



# LOCKHART SHIRE COUNCIL

## VOLUNTARY PURCHASE FEASIBILITY ASSESSMENT

### FINAL REPORT



JUNE 2015







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## LOCKHART SHIRE – VOLUNTARY PURCHASE FEASIBILITY ASSESSMENT

### DRAFT FINAL REPORT

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## FOREWORD

The NSW State Government's Flood Policy provides a framework to ensure the sustainable use of floodplain environments. The Policy is specifically structured to provide solutions to existing flooding problems in rural and urban areas. In addition, the Policy provides a means of ensuring that any new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

Under the Policy, the management of flood liable land remains the responsibility of Local Government. The State Government subsidises flood mitigation works to alleviate existing problems and provides specialist technical advice to assist Councils in the discharge of their floodplain management responsibilities.

The Policy provides for technical and financial support by the Government through four sequential stages:

1. ***Flood Study***
  - Determine the nature and extent of the flood problem.
2. ***Floodplain Risk Management***
  - Evaluates management options for the floodplain in respect of both existing and proposed development.
3. ***Floodplain Risk Management Plan***
  - Involves formal adoption by Council of a plan of management for the floodplain.
4. ***Implementation of the Plan***
  - Construction of flood mitigation works to protect existing development, use of Local Environmental Plans to ensure new development is compatible with the flood hazard.

WMAwater were engaged by Lockhart Shire Council (Council) to prepare the first three stages of the NSW Floodplain Risk Management Program for the townships of Lockhart and The Rock. These studies were completed in July 2014. The current study, the Lockhart and The Rock Voluntary Purchase (VP) feasibility assessment constitutes a continuation of the third stage of the program and is being undertaken by WMAwater on behalf of Council. This report is an implementation of the recommendations outlined in the Lockhart and The Rock Floodplain Risk Management Study and Plan (FRMS&P).

## 1. INTRODUCTION

Voluntary Purchase (VP) involves the acquisition of flood affected properties, in particular those frequently inundated in high hazard areas, and demolition of the residence to remove it from the floodplain. Removal of properties can help to restore the natural hydraulic capacity of the floodplain; the storage volume and waterway area.

VP is a recognised and effective floodplain risk management measure for existing properties in areas where:

- there are highly hazardous flood conditions from riverine or overland flooding and the principal objective is to remove people living in these properties and reduce the risk to life of residents and potential rescuers;
- a property is located within a floodway and the removal of a building may be part of a floodway clearance program that aims to reduce significant impacts on flood behaviour elsewhere in the floodplain by enabling the floodway to more effectively perform its flow conveyance function ; and/or
- purchase of a property enables other flood mitigation works (such as channel improvements or levee construction) to be implemented because the property will impede construction or may be adversely affected by the works with impacts not able to be offset.

The Office of Environment and Heritage, Floodplain Management Program Guidelines for Voluntary Purchase Schemes (Reference 2) are presented in Appendix E.

VP can be an effective strategy where it is impractical or uneconomic to mitigate the high flood hazard to an existing property and it is more appropriate to cease occupation to meet the above objectives. It is likely to be a measure that complements an overall floodplain risk management strategy for an area rather than an option that reduces flood risk on its own.

Residents currently located within the floodway and high hazard flow areas were asked to participate in a feasibility assessment for a VP scheme. The study undertaken herein was recommended as a high priority risk management measure in the FRMS&P and its key objectives are to determine the level of support from the community as well as the practicality, financial viability and applicability of the scheme to residents of Lockhart and The Rock.

### 1.1. Lockhart Shire Voluntary Purchase

The criteria presented in Table 1 have been accounted for during investigation of the Lockhart Shire VP feasibility assessment.

Generally, at Lockhart and The Rock it is appropriate to achieve mitigation of risk via flood mitigation works, sound emergency response and by ensuring appropriate development occurs within the floodplain i.e. imposing development controls such that all future development does not expose human life and significant assets to flood risk.

However, based on the mapping work carried out in the FRMS&Ps (References 6 and 7), a total

of 23 properties already lie within the high hazard floodway extent. *Hazard Categorisation* is a measure of the overall adverse effects of flooding which considers flow depth and velocity, as well as incorporating threat to life, danger and difficulty in evacuating people/possessions and the potential for damage, social disruption and loss of production. Classified land is determined to be either *low* or *high* hazard.

Table 1: Considerations for Voluntary Purchase of Properties

Consideration	Comments
<b>Flood hazard classification and associated risk to life</b>	All 23 properties identified as eligible for VP in Lockhart and The Rock are subject to high flood hazard flooding (see Reference 6 and 7). For these properties there is little other measures that can be undertaken to reduce flood risk to occupants and voluntary purchase would be the only measure which could achieve this.
<b>Hydraulic classification in relation to location in a floodway</b>	All 23 properties are identified as being with the hydraulic floodway (see Reference 6 and 7).
<b>The benefits of floodway clearance to flood affected areas</b>	By clearing the floodway and improving flow conveyance localised reductions in flood levels may occur although this is unlikely to significantly affect any properties.
<b>Economic, social and environmental costs and benefits</b>	<p>Residential properties within the voluntary purchase zone make up for some 33% of the residential AAD and 22% of the total AAD costs (commercial inclusive). Economically voluntary purchase for properties in the floodway would reduce overall flood damages for Lockhart Shire. In addition, there would be reduced costs for flood emergency response as occupants are moved from high risk areas. There will be initial economic costs with the purchase of properties, estimated to be approximately \$5.7 million for the 23 properties, although Council may be able to obtain some funding for this through the NSW Floodplain Management Program. See Section 5 for flood damages assessment.</p> <p>The social costs are generally felt by the occupants moved from their homes to other locations although this is often outweighed by the benefit of reduced flooding.</p> <p>Environmentally the costs and benefits are negligible. Returning the floodway to its natural function would allow for environmental benefits creating a designated floodway area. There are generally no environmental costs for removing development from an area, only benefits.</p>
<b>Viability of the scope and scale of the scheme and how the scheme will be prioritised generally on the basis of degree of flood hazard exposure</b>	<p>Priority for VP of the 23 homes has been based on:</p> <ol style="list-style-type: none"> <li>1. Property structural stability due to hydraulic influences and associated risk to life during flood events of various AEP;</li> <li>2. Number of /vulnerability of a property's residents;</li> <li>3. Evacuation route hydraulic hazard and access to egress; and</li> <li>4. Frequency of event for first over floor inundation and over floor inundation depth.</li> </ol> <p>Further details are presented in Section 6.</p>
<b>The support of the affected community for voluntary purchase as determined through consultation with affected owners</b>	Community consultation on voluntary purchase with property owners affected has been undertaken (see Section 4). Only three of 23 residences was not interested in being a part of the scheme indicating that community support is high. OEH require that Council reviews their voluntary purchase every three years. This provides an opportunity to remind residents in the future.
<b>An implementation plan for the scheme</b>	An implementation plan for the scheme is presented in this document.



Although measures such as flood proofing or property raising could reduce flood damages for these properties during smaller events, high hazard areas such as these make conditions unsafe for residents and emergency services personnel should evacuation be required after the onset of flooding. House raising can encourage people to remain in their properties for longer and thus increases their overall risk. Voluntary purchase of properties in the floodway removes the high hazard risk to residents at these locations and allows these areas to be classified as public open space. The purchased properties should be demolished and the land rezoned as appropriate use such as E2 Environmental Conservation or similar in the LEP so that no development may take place. The land can also be defined as floodway in Council's DCP.

A 1% AEP event at Lockhart and The Rock will cause considerable disruption, loss and risk to life. Twenty Lockhart buildings and 3 properties from The Rock will be flooded over floor level to a mean depth of 0.5 m. Many areas experience high velocities, deep flows and the potential for structural damage to buildings. While the VP Scheme is very capital intensive, it is the only feasible mitigation measure which effectively reduces flood risk and hazard for eligible residents in these study areas.

Voluntary purchase is recommended only in those instances where a property is located in the floodway or where there is a lack of egress to high land available during severe flooding and hence there is a risk of residences becoming isolated. The measure is seen as a last resort for addressing extreme flood risk when all other options are found to be impractical and is often undertaken on a social basis. Voluntary purchase has been recognised as the only feasible flood mitigation option for the residents residing in the Brookong and Burkes Creek floodways in the study areas of Lockhart and The Rock.

Individual details of the 23 properties investigated as part of this feasibility assessment are contained in Appendix C.

### **1.1.1. VP and Lockhart Shire's Floodplain Risk Management Plan**

Both the Lockhart and The Rock Floodplain Risk Management Plans (Section 6, References 6 and 7) recommend Voluntary Purchase feasibility studies be undertaken as a high priority for these two towns. A VP scheme is recommended for implementation for residential properties in areas situated in high hazard floodway (see Section 1).

Various flood mitigation options were investigated as part of the Lockhart and The Rock FRMS&P (References 6 and 7) to reduce flood risk and affectation. The following options were recommended for implementation:

#### **Lockhart**

1. Option G3 – Lockhart Government Dam Works; and
2. Option C2 – Brookong Street Channel.

## The Rock

3. Option S4 / DD2 – Upgraded drainage beneath the Railway and create new drainage channel on Davidson Street; and
4. Option ED3 / N4 / D2 / U1 – Emily Street drain, Nicholas Street levee and improved downstream drainage and Urana Street culvert upgrades.

None of the above listed flood mitigation works were able to remove flood risk and affectation for the properties selected for VP as part of this study. Accordingly, the only option available for risk mitigation for these properties is VP.

Ideally, the above listed mitigation options would occur concurrently with the VP scheme to address flood affection for all regions of both study areas. However, as the above mitigation works predominately address flooding issues relating to property damages as opposed to risk to life, it is recommended that VP be undertaken in preference to these works.

### 1.1.2. Recommendations for Mitigating Flood Risk Concurrent with VP

Due to the potentially long timeframe for a VP scheme to occur, other risk mitigation methods have been investigated as part of the Lockhart and The Rock FRMS&P (References 6 and 7) that should be implemented concurrently with the scheme to reduce risk to life.

It is recommended that for both towns early flood warning systems be installed to alert people of an impending flood. At Lockhart, it is recommended that automated rainfall and stream flow gauges be placed in the catchment to provide flood warning prior to an event. At The Rock it is recommended that an automated stream flow gauge be placed at Mangoplah to provide early flood warning. These measures will significantly reduce flood risk by allowing time for evacuation, particularly for people living in homes that are eligible for VP (i.e. within the floodway). Further details of these recommendations are contained in Section 5.6.1 of the Reference 6 and 7 studies.

