



NATURAL DISASTER RESILIENCE PROGRAM FINAL PROJECT REPORT

Project Name:	'Understanding and Managing Flood Risk in Perth's Eastern Region'		
Applicant:	Eastern Metropolitan Regional Council Organisation	File:	NDRP 1415-29
Project Ending:	May 2016	Report No:	FINAL
Hazard/s addressed:	River Flooding	NDRP Funding:	\$100,000 (excl. GST)

1. Project Background / overview

What led to the development of this project? Why did it need to be undertaken? Where was it undertaken?

Knowledge of the flood history of the Swan River through Perth dates back to the early 1800s, where the earliest anecdotal reference to major flooding was in 1830 (Avon River Flood Study, 1985). The last major Swan River flood occurred in 1983. However, a number of larger events are known to have been observed during the previous 150 years of European settlement, with the largest flood on record occurring in 1872.



Image 1 - Swan River viewed from Garvey Park, Belmont, 2010

The information in relation to catchment hydrology for the Swan and Helena Rivers is dated and does not reflect current industry standards and the impact of observed changes in catchment rainfall since the 1970s. Current floodplain mapping is based on hydrologic assessments undertaken in 1983. As a result, the available floodplain mapping of this region may not be suitable to support land use planning and development decision-making and flood emergency response. In addition, the existing mapping needs to be expanded to cover additional areas where no mapping currently exists.

There is increasing pressure on floodplain areas for land use planning and development as land availability decreases, particularly in urban areas, and as population growth increases. The population of Perth's Eastern Region is 358,714 with population growth forecast to reach around 390,000 by 2021 (profile.id, 2014 accessed at: <http://profile.id.com.au/emrc/population-estimate>). As much of the land area has already been developed, there will be increased pressure for further development along the river foreshore to accommodate this growth.

Without detailed mapping it becomes harder to make informed decisions in relation to potential flooding risks and develop appropriate risk management strategies for river foreshore assets, the natural environment and emergency response activities. There is also recognition that an understanding of the full range of expected flood events (i.e. larger than the 1 in 100 annual exceedance probability (AEP) event currently used for planning) is required to support flood emergency response planning, infrastructure design, and flood insurance.

The need for up to date flood risk information in the eastern reaches of the Swan and Helena Rivers was identified in two of the Eastern Metropolitan Regional Council's (EMRC) key strategic documents, being the *Regional Climate Change Adaptation Action Plan 2013 – 2016* and in the major review of the *Swan and Helena Rivers Management Framework* conducted in 2014. Mitigation strategies for flood are also identified in the State Emergency Management Plan for Flood (Westplan Flood, 2010).

The Swan and Helena Rivers catchment area encompasses the six member local government authorities of the EMRC. These local government authorities, with the assistance of State Government agencies, are responsible for ensuring the river’s foreshore environment is appropriately managed and existing and proposed development has adequate protection from major flooding.

The “Understanding and Managing Flood Risk in Perth’s Eastern Region” project began as a partnership between the EMRC, Department of Water and three of the EMRC’s member councils. The individual partners did not have the resources to complete a similar project on their own and it was determined that a collaborative approach with the EMRC as project manager would have the best chance of success, as the EMRC has extensive experience of managing complex, collaborative, grant-funded, regional-scale projects. Additional funds were required to undertake Stage One, so it was determined that the Natural Disaster Resilience Funding would be appropriate for a study of this type to understand risk and build resilience to flooding in Perth’s Eastern Region.

The Australian Emergency Management Handbook Series, *Managing the floodplain: A guide to best practice in flood risk management in Australia – AEM Handbook 7* (AEMI 2013) outlines the following key objectives that are relevant to studies into managing flood risk to communities:

- make information on flood risk readily available so that government, risk managers and community can make informed risk management and investment decisions;
- understand flood behaviour and risk to recognise the impacts of floods on the community and enable effective decisions to be made on flood management;
- understand and maintain the natural flood functions of flow conveyance and storage of the floodplain to enable effective flood risk management and minimise environmental impacts; and
- manage flood risk to improve community resilience to flooding, and to handle the potential growth of this risk through development and redevelopment, and future changes to floodplain topography and climate.

