrool Creek flood crossflow were a contributing factor to the Yenda inundation as flood water with nowhere to go built and over topped the Northern Branch Canal flooding Yenda and district. Twenty fours later Mirrool Creek flood waters also over topped the Main Canal in several locations.

A 2016 September Rainfall event of 88mm recorded at Binya Post Office, Council and Murrumbidgee Irrigation saw it prudent to excavate the free board off the Southern Main Canal Bank allowing rising floodwater to spill into Mirrool Creek. Consequently, 2018 reinstatement of the decommissioned southern bank flood gates occurred improving flood mitigation from the Main Canal. **To this day, 13 years and 8 months later the re-instatement of the North bank set of 9 flood gates are yet to be installed**. The failed Murrumbidgee irrigation set of 3 lay back doors in the northern bank remain. Please refer to Figure C-2-page C-8 of the attached documents.

2019 to save money Griffith City Council endorsed an interim EMR Emergency Breaching Protocol. Unfortunately, to date there have not been any site preparations, scour protection, budgetary considerations or adjacent stock piling of soil for Main Canal reinstatement following the activation of the EMR Emergency Breaching Protocol remembering that there are thousands of Griffith LGA irrigators depending on a daily continual supply of Irrigation water.

Objectives

- Increase protection against flooding events not only to safeguard Yenda and District but also villages and communities downstream along Mirrool Creek - Widgelli, Yoogali substation and solar farm, south Hanwood properties, Barren Box properties Benerambah and Warrawidgee properties in the event of an uncontrolled breach occurring.
- Modernize flood gate mechanisms to improve reliability and response times during emergencies.
- Comply with updated environmental and engineering standards for floodplain management.
- Improved Safety conditions for excavator drivers and supervisory staff not required if remote controlled flood gates are installed.

Key Considerations

1. Current Flood Gate Conditions

- The existing infrastructure is inadequate and doesn't meet the NSW Floodplain Development Manual standard of 1% AEP.
- The Murrumbidgee irrigation 3 lay back doors failed to remain in an open position pushed up into a closed position by rising Mirrool Creek flood waters.
- Changes to Upper Mirrool Creek landscape including over a dozen flood levees, some flood protection and other flood harvesting have all channelised flood waters, speeding up arrival times at the EMR.
- The recent Murrumbidgee irrigation North Merribee Channel re-alignment has converted a flood storage area into a 5000ML per day floodway speeding up flood waters arriving at the EMR.
- Also increased the volume of flood waters arriving on the Northbank of the Main Canal as the Daltons Runner (2000 ML per day) that once ran into the Main Canal has been connected to the new converted 5000ML per day floodway increasing the potential flow to 7000 ML per day.
- EMR under canal siphon transfer design capacity only 3400 ML per day
- If the Murrumbidgee Irrigation 3 layback doors fail again Council will be forced to breach the Main Canal Banks.
- Operational issues have been identified during recent flood events, highlighting the need for improvements.

2. Proposed Upgrade Mechanisms

- Incorporation of remote-control systems to enhance gate responsiveness.
- Use of corrosion-resistant materials to increase durability.
- Integration of remote monitoring systems to add confidence to real-time decision-making.

3. Budget and Funding

- Estimated cost of upgrades to be presented during the committee meeting.
- Potential sources of funding include state and federal grants, as well as council budget allocation.
- As the EMR Flood Gates re-instatement as recommended by Consultants BMT WBM August 2015 page C-5 has not been completed, funding can be fast tracked to complete the project.

4. Environmental Impact

- Assessment of potential impacts on local waterways and ecosystems during construction and operation.
- Measures to minimize disruption and ensure compliance with environmental regulations.
- As per 2019 installation of 8 flood gates in the south bank disruption to irrigation water supplies were minimal.

5. Community Engagement

- Consultation with residents and businesses potentially affected by the upgrades.
- Public awareness campaigns to inform about the benefits and timelines of the project.

Action Items

- Present technical evaluations and cost-benefit analyses to the committee.
- Discuss funding opportunities and finalize budget proposals.
- Review environmental assessments and ensure regulatory compliance.
- Plan community outreach and consultation efforts.

Next Steps

- Approval of the proposed upgrade mechanisms by the committee.
- Development of a detailed implementation timeline for the project.
- Coordination with stakeholders to ensure smooth execution of the upgrades.

MOTION

"That this Floodplain Management Committee recommend to Griffith City Council the completion of the reinstatement of EMR flood gates Option presented by consultants BMT WBM Griffith Main Drain J and Mirrool Creek Floodplain Risk Management Study Plan August 2015 C.2 EMR Flood Escape Upgrade C.2.1 Description of Works.

- Construction of new flood relief structure at the East Mirrool Regulator as a replacement of the existing structure. The existing five bay and eight bay flood check in the northern and southern bank of the Main Canal is proposed to be replaced with a 9 Bay 2.4 x 1.8 m gated structure (or similar) on each bank.
- Scour protection works at the structure inlets and outlets are provided to protect the receiving channel and downstream floodplain from excessive erosion.
- Channel modification works are required both upstream and downstream of the structure to provide appropriate transition of flow to the existing channel / floodplain of Mirrool Creek.
- Raising of strengthening of the right Northern Branch Canal (completed by MI)

Conclusion

This Motion represents a critical step in enhancing Griffith City Council's floodplain management capabilities. By investing in modern technologies in flood gate design and operation Griffith City Council aims to protect lives, (excavator operators) property, community infrastructure Yoogali substation and solar farm, and Grifith Local Government Area Economy by returning Irrigation supply as quickly as possible and ecosystems while preparing for future challenges posed by flooding events greater than 5% AEP.

Figure 7-8 Main Drain 'J' Railway and Griffith Road Structures March 2012

7.3 Yenda Structural Options

7.3.1 East Mirrool Regulator Works Overview

The objective of upgrade options for the flood relief structures at the EMR is to increase the flow capacity to prevent Mirrool Creek floodwaters bypassing the structure through overtopping of the Northern Branch Canal. There are numerous options available to increase the flow capacity at the EMR such as additional siphons, additional gates, new regulating structures etc. Given the scale of works, the detail of the most appropriate structure will not be determined in the Floodplain Risk Management Study. Appropriate feasibility assessments, including environmental impact assessments, would need to be undertaken to identify the preferred option and progress a preliminary design. A major consideration of any works is the implications for Murrumbidgee Irrigation's water supply operations, both in terms of infrastructure design and long term operations, but also short term construction impacts. Accordingly, the assessment of potential upgrade works within the current study is limited to identifying an appropriate design capacity and assessing potential impacts of changes in design flood behaviour.

The 2014 Flood Study determined the design flows approaching the EMR as summarised in Table 7-2. With consideration of the existing capacity of the EMR flood relief structures, the following is noted:

- The current status of the EMR flood relief structures with the flood gates decommissioned and only the siphons functioning provides for approximately a 5% AEP design capacity.
- Reinstatement of the decommissioned flood gates provides for a total design capacity of the order of a 2% AEP design event.
- Design 1% AEP event flows are ~1.5 times the 2% AEP flows such that a similar scale up of the EMR flood relief structures would be required to provide 1% AEP capacity.
- The estimated March 2012 event flow approaching the EMR is representative of the 0.5% AEP design flood condition.

Table 7-2 Adopted Design Peak Flood Flows for Mirrool Creek at the Main Canal

Design Event Magnitude	Peak Flow U/S of Main Canal
5% AEP	20m^3/s (~1,700 ML/day)
2% AEP	100m^3/s (~8,600 ML/day)
1% AEP	160m^3/s (~14,000 ML/day)
0.5% AEP	220m^3/s (~19,000 ML/day)
0.2% AEP	290m^3/s (~25,000 ML/day)

Given the elevated embankment of the Main Canal, there is considerable attenuation of the Mirrool Creek approach flows as floodwaters back up behind the embankment. Figure 7-9 shows the simulated hydrographs for the March 2012 event including the approach flow to the EMR, the representative outflow at the EMR, and the flow further downstream at McNamara Road. The peak approach flow to the EMR is of the order of 220m^3/s with some 140m^3/s discharged downstream of the EMR.

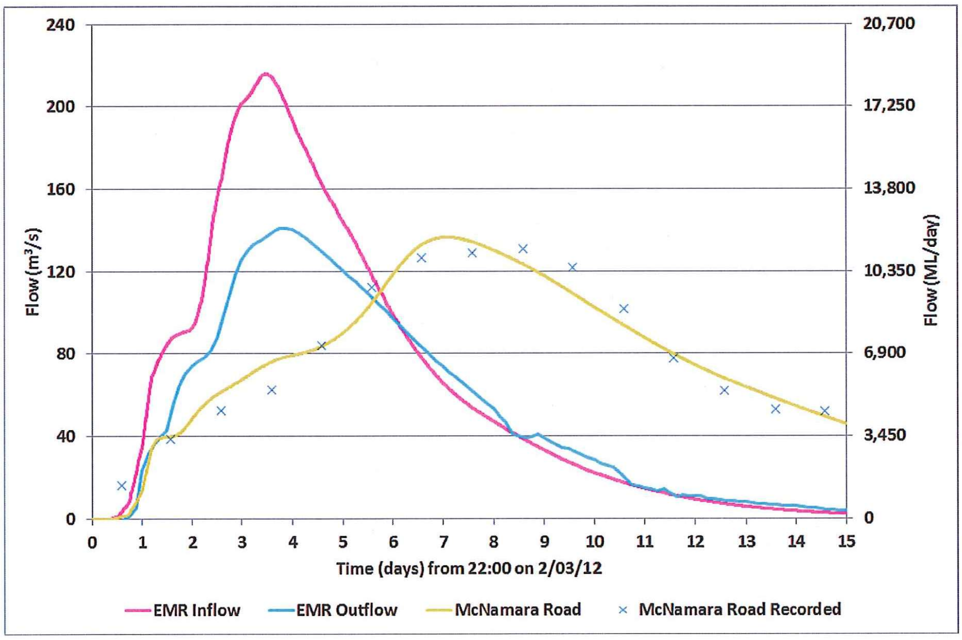


Figure 7-9 March 2012 Modelled Flow Hydrographs for Mirrool Creek

The report entitled *"MIA – Land and Water Management Plan: Hydrology of Mirrool Creek and Works Options on Floodway Lands"* (Dept. Water Resources, 1994) identified a number of potential options for upgrading of the EMR in order to better convey flood discharges from the Mirrool Creek. The options were summarised as:

1) **Retain Existing Regulator –** passes Mirrool Creek flows by means of subway and a five bay and eight bay flood check in the northern and southern bank of the Main Canal respectively.

2) **Option 2A –** retains the existing subway and eight bay flood check in the southern bank. The flood check in the northern bank is extended from five to eight bays.
3) **Option 4A –** passes Mirrool Creek flows by way of a natural waterway opening through the Main Canal. The Main Canal flows are siphoned under the Main Canal for a 48m width.
4) **Option 4A Amended –** As for Option 4A except the width of the natural opening increased by approximately 20m. The Main Canal flows by means of a 68m siphon.

The option to "Retain Existing Regulator" is equivalent to reinstatement of the currently decommissioned flood gates (i.e. eight bay southern bank check structure) as discussed above. "Option 2A" provides for an upgrade of the existing northern bank structure. The northern bank structure is the key limiting control for passing Mirrool Creek flood flows being of lesser width/flow capacity in comparison to the southern bank structure. Whilst some increase in overall design capacity would be achieved, the upgraded capacity would again be limited by current capacity of the southern bank structure.

