

Appendix A

Floodplain Risk Management Options Identified in the FRMS



Option ID	Option Description	Brief description	Primary Flood Issue addressed	Source of option	Capital Cost	Recurrent Cost	Reduction in AAD	BCR	Multi-Criteria Assessment Rank	Recommendation of FRMP
FM DT1	Davistown Foreshore Barrier	Foreshore barrier around Davistown (excluding properties where it is not likely to be economically viable to include them in the barrier design). Levee Elevation would be the 1% AEP Brisbane Water flood level.	Flooding caused by ocean storm surges and tides, which should be aggravated by the effects of Climate Change.	A foreshore levee was considered in the Brisbane Water FRMS (2015), however, insufficient local flood data was available to properly assess it. Community engagement identified support for further assessment of a levee option.	\$ 12,343,000	\$ 5,000	\$ 1,490,000	1.77	1	Recommended
FM DT2	Davistown Foreshore Barrier (all properties protected)	Foreshore barrier around Davistown, including all properties regardless of feasibility. Levee Elevation would be the 1% AEP Brisbane Water flood level.	Flooding caused by ocean storm surges and tides, which should be aggravated by the effects of Climate Change.	As for FM DT1	\$ 19,454,000	\$ 8,000	\$ 2,080,000	1.57	2	Not recommended This option was superseded by option FM DT1, which performed better in the MCA.
FM DT3	Davistown foreshore barrier (5%AEP Crest)	Foreshore barrier around Davistown. Same extent as Option 1A, but with elevation corresponding to the 5% AEP Brisbane Water flood level to reduce the potential aesthetic impacts and cost of the barrier.	Flooding caused by ocean storm surges and tides, which should be aggravated by the effects of Climate Change.	As for FM DT1	\$ 13,341,000	\$ 5,000	NA	NA	11	Not recommended This option was superseded by option FM DT1, which performed better in the MCA.
FM DT4	Road drainage improvements	Road drainage improvements. Approach would go beyond standard kerb and guttering, with possible letterbox inlet pit arrangement similar to the works recently completed on Greenfield Road, Empire Bay.	Excessive ponding caused by flat grades in Davistown	Key issue identified by the community in the Flood Study (2010) and October 2019 engagement.	\$ 2,072,000	\$ 3,000	NA	NA	16	Considered in FRMP as part of EM3 This FRMSP does not provide specific recommendations on road drainage improvements. However, the information provided in this FRMSP should be used to inform Council decisions on asset upgrades and road maintenance. Information on key access routes that might be impacted by flooding will be provided to the SES.
FM DT5	Drainage easement (Davistown Memorial Park to Paringa Ave)	Improve drainage through the drainage easement between Paringa Avenue and Davistown Memorial Park.	A number of residents from Restella Ave raised issues about the effects of the strata development on this easement where the land was filled and storage displacement of water.	Identified by local residents at the community drop-in session in October 2019.	<i>This option addresses an inter-allotment drainage issue for private property owners to address and has not been assessed further.</i>				Considered in FRMP as part of CCA-02 The drainage issues in this easement are a known public concern. Additionally, this easement is a key feature of the landforms proposed by the Climate Change Adaptation Study (Rhelm, 2020). For this reason, Council should ensure that the easement is managed effectively.	
FM DT6	Wetland dredging	Wetland dredging to improve existing drainage system capacity.	It is the perception of some residents that the drainage system becomes 'backed up' due to flows being unable to drain out of the wetland into Brisbane Water efficiently.	Identified by local residents at the community drop-in session in October 2019.	<i>The environmental impacts inhibit any further assessment.</i>				Not recommended	
FM EB1	Pomona Road drainage upgrades	Pomona Road culvert and drainage upgrades. Increase the capacity of the drainage network to reduce flooding of Pomona Road.	Flooding along Pomona Road, which is an important evacuation route	Residents at the October 2019 Drop-In sessions identified flooding along Pomona Road to be of concern with regards to accessing their properties during a flood event.	\$ 371,000	\$ 5,000	NA	NA	13	Recommended This measure is recommended in conjunction with option FM EB6.

