

# Resilient Highway Network 2017-2019

## Highways Maintenance & Asset Management



## Foreword

This report outlines the resilient highway network for Warrington. In 2014, the Department for Transport (DfT) undertook a review of how well the UK transport network copes in extreme weather events (the 'resilience'). This followed a period of extreme weather in 2013 / 2014, which saw high winds and heavy rainfall. A number of recommendations were made as a result. In particular, it was recommended that local highway authorities such as Warrington Borough Council "identify a 'Resilient Highway Network' to which they will give priority" when extreme weather events occur.



Executive board member  
Cllr Hans Mundry

This requirement was also included as a key element to be delivered in the Asset Management Self-assessment which had to be undertaken by councils to secure their share of the Incentive Funding from the DfT.

As the highway authority, we are responsible for the construction and maintenance of non-trunk roads, cycle ways, street lighting, bridges and structures and other highway assets. In addition, Warrington Borough Council is a Lead Local Flood Authority (LLFA) in respect of Flood Risk Management which is also considered as part of the Resilient Highway Network theme. We are determined to ensure our key assets cope with the effects of extreme weather events and effects of Climate Change.

A 'Resilient Highway Network' identifies particular roads that would be given priority during adverse events, such as extreme weather. When extreme weather occurs (floods, storms, ice, snow etc.), the main concern for us will be to keep these roads open in order to maintain economic activity and safe access to town centres, industrial estates and business parks, and access to key services such as schools, railway stations, key food shops, petrol stations, hospitals, police, fire services etc.

Warrington is situated in a unique position in the North West sitting between the M56 and M62 Motorways running east to west and the M6 Motorway running north to south. During incidents of severe weather, accidents, or motorway closures, Warrington's Highway Network is adversely affected by high volumes of traffic being diverted or seeking alternative routes. This emphasises the importance of a resilient highway network. If we are to effectively manage the demands placed on our Highway Network, an effective Resilient Highway Network will be critical.

The Resilient Highway Network has an approximate length of 311km long compared with the whole network of more than 948Km.

Warrington Borough Council has chosen to adopt the gritting route as the base for its Resilient Highway Network. The benefit of this is that the gritting route ensures the key road network receives appropriate winter treatment, whilst at the same time, the driven route is observed in real time to re-lay problems or developing issues as they happen across the Borough. In addition, the gritting routes are critical to the efficiency of the Public Transport and emergency services.

The key routes are chosen as they have the highest volumes of traffic and the greatest risk of accidents occurring. The roads within the Resilient Highway Network will be reviewed after an emergency event, or every two years if no events occur.

*Hans Mundry*

**Councillor Hans Mundry**

**Warrington Borough Council**

**Executive board member for Highways, Transportation and Public Realm**

## Report Authors and Approval

Status: **Final**

Date: **January 2017**

Prepared by: Title Signature

**Jim Turton** **Engineering & Flood Risk  
Manager**

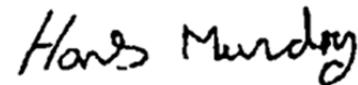


**Jonathan Dawson-Parry** **Asset & Flood Risk Engineer**



Approved by: Title Signature

**Councillor Hans Mundry** **Executive board member for  
Highways, Transportation and  
Public Realm**



**Warrington Borough Council**  
**Economic Regeneration, Growth & Environment**  
**Transport & Environment**  
**New Town House 3F**  
**Buttermarket Street**  
**Warrington**  
**WA1 2NH**

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## 1.0 Resilience of UK Infrastructure

National infrastructure, such as transport, energy, water supplies and communications, is essential to the UK and Warrington. Investment and careful planning is needed to protect it from existing natural hazards and any effects of future climate change. This briefing outlines efforts to improve the resilience of infrastructure and the Network to mitigate these risks. Vulnerability due to the interdependence of different infrastructure components, where failure of one may lead to failure of others, is also considered and discussed.