### 1.1.3. Voluntary House Raising

Voluntary house raising/rebuilding is recommended only in those instances where a building is located on the low hazard flood fringe (and hence has good access to higher ground). Raising floor levels for those properties that lie well within the floodway extent may only serve to exacerbate flood risk for an event higher than the 1% AEP event as residents may remain at home and find themselves cut-off during the event. As a result, Voluntary House Raising is not recommended for eligible properties in Lockhart and The Rock as these residents are located within the high hazard floodway extent.

The Office of Environment and Heritage, Floodplain Management Program Guidelines for Voluntary House Raising Schemes (Reference 3) are presented in Appendix E.

## 1.2. Background

The townships of Lockhart and The Rock are located in Lockhart Shire Council Local Government

Area situated in the Riverina and Murray regions of southern New South Wales (NSW). Lockhart Shire is surrounded by the LGA's of Wagga Wagga, Greater Hume, Urana and Narrandera. Further details on both towns is presented in the following sections.

### **1.2.1. Lockhart**

The township of Lockhart (population 837 at the 2006 Census) is located 60 km southwest of Wagga Wagga, 56 km south of Narrandera and 97 km north of Albury in Lockhart Shire LGA. Lockhart experiences significant flooding from Brookong Creek and major overland flow.

Brookong Creek flows from north to south through the township of Lockhart and discharges into Urangeline Creek, which drains to the Murray River via Billabong Creek and the Edward River. Brookong Creek is fed by numerous small ephemeral streams. At Lockhart the Creek has a catchment area of 150 km<sup>2</sup>. Upstream of Wattles Road, the Brookong Creek channel is incised within a confined floodplain. However, downstream of the Wattles Road crossing, the Creek is highly ephemeral and the channel slope flattens and the floodplain opens up. The Creek itself consists mainly of shallow gullies that remain dry for the majority of the year.

Land use for the township of Lockhart from the LEP 2012 is shown in Figure 2 of the Lockhart FRMS&P (Reference 6). The majority of Lockhart is comprised of lots zoned RU5 Rural Village areas while Brookong Creek is designated as W1 Natural Waterway. The RU5 classification not only allows for residential properties but also commercial. All properties investigated as part of this VP feasibility assessment for Lockhart are zoned RU5.

### **1.2.2. The Rock**

The township of The Rock is located in the Lockhart Shire LGA, 25 km southwest of Wagga Wagga and 96 km north of Albury. At the 2011 census, the population was estimated at 862. The Rock is affected by flooding from Burkes Creek and runoff from Flowerpot Hill.

Burkes Creek traverses the town from East to West and has a catchment area of some 630 km<sup>2</sup> at The Rock. Burkes Creek catchment extends approximately 45 km to the southeast and includes the towns of Mangoplah, Pulletop, Burrandana and Westby. Burkes Creek is a tributary of Bullenbong Creek, its confluence is located approximately 25 km to the northwest of The Rock, downstream of the Collingullie-Jerilderie Road.

In upstream areas of the catchment and within The Rock, the channel of Burkes Creek can be characterised as being relatively deep (deeper than 10 m in some locations) and narrow (40 m wide on average), its banks are vegetated mostly by red gums. Other tree species include yellow box, white box, red stringybarks, and others. Downstream of The Rock Burkes Creek's floodplain is relatively cleared and widens out towards Bullenbong Creek.

In The Rock, land use from the 2012 LEP is shown in Figure 2 of The Rock FRMSP (Reference 7). Much of the township of The Rock comprises RU5 rural village areas while Burkes Creek is designated as W1 natural waterway. All properties investigated as part of this VP feasibility

assessment at The Rock are zoned RU5.

## 2. DATA COLLECTION AND REVIEW

### 2.1. Previous Studies

Previous studies relevant to this VP feasibility assessment are:

- Lockhart Flood Study, 2014 (Reference 4);
- Lockhart Floodplain Risk Management Study & Plan, 2014 (Reference 6);
- The Rock Flood Study, 2014 (Reference 5); and
- The Rock Floodplain Risk Management Study & Plan, 2014 (Reference 7).

Other reports pertinent to flooding, or which make extensive use of their contents, are summarised References 4 to 7. The Office of Environment and Heritage, Floodplain Management Program Guidelines for Voluntary Purchase Schemes (Reference 2) are presented in Appendix E.

Findings from these studies were used to:

- Determine a properties eligibility for inclusion in the Lockhart Shire VP feasibility assessment based on the VP criteria presented in the Reference 2 guidelines; and
- Rank each property for VP based on criteria such as flood depth, over floor flood liability, flow velocity, evacuation routes and structural stability (further details presented in Section 6).

The Management Studies (References 6 and 7) findings relating to hydraulic hazard and categorisation were used to determine a properties eligibility for inclusion in the VP scheme based on the Reference 2 guidelines. The Flood Studies (References 4 and 5) findings were used to determine the flood behaviour at each property. Information relevant to the current study obtained from the above listed studies is presented in further detail in Section 3.

Floor level survey of all properties investigated as part of this feasibility assessment was obtained as part of the Reference 6 and 7 studies.

### **3. EXISTING FLOOD ENVIRONMENT**

#### **3.1. Flood History**

##### **3.1.1. Lockhart Flood History**

Brookong Creek at Lockhart has been subjected to numerous flood events since white settlement of the town. Significant flood events causing property inundation are known to have occurred in 1934 (Reference 4), 1931, 1974 and 1939 (presented in order of magnitude). However, the March 2012 and October 2010 floods surpassed all previous flood events in term of both magnitude and damage. The March 2012 event is estimated to have had an event magnitude of 1% AEP and the October 2010 event a 2% AEP.

The March 2012 event, the larger of the two events, inundated at least 67 houses and 31 commercial/public sector buildings above floor level. Brookong Creek reached a peak level of 2.1 m at the Green Street causeway gauge and occurred at night with little warning of the impending flood. This exacerbated risk exposure during the event.

This event was 0.15 m higher than the next largest flood event which occurred in October 2010. During both events areas bordering the Creek were directly inundated by deep fast flowing water. The Rural Fire Service evacuated numerous people from their homes by boat.

##### **3.1.2. The Rock Flood History**

Burkes Creek at The Rock is known to have been subject to flooding in January 2000, December 1992, April 1989, December 1988, January 1974, March 1955, February 1939, January 1934, June 1931, February 1928 and 1927, 1912 and 1891. More recently events have also occurred in March 2010, December 2010 and January and February 2011.

However, the period from 2010 to 2012 is the wettest on record throughout NSW with The Rock experiencing record flooding. The largest of these events again occurred in October 2010 and March 2012 which had estimated 300 year ARI and 500 year ARI recurrence intervals respectively.

The March 2012 event, the largest event on record at The Rock, exceeded the second largest event, the October 2010 event by 0.2 m at the Collingullie Road Bridge and the third largest event (1931) by 0.7 m. In excess of 35 houses and 11 business/public dwellings were inundated above floor level in this event. Floodwaters in and near the Burkes Creek channel were extremely hazardous with deep, fast flowing water.

The Rock is also affected by local overland flows from Flowerpot Hill to the south of town. Flowerpot Hill produces relatively minor flows and flood depths and accordingly properties in areas affected by Flowerpot Hill flooding are not eligible for VP.

## 3.2. Design Flood Information

The information and results obtained from the Flood Study (Reference 4) defined existing flood behaviour and provide a firm basis for the development of the Voluntary Purchase Feasibility Study. Primarily, the study was developed in order to meet the objective of defining the flood behaviour for the 5-year ARI, 10%, 2%, 1%, 0.5% AEP events and the PMF in Lockhart and The Rock.

In order to define flood behaviour, the Flood Study developed a hydrological model, WBNM, in conjunction with a 1D/2D hydraulic model, TUFLOW. This methodology is presented in the Flood Study (Reference 4).

### 3.2.1. Lockhart Design Results

Critical duration assessments were undertaken to determine which storm duration is responsible for generating the highest peak flood levels due to Brookong Creek at Lockhart. For all events excluding the PMF the critical duration was found to be 6 hours. The PMF was found to have a critical duration of 3 hours.

Design peak flood depths and extents for Lockhart are presented in Figure 14 – Figure 20 of the Flood Study (Reference 4) with the associated peak flood levels and flows at the Green Street gauge displayed below in Table 2. The Green Street causeway is overtopped at a level of 152.2 mAHD and is the main road crossing that separates east and west Lockhart.

Table 2: Green Street Causeway Flow Characteristics

Event	Level (mAHD)	Stage (m)	Flow (m <sup>3</sup> /s)
5Y ARI	153.5	1.3	67
10% AEP	153.7	1.6	95
5% AEP	153.9	1.8	134
<b>October 2010</b>	154.1	2.0	177
2% AEP	154.1	2.0	185
<b>March 2012</b>	154.3	2.1	231
1% AEP	154.3	2.1	231
0.5% AEP	154.4	2.2	281
PMF	156.4	4.2	2876

\* Modelled stage and levels recorded at Green Street causeway gauge.

A result of interest is that the March 2012 flood had the same flow and peak flood level as the 1% AEP event and the October 2010 event very closely approximated the 2% AEP event. The difference in peak flood level between these two events is 0.2 m.

Specific details of flood behaviour at Lockhart for the region eligible for VP are presented in Appendix B.

### 3.2.2. The Rock Design Results

For this VP feasibility assessment only flooding from Burkes Creek is applicable as flooding from overland flows from the Flowerpot Hill and Mangoplah regions do not produce the high hazard flow conditions required for VP eligibility.

A critical duration assessment was undertaken to determine which storm duration is responsible for generating the highest peak flood levels due to Burkes Creek at The Rock. For all events excluding the PMF the critical duration was found to be 18 hours. The PMF was found to have a critical duration of 3 hours.

Peak flood depths and extents for The Rock are presented in Figure 21 through to Figure 27 of the Flood Study (Reference 5) and Figure 20 shows flood profiles for all modelled design events in The Rock along with the invert and obvert of Burkes Creek key hydraulic structures.

The Collingullie Road bridge is the main road crossing over Burkes Creek that connects the northern and southern floodplains of the creek. The bridge was overtopped during the October 2010 and the March 2012 events, causing backwatering effects and exacerbating the mainstream flooding problem. A summary of the hydraulic performance of the bridge can be seen in Table 3.

Table 3: Collingullie Road Bridge Flow Characteristics

Event	Level (mAHD)	Flow (m <sup>3</sup> /s)
5Y ARI	210.4	143
10% AEP	211.0	194
5% AEP	211.7	268
2% AEP	212.4	353
<b>Bridge Obvert</b>	212.8	-
1% AEP	212.9	439
<b>Bridge Deck Invert</b>	213.3	-
0.5% AEP	213.3	513
October 2010 (~300 year ARI)	213.5	534
March 2012 (~500 year ARI)	213.7	560
PMF	215.5	1003

The bridge only becomes overtopped for events approximating or larger than the 0.5%, as the October 2010 and the March 2012 events were.

Specific details of flood behaviour at The Rock for the region eligible for VP are presented in Appendix B.



