WARRINGTON
Borough Council

Economic Regeneration, Growth & Environment

S19. (1) Flood Investigation Report

Engineering & Flood Risk Management Team

Warrington Borough Council – Lead Local Flood Authority

Date: February 2016

Location: Thelwall / Lymm

Flood Investigation Reference Number: 2016/006/001

Version: Final 01

Revision Schedule: 2016/006/001 Flood Investigation

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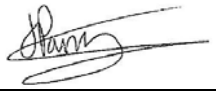
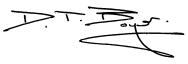
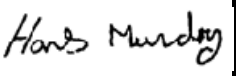
Date February 2016 Final 01	**Signature** 	**Signature** 	**Signature** 	**Signature** 
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Supporting Documents:

- **Drawing Number: LD2016/006/001 – Approximate Flood Depths, Extents, Breach Locations and Flooded / Affected Properties**
- **Drawing Number: LD2016/006/002 – Ferry Lane Level Survey and Drainage Survey Results**
- **Drawing Number: LD2016/006/003 – Return Period Estimates for Tributaries to the Manchester Ship Canal and River Mersey.**

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Contents

1.0 Introduction

Following this flood event an investigation under Section 19 (1) of the Flood and Water Management Act was undertaken to determine which risk management authorities had relevant flood risk management functions and whether each of those risk management authorities had exercised or was proposing to exercise those functions in response to the flood. In accordance with Section 19 (2) of the Flood and Water Management Act this report details the results of the investigation.

2.0 Details of the Flood Event

Reference:	2016/006/001		
Location:	Thelwall/Lymm		
Date of Flood Events:	26/12/2015	**Duration:**	
Reason for investigation:	Major flooding.		
Identified Cause:	Fluvial flooding.		

Copies of flood event data collection sheets produced by Environment Agency are located in appendix E.

3.0 Catchment Characteristics and Context

3.1 Catchment Land Use

The affected area is predominantly Greenfield consisting of agricultural land/recreational facilities.

3.2 Topography

Generally, the land in the area slopes down to the north where it meets with Manchester Ship Canal.

3.3 Watercourse Network

There are several watercourses within the affected area which are described as follows:

3.3.1 River Mersey

The Mersey is the dominant river in Warrington by size flowing in an east to west direction, it is an artificially modified watercourse (as part of the Manchester Ship Canal) and since the canal was built in 1894 its flow regime has been transformed.

The River Mersey is tidal with the normal tidal limit being at Howley weir in the centre of Warrington. Howley weir is managed by Manchester Ship Canal Company.

The Manchester Ship Canal plays an important role in the fluvial hydraulics of the River Mersey through Warrington. Upstream of Warrington, the canal receives flow from the Rivers Irwell and Mersey and several smaller tributaries. Around Bollin Point, the Mersey splits from the canal and flows through central Warrington whilst the canal continues to Eastham Locks at Ellesmere Port.

The Mersey continues to drain a number of tributaries flowing from the north of Warrington, including Padgate Brook, Spittle Brook and Sankey Brook. It also drains Thelwall Brook via a syphon system under the Manchester Ship Canal. However, the Manchester Ship Canal transfers the majority of flow from upstream of Warrington (collected mainly from the River Irwell and Upper Mersey), bypassing the Mersey through central Warrington.

Peel Ports are responsible for managing the Manchester Ship Canal, Warrington Borough Council are responsible the River Mersey through Warrington and Environment Agency are responsible for the 'Main Rivers' entering the Canal / River Mersey.

3.3.2 Manchester Ship Canal

The Manchester Ship Canal (MSC) was built by canalising sections of the lower River Irwell and River Mersey in the late nineteenth century to allow large ships to dock in Manchester city centre.

The canal is a canalised river which drains the River Irwell (plus the rivers which join it further downstream) from its upstream limit in Manchester to Rixton near Warrington where it splits from the Mersey.

The Manchester Ship Canal according to the Peel Ports website is a 12-terminal, 36 mile long seaway linking Liverpool and Manchester carrying around 8 million tonnes of cargo a year and managed by Peel Ports.

The Manchester Ship Canal runs through Warrington having split off from the River Mersey at Bollin Point. Upstream from Warrington, the Manchester Ship Canal receives flows from the River Mersey at Irlam and the Rivers Irwell, Irk and Medlock in Manchester. The total catchment area draining into the Manchester Ship Canal upstream of Bollin Point covers an area of approximately 1,965 km^2.

The Manchester Ship Canal also drains a number of watercourses from the south of Warrington, including the River Bollin, Sow Brook, Lumb Brook and the River Glaze from the north. Peel Ports is responsible for the operation and maintenance of the Manchester Ship Canal.

3.3.3 Manchester Ship Canal Operation

The following in respect of the operation of the Manchester Ship Canal was provided by Peel Ports Group in the statement contained in Appendix A:

"There are various inflows into the Canal, most notably the Rivers Irwell, Irk, Medlock, Mersey, Bollin and Weaver, plus various smaller streams, brooks, industrial discharges and surface water drains/run-off. The outflows from the Canal comprise the River Mersey above Latchford and primarily the Weaver Sluices at Runcorn.

The Canal enables sea-going vessels to reach the heart of Manchester, and Manchester Ship Canal Company's primary function is, as required by statue, to ensure the safety of navigation for vessels using the Canal.

To enable Manchester Ship Canal Company to fulfil this primary function (and having regard to the environment created by the various inflows/outflows mentioned), there are various lock, sluice and weir structures along the Canal's length, which are used to maintain, so far as is reasonably practicable, water levels for safe navigation. The sluice structures are computer controlled and react to changes in water level by opening/closing as required. The computer control system is monitored on a 24-hour basis and is backed-up by personnel available on a call-out basis should additional assistance be required. During periods of increased inflows, the sluice/weir structures regulate the passage of water downstream through the Canal to the estuary of the River Mersey.

Further information regarding the operation of the Manchester Ship Canal can be found at the following link: http://www.ecolex.org/server2.php/libcat/docs/COU/Full/En/COU-159716.pdf

3.3.4 Sow Brook

Sow Brook is classified as 'Main River' and flows in a south to north direction. It is understood that its source is in the area of Appleton Thorn and flows through a series of dams in Lymm Village before discharging into the Manchester Ship Canal. Sow Brook is managed by Environment Agency (EA).

3.3.5 Thelwall Brook

Thelwall Brook is classified as 'Main River' and flows in a north westerly direction before discharging into the River Mersey via a siphon under the Manchester Ship Canal (See figure 1). It is understood by Warrington Borough Council that the siphon is owned and maintained by Manchester Ship Canal Company. Thelwall Brook is managed by Environment Agency (EA).

Figure 1: Trash Screen on Thelwall Brook at inlet to siphon under the River Mersey. (30 March 2016 15:40)

4.0 Impacts/Extent of the Flooding

4.1 Flooded Properties

According to the Department for Communities and Local Government:

The definition of a "flooded property" is a property (includes both homes and businesses), where flood water has internally entered the fabric of a building, this definition includes:

- Basements and below ground level floors;
- Garages, if they form part of the fabric of a building. However, garages adjacent to, or separate from the main building are not included;
- Occupied caravans and park homes, but not tents.

At the time of writing this report, Warrington Borough Council is aware that the following was flooded:

- 1 residential property.
- 34 businesses.
- 2 electricity substation.

The location of flooded properties is shown on drawing no: LD2016/006/001.

4.2 Affected Properties

According to the Department for Communities and Local Government:

The definition of an "affected property" is one where:

- Water has entered gardens or surrounding areas restricting access to a property; and/or
- Flooding has disrupted essential services to the property, such as utility services e.g. sewage, drinking water, gas, electricity etc;
- And for businesses, this includes those businesses where flood waters are preventing an enterprise from trading as usual.

At the time of writing this report, Warrington Borough Council is aware that the following was affected by flooding:

- 38 residential properties.
- 8 businesses.
- 1 electricity substation.

The location of affected properties is shown on drawing no: LD2016/006/001.

4.3 Flood Peak Level and Extents

The estimated peak flood level for the flood event which occurred on 26 December 2015 is 9.189m AOD (Above Ordinance Datum) at Caddicks Nursery achieving a depth of approximately 0.9m.

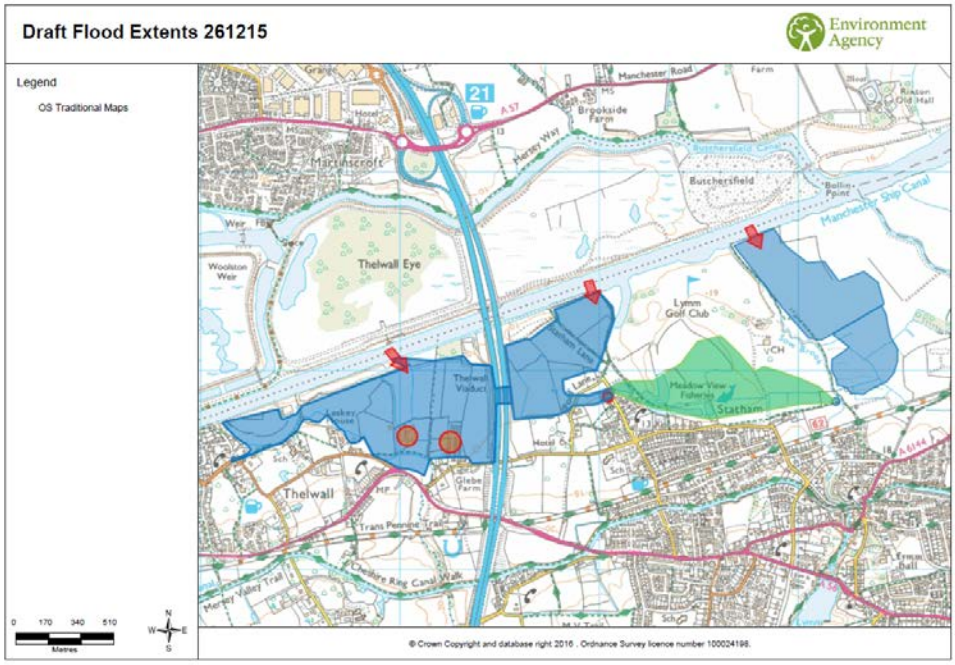
Figure 2: Example of observed wrack/tide mark. (03 February 2016 11:28)

The estimated flood extents and depths based upon the observed level is shown on drawing no: LD2016/006/001.

4.4 Manchester Ship Canal Breaches

A site visit and data gathering was undertaken by the Environment Agency in the first weeks of January. This found that water left the canal in at least three locations. The indicative breach locations are shown on drawing no. LD2016/006/001 and on the drawing provided to Warrington Borough Council by Environment Agency in figure 3 below.

Figure 3: Flood Extents and Breach Locations.



5.0 Site Visit (03 February 2016)

The following Officers from Warrington Borough Council and the Environment Agency attended the affected area on 03 February 2016 to discuss the flooding with affected customers and to gather information:

- Jonathan Dawson-Parry
  (Asset & Flood Risk Engineer: Warrington Borough Council)

- Brenda Fields
  (Partnerships and Strategic Overview Officer: Environment Agency)

- Carrie Wright
  (Asset Performance Officer: Environment Agency)

5.1 Flood History

During the site visit, Carrie Wright (Environment Agency) offered historical local knowledge of flooding. She stated that she can remember Caddicks Nursery flooding on numerous occasions over the years.

5.2 Customer Testimony

The common theme throughout discussion with customers was the speed at which the water level rose. They stated that the water level rose to “3ft deep” in approximately 45mins and the water appeared to come from the direction of the Manchester Ship Canal.

6.0 Online Media Coverage

Flying Fox Media have produced drone aerial footage of the flooding and uploaded the video to YouTube. The footage appears to show where water has escaped from the Manchester Ship Canal and has been used to reference the extents of the flooding.

Figure 4: Image from Flying Fox Media which shows water escaping the canal east of Sow Brook. (26/27 December 2015 Time Unknown)

Figure 5: Image from Flying Fox Media which shows flooding to Thelwall. (26/27 December 2015 Time Unknown)

Figure 6: Image from Flying Fox Media which shows flooding to Thelwall. (26/27 December 2015 Time Unknown)

There is widespread media coverage of flooding in the greater Manchester area due to the River Irwell overtopping its banks. The Engineering and Flood Risk Team have witnessed footage of the River Irwell in flood at Salford taken at approx. 3pm on 26 December 2015 (6.25hours before peak water level was observed on the River Mersey at Westy).

Examples of the coverage of the flooding in Manchester are shown in Figures 7 and 8.

Figure 7: Image of the Waterside pub in Summerseat which collapsed on 26 December 2015 (Time Unknown) into the River Irwell.

Source: Manchester Evening News

Figure 8: Image of the Riverside Drive in Radcliffe which flooded on 26 December 2015 (Time Unknown) when the River Irwell breached its banks.

