

# Somerset West and Taunton



## Taunton Strategic Flood Alleviation Improvements Scheme Project (TSFAI).

Non-Technical Summary Report

Report version: Final Version (V5)

Date: 28 October 2019

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# Introduction

## 1.1 Project Aims & Objectives

Taunton has a history of river flooding with notable flood events being recorded in the 1960's, 2000 and smaller events in 2007 and 2012.

Taunton was designated a Garden Town in 2017 to assist the Councils growth agenda including the proposed regeneration of key sites in the town centre and strategic allocations in local planning policy. One of the key constraints identified at the early stages was flood risk, and how can this be managed in the long term.

In response Somerset West & Taunton (SWT) Council and the Environment Agency (EA) have been working in partnership for a number of years, and have specifically scoped a 'Project Delivery Plan' (PDP) to identify strategic flood risk solutions for Taunton, including Bathpool, that can both reduce the current flood risk, and appropriately mitigate against the future impacts of climate change over the next 100 year period. The PDP was scoped using the EA's latest River Tone hydraulic model to test various option performance, and to provide a conceptual level of design detail when reporting on the most effective options.

This reports explains the key recommendations of the PDP and how both SWT and the EA intend to practically develop the flood risk reduction options for Taunton that could be delivered over the next 10 to 30 years periods (from 2019/20) to manage the predicted impact on river flooding from climate change up to 2118. The flood risk management options described in this report are all geographically located within the River Tone catchment.

Throughout the report, key messages have been included to highlight their importance to the reader.

This report **aims to**:

1. Provide a strategic overview detailing what the project partners and other risk management authorities could deliver in terms of effective flood risk management on the River Tone in Taunton for the next 100 year period.
2. Explain SWT Council's and the EA's current preferred way forward to reduce flood risk in Taunton by applying a phased approach over short, medium and long term periods
3. Highlight the challenges and opportunities, including a list of potential funding sources available.
4. Provide budget cost estimates as a range to assist option comparison and to inform future planning. Costs explained in this report have been sourced from our known suppliers and the Environment Agency's Project Cost Tool.
5. Identify the next steps to allow the project to enter the 'Delivery' phase, which will include work to progress the options from conceptual detail to detailed design, undertake appropriate consultation, and obtain the necessary consents and approvals, including information to inform a future construction project to deliver the flood alleviation solutions.

This report **does not**:

1. Repeat all of the findings described within the Project Delivery Plan Technical report and supporting appendices.
2. Does not provide planning permission to implement the works.

3. Identify all constraints. The report has been prepared at a strategic level therefore it should be recognised that there may ultimately be technical, financial, economic or other reasons for accepting or rejecting the various options identified.
4. Provide a detailed Environmental and/or Habitats Regulations assessment of the options individually or cumulatively. At this time we would expect that the options identified may require a statutory Environmental Impact Assessments (EIA) but this would need to be confirmed by the Local Planning Authority (LPA). For the PDP, work has been undertaken to understand key environmental constraints through targeted Phase 1 Habitat survey and mammal survey work, which has subsequently been used to inform the options.
5. Provide detailed costs or provide a detailed economic analysis with cost benefit ratio analysis.
6. Assess surface water flooding options in detail, although we believe the options presented could potentially offer a benefit to the existing drainage infrastructure.
7. Provide all the detail required for future site-specific Flood Risk Assessments.

## 2.0 Previous Studies

A number of studies have been undertaken in Taunton since 2005 to understand flooding and the possible options that could reduce flooding. These have informed the Project Delivery Plan alongside updated modelling and survey work.

1. Environment Agency “Taunton Flood Defence Improvements” (2005).
2. Project Taunton “Flood Risk Management Guidance” (2006).
3. Taunton Deane Borough Council “Level 2 Strategic Flood Risk Assessment” (2009).
4. Project Taunton “Effects of land raising report” (2011)
5. Project Taunton “Modelling of Town Centre Sites” (2012)
6. Taunton Deane Borough Council “Bradford on Tone Pre-feasibility Study Inception Stage” (2011)
7. Environment Agency “River Tone Defences Investigation” (2012)
8. Taunton Deane Borough Council “Phase 1 Options Study” (2014)



**Taunton Strategic Flood Alleviation Improvements Project:**  
Technical Report, Factsheets & Plans (2019)

## 3.0 Location & Context

### 3.1 What is fluvial flooding and climate change?

Fluvial flooding occurs when the water level in a river, lake or stream rises and overflows onto surrounding banks and neighbouring land. Throughout this report, river flooding describes a situation where the natural channel capacity is exceeded and/or where an existing flood defence are not high enough to prevent overtopping.

Climate change is the change in global or regional climate patterns and is largely attributed to the increased release of Greenhouse Gases produced by the use of fossil fuels. With global temperatures expected to continue to rise, this will increase sea levels and the frequency of intense extreme weather for the UK. Higher volumes of precipitation entering watercourses will cause floodplains to be larger in extent and depth, thus increasing their impact on the natural and built environment.

To explain some terms that are used frequently in this report:

Annual Exceedance Probability (AEP) refers to the probability of a flood occurring in any one year. The probability, or likelihood of the flood occurring is described as a percentage. For example, a large flood which may be calculated to have a 1% chance to occur in any one year, is described as a 1% AEP.

Standard of Protection (SOP) is used to describe the performance of a flood defence scheme and is linked to the above AEP definition. For example, if a flood defence scheme prevents the 1% AEP from overtopping it would be defined as having a SOP of 1% AEP.

### 3.2 Catchment overview.

The River Tone is one of the largest tributaries of the River Parrett catchment. Sourced in the Brendon Hills it has an average gradient of 1in 20, which becomes very shallow (1in 1000) by the time it reaches the River Parrett confluence at Burrow Bridge on the Somerset Levels & Moors. In total, the length of the river covers a distance of 51km. The Tone catchment is predominantly rural with the main urban areas only making up about 3 to 4% coverage of the total catchment area.

The main source of flood risk in Taunton is from river flooding from the River Tone and its tributaries.

One of the key reasons why flooding is a challenge to manage in Taunton is because there are multiple watercourses (Halse Water, Hillfarrance Brook, Norton Brook, Back Stream) joining the River Tone upstream, and within the town centre (Mill Lease Stream, Galmington Stream, Sherford Stream). When the River Tone is high, or bank full, this results in these smaller tributary watercourses being unable to discharge under gravity i.e. they become 'locked', causing a backup of water upstream, resulting in flooding along those tributaries near the Town centre.

Flooding in nearby Bathpool is also complicated by multiple watercourses (Kingston Stream, Maiden Brook, Allen's Brook, Dyers Brook) joining the River Tone near the A38 Bridgwater Road. When the River Tone is high in this location this causes the Old River Tone outfall flap gates to close, limiting the release of flood waters from the Bathpool area. Without the flap gates, flood water from the main River Tone channel would travel back up the Old River Tone and would cause more frequent and serious flooding in Bathpool.