The “Understanding and Managing Flood Risk in Perth’s Eastern Region” project was divided into four stages:

- Stage One - catchment hydrology assessment of the study area to determine design flow estimates for the Swan and Helena rivers at key locations; potential impact of climate change on design rainfall and flow estimates; data collation and estimation of the probable maximum flood
- Stage Two - preparation of a digital terrain model; hydraulic modelling utilising the results from Stage One and the 2013 *Assessment of Swan and Canning River Tidal and Storm Surge Water Levels* by URS; and revised floodplain mapping (for a range of flood extents, depths, velocities and hazards and how they vary with time)
- Stage Three - Flood Risk and Vulnerability Assessment informed by the results from Stage Two and key stakeholder consultation; and preparation of a Floodplain Development Strategy
- Stage Four - development of a Community Awareness Guide and other engagement materials to enable local government and the community to have a greater understanding of possible flood risks in the future and enable greater disaster resilience.

A flood study has three main technical components:

- Hydrology – how much water will flood an area?
- Hydraulics – where does the water go?
- Damage assessment – what damage will the water do?

Outputs from the overall flood study can be used for:

- Land use planning
- Development approvals
- Emergency planning
- Emergency response / flood forecasting.

This project was Stage One which undertook a hydrology assessment. The *Swan*

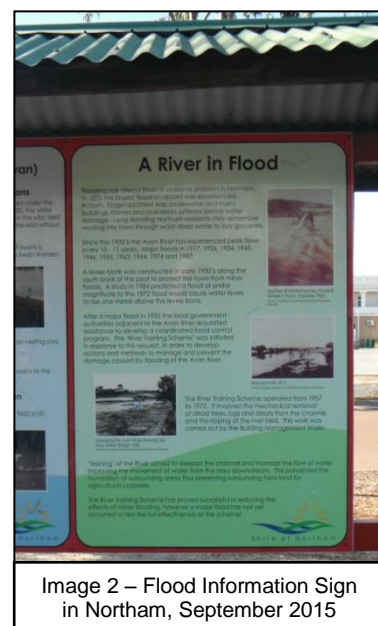


Image 2 – Flood Information Sign in Northam, September 2015

and Helena Rivers Flood Study: Hydrology assessment estimated how much water might flood Perth’s Eastern Region from the Swan Avon Catchment from a range of rainfall events. A catchment is an area where water is collected by the natural landscape. In a catchment, all rain and runoff eventually flows to a stream, river, dam, lake, ocean, or into the groundwater. This study looked at how long it needs to rain for and how much rain it will take to cause flooding in the catchment. This study estimated the probable maximum flood, which is the most intense rainfall that could theoretically occur over a catchment. Future stages of the project will work out where the water will go and how much damage it will do to infrastructure.

Study area overview

The Stage One project area covered the mainstream Swan River from Perth Water upstream to Walyunga National Park and the Helena River from its outlet to the Swan River to the Helena River Pipehead Dam. The Swan Avon River complete catchment covers an area of approximately 124,000 km². (See Attachment A - Flood Study Hydrology Swan Helena River Area Extent Map)

The Swan River is the major river flowing through Perth, the capital city of Western Australia. The Swan River is a 72 km permanently open estuary that flows across the coastal plain from Walyunga National Park to the Indian Ocean at Fremantle. The Helena River is one of the largest tributaries and drains into the Swan River near Midland, approximately 12 kilometres east of Perth.