Source: Manchester Evening News

7.0 River Level Information

7.1 River Level Information for River Mersey at Westy

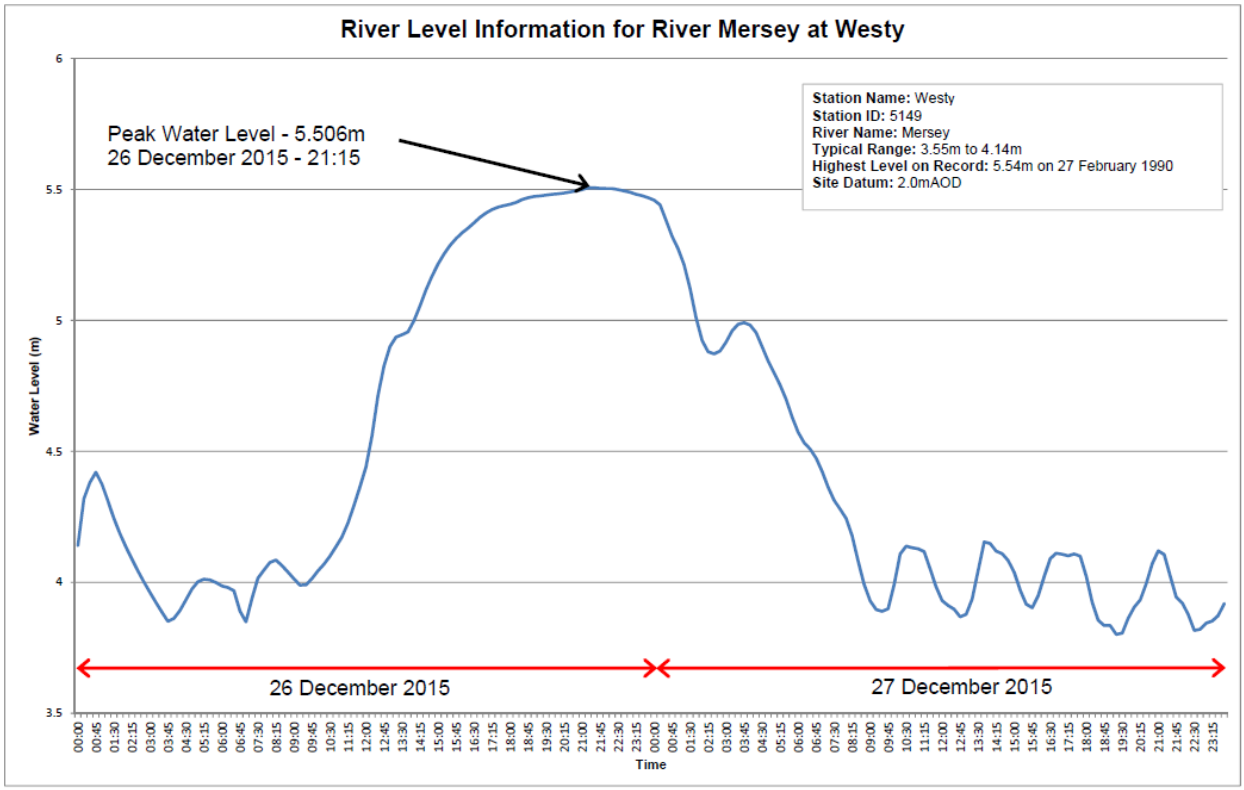


Figure 9: River Level Information for the River Mersey at Westy.

A peak water level of 5.506m was observed during the flood event at 21:15 on 26 December 2015.

The highest previously recorded level was 5.540m (34mm higher than event observed on 26 December 2015).

5.540m was recorded on 27 February 1990 when the River Mersey overtopped its banks flooding Knutsford Road and properties in Westy, Latchford, Howley, Arpley Bridge and Lower Walton.

7.2 Rivers Level Information for the Rivers Irwell, Irk and Medlock and their Tributaries

As the Rivers Irwell, Irk and Medlock drains into the Manchester Ship Canal/River Mersey, Warrington Borough Council requested detailed rainfall data and river telemetry data for the Irwell catchment from the Environment Agency.

Warrington Borough Council obtained the information regarding observed levels on the Rivers Irwell, Irk and Medlock and their tributaries on 23 February 2016.

Highest levels on record were recorded on 26 December 2015 at all telemetry stations along the River Irwell and its tributaries:

- Irwell at Holt Mill Bridge: 1.86m (typical range 0.13m to 0.40m)

- Irwell at Irwell Vale: 3.43m (typical range 0.24m to 0.130m)
- Irwell at Stubbins: 2.76m (typical range 0.01m to 1.30m)
- Irwell at Ramsbottom Weir: 3.39m (typical range 0.26m to 1.80m)
- Irwell at Bury Ground: 2.18m (typical range 0.23m to 1.30m)
- Eagley Brook (Tributary to Irwell) at Threadfold Way: 1.71m (typical range 0.19m to 0.39m)
- Croal at Farnworth (Tributary to Irwell): 1.41m (typical range 0.07m to 0.70m)
- Roch at Albert Royds Bridge (Tributary to Irwell): 2.43m (typical range: 0.26 to 1.30m)
- Roch at Rochdale ETW (Tributary to Irwell): 2.22m (typical range: 0.10 to 1.23m)
- Roch at Blackford Bridge (Tributary to Irwell): 3.36m (typical range: 0.07 to 0.75m)
- Irwell at Kearsley: 6.33m (typical range 0.62m to 2.30m)
- Irwell at Manchester Racecourse: 5.67m (typical range 0.73m to 2.70m)
- Irwell at Adelphi Weir: 3.86m (typical range 0.18m to 0.74m)

Highest levels on record were also recorded on 26 December 2015 at the following telemetry stations:

- Irk at Collyhurst Weir: 1.15m (typical range: 0.12m to 0.29m)
- River Medlock at Gurney Street: 2.46m (typical range: 0.08m to 0.44m)

7.3 Return Period Estimates for Tributaries to the Manchester Ship Canal and River Mersey

It is the understanding of the Council that the Environment Agency has employed a 3rd Party consultant to undertake modelling of the flood event on Boxing Day to understand the true magnitude of the event on the main river network that it oversees. The Environment Agency are currently in the process of updating its hydraulic model of the Manchester Ship Canal, once this has been completed and operational data is made available from Peel Ports concerning the canal; it is the intention to model the events of 26/27 December 2015. This information is key for our report. This report may be amended following the release of the Environment Agency report.

As a result, Warrington Borough Council requested the river and rainfall return period information for the tributaries to the Manchester Ship Canal/Mersey on 25 February 2016 from Environment Agency. The information was received by the Council on 05 April 2016 and is contained within Appendix B and has been mapped on drawing no: LD2016/006/003.

The return period is an estimate of how often a flood of a given size can be expected to occur and, since less frequent floods are more extreme, the 1000 year event would be bigger than the 100 year flood.

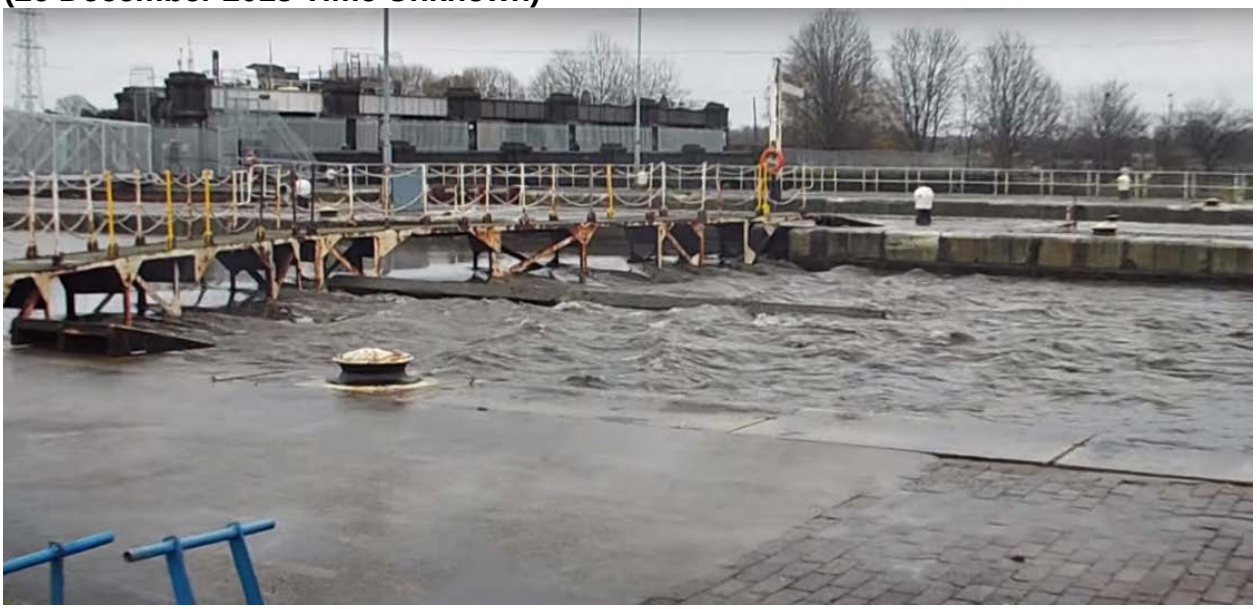
The probability that a flood with a particular return period will occur is the same every year and does not depend how long it was since a flood of this size last occurred.

7.4 Telemetry Information for the Manchester Ship Canal

Warrington Borough Council and the Environment Agency do not have access to telemetry information for the Manchester Ship Canal. However photographic evidence has been found on the internet which illustrates that the Canal appeared to be at

capacity at Irlam Locks on 26 December 2015 and overtopping Latchford Locks (see Figures 10, 11 and 12)

**Figure 10: Image of Manchester Ship Canal at Irlam Locks.
(26 December 2015 Time Unknown)**



Source: Warrington Guardian

**Figure 11: Image of Manchester Ship Canal at Latchford Locks.
(26 December 2015 Time Unknown)**

Source: Warrington Guardian

Figure 12: Image of Manchester Ship Canal at Latchford Locks (26 December 2015 Time Unknown)

Source: Warrington Guardian

7.5 Manchester Ship Canal Operational Issues

Warrington Borough Council received reports that over the weekend of 12/13 December 2015 that the water levels in the River Mersey had dropped rapidly which had caused bank collapses at Woolston (See figure 13).

As a result, Warrington Borough Council contacted Peel Ports who confirmed via e-mail dated 15 December 2015 that they were having an "*engineering problem at Latchford Locks Sluice No1*" and with all the rainfall, a large amount of debris had gathered into their sluices and that they had removed 40 tonnes from Latchford. Figure 14 shows the size of one of the trees which was removed from Latchford Sluices.

An e-mail dated 17 December 2015 from Peel Ports to Warrington Borough Council confirmed that Peel Ports had managed to fit the dams into No1 sluice at Latchford and the water levels had recovered.

A report from EA received by Warrington Borough Council on 24 February 2016 contains the following information:

"Prior to Christmas it is understood that the Manchester Ship Canal Company (MSCCo) experienced difficulties at Latchford with a sluice gate and were unable to close it. This resulted in water levels in the River Mersey being drawn down. We believe that this situation was resolved prior to Christmas by stanking off the sluice

gate. As a consequence we believe that the MSCCo were only able to operate 2 of the 3 sluice gates at Latchford Lock during the flood event."

Figure 13: Image of Mersey Way(15 December 2015 Time Unknown)

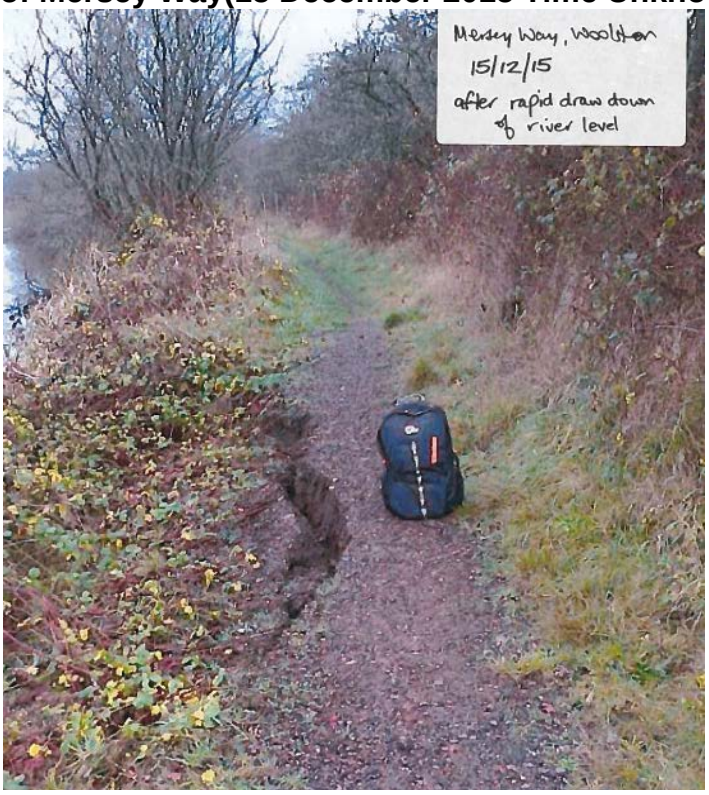


Figure 14: Image of Manchester Ship Canal at Latchford Locks (Date / Time Unknown)

Source: E-mail from Peel Ports Group to Warrington Borough Council (15 December 2015.

The following in respect of the operation of the Manchester Ship Canal on 26 December 2015 was provided by Peel Ports Group in the statement contained in Appendix A:

"According to information provided by the Environment Agency, the Boxing Day rainfall within Greater Manchester was such that a combination of heavy rainfall and saturated catchments led to very high flow rates. The Environment Agency also recorded unprecedented water levels and flow rates in many of the rivers and tributaries which flow into the Canal. MSCC's infrastructure responded in the normal way (as outlined above) with the sluices opening under the computer control to enable water to flow downstream towards the estuary of the River Mersey. However, owing to the significant (in some cases unprecedented) flows which were experienced, lengths of the Canal's banks were washed away, infrastructure was damaged and in some areas banks were breached by the unprecedented flood waters. Where it was safe to do so, personnel were deployed to ensure that assets which were of critical importance to the regulation of water levels in the Canal (such as sluices) remained in operation. A considerable amount of debris was carried downstream from the River Irwell and was deposited into the Canal at Salford Quays. This amounted to circa. 70,000 tonnes and was subsequently cleared, when safe to do so, once the volume and velocity of the water had subsided.

At Latchford Locks, heavy rainfall in mid-December had carried a significant amount of debris into the Canal, and this debris caused damage to one of the sluice gates. Flows subsided sufficiently for the sluice to be dammed and safely assessed on 17th December, when it was discovered that the damage sustained by the sluice gate was considerable, thus rendering it inoperable.