There is also a second flood mechanism for Bathpool caused by excess flood water passing down the Bridgwater & Taunton canal from the River Tone overspilling into the canal at Firepool Lock. The canal does not have sufficient capacity for this extra flood flow therefore overtopping occurs along the right bank into the Maiden Brook and ultimately the Allen's Brook in Bathpool, where it causes flooding. There is also a formal side spill weir from the canal at Bathpool into the Dyer's/Allen's Brook. From EA records this last major flood occurrence was in November 2012, but significant flooding did also similarly occur in 2000 to a lesser degree.

Surface water flooding does occur in Taunton as a result of the surface water drains exceeding their capacity or as result of direct rainfall. The strategic solution for fluvial flooding cannot solve the local sources of surface water flooding, but some of the solutions may help.

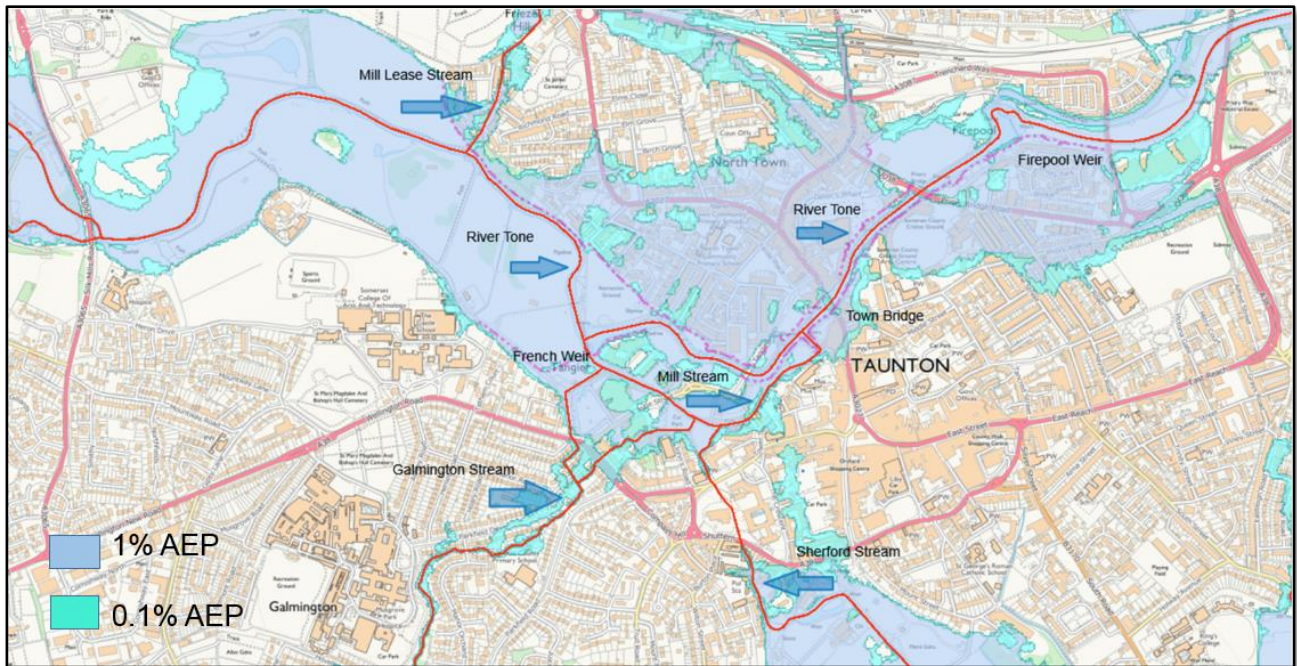


Figure 1 – River Tone and tributaries in Taunton Town Centre with 1% and 0.1% AEP flood maps.

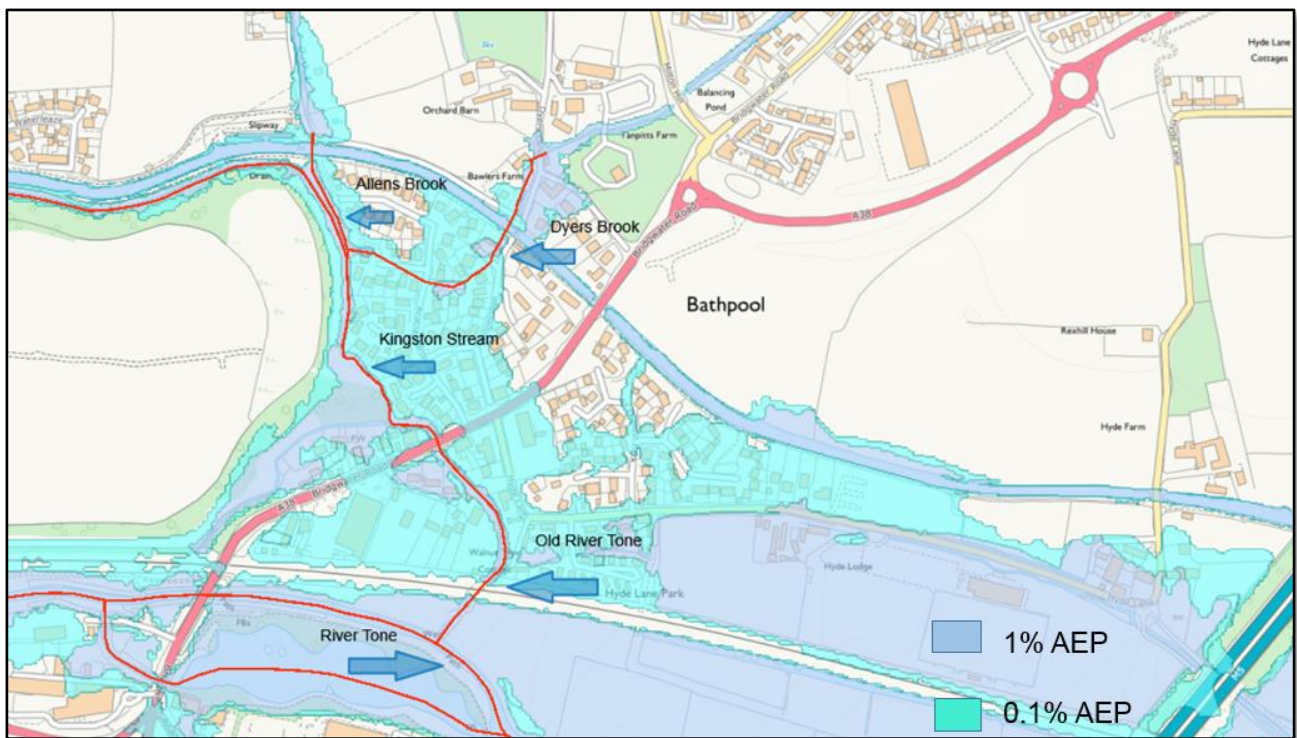


Figure 2 – River Tone and Bathpool tributaries with 1% and 0.1% AEP flood maps.