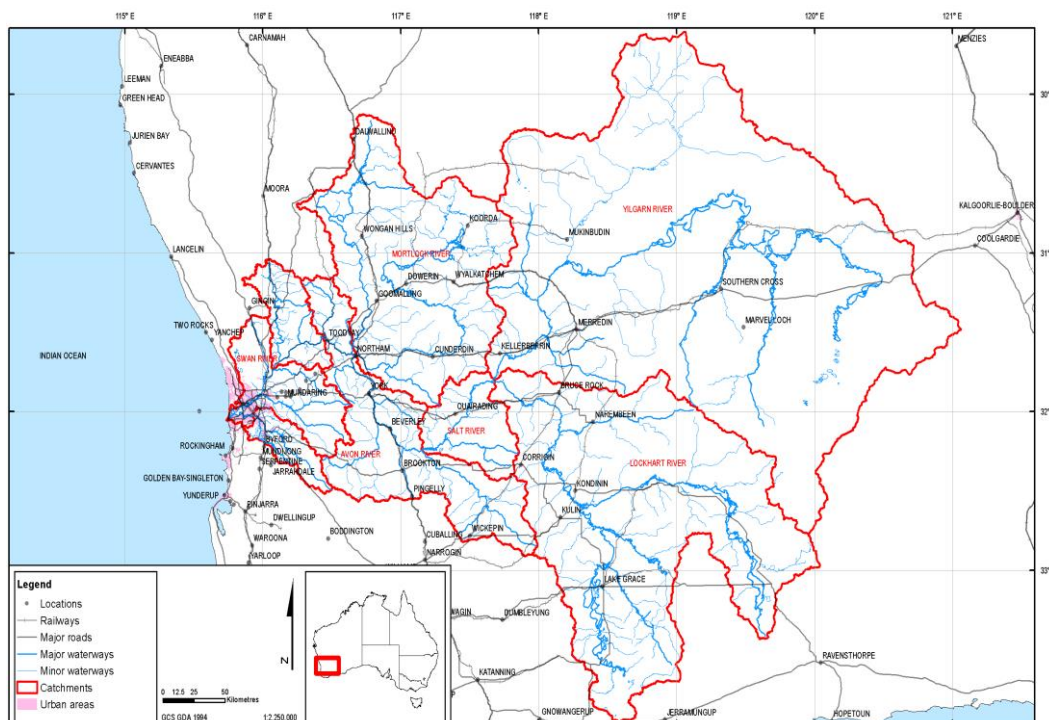


Image 3 - Swan Avon Catchment

Catchment description

The Avon River, with a catchment area of more than 120,000 km², is by far the largest catchment that drains into the Swan River. Two major systems of interconnected lakes (Lockhart and Yilgarn Systems), that account for approximately 75% of the entire catchment area, combine within the Yenyening Lakes which overflows into the Avon River upstream of Beverley during major events. The Avon River catchment has predominantly been cleared of native vegetation to support agricultural land use. (See Attachment B - Flood Study Hydrology Avon River Catchment Map)



Image 4 – Yenyening Lakes, September 2015



Image 5 – Mundaring Weir, September 2015

The Helena River has a total catchment area of around 1,655 km², with approximately 90% of the catchment area situated above Mundaring Weir. The catchment area of Mundaring Weir is largely natural forest that has not been subject to significant clearing, whilst much of the area downstream of the Darling Scarp has been cleared for agriculture and urban development. (See Attachment C - Flood Study Hydrology Helena River Sub-Catchment Map)

The mean annual rainfall varies from <300 mm in the east to greater than 1200 mm within the Darling Scarp. Major flooding can result from both winter frontal systems and

the passage of ex-tropical cyclones through the catchment during summer months.

2. Project Summary

EMRC was successful in receiving \$100,000 funding under the Natural Disaster Resilience Program administered by the Western Australian State Emergency Management Committee under a National Partnership Agreement with the Australian Government. The \$200,000 project to undertake stage one of a flood risk study for the Swan and Helena rivers is a collaboration between the EMRC, Department of Water and the Cities of Swan, Bayswater and Belmont, with the support of the Department of Parks and Wildlife (Rivers and Estuaries Division) and Town of Bassendean.

The project is the first component of a four stage flood study project to assess, collate, map and develop community awareness in relation to managing flood risk in Perth's Eastern Region.

This study included the hydrologic components of a flood study, which is a comprehensive technical investigation of expected peak discharges and volumes that will provide a main input to the subsequent development of a hydraulic model and floodplain management plan as part of later stages of this project. The study aimed to provide a better understanding of the full range of flood behaviour and consequences and involves consideration of the local flood history, available collected flood data, and development of hydrologic model/s calibrated and verified, where possible, against significant historic flood events and extended, where appropriate, to determine the full range of flood behaviour.

Riverine flooding, caused by heavy or prolonged catchment rainfall events, is the dominant mechanism of flooding within the study area. A study prepared for the Department of Water has shown that estuarine flooding, a form of major storm/tidal surges in the ocean produced from low pressure systems and increased wind velocities acting on the water, is the dominant flooding mechanism downstream of Perth city.