Owing to the on-going repairs to the damaged sluice gate, sluicing capacity at Latchford was reduced by a third on Boxing Day. Furthermore, the Spring tide which also occurred on Boxing Day night reduced the outflow capacity of the River Mersey at Woolston, which meant that flows down the Canal tended naturally towards Latchford Locks. This naturally occurring combination of Spring tide, extreme rainfall and the already significant flows coming down the Canal from the Manchester area resulted in higher than normal water levels at Latchford Locks (a perfect storm scenario)."

The Engineering & Flood Risk Team is not aware of the extent of the impact that the above event had on the flooding which occurred on 26 December 2015.

As the flooding affected several Local Authority areas, the Environment Agency as strategic overview has taken the lead with Manchester Ship Canal Company to coordinate and host meetings.

7.6 River Level Conclusions

It would appear from the values recorded that the water levels on the Irwell, Irk and Medlock and their tributaries were far in excess of their typical ranges and in many cases the levels set on 26 December 2015 were the highest on record.

It appears that the Irwell, Irk and Medlock catchments reacted in a 'flashy' manner (where the water level rose and fell quickly). This is most likely due to the highly

urbanised nature of the greater Manchester area meaning that the watercourses in the area would have received the rainfall quickly. This may possibly link in with customer testimony in section 5.2 which stated that water levels rose quickly.

8.0 Tide Information

8.1 Tide information for Mersey Estuary at Runcorn/Widnes

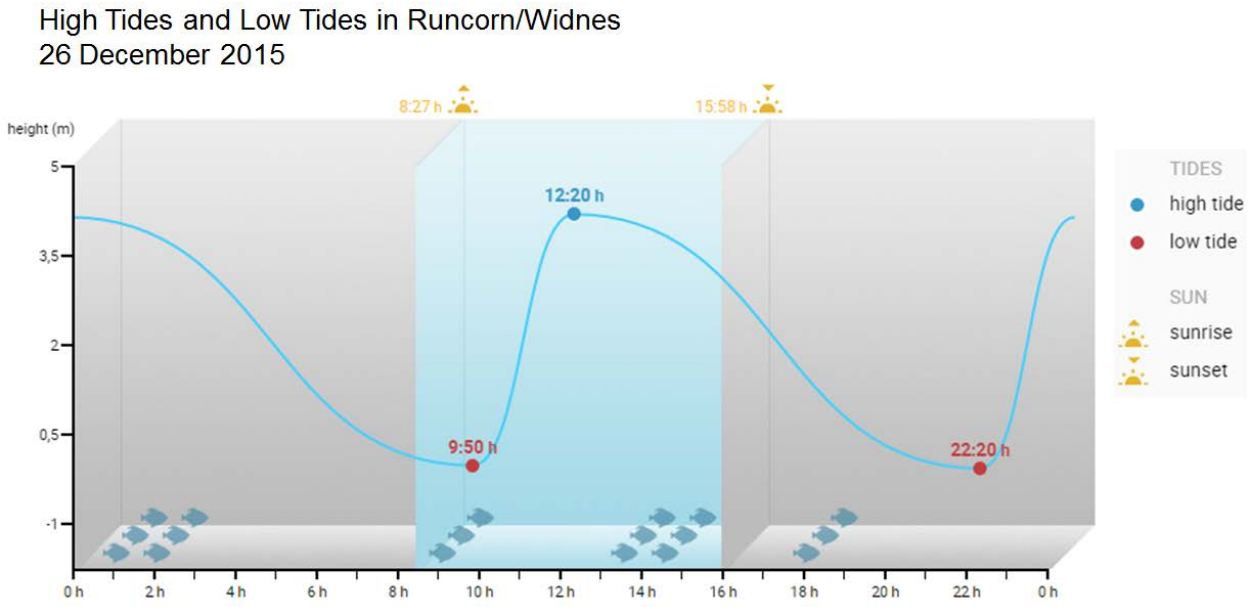
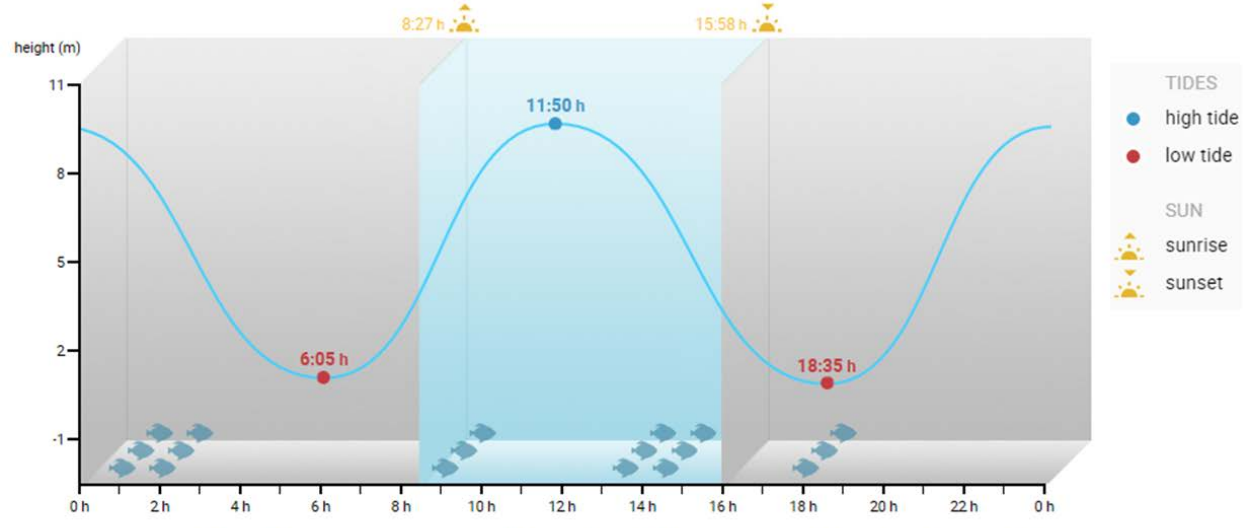


Figure 15: Tide information for Mersey Estuary at Runcorn/Widnes

On 26 December 2015 for the River Mersey at Runcorn/Widnes, the first low tide was at 09:50 and the next low tide was at 22:20. The only high tide of the day was at 12:20, another high tide was experienced at 00:40 on 27 December 2015.

8.2 Tide Information for Mersey Estuary at Eastham



The entrance locks at Eastham on the Wirral side of the Mersey seals off the Canal from the tidal estuary.

Figure 16: Tide information for Mersey Estuary at Runcorn/Widnes

On 26 December 2015 for the River Mersey at Eastham, the first low tide was at 06:05 and the next low tide was at 18:35. The only high tide of the day was at 11:50, another high tide was experienced at 00:10 on 27 December 2015.

8.3 Tide Conclusion

There is a set of 'storm gates' fitted at Eastham Locks. They are designed so that when closed they prevent the River Mersey flowing into the Canal when it is predicted to be at a higher level than the Canal.

The Council is not aware at what level the gates operate or whether they were open or closed on 26 December 2015 and as such what impact if any this had on the flood event which occurred at Thelwall/Lymm.

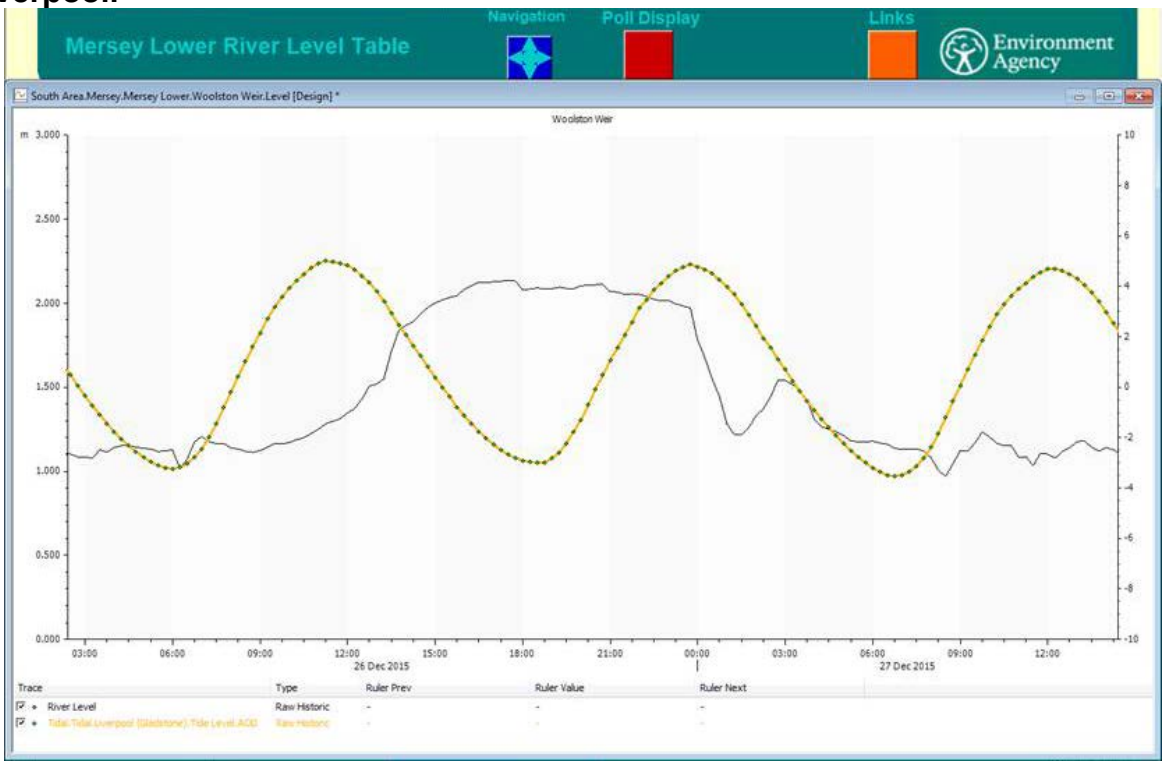
The following statement in respect of the tide was provided by the Environment Agency to Warrington:

"The times of the tidal peaks at Liverpool on the 26/12/15 was 11:00 and midnight. The tides were high but not exceptional. The tidal peak in Warrington typically peaks an hour and half after Liverpool.

Woolston weir on the Mersey at Warrington peaked between the tidal peaks. This is displayed in the graph below, the black line is Woolston Weir, the yellow line is Liverpool on the 26/12/15.

In the absence of water level recordings for the Manchester Ship Canal, the full impacts of the tide on the operational level of the canal cannot be quantified, however, they are likely to be considerably less significant than other effects."

Figure 17: Graph showing tidal peaks for the Mersey at Woolston Weir and Liverpool.



The following in respect of the tide was provided by Peel Ports Group in the statement contained in Appendix A. It appears that this information contradicts the information provided by Environment Agency above:

"The Spring tide which also occurred on Boxing Day night reduced the outflow capacity of the River Mersey at Woolston, which meant that flows down the Canal tended naturally towards Latchford Locks. This naturally occurring combination of Spring tide, extreme rainfall and the already significant flows coming down the Canal from the Manchester area resulted in higher than normal water levels at Latchford Locks (a perfect storm scenario."

9.0 Local Rainfall Information

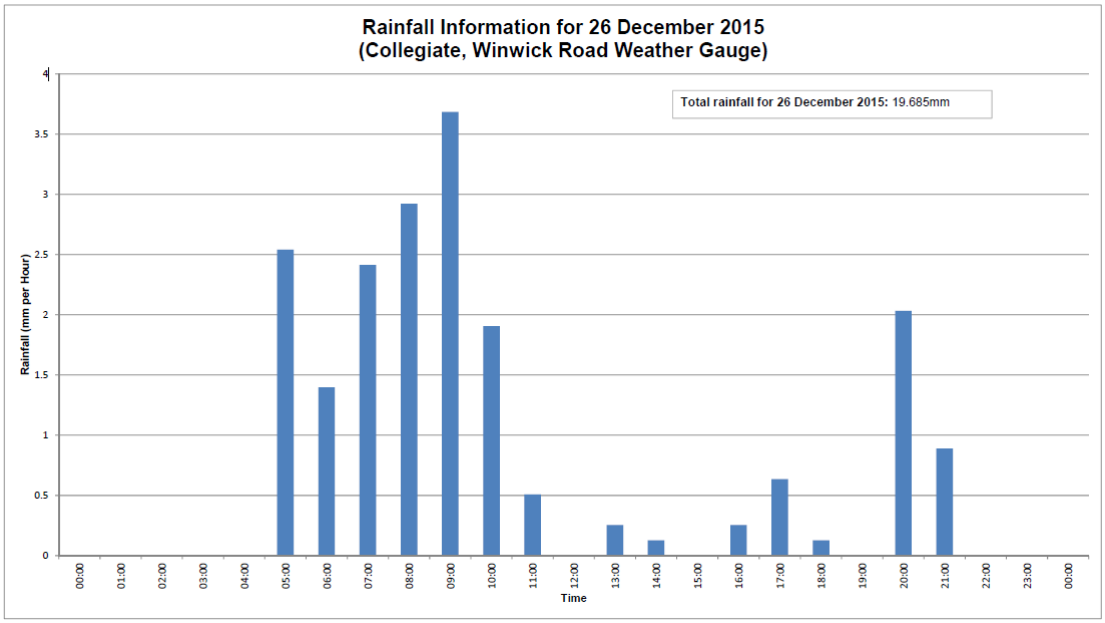
9.1 Warrington Borough Council Rain Gauge

The Warrington Borough Council rain gauge is positioned at the Collegiate (Long Lane, Longford). It is a distance of approx. 3.25miles (5.23km) from Bell Lane in Thelwall.

According to the rain gauge at the Collegiate, the following rainfall was observed:

- 25 December 2015: 9.271mm
- 26 December 2015: 19.685mm
- 27 December 2015: 0.00mm

Figure 18: Rainfall information.