### 3.3 Historic Flooding Events in Taunton

Records of flooding in the Taunton area go back to the late 19<sup>th</sup> century with 1889 flooding being mentioned in the Chronological of British Hydrological Events. In the 20<sup>th</sup> century the October 1960 flood event was the most severe and approximately 500 properties were flooded in Taunton town centre. In response to the 1960 flood event the River Tone Flood Alleviation Scheme (FAS) was constructed and it consisted of widening and straightening the River Tone channel and building new flood defences throughout the town.

The new defences were tested in 1968 and records confirm that the defences protected the centre of Taunton. These defences were subsequently upgraded in the 1990's to achieve a 1% Annual Exceedance Probability (AEP) standard of protection at that time.

In October 2000, the FAS was tested by a similar magnitude flood event to that recorded in 1968. From information collected during the 2000 event, the defences on the River Tone were successful in protecting the centre of the town, although flooding on the tributaries was more significant, and surface water flooding affected a number of other areas. Flood water was observed overtopping the canal lock gates at Firepool causing flooding in Bathpool. Evidence from observed events, photographs and local media reports suggest that flooding in Bathpool has occurred more than 20 times since 1960. Not all of these events have involved internal flooding to houses but have caused disruption and inconvenience with key access roads being underwater.

Other notable flood events were recorded in November/December 2012 when property flooding was noted elsewhere across the Town.

Smaller flood events have also occurred in 2007, 2009 and 2012 again on the tributaries in the town centre. In 2012 notable flooding occurred in Vivary Park and to the adjacent Cricket Club.



More recently, a major flood incident occurred on the Somerset Levels & Moors in 2013/14, which resulted in an extensive land area being flooded for 3 months. Taunton town centre narrowly avoided serious flooding but the town experienced significant disruption to local services and businesses, demonstrating that flooding events do not just impact the inundated area.



*Figure 3 – River Tone flooding in 2012 by Clarence Street, Taunton. (Environment Agency).*



*Figure 4 – Emergency works to Firepool Canal lock gates to prevent Tone water entering the canal in 2000. (Environment Agency).*



Figure 5 – River Tone flooding in 2012 by Morrison's, near Town Bridge, Taunton (Environment Agency).



Figure 6 - River Tone high levels by Pound Stretchers in 2012 adjacent to Town Bridge, Taunton (Environment Agency)



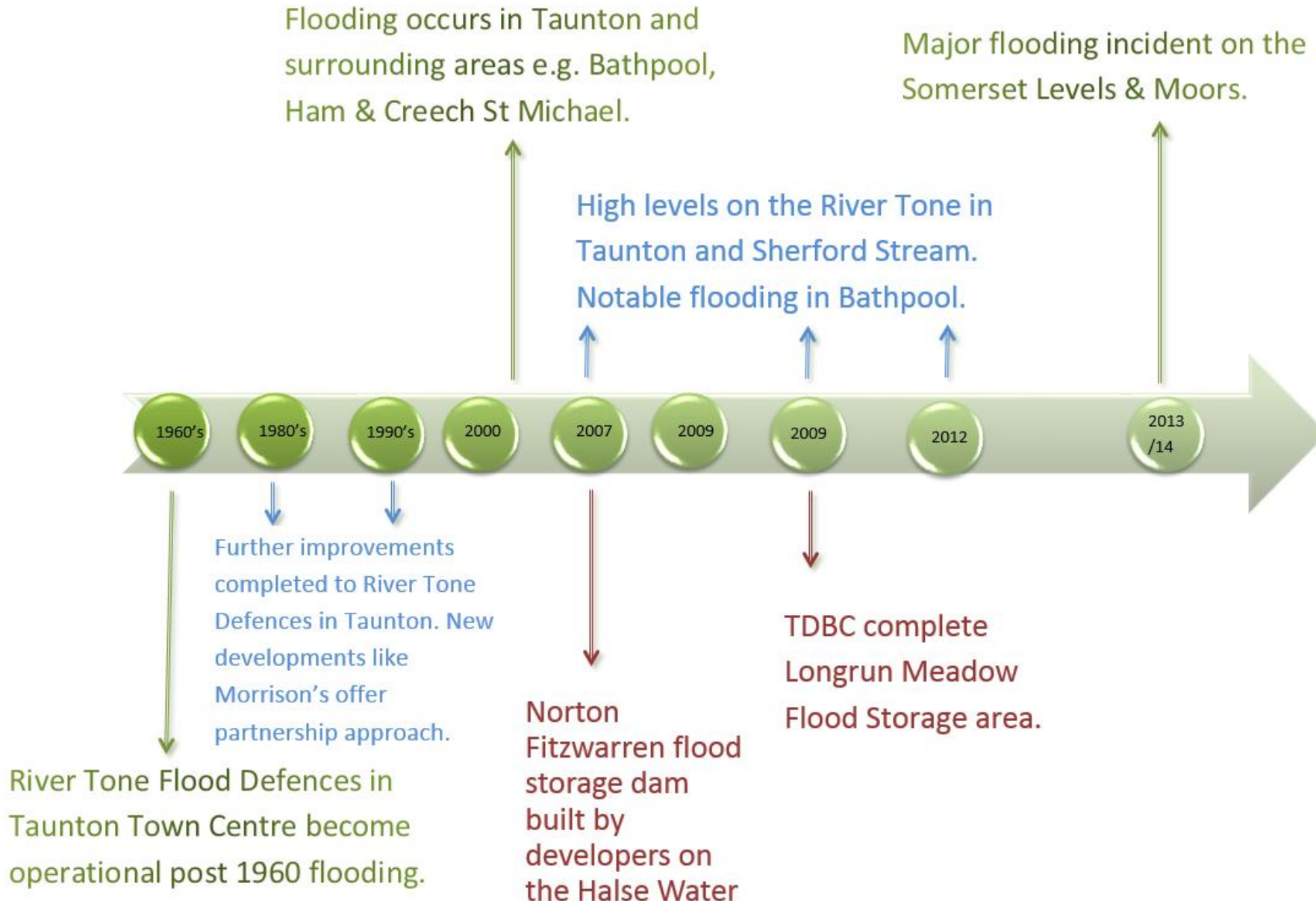


*Figure 7 – Flooding of road outside Acacia House, Bathpool in 2012 (Environment Agency)*



*Figure 8 – Flooding outside Swingbridge House, Bathpool alongside the A38 in 2012 (Environment Agency)*

## Timeline of key events on the River Tone in Taunton



## 4.0 Flood risk in Taunton

### 4.1 How is flood risk currently managed in Taunton?

River flooding in Taunton is managed by multiple Risk Management Authorities (RMA's), but predominantly led by the EA as the River Tone is classified as a 'Main River'. Using its permissive legal powers the EA undertakes scheduled condition inspections of the flood defences in the town centre, weekly checks on key assets to remove any large debris and annual in-channel vegetation clearances. Non-main watercourses i.e. typically smaller watercourses and ditches etc. fall under the jurisdiction of Somerset County Council (SCC) as the Lead Local Flood Authority (LLFA).

SWT Council, as the Local Authority, oversee various functions in Taunton. When considering flood risk in respect of new development and the Local Plan, the Council must consider this constraint by avoiding the risk completely or requiring developers to implement appropriate measures to remove or reduce the flood risk safely.

