# **Business Case**

# **Flood Preparedness**

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| --- | --- |
| Program Intent | Minimising flooding and flood damage by the delivery of flood risk awareness, education and engagement activities to flood prone communities. |
| Program Lead | Julie Bright, Manager Flood Preparedness ＆ Service Performance |
| Program Owners Group/Team/Section | Service Delivery   * W&CO - Flood Preparedness & Service Performance * AMS - Catchment Asset Management   Integrated Planning – Innovation and Resilience |

**Business Case Summary**

The Flood Preparedness Program aims to deliver flood risk awareness, education and engagement activities to flood prone communities as per the draft *Flood Management Strategy Port Phillip and Westernport* at an estimated cost of $3.03M over the period FY21/22 to FY25/26.

This includes the provision of our current flood preparedness services ($1.53M, $Real2021) and an uplift of $1.5M ($Real2021) over the 5-year period to enable the program to meet the escalating flood risk, our obligations and community expectations. The uplift of the Flood Preparedness program includes a suite of non-structural elements (no built assets) as outlined in Table 1 below.

These uplift services combined with the current Victorian State Emergency Services (VICSES) Education and Awareness programs and our riverine flood warning capabilities represent an estimated reduction in public flood risk in flooding hot spot areas from $735M to $723.5M over the next 5 years with a corresponding Annual Average Damages (AAD) reduction of $11.5M.

**Table 1:** Program Uplift Summary

|  |  |  |
| --- | --- | --- |
| **Program elements**  **(uplift only)** | **Cost (p.a.)** | **Benefits** |
| Expansion of our education and awareness program using the Community Engagement Disaster Risk Reduction (CEDRR) approach  Targeted social media campaign - *Know Your Flood Risk*  Improved flash flood warning capabilities in flooding hot spots | $170K  $55K  $75K | Improved awareness of effective flood response actions reducing the financial, emotional and physical impact of flooding.  Improved awareness of flood risks and potential impacts.  Flash flood warning notifications resulting in a reduction in AAD.  Estimated AAD reduction of $2.3M p.a. |

**Program Drivers**

The primary driver for this expenditure is compliance with Melbourne Water’s legislative obligations.

**Obligations**

The legislative drivers for flood preparedness in the Port Phillip and Westernport catchments are:

* *Victorian Water Act 1989* – Sections 201-202 under ‘Floodplain Management’ requires Melbourne Water “to develop and implement plans and to take any action necessary to minimise flooding and flood damage" and to “provide advice about flooding and controls on development to local councils, the Secretary to the Department and to the community”.

* *Statement of Obligation* (2015) – Part 6 requires Melbourne Water in its Waterway and Drainage Investment Plan to consider the State Floodplain Management Strategy and sets out responsibilities for waterway management, flood management and drainage and for the consideration of efficient and effective delivery of services.
* *Emergency Management Act 2013* outlines our role in contributing to flood response and recovery and our role in risk management of owned and operated critical infrastructure.

**Strategic Drivers**

The strategic drivers for flood preparedness in the Port Phillip and Westernport catchments are:

*The Victorian Floodplain Management Strategy (2016)*

The Strategy clarifies the roles and responsibilities of government agencies and authorities involved in flood management. The strategy supports priorities being developed at a regional level in consultation with local communities and encourages communities and individuals to work with their council and catchment management authorities to decide on the level of flood mitigation that best suits their locality. The strategy also identifies that Melbourne Water must prepare a Flood Management Strategy for our region (Accountability 26a).

*The draft Flood Management Strategy Port Phillip and Westernport (2021)*

The draft Strategyidentifies climate change and urban development, the effects of which are being experienced in Melbourne now, as key drivers for change. The Draft Strategy focuses on collectively understanding, preparing for, managing and recovering from flooding events. It is a co designed strategy with significant input from our flood management partners across government, emergency services, traditional owners and the community.

The key objectives of the strategy are:

* Objective 1 - the right information is available at the right time to the people who need it;
* Objective 2 - flood risks and opportunities are managed to reduce impacts and get the best social, economic and environmental outcomes; and
* Objective 3 - land, water and emergency agencies work together to manage flooding effectively.

The Flood Preparedness program has a significant role to play in achieving the first two objectives, specifically Focus Areas 2, 3 and 4 of the strategy, as outlined below.