9.2 Environment Agency Rain Gauge (Richard Fairclough House)

The Environment Agency rain gauge is positioned at Richard Fairclough House (Wash Lane, Latchford). It is a distance of approx. 1.93miles (3.11km) from Bell Lane in Thelwall.

According to the Environment Agency rain gauge at Richard Fairclough House, the following rainfall was observed:

- 25 December 2015: 18.17mm
- 26 December 2015: 6.32mm
- 27 December 2015: 0.00mm

9.3 Local Rainfall Conclusion

Due to the stochastic nature of rainfall, the above rainfall data may only be used indicatively.

Although the rainfall experienced in Warrington appears to be moderate, it should be noted that high river levels can cause surface water systems which are drained by gravity to fail to discharge or not operate efficiently as their outfalls are blocked or flap valves are closed to prevent river water entering the system and exacerbating the situation.

Minor surface water flooding may have been observed within the general surrounding area but is considered to not be the primary flood mechanism.

10.0 Upper Catchment Rainfall Information

In order to identify possible causes of the flood event in Thelwall/Lymm, rainfall data was requested from the Environment Agency for the Manchester Ship Canal / River Mersey upper catchment area.

Additional rainfall information was provided by Environment Agency for the wider north-west area, this is available in Appendix C.

11.0 Flood Mapping

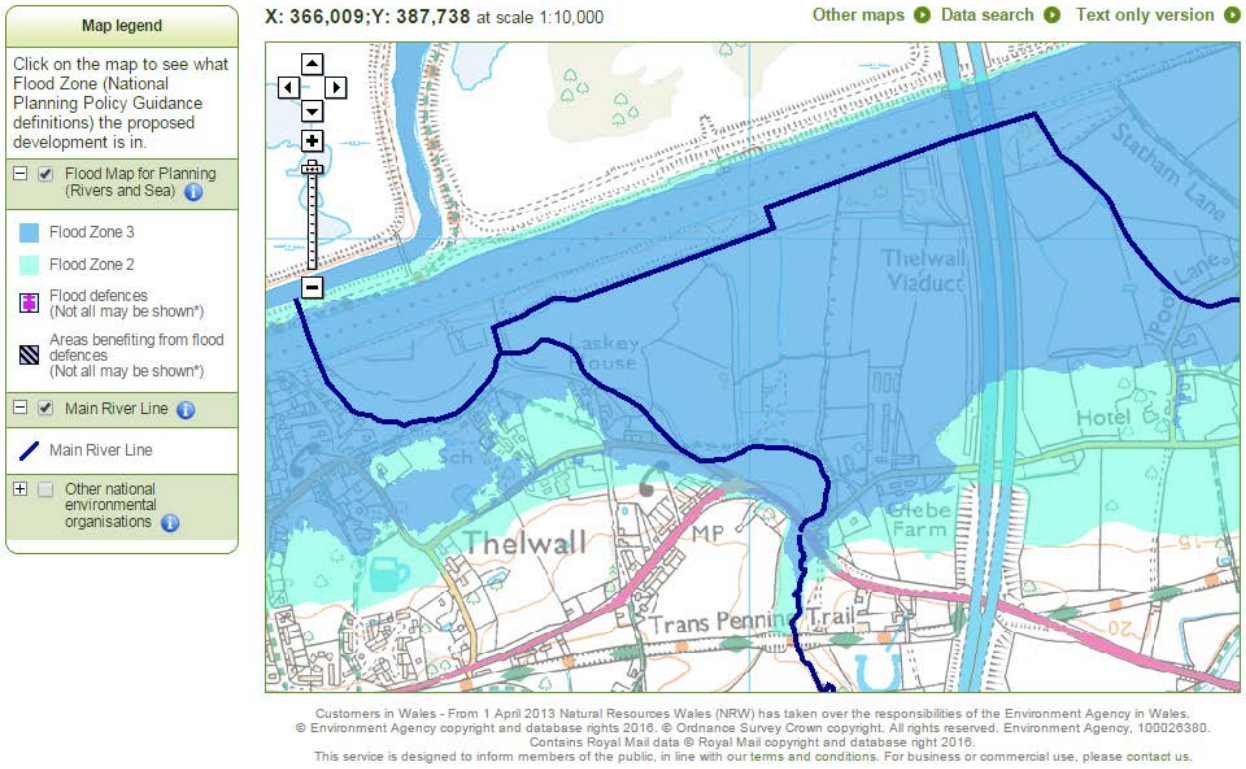
11.1 Fluvial & Tidal Flood Mapping

11.1.1 Environment Agency Flood Map for Planning

According to the Environment Agency Flood Map for Planning (Rivers and Sea) the affected area is shown as Flood Zone 3. (Based on flooding without defences)

Flood Zone 3 is land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Figure 19: Extract of Environment Agency Flood Map for Planning (Rivers and Sea).



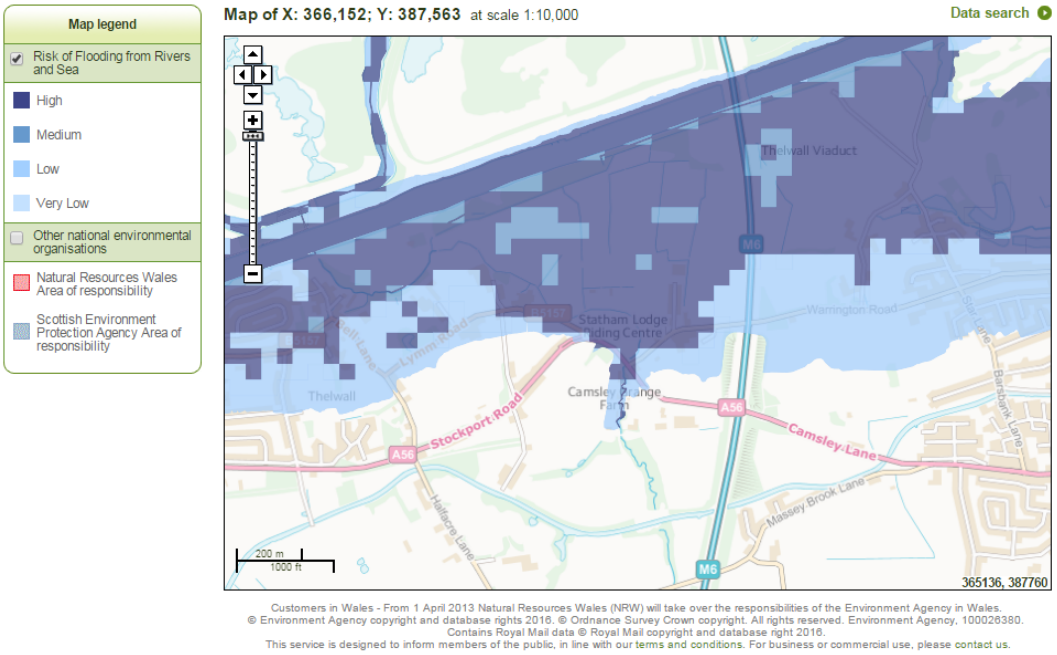
11.1.2 Environment Agency Risk of Flooding from Rivers and Sea Mapping

According to the Environment Agency Risk of Flooding from Rivers and Sea Mapping, the area is generally shown as at high/medium risk of flooding. (takes into account of any defences, if present)

High means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%). Flood risk in this area is ‘significant’ as per the definition in the ‘Statement of Principles’ agreement between the Government and the Association of British Insurers.

Medium means that each year, this area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).

Figure 20: Extract of Environment Agency Risk of Flooding from Rivers and Sea Mapping.

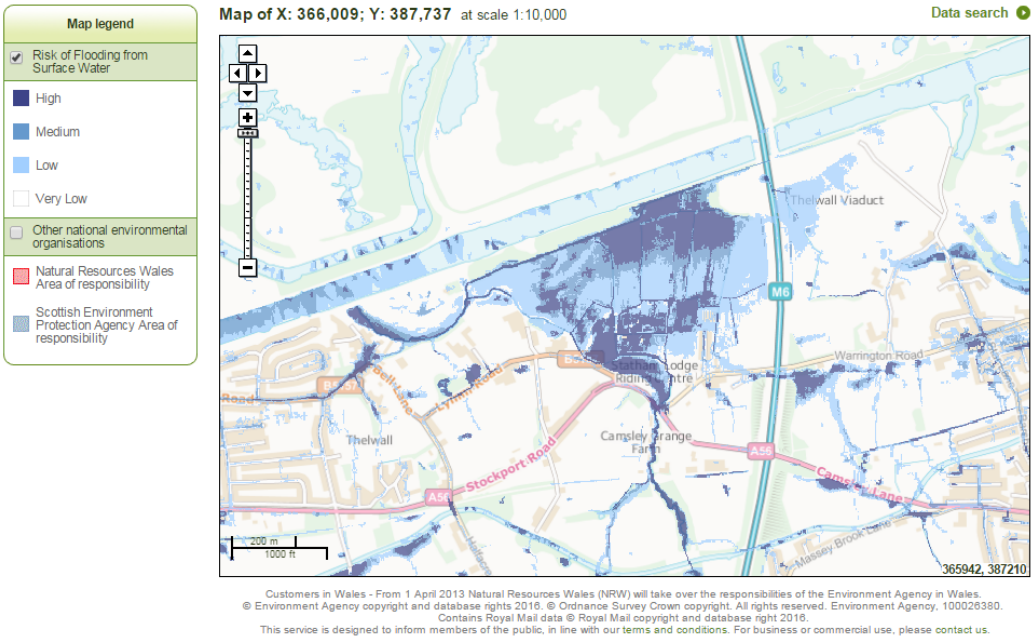


11.2 Environment Agency Risk of Flooding from Surface Water Mapping

According to the Environment Agency Risk of Flooding from Surface Water mapping, the affected area is generally shown as being at risk of surface water flooding but differing in degrees of risk across the area. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas.

It appears that an area next to the Manchester Ship Canal is shown as at high risk indicating that this is a low area. According to the Environment Agency, this is one of the three breach locations as shown in Figure 3 and on drawing no. LD2016/006/001.

Figure 21: Extract of Environment Agency Risk of Flooding from Surface Water mapping.



12.0 Land/Riparian Ownership

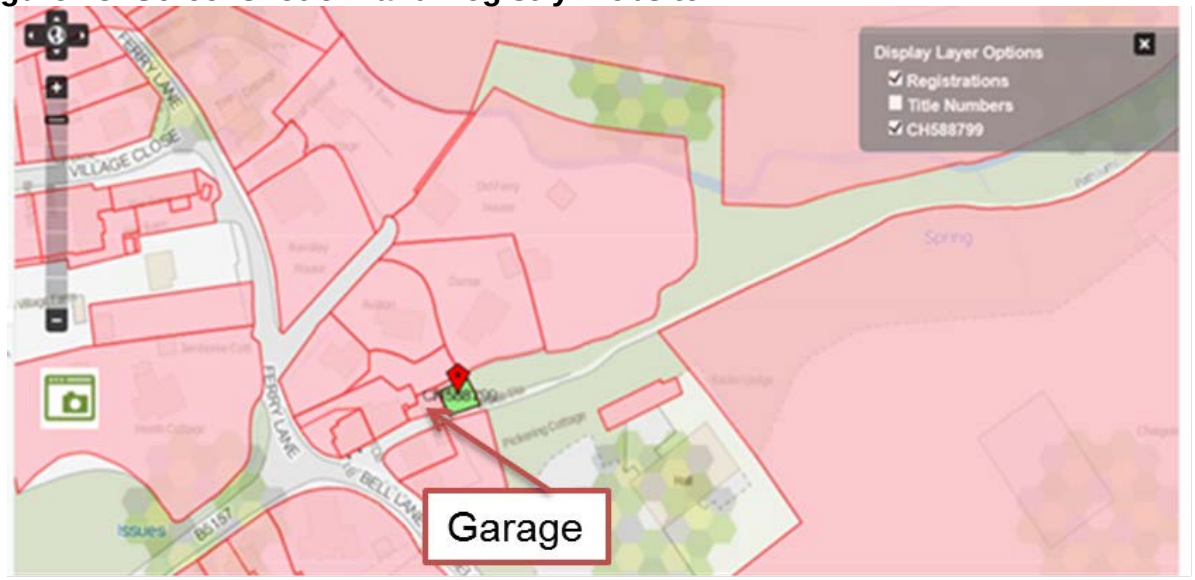
Warrington Borough Council received a number of complaints regarding the condition of the ordinary watercourse (tributary to Thelwall Brook) shown as a cyan line in figure 22 below.

Figure 22: Screenshot of Watercourse Classification Plan (Main river shown in green, ordinary watercourse shown in cyan).

In order to identify the riparian owner, Warrington Borough Council undertook a land registry search.

It appears that the land to the north of the ordinary watercourse which runs in an east to west direction from the outfall behind the garage to the east of Post Office Cottage is registered. The landowners are presumed to be the riparian owners to the centreline of the watercourse.

Figure 23: Screenshot of Land Registry Website.