## 2.0 Overview

Warrington is positioned in the North West and sits between the M56 and M62 Motorways running east to west and the M6 Motorway running north to south. During incidents of severe weather, accidents, or motorway closures, Warrington's Highway Network will be adversely affected by high volumes of traffic being diverted or seeking alternative routes. Incidents of this nature test the resilience of our Resilient Highway Network (RHN). Warrington continues to invest in its RHN and to continuously monitor and address vulnerability through regular management meetings with the Risk and Resilience team and to follow up incidents with lessons learnt exercises.

New and existing infrastructure must be prepared for effects of long-term climate change, such as severe higher or lower temperatures, increased precipitation etc. Population increase over the next 20 years, within the Borough has been considered and is part of the overall planning and development strategies. This will place extra pressure on Warrington's infrastructure. Better knowledge about the risks of infrastructure failure and the impact of interdependence between all assets is necessary to improve overall resilience.

## 3.0 Background

The government defines the UK's national infrastructure (NI) as "facilities, systems, sites and networks necessary for the functioning of the country and the delivery of the essential services upon which daily life in the UK depends". It identifies nine areas as energy, transport, water, communications, food, health care, emergency services, financial services and government itself. Some examples of issues surrounding resilience, which provide the core infrastructure, on which the remaining five depend include;

- **Short-term hazards:** flooding during the summer of 2007 cost an estimated £3.2 billion. The subsequent report, The Pitt Review: Learning Lessons from the 2007 Floods, 2 has set out the need to address resilience to current hazards.
- **Long-term climate change:** climate change may increasingly affect RHN. The Climate Change Act 2008 requires the government to report on climate change risk and prepare adaptation strategies.
- **Interdependence:** the national infrastructure is a highly interconnected network both within and between sectors. Failure in one area can spread unexpectedly to others. The need to replace ageing infrastructure and respond to population rise and changing patterns of demand are also key motives for investment.

## 4.0 The Summer Floods of 2007

The vulnerability of national infrastructure was dramatically highlighted during the summer of 2007, when widespread flooding led to power failures and loss of water supplies throughout Gloucestershire, Worcestershire and East Yorkshire. However, it was recognition of narrowly avoided disasters that made clear the need for a more systematic approach to resilience planning.

## 5.0 Key Areas of Damage

Warrington suffered serious flooding throughout the Borough in 2012. Many properties were flooded and residents in several areas required emergency evacuation. In addition, a live annual music festival was cancelled by order of the police on grounds of safety.

The area wide flooding affected the RHN but robust resilient processes were used to manage the situation and to minimise the impact of flooding to the RHN.

In 2016, Warrington received major flooding to the areas of Lymm and Thelwall following overtopping of the Manchester Ship Canal. A large number of residential properties were affected and some 44 businesses properties were submerged under 1m depth of water.

Again, the area wide flooding affected the RHN but robust resilient processes were used to manage the situation and to minimise the impact of flooding to the RHN. The key element was the communication strategy to establish links between internal management and emergency resilience team, emergency services, Council Members, customers and more importantly, residents who reside within or adjacent to known flooding hot spots.

## 6.0 Governance

Following recommendations from The Pitt Review, a *Natural Hazards Team (NHT)* was set up in the Civil Contingencies Secretariat at the Cabinet Office. Its role is to establish a cross-sector resilience programme between the government, regulators and industry, to address the short term (0-5 years) vulnerability of National Infrastructure to natural hazards. The NHT seeks to encourage better practice and to foster cooperation between operators. To this end, it has established a *Critical Infrastructure Resilience Programme (CIRP)*; where *Critical National Infrastructure (CNI)* is defined as those assets whose loss would lead to “severe economic or social consequences”. However, in the private sector, which accounts for the majority of national infrastructure, investment in resilience remains the responsibility of individual companies and market regulators.