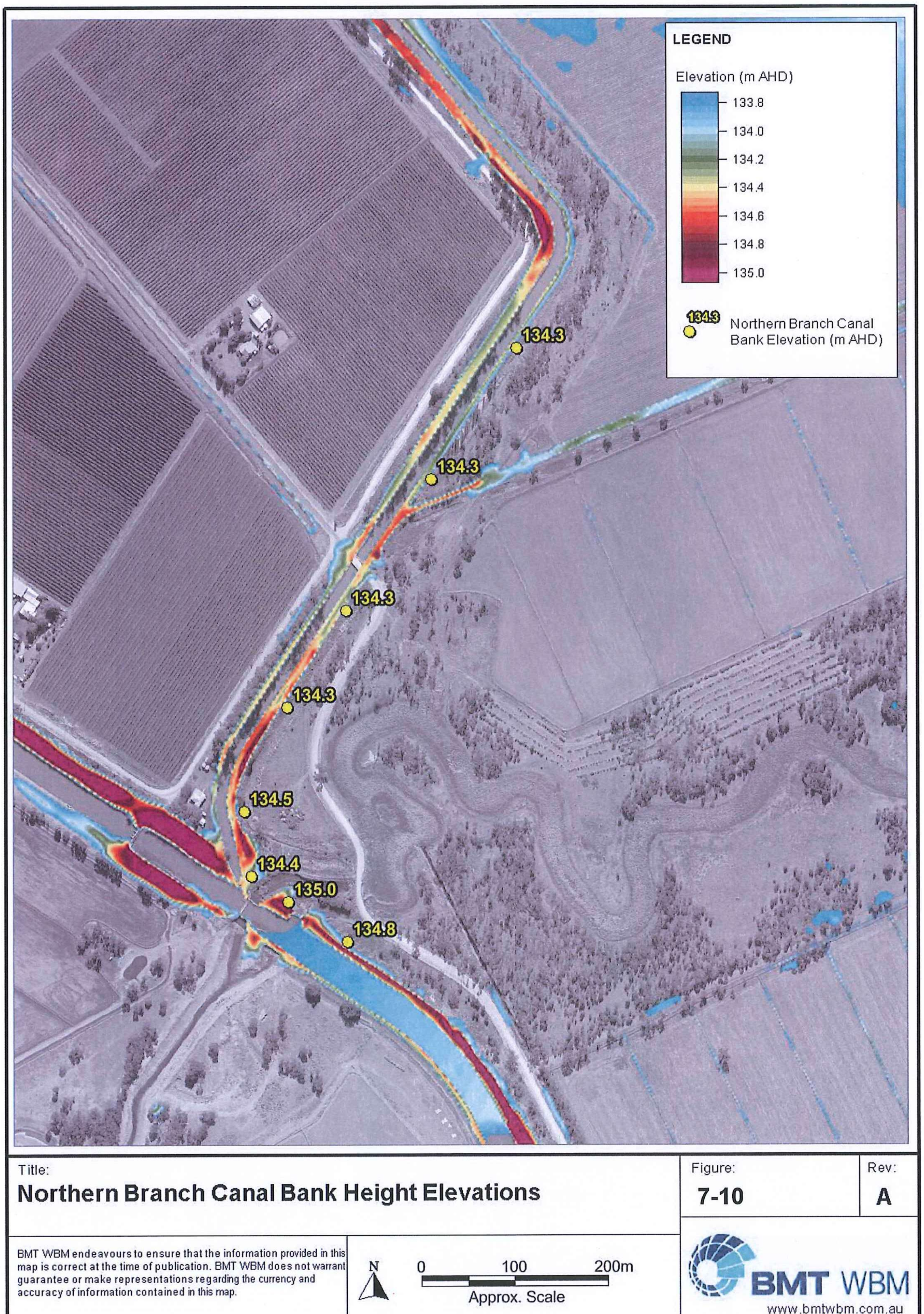
Both "Option 4A" and "Option 4A Amended" provide for a removal of the Main Canal embankments across a nominal width of the Mirrool Creek floodplain with the Main Canal flows siphoned beneath the natural floodplain section. This is similar to the "Lawson Siphon" arrangement for the Mulwala Canal across the Edward River floodplain at Deniliquin. The "Option 4A Amended" provided the greater waterway area for the passage of floods and was considered the most appropriate option moving forward.

Overtopping of the flood gates on the right bank of the Main Canal was noted as occurring at a water level of 134.9m AHD which was estimated to correspond to an estimated inflow of 140m^3/s. The nominal 68m siphon width provided for a design 1% AEP discharge (EMR outflow) of some 200m^3/s thereby providing a significant increase in design capacity. The increase in peak flows for the Option 4A Amended configuration from existing conditions was found to result in only minor increases in peak flood level of the order of 0.1m for downstream reference points including the Whitton Stock Route, Darlington Point Road and McNamara's Bridge.

7.3.2 Northern Branch Canal Bank Raising

The design capacity of the EMR upgrade options is linked to the maximum upstream water level able to be developed before overtopping of the Main Canal right bank. As noted, the Dept. Water Resources (1994) identified this critical headwater level to be 134.9m AHD. However, in undertaking the 2014 Flood Study and reviewing available detailed topographical data, flood flows towards Yenda are initiated at a level of only 134.3m AHD. This level represents the low points along the Northern Branch Canal at which overtopping are initiated. Figure 7-10 shows a detail of the elevations along the NBC with numerous low points identified. It can be seen that the NBC levels are generally below the Main Canal right bank levels at the EMR flood gates.

In investigating options for possible upgrades to the EMR flood relief structures, limiting the flow across the NBC and through to Yenda is a key objective. These flows are initiated as water levels increase upstream of the EMR, eventually overtopping the crest levels of the NBC. These threshold water levels that initiate overtopping of the NBC are an important design factor in assessing EMR upgrade options. It is these levels effectively provide a limit to the allowable head levels able to be built at the EMR flood relief structures, and accordingly define the structure capacity limits.



Title: **Northern Branch Canal Bank Height Elevations**

Figure: **7-10**

Rev: **A**

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant guarantee or make representations regarding the currency and accuracy of information contained in this map.

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The EMR upgrade options in the Dept. Water Resources (1994) assessment are therefore expected to have a lower design capacity. The nominal 68m siphon width for Option 4A Amendment would need to be increased in order to provide a similar design flow capacity at the lower maximum upstream water level threshold of 134.3m AHD.

Given the flows through Yenda are largely via overtopping of the NBC, and this level of overtopping provides a limit on the effective discharge capacity to the EMR flood relief structures, raising and strengthening of the bank levels is considered an integral component of any Yenda works option, including EMR upgrades.

Similar to the Yoogali embankment works considered in Section 7.2, the NBC works largely also represent localised bank raising to remove the relative low points alignment the existing top of bank alignment. The nominal minimum design level of 134.8m AHD is proposed which corresponds to the existing bank levels of the Main Canal at the EMR Flood Escape. As noted, the existing low points along the NBC are around 134.3m AHD such that an increase in bank height of 0.5m would be required at these lowest points. Typically lower depths of fill are required more broadly along the NBC alignment to provide the proposed design level.

Upgrades to the EMR flood relief structures discussed in the following sections have adopted a design 1% AEP peak flood level of 134.3m AHD. Accordingly, provision of a contiguous NBC bank elevation of 134.8m AHD would provide for an additional 0.5m freeboard above the design flood level.

7.3.3 Reinstatement of Decommissioned EMR Flood Escape

The significant flood impact at Yenda experienced in the March 2012 event drew much attention to performance of the EMR flood escape. Following flooding of Yenda in June 1931 a set of flood gates were installed that allow flow to be released from the Main Canal to Mirrool Creek on the downstream side of the canal. With the exception of March 2012, during flood events since 1931 the escape doors and flood gates have been opened to allow flood waters from Mirrool Creek to flow through the Main Canal to the downstream floodplain. This was the case for the March 1939 event and March 1989 event which were both significant events on the Mirrool Creek system. Whilst major flooding of Yenda was avoided in 1939 and 1989, the structure was close to capacity with original gates operational.

The left bank flood gates (southern bank check structure) were decommissioned in the early 1990s and were unable to be operated during the March 2012 event. Figure 7-11 shows a photograph of the decommissioned gates with bulk spoil placed in from of the gates The March 2012 event was the first event since the flood gate installation in which the design capacity has been exceeded. Given the magnitude of the flows approaching the EMR for the March 2012, the capacity of the EMR would have been well exceeded even with full design operational capacity of both the siphon and flood gates.

The observed flood conditions for Mirrool Creek for the March 2012 event are estimated to be in excess of the 1% AEP (1 in 100-year) design conditions. The flood risk to Yenda from Mirrool Creek floodwaters emanates as the EMR capacity is exceeded, resulting in flow from the Mirrool Creek floodplain spilling over the Northern Branch Canal and progressing to Yenda. With both existing siphon and flood gates fully operational, this flow capacity may be expected to be exceeded for events in excess of the 2% AEP (1 in 50-year probability event). The current decommissioned status of the EMR flood gates structures significantly reduces the capacity to transfer Mirrool Creek flood flows across the Canal to the order of a 5% AEP (1 in 50-year probability) design standard. Accordingly, substantial flood mitigation measures may be required to provide increased flood immunity to the Yenda township.

Figure 7-11 March 2012 Photograph of Decommissioned EMR Flood Escape

A 5% AEP flood protection standard is not considered appropriate for Yenda, with some 500 properties at potential risk. Further, as experienced in March 2012, such widespread inundation across the township provided significant hardships in the flood recovery.

The reinstatement of the decommissioned flood gates is considered as a standalone option as an interim measure. Whilst the reinstatement would provide additional discharge capacity to convey Mirrool Creek floodwaters, the combined siphon and reinstated flood gate capacity still only provides a 2% AEP design flood capacity. The generally accepted standard of protection considered for residential property is typically the 1% AEP design event. Accordingly, reinstatement of the flood gates in the current configuration is considered as an interim measure, with further options for augmentation considered separately.

The reinstatement of the existing structure may not be straight forward. Although recommended as an interim measure, there is some key constraints that require further consideration as part of the works assessment. These include:

- Structural integrity - this refers to both the existing structure and also the bed/banks of the Main Canal. Given the age of the structure, a full condition assessment (structural and geotechnical) would be required to inform the opportunity for reinstatement and the economic viability of an existing structure refurbishment in comparison to a replacement structure.

- Gate arrangements – refurbishment requires work on both flood escape structures, including gate modifications to provide the function of transferring Mirrool Creek floodwaters across the Canal and not close under headwater pressure from the upstream side.
- Siphon operation – part of the function of the existing northern bank structure is to provide maintenance flows to scour the siphons and remove siltation that may impact on siphon capacity. This function will need to be retained in any flood gate refurbishment.

7.3.4 EMR Flood Gate Upgrade

It is not the intention of the current study to determine the preferred configuration for providing the recommended capacity upgrades to the EMR flood relief structures. The solution involves major engineering design with potentially a number of design solutions. For example, this may incorporate a major upgrade to the existing structure through expansion of current flood gates, or alternative solutions such as siphoning Main Canal flows underneath the Mirrool Creek floodplain (similar to the Lawson Siphon at Deniliquin).

Various upgrade options to the existing flood relief structures were simulated using the existing flood models. Iterations were undertaking gradually increasing design capacity of the flood relief structures.

Some key indicators were identified to assess the relative performance of the upgrades options:

- Peak discharge through the EMR flood relief structures – this considered the combined discharge of the siphons and existing or upgraded gate structures.
- Peak water level U/S of the EMR flood relief structures – a critical level of approximately ~134.3m AHD has been identified as the initiation of significant overtopping of the NBC.
- Peak flow through Yenda – this is obviously the key indicator of effective performance of the management option
- Yenda flood depth – a reference location in Leaver Street, Yenda, was selected representing a location potentially subject to significant inundation.
- Myall Park flows – these represent combined flows moving through to Myall Park via Yenda and North Yenda.

The relative performance of a combination of upgrades to the EMR flood relief structures and a NBC levee is summarised in Table 7-3. The options represent:

a) Reinstatement of the decommissioned flood gates - this option provides for no major augmentation but a return to full function of the existing configuration.

b) Upgrade of the flood gates – this option provides for an approximate duplication of the capacity of the existing flood gates.

c) Reinstatement of the decommissioned flood gates plus construction of a NBC levee.

d) Upgrade of the flood gate plus construction of a NBC levee – as per above in provision of approximate duplication of existing flood gate capacity.

Results are provided in Table 7-3 for the 1% AEP and 0.5% AEP design flood events. Whilst the 1% AEP event would typically be considered an appropriate design flood standard for flood mitigation options, the 0.5% AEP is more representative of the conditions experienced in the March 2012 flood event.

Table 7-3 Peak Flow and Water Level for Yenda Mitigation Works

Reference Location	Reinstate Flood Gates	Upgrade Flood Gates	Reinstate Gates & Levee	Upgrade Gates & Levee
1% AEP Event				
Flow through EMR Flood Structures (m^3/s)	84	114	92	114
Peak Level U/S Flood Structure (m AHD)	134.43	134.32	134.51	134.32
Flow through Yenda (m^3/s)	32	7	0	0
Leaver Street Yenda Flood Depth (m)	0.6	0.5	0.1	0
Myall Park Flow (m^3/s)	30	26	58	38
0.5% AEP Event				
Flow through EMR Flood Structures (m^3/s)	92	132	99	135
Peak Level U/S Flood Structure (m AHD)	134.49	134.43	134.64	134.45
Flow through Yenda (m^3/s)	60	24	1	1
Leaver Street Yenda Flood Depth (m)	0.7	0.6	0.3	0.1
Myall Park Flow (m^3/s)	44	41	103	74

Ultimately the key indicator of performance of each option is in the reduction in flooding in Yenda as represented by the “Flow through Yenda” and “Leaver Street flood depth” in the above table.

Although increasing the flood protection to Yenda, the reinstatement of the flood gates does not provide sufficient capacity to manage events of the order of the 1% AEP. Significant discharges of the order of $30m^3/s$ and $60m^3/s$ for the 1% AEP and 0.5% AEP events respectively would spill through to Yenda providing for significant inundation in the township, similar to conditions experienced in March 2012.