### 4.2 The Need for Intervention – A Summary of Key Flood Risk Facts.

From our 2016 flood mapping there are approximately **1031** total properties (residential, commercial and infrastructure) at risk from river flooding in Taunton from the 1% Annual Exceedance Probability (AEP) taking into account current flood defences. From the above total we estimate that **527** of these are residential properties currently at risk.

When considering the impacts of climate change on river flooding up to 2118 this increases the total number of properties at risk in Taunton to **2548** for the 1% AEP, with **1604** being residential properties. Maintaining the existing flood defences at their current height in perpetuity does not offer a sufficient level of protection, which means that they are likely to be overtopped more frequently in the future.

#### Typical patterns of flooding in the Town Centre.

1. Tangier and Bathpool are two of the first areas to flood in Taunton.
2. Flooding from the tributaries (Galmington Stream, Sherford Stream & Mill Stream) in the Tangier area begins from the 10% AEP and is attributed to exceedance of channel capacity. While limited properties are effected 'small pockets of flooding' occur as there are no formal defences along these tributaries.
3. Major River Tone flooding in Taunton town centre first starts to occur between the 2% and 1.33% AEP. The critical lower sections of flood defences that are overtopped first are on the left bank upstream of the Town Bridge, near Clarence Street, BT Exchange and also downstream at the Firepool (former Cattle Market) site. Significant overtopping can presently occur, and would be very similar in consequence to the 1960's flood, which saw flows travel overland along Station Road towards Taunton railway station.
4. The lock gates on the entrance to the Bridgwater and Taunton canal are likely to be overtopped causing flooding in Bathpool to occur, which was last observed in the 2000 event.



5. Flooding of Vivary Park adjacent to the cricket pitch and bandstand area typically occurs for the 10% AEP from the Sherford Stream.

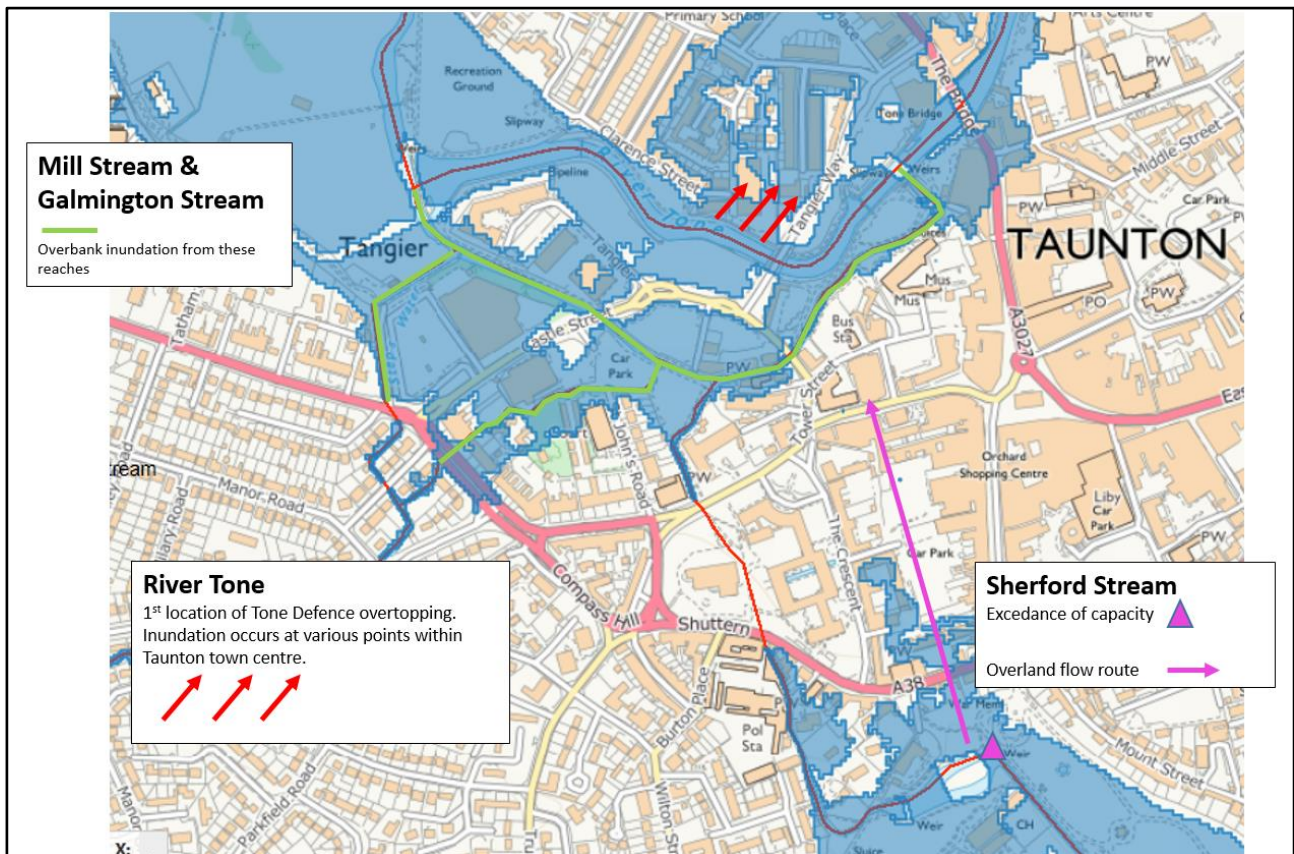


Figure 9 – Key out of bank, defence overtopping and flood flow paths locations in Taunton Town Centre.

**Predicted flooding pattern for the 1% AEP event in Taunton & Bathpool today and in the future from climate change.**

1. The 1% AEP flood mapping (2016) shows significant flooding in Tangier as a consequence of the channel capacity being exceeded from the Mill Stream, Galmington Stream and Sherford Stream. Flood depths vary across this area, but on average are between 0.60m and 0.90m. In 2118, with an allowance for increased river flows due to climate change, flood depths increase significantly to 0.90m to 1.5m.
2. The River Tone overtops existing defences at various locations between French Weir and Obridge Viaduct resulting in extensive property flooding, which increases significantly when considering climate change. The River Tone is sensitive to an increased flow and this presents a major challenge to the performance of the existing town flood defences. **Please refer to Figure 10.**
3. Flooding of Taunton town centre caused by the overtopping of the existing critical low defences sections on the left bank of the River Tone results in flood water depths of 0.30m to 0.60m across the North Town area. The flood extent increases significantly when considering the worst case climate change scenario in 2118. Flood depths at their deepest are in the order of 0.90m to 1.5m but there are smaller pockets of 0.30 and 0.60m depth.

4. By 2118 the risk of overtopping and flooding to the County Cricket Ground is the 1% AEP with climate change impacts. For the worst case climate change scenario floodwater continues into Winchester Road running parallel to Priory Bridge Road. Flood depths are in the order of 0.30m to 0.60m.
5. Vivary Park becomes inundated by the current 1% AEP today in 2019 and for the worst case climate change scenarios in 2118 due to out of bank flooding from the right bank of Sherford Stream by the ornamental lake. More importantly this overland flow path would cut across the Upper High Street causing significant inundation to the Crescent shopping precinct and disrupt the A38, a key road in the town centre.