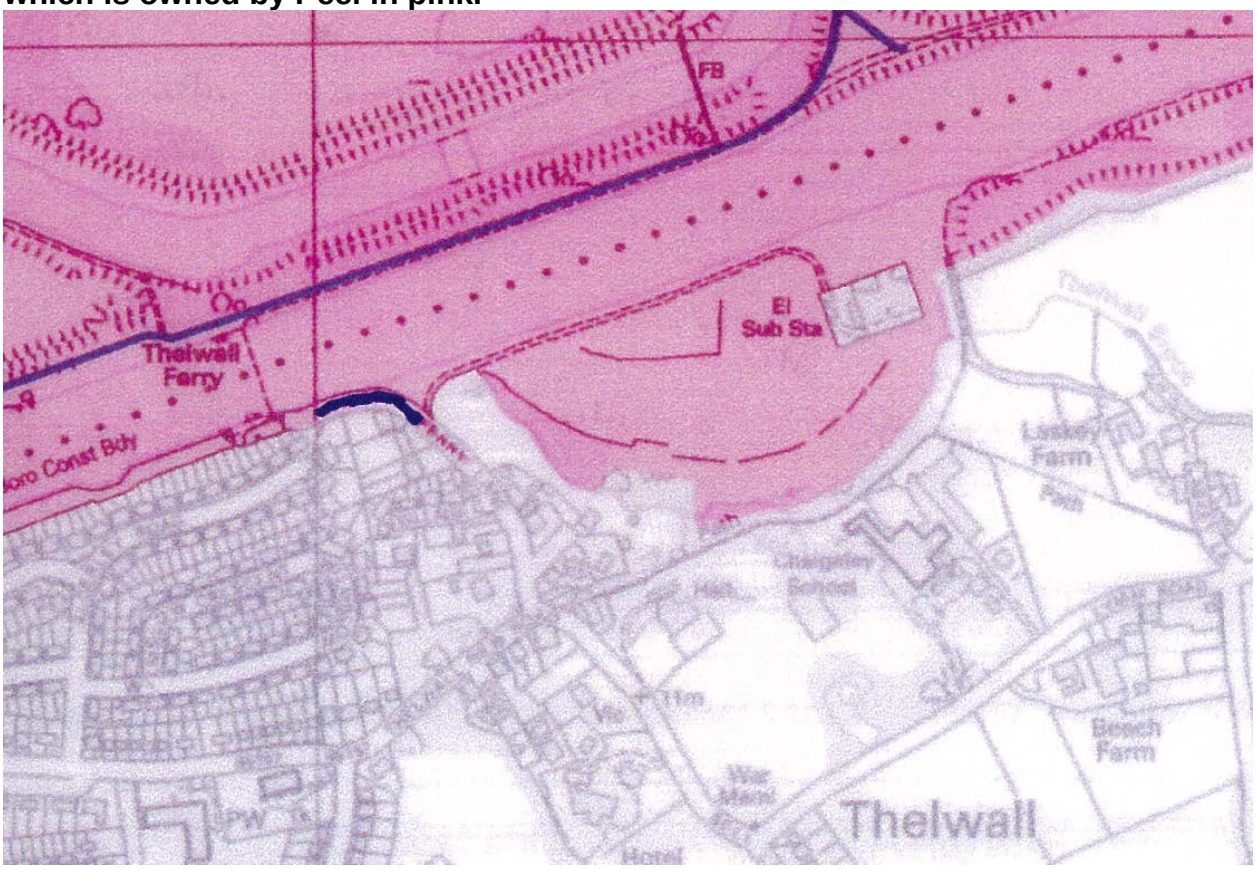


The land to the south of the ordinary water is not registered with HM Land Registry, but this does not mean that it is not owned. For unregistered land, proof of title is based upon historical title deeds.

Section 31 (6) of the Highways Act 1980 enables landowners to protect their land from gaining public rights of way through use by the public (often referred to presumed dedication). The provisions require landowners to deposit a map, statement and subsequent declaration with the Council showing which rights of way of way they acknowledge over their land. The Council encourages landowners to deposit these documents to protect their interest, and to provide greater certainty for users.

Deposit reference: 31A02011004 was made by Peel Investments (North) Limited of Peel Dome on 21 April 2011. See figure 24 for an extract of the map showing the limit of their land ownership. It appears that Peel Investments do not own the land to the southern side of the ordinary watercourse.

Figure 24: Extract of deposit reference 31A02011004 map showing the land which is owned by Peel in pink.



On 01 April 2016, Land Terrier Services Manager at Warrington Borough Council confirmed that the Council has no record of ownership for the land.

According to historic tithe maps (1836-51), the plot of land in question was owned by a James Stanton. James Stanton also owned the land upon which the Parish Hall sits. The Parish Hall land is also unregistered.

Subsequently, the Engineering & Flood Risk Team made enquiries with Grappenhall & Thelwall Parish Council on 05 April 2016. The Parish Council confirmed that the land is owned by All Saints Church, Thelwall.

Reverend Douglas Black of All Saints Church, Thelwall was not not able to confirm who owns the unregistered land to the south of the watercourse on 05 April 2016.

The Engineering & Flood Risk Team is continuing to make enquiries with regard to the ownership of the land. It should be noted that the effect of these enquiries may influence the contents of this report.

12.1 Legal Presumptions of Riparian Ownership

As property boundaries are frequently described poorly in conveyances, a number of legal presumptions have been adopted through case law as a means of filling gaps in the evidence. These presumptions may be rebutted by evidence to the contrary.

Presumption of riparian ownership is as a result of case law and *prima facie [in law, an obvious case that requires no further proof]* applies. The proprietors on each side of a non-tidal watercourse are respectively entitled to the soil *usque ad medium aquae [all the way up to the middle of a stream]*. Hence in Blount v. Layard (1891) it was stated that the natural presumption is that a person whose land abuts a watercourse owns the bed up to the middle of the stream. This is more commonly known as the *ad medium filum aquae [up to the middle of the stream]* rule.

The rule applies despite the fact that during the conveyance process, the measurement of the property can be satisfied without including half of the bed of the watercourse.

Riparian owners have various responsibilities including:

- Accepting flood flows through land, even if these are caused by inadequate capacity downstream. A landowner has no duty in common law to improve the drainage capacity of a watercourse that he/she owns.

- Letting water flow through their land without any obstruction, pollution or diversion.

- Maintaining the bed and banks of the watercourse and the trees and shrubs growing on the banks including clearing any litter and animal carcasses from the channel and banks, even if they did not come from your land

(NOTE: This list is not exhaustive, for more information please see the Environment Agency Publication ‘Living on the Edge’.)

Failure to adhere to these responsibilities could result in legal action being undertaken by neighbouring riparian owners or in powers being applied by the Lead Local Flood Authority.

12.2 Ferry Lane Level Survey & Drainage Survey

In order to confirm the condition of the culverted section of the ordinary watercourse shown as a cyan line in figure 32, Warrington Borough Council undertook a CCTV survey with jetting on 07 March 2016 and 08 March 2016.

In addition, a level survey was undertaken to confirm depth of pipes and other details relating to the culverted sections on 22 March 2016.

The results are shown on drawing no: LD2016/006/002.

The culverted section of the Ordinary Watercourse was observed to be in good overall condition.

There was minor floating debris caught by utility services passing through the culvert under Ferry Lane which was removed by the drainage crew undertaking the survey. However this was not causing an obstruction to flow.

The end of the culverted section was partially blocked due to siltation/debris. This is most likely as a result of material being pushed back upstream by the rising water during the flood event on 26 December 2015.

It was noted that the ordinary watercourse is in need of de-silting as the outfall pipe is approximately 30% blocked due to the siltation level. The de-silting of the watercourse is the responsibility of the riparian owner.

The headwall at the outfall is in poor condition, however during a site visit on 30 March 2016. It was observed to have partially collapsed but not blocking flow in the watercourse. The repair of this structure is the responsibility of the riparian owner.

Figure 25: Image of headwall and outfall. (30 March 2016 15:08)

12.3 Legal Advice

Engineering & Flood Risk Team sought legal advice from our Legal Team on 06 April 2016 regarding the poor condition of the headwall and land ownership issues. The advice is summarised as:

1. Regarding the headwall, Warrington Borough Council has no responsibility for repairs. The Council's duty is to only ensure that the watercourse continues to flow.

2. Regarding land ownership issues, the Council should take all reasonable measures to identify who owns land to south of the watercourse.

3. The Engineering & Flood Risk team will write to the 3 potential land owners to make them aware of the poor condition of the headwall which is retaining the land on which the garage is positioned.

4. The Engineering & Flood Risk team will place notices on the unregistered land requesting that the owner comes forward.

5. The Engineering & Flood Risk team will write to all nearby residents to ask if they know who owns the land.

6. If no owner can be found, the Council will investigate whether adverse possession has taken place and if required, undertake appropriate action.

13.0 Historical Mapping

Thelwall Brook which runs to the east of Ferry Lane was part of the bottom loop of a meander on the River Mersey before the Manchester Ship Canal was constructed and the River Mersey re-aligned.

The River Mersey was filled in at this location and is reflected in the official copy of register of title for Old Ferry House, Ferry Lane which states:

"And together with all rights of the Vendor under an agreement dated the twentieth day of January One thousand eight hundred and eighty eight made between Henry Stanton of the one part and The Manchester Ship Canal Company of the other part and an Undertaking under the sale of The Manchester Ship Canal Company dated the nineteenth day of October One thousand eight hundred and eighty eight to require The Manchester Ship Canal Company to fill up the Bed of the River Mersey so far as such Agreement and Undertaking respectively relate to or affect the said premises".

It is assumed by the Engineering & Flood Risk Team, that the siphon under the Manchester Ship Canal which allows Thelwall Brook to drain was constructed due to the difference in levels between the Manchester Ship Canal and the surrounding land.

It is also assumed that this facility is owned and managed by the Manchester Ship Canal Company.

A critical element to ensure functionality of the ordinary watercourse managed by Warrington Borough Council, and Thelwall Brook managed by Environment Agency is the trash screen located at the siphon.

Environment Agency has confirmed that Manchester Ship Canal Company attends the trash screen to ensure all debris is removed on a regular basis and Environment Agency inspects the screen as part of their inspection process for Thelwall Brook.

If the trash screen becomes blocked, water will not discharge into the siphon from Thelwall Brook. This will in turn prevent water discharging from the ordinary watercourse which may result in flooding to adjacent gardens and properties.

14.0 Flood Guidance Statements

Three Flood Guidance Statements were produced by the Flood Forecasting Centre (Environment Agency/Met Office) on 26 December 2015, they were produced at:

- 07:30
- 09:30
- 15:30

15.0 External Consultation

Due to the complicated nature of flooding and that risk management responsibilities are spread across several organisations, Warrington Borough Council has consulted with other Authorities.

15.1 Consultation with Environment Agency

Throughout this investigation, Warrington Borough Council and Environment Agency have worked closely and discussed their findings.

Due to the widespread flooding across the region, it should be noted that the Environment Agency in their strategic overview role for flood and coastal erosion risk management are coordinating and hosting meetings between affected Local Authorities and Manchester Ship Canal Company.

The Environment Agency holds flood modelling information for the Manchester Ship Canal which they are currently reviewing. The results of the Environment Agency model review may affect the conclusions of this report.

15.2 Consultation with Peel Ports/Manchester Ship Canal Company

Warrington Borough Council and Environment Agency have approached Manchester Ship Canal Company as the owner and operator of the Manchester Ship Canal regarding the events which occurred on 26 December 2016 and the alleged flooding from the Manchester Ship Canal.

Manchester Ship Canal Company stated that they were in the process of undertaking their own investigation into the flooding and could not comment until their investigation had completed. They have provided a statement (see Appendix A) that described their position.

The Manchester Ship Canal Flood Risk Partnership Group meets every 6 months to consider and address strategic issues. The group consists of MSCCo/Peel Ports, seven Lead Local Flood Authorities through which the canal passes and the Environment Agency. Following the flooding, the MSC Flood Risk Partnership Group has discussed what improvements could be made to prepare for and respond to similar future incidents. As a result of this discussion it was agreed that the Partnership Group would: -

1. Hold a joint workshop on incident response arrangements for flooding from the MSC for MSCCo staff and incident response staff from public authorities.
2. Establish a task group to examine the possibility of sharing data and real-time information between all parties e.g. water levels. This is particularly key to establishing a system for providing flood warnings to communities, businesses and residents at risk from the MSC.
3. Establish a task group to build an understanding of the ownership, operation, maintenance and repair/replacement of assets. This improves awareness of issues and identifies opportunities to improve how they are managed.

15.3 Consultation with United Utilities

Warrington Borough Council met with United Utilities on 12 January 2016 and 28 January 2016 to discuss the flood event in Thelwall/Lymm as part of wider flood risk discussions.

It was agreed that as the flooding in Thelwall/Lymm appeared to be as a result of fluvial flooding that United Utilities would not become involved in the investigation unless evidence became available which demonstrates failure of the public sewer network. This is not the case.

16.0 Watercourse Regulation

A watercourse is defined as any channel through which water flows and can be open or enclosed underground as a culvert. This includes any channel that takes seasonal flows and may at times be dry.

Watercourses are generally the responsibility of the riparian owner (the owner of property adjoining a watercourse). All riparian owners have various responsibilities, for example:

- Accepting flood flows through land, even if these are caused by inadequate capacity downstream. A landowner has no duty in common law to improve the drainage capacity of a watercourse that he/she owns
- Letting water flow through their land without any obstruction, pollution or diversion
- Maintaining the bed and banks of the watercourse and the trees and shrubs growing on the banks including clearing any litter and animal carcasses from the channel and banks, even if they did not come from your land

(NOTE: This list is not exhaustive, for more information please see the Environment Agency Publication ‘Living on the Edge’.)

16.1 Ordinary Watercourses/Main Rivers

From a regulatory perspective, watercourses may be classified as either 'main rivers' or 'ordinary watercourses'.

16.1.1 Main River

Main rivers are usually larger streams and rivers, but some of them are smaller watercourses of local significance.

In England, Defra decides which watercourses are the main rivers. Main rivers are marked on an official document called the main river map. Main rivers can include any structure that controls or regulates the flow of water in, into or out of the channel.

The Environment Agency is designated as the risk management authority under the Flood and Water Management Act 2010 for main rivers and as such they are under the regulatory powers of the Environment Agency.

Within the affected area, there are the following Main Rivers:

- Sow Brook
- Thelwall Brook

It is understood that Thelwall Brook flooded. The Environment Agency believes this to be as a direct consequence of the overtopping of the Manchester Ship Canal. Given the amount of water present, the main rivers would not have had capacity to cope.

It is the understanding of the Environment Agency that Sow Brook was contained within its channel during flood event on 26 December 2015.

16.1.2 Ordinary Watercourse

An ordinary watercourse is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows, but is not shown on the ‘Main River’ map.