## 4. COMMUNITY CONSULTATION

Given the voluntary basis of the mitigation works being examined, close consultation with the community was key to achieving the studies overall goals. The community at risk in Lockhart and The Rock is small enough that personal attention could be given to residents over the course of the project. During the process, heavy emphasis was placed on making sure that all participants were treated equally, communicated with respectfully and clearly, and that all communication was optimally timed in the context of the overall work and accompanied by pertinent information.

Due to the sensitive nature of VP, information pertaining to details of address and property to be considered for involvement in any VP scheme will not be made publicly available. Following an inception meeting with the floodplain risk management committee (FRMC) it was agreed that the information would be available to Council and the OEH as an Appendix (Appendix C) and each individual property owner would be issued with their relevant lot details as per the overall submission.

A newsletter (example enclosed in Appendix D) was mailed to residents within the floodplain explaining VP and inviting them to a meeting on the 13<sup>th</sup> of April 2015. The meeting took place at Lockhart Council chambers and was held in order to provide the community with information regarding the project and to identify if residents eligible for VP were interested in the scheme. Follow up discussions were then undertaken with all residents and this included a site visit as well as an assessment of the buildings themselves and their suitability for VP. The findings from these meetings are summarised in Appendix C.

The community consultation process indicated that all three eligible residents of The Rock are interested in the VP scheme. However, only 17 of 20 residents of Lockhart are interested in the VP scheme. Individual details of all properties are contained in Appendix C.

As part of the community consultation process, the Draft Final Lockhart Shire Voluntary Purchase Feasibility Assessment report was sent to each of the study's participants for scrutiny and comment. Two submissions were made and have been discussed with amendments to the report made where necessary. The submissions with names omitted and responses to these submissions are presented in Appendix F. A number of small changes to the Draft Final report in response to these submissions were made and are contained in this Final Report.

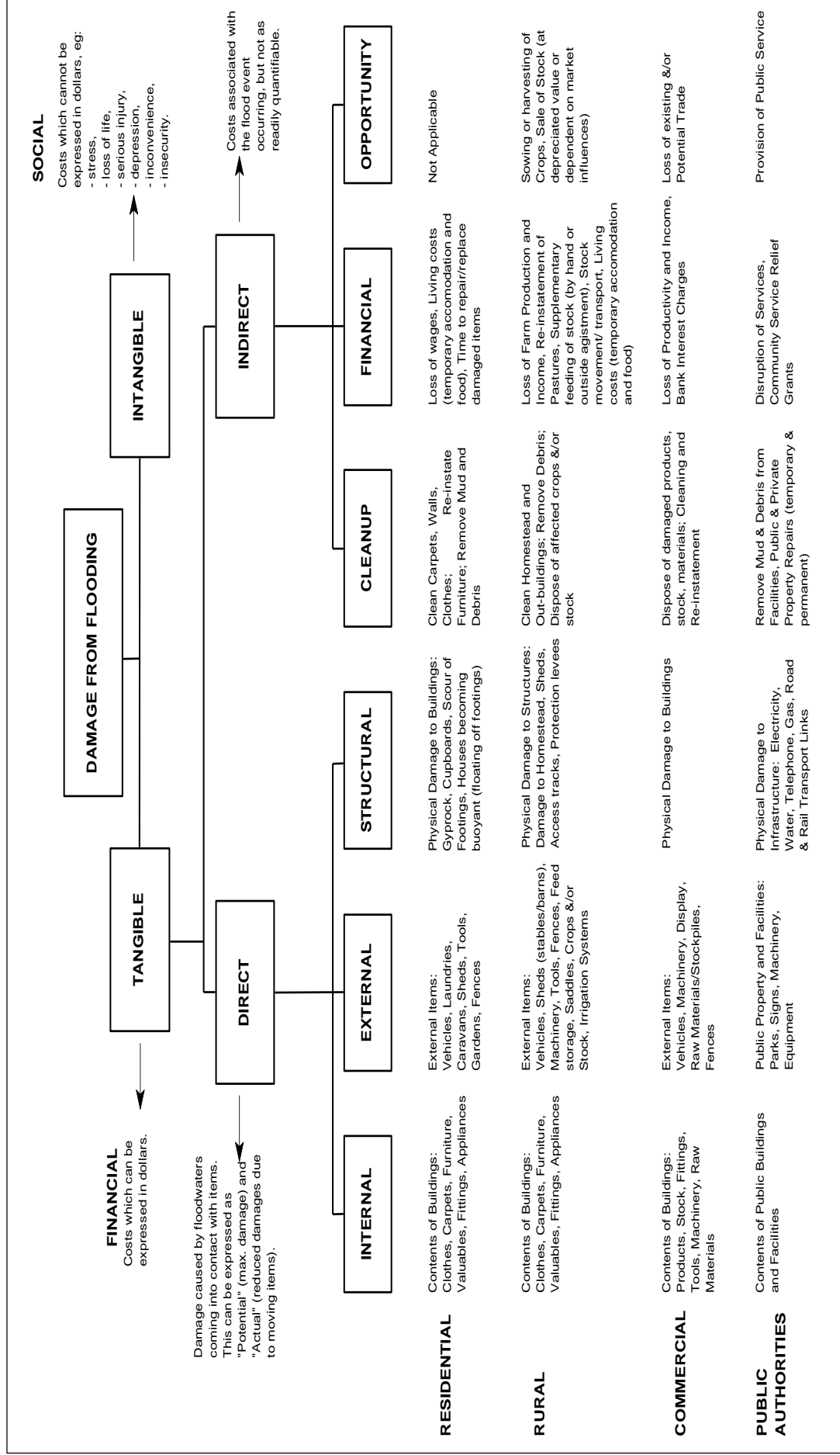
## 5. FLOOD DAMAGES

Flood impact can be quantified in the calculation of flood damages however flood damage calculations do not include all impacts associated with flooding. They provide a basis for assessing the economic loss of flooding and also a non-subjective means of assessing the merit of flood mitigation works/programs such as retarding basins, levees, drainage enhancement and VP. The quantification of flood damages is an important part of the floodplain risk management process. Quantification of flood damages enables the selection of appropriate cost effective management measures that can be analysed in terms of their benefits (reduction in damages) versus the cost of their implementation. The cost of damage and the degree of disruption to the community caused by flooding depends upon many factors including;

- The magnitude (depth, velocity and duration) of the flood;
- Land use and susceptibility to damages;
- Awareness of the community in regards to flood risk;
- Effective warning time;
- The availability and practicality of an evacuation plan or damage minimisation program;
- Physical factors such failure of services (sewerage), flood borne debris, sedimentation;
- The types of asset and infrastructure affected.

The estimation of flood damages tends to focus on the physical impact of damages on the human environment but there is also a need to consider the ecological cost and benefits associated with flooding. Flood damages can be defined as being tangible or intangible. Tangible damages are those for which a monetary value can be easily assigned, while intangible damages are those to which a monetary value cannot easily be attributed. Types of flood damages are shown on Table 4.

Table 4: Flood Damages Categories



Subsidised funding for a VP scheme is generally only available for residential properties. This damages assessment has only been carried out for properties involved in the VP feasibility assessment. In all, 20 Lockhart residential properties and 3 properties from The Rock were included in the damages assessments for the VP scheme. Of note is that the properties eligible for VP account for a very high portion of the overall AAD as determined in References 4 and 5.

## 5.1. Tangible Flood Damages

Tangible flood damages are comprised of two basic categories; direct and indirect damages (Table 4). Direct damages are caused by floodwaters wetting goods and possessions thereby damaging them and resulting in either costs to replace/repair or in a reduction to their value. Direct damages are further classified as either internal (damage to the contents of a building including carpets, furniture), structural (referring to the structural fabric of a building such as foundations, walls, floors, windows) or external (damage to all items outside the building such as cars, garages). Indirect damages are the additional financial losses caused by the flood, for example the cost of temporary accommodation, loss of wages by employees etc.

Given the variability of flooding and property and content values, the total likely damages figure in any given flood event is useful to get a feel for the magnitude of the flood problem, however it is of little value for absolute economic evaluation. Nevertheless, considering damages estimates is of use when studying the economic effectiveness of proposed mitigation options. Understanding the total damages prevented over the life of the option in relation to current damages, or to an alternative option, can assist in the decision making process.

The standard way of expressing flood damages is in terms of Average Annual Damages (AAD). AAD is equal to the damage caused by all floods over a period of time divided by the number of years in that period and represents the equivalent average damages that would be experienced by the community on an annual basis. This means that the smaller floods, which occur more frequently, are given a greater weighting than the rare catastrophic floods.

The flood damages assessment was undertaken for existing development in accordance with current OEH guidelines (Reference 11) and the Floodplain Development Manual (Reference 1). The damages were calculated with use of a number of height-damage curves which relate the depth of water above the floor with tangible damages. Each component of tangible damages is allocated a maximum value and a maximum depth at which this value occurs. For flood depths exceeding 2 m, total destruction of the property was assumed due to the high velocity flows occurring in the Lockhart floodplain causing large debris collisions likely to destroy the structural integrity of the property.

Total damage refers to the total damage estimated for a given flood event. Average damage per property is the total damage estimated for a particular flood event divided by the number of properties flood affected in this event; either by flooding on the yard and/or above floor level of a building. These are useful to compare damages likely to occur as a result of a particular design event and identify whether there are high damages for smaller events or just the larger less frequent events.

The same methodology used in the Lockhart FRMS&P (References 6) and The Rock FRMS&P (References 7) was used to determine the VP flood damages. Please see these studies for further details.

### 5.1.1. Lockhart Damages

The total estimated Lockhart AAD was determined in the Flood Study (Reference 4) to be \$726,000. Of this, approximately 70%, or \$486,000, is due to damages to residential developments. Table 5 presents the flood damages assessment for the 20 properties eligible for VP in Lockhart. An AAD of \$164,000 is obtained for Lockhart VP candidates.

Table 5: Potential Residential Damages for VP Participants in Lockhart

Event	No. Properties Affected	No. Flooded Above Floor Level	Total Damages for Event	% Contribution to AAD
<b>20% AEP</b>	11	1	\$ 129,000	12
<b>10% AEP</b>	17	9	\$ 568,000	21
<b>5% AEP</b>	20	13	\$ 1,030,000	24
<b>2% AEP</b>	20	18	\$ 1,376,000	22
<b>1% AEP</b>	20	19	\$ 1,514,000	9
<b>0.5% AEP</b>	20	20	\$ 1,716,000	5
<b>PMF</b>	20	20	\$ 2,728,000	7
<b>Average Annual Damages (AAD)</b>			<b>\$ 164,000</b>	

A VP scheme cost per property of \$250,000 has been assumed which is slightly higher than the 'realestate.com' listed median price (\$180,000). It has been assumed that the flood unencumbered (i.e. not affected by flooding) house price of homes bordering Brookong Creek is likely higher than Lockhart as a whole and also accounts for other VP costs such as property valuation, legal fees, demolition, lot clean up etc. This brings the total cost of the voluntary purchase scheme to \$5 million assuming all residents participate in the scheme. The AAD would be reduced by \$164,000. Assuming a 50-year time period, the Net Present Value (NPV) of the reduction in damages is \$2.4 million giving a B/C ratio of 0.5 for the entire town of Lockhart.