The Department for Environment, Food and Rural Affairs (Defra) leads a cross-departmental project examining how to increase the resilience of NI to future climate impacts (see “Long-term Climate Change” below). Nevertheless, several bodies, such as the Council for Science and Technology, have expressed concern that no single authority for national infrastructure exists.

## 7.0 Short-Term Resilience to Natural Hazards

As part of the CIRP, government departments which deal with aspects of national infrastructure are working with the NHT to develop *Sector Resilience Plans (SRPs)*. The first version of these plans

identified the present level of resilience of CNI to flooding. The SRPs form part of a longer consultation leading to a *National Resilience Plan for Critical Infrastructure* (2011). This document seeks to address current risks identified by the Cabinet Office's National Risk Register, such as storms and heat-waves.

The level and type of protection needed for an infrastructure component depends on the risks involved: that is, an assessment of the consequences of losing a component combined with the probability of such loss. Furthermore, improving resilience can be approached in a number of ways, for example, by:

- **reducing risk** - relocating key sites away from hazards;
- **mitigating risk** - investing in protection and defences;
- **preparing for consequences** - contingency planning to ensure alternative supplies, reserve capacity, or the rapid restoration of services.

Risk assessment helps to provide for the effective targeting of resources by making economic cases for the most appropriate actions. A key part of the SRPs has been to identify the most crucial components of NI and try to establish the consequences of their loss to other assets.

The first iteration of the Sector Resilience Plans was completed in March 2010 and focused on vulnerability of components to flooding. The plans set an initial resilience standard for CNI assets at 0.5% annual flooding probability, meaning protection to a level that has a 1 in 200 chance of being equalled or exceeded each year.

Because risks change over time it is necessary to re-evaluate risk and to modify resilience strategies continually. However, there are no fixed plans for the form of any transition between the short-term work started by the NHT and the long-term implications of climate change.

## **8.0 Long-Term Climate Change**

The Defra-led cross-government *Adapting to Climate Change (ACC)* programme has identified infrastructure adaptation as a priority. In April 2009, the ACC started a cross-departmental project *Adapting Infrastructure to Climate Change* to examine how to increase the resilience of NI to future climate impacts. It is due to report its findings and recommendations for increasing long-term climate resilience in March 2011.

The most recent set of UK Climate Change projections for the coming century, UKCP09, predict hotter and drier summers, warmer and wetter winters and more frequent extreme weather such as heat waves, storms, floods and droughts. In addition, sea-level rise is expected to increase the frequency of flooding in tidal areas. While flooding is a hazard for all sectors, other changes pose specific problems.

## **9.0 Warrington Borough Council Commitment**

Warrington Borough Council has reacted positively to resilience issues. In 2010, Warrington Borough Council was designated a Lead Local Flood Authority (LLFA) under the Flood and Water Management

act 2010. A Flood Risk Management team was established to deal with Flood Risk Management in accordance with requirements of the Pitt Report.

## **10.0 Management & Governance**

A series of meetings were arranged between Warrington Borough Council and Environment Agency. Terms of reference was written to outline roles and responsibilities in relation to future governance.

A Tactical Management Team was established and consists of partner Local Authorities including Warrington BC, Halton BC, St Helens MBC, Cheshire East Council and Cheshire West and Chester Council and Environment Agency (EA). A later addition of Staffordshire Council was allowed. This group was established and is termed Cheshire Mid-Mersey Partnership and managed in accord with the Terms of Reference.

The Tactical Group is chaired by Warrington BC as Lead Local Flood Authority.

Tactical group report on monthly meetings to Strategic Group consisting of Assistant Directors from respective organisations and some Council Members. This meeting is also attended by the chairman of the North West RFCC.

In addition to the above, Warrington BC engage at an operational level with other partner Agencies including United Utilities (UU), EA. This meeting is key to identifying operational issues which may be detrimental to the RHN.