Warrington Borough Council is classified under the Flood & Water Management Act 2010 as a “Lead Local Flood Authority” and as such is designated as a Risk Management Authority for local sources of flood risk.

“Local flood risk” means flood risk from –

- Surface Runoff
- Groundwater, and
- Ordinary Watercourses

As such, Ordinary Watercourses within Warrington are under the regulatory powers of the Council. The risks associated with minor ordinary watercourses are generally low throughout Warrington due to their location (mainly upstream rural areas feeding larger watercourses) and catchment size.

Warrington Borough Council is under no obligation to undertake watercourse inspections and is only obliged to maintain watercourses where they pass through land belonging to the Council as riparian owner.

It should be noted that the reach of the River Mersey through Warrington in not classified as main river, as it falls under the jurisdiction of the Manchester Ship Canal Company. It is a heavily modified river system as extensive re-sectioning and embankment works were carried out in the 1960s. It is therefore classified as 'Ordinary Watercourse' and under the regulatory powers of Warrington Borough Council.

Within the affected area, there are numerous small drains/ditches acting as tributaries to the 'Main River' network (Sow Brook/Thelwall Brook) which flooded during the event. Given the amount of water present and the minor nature of these drains/ditches rivers would not have had capacity to cope.

16.2 Manchester Ship Canal Regulation

As noted from the Warrington Local Flood Risk Management Strategy: Manchester Ship Canal Company is responsible for managing the Manchester Ship Canal primarily for navigation and secondary flood risk purposes.

Manchester Ship Canal Company Limited is the statutory harbour authority for the Harbour and Port of Manchester, which includes the Manchester Ship Canal and as such is responsible for managing the shipping movements along the entire length of the canal.

17.0 Community & Business Support

In order to support recovery of communities and businesses following Storm Desmond and Storm Eva, the Government made funding available for the following schemes:

- Communities and Business Recovery Scheme, including:
  - Community Recover Scheme
  - Business Support Scheme
  - Property Level Resilience Scheme
- Council Tax Discount Scheme
- Business Rate Relief Scheme

Warrington Borough Council has and is continuing to work closely with the Department for Communities and Local Government (DCLG) to ensure that this funding reaches those for whom it was intended.

At the time of writing this report, the one residential property which was internally flooded had received:

- Community Recovery Grant
- Council Tax Relief

The Engineering & Flood Risk Team are continuing to work with the affected resident to put forward a suitable application for property level resilience grant in order to reduce the risk to their property going forward.

In respect of business recovery, the Cheshire and Warrington Growth Hub are supporting affected businesses in making applications.

At the time of writing this report, 19 business grants had been approved.

18.0 Flood Risk Management Authority Responsibility

It is the conclusion of this report that;

- Warrington Borough Council is responsible for managing the fluvial flood risk from the River Mersey (for the section within the Councils administrative boundary) as it is classified as an ordinary watercourse. The Environment Agency is responsible for managing the tidal flood risk from River Mersey. Despite the 'ordinary watercourse' status of the River Mersey, the Environment Agency takes a strategic overview role in its management, due to the level of flood risk which it presents.

- Environment Agency is responsible for managing the flood risk from Sow Brook and Thelwall Brook as they are classified as "Main Rivers".

- Warrington Borough Council is responsible for managing the flood risk from the numerous small drains/ditches which form the Ordinary Watercourses network within the affected area.

- Manchester Ship Canal Company is responsible for managing the flood risk directly from the Manchester Ship Canal.

19.0 Conclusions

In the absence of further information, the following conclusions have been made:

- It appears from the Environment Agency flood mapping that the area affected by flooding on 26 December 2015 is at a significant risk of fluvial flooding and will remain so in the future.

- It is the opinion of the Engineering & Flood Risk Team that the flood mechanism was primarily fluvial (river/canal exceeding capacity).

- It would appear that the heavy rainfall in the upper catchment for the Mersey / Manchester Ship Canal (across north Manchester) is a significant factor in the cause of the flooding which affected Thelwall / Lymm.

- It appears that water had overtopped the Manchester Ship Canal in at least 3 places according to the Environment Agency causing flooding to the surrounding area. It is unclear whether this was due to operational issues on the Manchester Ship Canal (failed sluice gate at Latchford Lock) or as a result of the extremely high flows being received from the Irk/Irwell/Medlock catchments upstream of Warrington or a combination of both.

- It appears that Thelwall Brook backed up through the siphon under the Manchester Ship Canal as a result of high water levels on the River Mersey and additional flow being received from the overtopping of the Manchester Ship Canal.

- Given the circumstances surrounding the flood event on 26 December 2015 namely the extreme levels of rainfall over the north Manchester area leading to unprecedented water levels and flow rates entering the Manchester Ship Canal from its tributaries, it is the overall conclusion that all Risk Management Authorities acted in an appropriate manner to manage the situation. However it is recognised that there is still areas for improvement namely communication between the Authorities.

20.0 Action Plan

The following are recommended but not binding actions for Warrington Borough Council and its partner organisations:

Warrington Borough Council

- To continue to offer community and business support to residents/businesses as required.
- To install a trash screen at the upstream end of the culvert which flows under Ferry Lane from the open ditch section at its junction with Thelwall New Road.
- To continue to monitor condition of culvert under Ferry Lane.
- To try to identify land owner/owners of headwall at point E on drawing no: LD2016/006/002 and discuss the necessary repairs.
- To update and review this report following further information becoming available.
- To continue to engage with Manchester Ship Canal Company; to request information relating to this flooding event.
- Will continue to monitor this location for flooding.
- To ask Environment Agency and Manchester Ship Canal Company to investigate the possibility of a flood warning service for the Manchester Ship Canal.
- To ask Manchester Ship Canal Company to confirm how they are managing flood risk from the canal to Warrington Borough Council.
- To ask Manchester Ship Canal Company to confirm their understanding of the flood event to Warrington Borough Council.
- To ask Manchester Ship Canal Company to confirm if their assets were fully functional during the flood event.
- To ask for comment from Manchester Ship Canal Company regarding the efficiency of the sluice gates at Latchford.
- To discuss with other affected Local Authorities regarding whether the Manchester Ship Canal Company should be made a Risk Management Authority under the Flood & Water Management Act 2010.

Environment Agency

- To review flood modelling information for the Manchester Ship Canal and provide outputs to Warrington Borough Council.

Joint Actions

- All partner organisations to continue to work together to manage flood risk going forward.

- The MSC Flood Risk Partnership Group has also discussed what improvements could be made to prepare for and respond to similar future incidents. As a result of this discussion it was agreed that the Partnership Group would: -
  1. Hold a joint workshop on incident response arrangements for flooding from the MSC for MSCCo staff and incident response staff from public authorities.
  2. Establish a task group to examine the possibility of sharing data and real-time information between all parties, eg water levels. This is particularly key to establishing a system for providing flood warnings to communities, businesses and residence at risk from the MSC.
  3. Establish a task group to build an understanding of the ownership, operation, maintenance and repair/replacement of assets that affect flood risk and by doing improve awareness of issues and identify opportunities to improve how they are addressed.

21.0 Disclaimer

Although every effort has been taken to ensure the accuracy of the information contained within the pages of this report, we can't guarantee that the contents will always be current, accurate or complete.

This report has been prepared as part of Council's responsibilities under the Flood and Water Management Act 2010 as Lead Local Flood Authority (LLFA).

The findings of this report are based on a subjective assessment of the information available to those undertaking the investigation and therefore may not include all relevant information. Therefore it shouldn't be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.

The opinions, conclusions and any recommendations in this report are based on our assumptions when preparing this report, including, but not limited to those key assumptions noted in the reports, including reliance on information provided by third parties.

The Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the assumptions made being incorrect. The opinions, conclusions and any recommendations in these reports are based on conditions encountered and information reviewed at the time of preparation and the Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with those opinions, conclusions and any recommendations.

22.0 Control and Distribution

This document is owned, maintained, and updated by the Engineering & Flood Risk Team, Warrington Borough Council.

All users are asked to advise the Engineering & Flood Risk Team of any changes in circumstances or information that may materially affect this investigation.

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This document will be reviewed following any new information being received in relation to the flood event and its causes/effects.

Appendix A – Peel Ports Group Statement

The Manchester Ship Canal – Boxing Day 2015

The Manchester Ship Canal Company Limited ("MSCC") is the statutory harbour authority for the Harbour and Port of Manchester, which includes the Manchester Ship Canal ("the Canal").

The Canal, which opened in 1894, was constructed by canalising the Rivers Irwell and Mersey above Latchford and by constructing a new watercourse between Latchford and Eastham (the entrance to the Canal).

There are various inflows into the Canal, most notably the Rivers Irwell, Irk, Medlock, Mersey, Bollin and Weaver, plus various smaller streams, brooks, industrial discharges and surface water drains/run-off. The outflows from the Canal comprise the River Mersey above Latchford and primarily the Weaver Sluices at Runcorn.

The Canal enables sea-going vessels to reach the heart of Manchester, and MSCC's primary function is, as required by statue, to ensure the safety of navigation for vessels using the Canal.

To enable MSCC to fulfil this primary function (and having regard to the environment created by the various inflows/outflows mentioned), there are various lock, sluice and weir structures along the Canal's length, which are used to maintain, so far as is reasonably practicable, water levels for safe navigation. The sluice structures are computer controlled and react to changes in water level by opening/closing as required. The computer control system is monitored on a 24-hour basis and is backed-up by personnel available on a call-out basis should additional assistance be required. During periods of increased inflows, the sluice/weir structures regulate the passage of water downstream through the Canal to the estuary of the River Mersey.

According to information provided by the Environment Agency, the Boxing Day rainfall within Greater Manchester was such that a combination of heavy rainfall and saturated catchments led to very high flow rates. The Environment Agency also recorded unprecedented water levels and flow rates in many of the rivers and tributaries which flow into the Canal. MSCC's infrastructure responded in the normal way (as outlined above) with the sluices opening under the computer control to enable water to flow downstream towards the estuary of the River Mersey. However, owing to the significant (in some cases unprecedented) flows which were experienced, lengths of the Canal's banks were washed away, infrastructure was damaged and in some areas banks were breached by the unprecedented flood waters. Where it was safe to do so, personnel were deployed to ensure that assets which were of critical importance to the regulation of water levels in the Canal (such as sluices) remained in operation. A considerable amount of debris was carried downstream from the River Irwell and was deposited into the Canal at Salford Quays. This amounted to circa. 70,000 tonnes and was subsequently cleared, when safe to do so, once the volume and velocity of the water had subsided.

At Latchford Locks, heavy rainfall in mid-December had carried a significant amount of debris into the Canal, and this debris caused damage to one of the sluice gates. Flows subsided sufficiently for the sluice to be dammed and safely assessed on 17th December, when it was discovered that the damage sustained by the sluice gate was considerable, thus rendering it inoperable.

Owing to the on-going repairs to the damaged sluice gate, sluicing capacity at Latchford was reduced by a third on Boxing Day. Furthermore, the Spring tide which also occurred on Boxing Day night reduced the outflow capacity of the River Mersey at Woolston, which meant that flows down the Canal tended naturally towards Latchford Locks. This naturally occurring combination of Spring tide, extreme rainfall and the already significant flows coming down the Canal from the Manchester area resulted in higher than normal water levels at Latchford Locks (a perfect storm scenario).

To avoid any risk to members of the public, at MSCC's request Cheshire Police closed the public right of way at Latchford Locks during this event.

The Environment Agency (as part of the Cheshire Strategic Command Group) was in communication with MSCC, via an incident management teleconference, and information was shared regarding how flows down the Canal were being managed.

The Canal is fed by main rivers, principally the Irwell and Mersey at its eastern end and the Weaver at its western end. In recognition of this, MSCC, the Environment Agency and the seven Lead Local Flood Authorities along the Canal's route agreed in 2015 to meet bi-annually to discuss issues of mutual interest and to improve co-ordination between the respective parties. The events on Boxing Day confirmed the necessity of this group, and the need to broaden the understanding of how the Canal's water levels are managed and how this relates to the wider flood management for areas adjacent to the Canal.