Although the B/C ratio is low, the damages assessment does not include for intangible damages to people such as loss of life and stress for which removing themselves from the floodway and high hazard flood area is the only way of minimising this. Neither does it account for the increased risk to emergency services due to likely required rescues.

It should be noted that due to the voluntary nature of the process and its potentially lengthy duration (it may take 15-20 years subject to funding), the AAD and estimated property purchase price could change significantly throughout the course of the scheme.

### 5.1.2. The Rock Damages

The total estimated The Rock AAD was determined in the Flood Study (Reference 5) to be \$261,000 due to residential damages. Table 6 presents the flood damages assessment for the three properties eligible for VP in The Rock. An AAD of \$5,500 is obtained for The Rock VP candidates.

Table 6: Potential Residential Damages for VP Participants in The Rock

Event	No. Properties Affected	No. Flooded Above Floor Level	Total Damages for Event
20% AEP	0	0	\$ -
10% AEP	0	0	\$ -
5% AEP	0	0	\$ -
2% AEP	2	1	\$ 72,000
1% AEP	3	3	\$ 226,000
0.5% AEP	3	3	\$ 269,000
PMF	3	3	\$ 403,000
<b>Average Annual Damages (AAD)</b>			<b>\$ 5,500</b>

A VP scheme cost per property of \$300,000 has been assumed which is slightly higher than the 'realestate.com' listed median price (\$239,000). It has been assumed that the flood unencumbered (i.e. not affected by flooding) house price of homes bordering Burkes Creek is likely higher than Lockhart as a whole and also accounts for other VP costs such as property valuation, legal fees, demolition, lot clean up etc. A total VP scheme cost of approximately \$900,000 is estimated for purchase of the three properties. A damage assessment was undertaken to determine the B/C ratio assuming the purchase of three homes under the voluntary purchase scheme. Total flood damages for the three properties in the 1% AEP event are in the order of \$ 226,000 with the average total event damage per property at around \$ 75,000. A B/C ratio has been estimated for voluntary purchase of the three properties assuming a cost of \$ 750,000. AAD is reduced by \$ 5,500 (see Table B 10). Assuming a 50-year time period, the NPV of the reduction in damages is \$ 79,400 giving a B/C ratio of 0.1.

The B/C ratio does not include for intangible damages to people such as loss of life and stress as a result of floods. Neither does it account for the increased risk to emergency services due to likely required rescues.

### 5.2. Intangible Flood Damages

The intangible damages associated with flooding, by their nature, are inherently more difficult to estimate in monetary terms. In addition to the tangible damages discussed above, additional costs/damages are incurred by residents affected by flooding, such as stress, risk/loss to life, injury, loss of sentimental items etc. It is not possible to put a monetary value on the intangible damages as they are likely to vary dramatically between each flood (from a negligible amount to several hundred times greater than the tangible damages) and depend on a range of factors such

as the size of flood, the individuals affected, and community preparedness. However, it is still important that the consideration of intangible damages is included when considering the impacts of flooding on a community.

Post flood damages surveys have linked flooding to stress, ill-health and trauma for the residents. For example the loss of memorabilia, pets, insurance papers and other items without fixed costs and of sentimental value may cause stress and subsequent ill-health. In addition flooding may affect personal relationships and lead to stress in domestic and work situations. In addition to the stress caused during an event (from concern over property damage, risk to life for the individuals or their family, clean up etc.) many residents who have experienced a major flood are fearful of the occurrence of another flood event and the associated damage. The extent of the stress depends on the individual and although the majority of flood victims recover, these effects can lead to a reduction in quality of life for the flood victims.

During any flood event there is the potential for injury as well as loss of life due to causes such as drowning, floating debris or illness from polluted water. Generally, the higher the flood velocities and depths the higher the risk. The Brookong and Burkes Creek floodways at Lockhart and The Rock are high hazard flow area that poses significant risk to life during flood.

## 6. VP ELIGIBILITY RANKING CRITERIA

The process of assigning a priority rank to properties eligible for VP considered a number of criteria with the highest priority assigned to those which were considered to have the greatest risk to life. These criteria are:

1. Property structural stability due to hydraulic influences and associated risk to life during flood events of various AEP (see Section 6.1);
2. Number of /vulnerability of a property's residents (see Section 6.2);
3. Evacuation route hydraulic hazard and access to egress (see Section 6.3); and
4. Frequency of event for first over floor inundation and over floor inundation (see Section 6.4) depth.

The above criteria were individually assessed and ranked to determine an overall VP priority rank for eligible properties.

### 6.1. Property Structural Stability and Risk to Life

The structural integrity of the building has been considered as the highest priority during the VP ranking process. Risk is increased if structural stability is compromised during a flood event as residents are unable to safely remain in their homes. Recent large flood events in the Lockyer Valley (2011 flood) and Dungog (2015 flood) reveal the potential for increased risk to life for residents if they do not/ cannot evacuate prior to structural failure.

An examination of building stability during flood events of various AEP has been completed as part of this study. Proposed stability criteria for buildings as presented in the Reference 12 study are presented in Image 1. There is considerable variability in the range of criteria specified in literature for the stability of buildings of varying construction types exposed to floodwaters. While the considerable variability is acknowledged, the analysis of building damage leading to collapse reported by Mason et al. (2012) for the Lockyer Valley floods in January 2010 is compelling. This work shows that buildings constructed for Australian conditions are vulnerable to damage and collapse under flood hazard conditions at the lower end of the scale, toward the green curve in Image 1.

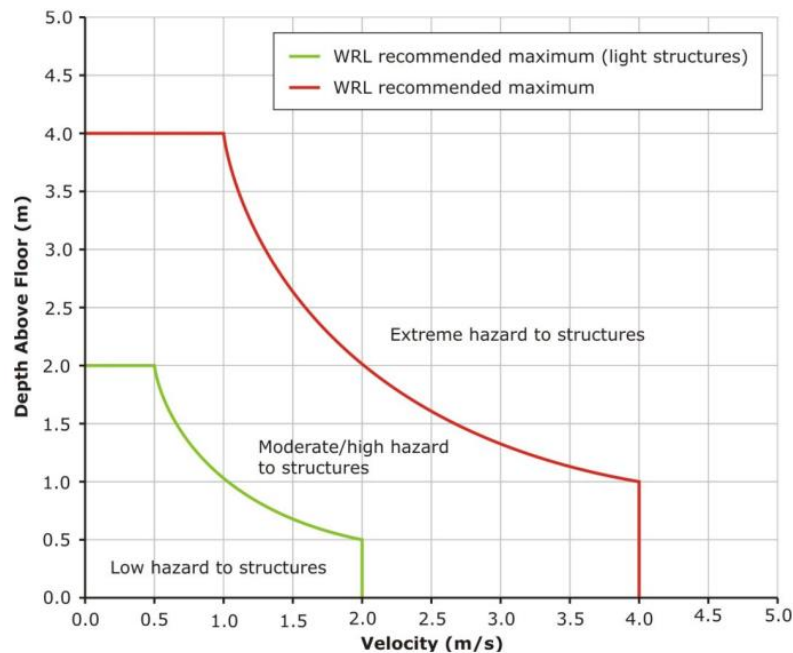
The green curve is proposed as a lower threshold for buildings constructed without consideration of flood forces. The hazard zone between the green curve and the upper limit red curve identifies flood hazard conditions where it is considered possible to design and build a structure capable of withstanding flood forces if required. Purpose built structures in such flood affected locations should be designed by suitably qualified engineers specifically to withstand the full range of anticipated flood forces which include: hydrostatic forces; buoyancy forces; hydrodynamic forces including impulsive, uplift and debris impact forces; damming of waterborne debris; wave actions; and erosion and scour.

It should be noted that all structures eligible for VP at Lockhart and The Rock have not taken these factors into account during construction and are therefore could potentially suffer from compromised stability once the moderate to high hazard to structures threshold is exceeded.



It should be noted that building and foundation design have not been investigated as part of this study and only the hydraulic influences on structural stability have been determined. Some variability depending on design characteristics may impact on the true building stability criteria for each property, however further investigation is outside the scope of the current study.

Image 1: Proposed Thresholds for Building Stability in Floods



A number of properties in both Lockhart and The Rock have been determined to have a moderate to high hazard to structure during the 1% AEP flood event and many properties have been determined to have an extreme hazard to structure during the PMF event. Each property's estimated structural stability for events of various AEP are displayed in Appendix C.

## 6.2. Number of / Vulnerability of Residents

The number of residents per property and the level of vulnerability of these residents has been considered when evaluating VP priority ranking. Residents that are vulnerable include children, disabled and the elderly. Vulnerable residents cannot withstand as high flood depths and velocities as the general population and thus are more exposed to risk during a flood event.

Additionally, the number of residents at a property directly impacts on the number of lives at risk and the number of people requiring evacuation. More people at a property increases requirements on emergency rescue personnel needed to assist residents during evacuation.

## 6.3. Evacuation Route Hydraulic Hazard and Access to Egress

The potential evacuation route for each property has been analysed. This includes the evacuation distance to the flood extent as well as flow velocities and depths. While a property may not be subject to treacherous flood conditions, there may be significant risk to life for residents as they evacuate to safer areas. This is directly impacted by the flow velocity and depth which is termed as hydraulic hazard. Increased hydraulic hazard during evacuation can endanger the lives of

residents and rescue personnel. For example, residents noted that during the 2012 floods that flood flows hindered a rescue boats ability to travel in an upstream direction, increasing the risk and difficulty of evacuation.

Reference 12 provides plots that present the thresholds for people and vehicle stabilities in flood. The escape routes of many properties exceed hazard thresholds for both people and vehicles in events exceeding the 5% AEP.

#### **6.4. Over Floor Inundation Frequency and Depth**

As a final measure of the VP assessment, over floor inundation depth at each property was taken into account. While the depth above floor level can be disastrous from a monetary and personal position, it does not necessarily pose a threat to the lives of residents. Therefore, the depth above floor level has been assigned a moderate priority during the VP ranking process. Since several properties often had similar characteristics in terms of risk to life, the depth of over flood inundation was used to differentiate these residences to develop a ranking order with priority given to properties that are flooded the most frequently or severely.

The over floor inundation depths for each property for events of various AEP are presented in Appendix B and Appendix C.