Issues are logged and potential solutions are discussed and planned at an early stage to allow collaborative projects to be implemented.

Information from this meeting is reported upwards to Tactical and then on to Strategic Board as necessary.

## **11.0 Extreme Weather Board**

A strategic level meeting is undertaken twice per year with Assistant Director Transport and Operations, Engineering and Flood Risk Manager, Highway Maintenance Manager, Emergency Risk and Resilience Manager, Climate Change Officer and other representatives from Council Members and others as invited.

One meeting is held in advance of winter to ensure preparedness for the coming winter and the second to follow up on any events and to undertake a “lessons learnt” exercise from the previous year.

Although we have focused on the effects of flooding, the other key areas considered are as follows;

- **Water:** the water sector is particularly vulnerable to flooding due to the position of assets close to lakes and rivers. The CIRP mapping exercise identified a total of 63 sites at a risk exceeding the 1 in 200 year standard. During the most recent price review in 2009, the water regulator Ofwat allowed water companies to charge an additional £400 million to customer bills for investment in resilience.

Though extreme weather, such as periods of heavy rain, will place extra demands on drainage and add to the risk of flooding, changing precipitation patterns are the greatest hazard to the water sector from climate change. Effects will differ throughout the country: drier summers and wetter winters will leave some regions with more water while others are faced with periods of drought. Replenishment of ground water is predicted to reduce by 5-15% and coupled with more intermittent rain this will result in lower average river flow; in summer by up to 50-80% in some areas. Reduced availability of water will also increase the concentration of pollutants, damaging the environment and raising the cost of treatment.

- **Energy:** the electricity transmission and distribution companies in Great Britain have plans and cost options to provide a target level of protection of a 0.1% annual flooding probability (1 in 1000yr) for critical assets. A similar exercise is being conducted for gas infrastructure. In the price review for the period 2010-2014, Ofgem, the energy regulator, permitted electricity companies to collect an extra £112 million from customers for flooding resilience.
- **Transport:** a large range of transport options (road, rail, aviation and shipping) provides alternatives should a given subsector fail. Sector operators have thus decided to accept some interruption of service, rather than providing extra protection, as the most cost effective approach to flood management. The Highways Agency undertakes risk assessments monthly of key hazards on major trunk roads and motorways. Network Rail operates a similar policy. The majority of the rail network is built to withstand a 1% annual flooding probability.
- **Communications:** the 2007 floods had a limited impact on this sector but options for 14 sites found to be at risk during the CIRP mapping exercise are being discussed. Flooding can prevent engineering work on components, such as mobile phone masts, and assets may be vulnerable when they depend on other sectors. The Digital Economy Act 2010 assigned a duty to the communications regulator Ofcom to report on resilience.

## 12.0 Demographic Change

The threats to RHN associated with climate change are likely to be exacerbated by concurrent demographic change as greater demand reduces spare capacity. The UK population is projected to reach 71.6 million by 2033, an increase of 16.6% from 2008; much of this will occur in London (19.8% increase) and the South East of England (20.1% increase).

The impact of population growth on water infrastructure is a particular concern; the South East of England is already one of the most heavily pressured areas in the UK with current demand causing “unacceptable damage” to the local environment during periods of low water flow. Important decisions must be made about land use in future adaptation strategies, particularly concerning the desirability of accommodating a growing population in the South East as opposed to encouraging development in other regions. An ageing population and altering lifestyles will also affect demands on the RHN, particularly the transport sector, as

People choose to retire or live away from urban areas. Infrastructure built now must be prepared for such changes.

**Reducing coupling:** gaining a better understanding of interdependencies, and if possible eliminating them, makes it easier to manage consequences of asset failure.

**Improving diversity:** where dependence on supply from other assets is unavoidable, ensuring the availability of a range of sources can remove single points of failure.