* Focus Area 2: Community knowledge platform – provide the community with the right information they can prepare, respond and recover from flood events
* Focus Area 3: Empowered communities – Ensuring that communities are ‘flood ready’. Flood ready communities are aware of their level of flood risk, can take steps to prepare for flooding, and understand what to do when warnings are issued. They are likely to experience less loss, damage, stress and disruption, and recover faster when flood events occur.
* Focus Area 4: Flood Effects Reduction - Identify high priority areas for flood effects reduction with consideration for a diverse range of solutions.

*Melbourne Water Strategic Direction (2016)*

The flood preparedness program aligns with the *Healthy Places* pillarby managing the impacts of climate change, building our resilience to flooding across the region, and partnering to deliver sustainable land and water management, so that we create more desirable places to live. The Strategic Direction states ‘we will continue to build a region that is resilient to floods and manage the impacts of climate change and urban development’. The program provides secondary benefits to both the *Healthy People* and *Healthy Environment* pillars.

**Customer Priority**

As the floodplain manager for the region there are expectations from Emergency Management Victoria, the VICSES, local government and the community, that Melbourne Water will take action to ensure flood risk associated with our assets is managed appropriately.

Extensive customer engagement has been undertaken to develop the draft *Flood Management Strategy (2021)*. The draft Strategy was collaboratively designed with over 60 agencies to ensure it is relevant and representative of a collective approach to flood management. This engagement provided strong and diverse support for improvements in flood preparedness and the adoption of innovative approaches to flood risk reduction as outlined in the Table 1.

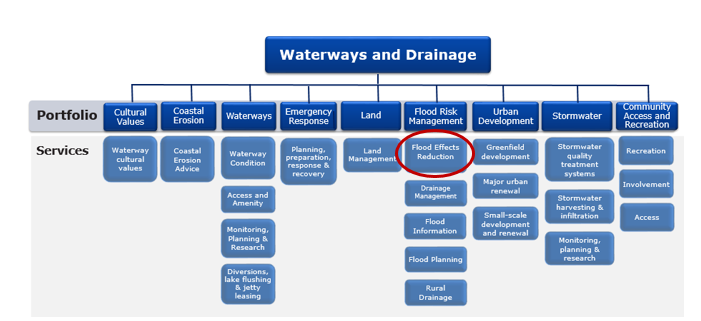
Beyond the collaboration with stakeholders and partners for the draft *Flood Management Strategy (2021),* customers and community were also engaged for the Waterways and Drainage Investment Plan. This engagement showed our customers generally expect improvement in flood management with more needing to be done for flood preparedness and flood mitigation. The Waterways and Drainage Customer Council, the Customer Preference Survey and the Deliberative Panel all supported doing more for flood preparedness acknowledging that it was a comparatively cheaper management approach of flood risk than other solutions.

**Program Background**

Melbourne Water is the floodplain manager for the region and manages an extensive drainage network of over 25,000km of waterways and 1,400km of underground drains including urban, semi urban and rural catchments. These catchments are changing over time with increased pressures being placed on them due to climate change and urban growth. Melbourne Water is responding to these changes by expanding the drainage network and supporting appropriate development. Despite this, there are a range of legacy issues which cannot be addressed by improvements to the drainage network (built assets) alone and more innovative and efficient non-structural flood risk reduction approaches are required, such as those proposed through this program.

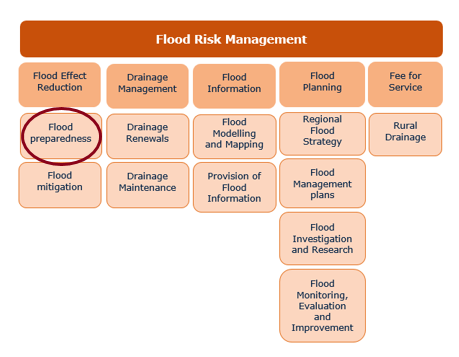
Flooding is a serious hazard for our community. It is also our most expensive natural disaster, with an estimated $735 million in annual average damages. Approximately 232,000 properties are at risk of flooding across Melbourne (Waterways and Drainage Investment Program, Melbourne Water, 2020). Many of these properties are in areas of Melbourne which were developed before planning controls were released in 1975 and are affected by a 1% AEP flood, these areas are called flood hot spots. The Flood Preparedness program focusses our efforts in these hot spots as other risk reduction approaches are less feasible here.

The Flood Preparedness program forms part of the Flood Effects Reduction Service under Melbourne Water’s Flood Risk Management Portfolio as shown below.

**Table 2:** WDIP Portfolio's and Services 

There are 11 programs to deliver under the Flood Risk Management Portfolio, as shown below.