## 7. CONCLUSIONS

Residents currently located within the floodway and high hazard flow areas were asked to participate in a feasibility assessment for a VP scheme at Lockhart and The Rock. All but three properties indicated that they are interested in involvement with the VP scheme indicating that the level of community support is high. The study undertaken herein was recommended as a high priority risk management measure in the FRMS&P based on the location of these properties in relation to the floodway and high hazard conditions. The financial viability of the scheme has been assessed and each of the properties analysed in this study fit the criteria for eligibility for VP as presented in Section 1. These properties have then been prioritised based on the criteria presented in Section 6.

It is recommended that VP schemes for both Lockhart and The Rock are undertaken to reduce risk to life associated with flooding.

## **8. ACKNOWLEDGEMENTS**

WMAwater wish to acknowledge the assistance of Lockhart Shire Council staff in carrying out this study as well as the residents of Lockhart and The Rock. Lockhart Shire Council has prepared this document with financial assistance from the NSW and Commonwealth Governments through the Natural Disaster Resilience Program. This document does not necessarily represent the opinions of the NSW or Commonwealth Governments.

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**APPENDIX A: GLOSSARY**

Taken from the Floodplain Development Manual (April 2005 edition)

acidsulfate soils	Are sediments which contain sulfidic mineral pyrite which may become extremely acid following disturbance or drainage as sulfur compounds react when exposed to oxygen to form sulfuric acid. More detailed explanation and definition can be found in the NSW Government Acid Sulfate Soil Manual published by Acid Sulfate Soil Management Advisory Committee.
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500 m <sup>3</sup> /s has an AEP of 5%, it means that there is a 5% chance (that is one-in-20 chance) of a 500 m <sup>3</sup> /s or larger event occurring in any one year (see ARI).
Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
Average Annual Damage (AAD)	Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time.
Average Recurrence Interval (ARI)	The long term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
caravan and moveable home parks	Caravans and moveable dwellings are being increasingly used for long-term and permanent accommodation purposes. Standards relating to their siting, design, construction and management can be found in the Regulations under the LG Act.
catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
consent authority	The Council, government agency or person having the function to determine a development application for land use under the EP&A Act. The consent authority is most often the Council, however legislation or an EPI may specify a Minister or public authority (other than a Council), or the Director General of DIPNR, as having the function to determine an application.



development	<p>Is defined in Part 4 of the Environmental Planning and Assessment Act (EP&amp;A Act).</p> <p><b>infill development:</b> refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development.</p> <p><b>new development:</b> refers to development of a completely different nature to that associated with the former land use. For example, the urban subdivision of an area previously used for rural purposes. New developments involve rezoning and typically require major extensions of existing urban services, such as roads, water supply, sewerage and electric power.</p> <p><b>redevelopment:</b> refers to rebuilding in an area. For example, as urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale. Redevelopment generally does not require either rezoning or major extensions to urban services.</p>
disaster plan (DISPLAN)	A step by step sequence of previously agreed roles, responsibilities, functions, actions and management arrangements for the conduct of a single or series of connected emergency operations, with the object of ensuring the coordinated response by all agencies having responsibilities and functions in emergencies.
discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m <sup>3</sup> /s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).
ecologically sustainable development (ESD)	Using, conserving and enhancing natural resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be maintained or increased. A more detailed definition is included in the Local Government Act 1993. The use of sustainability and sustainable in this manual relate to ESD.
effective warning time	The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions.
emergency management	A range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding.
flash flooding	Flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. Often defined as flooding which peaks within six hours of the causative rain.
flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
flood awareness	Flood awareness is an appreciation of the likely effects of flooding and a knowledge of the relevant flood warning, response and evacuation procedures.

flood education	Flood education seeks to provide information to raise awareness of the flood problem so as to enable individuals to understand how to manage themselves and their property in response to flood warnings and in a flood event. It invokes a state of flood readiness.
flood fringe areas	The remaining area of flood prone land after floodway and flood storage areas have been defined.
flood liable land	Is synonymous with flood prone land (i.e. land susceptible to flooding by the probable maximum flood (PMF) event). Note that the term flood liable land covers the whole of the floodplain, not just that part below the flood planning level (see flood planning area).
flood mitigation standard	The average recurrence interval of the flood, selected as part of the floodplain risk management process that forms the basis for physical works to modify the impacts of flooding.
floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is, flood prone land.
floodplain risk management options	The measures that might be feasible for the management of a particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options.
floodplain risk management plan	A management plan developed in accordance with the principles and guidelines in this manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.
flood plan (local)	A sub-plan of a disaster plan that deals specifically with flooding. They can exist at State, Division and local levels. Local flood plans are prepared under the leadership of the State Emergency Service.
flood planning area	The area of land below the flood planning level and thus subject to flood related development controls. The concept of flood planning area generally supersedes the flood liable land concept in the 1986 Manual.
Flood Planning Levels (FPLs)	FPLs are the combinations of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. FPLs supersede the standard flood event in the 1986 manual.
flood proofing	A combination of measures incorporated in the design, construction and alteration of individual buildings or structures subject to flooding, to reduce or eliminate flood damages.
flood prone land	Is land susceptible to flooding by the Probable Maximum Flood (PMF) event. Flood prone land is synonymous with flood liable land.
flood readiness	Flood readiness is an ability to react within the effective warning time.

flood risk	<p>Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below.</p> <p><b>existing flood risk:</b> the risk a community is exposed to as a result of its location on the floodplain.</p> <p><b>future flood risk:</b> the risk a community may be exposed to as a result of new development on the floodplain.</p> <p><b>continuing flood risk:</b> the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.</p>
flood storage areas	<p>Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.</p>
floodway areas	<p>Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flows, or a significant increase in flood levels.</p>
freeboard	<p>Freeboard provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level.</p>
habitable room	<p><b>in a residential situation:</b> a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom.</p> <p><b>in an industrial or commercial situation:</b> an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.</p>
hazard	<p>A source of potential harm or a situation with a potential to cause loss. In relation to this manual the hazard is flooding which has the potential to cause damage to the community. Definitions of high and low hazard categories are provided in the Manual.</p>
hydraulics	<p>Term given to the study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity.</p>
hydrograph	<p>A graph which shows how the discharge or stage/flood level at any particular location varies with time during a flood.</p>
hydrology	<p>Term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.</p>
local overland flooding	<p>Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.</p>
local drainage	<p>Are smaller scale problems in urban areas. They are outside the definition of major drainage in this glossary.</p>

mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
major drainage	<p>Councils have discretion in determining whether urban drainage problems are associated with major or local drainage. For the purpose of this manual major drainage involves:</p> <ul style="list-style-type: none"> <li>\$ the floodplains of original watercourses (which may now be piped, channelised or diverted), or sloping areas where overland flows develop along alternative paths once system capacity is exceeded; and/or</li> <li>\$ water depths generally in excess of 0.3 m (in the major system design storm as defined in the current version of Australian Rainfall and Runoff). These conditions may result in danger to personal safety and property damage to both premises and vehicles; and/or</li> <li>\$ major overland flow paths through developed areas outside of defined drainage reserves; and/or</li> <li>\$ the potential to affect a number of buildings along the major flow path.</li> </ul>
mathematical/computer models	The mathematical representation of the physical processes involved in runoff generation and stream flow. These models are often run on computers due to the complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain.
merit approach	<p>The merit approach weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and well being of the States rivers and floodplains.</p> <p>The merit approach operates at two levels. At the strategic level it allows for the consideration of social, economic, ecological, cultural and flooding issues to determine strategies for the management of future flood risk which are formulated into Council plans, policy and EPIs. At a site specific level, it involves consideration of the best way of conditioning development allowable under the floodplain risk management plan, local floodplain risk management policy and EPIs.</p>
minor, moderate and major flooding	<p>Both the State Emergency Service and the Bureau of Meteorology use the following definitions in flood warnings to give a general indication of the types of problems expected with a flood:</p> <p><b>minor flooding:</b> causes inconvenience such as closing of minor roads and the submergence of low level bridges. The lower limit of this class of flooding on the reference gauge is the initial flood level at which landholders and townspeople begin to be flooded.</p> <p><b>moderate flooding:</b> low-lying areas are inundated requiring removal of stock and/or evacuation of some houses. Main traffic routes may be covered.</p> <p><b>major flooding:</b> appreciable urban areas are flooded and/or extensive rural areas are flooded. Properties, villages and towns can be isolated.</p>
modification measures	Measures that modify either the flood, the property or the response to flooding. Examples are indicated in Table 2.1 with further discussion in the Manual.
peak discharge	The maximum discharge occurring during a flood event.

Probable Maximum Flood (PMF)	The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation, and where applicable, snow melt, coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study.
Probable Maximum Precipitation (PMP)	The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to PMF estimation.
probability	A statistical measure of the expected chance of flooding (see AEP).
risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
runoff	The amount of rainfall which actually ends up as streamflow, also known as rainfall excess.
stage	Equivalent to water level. Both are measured with reference to a specified datum.
stage hydrograph	A graph that shows how the water level at a particular location changes with time during a flood. It must be referenced to a particular datum.
survey plan	A plan prepared by a registered surveyor.
water surface profile	A graph showing the flood stage at any given location along a watercourse at a particular time.
wind fetch	The horizontal distance in the direction of wind over which wind waves are generated.

 Appendix B

 Appendix C







John Citizen

Mailout\_Letter\_Lockhart\_VP.docx

XX Lockhart Street  
LOCKHART NSW 2656

1 May 2015

**Attention: John Citizen**

Dear Mr Citizen,

**Re: XX Lockhart Street, Lockhart - Voluntary Purchase Feasibility Assessment**

Under the NSW Government's Flood Prone Land Policy, management of flood prone land is primarily the responsibility of Councils. WMAwater completed the Floodplain Risk Management Study and Plan (FRMS&P) for Lockhart Shire Council in August 2014 and identified a number of properties situated in priority flood areas. The FRMS&P determined that the feasibility of reducing flood risk through a NSW Government Voluntary Purchase (VP) Scheme flood risk for these properties should be assessed.

Your property, XX Lockhart Street Lockhart, has been identified as being potentially eligible for VP and is therefore being assessed as part of this VP feasibility assessment.

VP is an effective strategy where other flood mitigation measures, such as levees, are impractical and the risks due to flooding are high. It involves removing residential properties from the high hazard areas by purchasing them from willing sellers (at a fair and reasonable price), demolishing them and rezoning the land thus allowing the residents to relocate to less hazardous areas while ensuring that no reoccupation of the vacated high hazard area occurs. Further details are provided in the enclosed "Floodplain Management Program Guidelines for voluntary purchase schemes".