In conjunction with a NBC levee, reinstatement of the flood gates would provide suitable flood protection to Yenda. However, this protection is at the detriment to North Yenda properties in that the flow exceeding the EMR flood gate capacity is pushed north around the levee to North Yenda and through to Myall Park as indicated by the increased flows in the table.

The upgraded flood gate option (approximate duplication in flow capacity at the EMR flood relief structures) provides for almost a 1% AEP discharge capacity with a reduced flow through Yenda as shown in Table 7-3. The peak water level U/S of the EMR structure is just over the critical threshold value of 134.3m AHD. Under the greater flood magnitude of the 0.5% AEP event, this capacity would be insufficient to protect Yenda form significant inundation. A further increase in structure capacity of $20\text{-}30m^3/s$ however would appear sufficient to provide the higher flood immunity.

The combination of the flood gate upgrades and NBC levee effectively provide a 0.5% AEP flood immunity standard to Yenda. There is some increase flows through North Yenda to Myall Park as the levee pushes to the north the flow that would have previously inundated Yenda township.

7.3.5 EMR "Lawson Siphon" Type Structure

The Floodplain Risk Management Study has identified a required flood relief structure capacity of the order 120m^3/s to provide a 1% AEP design flood standard. This represents approximately a 50% increase in the current capacity of the combined siphon/flood gate arrangement if fully operable. This arrangement however would not provide full protection to Yenda for a similar to the March 2012 event conditions. This event has been estimated as representative of a 0.5% AEP event. Accordingly, an upgraded flow capacity of the order of 140 - 150m^3/s would be required to provide an equivalent flood standard protection to Yenda.

A siphon type structure was previously identified in the Dept. Water Resources (1994) options study. This study presented options for siphon widths of 48m and 68m providing for nominal flow capacities of approximately 140m^3/s and 200m^3/s respectively. However, in determining these arrangements a maximum allowable water level at the structure was assumed to be 134.9m AHD. As noted in Section 7.3.2, the current maximum water level prior to overtopping the NBC is only is approximately 134.3m AHD. Accordingly, to provide for a similar flow capacity at a lower operating water level, significantly larger siphon widths than the Dept. Water Resources (1994) options would be required.

Similar targets to the flood gate upgrade option are adopted in defining a design flow capacity for the siphon type structure. With consideration of the minimum level of the NBC embankment elevated to 134.8m AHD, the target design capacity provides for:

- 1% AEP discharge of 120m^3/s at operating water level of 134.3m AHD (0.5m freeboard to NBC overtopping); and
- 0.5% AEP discharge of 140m^3/s at operating water level of 134.5m AHD (0.3m freeboard to NBC overtopping)

The width of the siphon structure required to provide the nominal design discharge capacity is somewhat dependent on the channel and floodplain topography through the structure opening. Depending on design constraints, particularly in relation to integrating a siphon arrangement with the existing major regulating structures of the Main Canal and NBC offtake, the alignment of the floodway opening may not coincide with the location of the Mirrool Creek main channel. With general floodplain levels typically higher than the normal channel geometry, the flow capacity of the floodway opening section can vary considerably depending on location.

It is envisaged that a siphon type arrangement may require some realignment of the main Mirrool Creek channel section. The extent of Creek realignment and excavation works may be limited by environmental constraints. Accordingly, in determining a nominal width of floodway opening, consideration has been given to the potential variability of the design floodway section through the opening.

Figure 7-12 presents stage-discharge relationship for two siphon floodway arrangements, one with a nominal floodway opening of 100m width at existing floodplain levels (no Creek excavation), and a 70m width incorporating a realigned Mirrool Creek channel (excavated channel) of some 20m. The excavated Creek channel provides for some additional flow conveyance compared to the higher typical floodplain levels. Shown for reference is the indicative design window with the targeted 1% AEP and 0.5% AEP peak design flows and upstream water levels.

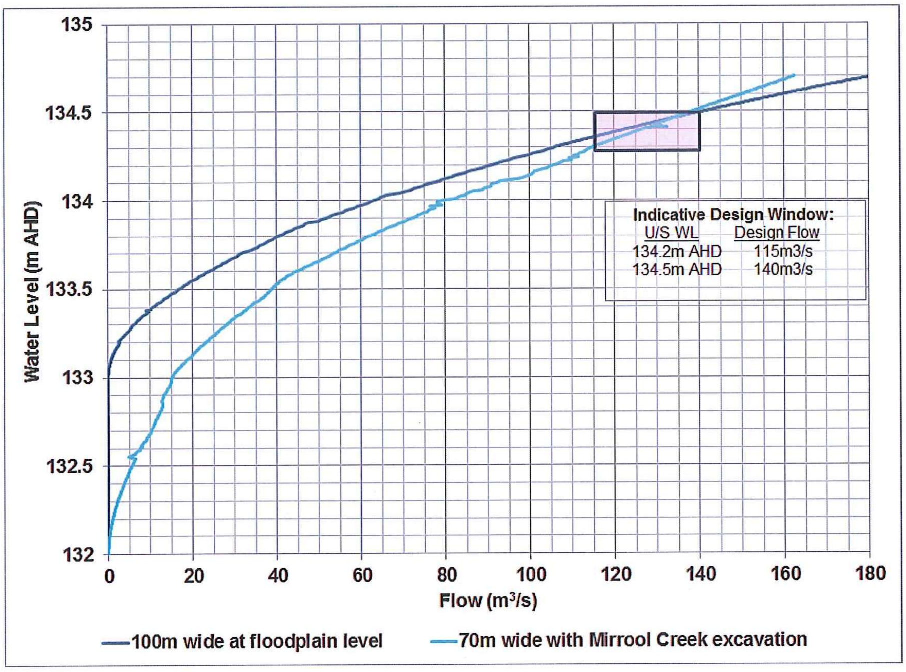


Figure 7-12 "Lawson Siphon" Type Structure Design Stage-Discharge

Concept design details for a gate upgrade arrangement and an alternative "Lawson Siphon" type arrangement are presented in Appendix C. To provide the nominal 1% AEP design protection to Yenda, the gate upgrade option provides for a structure consisting of 9 bays of 2.4m x 1.8m gate openings. The corresponding design for the siphon type structure provides for a floodplain opening of some 70-100m. Any additional capacity provided at the structures would increase the design flood immunity for the Yenda and North Yenda localities.

Murrumbidgee Irrigation is one of the major stakeholders in any future upgrade works. MI's ongoing operations represent one of the major constraints within design of upgrade options with consideration of:

- Integrating works within the existing operational supply system;
- Maintenance and operational responsibilities; and
- Construction phase impacts and potential disruption to MI business and impacts to customers.

Accordingly, in the context of the Floodplain Risk Management Plan, the recommendation is to progress concept design for the upgrade of the EMR flood relief structures. It is envisaged this works would identify a preferred option (e.g. gate upgrade configuration or Lawson Siphon type arrangement), undertake a review of environmental factors, confirm planning and approvals process and progress the preliminary design.

7.3.6 Impacts of EMR Works

Whilst the EMR upgrade options specifically aim to reduce the flood impact on the Yenda community, the changes in flow distribution through increasing discharge through the EMR flood relief structures and the NBC levee directing flow to the north, provide some changes in peak flood levels throughout the system.

Figure 7-13 to Figure 7-24 show the change in peak flood levels for three representative mitigation options; 1) upgrade of the flood gates (approximate duplication of existing capacity); 2) NBC levee; and 3) combined upgrade of flood gates with levee. Note that when referencing "upgrade of the flood gates", this condition is also representative of the siphon type structure which has been designed for the same flow capacity. Accordingly, the potential impacts of the different options are effectively the same.

The plots show the relative change in peak flood levels compared with conditions assuming only the reinstatement of the decommissioned flood gates. This has been used as the base case as represents the scenario upon which previous floodway definition and land use management have been based. It is noted it doesn't represent existing conditions given the decommissioned status of the flood gates, however, the reinstatement of the gates has been recommended as an interim measure. For each of the three upgrade options, the change in peak flood level for the 1% AEP and 0.5% AEP is presented for both the Yenda township locality and the broader Mirrool Creek floodplain. A summary of the key observations from the figures is provided below.

EMR Flood Relief Structure Upgrade 1% AEP Impact (Figure 7-13 and Figure 7-14)

- Option provides for limited reduction in flood inundation in Yenda. Whilst there are flood level reductions of the order of 0.1-0.2m, the majority of the township remains inundated.
- Areas in North Yenda and Myall Park show modest peak flood level reductions (0.1–0.2m).The larger capacity of upgraded EMR flood relief structures conveys greater flow down the Mirrool Creek with less flow spilling through Yenda and North Yenda in Myall Park.
- The higher flows discharged into Mirrool Creek provide for general increases in peak level of around 0.1-0.2m throughout the floodplain downstream of the Main Canal. A smaller percentage of floodplain area show flood level increases of 0.1-0.2m
- Downstream of the confluence with Main Drain 'J', the impacts of increased Mirrool Creek discharges are less significant.

EMR Flood Relief Structure Upgrade 0.5% AEP Impact (Figure 7-15 and Figure 7-16)

- Option provides for reduction in flood depths in Yenda with levels reduced by around 0.2m in general. However, the township is still subject to significant inundation at this flood magnitude.
- Areas in North Yenda and Myall Park again show modest peak flood level reductions (0.1–0.2m, although the benefit is not as extensive as for the 1% AEP event.
- The higher flows discharged into Mirrool Creek provide for general increases in peak level of around 0.05-0.1m throughout the floodplain downstream of the Main Canal. A smaller percentage of floodplain area show flood level increases of 0.1-0.2m.
- Impacts for areas downstream of the confluence with Main Drain 'J' remain less significant.

Northern Branch Canal Levee 1% AEP Impact (Figure 7-17 and Figure 7-18)

- Option provides for effective reduction in flood inundation in Yenda. Areas of previous flooding with depths of the order of 0.5-0.6m within the Yenda township now free from flooding. However, in the western corner of the town bounded by the Main Canal and the railway, some inundation is still evident. This inundation results from floodwater spilling over the railway embankment due to the higher flows forced around the levee through North Yenda, without any additional capacity provided at the EMR.
- Areas in North Yenda show peak flood level increases generally around 0.2m as flow is redirected by the levee alignment over the railway line in the vicinity of the Whitton Stock Route.
- With no additional capacity provide at the EMR flood relief structures, there is no significant impacts for the Mirrool Creek floodplain downstream of the Main Canal.

Northern Branch Canal Levee 0.5% AEP Impact (Figure 7-19 and Figure 7-20)

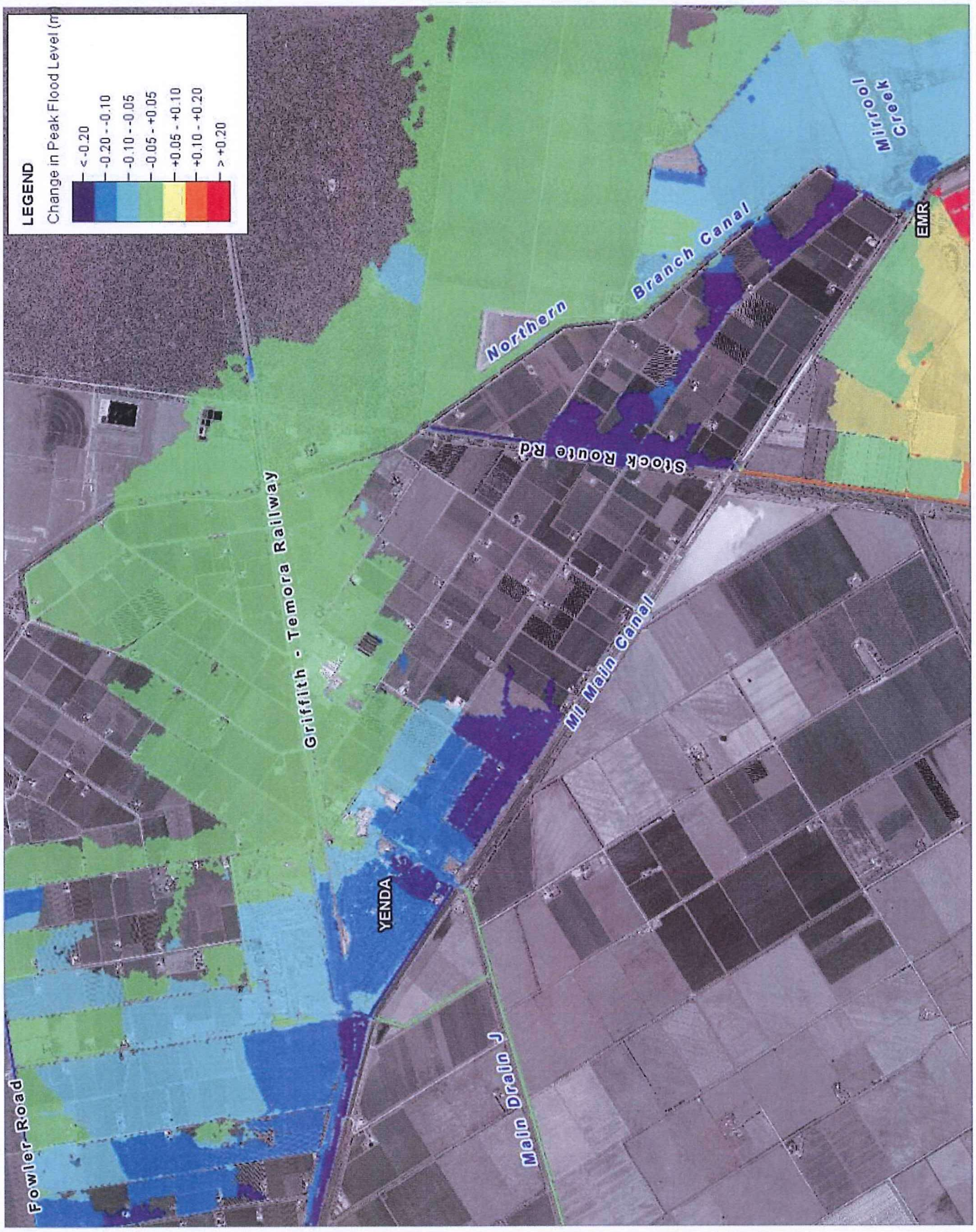
- Similar impacts as for the Option under the 1% AEP design flood condition. There is an increase in inundated are within Yenda from floodwater spilling over the railway embankment.
- The extent and magnitude of water level increases for areas upstream of the NBC and North Yenda are more significant. Peak flood level increases across broader areas in North Yenda are of the order of 0.2m.
- With no additional capacity provide at the EMR flood relief structures, there are no significant impacts for the Mirrool Creek floodplain downstream of the Main Canal.