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FM EB2	Seawall construction guidelines	Private seawall maintenance and/or upgrade in existing guidelines	Seawalls along private properties provide protection against flooding from storm surge and extreme tides. However, no clear guidance exists for the local area to assist land owners in maintaining or upgrading seawalls to contribute to this flood protection.	Brisbane Water FRMP (2015)	\$ 10,000	-	NA	NA	12	Recommended
FM EB3	Maintenance and upgrade of private seawalls	Private seawall maintenance and/or upgrade in construction	Seawalls along private properties provide protection against flooding from storm surge and extreme tides. However, seawalls on private properties are set at various levels and are in various conditions reducing their effectiveness	Brisbane Water FRMP (2015)	\$ 435,000	\$ 5,000	NA	NA	20	Not Recommended This option was superseded by option FMEB3, which performed better in the MCA.
FM EB4	Empire Bay foreshore barrier	Foreshore barrier around Empire Bay. Levee Elevation at the 1% AEP Brisbane Water flood level.	Flooding caused by ocean storm surges and tides, which should be aggravated by the effects of Climate Change.	A foreshore levee was considered in the Brisbane Water FRMS (2015), however, insufficient local flood data was available to properly assess it. Community engagement identified support for further assessment of a levee option.	\$ 4,554,000	\$ 3,000	\$ 1,469,000	4.72	5	Recommended
FM EB5	Drainage easement (Myrtle to Kendall Rd)	Drainage channel and easement from Myrtle Road to Kendall Road	Excessive ponding in Empire Bay (private properties and roads).	Collaboration between Council, DPIE and Rhelm.	\$ 6,481,000	\$ 4,000	\$ 170,000	0.43	3	Recommended
FM EB6	Pomona Road easement and drainage upgrades	Pomona Road Easement and drainage upgrades	Flooding in properties along Pomona Road and section of Empire Bay Drive	Pomona Road Structure analysis provided by Council	\$ 737,000	\$ 2,000	\$ 91,000	1.75	18	Recommended This measure was recommended in conjunction with option FM EB1.
FM EB7	Empire Bay Drive easement	Swale along Empire Bay Drive to divert flows into the adjacent creek.	Flooding of Empire Bay Drive, which is an important evacuation route, and flooding through Palmers Lane properties.	Analysis of Flood Study (2010) results and liaison between Rhelm, Council and DPIE.	\$ 310,000	\$ 1,000	\$ 10,000	0.46	17	Considered in FRMP as part of EM3 This option does not reduce flood depths or flood impacts on properties or roads significantly. However, flooding in Empire Bay Drive is an important issue and this location should be included on Council's capital works program.
PM1	Land Use Planning Recommendations	Council's existing land use planning controls were reviewed as part of this study. As an outcome of this review a series of recommendations have been made to assist Council in achieving best practice flood planning in the Davistown and Empire Bay catchments	Catchment flooding in Davistown and Empire Bay	Standard option to be assessed as part of the NSW Floodplain Risk Management Process	-	-	NA	NA	4	Recommended

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PM2	Voluntary House Purchase	Properties in high flood hazard areas (areas with high flood depths and velocities) would be purchased to permanently remove flood risk people. The dwelling would then be removed (for relocation, if suitable) or demolished and the property would be back zoned to a more flood compatible land use, such as recreational park.	Properties subjected to high flood risk from Catchment flooding in Davistown and Empire Bay	Standard option to be assessed as part of the NSW Floodplain Risk Management Process	<i>No properties qualify for a Voluntary House Purchase Program</i>					Not Recommended
PM3	Voluntary House Raising	Under the NSW Floodplain Management Program, DPIE provides funding to assist home owners raise the floor level of their house to reduce the damages and trauma caused by flood water inundating their house.	Properties subjected to high flood risk from Catchment flooding in Davistown and Empire Bay	Standard option to be assessed as part of the NSW Floodplain Risk Management Process	\$ 500,000	-	\$ 47,000	1.38	10	Considered in FRMP as part of CCA-02 Considering the context of the Climate Change Adaptation Plan (Rhelm, 2019), it is preferable that properties fill and redevelop, rather than raise existing structures and maintain existing ground levels. It has been recommended that Council investigate opportunities to incentivise property filling and redevelopment at these high risk properties.
PM4	Property Flood Risk Education Program	A strategic, balanced and socially sensitive education program to advise the local community and prospective property purchasers about the risk and effects of catchment and coastal flooding	It cannot be assumed that all residents are sufficiently aware of the flood risk they are subjected to and of how respond in a flood emergency.	Brisbane Water FRMP (2015)	\$ 100,000	\$ 5,000	NA	NA	6	Recommended This measure was recommended in conjunction with option EM06.
EM1	Review of evacuation centre locations	Identification of Flood-free locations that could function as evacuation centres for Davistown and Empire Bay.	Currently there is not an official designated evacuation centre in Davistown and Empire Bay.	Brisbane Water FRMP (2015)	-	-	NA	NA	8	Recommended
EM2	Road raising	Moderate road raising and associated cross drainage works for flood affected roads that are part of key access routes.	Flooding on key access routes		\$ 13,545,000	-	NA	NA	19	Considered in FRMP as part of EM3 This FRMSP does not provide specific recommendations on road raising. However, the information provided in this FRMSP should be used to inform Council decisions on asset upgrades and road maintenance. Information on key access routes that might be impacted by flooding will be provided to the SES.
EM3	Drainage upgrades on Empire Bay Drive	Drainage upgrades to Improve the flood immunity of Empire Bay Drive	Flooding along Empire Bay Drive, which is an important access route in and out of Empire Bay		\$ 180,000	-	NA	NA	14	Considered in FRMP as part of EM3 This FRMSP does not provide specific recommendations on road drainage improvements. However, the information provided in this FRMSP should be used to inform Council decisions on asset upgrades and road maintenance. Information on key access routes that might be impacted by flooding will be provided to the SES.

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EM4	Flood warning systems	Implementation of a flood warning system, through which Council and the SES can effectively disseminate warnings issued by BOM.	Currently there is not an official system in place to warn the community of potential flood events.	Brisbane Water FRMP (2015)	\$ 50,000	\$ 5,000	NA	NA	8	Recommended
EM5	Flood warning signage	Positioning of flood warning signs and depth markers in roads that are subjected to frequent flooding, to inform drivers and prevent potential accidents	Frequent flooding in road sections		\$ 5,000	-	NA	NA	15	Depth marker or flood warning sign is only recommended at Empire Bay Drive.
EM6	Flood Education Programs	Education program to promote flood awareness in the community	It cannot be assumed that all residents are sufficiently aware of the flood risk their properties are subjected to and of how respond in a flood emergency.		\$ 100,000	\$ 5,000	NA	NA	7	Recommended This measure was recommended in conjunction with option PM04.