June 2016

JB2AFL

Appendix B – Return Period Estimates

26th-27th December 2015 event
Summary of selected river gauging stations

Return Period Estimate M Parkes & S Soames 5/1/16
Estimates extracted from NFCDD for the model node chosen as closest to gauging station.
These estimates are from previous studies, and take no account of the December 2015 events

Station	River	Area (1)	Peak stage (m)	Surveyed level (m)	Peak flow (m^3/s) (2)	Years of data	Rank	WISKI Datum (mAOD)	Peak stage (mAOD)	Highest Historical (m)	2nd Highest Historical (m)	Return Period: less than	Return Period: more than	Comment	Model	Model Node	Easting	Northing
Lilford Park Basin	Atherton Lane Brook	G	4.515		-	10	1	20.690	25.205	3.214 (25/08/2004)	3.103 (22/06/2012)		1000	operational issues	Bedford (2008)	EA01317_LILF01_1083d	366474	401054
Irwell Vale	Irwell	G	3.428	3.753	177.0	17	1	139.223	142.651	2.834 (22/06/2012)	2.266 (21/01/2008)	100	75	(4) (5)	Lower Irwell (2007)	ea013_Model_IRWE07_3490	379126	420168
Stubbins	Irwell	G	2.763		-	24	1	131.000	133.763	2.565 22/06/2012	2.488 (14/06/2012)	*100 See notes (6) (0riginally entered as 5*	*75 (See notes 6) 0*	(4), low confidence	Lower Irwell (2007)	ea013_Model_IRWE07_1591u	379291	418758
Ramsbottom Weir	Irwell	G	3.385		-	10	1	124.030	127.415	2.726 (22/06/2012)	2.385 (21/01/2008)	200	101	(3) (4)	Lower Irwell (2007)	ea013_Model_IRWE06_4223	379371	417109
Bury Grounds	Irwell	G	2.178		284.0	37	1	79.725	81.903	1.758 (22/06/2012)	1.633 (21/01/2008)	1000	200	(4)	Lower Irwell (2007)	ea013_Model_IRWE05_2600	379987	411430
Kearsley Ultrasonic	Irwell	G	6.330		650.0	13	1	40.330	46.660	4.677 (21/01/2008)	4.643 (22/06/2012	100		(4)	Kearsley Flood Warning (2010)	IRW1_20195	375426	405586
Manchester Racecourse	Irwell	G	5.668	QA'd	700.0	71	1	24.160	29.828	4.334 (21/01/2008)	4.283 (23/06/2012)	101	100	(3)	Salford Flood Hazard Mapping (2012)	ea013_0111IRW1_7287	382104	400387
Pioneer Mills	Irwell	G	5.331	5.992	-	5	1	57.637	62.968	4.445 (23/06/2012)	3.728 (31/03/2015)	200	100	(4) (5)	Lower Irwell (2007)	ea013_Model_IRWE04_0000u	379106	407241
Littleborough	Roch	G	2.003		20.4	19	1	142.678	144.681	1.719 (22/6/2012)	1.587 (2/8/2002	100	75	(4)	Rochdale & Littleborough Hazard Mapping (2013)	ea013_ROCH05_9729u	394022	416548
Blackford Bridge	Roch	G	3.362	QA'd	192.0	64	1	62.920	66.282	2.264 (22/06/2012)	2.192 (21/1/2008)	1000	200	(4)	Lower Irwell (2007)	ea013_Model_ROCH01_0680	380674	407728
Albert Royds Bridge	Roch	G	2.425		50.8	22	1	122.676	125.101	2.008 (21/01/2008)	1.905 (22/06/2012)	100	75		Rochdale & Littleborough Hazard Mapping (2013)	ea013_model_ROCH04_5108	391045	414480
Rochdale ETW	Roch	G	2.222		92.8	22	1	110.254	112.476	1.788 (21/01/2008)	1.637 (31/01/1995)		1000		Rochdale & Littleborough Hazard Mapping (2013)	ea013_model_ROCH04_0077d	388275	412740
Uppermill	Tame	G	1.242		28.7	17	1	155.550	156.792	1.014 (22/06/2012)	0.994 (21/01/2008)		1000		River Tame Reach 6 (2009)	ea01325_Tame_TAME06_3812	399512	405149

Notes
(1) C=Cumbria, L=Lancashire, G=Greater Manchester, Merseyside and Cheshire
(2) Peak flow data taken from WISKI
(3) Return period of 101 means the 100 year return period plus a 20% allowance for climate change
(4) Return Period data taken from model report, not NFCDD
(5) Based on Surveyed level, not WISKI level
(6) This was originally entered as 5 year return period. Checked with Peter Spencer, Stubbins would be in the magnitude of Irwell Vale. (Estelle 29/02/16)

Appendix C – Rainfall Information

Final Rainfall Totals and Initial Return Periods (Can be circulated)

Rain Gauge	NGR (WISKI)			6hr rainfall (mm)	Return Period (Yrs)	12hr rainfall (mm)	Return Period (Yrs)	24hr rainfall (mm)	Return Period (Yrs)	36hr rainfall (mm)	Return Period (Yrs)	Comments
Mearley Hall	SD	77130	40690	37	5.0	62.6	18	104.6	100	121.8	100	
Colne Swinden	SD	87224	39425	33.8	4.0	53.2	9	85.2	30	95.8	30	
Trawden	SD	93229	37453	42.78	9.0	62.76	18	93.64	35	107.18	35	
Great Harwood	SD	72169	32758	42.18	9.0	61.28	20	95.16	75	103.47	60	
Sunnyhurst	SD	67908	22127	52.4	20.0	67.2	30	99.2	60	110.6	75	
Common Bank	SD	56733	17695	42.8	13.0	53	17	73.2	35	80.8	30	
Worthington	SD	58095	10271	38.96	10.0	46.52	11	66.29	25	73.83	25	
Hoscar Wigan s wks	SD	47803	11361	40.4	10.0	46	7	61.4	15	66.6	12	
Billinge Hill Auto	SD	52263	01791	32.2	5.0	36.4	4	48.8	4	56	5	
Bedford ps tel	SD	66865	00032	22.2	2.0	25.4	2	33.2	2	36.2	1	
Causey Bridges	SJ	58748	92213									
Holden Wood	SD	76657	22605	50.8	17.0	71	35	108.8	75	127.8	100	
Bacup	SD	87258	24742	47.4	13.0	71.2	35	102.8	75	117.8	75	
Cowm Res	SD	88131	18588	47.8	10.0	69.6	23	106.6	60	116.4	50	
Blackstone Edge	SD	96800	18300	37	4.0	47.8	3	74.4	7	79	5	
Sweetloves	SD	70953	12620	39.2	6.0	50.4	7	72.8	15	83.4	15	
Ringley	SD	76722	4896	34.8	6.0	41.6	5	52.2	6	56	5	
Heaton Park	SD	82636	4301	31.8	5.0	39.4	4	49.8	5	54.4	4	
Royton	SD	90719	07122	32	4.0	40.8	4	56.4	5	64.2	5	

Notes

Produced using a hybrid between FEH DDF and FEH13 methods

Produced by Matt Parkes and Peter Spencer

Appendix D – Flooded / Affected Properties

Affected Businesses
Meadow View Fisheries
Lymm Golf Course
Vine House Stables, Lymm Road
Old Hall Farm, Lymm Road
The Stables
Pickering Arms
Laskey Farm, Laskey Lane
Laskey House, Laskey Lane

Affected Critical Infrastructure
Electricity Substation, Gigg Lane

Affected Residential Property
Laskey House
78 Warrington Road
76 Warrington Road
1 Thelwall New Road
3 Thelwall New Road
Mayfield, Thelwall New Road
Old Village School, 1 Gigg Lane
School House, Gigg Lane
Tall Trees, Gigg Lane
Ferryway, Ferry Lane
Beech Cottage, Ferry Lane
Ferry Villas, 1 Ferry Lane
Ferry Villas, 2 Ferry Lane
Glenton, Ferry Lane
Bremen, Ferry Lane
Lyndene, Ferry Lane
Elston, 2 Village Close
Bracklyn, 4 Village Close
Caerhays, 6 Village Close
Shelbrae, 8 Village Close
Avalon, 10 Village Close
The Chimes, 12 Village Close
Glendalough, 14 Village Close
Orchard End, 16 Village Close
The Hay Barn, Ferry Lane
The Barn, Ferry Lane
Old Village Farm, Ferry Lane
United Utilities Pumping Station, Ferry Lane
Heath Cottage, Ferry Lane
Thelwall Old Hall, Ferry Lane
Withy Barn, Ferry Lane
Ivy Cottage, Ferry Lane
Romiley House, Ferry Lane
Damar, Ferry Lane
Avalon, Ferry Lane
Jamboree Cottage, Ferry Lane
Old Post Office, Ferry Lane
The Caravan, Woodacre Farm, Lymm Road

Flooded Businesses
Caddicks Clematis Nursery, Lymm Road
Bridgewater Bait & Tackle, Lymm Road

Woodacre Fm, Lymm Road
- 32 Businesses & 11 Storage Users
  French Countrystyle
  Pineapple Landscapes
  Beauford Belle Wedding Cars
  Eric Morgan (Joinery)
  Christine Gilbert Designs
  Cheshire Pianos
  Paul Gibson PR Trading
  Bentley Logistics & Packaging Supplies Ltd
  Cheshire Copper Lanterns
  J & R Rudge Properties
  Bridge Furnishings
  P. Burgess Construction Ltd
  Manvale Ltd (GreenThumb)
  Belle Celebrations
  S P Maloney Revival Restorations
  Dave Watson (Plumber)
  Bitter Twisted
  Resin Surface Installations
  Pulse Systems Ltd
  Reyes & Reyes Ltd
  Tuw Designs
  VerdeGreen UK
  Eastside Developments
  Next Generation Doors
  Burrill Building Solutions
  The House Next Door
  Lloyds Decorators
  Seddons Industrial Heritage
  Karl Welsh Floral Design
  Gilberts Gardening
  Mad Med Ltd
  M L Events

Flooded Residential Property
Post Office Cottage, Ferry Lane

Flooded Critical Infrastructure
Electricity Substation, Bell Lane
Electricity Substation, Ferry Lane

Appendix E – Flood Event Data Collection Sheets

FLOOD EVENT DATA COLLECTION SHEET - SITE

REFERENCE NO.		**LOCATION**	Statham (Statham Pools)		
		Grid. Ref.	SJ6694488362		
EVENT	26/7th Dec 2015	Start Date	26th	End Date	27th
Collection Date	14/01/16	Observer	D Brown & M Jackman		

SOURCE OF FLOODING N/A.		**CAUSE OF FLOODING**			
Watercourse	Manchester Ship Canal	capacity exceeded (no raised defences)			
Reach		mechanical failure			
Main		operational failure/ breach of defence			
Ordinary		overtopping of defences			
Drainage		groundwater/ high water table			
Sewer		Local drainage/ surface water			
Sea		blockage – bridge		blockage – culvert	
Ephemeral		blockage – channel		blockage –screen	
Unknown		Unknown		Other	*Y*
TYPE *Fluvial*	*Tidal*	*Coastal*		Map Attached showing location of Cause?	

Reports of flooding in the Lymm area have been investigated. The first stage of the investigation was upstream to collect data on possible breach locations.

Marked up on site flood levels (wrack) for later survey?	N

EFFECT		Map Attached of flood boundary?	Y
Flooded Location		Photos (see over to list.)	Y
Properties flooded (Commercial)		Source of boundary *(from list below):*	
Properties flooded (residential)		Local Authority	
Source of Damage Estimate		Surveyed- Agency	
Estimated Damage (£)		Surveyed- consultants	
Any additional comments on the effect of flooding:		Aerial photography	
		Visual	
		Memory	
		Public	
		Other	

FLOOD FLOW ROUTE			
Map Attached of Flood Flow Route?	Y	Flow @ nodepoint (cumecs)	

Description of Flood Flow Route: Water from MSC onto adjacent land.

In location 2 (map 1), water was observed to have overtopped the bank and then flooded out onto the adjacent field's. The area of overtopping is a large eroded section where the MSC embankment is missing (see photo 1, and also observable on aerial photographs (that predate the event)).

Photo 2 shows the flood level on the field, with wrack in the standing vegetation. The flood envelope extended westwards towards the M6 Thelwall. This was traced to the next field (photo 3) and then over to Statham Pool Brook. This is a ditch, wrack was observed on the East side of the brook (photo 4). The Brook was crossed a and wrack was then observed at the boundary fence on the far side of the field that marks the boundary with the M6 Thelwall, where wrack was observed and recorded (Photo 5). Beyond this, access was not possible and the previous wrack level (photo 5) appears to be roughly similar to that of the ground level under Thelwall Viaduct (photo 6).

FLOOD EVENT DATA COLLECTION SHEET - SITE

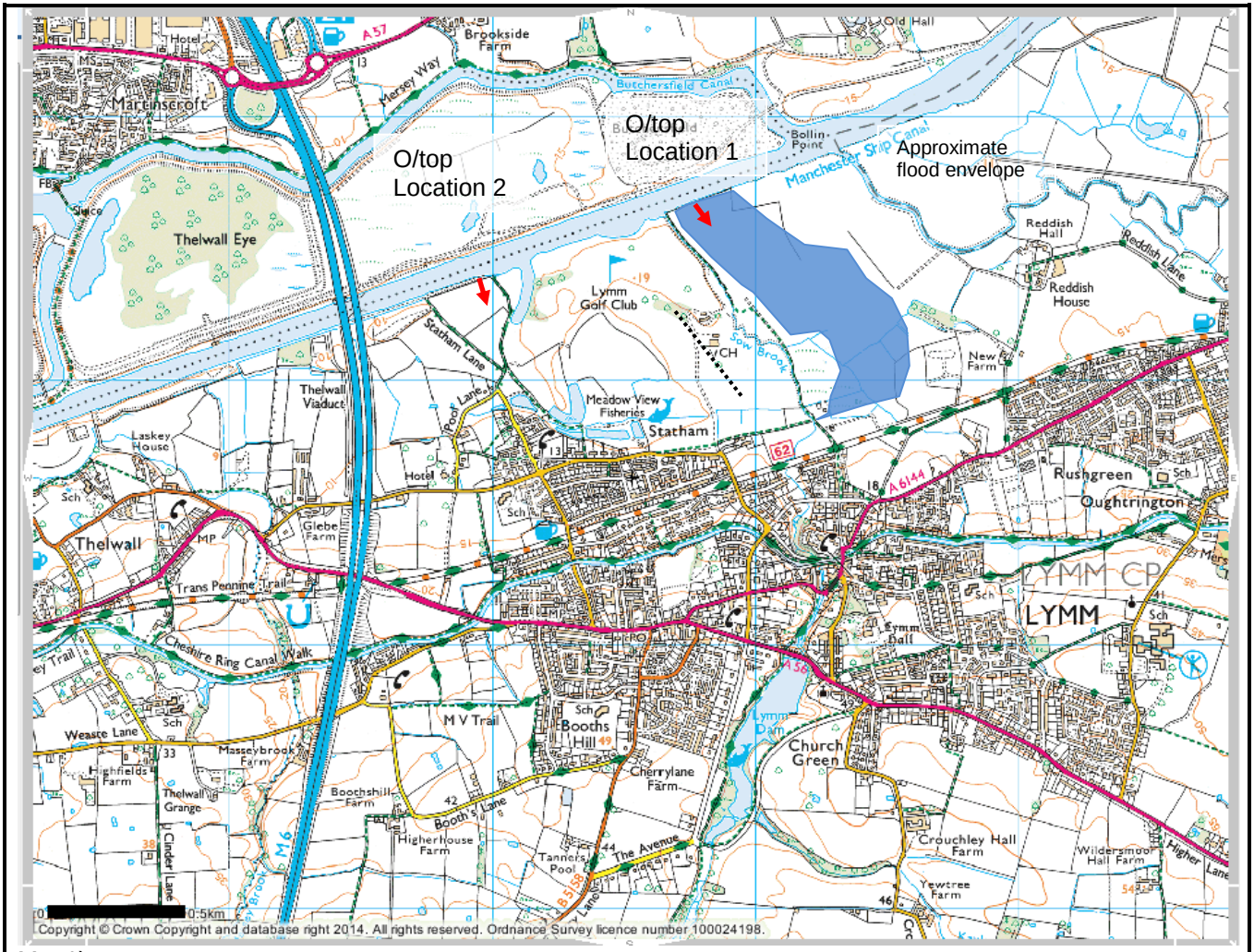
ACTUAL MEASUREMENT (NODE POINT)						
Point ref	Grid Ref	Date	Time	Level mAOD	Flow (m/s)	Water Depth (m)