#### **Key Message No.1**

There are approximately **1031** total properties (residential, commercial and infrastructure) at flood risk from the River Tone and its tributaries for the 1% AEP. From the above figure **527** are residential properties.

As a result of Climate Change impacts on river flooding this will increase to **2548** by **2118** if additional flood management interventions are not implemented. From the above figure **1604** are residential properties.

#### **Key Message No.2**

Flooding from the tributaries in Tangier starts for the 10% AEP.

Significant flooding from the River Tone occurs from the 2% AEP impacting the area of North Town.

The existing FAS along the River Tone was designed to achieve a 1% AEP standard of protection in the 1990's. Our analysis now shows that the FAS is now overtopped for a 2% AEP as defences are not high enough to protect from the current 1% AEP in 2019 or in the future in 2118 from climate change

### **4.3 Economic Impacts of Flooding.**

The project undertook a literature review of recent floods in the UK and the associated losses experienced in large towns or areas with some similarity to Taunton. While an accurate economic appraisal has not been undertaken it is reasonable to estimate that a single major flood in Taunton could approximately cost the local economy **£50million (2019 cost base)**.

Please refer to the PDP Technical Report to view the flood case studies.

#### **Key Message No.3**

After considering the experience of other floods elsewhere, it is reasonable to estimate that a single major flood in Taunton could approximately cost the local economy **£50million (2019 cost base)**.