## **13.0 Examples of Interdependence**

### **13.1 Cascade Failure**

The Cumbrian Floods in 2009 destroyed a bridge carrying 312 fibre optic circuits serving 40,000 people, including police and local businesses. Disruption to the transport sector due to the collapsed bridge was compounded by the loss of communications. Had the Ulley Reservoir dam failed in 2007 and flooded the nearby electricity substation and M1 motorway this would have been a case of cascade failure.

### **13.2 Single Point of Failure (SPF)**

Many infrastructure components rely on precise time signals to synchronise with other assets. Dependence on signals from Global Positioning System (GPS) satellites is now a widespread SPF.

In April 2010, a faulty anti-virus update, supplied by the McAfee software company, crashed thousands of computers running an identical version of the Microsoft Operating System.

A recent case study of Humberside has identified three major coal fired power stations and renewable energy assets, 17% of the UK's generating capacity, co-located in a region vulnerable to flooding.

## **14.0 Resilience to UK Infrastructure – Barriers to Improving Resilience**

### **14.1 Interdependence and Governance of Proposed and Ongoing Schemes**

Insufficient knowledge about the level of coupling between assets can undermine other attempts to improve resilience. In 2004, for example, more than 130,000 telephone lines were blocked in the North West due to a fire in a communications tunnel; spare capacity was situated next to the main cables and, as a consequence, also damaged. Furthermore, lack of communication between different operators can make it difficult to identify interdependence, to establish responsibility for resilience and to target resources efficiently. The Council for Science and Technology has recommended that a body be established to provide clear leadership, to coordinate systems-based approaches, to mediate responsibilities, and to oversee both the short and long-term planning of national infrastructure.

### **14.2 Mitigation**

To mitigate this risk, monthly coordination meetings are held at Warrington BC offices with representatives from all Statutory Utilities to plan and coordinate works on the RHN. This enables accurate planning of works and to cancel or withdraw schemes at short notice if there is an incident elsewhere on the RHN to reduce the overall impact.

## **15.0 Relationships with EA and other Partner Agencies**

The following hypothetical scenario illustrates some of the challenges posed by interdependency.

EA is responsible for the maintenance of the main river network and should be consulted with regard to interdependent issues or schemes.

Warrington BC has a very close relationship with EA and has undertaken a multi- million pound flood defence scheme in Warrington. Although the project is in the final phase, the flood defence was tested in 2015 when high tides on the River Mersey breached river banks but the water was retained by the flood defence. This prevented flooding to some 250 properties and certain flooding and closure of a section of RHN.

## 16.0 RHN and Overlap with Winter Maintenance

Where practical, there is a need to make our transport network more resilient to such events and the Transport Resilience Review was published in July 2014. The review contains a section on local roads which not only recommends the use of asset management principles but also states as Recommendation 35 “Each Local Highway Authority should make an early start in identifying a resilient network to which it will give priority through maintenance and other measures in order to maintain economic activity and access to key services during extreme weather”.

The Transport Resilience Review identified the need for local highway authorities to identify its ‘snow network’ e.g. the local roads that it would apply its winter service to as a priority over other roads in the local highway network. This ‘snow network’ was recognised as being likely to “include those routes crucial to the economic and social life of the area.

The Council currently classifies its resilient network as being its Primary Winter Service Gritting Network and its Strategic Winter Gritting Network in severe weather conditions/reduced resources.

With the Major development projects taking place and planned within Warrington a review of the authorities resilient network to ensure it reflects usage, traffic type, recent developments and importance to Warrington’s economy is planned for 2017/18

The key stakeholders for the review are identified below:

Stage	Item	Details	Start	End
1	Review Existing Resilient Network	Primary Gritting Network		
2	Identify Internal Stakeholders	Traffic - Mark Tune, Dave Rostron Emergency Planning – Theresa Whitfield Highways Structural Maintenance Team - Jim Turton Highway Maintenance - Dave Vasey/John Ansell		
3	Agree/amend Resilient Network	Agree resilient network to ensure it reflects usage, traffic type, recent developments and importance to Warrington’s economy rather than simply the traditional road type classification.		

