

**TABLE S1
RECOMMENDED MEASURES FOR INCLUSION IN LITHGOW FLOODPLAIN RISK MANAGEMENT PLAN 2023**

Measure	Required Funding	Features of the Measure	Benefit Cost Ratio	Priority
1. Update of <i>Lithgow LEP 2014</i>	Council's staff costs	<ul style="list-style-type: none"> ➤ A new <i>special flood considerations</i> clause should be incorporated in <i>Lithgow LEP 2014</i> which applies to land that lies between the FPA and the PMF. The new clause relates to development with particular evacuation or emergency response issues (e.g. group homes, residential aged care facilities, etc). It is also aimed at protecting the operational capacity of emergency response facilities and critical infrastructure during extreme flood events. 	-	High Priority: this measure is designed to mitigate the flood risk to future development and has a high priority for inclusion in the <i>Lithgow FRMP 2023</i> . It does not require Government funding.
2. Incorporate recommended approach to managing future development on flood prone land in <i>Lithgow DCP 2021</i> .	(Council's staff costs)	<ul style="list-style-type: none"> ▪ Graded set of flood controls based on the type of development and their location within the floodplain, defined as land inundated by the PMF. ▪ Floodplain divided into five zones based on the assessed flood hazard and hydraulic categorisation. ▪ The minimum floor levels for all land use types is the level of the 1% AEP flood event plus 0.5 m freeboard in the case of areas affected by Main Stream Flooding and plus 0.3 m freeboard in areas affected by Major Overland Flow. ▪ Additional controls applied to development that is located on land which lies above the Flood Planning Level where the large flood range is considered to pose a significant risk to life. 	-	High Priority: this measure is designed to mitigate the flood risk to future development and has a high priority for inclusion in the <i>Lithgow FRMP 2023</i> . It does not require Government funding.
3. Ensure flood data in the <i>Lithgow FRMS 2023</i> are available to the NSW SES for improvement of flood emergency planning.	NSW SES costs	<ul style="list-style-type: none"> ➤ NSW SES should update the <i>Lithgow City Local Flood Plan</i> using information on flooding patterns, times of rise of floodwaters and flood prone areas identified in this report. 	-	High Priority: this measure would improve emergency response procedures and has a high priority. It does not require Government funding.
4. Implement flood awareness and education program	Council staff costs	<ul style="list-style-type: none"> ➤ Council to inform residents of the flood risk, based on the information presented in the <i>Lithgow FRMS 2023</i>. (e.g. displays of flood mapping at Council offices, preparation of <i>Flood Information Brochure</i> for distribution with rate notices, etc). 	-	High Priority: this measure would improve the flood awareness of the community and has a high priority. It does not require Government funding.
5. Prepare a stormwater and flood risk management strategy for future release areas located in the Marrangaroo Creek catchment.	Council cost	<ul style="list-style-type: none"> ➤ Council to engage a suitably qualified consultant to the prepare a stormwater and flood risk management strategy for future release areas located in the Marrangaroo Creek catchment ➤ The strategy will determine the scope of measures which would be required to mitigate the impact that future development would have on both the quality and quantity of stormwater runoff, as well as determine the land-take requirements for the construction of such measures. 	-	Low Priority: this measure need only be implemented prior to Council seeking to rezone the land to facilitate future development
6. Investigate and design an integrated flood warning system for Lithgow	\$0.07 Million	<ul style="list-style-type: none"> ➤ Liaison with the Bureau of Meteorology to determine whether the flood forecasting and warning system that it is in the process of developing is sufficiently detailed to provide sufficient advance warning to occupiers of the floodplain at Lithgow, noting that the Farmers Creek and Marrangaroo Creek catchments are located in the headwaters of the valley. ➤ If the system that BoM is in the process of developing is deemed unsuitable for Lithgow, then this measure would comprise the development of an integrated flood warning system which is specific to Lithgow. As a minimum, such a system would include: <ul style="list-style-type: none"> ○ The installation of a network of telemetered pluviographic rain gauges in combination with a series of telemetered stream gauges would assist BoM and NSW SES in providing more accurate and timely flood warnings for urbanised areas in Lithgow. ○ The linking of an alarm and public announcement system to the telemetered stream gauges (where applicable) would warn residents and business owners that a key trigger level(s) has been reached and to monitor and take action where required. ○ The installation of warning signs and self-deploying boom gates at low-level creek crossings would prevent motorists and pedestrians from accessing inundated roads and footpaths. 	-	High Priority: this measure would reduce flood damages by providing advance warning of potential flooding.
7. Implement integrated flood warning system for Lithgow	\$0.50 Million			
8. Commission <i>Voluntary Purchase and House Raising Feasibility Study</i> at an estimated cost of \$50,000 for 30 residential properties that are located in a High Hazard Floodway area and raise 25 dwellings that are located in High Hazard Flood Storage areas (Allocated amount of \$12.78 Million assumes all affected property owners opt into the two schemes)	\$12.83 Million ⁽¹⁾	<ul style="list-style-type: none"> ▪ Council to approach the owners of the 30 properties that are located in the High Hazard Floodway area to assess their willingness to participate in the NSW Government's <i>Voluntary Purchase Scheme</i>. Upon gaining agreement, Council to seek grant funding from the NSW Government to purchase the relevant properties. ▪ Council to approach the owners of the 25 properties that are located in hazardous flood storage areas to assess their willingness to participate in the NSW Government's <i>Voluntary House Raising Scheme</i>. Upon gaining agreement, Council to seek grant funding from the NSW Government to raise the dwelling to the required level. 	0.18 (VP) 0.30 (VHR)	High Priority: this measure would reduce flood risk within existing development