EMR Flood Relief Structure Upgrade and NBC Levee 1% AEP Impact (Figure 7-21 and Figure 7-22)

- Option provides for effective reduction in flood inundation in Yenda. Areas of previous flooding with depths of the order of 0.5-0.6m within the Yenda township now free from flooding.
- Areas in North Yenda and Myall Park show modest peak flood level reductions (0.1–0.2m).The larger capacity of upgraded EMR flood relief structures conveys greater flow down the Mirrool Creek with less flow spilling through Yenda and North Yenda in Myall Park.
- The higher flows discharged into Mirrool Creek provide for general increases in peak level of around 0.1-0.2m throughout the floodplain downstream of the Main Canal. A smaller percentage of floodplain area show flood level increases of 0.1-0.2m
- Downstream of the confluence with Main Drain 'J', the impacts of increased Mirrool Creek discharges are less significant.

EMR Flood Relief Structure Upgrade and NBC Levee 0.5% AEP Impact (Figure 7-23 and Figure 7-24)

- Option provides for reduction in flood depths in Yenda with levels reduced by around 0.2m in general. However, the township is still subject to significant inundation at this flood magnitude.
- Areas in North Yenda and Myall Park again show modest peak flood level reductions (0.1–0.2m, although the benefit is not as extensive as for the 1% AEP event.



Title:
Yenda Mitigation Options - Change in Peak Flood Level 1% AEP Event EMR Structure Upgrade

Figure: **7-13**

Rev: **A**

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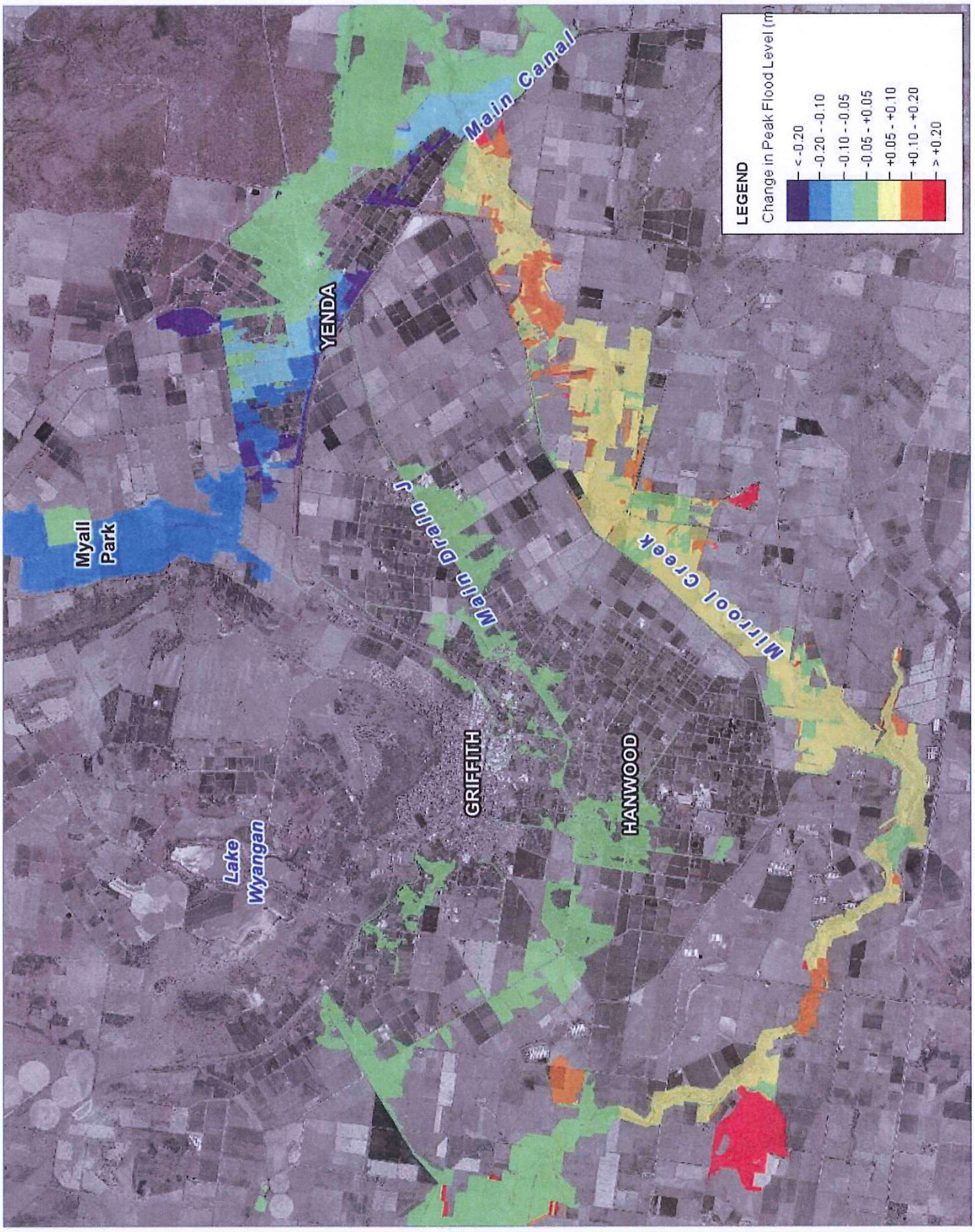

Title:
Yenda Mitigation Options - Change in Peak Flood Level 1% AEP Event EMR Structure Upgrade

Figure: 7-14

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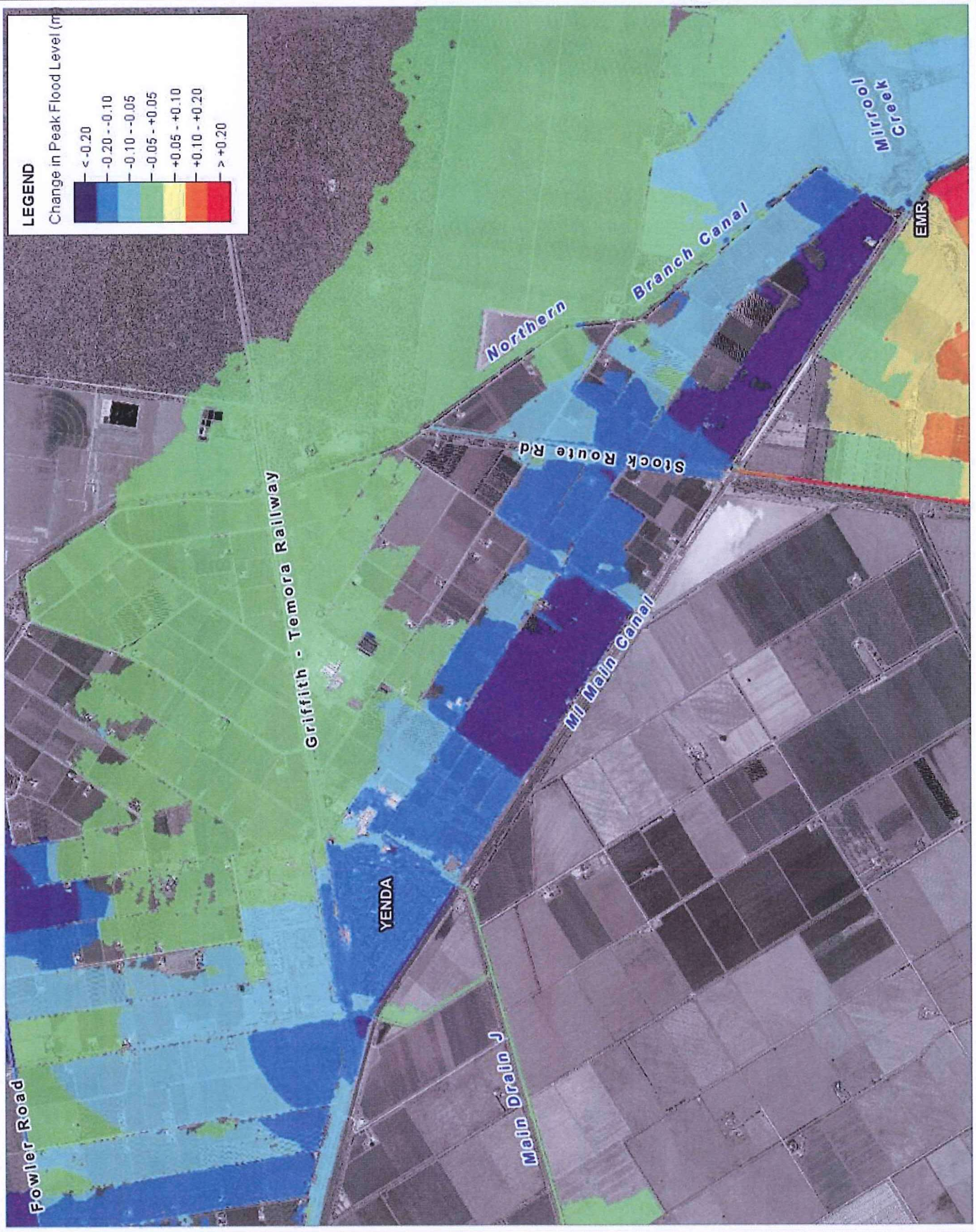

Title:
Yenda Mitigation Options - Change in Peak Flood Level
0.5% AEP Event EMR Structure Upgrade