**Table 3:** Flood Risk Management Programs



The intent of the Flood Effects Reduction Service is to prepare for and mitigate the impacts of flooding.  Flood impacts can include fatalities, injuries, property damage, social disruption, and loss or disruption of critical infrastructure and services. The impacts of flooding (flood effects) can be reduced by increased awareness and education (Flood preparedness), as well as through additional or enhanced flood infrastructure (Flood mitigation).

**Program Objectives**

Melbourne Water addresses its legislative obligations through the Flood Preparedness Program. Traditional approaches to flood risk management are not always feasible or cost effective and we need to expand and diversify our flood awareness and education capabilities to ensure we have an informed, aware and prepared community.

The program’s objective is to reduce flood risks and costs to the communities who live in flood hot spots that are affected by flash flooding. We aim to achieve this by making these communities aware of their flood risks through the Community Engagement Disaster Risk Reduction (CEDRR) awareness program and the VICSES education program, coupled with a social media campaign and improved flash flood warning capabilities. The program supports the flood mitigation program in areas where structural mitigation activities are not viable due to high costs to build pipelines, retarding basins and other infrastructure, and to areas where there is no physical space left to store or transfer water.

Being aware of and prepared for flooding enables property owners to take action to reduce the impacts of flood events. This includes avoiding placing possessions in low lying areas, considering flow paths when landscaping and fencing, ensuring reliable access to flood warning systems, and pre-planning responses such as sandbagging and ‘stay or go’ actions in the event of flood warnings.

The key elements of our current flood preparedness program enable agencies and the community to be aware and ready to manage flooding before, during and after it occurs.

Our current services include:

* Community flood education and awareness program, delivered in partnership with VICSES
* Riverine flood warnings including waterway monitoring and agency notifications before, during and after flood events, and flash flood warnings and notification to residents via SMS in pilot areas
* Collaboration with the SES and local government in developing and reviewing flood emergency management plans.

Melbourne Water has been working in partnership with the VICSES for several years to provide community flood education and awareness programs. This fulfils the VICSES’s responsibility under the State Emergency Management Plan to engage and inform the community, and forms part of Melbourne Water’s flood risk reduction approach. At the start of the previous Flood Management Strategy in 2015, 41% of people, directly impacted by flooding, were aware of their flood risk with the aim to increase this to 58%. Social research commissioned by Melbourne Water and VICSES mid-way through strategy implementation found that only 44% of people who lived in flood-prone areas were aware of their risk, and only 34% felt prepared for flooding. Whilst this demonstrates an improvement to flood affected communities’ awareness, it has also highlighted the need to try different approaches to building the community’s awareness and preparedness for flooding.

In 2018 Melbourne Water partnered with University of Melbourne to undertake a pilot project using the Community Engagement Disaster Risk Reduction (CEDRR) approach to flood prone properties in the Whittlesea municipality. The CEDRR project has developed and tested an approach to disaster risk reduction that draws on recent social science. Specifically, it incorporates research of learning, knowledge transfer, knowledge communication, expertise, and participation to develop a behaviour change program. Broadly, risk reduction actions will be prompted through an innovative form of engagement and, as importantly, those actions by the public will be measured, providing quantitative verification and evaluation of the impact of community engagement. The success of this project demonstrated that the methodology and quantitative data would help to track the communities’ existing flood awareness and become the basis of an ongoing continuously evaluated effort to build MW and VICSES understanding of different approaches to engagement and their effectiveness.

Melbourne Water’s Annual Enterprise Risk Report recognised that the controls in place to manage riverine flood warnings are effective and well established yet more needs to be done to address flash flooding warnings. Flash flooding is more complex than riverine flooding given the highly localised and rapid onset of flooding. Flash floods require expedited warning processes. Riverine flood warning is based on having at least six hours to collect data, run prediction models, interpret flood mapping, determine potential consequences, and construct and disseminate warnings. Flash floods do not allow time to run those processes; they call for a different approach. A trial of artificial intelligence (AI) technology conducted in 2019 has proven to be successful in predictive flash flood warning detection and will be expanded under our proposed Flood Preparedness uplift program.

**Innovation and Improvements**

Our Flood Preparedness program is not a new program and we have some tried and tested approaches which are proving to be effective in reducing flood risk such as the riverine flood warning program and elements of the education and awareness programs.

We continue to have a continuous improvement focus towards the program as demonstrated through the CEDRR trial and the AI pilot project for flash flood warnings. The results of both these projects have identified that these approaches are cost effective mechanisms to reduce the flood risk hence the proposed program uplift to facilitate this expansion.

The results of the CEDRR pilot project show a significant number of households took flood preparedness action as a result of the engagement. The approach also pioneers an engagement form that creates a ripple effect which enables and facilitates the community taking ownership and leading the sharing of flood preparedness information. There is currently a lack of Australia-specific data on the value of household actions within the peer-reviewed literature, though (Poussin, Botzen and Aerrs, 2015) provide rigorous estimates for homes in France, which are drawn upon for the CEDRR program evaluation. The adoption of the CEDRR approach as part of the Flood Preparedness program uplift will enable the collection of local data to support the findings to date. The CEDRR approach aims to determine and quantify the cost/benefit ratio of the proposed community engagements undertaken for flood risk reduction.

The CEDRR trial, whilst acknowledging the limitations of a small sample size, resulted in an unprecedented number of actions taken by households to prepare for flooding. The project demonstrated that 40% of participants had taken actions to mitigate risk in their households while 46% discussed the interaction with friends or family. Given the combination of variability and sample size issues, a conservative estimate of potential benefits is appropriate. Additionally, the estimate relies on mitigation actions that do not require substantial costs for implementation. As such, sandbags and anti backflow valves and adapted furniture are used, which equals $21,550 per household over 50 years (Poussin et al., 2015). Using this estimate, the greatest potential benefit of the proposed CEDRR analysis of the 5000 most flood-prone locations in Melbourne Water’s catchments suggests a benefit of $2,155,000 per annum. Targeting catchments where the biggest reductions in AAD can be achieved (see Appendix 1) ensures that the program is as effective as possible.

In terms of flood warning innovation, Melbourne Water has developed an Artificial Intelligence (AI) Flood Warning system which uses machine learning to provide automated flood alerts to three trial catchments, Elster Creek in Elsternwick, Laburnum in Blackburn Nth and Brushy Creek at Croydon Nth. The system generates alerts based on severe rainfall enabling up to 2 hours notification of potential flooding, including flood maps.

**Program Scope**

The key elements of our proposed uplift for the Flood Preparedness Program will build upon the successful CEDRR trial and the Flash Flood warning AI pilot project to improve community resilience to flooding and complement existing programs. It is often not economical or feasible to eliminate flooding and structural mitigation approaches may be cost prohibitive in some areas, it is these areas where the most cost effective and prudent approach to flood risk reduction is education and awareness.

Flood preparedness involves building awareness of the risk and potential impacts of flooding and educating customers and the community on the most appropriate course of action for an individual to take to reduce the financial, emotional and physical impact of flooding.

Our uplift services include a suite of non-structural elements including:

* expansion of our education and awareness program utilising the CEDRR approach;
* the *Know Your Flood Risk* social media campaign; and
* improved flash flood warning capabilities in flooding hot spots utilising predictive AI and Internet of Things (IoT) technologies combined with existing flood monitoring networks

Collectively, these activities are required to provide an end-to-end solution to reducing flood risks to our most flood affected communities.

* The CEDRR approach working with the University of Melbourne will contribute the most robust flood awareness and education engagement to 4500 residents with supporting awareness and evaluation metrics.
* The SES program although comprehensive does not reengage with community as frequently, the means of determining increased flood awareness needs to be conducted via surveys. This program is expected to deliver to between 5-10,000 residents.
* The *Know Your Flood Risk* social media campaign and portal will provide metrics for measuring flood awareness statistics via dashboards and reports. This will include richer data derived from our mapping team and external agencies such as VICSES, DELWP and EMV.
* The VicEmergency app, not released for flash floods yet, is expected to provide notifications of flood risks to communities in flood hot spots which will help maintain awareness of flood risks and provide access to live flood data and flood safety information. There are 85,000 people within a 50km radius of Elster Creek catchment in Elsternwick that already have the app. The expansion of AI will enable early warning of flash floods for residents of the flood hot spot catchments that it is released to, expecting 5 to 7 catchments p.a. focusing on the areas where the highest reduction in AAD can be achieved.

Linking all these Flood Preparedness programs together is expected to enable the most unique and likely first ever end-to-end flash flood system. It will reduce the risk to these communities through non-structural strategies enabling access to information that can result in actions to be taken before, during and after large flood events, to reduce costs, risks to life and assets.

**Options Identification and Assessment**

Three different options were considered. Scenario 1 is the current level of service acknowledging that this will not meet our increasing obligations as the challenges of climate change and urban densification increase. Scenario 2 builds upon our current program with the incorporation of innovate approaches which we have trialled already and have proven to be successful. Scenario 3 is based on Scenario 2 with greater uplift, however it was acknowledged that this would be a challenge to achieve without increased resources to deliver it, internally and externally.

An overview of the three scenarios is provided below:

***SCENARIO 1:*** *Existing Forecast of Operational Expenditure*

* Continue current education and awareness program with VICSES to 10,000 households
* Continue to monitor riverine flood levels and provision of timely and appropriate flood warnings and education to the community for riverine flooding
* Limited flash flood warning capability
* Provision of flood information to the general community
* Social media campaign to raise awareness across five flood hot spot areas
* Estimated AAD savings of $1.4M

***SCENARIO 2:*** *Existing Operational Expenditure + $1.5M $Real2021*

* Expanded education and awareness program comprising of both the VICSES and CEDRR approaches to 14,500 households
* Continue to monitor riverine flood levels and provision of timely and appropriate flood warnings and education to the community for riverine flooding.
* Improvements to flash flood warning capabilities in 5-10 catchments utilising AI for Flood and IoT technology for predictive flood impact determination
* Social media campaign to raise awareness across all flood affected areas in Melbourne – *Know Your Flood Risk* with targeted and localised campaigns in 5-10 flood affected areas.
* Estimated AAD savings of $2.3M

***SCENARIO 3:*** *Existing Operational Expenditure + $3.1M $Real2021*

* Expanded education and awareness program comprising of both the VICSES and CEDRR approaches to 29,000 households i.e. double the program
* Continue to monitor riverine flood levels and provision of timely and appropriate flood warnings and education to the community for riverine flooding.
* Improvements to flash flood warning capabilities in 10-20 catchments utilising AI for Flood and IoT technology for predictive flood impact determination
* Social media campaign to raise awareness across all flood affected areas in Melbourne – *Know Your Flood Risk* with targeted and localised campaigns in 10-20 flood affected areas.
* Estimated AAD savings of $4.6M

**Preferred option**

**Scenario 2** is the recommended option as this represents a Flood Preparedness program that meets our obligations, best responds to the growing flood risk and meets our communities’ expectations in the most cost effective manner.  Scenario 2 includes the addition of 4,500 additional flood affected homes that will be engaged through the CEDRR program which is expected to be evenly delivered across the water plan, i.e. approximately 900 homes per annum. The CEDRR program will deliver a more intense education/awareness campaign with metrics informing of residents increased understating of their flood risk. Compared to how metrics are currently collected through surveys of residents, this is expected to result in a much higher education of residents and reduction of the flood risks as a result.

Scenario 1 does not sufficiently meet our obligations or our stakeholders and community expectations and presents an unacceptable level of risk with no reduction in AAD from current levels. It also compromises our ability to meet our draft *Flood Management Strategy* commitments. Scenario 3 proposes an ambitious program which whilst providing the highest level of risk reduction, may be challenging to scale up to in a single stage and is therefore not recommended at this time, however should be considered in the future where cost benefit is demonstrated.

**Program Uplift Costs**

The proposed flood preparedness operational expenditure uplift is $1.5M. The breakdown of this expenditure is shown below. Costs are reflective of our experience in delivering similar services and where possible incorporates quotes from vendors and estimates for delivery of projects to increase flood education and awareness across the next five years.

**Table 4:** Flood Preparedness uplift expenditure

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **2021/22** | **2022/23** | **2023/24** | **2024/25** | **2025/26** | **Total** |
| **CEDRR Program** | $170,000 | $170,000 | $170,000 | $170,000 | $170,000 | $850,000 |
| **Social Media Campaign** | $75,000 | $35,000 | $75,000 | $35,000 | $55,000 | $275,000 |
| **Flash Flood systems** | $95,000 | $95,000 | $75,000 | $55,000 | $55,000 | $375,000 |
| **Total Opex endorsement** | $ 320,000 | $ 320,000 | $ 300,000 | $280,000 | $280,000 | $1,500,000 |

**Program Benefits**

The benefits of the Flood Preparedness program uplift include:

* Meeting our obligations under the Water Act 1989, Statement of Obligation (2015), Emergency Management Act 2013 through reducing flood risks and costs to communities by improved notification and understanding of these risks before, during and after floods
* Meeting our Strategic drivers including the draft Flood Management Strategy and the Strategic Direction objectives and community and stakeholder expectations
* Improved community notification of flash flood events allows sufficient time for individual action to reduce impacts. For example, the first assets that are usually flood damaged are vehicles as streets convey floodwaters. By providing a flash flood alert it is expected to reduce damage/loss of vehicles by residents taking action to relocate them prior to the flooding occurring.
* Decreased economic damages both now and into the future. Costs are associated with clean-up and recovery, loss of work and other economic disruption. The AAD is estimated to be reduced by $11.5M through the Flood Preparedness program over the next 5 year
* Improved community safety due to improved flood warning capabilities and awareness of what to do to reduce risk leading to more flood safe actions and a more resilient community
* Reduced social costs including emotional stress, psychological and physical illness, and loss of life
* More efficient and prudent flood risk management programs, delivered at lower costs
* Improved data and technology capabilities with a focus on partnership approaches and working collaboratively

The improvements to the Flood Preparedness program and linkages to systems is also likely to benefit other projects such as Melbourne Storm Water Institutional Arrangements (MUSIA) through increased data and monitoring of urban drainage networks and the sharing of data from connected IT systems.

**Program Risks**

The primary risks associated with the flood preparedness program are the translation of the benefits and associated risk reduction of flood awareness and education campaigns to action. Utilising the CEDRR program provides a significant increase in our evaluation capabilities to address this risk. In terms of the improved flash flood warning capabilities, due to the nature of flash floods the risk remains that the community may not be given sufficient time to act. Whilst this risk remains, the improvements and expansion of the flash flood warning program provide a lower residual risk than without the program. Further analysis and engagement with flood affected communities post flood events will provide valuable insights into the effectiveness of this approach.

**Program Implementation**

The CEDRR program has already been trialed and will therefore commence immediately and will target 2000 properties initially with additional properties added biannually to allow sufficient time for re-engagement and evaluation.

The targeted social media campaign will focus on three high risk catchments initially. In subsequent years additional catchments will be targeted and previously targeted catchments re engaged to maintain awareness.

The flash flood program will requires some initial development work with Emergency Management Victoria and the VICSES prior to deployment in year 2.

**Table 5:** Flood Preparedness program uplift implementation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | FY21/22 | FY22/23 | FY23/24 | FY24/25 | FY25/26 |
| CEDRR Program | 2000 properties targeted | Re-engagement and evaluation | Additional 2000 properties targeted | Re-engagement and evaluation | Additional 500 properties targeted |
| Social media campaign | 3 catchments targeted | 2 catchments targeted plus re–engagement of existing catchments | 3 catchments plus re–engagement of existing catchments | 2 catchments plus re–engagement of existing catchments | Re-engagement of all 10 catchments |
| Flash Flood program | Development | 3 catchments | 3 catchments | 2 catchments | 2 catchments |

**Appendix 1**

The sub catchments where investment in improved flood warning and education capabilities will achieve the greatest reduction in AAD are listed below. These catchments have been identified as priority catchments for targeted education and awareness campaigns and improved flash flood warning capabilities under the Flood Preparedness uplift program.

|  |  |  |
| --- | --- | --- |
| **Catchment Name** | **Type of Flooding** | **# properties impacted** |
| WATERFALL CREEK | Overland | 1705 |
| KOORNANG RD M.D. | Overland | 5671 |
| SHEEPWASH CREEK | Riverine | 1589 |
| CAULFIELD SOUTH M.D. | Overland | 3118 |
| MURRUMBEENA DRAIN | Overland | 5647 |
| CORHANWARRABUL CREEK | Riverine | 12238 |
| Old Joe's Creek | Overland | 5386 |
| ELSTERNWICK M.D. | Overland | 3158 |
| MERLYNSTON M.D. | Overland | 10993 |
| MOORABBIN M.D. | Overland | 5914 |
| ESSEX STREET MAIN DRAIN | Overland | 3853 |
| MELVILLE M.D. | Overland | 9329 |
| BYRON ST M.D. | Overland | 4917 |
| NUNAWADING OUTFALL | Overland | 3879 |
| PRAHRAN MAIN DRAIN | Overland | 4120 |
| "W" CREEK | Overland | 4934 |
| OAKLEIGH M.D. | Overland | 2627 |
| GILARTH ST M.D. | Overland | 3762 |
| MURRAY ANDERSON CREEK | Riverine | 2244 |
| BURWOOD M.D. | Overland | 3173 |