EMRC engaged the services of Hydrology and Risk Consulting (HARC) to undertake the catchment hydrology assessment (study) following a rigorous tender process including expert technical assistance from the Department of Water. The following components were required under the tender:

- Written summary report of data collected, collated, reviewed and validated;
- A report summarising the data used, methodology, and results of the hydrologic analyses;
- The calibrated loss and hydrologic model(s) and output design hydrographs developed as part of the study along with a discussion of their interpretation;
- GIS files created to support hydrologic analyses; and



Image 6 – Mortlock River East near Meckering, September 2015

- Draft and Final Study Reports.

To address the hydrologic complexities, HARC proposed to develop separate models for the Swan and Helena River catchments. The modelling approach proposed employed the runoff routing (RORB) hydrological model, coupled with the soil, water loss model (SWMOD) rainfall runoff model. The RORB/SWMOD model was calibrated and verified using information for observed historic flood events. These models were then run in a probabilistic Monte Carlo framework to allow for variability in a range of input parameters to determine design flood estimates.

It was determined that a Technical Peer Review of the preliminary catchment and hydrologic analyses undertaken was required to ensure that the approach proposed by HARC together with the underlying assumptions being relied upon were both appropriate and defensible. University of Melbourne Commercial (UoMC) was engaged to undertake the Technical Peer Review which was completed at the methodology and draft catchment hydrology report stages of the study.

HARC undertook an initial data review, followed by a site visit to the catchment area, including Meckering, Northam, York, Beverley, Yenyenning Lakes, Brookton and Mundaring Weir. The methodology was refined and a report prepared for peer review. Following discussions with both UoM Commercial and Department of Water, adjustments were made to some of the assumptions and parameters and the model was calibrated using three historic flood events, selected from the gauge data record. Modelling results demonstrated that these events could be reproduced well using reasonable model parameter values. A fourth historic event was used to validate the calibration results.



Image 7 – Avon River at Beverley, September 2015

The model was then verified to the gauged record of flood frequency estimates at two gauges; the Swan River at Walyunga and the Helena River at Craignish. At Walyunga, there was considerable uncertainty surrounding the estimation of the gauged flood frequency, especially when estimates of historic floods prior to the gauged record were included. Nevertheless, it was found that the model results were consistent with the gauged information as well as anecdotal evidence on flood behaviour within the catchment.

The model was used in design mode to estimate flood peaks and flood hydrographs for a range of annual exceedance probabilities, including 10% (1 in 10), 5% (1 in 20), 2% (1 in 50), 1% (1 in 100), 0.2% (1 in 500) and 0.05% (1 in 2,000). An estimate of the probable maximum flood (PMF), which is the largest flood which could conceivably be generated from this catchment, was also made. The resulting estimates of the PMF peak flow at Walyunga was 59,000 m³/s, with a critical duration of 120 hours. The estimate of the PMF peak flow at Whiteman Road was 9,650 m³/s, with a critical duration of 96 hours.

It should also be noted that the PMF is also considered to be most likely during an extreme winter event, where the catchment is already wet, rather than a summer event, where the initial losses from soil infiltration will be higher.

HARC provided a Final Report Version 3 which incorporated the outcomes from the modelling and subsequent revisions of graphs to ensure consistency with the final data set as well as the full set of technical data including calibration events, design hydrographs and RORB spatial files. (See Attachment D - Flood Study Hydrology HARC Swan Helena Rivers Final Report V3.0)



Image 8 – Avon River at Northam Weir, September 2015

UoMC provided a Review Report which outlined the Technical Peer Review undertaken progressively throughout the study. It was concluded that the approach followed is consistent with best practice as defined in the draft (2015) Australian Rainfall and Runoff national guidelines and that the study undertaken by HARC provides a defensible set of flood estimates that are suitable for design and planning purposes, as long as due consideration is given to the inherent uncertainty involved in their derivation.



Image 9 – Flood marker with HARC and Department of Water staff, Avon River at Waterhatch Road near Beverley, September 2015

The investigation of the sensitivity of design flows to catchment wetness and dam starting water levels at the onset of a rainfall event will assist the preparation of a flood forecasting tool for the Swan and Helena Rivers.

The design flood hydrographs and data determined in this study will be used in subsequent stages of the larger project as input to hydraulic modelling. This, in turn, will enable the future development of up-to-date floodplain mapping and a revised floodplain management strategy that considers the full range of flood events that can be expected. (See Attachment E - Flood Study Hydrology

University of Melbourne Technical Peer Review)

When did the project start and finish?