4	Identify Know Risks	Identify known risks and mitigation		
5	Consult External Stakeholders	Emergency Services, Utilities, adjoining authorities		
6	Finalise Resilient Network	Finalise resilient network with all stakeholder and obtain approval with reference back to HAMP		
7	Communicate	Communicate Resilient Network to stakeholders		

\*The Highway Gritting Route Plan is currently used as the base for the RHN.

Infrastructure making up these existing networks has been used as the initial starting point for the development of the Warrington RHN.

## 17.0 Key Service Locations

In order to ensure that the RHN incorporates all key elements to maintain economic activity and access to key services during extreme conditions, the following locations have also been identified across the region.

### 17.1 Critical Health infrastructure

- Hospitals, (particularly roads leading to A&E entrances),
- Ambulance stations,
- Other clinics,
- Blood banks etc.

### 17.2 Critical utilities/emergency services infrastructure

- Fire stations,
- Police stations,
- Ambulance stations,
- Critical power distribution sites,
- Water treatment works,
- Telecommunication hubs,
- Waste handling sites etc.

### 17.3 Key Transport Hubs

- Key Railway stations,
- Key bus stations / depots etc.

### 17.4 Key Locations of Economic Value

- Regional and District Centres,
- Large retail / business parks etc.

### 17.5 Key Road Infrastructure

Roads assessed as having a high risk of flooding during periods of wet weather

These have been identified through historic flooding data and access to the Environment Agency Flood Maps online. Consideration has been given to areas in proximity to water courses, culverts and known flooding hot-spots.

The framework for a coordinated response to a flood incident is detailed in the Warrington Borough Council Strategic Multi-Agency Flood Response Plan.

Cameras in the UTMC Office allow flood levels on the River Mersey to be monitored remotely and variable message signs to be set across the Borough to inform motorists to avoid areas as appropriate.

## **18.0 Other Factors Considered**

### **18.1 Industrial Action**

There are various Designated Fuel Stations (DFS) across Warrington which would be used for priority users and the emergency services in the event of a fuel shortage. Access to these sites will be considered as part of this report.

### **18.2 Wind**

Wind is a key risk for Warrington, high winds often result in closure / restrictions on the M6 at Thelwall Viaduct which forces traffic onto local routes throughout Warrington. Traffic gridlock is exacerbated when trees are brought down on the local road network due to high wind and responding to this is a key issue.

Often Warrington Borough Council is subject to flood warnings at the same time as high winds, often this creates difficulties when deploying sandbags.

### **18.3 Emergency Road Closures**

Due consideration has been given to alternative route(s) into, out of, and across the region if a key route(s) was lost due to weather or a major incident; e.g. fire/ road collapse etc. Clearly it is not possible to specifically identify where a major incident might occur or the magnitude or overall effect of the incident.

However there are several major chemical sites (COMAH Upper Tier sites) within the area and major incidents of various types can occur at any time. For example, fires at waste sites are becoming more common and can which can cause major disruption to vehicles throughout the Highway network.

## **19.0 Warrington Recovery Actions**

In the event of a major incident in Warrington, the Multi Agency Response Team will be called to meet at the Multi Agency Response facility in Warrington. Attendees will include representatives from emergency services and officers of Warrington BC at Strategic level.

In most circumstances the relevant local authority would take the lead during the recovery phase. The recovery phase continues until the disruption has been rectified, demands on services have returned to normal levels, and the needs of those affected (directly or indirectly) have been met.

The Warrington BC Emergency Response Plan describes the multi-agency response arrangements in an emergency and highlights the need to consider the recovery phase.

## **20.0 RHN Review**

The roads within the Resilient Highway Network will be reviewed after an emergency event, or every two years if no events occur.

# Appendix A – Resilient Highway Network Graphic