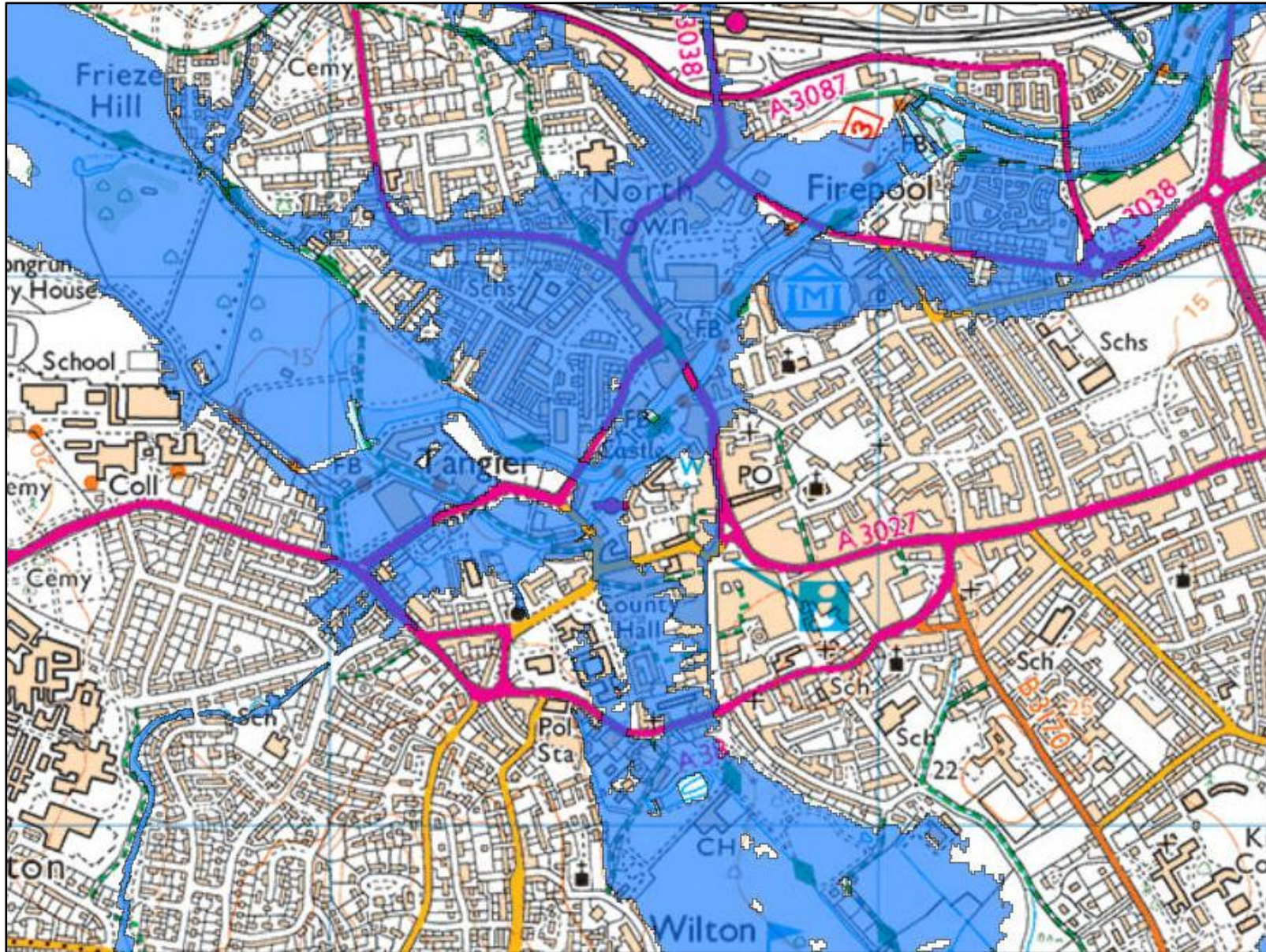


Figure 10 – 1% AEP with climate change flood map in Taunton Town Centre



# 5.0 Options Overview & Evaluation.

## 5.1 Location of Options

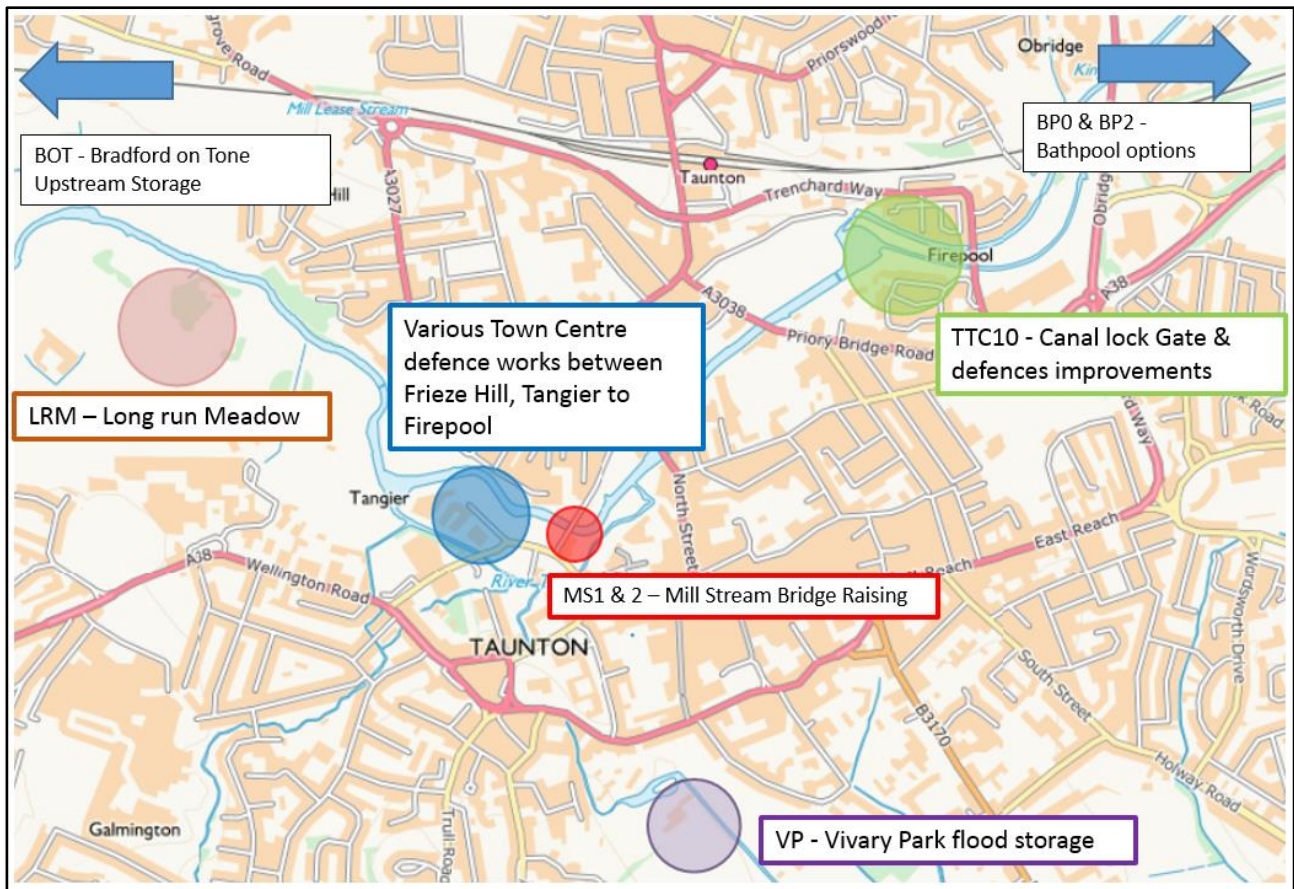







Figure 11 – Option Location Map

## 5.2 Flood risk performance of the options.








The table below summarises the ‘long list of options’ that have been assessed to determine if they could positively contribute towards reducing flood risk to existing properties and future development in Taunton today and when considering climate change. Historic options from previous studies have also been included for completeness.

The options that have been taken forward to the ‘Preferred Approach’ have a green tick next to them. The evaluation process has largely been based on flood risk reduction performance criteria.

Table Ref No.	Section 6: PDP Table Option Ref no.	Intervention Description	Accepted or Rejected	Flood Risk Evaluation.
1.	N/A	Do Nothing – Under this option all flood risk management activities would cease to occur in	<b>X</b>	This is not a sustainable long term solution. This would potentially increase the risk of flooding to Taunton.

		Taunton. For example the EA would not operate or maintain Stepswater sluice, maintain flood defence walls or deploy the Bathpool mobile pump.		The condition of existing assets would deteriorate more quickly resulting in more frequent flooding today and in the future. This option is not effective in managing future flood risks from climate change.
2.	N/A	Do Minimum – Continue operating the existing Flood Alleviation Scheme through to 2118.  Under this option the existing defences would be maintained at their current height.		This is not a sustainable long term solution.  This would not provide a means to reduce the risk of flooding to the current 1031 properties that are currently at risk from the 1% AEP. With no increase in height the standard of protection that defences provide will diminish over time as climate change impacts increases flood frequency.  Not consistent with the Catchment Flood Management Policy for Taunton to reduce flood risk.
3.	BOT (Bradford on Tone)	Large upstream storage area on the River Tone near Bradford on Tone to manage climate change.		Effective catchment flood risk solution but there are number of delivery challenges that need to be recognised if this option is progressed.
4.	TTC2, 5, 10	Improving and or new raised flood defences on the River Tone and tributaries in Taunton. Under this option this is from Frieze Hill through to Hankridge Farm on both sides of the River Tone watercourse and along all of the town centre tributaries to achieve a 1% AEP standard of protection.		While this is an effective option this has potential to increase flood risk downstream of the M5 motorway.
5.	TTC2	Improving and or new raised flood defences on the Town centre tributaries in the Tangier area.		Effective solution that can reduce flood risk in the centre of Taunton.
6.	TTC 5	Improving and or new raised flood defences for certain sections on the left bank of the River Tone.		Effective solution that can reduce flood risk in the centre of Taunton.



7.	TTC 1-2 or TTC1-3	Improving and or new raised flood defences on the River Tone and tributaries in Taunton to manage climate change.		While this is an effective option this has potential to increase flood risk downstream of the M5 motorway. While this is not a desirable climate change solution, due to the impacts downstream, this does present a 'Plan B' if the preferred climate change solution is discounted.
8.	LRM	Optimisation of Longrun Meadow flood storage to utilise the existing scheme and the natural floodplain more effectively.		Effective solution that can reduce flood risk in the centre of Taunton.
9.	VP	River restoration and new flood storage at Vivary Park.		Effective solution that can reduce flood risk in Taunton.
10.	N/A	Removal of either French or Firepool weirs.		Has potential to increase flood risk immediately downstream.  Difficult to find space to suitably grade a new channel in place.
11.	N/A	Modifications to the existing French or Firepool weir crests or sluices.		Doesn't reduce flood risk at larger events.
12.	MS2	Mill Stream flow diversions by adding a weir to change the flood direction of the Galmington and Sherford Stream.		A small scale option that could reduce flood risk reduction in the Tangier area when combined with other options in this list.
13.	N/A	Removal of ineffective structures on the Galmington Stream		Limited number of structures that could make a significant flood risk reduction in the area of Tangier.
14.	MS1	Raising of Castle Street and Bus Station footbridge on the Mill Stream		A small scale option that could reduce flood risk reduction when combined with other options in this list.
15.	TTC10	Bathpool – closing the canal route at Firepool lock by raising the existing lock gates. Raising the existing left bank embankment on the River Tone between Firepool and Obridge.		Effective solution that can reduce flood risk in Bathpool, provided it is considered with other options to mitigate any upstream flood level changes.