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TABLE S1 (Cont'd)
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Measure	Required Funding	Features of the Measure	Benefit Cost Ratio	Priority
9. Investigate and prepare concept design for George Coates Street Drainage Improvement Works	\$0.08 Million	<ul style="list-style-type: none"> ➤ Underground utilities search ➤ Geotechnical investigation to assess foundation conditions ➤ Hydraulic modelling to confirm sizes of the key elements of individual elements of the measure ➤ Prepare concept design and cost estimate ➤ Cost-benefit analysis to confirm the economics of the scheme ➤ Prepare a submission for Council and Government funding for detailed design and construction 	0.02	Medium Priority: this measure would reduce the flood risk in parts of Lithgow
10. Prepare detailed design and construct George Coates Street Drainage Improvement Works	\$6.22 Million	<ul style="list-style-type: none"> ➤ Tasks involved are as follows: <ul style="list-style-type: none"> ○ Prepare detailed design and documentation ○ Prepare a submission for Council and Government funding. ○ Construct drainage improvements. 		
11. Investigate and prepare concept design for Lithgow High School Detention Basin	\$0.08 Million	<ul style="list-style-type: none"> ➤ Underground utilities search ➤ Geotechnical investigation to assess foundation conditions and basin embankment requirements ➤ Hydraulic modelling to confirm sizes of the key elements of individual elements of the measure ➤ Prepare concept design and cost estimate ➤ Cost-benefit analysis to confirm the economics of the scheme ➤ Prepare a submission for Council and Government funding for detailed design and construction 	1.31	Medium Priority: this measure would reduce the flood risk in parts of Lithgow
12. Prepare detailed design and construct Lithgow High School Detention Basin	\$0.57 Million	<ul style="list-style-type: none"> ➤ Tasks involved are as follows: <ul style="list-style-type: none"> ○ Prepare detailed design and documentation ○ Prepare a submission for Council and Government funding. ○ Construct drainage improvements. 		
13. Investigate and prepare concept design for Farmers Creek Channel Works – Stages 3, 4, 5 and 6	\$0.20 Million	<ul style="list-style-type: none"> ➤ Underground utilities search ➤ Geotechnical investigation to assess foundation conditions ➤ Hydraulic modelling to confirm sizes of the key elements of individual elements of the measure ➤ Prepare concept design and cost estimate ➤ Cost-benefit analysis to confirm the economics of the scheme ➤ Prepare a submission for Council and Government funding for detailed design and construction 	0.11	High Priority: this measure would reduce the flood risk in a significant number of properties that are located adjacent to the main arm of Farmers Creek
14. Prepare detailed design and construct Farmers Creek Channel Works – Stages 3, 4, 5 and 6	\$15.0 Million	<ul style="list-style-type: none"> ➤ Tasks involved are as follows: <ul style="list-style-type: none"> ○ Prepare detailed design and documentation ○ Prepare a submission for Council and Government funding. ○ Construct drainage improvements. 		
15. Develop and implement <i>Vegetation Management Plan</i> for Farmers Creek and its major tributaries	\$0.4 Million	<ul style="list-style-type: none"> ➤ The <i>Vegetation Management Plan</i> will identify the reaches of Farmers Creek and its major tributaries which require regular maintenance. It will also describe the scope of any rehabilitation works which would be required following the completion of any inbank works. ➤ The required funding would permit the development of the <i>Vegetation Management Plan</i>, the removal of dense vegetation from the inbank area of the watercourse and the implementation of a regular maintenance program over a five year period. 	-	Medium Priority: this measure would reduce the risk of a blockage being experienced at the various road crossings, as well as reduce the frequency of nuisance flooding.
16. Review and update of investigation into operation of existing sewerage system at Lithgow	\$0.15 Million	<ul style="list-style-type: none"> ➤ Review and update previous investigation that was undertaken in about 2008-09 into the existing sewerage system at Lithgow using the flooding and drainage information set out in the <i>Lithgow FRMS 2023</i> report. 	-	Low Priority: while this measure would reduce the social and environmental impacts associated with sewer overflows, it would not reduce the flood risk at Lithgow.
Total Estimated Cost	\$36.15 Million			

1. Assumes the costs associated with implementing this measure are reduced by \$3.0 Million through the implementation of the Farmers Creek Channel Works – Stages 3, 4, 5 and 6