PHOTOS		
Ref	Description	Direction of view

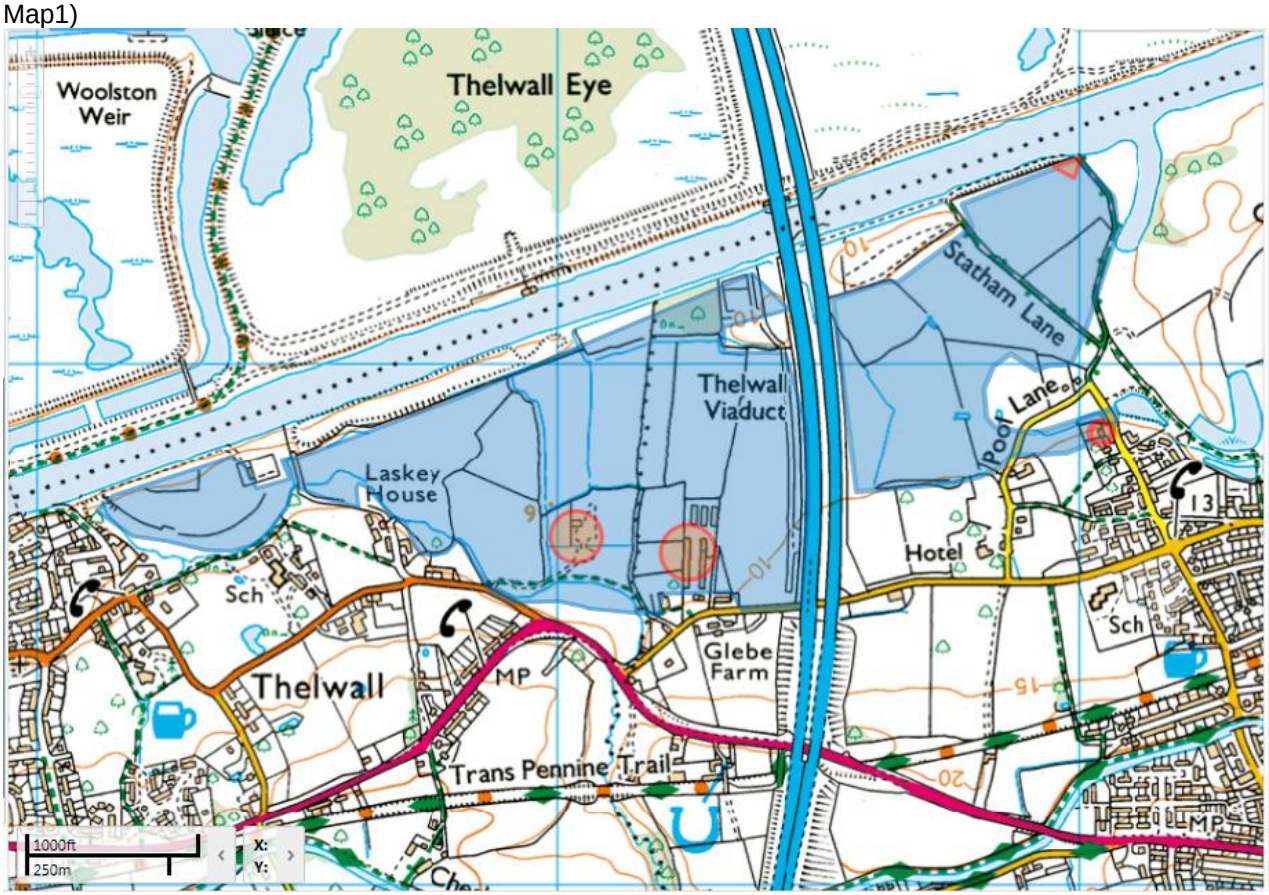
PERSONS AFFECTED – INDIVIDUAL FLOOD LEVELS				
Address	Contact Name	Contact Number	Flood Level	Threshold / Floor Level

Any Additional Information:
(include: Action taken Immediately, Action required and by who, any issues that require investigation (capital schemes, flood warning procedures, development control), if in capital programme and start/end year, if in maintenance programme and year, etc)

FLOOD EVENT DATA COLLECTION SHEET - SITE



Map1)



Map 2, location 1, flood envelope.

Photo 1. One of the embankment low spots. From SJ6700088350, view N. 14/01/16.

Photo 2) Back into the field – Wrack on vegetation indicates water height. From SJ6697788380, view S. 14/01/16

Photo 3. Flood wrack showing Westward progress towards M6 Thelwall. From SJ6681488292, W.

Photo 4, Next field. Flood wrack showing Westward progress towards M6 Thelwall. From SJ6667988170, W

Photo 5) Thelwall boundary (drain), level indicates wrack. From SJ6655588102, W.

Photo 6) Under M6 Thelwall. Access difficult, wrack not easily discernible. From SJ6653988107, W.

FLOOD EVENT DATA COLLECTION SHEET - SITE

REFERENCE NO.		**LOCATION**	Thelwall		
		Grid. Ref.	SJ6781388669		
EVENT	26/7th Dec 2015	Start Date	26th	End Date	27th
Collection Date	27/01/16	Observer	D Brown & M Jackman		

SOURCE OF FLOODING N/A.		**CAUSE OF FLOODING**	
Watercourse	Manchester Ship Canal	capacity exceeded (no raised defences)	
Reach		mechanical failure	
Main		operational failure/ breach of defence	
Ordinary		overtopping of defences	
Drainage		groundwater/ high water table	
Sewer		Local drainage/ surface water	
Sea		blockage – bridge	blockage – culvert
Ephemeral		blockage – channel	blockage –screen
Unknown		Unknown	Other Y
TYPE *Fluvial*	*Tidal*	*Coastal*	Map Attached showing location of Cause?

Reports of flooding in the Statham and Thelwall area have been investigated. The first stage of the investigation was upstream to collect data on possible breach locations.

Marked up on site flood levels (wrack) for later survey?	N

EFFECT		Map Attached of flood boundary?	Y
Flooded Location		Photos (see over to list.)	Y
Properties flooded (Commercial)		Source of boundary *(from list below):*	
Properties flooded (residential)		Local Authority	
Source of Damage Estimate		Surveyed- Agency	
Estimated Damage (£)		Surveyed- consultants	
Any additional comments on the effect of flooding:		Aerial photography	
		Visual	
		Memory	
		Public	
		Other	

FLOOD FLOW ROUTE			
Map Attached of Flood Flow Route?	Y	Flow @ nodepoint (cumecs)	

FLOOD EVENT DATA COLLECTION SHEET - SITE

Description of Flood Flow Route: Water from MSC onto adjacent land.

The 2nd report (Statham flooding) indicated where floodwaters had come out of bank on the MSC upstream of the M6.

The Wrack was tracked to the East side of the M6, but then access was difficult. The West side was accessed to determine whether floodwater had flowed under the M6.

On the West side of the M6, wrack pushing the security fence our (i.e. flows from East to West) were observed (photos 1 to 3). This shows a flood route from the breach on the east side to the land on the west side (Thelwall Brook).

Flooding has been reported in to the EA at Woodacre Farm, Nursery (SJ6603887672) and Vine House Farm.

Under the M6. The MSC has a high embankment along most of its length. However, at two locations, the embankment is lower, and overtopping was observed at two locations. the first (SJ6607088077) is minor, the second (SJ6601388046)more significant, with erosion observed.

Further along, the embankment is high, with Thelwall brook forming a bowl on the land side of the MSC. At the Thelwall Brook debris screen under the MSC, significant wrack was observed. Wrack was observed upstream of the brook, in the valley. Circling round, sandbags were observed at properties adjacent to the Old Post Office (SJ6518887552), and at the Old Post office itself. Wrack was observed in the field upstream. Round to Laskey's farm industrial estate, no flooding was observed there.

ACTUAL MEASUREMENT (NODE POINT)

Point ref	Grid Ref	Date	Time	Level mAOD	Flow (m/s)	Water Depth (m)

PHOTOS

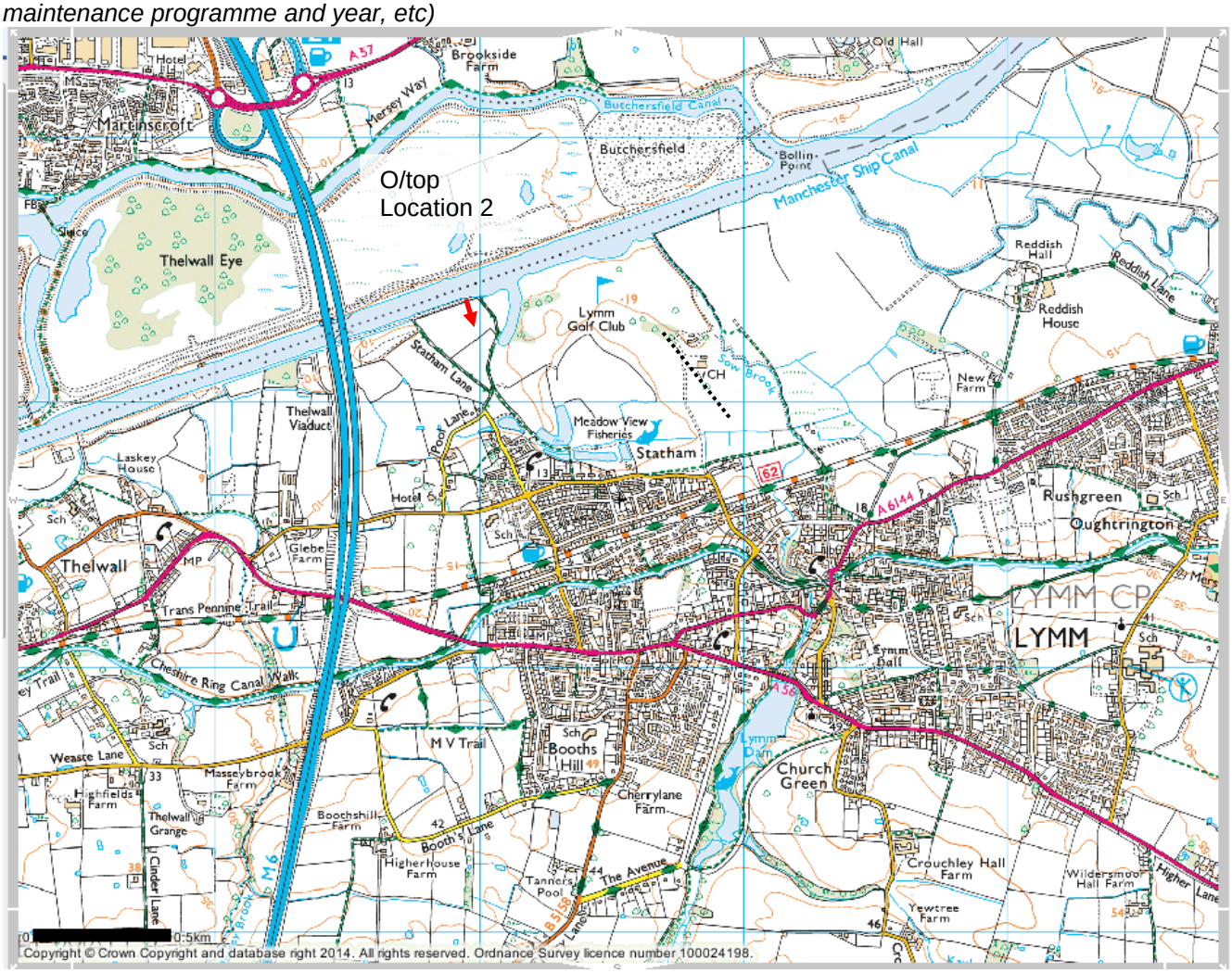
Ref	Description	Direction of view

PERSONS AFFECTED – INDIVIDUAL FLOOD LEVELS

Address	Contact Name	Contact Number	Flood Level	Threshold / Floor Level

FLOOD EVENT DATA COLLECTION SHEET - SITE

Any Additional Information:
(include: Action taken Immediately, Action required and by who, any issues that require investigation (capital schemes, flood warning procedures, development control), if in capital programme and start/end year, if in maintenance programme and year, etc)



Map1)

FLOOD EVENT DATA COLLECTION SHEET - SITE

Photo 1. Flow under Motorway. From SJ6648487736, N. 27/01/16.

Photo 2) Flow under Motorway to rabbit Farm land. From SJ6648287806, S. 27/01/16.

Photo 3. Another Flow route under Motorway. From SJ6647487948, N (approx.). 27/01/16.

Photo 4) Overtopping embankment low spot. From SJ6607088077, West.

Photo 5) More significant overtopping embankment low spot. From SJ6601388046, North.

Photo 6) Ferry Lane Wrack. From SJ6514087733, N.

Photo 7) Back of Old Post Office, Thelwall. From SJ6521987561, N.

Photo 8) flood Level on Thelwall Brook. From SJ6548887724, West

Photo 9) Thelwall Brook, adjacent to Lymm Rd., and Old Hall Farm.