**Come along to our Community Information Day**  
**When: Monday 13<sup>th</sup> April at 6:30 pm to 8:00 pm**  
**Where: Lockhart Community Hall**

You are invited to attend a community information session **Monday 13<sup>th</sup> April 2015 at 6:30 pm at the Lockhart Community Hall**. This information session will provide information details in regard to the VP feasibility assessment process for interested parties.

**WMAwater Pty Ltd (Formerly Webb McKeown and Associates)**

**DIRECTORS**

M K Babister  
R W Dewar  
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In the days following the information session WMAwater engineers will be meeting with residents that have expressed interest in the VP scheme. You will be contacted prior to the information session to arrange a meeting time.

**Please note that the VP scheme is entirely voluntary, residents are under no obligation to be involved in the scheme and may withdraw from this process at any stage.**

Please feel free to contact either of the two project contacts displayed below for additional information.



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Yours Sincerely,  
**WMAwater**

A handwritten signature in blue ink, appearing to read "Zac Richards", is written in a cursive style.

**Zac Richards**  
Project Engineer



# Floodplain Management Program Guidelines for voluntary purchase schemes

## 1. Introduction

This guideline has been prepared for councils seeking funding from the NSW Government's Floodplain Management Program to implement voluntary purchase (VP) schemes.

This guideline details the objectives, eligibility criteria, funding and implementation procedure for a VP scheme that has been included in a council's adopted Floodplain Risk Management Plan (FRMP) as part of a set of flood risk management measures. It does not provide guidance on assessing the viability of VP as a management option as part of an FRMP.

Councils should discuss all proposed voluntary purchase schemes and their potential for funding with their Office of Environment and Heritage (OEH) representative.

## 2. Objectives

VP is a recognised and effective floodplain risk management measure for existing properties in areas where:

- there are highly hazardous flood conditions from riverine or overland flooding and the principal objective is to remove people living in these properties and reduce the risk to life of residents and potential rescuers
- a property is located within a floodway<sup>1</sup> and the removal of a building may be part of a floodway clearance program that aims to reduce significant impacts on flood behaviour elsewhere in the floodplain by enabling the floodway to more effectively perform its flow conveyance function
- purchase of a property enables other flood mitigation works (such as channel improvements or levee construction) to be implemented because the property will impede construction or may be adversely affected by the works with impacts not able to be offset.

VP can be an effective strategy where it is impractical or uneconomic to mitigate the high flood hazard to an existing property and it is more appropriate to cease occupation to meet the above objectives. It is likely to be a measure that complements an overall floodplain risk management strategy for an area rather than an option that reduces flood risk on its own.

## 3. Consideration of properties for VP

Assessing the viability of a VP scheme or an individual property for VP is part of a collective assessment of floodplain risk management options for the community when an FRMP is developed. The FRMP will be adopted by the council and should have considered:

- flood hazard classification and associated risk to life
- hydraulic classification in relation to location in a floodway
- the benefits of floodway clearance to the flood-affected areas

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<sup>1</sup> Area of the floodplain where a significant discharge of water occurs during floods

- economic, social and environmental costs and benefits
- viability of the scope and scale of the scheme and how the scheme will be prioritised generally on the basis of degree of flood hazard exposure
- identification of each affected property and the buildings on them
- the support of the affected community for VP as determined through consultation with affected owners
- an implementation plan for the scheme.

#### 4. Defining the scope of a new VP scheme

Although properties may have been identified for VP within an FRMP, a more detailed assessment may be required to scope, cost and fully prioritise the VP scheme prior to making an application for funding of the scheme. This assessment will involve consideration of the items identified in Section 3 above.

This may involve development in consultation with OEH flood staff of a short report which is eligible for funding through the normal application process under the Floodplain Management Program. Completion of a new works project ranking form is recommended as part of the report as this will provide an indication of the potential priority of the VP scheme. The new works project ranking form can be downloaded from [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm).

Inclusion of a property in a council's VP scheme places no obligation on the owner to sell the property or on the council or NSW Government to fund the purchase of the property. Owner participation in the scheme is voluntary and there are limitations on the availability of funding.

#### 5. Eligibility criteria for funding a VP scheme

The following criteria need to be met for a property within a VP scheme to be eligible for funding:

1. Only councils are eligible to apply for funding under the program. It is not open directly to individuals. Requests from home owners for properties to be purchased for hardship reasons are not eligible for funding.
2. VP will be considered only where no other feasible flood risk management options are available to address the risk to life at the property.
3. Subsidised funding is generally only available for residential properties and not commercial and industrial properties.
4. Funding is only available for properties where the buildings were approved and constructed prior to 1986 when the original Floodplain Development Manual was gazetted by the State Government. Properties built after this date should have been constructed in accordance with the principles in the manual.
5. The individual properties within a scheme should be identified<sup>2</sup> within an FRMP developed in accordance with the [Floodplain Development Manual](#) (2005) and adopted by the council.
6. Funding under the program is only available for properties identified in a VP scheme that has been fully defined, scoped and prioritised. The report to scope and prioritise the VP scheme is eligible for funding.

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<sup>2</sup> Individual properties do not need to be identified within the FRMP itself; they can be included within a commercial and confidential appendix.

7. Under limited circumstances, VP can be considered for funding prior to completion of an FRMP. However appropriate investigations and assessments need to be completed and clear and compelling evidence provided as the basis for expediting consideration ahead of a completed FRMP. This would generally include scoping the VP scheme.
8. Properties being considered for VP should be located:
  - within high hazard areas where there is a significant risk to life for occupants and those who may have to evacuate or rescue them – However, a house in a location that is classed as high hazard on the basis of depth or provisional hazard alone would not be automatically eligible for VP. Hazard categorisation should be based on the true hazard assessment and consider a range of other factors that influence flood hazard as detailed in the [Floodplain Development Manual](#) (2005).
  - within a floodway where the removal of the house may be part of a floodway clearance program aimed to reduce the significant impacts caused by the existing development on flood behaviour elsewhere in the floodplain and enable the floodway to more effectively perform its flow conveyance function
  - within the footprint of a proposed flood mitigation measure or where a flood mitigation measure may result in a significant increase in flood risk to a house that cannot be protected – Eligibility will be considered as part of the detailed investigation and design for the works project. Funding the purchase of the property would be considered as part of the total works package which could include pre-construction activities.
9. Unless it is being purchased to facilitate a mitigation work, vacant land is not generally eligible for funding as it does not achieve the main aim of VP. Development controls should be used to limit the potential development of vacant land so that this is consistent with the flood function and flood hazard at the location.
10. Two- or multi-storey properties may be eligible for funding despite the upper floors not being directly affected by over-floor flooding. Residents retreating to the upper floors and their potential rescuers may still face significant risk to life and the building may not be designed to be structurally sound for the potential range of flood conditions. An additional hazard assessment needs to be undertaken to confirm eligibility of multi-storey properties.

## 6. Eligible/ineligible costs

Costs **eligible for funding** are those that support the purchase of the property including:

- actual purchase price, where this is within the range of a valuation undertaken in accordance with Valuer General requirements to provide a range that is considered fair and equitable in relation to market value
- legal costs of the council
- vendor's legal costs for the sale of the property
- valuation fees
- demolition costs that are incurred within six months of purchase – Eligibility for subsidy of demolition costs outside this period is subject to the agreement of OEH. If unforeseen elements, such as asbestos removal, are discovered during the demolition, the inclusion of these fees will need to be discussed with OEH.

Councils are generally offered funding based on the projected total cost over the three-year period of the scheme at a funding ratio of \$2 State to \$1 Council or local contribution. Where the council believes that their specific financial circumstances warrant a higher funding ratio, this should be discussed with OEH staff.

Costs which are **not eligible for funding** are:

- solatium<sup>3</sup> (set compensation amount payable to cover the non-financial inconvenience of relocation)
- removalist costs
- fees associated with any purchase of a new property by the VP vendor
- administrative costs
- retrospective works (with the exception of valuation fees)
- vendor legal costs for purchase of a new property
- costs of maintaining the land after purchase
- costs associated with rezoning the land
- house and land costs outside the range of the valuation outlined above, although the council may purchase the property for more than the maximum valuation.

## 7. Implementation procedure

### Applying for funding

If a scoping study is required to be completed prior to application for a VP scheme, as detailed in Section 4 above, the following steps apply:

- An application is made to undertake a scoping study for the proposed scheme during a funding round. Standard details relating to the provision of grants and a sample funding agreement are available at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm). The council must also submit the accompanying *New Works Project Ranking Form* also available at this web address. Note this may not be required if the scheme was sufficiently scoped through the FRMP process.
- The scoping study report is finalised in consultation with OEH and the scoping study grant is acquitted.

Once all of the required information detailed in Section 3 above is available through either the completion of a scoping report or the FRMP process, the following steps apply:

- The council submits a funding application for the VP scheme to OEH during a funding round. Standard details relating to the provision of grants and a sample funding agreement are available at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm).
- The application should outline the scope of the VP scheme, progress on scheme implementation to date and the number of properties that the council wishes to purchase in the three-year funding round in priority order. The council must also submit the accompanying *New Works Project Ranking Form* available at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm)
- OEH reviews the funding application and confirms that all required information to make an assessment is available. If insufficient evidence has been provided, additional information will be requested from the council. If not already completed, this may require the completion of a specific study to scope the VP scheme as outlined above.

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<sup>3</sup> In the context of VP, 'solatium' is the compensation for non-financial disadvantage resulting from the necessity of a person to relocate their principal place of residence.

- Applications are reviewed by the State Flood Mitigation Assessment Committee and recommendations made to the Minister for approval. Consideration of funding for all flood risk management projects is based on statewide prioritisation for a maximum three-year period. Where a VP scheme is considered a priority and therefore recommended for funding, this is generally provided through access to the statewide Voluntary Purchase/Voluntary House Raising Pool (VP/VHR Pool) for a three-year period.
- If approved, the council will be notified by OEH that they have been given access to the VP/VHR Pool and outlining the conditions of access to the pool for VP.

## **Purchasing properties**

The council approaches eligible property owners in the VP scheme in priority order. However, given the voluntary nature of VP, the owners of these properties may not be willing to sell when initially approached and the owners of properties with lower priority in the VP scheme can then be approached. The council may wish to seek non-binding expressions of interest from a number of owners to expedite this process.

For each property:

- Where an owner is interested, the council should advise OEH and confirm that funds are available from the VP/VHR Pool for the purchase.
- The council should obtain a valuation in accordance with the Valuer General requirements to provide a range that is considered fair and equitable in relation to market value. This provides a basis for determining the maximum value that is eligible for subsidy. The valuation should assume no VP scheme is in place, consider the requirements for minimum floor levels due to flooding, but disregard any flood-related development constraints that may apply on that land due to its flood hazard. The valuation should be undertaken by a registered land and house valuer.
- The council should negotiate with the owners in accordance with its procedures.

Before entering into a binding contract with a recipient for VP or bidding at an auction, the council must:

- receive written confirmation from OEH that funds are still available from the VP/VHR pool as this may have altered due to the timescales involved
- submit a work plan for the purchase of the property, in accordance with the template provided on the OEH website at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm) – The work plan includes proposed milestones and associated payments for eligible costs. The council will receive written confirmation if the work plan is approved.
- enter into a funding agreement with OEH detailing the cost-sharing arrangement between the council and OEH for the estimated amount covering eligible costs as outlined in the approved work plan.

The council may then enter into a contract with a recipient for VP or bid at an auction.

## **Actions by councils to ensure outcomes**

Once the property is purchased, the house must be vacated as a matter of priority and remain vacant unless agreed to in writing by OEH.

Except for heritage-listed buildings or where agreed to in writing by OEH, once a property has been purchased as part of a VP scheme, all buildings/structures must be demolished in accordance with environmental, disposal, work safe and OH&S controls as soon as possible (ideally within six months) and either:



- the site rezoned to an appropriate land use compatible with the flood hazard (such as open space), or
- where rezoning is not expeditious, the application of development controls to the land in the interim to ensure that any future redevelopment is compatible with the flood hazard and flood function at the site.

For heritage-listed buildings or where agreed to in writing by OEH, the buildings can remain. However, the land should be rezoned to an appropriate flood-compatible use and occupancy of the building and property limited to uses compatible with the flood risk. The council should advise OEH of the intended use.

Grant funding would be provided in accordance with the milestones in the approved work plan following submission of an expenditure certificate and milestone report to OEH. This should include evidence of completion of the stage, that is, completion of scoping study, property purchase and/or demolition.

Any profits from the sale of land purchased under a VP scheme funded from the VP/VHR pool must be returned to the pool, in line with the funding ratio, prior to the grant being acquitted.

### **Monitoring and review**

The council is required to keep OEH informed of progress in line with the work plan. Where difficulties arise and the council is unable to spend the agreed grant amount under the funding agreement in the required timeframe, the council is required to inform OEH as soon as possible to enable other VP/VHR projects to proceed.

The council should review the scope of a VP scheme every three years or before submitting a new application for funding under the program. This review should confirm the eligibility and priority of the properties under the scheme and be submitted to support the application.

### **Acquittal**

Grants should be acquitted (as outlined in the agreed funding agreement) in line with funding agreements and associated documentation provided. This should include evidence of the transfer of the land into the council's name and the submission of a final report in accordance with the template provided on the OEH website.

Where a purchase is not completed and costs have been incurred for valuations, a claim may be submitted to OEH supported by evidence of the expenditure for payment.

## **8. References**

Department of Infrastructure, Planning and Natural Resources (2005), [Floodplain Development Manual](#), New South Wales Government, Sydney

# Floodplain Management Program

## Guidelines for voluntary house raising schemes

### 1. Introduction

This guideline has been prepared for councils seeking funding from the NSW Government's Floodplain Management Program for voluntary house raising (VHR) schemes.

This guideline details the objectives, eligibility criteria, funding and implementation procedure for a VHR scheme that has been included in a council's adopted Floodplain Risk Management Plan (FRMP) as part of a set of floodplain risk management measures. It provides general information in relation to the process but does not cover all specific circumstances or provide guidance on assessing the viability of VHR as a management option as part of an FRMP.

Councils should discuss all proposed voluntary housing raising schemes and their potential to attract funding with their Office of Environment and Heritage (OEH) representative.

### 2. Objectives

VHR is recognised as an effective floodplain risk management measure for both riverine and overland flood conditions. It is generally undertaken to:

- reduce the frequency of exposure to flood damage of the house and its contents – Reducing the frequency of household disruption, associated trauma and anxiety, and clean up after floods may also have social benefits.
- as a compensatory measure where flood mitigation works adversely affect a house which is generally considered part of the mitigation work rather than a separate VHR scheme.

VHR can be an effective strategy for existing properties in low flood hazard areas where mitigation works to reduce flood risk to properties are impractical or uneconomic. It should be part of an overall floodplain risk management strategy for an area rather than a stand-alone option as it does not deal with issues such as risk to life.

### 3. Consideration of houses for VHR

Assessing the viability of a VHR scheme or an individual house for VHR is part of the broader assessment of floodplain risk management options for a community in an FRMP. The FRMP will be adopted by the council and should have considered:

- the full range of flood events and their associated impacts
- the hydraulic function of the area, as VHR is generally excluded in floodways<sup>1</sup>
- the area's flood hazard classification, as VHR is generally limited to low hazard areas
- the effectiveness as an ongoing maintenance requirement of complementary measures to address risk to life, such as those based around supporting self-evacuation in response to directions from the State Emergency Service (SES)

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<sup>1</sup> Area of the floodplain where a significant discharge of water occurs during floods

- the identification of individual houses' suitability for raising
- cost-effectiveness of the scheme (benefit–cost ratio) measured across the full range of floods with VHR aiming to generate positive financial returns from reduced damage relative to costs<sup>2</sup>
- the viability of the scope and scale of the scheme and how the scheme will be prioritised (considering flood hazard exposure)
- the support of the affected community for VHR as determined through consultation with affected owners
- an implementation plan for the scheme.

#### 4. Defining the scope of a new VHR scheme

Although houses may have been identified for VHR within an FRMP, a more detailed assessment may be required to scope, cost and fully prioritise the VHR scheme prior to making an application for funding of the scheme. This assessment will involve consideration of the items identified in Section 3 above.

This scoping study may involve development in consultation with OEH flood staff of a short report which is eligible for funding through the normal application process under the Floodplain Management Program. Completion of a new works project ranking form is recommended as part of the report as this will provide an indication of the potential priority of the VHR scheme. The new works project ranking form can be downloaded from [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm)

Inclusion of a house in a VHR scheme as part of an FRMP adopted by the council places no obligation on the owner of the property to raise the house or on the council or NSW Government to fund the raising. Owner participation in the scheme is voluntary and there are limitations on the availability of funding.

#### 5. Eligibility criteria for funding a new VHR scheme

The following criteria need to be met for a house within a VHR scheme to be eligible for funding:

1. Only councils are eligible to apply for funding under the program. It is not open directly to individuals. Requests from home owners to raise houses for hardship reasons are not eligible for funding.
2. Subsidised funding is generally only available for residential properties and not commercial and industrial properties.
3. Funding is only available for properties where the buildings were approved and constructed prior to 1986 when the original Floodplain Development Manual was gazetted by the State Government. Properties built after this date should have been constructed in accordance with the principles in the manual.
4. The individual properties in a scheme should be identified<sup>3</sup> in an FRMP developed in accordance with the [Floodplain Development Manual](#) (2005) and adopted by the council.

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<sup>2</sup> The cost of raising a house will depend on the size and complexity of the house to be raised, the location of the house in NSW, the height to be raised and other factors.

<sup>3</sup> Individual properties do not need to be identified within the FRMP itself; they can be included within a commercial and confidential appendix.

5. Funding under the program is generally only available for properties identified in a VHR scheme that has been fully defined, scoped and prioritised. The report to scope and prioritise the VHR scheme is eligible for funding.
6. Under limited circumstances, VHR can be considered for funding prior to completion of an FRMP. However scoping, prioritisation and assessments need to be completed and clear and compelling evidence provided as the basis for expediting consideration ahead of a completed FRMP. This would generally include scoping the VHR scheme and addressing the issues outlined in Section 3 above.
7. Properties which are benefiting substantially from other floodplain mitigation measures – such as houses already protected by a levee or those that will be – will not be funded for VHR.
8. VHR should generally return a positive new benefit in damage reduction relative to its cost (benefit–cost ratio<sup>4</sup> greater than 1). Consideration may be given to lower benefit–cost ratios where there are substantial social and community benefits or VHR is compensatory work for the adverse impacts of other mitigation works.
9. The scheme should involve raising residential properties above a minimum design level, generally the council's flood planning level (FPL) and comply with the council's relevant development control requirements.

## 6. Eligible/ineligible costs

Costs **eligible for funding** are those that are essential to raise the footprint of the existing habitable floor area including:

- plan and document preparation, including survey costs
- development application costs
- site preparation
- disconnection of services and provision of temporary services (water, electricity, communications, gas and stormwater, including rainwater tanks)
- preparation for and raising of the floor to at least above the required minimum design level
- installation of supporting structure for the elevated floor
- reconnection of services
- the installation of front and back door steps or ramp and associated safety rails/devices
- costs associated with inspection and approval by the council.

Councils are generally offered funding based on the projected total cost over the three-year period of the scheme at a funding ratio of \$2 State to \$1 Council or local contribution. Councils often structure VHR schemes to require the local contribution to be fully paid by the house owner as the beneficiary of the damage reduction under the project. In these cases councils may assist the owner by waiving their inspection and approval fees. Where the council is contributing the local funding component to the project and their specific financial circumstances warrant, a higher funding ratio may be available and should be discussed with OEH staff.

Costs which are **not eligible for funding** are:

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<sup>4</sup> Flood damages relative to the cost of the scheme compared on a net present value basis

- additional features, improvements, renovations and substitutions of services requested by the homeowner as part of a VHR scheme, such as landscaping and concrete floor to the understorey, which must be undertaken at the owner's full expense
- any relocation costs incurred during the work
- remedial works to the house if the house needs to be brought up to a standard to allow it to be raised
- retrospective works (with the exception of valuation fees).

## 7. Implementation procedure

### Applying for funding

If a scoping study is required to be completed prior to application for a VHR scheme, as detailed in Section 4 above, the following steps apply:

- An application is made to undertake a scoping study for the proposed scheme during a funding round. Standard details relating to the provision of grants and a sample funding agreement are available at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm). The council must also submit the accompanying *New Works Project Ranking Form* also available at this web address. Note this may not be required if the scheme was sufficiently scoped through the FRMP process.
- The scoping study report is finalised in consultation with OEH and the scoping study grant is acquitted.

Once all of the required information detailed in Section 3 above is available through either the completion of a scoping report or the FRMP process, the following steps apply:

- The council submits a funding application for the VHR scheme to OEH during a funding round. Standard details relating to the provision of grants and a sample funding agreement are available at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm).
- The application should detail the total number of properties with houses to be raised in the scheme and the number of properties that the council desires to raise in the three-year funding round in priority order. The council must also submit the accompanying *New Works Project Ranking Form* available at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm).
- OEH reviews the funding application and confirms that all required information to make an assessment is available. This may include information on current and proposed floor height, hazard category for selected design event, prioritisation and associated costs. If insufficient evidence has been provided, additional information will be requested from the council.
- Applications are reviewed by the State Flood Mitigation Assessment Committee and recommendations made to the Minister for approval. Consideration of funding for all flood risk management projects is based on statewide prioritisation for a maximum three-year period. Where a VHR project is considered a priority and therefore recommended for funding, this is generally provided through access to the statewide Voluntary Purchase/Voluntary House Raising Pool (VP/VHR Pool) for a three-year period.
- If approved, the council will be notified by OEH that they have been given access to the VP/VHR pool and will be requested to submit an estimate of expenditure for the three-year funding cycle.
- OEH will review the estimates of expenditure from all councils with access to the VP/VHR pool against the funding available. Funding is targeted to the eligible properties with the

highest flood exposure wanting to access the program. OEH will advise the council of the outcome of this assessment and where funds are available will make an offer to the council based on the scale of funding that they can access from the pool. This offer will set out the conditions of access to the VP/VHR pool for the council.