Figure: 7-15

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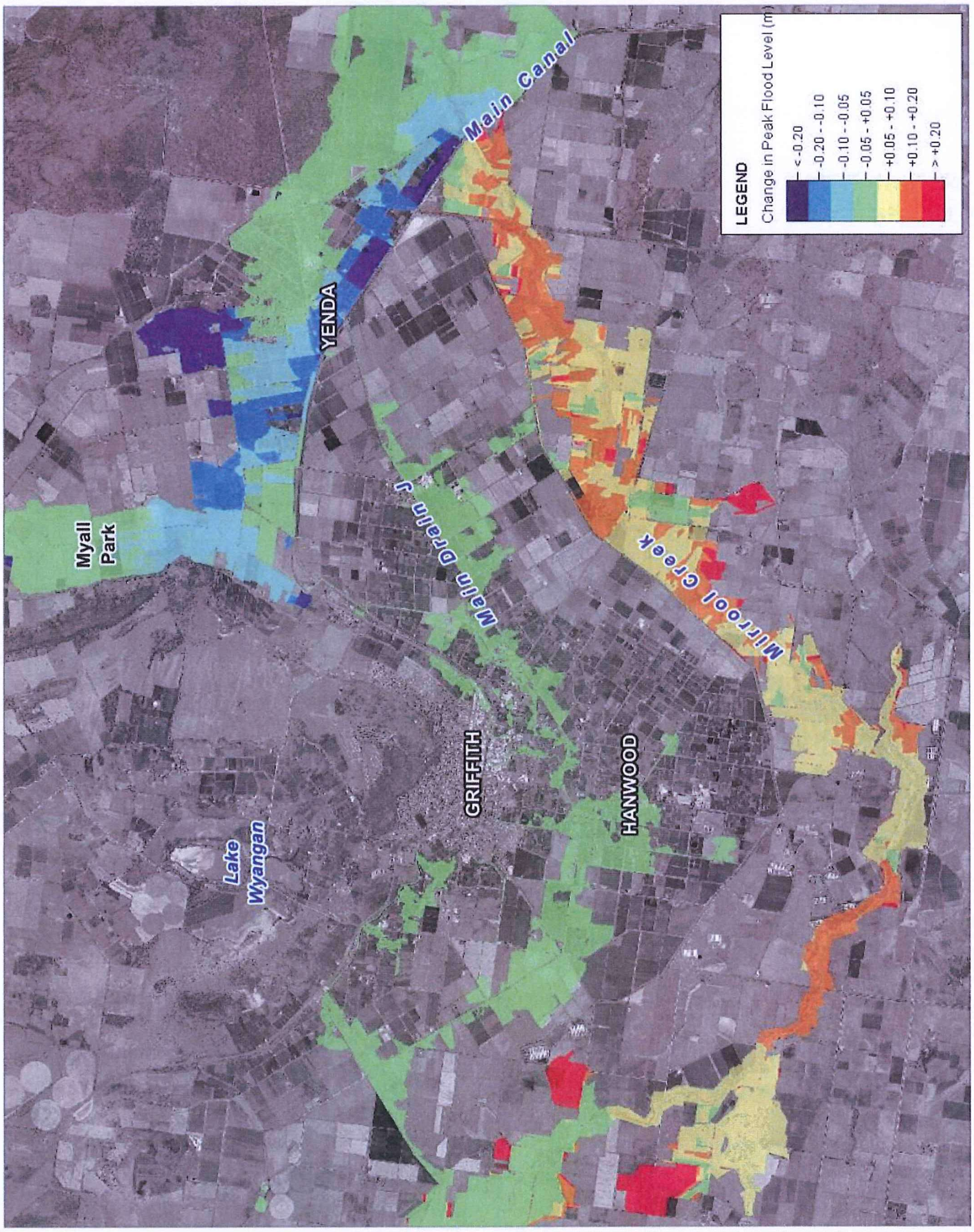

Title:
Yenda Mitigation Options - Change in Peak Flood Level 0.5% AEP Event EMR Structure Upgrade

Figure: 7-16

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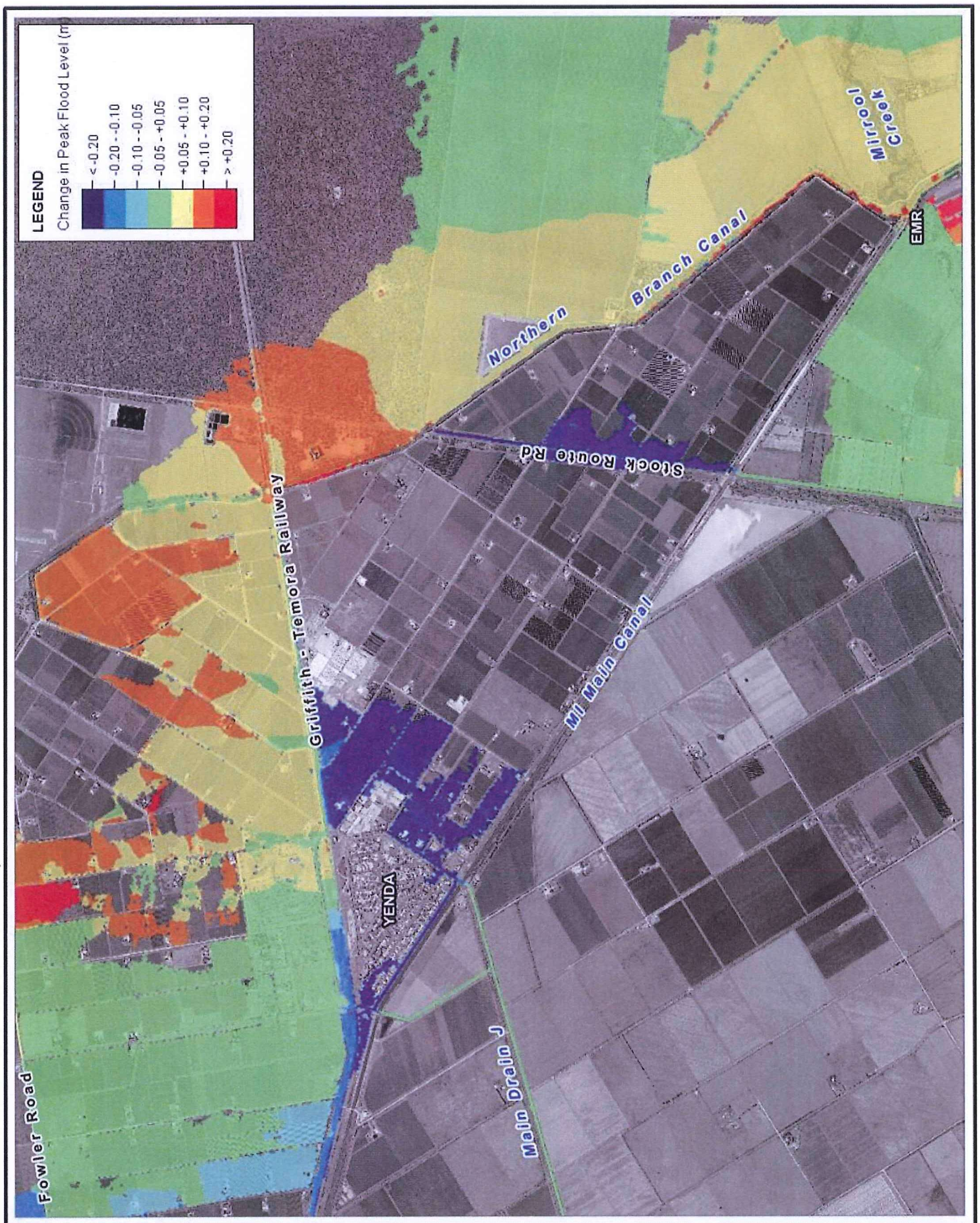

Title:
Yenda Mitigation Options - Change in Peak Flood Level 1% AEP Event Northern Branch Canal Levee

Figure: 7-17

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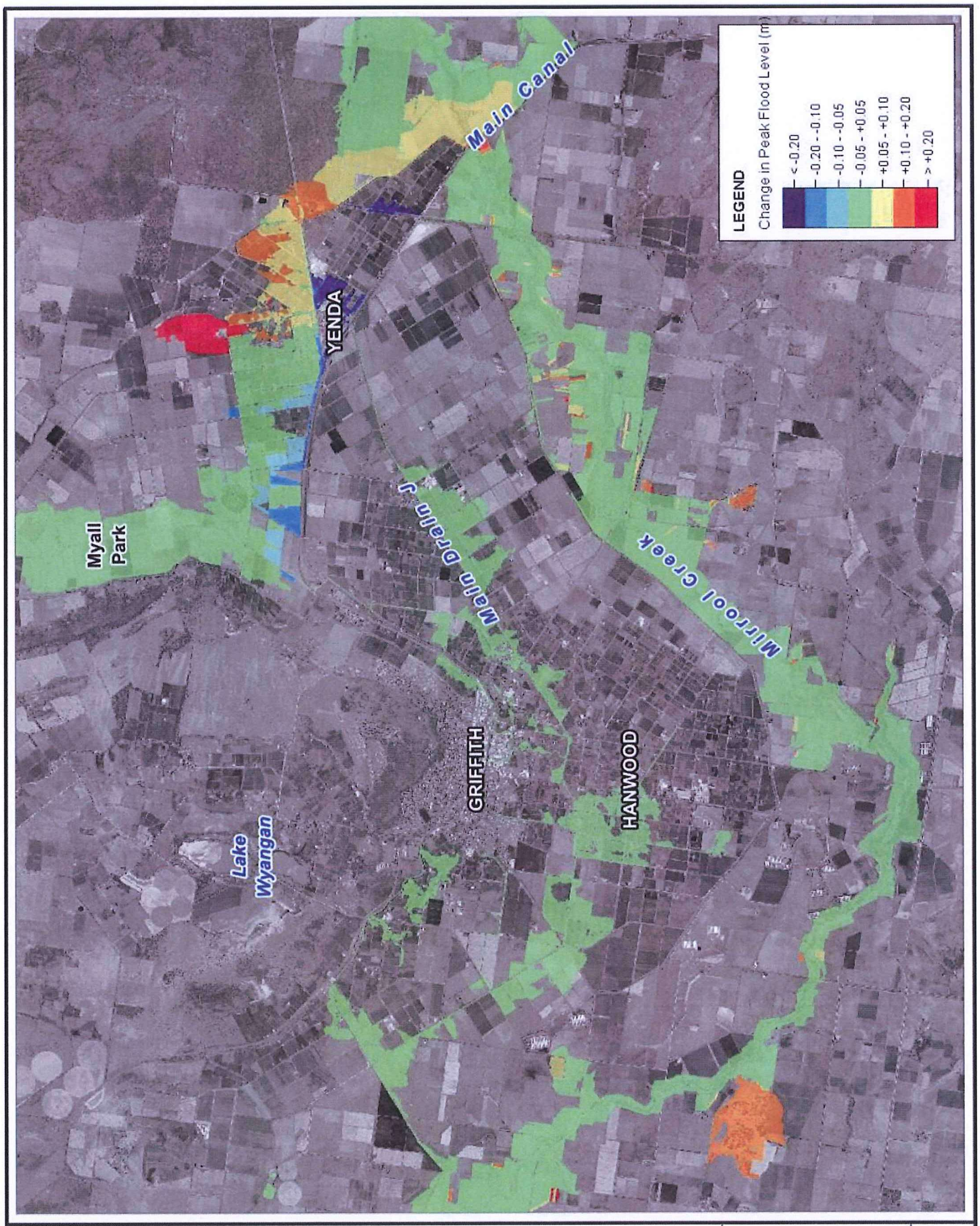

Title:
Yenda Mitigation Options - Change in Peak Flood Level 1% AEP Event Northern Branch Canal Levee

Figure: 7-18

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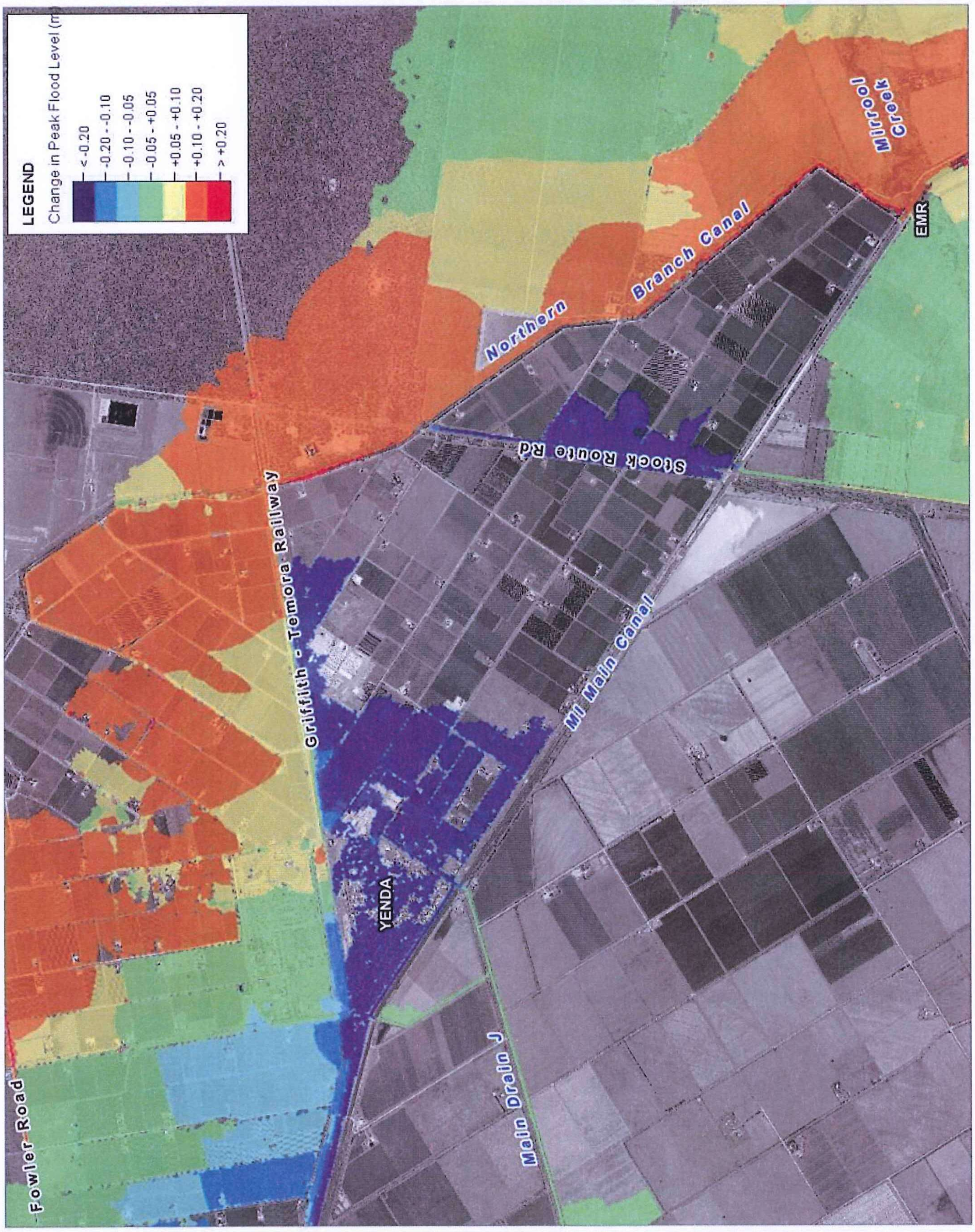

Title:
Yenda Mitigation Options - Change in Peak Flood Level 0.5% AEP Event Northern Branch Canal Levee

Figure: **7-19**

Rev: **A**

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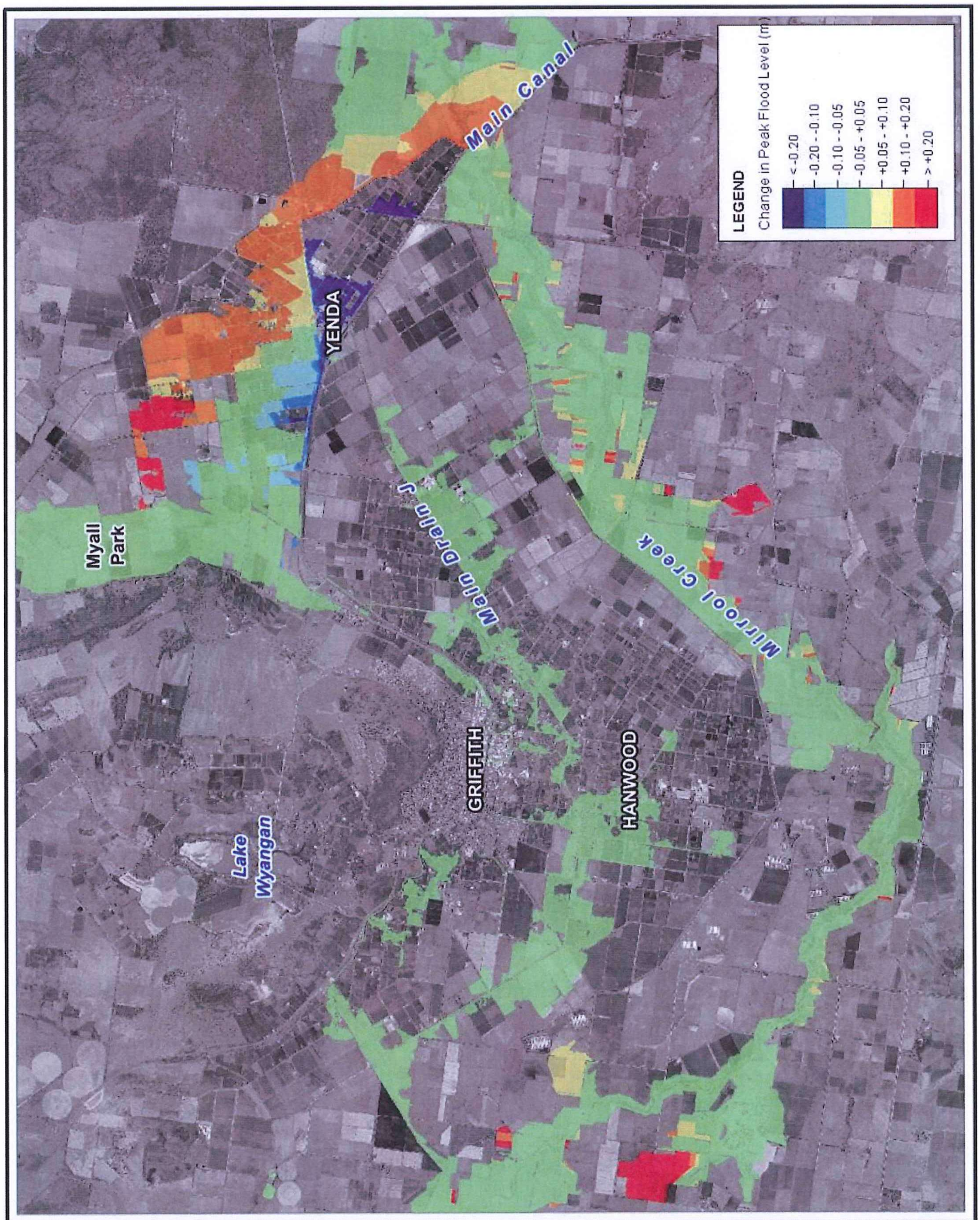

Title:
Yenda Mitigation Options - Change in Peak Flood Level 0.5% AEP Event Northern Branch Canal Levee

Figure: 7-20

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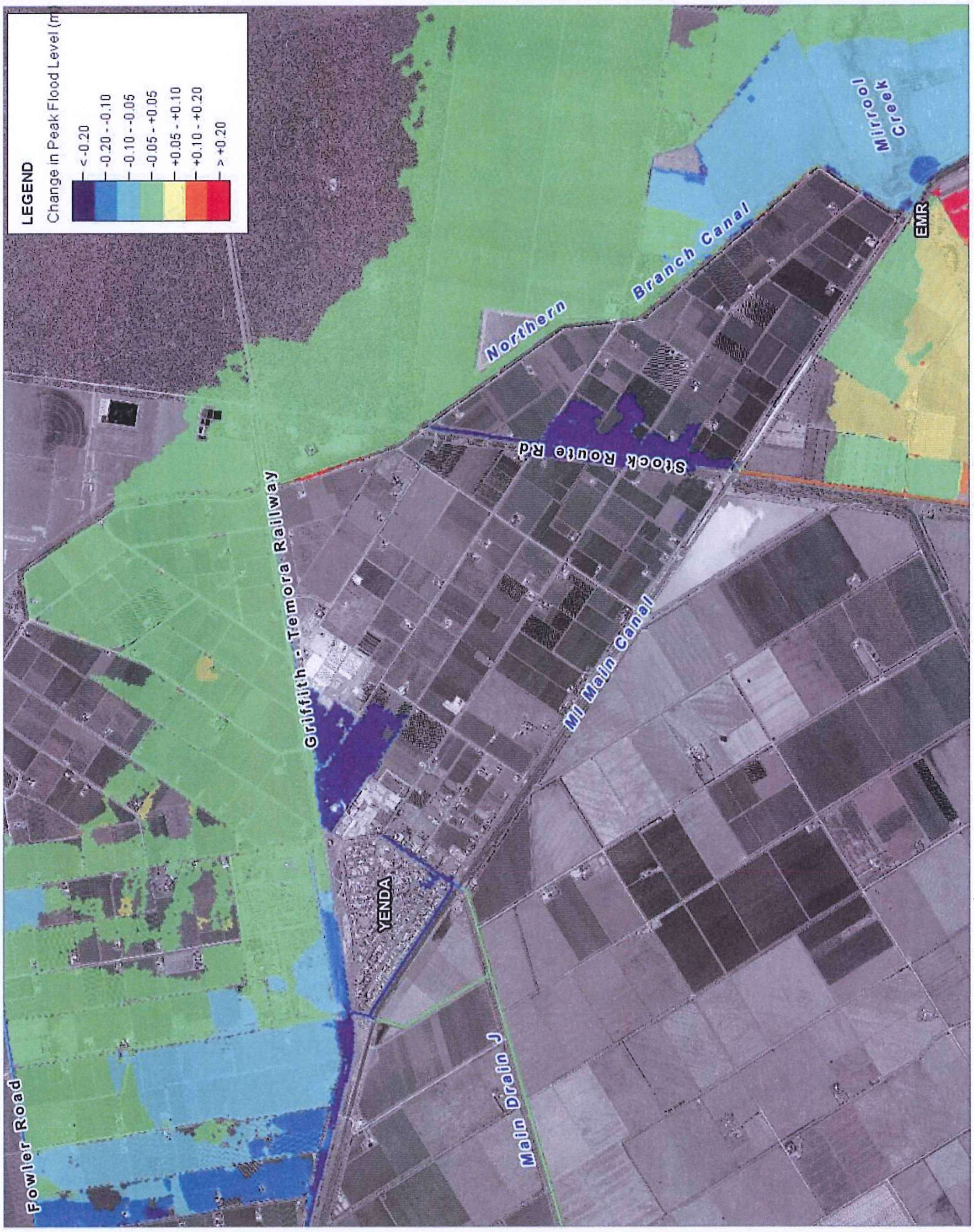

Title:

Yenda Mitigation Options - Change in Peak Flood Level 1% AEP Event EMR Structure Upgrade & NBC Levee

Figure: 7-21

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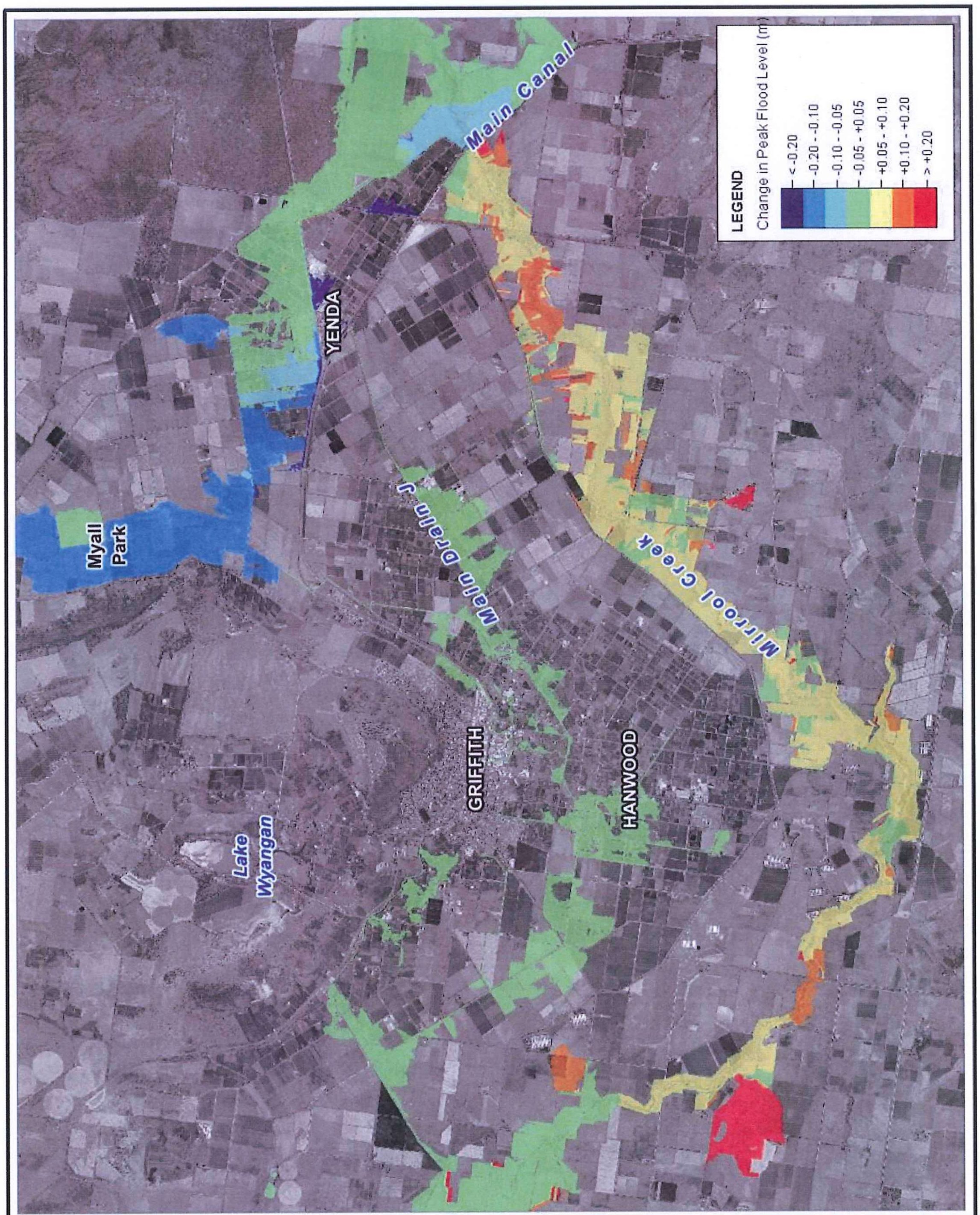