The project was initiated on 1 May 2015 with a meeting between EMRC and the Department of Water and concluded on 30 May 2016 with the consultant providing the Final Report Version 3 and handing over all data and technical information.

What were your proposed milestones? Were they all achieved? Any relevant comments?

The proposed milestones for the project are listed in the table below:

Understanding and Managing Flood Risk in Perth's Eastern Region – NDRP1415-29	
Milestone	Due Date
Data collation and preparation a) Collate information on previous reports b) Review streamflow rating curves c) Extract required rainfall and streamflow data d) Extract relevant GIS information	May - June 2015
Quarterly report 1	July 2015
Engage consultant – EMRC Tender process	July 2015
Quarterly report 2	14 October 2015
Complete catchment hydrology assessment	14 April 2016
Quarterly report 3	14 January 2016
Quarterly report 4	14 April 2016
Quarterly report 5 and Final report	May 2016

All timeframes for the submission of quarterly reports were met, apart from the last, which was delayed by several weeks. Completion of the catchment hydrology assessment was delayed due to the complexity of the modelling and additional work required following peer review to ensure that the model and outcomes were robust and defensible.

What were the projects' objectives / aims / outcomes? Were they achieved? Why / why not?

The objective of the Stage One hydrology study was to provide a better understanding of the full range of flood behaviour and consequences and involved consideration of local flood history, available collected flood data and the complexity of the complete catchment to develop a hydrologic model calibrated and verified against significant historic flood events and extended to determine the full range of flood behaviour. The aim of the study was to provide up to date, best practice derived data within the tender period to be used as inputs to further stages of the larger project to improve natural disaster resilience.

This objective was achieved by the preparation of design flood estimates for the Swan and Helena Rivers based on the production of a hydrologic model that combines design event rainfalls, a variety of catchment conditions (i.e. dry, average, wet) and dam starting water levels by an experienced consultant in consultation with an expert peer reviewer. The design flood hydrographs and data determined in this study will be used in subsequent stages of the larger project as input to hydraulic modelling.

The results of the study will enable the future development of up-to-date floodplain mapping and a revised floodplain management strategy that considers the full range of flood events that can be expected. This information will inform mitigation and adaptation strategies and decision-making on proposed land use and development of flood prone land. It will assist local government authorities and emergency response agencies to target flood emergency activities and increase the flood awareness of local government authorities, urban planners, land developers and the community to improve natural disaster resilience.

Overall, the 'Understanding and Managing Flood Risk in Perth's Eastern Region' Stage One project was very successful and substantively met its objectives, by providing a greater understanding of the expected runoff rates from the catchments that will increase the reliability of real-time flood forecasts which will in turn improve the ability of emergency response agencies and the community to take appropriate actions during major events.

Outcomes of the project include:

- Providing up to date flood risk information in the study area to inform a hydraulic study and flood mapping;
- Assisting local government authorities and other emergency response agencies to target flood emergency response activities;
- Increasing the flood awareness of local government authorities, planners, land developers, the community, etc. by providing up to date flood risk information.

How did you meet State and National priorities (refer application)?

The project addressed the following National Strategy for Disaster Resilience priorities:

Understanding risk

By undertaking a catchment hydrology assessment to obtain up to date flood behaviour information, the potential flood hazard (risk) is able to be identified and understood for the full range of flood events that can be expected, based on best available information and best practice modelling. The findings of the project will be incorporated in the State Government flood mapping databases (held by Department of Water) and the Flood Risk Information Portal (currently being prepared by Geoscience Australia) to ensure that the information is freely available to all parties needing to understand flood risk in relation to the Swan and Helena Rivers.

Partnering with those who effect change

This project was a partnership with Department of Water and the Cities of Swan, Bayswater and Belmont who ensure that the river's foreshore environment is appropriately managed and existing and proposed development has adequate protection from major flooding. Findings from the project will be able to be incorporated into risk management and decision-making of the partners as well as other local governments

within the study area. The project partners also have responsibility for flood emergency management response activities and will now be able to provide appropriate advice in relation to the management of flood risk hazards. Partnerships with those involved in land use planning and development decision-making will promote the wise use of floodplains while minimising potential flood risk and damage.

Reducing risk in the built environment

Findings from the study will provide the foundation for further work which will, in turn, be incorporated into planning and development processes and emergency management planning by communities, local government authorities and government agencies. This will enable new policies, legislation, planning instruments and/or emergency management response plans to be produced which ensure that risk is minimised in the built environment, as well as inform conceptual designs of any treatment works that will increase flood protection and reduce risk to existing development on the floodplain.

The project addressed the following State priorities:

Developing shared responsibility

Findings from the study will be made available to the public through State Government flood mapping databases (held by Department of Water) and the Flood Risk Information Portal (currently being prepared by Geoscience Australia) enabling all land managers with floodplain responsibilities access to best practice, up to date flood hazard information.

Project partners have a responsibility to ensure that the river's foreshore environment is appropriately managed and existing and proposed development has adequate protection from major flooding. Stakeholders also have responsibility for flood emergency management response activities and will now be able to provide appropriate advice in relation to the management of flood risk hazards, developing shared responsibility for flood hazard planning. Partnerships will promote the wise use of floodplains while minimising potential flood risk and damage.

Promote a risk management approach and developing risk management assessments and/or treatments

The project promoted a risk management approach to managing flood hazards in Perth's Eastern Region by preparing up to date flood hazard data to assist with risk identification in the study area. The findings of the project will be used to inform a hydraulic study, flood mapping, flood risk and vulnerability assessment and development of a floodplain development strategy.

The improved understanding of flood behaviour and flood risk will provide land use planning and development decision-makers with the necessary information to balance the risk of proposed development on flood prone land with the benefits of the proposals. It will also provide those with emergency management responsibilities to better plan for and allocate resources to manage future flood events as well as inform conceptual designs of any treatment works that will increase flood protection to existing development on the floodplain.

Were there any delays / changes? Why? What did you do?

The project experienced some delays in the delivery of outputs, mainly due to the size and complexity of the project scope, as well as internal procurement and approval processes.

The consultant, HARC, was not engaged until September 2015 due to a lengthier than expected tender process to ensure compliance with local government procurement guidelines. There were more submissions for the tender than expected, which took the project team longer to evaluate. Upon selection of the consultant, some minor delays in preparing contracts were also experienced. Local government procurement, approval and engagement processes need to be taken into consideration over the entire term of the project.

The timeframe for completion of the catchment hydrology assessment was revised. At the project inception meeting, the project team and consultants determined that an independent peer review of both the project methodology and draft catchment hydrology report was necessary given the complexities involved to minimise any potential for re-work later in the project. This was to ensure that the methodology was sound and the project would provide defensible results, as the results will be used for future hydraulic modelling and mapping to inform mitigation strategies and decision-making on proposed land use and development on flood prone land.

Additional delays of several weeks during the methodology stage were experienced as the complexity of the project, particularly taking peer review feedback into consideration, meant significant additional work was required by the consultants. Accommodating annual leave of the peer reviewer was also needed due to the initial delays.

The Swan Avon River catchment has a number of characteristics which complicated the flood hydrology. These may be simply summarised as:

- Catchment size. The total catchment area is close to 124,000 km². This raises complexities such as the influence of partial area storms in flood generation, as well as the extreme gradients in design and historic rainfalls across such a vast area.
- The presence of lakes and highly anabranching channels. These characteristics imposed a significant storage, attenuation and loss effect on the flood hydrology.

There was a further delay when the peer reviewer was of the opinion that there may be a problem with the software used for the flood frequency modelling, which required further investigation and provision of all data to the software developer to determine if there was a problem with the program. There was a marked difference in the flood regime when gauged data only was used in the modelling compared to modelling using the estimated historic pre-gauged information. Following investigation, it was determined that the reduction in flood peaks was consistent with the well-recognised reduction in rainfall and streamflow yields in Perth, so the results may have shown the effect of climate change.

For future stages of the overall project, additional time will be allowed for procurement and approval processes as well as any peer review which may be needed, particularly related to data modelling.

Were there any reports / maps etc. produced? Include with your report (USB /electronic is acceptable)

The outputs of Stage One of the project included:

- Swan Helena Rivers Flood Study: Hydrology Final Report that details the expected runoff rates from the catchment and design flood estimates for events ranging from 1 in 2 annual exceedance probability (AEP) to the probable maximum flood (Attachment D - Flood Study Hydrology HARC Swan Helena Rivers Final Report V3.0)
- Calibrated rainfall - runoff models of the Swan / Avon River and Helena River catchments (data files only)
- Design hydrographs, data and GIS shapefiles (data files only)
- Peer review report (Attachment E - Flood Study Hydrology University of Melbourne Technical Peer Review)

1. Forward Planning

What needs to be done now? Who will do it? Who will be responsible for funding it?

Stages Two and Three are proposed to be undertaken in the 2016/2017 financial year, subject to funding.

Stage Two will involve hydraulic modelling utilising the results from Stage One and the recent Swan River tide and storm surge water level assessment by the Department of Water to develop floodplain mapping. Stage Three would see a Flood Risk and Vulnerability Assessment undertaken and Floodplain Development Strategy prepared. The EMRC, the Department of Water, EMRC member councils and neighbouring river councils have committed funding to engage consultants to undertake this work, and a grant application has been submitted.

Stage Four (subject to future funding) would involve developing a Community Awareness Guide and other engagement materials to enable local government and the community to have a greater understanding of possible flood risks in the future and enable greater disaster resilience.

Where NDRP funding is not available for future stages of the project, alternative funding will be sought by the EMRC and Department of Water. EMRC member councils, other local governments along the Swan River and relevant stakeholder agencies will be invited to contribute to the cost of the proposed projects, with grant funding being sought to make up any shortfall.

2. **Acknowledgements**

Include any personnel / organisations you believe were integral to this project.

EMRC would like to acknowledge the Federal Attorney General's Department for providing the funding for this project under the Commonwealth Government's Natural Disaster Resilience Program, managed by the Western Australian State Emergency Management Committee.

EMRC would like to acknowledge the Department of Water, a major funding partner, for collaborating on the project. The staff, in particular Mr Simon Rodgers, Supervising Engineer, Floodplain Management, and Mr. Damon Grace, Surface Water Engineer, provided invaluable subject matter expertise and support to the EMRC throughout the life of the project.

The EMRC would like to acknowledge the assistance of our participating councils, the Cities of Belmont, Bayswater and Swan, particularly the commitment by senior management and Councillors to the project. The EMRC would also like to acknowledge the staff at the Rivers and Estuaries Division, Department of Parks and Wildlife for their ongoing support of the project.

EMRC appreciates the invaluable work undertaken by the consultants, HARC, particularly Mr David Stephens and Mr Peter Hill, and the technical peer reviewer, Associate Professor Rory Nathan from UoM Commercial, the commercial arm of the University of Melbourne.

Attach any evidence of media / promotional activities.

Media and publicity activities included media releases and newsletter articles giving detail of the project's progression. These activities were aimed at all levels of stakeholders, from participating councils and EMRC staff through to external parties and members of the public interested in the flood study.

Articles published included:

- EMRC Newsletter - Understanding and Managing Flood Risk in Perth's Eastern Region – March 2015
- WALGA Eco News - Understanding and Managing Flood Risk in Perth's Eastern Region – June 2015
- EMRC Newsletter – Understanding and Managing Flood Risk in Perth's Eastern Region – June 2016

The Department of Water presented information on the project at the Swan Local Emergency Management Committee meeting on the 3 September 2015 and at the final project presentation on the 31 March 2016. The consultants engaged to do the catchment hydrology assessment provided an initial presentation on 18 September 2015 and also presented the findings to interested stakeholders at the final project presentation on the 31 March 2016.

The EMRC corporate website was updated on a regular basis with information relating to the project's progression.
<http://www.emrc.org.au/understanding-and-managing-flood-risk.html>

The EMRC provided quarterly updates to the participating member councils and other stakeholders.

Are there any future opportunities for promotion?

There may be future opportunities to promote the project at Local Emergency Management Committee meetings. Engineers Australia may be interested in a technical presentation on the catchment hydrology methodology and findings. The EMRC's website will continue to provide information regarding the project.

As the project findings will be used in later stages of the project, promotion of Stage One and the associated funding will be ongoing.

Attachment A - Flood Study Hydrology Swan Helena River Area Extent Map

Attachment B - Flood Study Hydrology Avon River Catchment Map

Attachment C - Flood Study Hydrology Helena River Sub-Catchment Map

Attachment D - Flood Study Hydrology HARC Swan Helena Rivers Final Report V3.0

Attachment E - Flood Study Hydrology University of Melbourne Technical Peer Review