## **Raising properties**

Once funding availability is known, the council will approach eligible landowners according to their priority ranking. Given the voluntary nature of VHR, the owners of these properties may not be interested when initially approached and the owners of properties with lower priority can then be approached. The council may wish to seek non-binding expressions of interest from a number of owners to expedite this process.

Before entering into a binding contract with a recipient for VHR, the council must seek confirmation from OEH that funds are still available from the pool as this may have altered due to the timescales involved.

Where the council receives confirmation from OEH that funds are available, it must submit a work plan for the three-year period of the scheme, in accordance with the template provided on the OEH website at [www.environment.nsw.gov.au/coasts/Floodgrants.htm](http://www.environment.nsw.gov.au/coasts/Floodgrants.htm). The work plan includes proposed milestones and associated payments for eligible costs. The council will receive written confirmation if the work plan is approved.

A funding agreement between the council and OEH is then signed, detailing the cost-sharing arrangement between them for the estimated amount covering eligible costs as outlined in the work plan.

When the council enters into an agreement with landowners, the parties should agree on an itemised raising cost of the house, set a time limit for the task, and develop an agreed funding payment schedule.

The landowner enters into a contract directly with the builder. Unless agreed in writing with OEH, the council should require the owner to obtain three competitive quotes from suitable builders to ensure all works are completed for the best value for money. The owner is encouraged to check that the builder is qualified and licensed to carry out this type of work. Copies of the builders and subcontractors licences and insurance documents should be provided to the council for its records.

Before work commences, the property owner must submit a signed liability waiver which indemnifies the council and the State Government from or against all claims, expenses and damages for loss or damage to the house or personal injury (including death) arising out of the house raising work.

Following raising of the property, the council will inspect the house and provide confirmation to OEH that the work has been completed. Payments will be made on the successful completion of milestones (as outlined in the approved work plan) and receipt of the accompanying expenditure certificate and milestone report.

## **Monitoring and review**

The council is required to keep OEH informed of progress in line with the work plan. Where difficulties arise and the council is unable to spend the agreed grant amount under the funding agreement in the required timeframe, the council is required to inform OEH as soon as possible to enable other VP/VHR projects to proceed.

The council should review the scope of a VHR scheme every three years or before submitting a new application for funding under the program. This review should outline progress of the scheme to date, confirm the eligibility and priority of properties remaining under the scheme and be submitted to support the application.

### **Actions by councils to ensure outcomes**

The FRMP or detailed scoping report will contain complementary recommendations, such as flood emergency response planning, necessary to support VHR in an area, particularly in relation to risk to life. The council must ensure that these recommendations are instigated and maintained.

Councils should implement development controls to ensure that the areas beneath the properties do not become habitable over time or through a change of ownership. Councils need to ensure that subsequent owners are made aware of restrictions on development on the areas beneath the habitable floor level of the raised property, with these details included on Section 149 certificates or by placing a restriction on the use of the land under the *Conveyancing Act 1919*.<sup>5</sup> Any breaches in planning requirements, such as under-storey development, may be identified on a building certificate at the sale of a property.

As part of its maintenance strategy for the VHR scheme, the council should set up an annual review to ensure that:

- no habitable development is occurring below the raised habitable floor levels of any property raised under the scheme
- complementary recommendations (such as emergency response planning) necessary to support VHR in an area are instigated and effective.

### **Acquittal**

The council is required to acquit each VHR grant in line with the relevant funding agreement (and as part of the final report) and provide associated documentation such as surveying certificates or final drawings detailing habitable floor level information relative to minimum requirements.

## **8. References**

Department of Infrastructure, Planning and Natural Resources (2005), [Floodplain Development Manual](#), New South Wales Government, Sydney

[Reducing Vulnerability of Buildings to Flood Damage: Guidance on building in flood-prone areas](#) (2007), report prepared for the Hawkesbury-Nepean Floodplain Management Steering Committee, Parramatta

Office of Environment and Heritage  
Email: [info@environment.nsw.gov.au](mailto:info@environment.nsw.gov.au)  
Website: [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)  
OEH 2013/0056 February 2013

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<sup>5</sup> This could be through the creation of a public positive covenant under either Section 88D or 88E of the *Conveyancing Act 1919* which imposes obligations on the new owner of the land burdened (the servient tenement) in favour of a prescribed authority:  
[http://rgdirections.lpi.nsw.gov.au/deposited\\_plans/easements\\_restrictions/positive\\_covenants/public\\_positive\\_covenants](http://rgdirections.lpi.nsw.gov.au/deposited_plans/easements_restrictions/positive_covenants/public_positive_covenants)





## Appendix F: Draft Final Report Submissions

### Submission 1

Page 1, Paragraph 1 – Taken as comment.

Page 1, Paragraph 2 – Taken as comment.

Page 1, Paragraph 3 – Taken as comment.

Page 1, Paragraph 4 – Taken as comment.

Page 1, Paragraph 5 – The building stability in flood has been determined using flood depth over floor and velocities proximate to the property, determined from the hydraulic model. Further details can be found in the paper 'Updating National Guidance on Best Practice Flood Risk Management' (McLuckie 2014) that is available online.

The design characteristics of the property and its foundations have not been taken into account for this study as this is outside the studies scope and WMAwaters engineering expertise. Only hydraulic influences on structural stability have been determined

Accordingly, text has been added to Section 6 and 6.1 of the main report to indicate that structural stability due to hydraulic influences only have been investigated as part of this study.

The 'market value' of each property has been estimated to be \$250,000. This is slightly higher than the 'realestate.com' listed median price (\$180,000). However this price estimate has only been used to undertake a damages assessment and is in no way associated with the valuation of the property. Property price evaluation will be undertaken by the NSW Valuer General's Office.

Report changed to indicate that the property has four, not three bedrooms.

Page 2, Paragraph 1 – Taken as comment.

Page 2, Paragraph 2 – Taken as comment.

**Attachment 1 – response to Flood Risk and management Study 2014.docx**

Page 3, Paragraph 6 (continued over page) - Section relates to defining the FPA and does not pertain to property inundation.

Page 5, Paragraph 1 - local runoff will have negligible impacts on event volume when compared to the 150 km<sup>2</sup> upstream catchment.

**Attachment 2 – May 2015 Feedback and Response to WMA.docx**

Predominately taken as comment. A few clarifications are presented below.

Page 3, Paragraph 7 - The AAD is determined using design flood events and their associated probability to determine an estimate of potential damages for any given year. It is very generalised and does not account for individual properties on a case by case bases. The AAD is only used to give an indication if a potential risk mitigation works is likely to provide a tangible monetary benefit.

Page 4, Paragraph 2 & 3- All depths and velocities have been determined from the calibrated 2D hydraulic model produced during the Lockhart Flood Study.

The 'depth in yard' and 'velocity' have been determined as the maximum depth and velocity proximate to the house. It is acknowledged that depths and velocities may be greater within the lot than those displayed, however this is inconsequential in relation to the study findings.

Page 4, Paragraph 1 - Report has been amended to state three bedrooms, not four. Property price estimate have only been used to undertake a damages assessment and is in no way associated with the valuation of the property. Property price evaluation will be undertaken by the NSW Valuer General's Office at the time of purchase.

Page 4, Paragraph 4 - Only hydraulic influences on structural stability have been determined. Structural and substructure design has not been examined and is outside the scope of this study. Further details of this are contained in Section 6.1 of the report.

The number of residents at a property directly impacts on the number of lives at risk and the number of people requiring

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evacuation as well as having implications during rescue operations (see Section 6.2).

## Submission 2

Page 1, Paragraph 4 – The process of assigning a priority rank for the properties eligible for VP is presented in Section 6 of the report. Four criteria were accounted for: Property structural stability (1), number of/vulnerability of residents (2), evacuation route hydraulic hazard (3) and access to egress and over floor inundation depth and frequency (4). The criteria was determined by both WMAwater (points 1, 3 and 4 - Section 6 of the report) and OEH (point 2).

Page 1, Paragraph 5 – As above.

Page 1, Paragraph 6 – The building stability in flood has been determined as per Section 6.1 of the report. The criteria uses flood depth over floor and velocities proximate to the property, determined from the hydraulic model, to determine the hazard to structural stability. Further details can be found in the paper ‘Updating National Guidance on Best Practice Flood Risk Management’ (McLuckie 2014) that is available online.

The design characteristics of the property and its foundations have not been taken into account for this study as this is outside the studies scope. Only hydraulic influences on structural stability have been determined

Text added to Section 6 and 6.1 of the main report to indicate that structural stability due to hydraulic influences only have been investigated as part of this study.

Page 1, Paragraph 7 – All depths and velocities have been determined from the calibrated 2D hydraulic model produced during the Lockhart Flood Study.

The ‘depth in yard’ and ‘velocity’ have been determined as the maximum depth and velocity proximate to the house. It is acknowledged that depths and velocities may be greater within the lot than those displayed, however this is inconsequential in relation to the study findings.

Page 1, Paragraph 8 – Taken as comment.

Page 2, Paragraph 1 – Taken as comment.

Page 2, Paragraph 2 – All levels, depths and velocities have been determined from the hydraulic model produced as part of the Lockhart Flood Study. The model was calibrated and verified during this Study with a high level of accuracy. WMAwater are confident of the model results and the findings have been endorsed by Council and OEH.

Page 2, Paragraph 3 – Yes. Funding for Voluntary Purchase has joint contribution from Council and OEH.

Page 2, Paragraph 5 – Yes. The number of people residing in a property does impact on the rank of the property for VP with properties in which few people reside being prioritised lower than a property with more people, assuming all other influences being equal. It is acknowledged that the number of people residing in a property could change over time, however we can only provide advice for current conditions. Appendix C of the report makes comment that the priority ranking of properties with similar hydraulic characteristics can be changed if necessary if circumstances change.

Page 2, Paragraph 6 – No. As stated previously, WMAwater are confident that flood levels, depth and velocities produced by the model are accurate. The provided values have been determined by examining model results proximate to the residence for all properties.

Page 2, Paragraph 7 - 13 – Taken as comment.

Page 3, Paragraph 1 - 3 – Taken as comment.