16.	BPO	Bathpool – protection to railway culverts to avoid Tone water entering Priorswood area.	✓	A small scale “no regrets” option that can help to reduce flooding locally in Bathpool.
17.	N/A	Bathpool – a new flood relief channel along Hyde Lane to convey flood water upstream or downstream of the M5 culvert.	✗	The existing floodplain is extensive here thus requiring new flood bunds to protect any proposed channel from being inundated. The cost of a new channel with flood bunds would also be expensive with limited benefits. The main reason for it being discounted is due to insufficient gradient preventing floodwater being conveyed away effectively.
18.	BP2	Bathpool – pumping station at Allen’s Brook	✓	This operation already exists and forms part of the EA contingency plans for reducing the impact of flooding in Bathpool. Through this option a larger pump would be implemented. An effective option that would assist to reduce the impact of flooding from small flooding events. This would replace the EA’s current temporary working arrangement and could either be a permanent building, an underground system or a larger mobile unit. For all options a better site arrangement would be required.
19.	N/A	Bathpool – Bund around the River Tone flap valve to provide more capacity	✗	Ineffective option and increased flood risk locally.
<b>Combined options</b>				
20.	TTC 2 & TTC 5	New or improved raised defences the River Tone between Frieze Hill to Town Bridge (left bank) <b>and</b> new defences along the tributaries in the Tangier area.	✓	Effective solution that can reduce flood risk in Taunton.
21.	TTC 10 & BP 02	New and/or improved defences alongside the left bank of the River Tone between Firepool lock and Obridge and a pumping station at Bathpool.	✓	Effective solution that can reduce flood risk in Bathpool

Historic Options investigated in 2005 and 2006.				
22.	N/A	Upstream storage on the Sherford Stream by Wild Oak Lane.	X	Limited flood risk benefit vs high cost
22.	N/A	Upstream Storage on Galmington Stream by Amberd Lane	X	Limited flood risk benefit vs high cost.
23.	N/A	Upstream storage on the River Tone near Greenham, Wellington	X	Too far upstream to reduce flood risk in Taunton sufficiently.

#### Key Message No.4

There isn't a single option that completely removes or reduces flooding in isolation. Instead a combination of interventions is required.

## 5.2 Explaining how the preferred approach was determined.

A key objective of this project was to identify how a 1% AEP standard of protection could be achieved and maintained when considering climate change.

The preferred approach was achieved by using the following principles:

1. The options ability or performance to reduce flood risk.
2. The costs to build and to maintain the option over its design life.
3. If the option could be phased over a period of time to make it easier to deliver.
4. Avoiding or minimising any increase in flood risk caused to other areas as a result of the new flood management interventions, including the Somerset Levels & Moors downstream.

The aim is to phase the delivery of the strategic solution to make them more affordable and ultimately more deliverable. The various short, medium and long term elements that create the overall Strategic Solution can be phased to align with future funding sources.

The table on page 23 sets out the preferred approach that is recommended for delivery in Taunton to manage the impact of flooding over the next 100 years (from 2019 onwards).

## 5.3 Consideration of Downstream Receptors

During the option evaluation process the flood levels and flows at the M5 culvert downstream of Taunton and Bathpool were reviewed for all the options considered in Section 5.0. Options where no modelled impact was found were selected to demonstrate that downstream areas including the Somerset Levels & Moors would not be impacted by the PDP's 'preferred approach'.

As expected, all of the storage options located upstream of Taunton or in the town centre all have either a positive reduction, or cause no difference to flood levels or flows at the M5 culvert. This is an important outcome of the project.

Any new raised flood defences need to be limited such that they have a negligible impact on flood risk in other areas. Our analysis has shown that smaller sections of new flood defences, or raising existing defences in Taunton will have negligible flood risk change beyond Firepool weir.

## 6.0 The Preferred Approach

Works Description	Priority Order	Capital Cost (£m)	Whole Life Cost (£m)	No. of properties removed from the floodplain					No. of properties with a reduced depth of flooding. These properties are still in a floodplain					Other Potential Benefits				Fact sheet ref:	Comments
				Residential	Commercial	Infrastructure	Other	Total	Residential	Commercial	Infrastructure	Other	Total	Regeneration	Garden Town Amenity	Biodiversity Opportunities	Natural Flood Management		
Optimise Longrun Meadow.	Short Term (Funding Identified) 0-10 Years	3 to 5	5	37	18	0	10	65	328	268	1	90	687	✓	✓	✓	✓	LRM	Detailed design required and scheduling of works to manage potential detriment to other areas.
Raised / New Defences on the Tangier Tributaries and on the River Tone (left bank) from Frieze Hill to Town Bridge.	Short Term (Funding partially secured) 0-10 years.	10 to 12	13	178	84	0	27	289	324	212	0	59	595	✓				TTC2 & TTC5	Detailed design required and scheduling of works to manage potential detriment to other areas
Raise Firepool canal lock gates, increase the height of defences between Firepool and Obridge (left bank). A new pumping station at Bathpool.	Short Term (Funding Required) 10-15 Years	6.5 to 11	30	-10	19	0	40	49	65	55	1	51	172					TTC10 & BP2	Detailed design required and scheduling of works to manage potential detriment to other areas
River Restoration and flood storage at Vivary Park	Short Term (Funding Required) 10-15 Years	8 to 10	10	42	14	0	16	72	52	20	0	16	88	✓	✓	✓	✓	VP	Detailed design required and scheduling of works to manage potential detriment to other areas
Upstream storage at Bradford on Tone	Medium/ Long Term. Adapting to Climate Change (Funding Required) 30 Years +	43 to 56	81	841	129	1	110	1081	1381	488	2	266	2137	✓				BOT	Detailed design required and scheduling of works to manage potential detriment to other areas
Raising Castle Street Bridge & Bus Station footbridge	Opportunities	8 to 10	15	-11	-2	0	0	-13	59	28	0	12	99					MS01	Detailed design required and scheduling of works to manage potential detriment to other areas
Mill Stream flow diversion	Opportunities	0.1	0.1	-23	-2	0	-4	-29	54	27	0	9	90					MS02	Detailed design required and scheduling of works to manage potential detriment to other areas



## 7.0 Deliverability challenges & opportunities.

At this stage in the project there remain a number of challenges that could impact delivery, which are listed below.

### 7.1 Deliverability Challenges

1. Affordability – The total whole life costs of the PDP Preferred Approach is high. While SWT has earmarked capital funds towards the delivery of the short term options, to deliver the complete programme will require joining together multiple sources of funding. It is recommended that a Funding Plan is created for the future.
2. Complex construction within a busy town centre will need to be carefully managed well.
3. Detailing and scheduling interventions to avoid flood risk detriment without reducing option flood risk performance.
4. Securing the necessary planning consents and legal compliance with the Reservoir Act 1975 and the Water Framework Directive.
5. Securing landowners approval for some of the options will be challenging. Further consideration of third party land acquisition and potential impact on third party land required.
6. Securing Network Rail approval for Bradford on Tone in relation to the main west coast line adjoining the site of the proposed large flood storage reservoir.
7. Avoiding an increase in maintenance burden from uprating existing assets or from the creation of new assets.

The supporting table in **Appendix 1** lists more detailed technical risks for each option based on our current understanding.

#### Key Message No.5

All the options have financial, technical and legal challenges. We need to keep a flexible approach.

## 7.2 Opportunities

Somerset West and Taunton and the Environment Agency are working together to provide a long-term strategic solution to reducing flood risk to Taunton and where possible to the wider catchment. It is recognised that the risk to the town will get worse as climate change is predicted to increase maximum flood flows over time. The risk comes not just from the River Tone, but initially from 3 other tributaries that flow into the town centre, namely the Galmington, Sherford and Mill Streams. The onset of flooding from the tributaries is estimated to be 10% AEP and from the River Tone is 2% AEP.