Title:
Yenda Mitigation Options - Change in Peak Flood Level 1% AEP Event EMR Structure Upgrade & NBC Levee

Figure: 7-22

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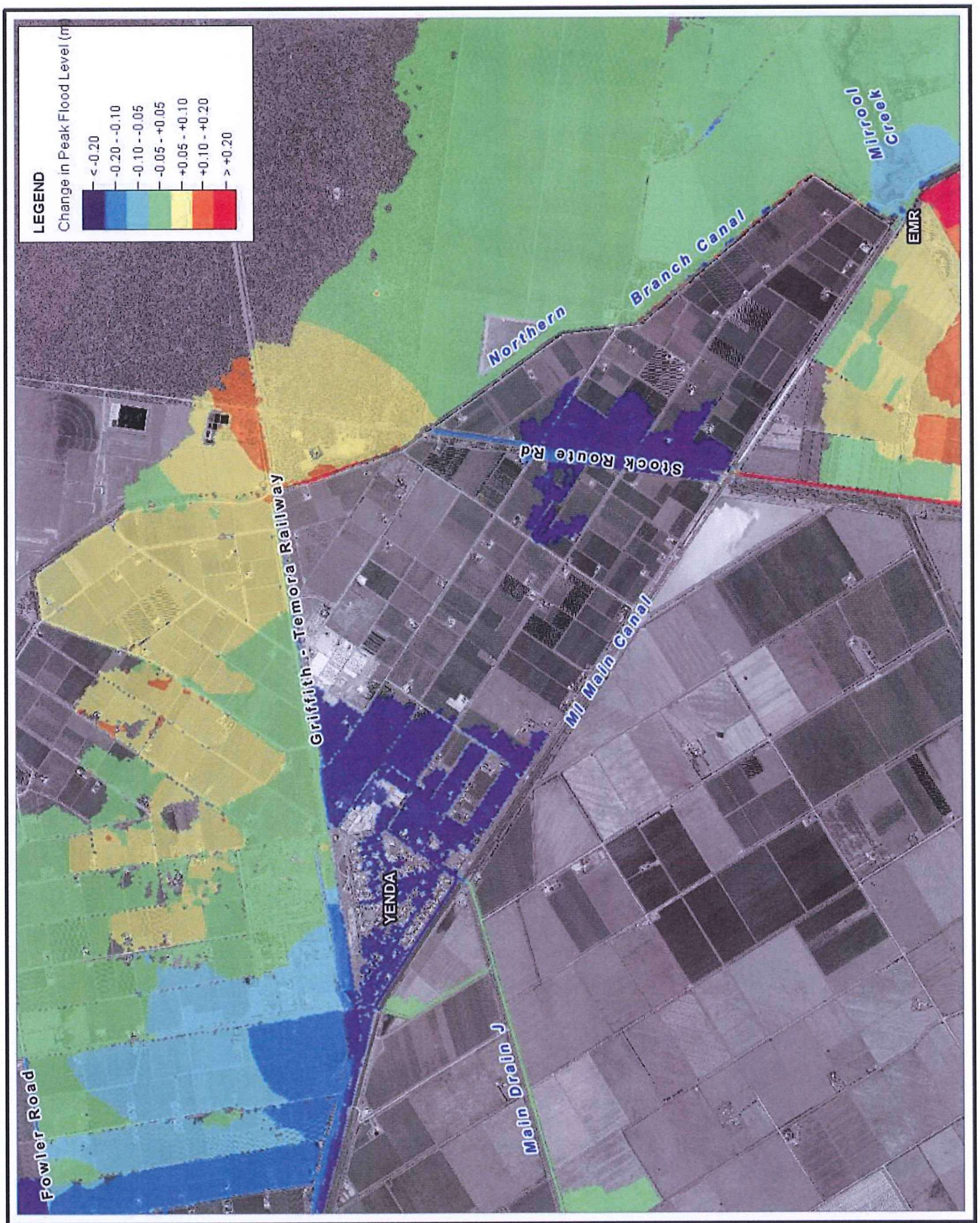

Title:
Yenda Mitigation Options - Change in Peak Flood Level 0.5% AEP Event EMR Structure Upgrade & NBC Levee

Figure: 7-23

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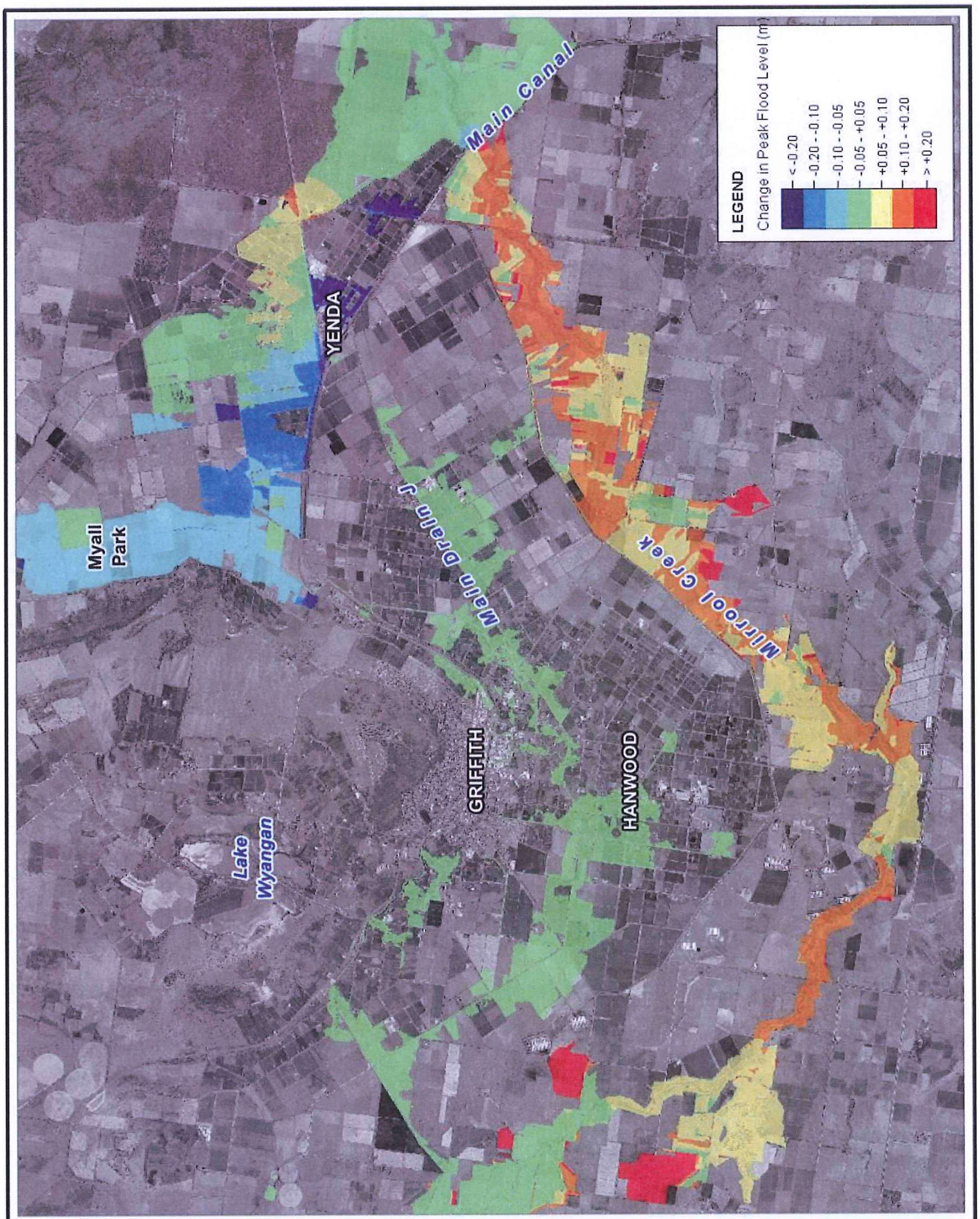

Title:
Yenda Mitigation Options - Change in Peak Flood Level 0.5% AEP Event EMR Structure Upgrade & NBC Levee

Figure: 7-24

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The combined option of upgrades to the EMR flood relief structures and NBC levee provides for an effective solution to the Yenda flood problem. The peak design flood inundation depth and extent for the mitigation option is shown in Figure A-7 in Appendix A for the 0.5% AEP design event (similar to March 2012 magnitude). The minor residual flooding shown in Yenda is due to a combination of local catchment rainfall and some backflow across the railway from the North Yenda side. The majority of this flow may be expected to be managed effectively by the local drainage system, including the recent pump installations.

Whilst providing effective mitigation to the Yenda township, it is noted that changes in the flow distribution arising from the works provide for adverse impacts to other parts of the floodplain. Specifically the two key areas of potential adverse impact are North Yenda and the broader Mirrool Creek floodplain downstream of the Main Canal.

The impacts to North Yenda only come into effect for the 0.5% AEP flood event with relatively minor increases of the order of 0.05-0.1m in a relatively localised area. Impacts of this scale and magnitude are not considered a significant increase in overall flood risk and may be considered acceptable. Nevertheless, further reductions in peak flood impact in this area may be achieved by providing even more flow capacity at the EMR flood relief structures.

The most significant of the impacts of the proposed mitigation option is the extensive area of increased flood levels throughout the Mirrool Creek floodplain downstream of the Main Canal. Whilst this area largely represents the natural floodplain of the Mirrool Creek system, it has to be recognised that significant agricultural development has taken place, such that increases in flow has the potential to adversely impact existing landholders.

Nevertheless, typical increases in peak flood levels are only of the order 0.1m for the 1% AEP event and 0.2m for the 0.5% AEP. This magnitude of impact was similar to that documented in the Dept. of Water Resources (1994) options study. Considering the nature of flooding within this existing floodplain area, peak flood level increases of this magnitude are not considered to major implications. There is limited opportunity to offset these impacts within the natural floodplain areas with alternative measures.

In terms of changes in the peak flood extents these increases in flood levels translate into significant changes in the extent of floodplain inundation, as presented in Table 7-4. This shows reasonably consistent changes in the area of modelled floodplain inundation, with the EMR upgrade works indicating around a 20% reduction in flood extents in the Yenda and Myall Park locality corresponding to a 20% increase in flood extents along the Mirrool Creek floodplain. In reality these changes in flood extent may not always be evident, as the interface between flood waters emanating from Mirrool Creek and those from local rainfall and drainage can be difficult to discern. However, it indicates that increased flood extents are likely to be experienced along the Mirrool Creek floodplain with reduced flood extents being experienced in and around Yenda.

Another important consideration for the increased flooding conditions along Mirrool Creek is the potential impact on road inundation depth and duration, particularly for the principal transport link of Kidman Way. Figure 7-25 shows the modelled water level hydrographs on Mirrool Creek upstream of Kidman Way. The road is overtopped at an elevation of approximately 123.6m AHD and so the modelled indicates that overtopping of the road may be expected to occur for around 12 hours longer over a total period of several days under the upgraded EMR condition, with upstream flood levels increased by around 0.05m to 0.1m.

Table 7-4 Summary of Floodplain Inundation Extents for the EMR Upgrade Works

Design Flood	Area of Modelled Flood Extent (ha) Reinstated EMR	Upgraded EMR	% Change
Yenda and Myall Park			
1% AEP	689	536	-22%
0.5% AEP	838	705	-16%
Mirrool Creek from the Main Canal to Barren Box Swamp			
1% AEP	821	993	+21%
0.5% AEP	970	1,160	+20%

The peak flow rate along Mirrool Creek during the March 2012 event was larger than that of the modelled 0.5% AEP upgraded EMR condition (due to the Main Canal breaching) and Kidman Way was still trafficable throughout the event. Therefore the modelling suggests that the upgrade of the EMR is unlikely to impact on the trafficability of Kidman Way for events up to the 0.5% AEP.

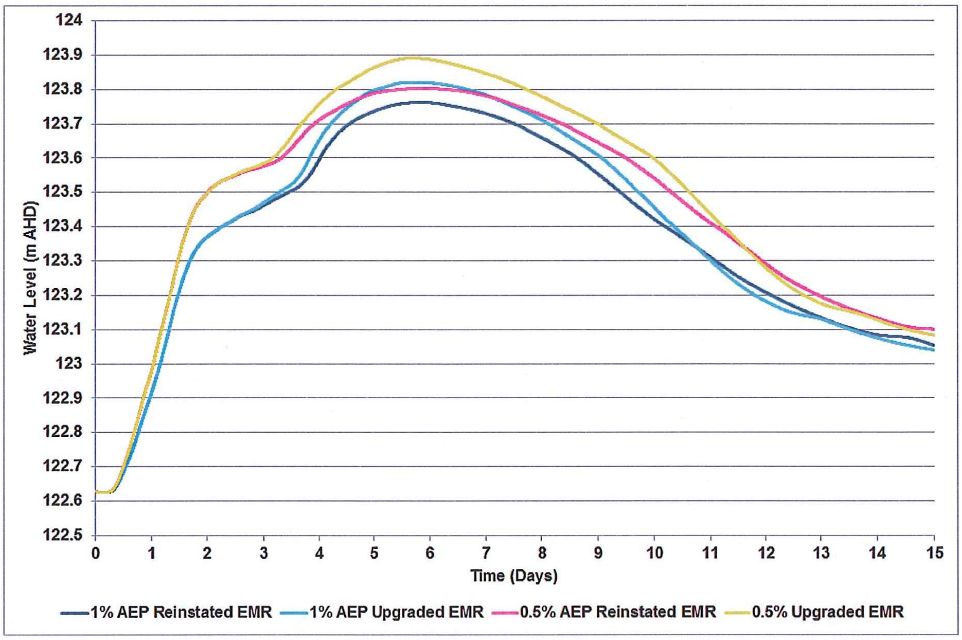

Figure 7-25 Impact of EMR Upgrade on Modelled Water Level Hydrographs at Kidman Way

The relative changes in flood level response shown at Kidman Way in Figure 7-25 is also indicative of the changes at other locations in the Mirrool Creek floodplain downstream of the Main Canal, such as Irrigation Way and the Railway at Widgelli. Increasing the capacity of the EMR flood relief structures to a 0.5% AEP design standard typically provides for peak water level increases of the order 0.1m. The 0.5% AEP discharge capacity is similar to the peak flow conditions experienced in March 2012 that included significant breaching of the Main Canal. Accordingly, the EMR upgrades provide no significant additional flood impact to the main transport routes relative to the March 2012 conditions.

There was also some concern in March 2012 in regard to potential flooding of the electricity substation along Irrigation Way. Some localised earthworks was undertaken to prevent any significant spilling from the Mirrool Creek floodplain and provide additional protection to the substation. As with the general water levels in the vicinity of Irrigation Way, the magnitude of changes resulting from potential upgrade works provides no further significant increase in flood risk to the substation. Events in excess of the 0.5% AEP event may require some localised protection as undertaken for March 2012.

The changing of Mirrool Creek flow distributions can also potentially impact on the flood volumes being discharged through the Mirrool Creek floodplain. This is of most concern for Barren Box Swamp, where flood conditions are driven by the volume of floodwaters being discharged to the swamp rather than the peak discharge rate of the inflows.

Table 7-5 shows the modelled discharge volumes within Mirrool Creek over a 15 day duration. It can be seen that the modelling indicates an increase in discharge volumes of around 10% at Kidman Way under the upgraded EMR scenario. However, at McNamara Road the discharge volumes are similar as the total flood volume of the system is being accounted for once downstream of Main Drain J. Under the reinstated EMR scenario a greater volume of water is discharged to Myall Park, which is then drained back to Mirrool Creek via Main Drain J.

The overall change in flood volumes entering Barren Box Swamp will approach zero when considering volumes over periods longer than 15 days. As the flood waters being discharged along Mirrool Creek or into Myall Park both ultimately drain to Barren Box Swamp the total volume being discharged under different flow distributions between the two flow paths should be similar, given a long enough period of time. However, as more flow is directed along the Mirrool Creek alignment, the timing of flood volumes entering Barren Box Swamp will change. Flows along the Mirrool Creek floodplain will arrive at the swamp sooner than those being conveyed via Myall Park.

Despite the magnitude of the March 2012 flood event, significant flooding problems were not experienced within Barren Box Swamp. MI manages Barren Box as one of its key storages including for flood risk management within the system, with controlled storage/releases dependent on forecast hydrological conditions. The March 1989 flood event produced far more serious flooding conditions at Barren Box Swamp and subsequently land situated further downstream. Although a much smaller event in terms of magnitude of peak flows, the March 1989 event was of much greater volume than that of March 2012. This is because the March 1989 flood event was actually a series of flood events occurring over a period of several weeks. The cumulative discharge volume of these flood events exceeded that of the single event experienced in March 2012. Given the long periods of time over which the critical flood conditions of Barren Box Swamp occur it is not expected that alterations to the Mirrool Creek flow distribution would significantly impact on the flood immunity of the Barren Box Swamp storage capacity.

A key driver for the current study was to find solutions to the significant problems at Yenda as experienced in March 2012. On balance, the increase in flood discharges to the natural floodplain of Mirrool Creek as opposed to the redistribution of the flow to Yenda by irrigation infrastructure would appear the most appropriate scenario. Whilst it is recognised there are some adverse impacts to properties through the Mirrool Creek floodplain, the EMR upgrade works would effectively restore the flow distributions to more like natural conditions. The formal floodways adopted through the floodplain downstream of the Main Canal were based on Mirrool Creek flood flows being conveyed across the structure in a relatively natural distribution (i.e. no diversion of flow to Yenda).

Table 7-5 Summary of Mirrool Creek Flood Volumes for the EMR Upgrade Works

	15 day Discharge Volume (GL)		
Design Flood	Reinstated EMR	Upgraded EMR	% Change
Kidman Way			
1% AEP	754	810	+7%
0.5% AEP	878	970	+10%
McNamara Road			
1% AEP	1,116	1,122	+1%
0.5% AEP	1,260	1,301	+3%

In the context of flood events of the 1% AEP magnitude and above, the incremental increase in flood affectation as a result of mitigation works at the EMR over and above the existing 1% AEP and higher flood condition is not particularly severe and largely affects agricultural property as opposed to significant residential property in the case of Yenda.

7.4 Hanwood Structural Options

7.4.1 Hanwood Local Drainage Works

Flooding in Hanwood largely occurs when Main Drain 'J' is running at capacity. The elevated water levels in Main Drain 'J' extend a backwater influence along DC 'A'. This (together with a hydraulic gradient to drain DC 'A' and its contributing catchments) initiates extensive out of bank flooding, including within Hanwood. Flooding may last for a few days, until the tailwater level in Main Drain 'J' lowers to enable drainage out of Hanwood.

The flows draining through Hanwood are relatively small due to the size and flat nature of the upstream catchment, which is drained via DC 'DA'. It is principally the backwater influence of flooding from Main Drain 'J' that causes flooding within Hanwood, rather than a lack of capacity within the drainage channels to convey the local catchment runoff.

The extent of the backwater flooding into Hanwood can be limited through the construction of a bund. The proposed bund alignment is shown in Figure 7-26 with respect to the local flooding and drainage. The bund height is limited to that of the surrounding topography with which the ends of the embankment can be tied into. The nature of earthworks required is similar to those presented for Yoogali.

C.2 EMR Flood Escape Upgrade

C.2.1 Description of Works

The proposed works as discussed in Section 7.2.2 and presented in the general arrangement shown in Figure C2 incorporates:

- Construction of new flood relief structure at the East Mirrool Regulator as a replacement of the existing structure. The existing five bay and eight bay flood check in the northern and southern bank of the Main Canal respectively is proposed to be replaced with 9 bay 2.4 x 1.8m gated structure (or similar) on each bank. There may be a number of alternative structure arrangements including bay dimensions and gate types which would be determined at preliminary design phase. The structure as proposed in the concept design provides for the required flow capacity under flood operations in which both the northern and southern bank structures are fully open to pass Mirrool Creek floodwaters across the Main Canal.
- Scour protection works at the structure inlets/outlets are provided to protect the receiving channel/floodplain from excessive erosion. Flow through the structures provides for concentrated high velocity discharge of Mirrool Creek floodwater (and Main Canal flows in certain operations) at the structure inlet and outlet.
- Channel modification works are required both upstream and downstream of the structure to provide appropriate transition of flow to the existing channel/floodplain of Mirrool Creek. Similar channel transitions exist for the existing structures, however, with a proposed widening of the structure additional channel modification is required.
- Raising and strengthening of the right bank of the Northern Branch Canal to increase the level of overtopping providing for an effective levee protection. Note that the NBC embankment is already elevated above the natural ground surface thereby providing some levee type protection to Yenda under existing conditions. The works may involve a length of some 4km (of the total 6km from the EMR to the Griffith-Temora Railway) with bank raising typically less than 0.5m required. Bank raising of this order may be undertaken by placement of compacted fill (of appropriate material) on the existing embankments.

C.2.2 Hydraulic Performance / Flood Impacts

The hydraulic performance of the proposed works in terms of flood mitigation function and potential impacts are summarised below:

- The design of the flood gate structures is to provide a nominal flow capacity to discharge Mirrool Creek floodwater across the Main Canal. Under existing conditions, the maximum headwater level at the structure before flow diversion towards Yenda is initiated is 134.3m AHD. This flow to Yenda is initiated via overtopping of the NBC at localised low points. The top of bank elevation of the Main Canal at the existing flood relief structures is some 134.8m AHD. Accordingly, the NBC bank raising proposed as part of the works provides for a similar maximum headwater level.
- Table 7-3 provided a summary of the performance of the flood gate upgrade with the NBC levee works. The proposed structure provides for a discharge capacity of the order of 140m^3/s (0.5% AEP) at a design peak headwater level of ~134.5m AHD. This provides for an effective

freeboard of some 0.3m to overtopping of the Main Canal and the NBC. Accordingly the proposed structure provides for a nominal 0.5% AEP design capacity and equivalent standard of protection to the Yenda township.

- Flows are still passed through to North Yenda via flow around the NBC and overtopping of the Griffith-Temora railway. Whilst there is some concentration of flow at this location over the railway, the nominal upgraded structure capacity provides for most flow to be transferred to the Mirrool Creek floodplain downstream.
- The increase in flow to the Mirrool Creek floodplain downstream of the structure provides for increase in peak flood water level for the inundated floodplain areas beyond the confluence with Main Drain J. Whilst covering an extensive area, the magnitude of the flood level impacts are typically of the order of 0.1m – 0.2m for the 1% AEP and 0.5% AEP events.

C.2.3 Design Constraints / Issues

Key design constraints and construction issues for the proposed works are identified as:

- Murrumbidgee Irrigation is one of the major stakeholders in any future upgrade works. MI's ongoing operations represent one of the major constraints within design of upgrade options with consideration of construction phase impacts and potential disruption to MI business and impacts to customers, integrating works within the existing operational supply system, and maintenance and operational responsibilities.
- The works would become an integral component of Murrumbidgee Irrigation's infrastructure including the operation of the gates for flood mitigation purposes. Operational procedures and protocols for flood operations would need to be developed, including clear identification of responsibilities and the interaction with other flood emergency response agencies under appropriate disaster management plans (e.g. Local Flood Plan).
- In the context of the above, the nominal flood gate arrangement presented represents a single option considered only in terms of design discharge capacity. Alternative arrangements/designs would be expected that offer a more suitable design solution considering other design constraints. These alternative solutions have limited impact on the Floodplain Risk Management Plan recommendations provided a similar design capacity is provided ensuring the key outcomes in terms of Yenda flood risk protection is maintained.
- Although the proposed raising of the NBC does not require major increases in bank height, there are numerous accesses and other irrigation infrastructure that need to be considered. The detail of the integration of existing infrastructure has not been considered at this stage. The overarching requirement is to provide a consistent bank level along the NBC to prevent overtopping to an appropriate design flood standard (nominally this has been the 0.5% AEP + 0.3m freeboard as discussed above).

C.2.4 Environmental Impacts

The following environmental concerns or impacts have been identified to be addressed in the approvals and design phases of the works:

- The proposed works represents a major construction and the design approvals process is expect to require a Review of Environmental Factors or other environmental impact assessment in accordance with scale and nature of the works.
- Typical construction phase impacts such as noise, dust and air quality, water quality etc. would need to be considered in terms of the existing environment and neighbouring property.
- The structure inlet and outlet transitions require modification to existing watercourses including excavation within the riparian corridor. Whilst the Mirrool Creek channel and floodplain in the immediate locality of the structure is largely a modified / engineered channel, further modification of the existing waterways is required as part of the works.
- The existing siphons are to be retained such that the normal flow regimes of Mirrool Creek will be retained. The flood relief structures only come into effect for major flood event (>20% AEP) and accordingly have no real impact on the typical flow properties of the system that would impact on ecology. Flood flows are effectively being retained in terms of flow frequency albeit with some minor changes in peak flood level elevations and inundation extents. However, these changes are only for the higher order events of the 1% AEP and greater and accordingly would have limited impact on the downstream environment. Whilst peak flows and flood levels may increase marginally downstream, overall flood volumes and durations of inundation have no material change. This perhaps most significant in terms of Barren Box Swamp towards the downstream end of the Mirrool Creek system in the current study.

Title:
EMR Flood Escape Gate Upgrade General Arrangement

Figure: C-2

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 12.5 25m

Approx. Scale

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Filepath :K:\N20024_Main_Drain_J_Mirrool_Ck_FRMS\MapInfo\Workspaces\DRG_049_150328_EMR_Upgrade_Arrangement.WOR