To protect existing property in the town and to allow the town to develop safely a holistic and strategic flood risk reduction solution is required. The work to date provides a framework which can be built on to secure long term strategic protection for the town centre through the delivery of the flood options described in this report.

The flood alleviation solutions required are varied, they include natural solutions such as the creation of wetland habitat and earth bunds as well as formal built structures such as defence walls and a pumping station. All solutions will consider improvements to the natural and built environment

This work supports the regeneration of Taunton town centre, The Taunton Garden Town status, the Councils Climate Change and Resilience work; and will be critical for allowing the town to prosper and develop safely in the future.

## 7.3 Firepool development

The redevelopment of Firepool remains a priority for the Council and the site is currently within the 1% AEP floodplain. Through the planning application process, site specific flood measures have been agreed between the EA and the LPA to protect the site from flooding, which include land raising of the site ground levels and 300+ metres of temporary demountable defences alongside the left bank of the River Tone by French Weir park entrance near Clarence Street.

The Preferred Approach described in this approach recommends new flood defence walls on the left bank of the River Tone between Frieze Hill to the Town Bridge and along the Tangier tributaries. That option provides an opportunity to replace the temporary demountable defences approach with a permanent solution, which would not only offset the operational challenges faced with erecting the temporary defence in times of flood, but offer a means to permanently improve the level of flood protection to the wider North Town community.

The long term climate change solution would also offer increased protection to the wider Town centre and all of the regeneration sites, including Firepool.

### **Key Message No.6**

The options are technically challenging and will require partnership working, but they provide a strategic solution to protecting existing property and future regeneration of the Taunton.

## 8.0 Conclusions

This project has been successful in identifying a 'Preferred Approach' that can reduce flood risk in Taunton today and in the future.

- a) Fluvial flood risk is a significant matter for Taunton's current built area and for future regeneration plans in and around the town. There are currently 1031 total properties at flood risk from the River Tone and its tributaries for the 1% AEP flood event.
- b) If the existing defences are maintained at their current crest level with long term climate change the number of properties at risk in a 1% AEP event would increase from 1031 to 2548.
- c) Do minimum i.e. just maintaining existing defences, is not an option to take forward as it does not improve the standard of protection to Taunton, neither does it protect SWT's regeneration sites from the impact of climate change up to 2118. Intervention at a strategic level is required to ensure safe development is achieved in accordance with National Planning Policy Framework (NPPF), otherwise planning restrictions could be imposed.
- d) Reliance on the existing 4km of flood defences structural condition being maintained by a 'patch and mend' approach is not sustainable as deterioration will occur.
- e) When considering a long term plan for managing flood risk in Taunton the importance of a strategic approach is critical. There isn't a 'single intervention or option' that reduces the risk of flooding significantly, therefore a combination of multiple measures i.e. the 'Preferred Approach' is required.
- f) The Preferred Approach consists of upstream flood storage, optimising existing flood storage assets in the town centre, new or raised flood defences along the River Tone and Tangier tributaries and a pumping station at Bathpool.
- g) The proposed flood storage options in Longrun Meadow and Vivary Park not only offer a flood risk reduction but offer opportunities to improve existing habitats or create new habitats.
- h) The preferred combined approach must be co-ordinated to avoid any interim flood risk detriment.
- i) The Preferred Approach will need to be phased to make it affordable as it is unlikely to attract full or majority funding from central government Flood Defence Grant in Aid (FDGIA). Alternative funding sources to date have been identified by the SWT & EA Project Team (Community Infrastructure Levy (CIL), Housing Infrastructure Fund (HIF), New Homes Bonus and the Wessex Flood Defence Committee.
- j) There remain a number of significant delivery challenges that could prevent some of these options being implemented e.g Upstream storage on the River Tone. These have been suitably highlighted for the Council's elected members to assist with understanding the risks.

## 9.0 Next Steps/Recommendations

1. SWT and the EA should continue to work in partnership to support the development of a holistic solution for Taunton. SWT should continue to be Lead Partner to ensure a joined up approach across the community, regeneration and economic development occurs.
2. Recommendation: SWT accepts the findings of this report and endorses the recommended strategic approach to flood risk management.
3. Recommendation: SWT endorses the programmes of works listed in section 6, as a basis for future investment planning and securing of necessary funding
4. Recommendation: SWT, in partnership with the EA, moves forward with the identified Longrun Meadow scheme and the town centres defence improvements on the left bank of the River Tone to an appropriate design standard to secure the necessary approvals, with appropriate key stakeholder and public consultation.
5. Recommendation: that SWT and the EA develop a funding strategy to support implementation of the entire preferred approach.

## 10 Glossary and abbreviations.

AEP	Annual Exceedance Probability	The percentage chance of a flood of a given magnitude being exceeded in any one year
AOD	Above Ordnance Datum	Height relative to the average sea level at Newlyn, Cornwall UK
CFMP	Catchment Flood Management Plan	A plan which consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding on a catchment basis to provide a strategic overview of issues.
EA	Environment Agency	
FBC	Full Business Case	The final stage for government spending approvals process following the five case business model. The first two stages being the Strategic Outline Case (SOC) and Outline Business Case (OBC)
FDGiA	Flood Defence grant in Aid	A grant from Defra administered by the Environment Agency to support the construction of new or improved flood risk management measures
FRA	Flood Risk Assessment	Required to support any planning application it considers the flood risk at a development site as well as the impacts of the development on flood risk elsewhere. All sources of flooding are considered including fluvial, surface water and groundwater.
LLFA	Lead Local Flood Authority	
L&M	Levels and Moors	Coastal plain and wetland area of Somerset, running south from the Mendips to the Blackdown Hills and containing numerous nationally and internationally environmentally designated sites.
LEP	Local Enterprise Partnership	Voluntary partnerships between local authorities and businesses set up in 2011 by the Department for Business, Innovation and Skills to help determine local economic priorities and lead economic growth and job creation within the local area.
NPPF	National Planning & Policy Framework	
OBC	Outline Business Case	The middle stage for government spending approvals process following the five case business model. The other two stages being the Strategic Outline Case (SOC) and Full Business Case (FBC)
PDP	Project Delivery Plan	

RFCC	Regional Flood and Coastal Committee	A committee established by the Environment Agency under the Flood and Water Management Act 2010 that brings together members appointed by Lead Local Flood Authorities (LLFAs) and independent members with relevant experience for the purpose of ensuring there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines; encouraging efficient, targeted and risk-based investment in flood and coastal erosion risk management that represents value for money and benefits local communities; and to provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies to build understanding of flood and coastal erosion risks in its area
RMA	Risk Management Authority	
SCC	Somerset County Council	
SFRA	Strategic Flood Risk Assessment	An assessment of flood risk from a variety of sources to support a Local Authority's local plan and to help make planning decisions
SOP	Standard of Protection	A term used by the EA to describe the level of protection offered by a flood defence scheme.
SWT	Somerset West & Taunton	
WFD	Water Framework Directive	A European Union directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies