

**AREA 13  
SEVERE WEATHER PLAN  
2013/2014**

## CONTENTS

<b>DOCUMENT CONTROL AND DISTRIBUTION</b> .....	Error! Bookmark not defined.
<b>1 INTRODUCTION</b> .....	<b>1-4</b>
1.1 Statement of service.....	1-4
1.1.1 Risk periods.....	1-4
1.1.2 Service timetable.....	1-5
1.2 Contractual arrangements.....	1-6
1.2.1 Liability.....	1-6
1.3 [Area Network / Network / Project Road] .....	1-6
1.3.1 Description of [Area Network / Network / Project Road].....	1-6
1.3.2 Extent of Area Network.....	1-6
1.3.3 [Area Network / Network / Project Road] Features .....	1-7
1.3.4 Vulnerable locations .....	1-7
<b>2 GENERAL PLANNING</b> .....	<b>2-1</b>
2.1 Operational planning .....	2-1
2.1.1 General arrangements.....	2-2
2.1.2 Liaison and arrangements.....	2-4
2.1.3 Highways Agency's Crisis Management Manual .....	2-7
2.1.4 Health and Safety .....	2-10
2.2 Reporting .....	2-11
2.2.1 Winter Reporting.....	2-11
2.2.2 Severe Weather reporting .....	2-12
2.2.3 Additional reporting.....	2-12
2.3 Records .....	2-13
2.4 Review .....	2-14
2.5 Weather information .....	2-14
2.5.1 National Domain Network of Environmental Sensor Stations.....	2-15
<b>3 RESOURCES</b> .....	<b>3-1</b>
3.1 Human resources .....	3-1
3.1.1 Key personnel.....	3-1
3.1.2 Staffing levels .....	3-3
3.2 Compounds and facilities .....	3-4
3.2.1 Compounds .....	3-4
3.2.2 Fuel.....	3-4
3.3 Treatment materials.....	3-4
3.3.1 Material storage and brine production.....	3-5
3.3.2 Supply arrangements .....	3-5
3.3.3 Reserve / contingency arrangements .....	3-6
3.4 Vehicles and plant .....	3-6
3.4.1 Area Operational Reserve Winter Service Vehicle and contingency arrangements ...	3-6
3.4.2 Vehicle maintenance arrangements.....	3-7
3.4.3 Arrangements with supply chain partners .....	3-7
<b>4 WINTER SERVICE ROUTE PLANNING</b> .....	<b>4-1</b>
4.1 Winter Service Route design.....	4-1
4.1.1 Precautionary treatment routes .....	4-2
4.1.2 Snow clearance routes.....	4-2
4.2 Winter Service Route summary.....	4-3
<b>5 ACTIONS FOR WEATHER CONDITIONS</b> .....	<b>5-1</b>
5.1 Winter decision and treatment matrices.....	5-1
5.1.1 Decision Matrix.....	5-2
5.1.2 Guidance for repeat treatments for road surface temperatures expected to fall below 1°C .....	5-3
5.1.3 Treatment Matrix Guide.....	5-7
5.1.3 Treatment Matrix Guide.....	5-7

5.1.4	Precautionary Treatment Matrix Guide - Treatments, including alternative materials, when spreading in extreme cold.....	5-9
5.1.5	Precautionary Treatment Matrix Guide - Treatments, including alternative materials, before snow and freezing rain when spreading in extreme cold.....	5-10
5.1.6	Reactive Treatment Matrix Guide - Treatments, including alternative materials, for compacted snow or ice when spread in extreme cold .....	5-11
5.1.7	Footway and cycle track treatment snow clearance .....	5-12
5.2	Treatment/Actions .....	5-12
5.2.1	Precautionary treatment .....	5-12
5.2.2	Reactionary treatment for snow and ice.....	5-14
5.2.3	Freezing rain / rain falling on extremely cold surfaces.....	5-17
5.2.4	High winds (including Severe Gales and Storms).....	5-18
5.2.5	Heavy rain.....	5-18
5.2.6	Fog.....	5-19
5.2.7	High temperatures .....	5-20
<b>APPENDICES &amp; SCHEDULES.....</b>		<b>- 0 -</b>
<b>A.1</b>	<b>Definitions and Abbreviations .....</b>	<b>A.1-1</b>
<b>A.2</b>	<b>Audit Checklist.....</b>	<b>A.2-1</b>
<b>A.3</b>	<b>Area Map.....</b>	Error! Bookmark not defined.
<b>A.4</b>	<b>Interface Drawings .....</b>	Error! Bookmark not defined.
<b>A.5</b>	<b>Network Features .....</b>	Error! Bookmark not defined.
<b>A.6</b>	<b>Decision Maker Duty Rota .....</b>	Error! Bookmark not defined.
<b>A.7</b>	<b>Internal Contact List.....</b>	Error! Bookmark not defined.
<b>A.8</b>	<b>External Contact List.....</b>	Error! Bookmark not defined.
<b>A.9</b>	<b>Mutual Aid Agreements .....</b>	Error! Bookmark not defined.
<b>A.10</b>	<b>Severe Weather Desk Duty Rota.....</b>	Error! Bookmark not defined.
<b>A.11</b>	<b>Risk Assessments.....</b>	Error! Bookmark not defined.
<b>A.12</b>	<b>Back up Reporting Forms .....</b>	Error! Bookmark not defined.
<b>A.13</b>	<b>Operatives Schedule .....</b>	Error! Bookmark not defined.
<b>A.14</b>	<b>Training Records .....</b>	Error! Bookmark not defined.
<b>A.15</b>	<b>Compounds, Depots and Facilities Schedule .....</b>	Error! Bookmark not defined.
<b>A.16</b>	<b>Fuel, Pump Maintenance and contingency arrangements.....</b>	Error! Bookmark not defined.
<b>A.17</b>	<b>Vehicles and Plant Schedule.....</b>	Error! Bookmark not defined.
<b>A.18</b>	<b>Winter Service Route Schedules and Drawings .....</b>	Error! Bookmark not defined.
<b>A.19</b>	<b>Solid Vertical Barrier Schedule and Clearance Plan .....</b>	Error! Bookmark not defined.
<b>A.20</b>	<b>Vulnerable Locations schedule .....</b>	Error! Bookmark not defined.
<b>A.21</b>	<b>Salt Re-stocking plan.....</b>	Error! Bookmark not defined.
<b>B.1</b>	<b>Severe Weather Desk Exercises and Briefings.....</b>	<b>B.1-1</b>
<b>B.2</b>	<b>Weather Information.....</b>	<b>B.2-1</b>
<b>B.3</b>	<b>Anti-icing/De-icing Materials .....</b>	<b>B.3-1</b>
<b>B.4</b>	<b>Deployment of Reserve Winter Service Vehicles .....</b>	<b>B.4-1</b>
<b>B.5</b>	<b>Special Considerations.....</b>	<b>B.5-1</b>
<b>B.6</b>	<b>Treatment Options/Techniques .....</b>	<b>B.6-1</b>

## **1 INTRODUCTION**

Severe Weather refers to any meteorological phenomena with the potential to endanger safe passage or cause disruption on the Area 13 Network, and includes snow, ice, heavy rain, high winds, fog and high temperatures. As such year round planning is required to manage Severe Weather events in an appropriate manner.

Severe Weather Service comprises the operational and alert procedures, and actions necessary to ensure safe passage on the Area 13 Network is not endangered by Severe Weather, as far as is reasonably practicable. Winter Service is the element of Severe Weather Service which focuses on the routine precautionary and reactive treatments required to keep lanes on the Area 13 Network free of ice and snow.

This section of the Severe Weather Plan outlines the scope of the services provided, responsibilities for provision of those services and details the extent of the Area 13 Network on which the service is provided. The definitions and abbreviations are provided in Appendix A.1.

This Severe Weather Plan for Area 13 describes the procedures and operational arrangements for the delivery of an effective Winter Service, to ensure safe passage for customers using the highway, and details the alert procedures and actions in the event of other Severe Weather. It is a mandatory requirement for the Service Provider to demonstrate their preparedness by developing this Severe Weather Plan. Instruction and contextual guidance to help the Service Provider compile the Severe Weather Plan is appended.

EM Highways Services Ltd (EM) will ensure the operational activities contained in this plan dovetail with other Highways Agency's Severe Weather Plans (e.g. Traffic Officer's Severe Weather Plan) and the Crisis Management Manual.

The document serves a number of specific purposes:

- Contract Document - The Severe Weather Plan outlines contractual responsibilities of the Highways Agency and their Service Provider.
- Quality Plan - The Severe Weather Plan forms part of Service Provider's quality or business management system.
- Contingency Plan - The Severe Weather Plan is linked with the Highways Agency's wider contingency arrangements.
- Operations Manual - The Severe Weather Plan describes the processes, procedures and operational arrangements for those responsible for delivering Winter Services and details the alert procedures and actions in the event of Severe Weather.
- Reference Document - The Severe Weather Plan is a comprehensive reference document.

### **1.1 Statement of service**

EM will endeavour to fulfil the Highways Agency's Severe Weather Requirement within Area 13 in an efficient and safe manner.

#### **1.1.1 Risk periods**

The year round weather service provided through HAWIS facilitates improved planning and warning for Severe Weather events. Certain weather types can be expected during particular risk periods, these are shown below for guidance. This does not absolve the Service Provider of the obligation to provide an appropriate service at any other time of the year if the need arises.

Weather Type	Risk Periods (months inclusive)
Snow, Ice and Freezing rain	October through to April
Heavy rain	January through to December
High winds (including Severe Gales and Storms)	September through to June
Fog	October through to January
High temperatures	June through to August

### 1.1.2 Service timetable

Key dates for the provision of reports and preparedness are summarised in the following table.

A checklist is provided in Appendix A.2.

Date	Who	Action
21 August	Service Provider	Submit Severe Weather Plan <i>hold point</i>
18 September	HA Service Manager HA National Winter & Severe Weather Team	Check and accept Severe Weather Plan
30 September		Operational Summer Period concludes
1 October		Operational Winter Period commences
Monthly from 15 October	Service Provider	Complete and submit Non warranty defect report spread-sheet
No later than end of October	Service Provider	Completion of Snow Desk exercises
No later than end of November	Service Provider	Completion of Severe Weather briefings
Between 1 December and 31 March	Service Provider	Include daily Vehicle Off Road (VOR) numbers on defect reports
by 18 December	Service Provider	Feedback and action planning from exercises and briefings
1 March	Service Provider	Review and update the Winter Service and Severe Weather infrastructure inventory database
30 April	Service Provider	Finalise list of lessons learnt (or update Severe Weather Action Plan (SWAP) to feed into the Operational Assessment Report
30 April		Operational Winter Period concludes
1 May		Operational Summer Period commences
May	Service Provider	Winter & Severe Weather review
31 May	Service Provider	Submit Salt Restocking Plan <i>hold point</i>
30 June	HA Service Manager HA National Winter & Severe Weather Team	Check and accept Salt Restocking Plan
June	Service Provider	Winter & Severe Weather report to HA (Operational Assessment Report)

## 1.2 Contractual arrangements

Winter Service duties including precautionary treatment, reactive treatment and snow clearance are the responsibility of EM.

Severe Weather duties including operational considerations, alert procedures and actions are the responsibility of EM.

### 1.2.1 Liability

Where arrangements are made with other service providers or Highway Authorities for Winter Service provision and Severe Weather actions to be provided by them on the Area 13 Network, it is the responsibility of EM to ensure such service has been carried out. Arrangements made do not absolve the Service Provider's obligations.

## 1.3 Area 13 Network

### 1.3.1 Description of Area 13 Network

Area 13 extends over a large geographical area covered by several district climatic domains. These domains range from low level coastal areas in the west, higher level non-mountainous regions that constitute the majority of the network, and several high level sections on the M6 and A66, that are particularly susceptible to severe weather.

The network as a whole experiences a wide range of weather conditions, with heavy precipitation being prevalent during the winter months. A synopsis of which and their different weather characteristics is given in Appendix A.3.

### 1.3.2 Extent of Area Network

The extent of Area 13 Network covered by this plan is shown in the following table and also detailed in the Area Map at Appendix A.3. The key interfaces are defined in the interface drawings which are included within Appendix A.4.

Extent of Area 13 Network		
Road	Extent	Length (km)
M6	Area 10 Boundary to Scottish Border	364.46
A66	Workington to Area 14 County Boundary	149.93
A69	Junction 43 Interchange, Carlisle	0.46
M55	Junction 1 to Junction 4	43.93
A590	M6 Junction 36 Farleton to Park Road, Barrow	77.66
A595	Chapel Brow to Calderbridge	35.56
A585	M55 Junction 3 to Fleetwood	20.85
A7	Junction 44 Interchange, Carlisle	0.57

Sections of three lane or more carriageway		
Road	Extent	Number of lanes
M6	Area 10 Boundary to Junction 32	4
M6	Junction 32 to Scottish Border	3
M55	Junction 1 to Junction 4	3

Details of footway and cycle track routes to be treated can be found in Appendix 3 with plans showing locations of footway and cycle track locations.

### 1.3.3 Area 13 Network Features

EM has identified the following network features that require special consideration with regard to weather within the Area 13 Network, and features that occur at boundary interfaces. Details of each Network Feature are contained in Appendix A.5.

### 1.3.4 Vulnerable locations

Certain locations on the network are particularly vulnerable to severe weather conditions. In addition there are a number of locations where although problems may not have actually occurred, due to a number of factors they may be at increased risk of suffering problems during a severe weather event. These vulnerable locations (or trouble spots) requiring special consideration and mitigation measures within the Area 13 Network include:

Following recent successive severe winters it is apparent that certain locations on the network are particularly vulnerable to severe winter conditions. In addition there are a number of locations where although problems may not have actually occurred, due to a number of factors they may be at increased risk of suffering problems during a severe weather event. These vulnerable locations (or trouble spots) requiring special consideration and mitigation measures within the Area 13 Network.

There are three high altitude locations on the Area 13 network at Troutbeck and Stainmore on the A66 Trunk Road and Shap on the M6 Motorway. Due to the severe and increased climatic conditions associated with high altitude sites, specific high altitude and extra effort routes have been identified.

The section of A66 trunk road at Stainmore is also prone to snow drifting, due to its exposed nature and the strong cross winds associated with the high altitude. In addition the steep gradient of the carriageway can also cause traction problems for HGV's. To combat this problem snow gates and fences have been installed at this location.

The A66 Stainburn Bypass which forms part of the Lillyhall 01 route does not have a treated Emergency Diversion Route. If the circumstances arose which led to this section of the A66 being closed then EM would need to treat the diversion route prior to implementation.

The High and Low Newton Bypass on the A590 Trunk Road has a known cold spot on Lindale Hill. This area can often be several degrees lower than the rest of the carriageway throughout this domain to the topography and layout. A new sensor site was installed along this section of carriageway to monitor conditions.

Parkhead Culvert passes over the M6 via an aqua-duct located within the motorway over bridge at MP367/8. The culvert then passes under the west-coast railway line which runs parallel to the M6 at this location. Prior to passing underneath the railway the watercourse passes through a trash screen installed to stop debris including tree branched entering the culvert under the railway. During periods of heavy rain the culvert flows at full capacity and any build up of debris

at the trash screen can cause surcharging of the culvert and flooding to the lower lying west-coast railway line.

Lowfield Bridge carries the Lancaster to Barrow railway line over Green Lane at its junction with the A590 Trunk Road. The A590 is at a low point adjacent to this structure and during periods of heavy rainfall the road is liable to flood.

Chapel Beck aqua-duct passes over the A66 Trunk Road via an aqua-duct located within the over-bridge at MP28/0. The stream comes down from the fells and makes its way into a sheet piled lined channel prior to crossing the A66. Prior to entering the sheet piled section the stream deviates left then right at Thornthwaite Church. During periods of heavy rain the stream flows at full capacity and a build-up of debris at the bend causes the stream to block resulting in a diversion flow over adjacent land and down the batter of the A66. The A66 at this location is on crossfall and the water has to cross both lanes to get into the kerb drainage system on the eastbound verge.

The following table shows the location and brief key word summary of the problem. Each is cross referenced to detailed individual site mitigation plans contained within Appendix A.20. These must be reviewed at a minimum annually.



<b>Vulnerable Locations</b>			
<b>Location</b>		<b>Reference</b> <i>To individual mitigation plan</i>	<b>Problem (very brief summary)</b>
1	<a href="#">A66 Troutbeck</a> <a href="#">A66 Stainmore</a> <a href="#">M6 Shap</a>	High Altitude	Specific high altitude and extra effort routes have been developed.  Existing procedure for use of emergency crossovers for ploughing operations.
2	<a href="#">A66 Stainmore</a>	Drifting Snow  Gradient/HGV Traction  Freezing Fog	Provision of snow gates & fencing, existing procedure for closure of snow gates and subsequent treatments.  Snow fences are installed on the northern side of the carriageway. Mobilisation of extra effort/reserve vehicles from Brough depot when severe snow is forecast.  Patrols during forecast fog with sub-zero temperatures.
3	<a href="#">A66 Stainburn Bypass</a>	Untreated Diversion Route	Cumbria County Council does not treat sections of the EDR that would be implemented between Stainburn and Chapel Brow roundabouts. This section must be treated before the diversion can be implemented.
4	<a href="#">A590 Lindale Hill</a>	Accident Site	This location has been prone to accidents due to the sheltered location proving to be colder than other areas of the route leading to ice and skidding incidents.
5	<a href="#">M6 Parkhead Culvert</a>	Flooding Site	Additional inspections of the culvert grid are required during periods of heavy rainfall to monitor water levels and culvert grid.
6	<a href="#">A590 Low Field Bridge</a>	Flooding Site	Additional inspections of the culvert are required during periods of heavy rainfall to monitor water levels. Water pumps have been used in the past to discharge flood waters onto adjacent land.
7	<a href="#">A66 Chapel Beck Aquaduct</a>	Flooding Site	Additional inspections of upland stream near Thornthwaite Church are required during periods of heavy rainfall to monitor levels of debris being carried downstream.

## 2 GENERAL PLANNING

### 2.1 Operational planning

This section of the Severe Weather Plan contains EM general operational procedures for delivery of Winter Service and details the alert procedures and actions in the event of Severe Weather on the Area 13 network and includes arrangements for liaison and co-operation with key stakeholders to promote delivery of a consistent and co-ordinated service.

EM is employed by the Highways Agency (HA) in the role of Managing Agent Contractor for the Area 13 Network. This severe weather plan has been compiled in accordance with the HA requirements contained in the Area 13 MAC contract 2010 – 2015 sub-process 3.01 of the EM Quality Plan.

It is the aim of the Area 13 MAC team, to provide an efficient severe weather service that enables the safe movement of traffic and minimises delays and incidents to road users, caused by adverse weather on the Area 13 network.

The service has been designed to suit the varying nature of the Area 13 network relative to its topography, weather characteristics, traffic flows and strategic importance.

We will deliver this service by building on the expertise that exists within EM and ensuring our winter maintenance team has appropriate resources that are managed and operated to the highest standards. EM's primary Severe Weather Service management will be based at the Area 13 Head Office at Penrith in conjunction with the Network Control Centre contained within.

EM recognises that co-operation & liaison with emergency services, adjacent authority agents and other relevant stakeholders, is vital to ensure that an appropriate and consistent severe weather service is provided both throughout Area 13 and beyond the boundaries of the trunk road network.

A summary of the principal contacts are as follows:

EM, switchboard: [REDACTED]

EM fax: [REDACTED]

Network Control Centre: [REDACTED]

E-Mail Address: [REDACTED]

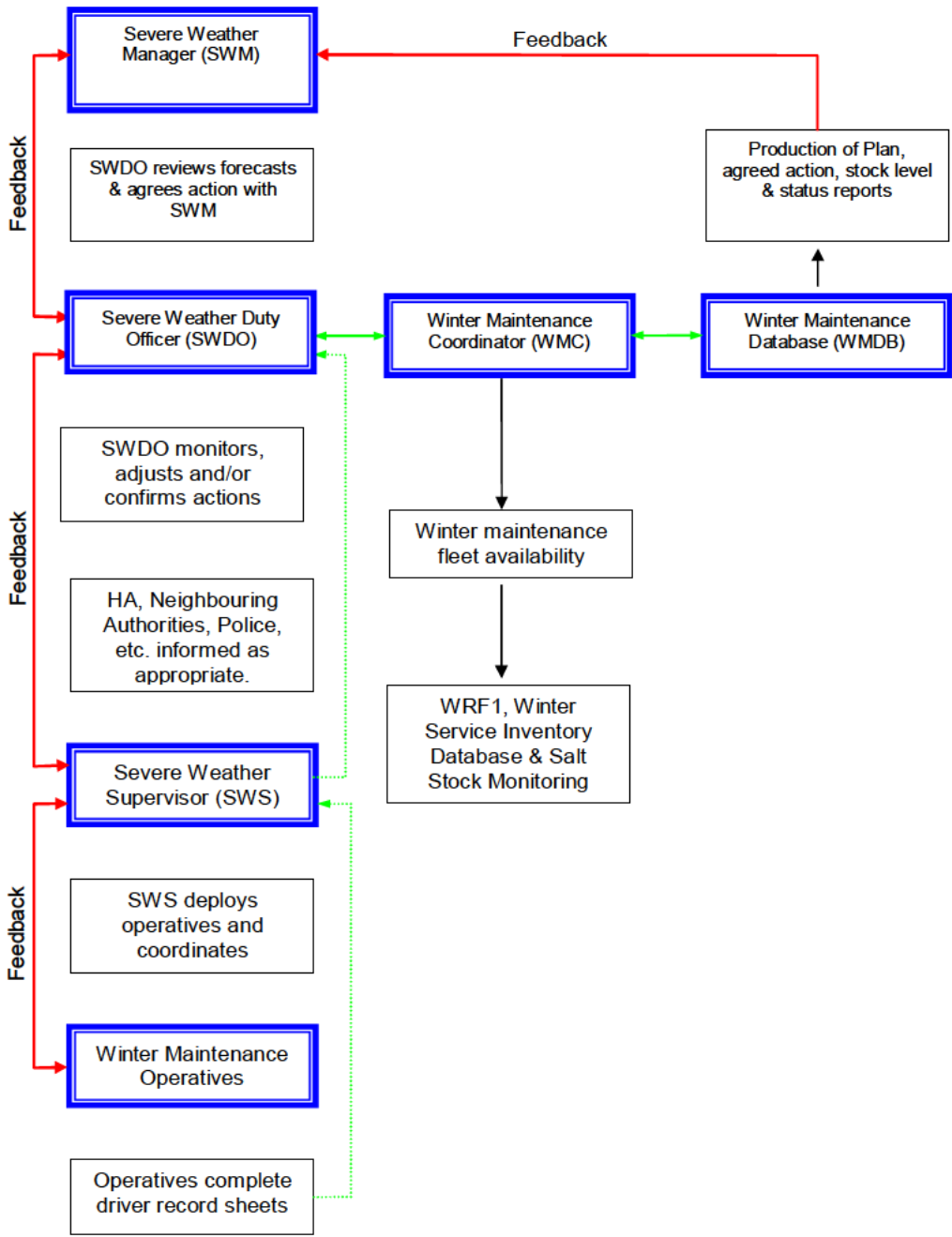
Operational procedures detailed in this Severe Weather Plan will be tested through a Severe Weather Desk exercise. EM will plan and execute a Severe Weather Desk exercise prior to the Operational Winter Period to test the delivery and resilience of the Severe Weather Plan and identify areas for improvement. Planning for the exercise must be in consultation with the Service Manager, Emergency Planning Managers and the National Winter & Severe Weather Team to ensure critical and vulnerable points in the service are tested (Appendix B.1).

EM will hold Severe Weather briefing sessions prior to the Operational Winter Period to ensure the relevant stakeholders are fully briefed. Feedback and actions will be reported to the National Winter and Severe Weather Team as per the service timetable (Section 1.1.2).

## 2.1.1 General arrangements

### 2.1.1.1 Process

#### Operating & Reporting Structure



#### 2.1.1.2 Decision Maker

The Severe Weather Manager (SWM) (Verifying Officer) will be selected from senior network staff, and will be responsible for verifying and reviewing the Severe Weather Duty Officers' (SWDO's) decisions. The SWM will also be available for consultation / final decision making in severe weather and/or critical situations.

The SWDO's will be selected from the network staff and will be responsible for obtaining weather information, decision making, monitoring and reporting. The SWDO will also initiate the appropriate actions for all winter maintenance events that occur during their shift period. The SWDO's will also have designated deputy officers (DSWDO'S) who will provide day-to-day assistance and additional cover during prolonged periods of severe weather.

In the marginal and low periods the SWDO will be able to pass on all of his duties to the DSWDO at anytime. However during the high period delegation of duties will be restricted to normal working hours only i.e. midday decision making. The only exception to this will be during prolonged periods of severe weather when delegation of duties outside normal working hours can only be authorised by the Service Manager, Network Manager or the Severe Weather Manager. Review and verification of the DSWDO's decision will be carried out by either the SWM or the SWDO.

The deputies will also form part of the Area 13 Contingency Planning as their delegated duties will result in them becoming experienced in winter maintenance decision making and use of reporting systems, and as such make them natural successors to the SWDO's.

The Winter Maintenance Coordinator (WMC) role will be undertaken by a combination of Route Technicians, NCC Operators and the Fleet Co-ordinators. This role involves collating winter maintenance information and populating the Winter Maintenance Database (WMDB), with the Fleet Co-ordinator having specific responsibility for producing fleet availability reports and maintenance of winter maintenance vehicles.

The Severe Weather Supervisors (SWS's) will be selected from the operational team of Supervisors and will be the SWDO's main point of contact for operational issues. The WMS will be responsible for the deployment of drivers and the coordination of treatments.

The key personnel responsible for delivery of the services defined within this document are detailed in Section 3.1.1.

#### 2.1.1.3 Duty Rota

Rotas for Severe Weather Duty Officers, Supervisors and Operatives will be stored and updated electronically within the EM IMS.

EM operatives work a continuous shift pattern all year round enabling compliance with all timescales set within the contract.

The Decision Maker Duty Rota is included at Appendix A.6.

#### 2.1.1.4 Salt management

EM will develop and submit a Salt Restocking Plan (Service Timetable Section 1.1.2), providing evidence for supply arrangements, including the Reporting Threshold profile (with supporting evidence) in line with the Minimum Contractual Salt Stock Levels (Appendix B.3). A template for Service Providers to complete is contained in Appendix A.21.

The Salt Restocking Plan is to be submitted by 31<sup>st</sup> May.

EM will submit a Salt Capability Spreadsheet (Service Timetable Section 1.1.2) to indicate EM stock holding capability and Reporting Threshold profile (with supporting evidence) in line with the Minimum Contractual Salt Stock Levels as stated in Appendix B.3.

**Comment [pf1]:** Tim – please could you insert a table for the reporting threshold as per AMM 113 in App 21?

Compound Name	Max Capacity	Contract Minimum	Route Usage at 20g	Maximum Capability	Minimum Capability
Wesham	1,600 tonnes	300 tonnes	0 tonnes	<i>Strategic stock Only</i>	
Garstang	2,500 tonnes	750 tonnes	47.5 tonnes	8.8 days	2.6 days
Millness	1,250 tonnes	500 tonnes	20.3 tonnes	10.3 days	4.1 days
Tebay	2,500 tonnes	750 tonnes	34.2 tonnes	12.2 days	3.4 days
Hardendale	3,500 tonnes	1000 tonnes	0 tonnes	<i>Extra Effort Route Only</i>	
Penrith	3,000 tonnes	750 tonnes	18.9 tonnes	26.4 days	6.6 days
Low Hurst	2,500 tonnes	750 tonnes	25.3 tonnes	16.5 days	4.9 days
Lillyhall	2,000 tonnes	500 tonnes	9.5 tonnes	35.1 days	8.8 days
Brough	1,000 tonnes	300 tonnes	0 tonnes	<i>Extra Effort Routes Only</i>	
<b>Totals</b>	<b>19,850 tonne</b>	<b>6,000 tonnes</b>	<b>155.6 tonnes</b>	<b>21.3 days</b>	<b>6 days</b>

The Reporting Threshold profiles for salt stocks (and stocks of other appropriate material) have been defined taking into consideration local circumstances and other known risks to stock supplies. The reporting threshold will be the threshold for the automatic ordering of additional stock to keep above the required minimum stock levels.

EM will review the defined threshold profile on a monthly basis and, if necessary, adjust it to account for changing circumstances during the Operational Winter Period.

### 2.1.2 Liaison and arrangements

The management of the Area 13 Network and the interface with other networks is essential to the consistent provision of Winter Service and actions in the event of Severe Weather. Liaison with Traffic Management Directorate (TMD) is also important to provide up to date customer-facing functions such as traffic information, active management of traffic flows and incident response.

#### 2.1.2.1 Internal communication arrangements

EM will provide and maintain an effective telecommunications system between the Service Manager, the Service Provider's supervisory staff and operational vehicles. Mobile telephone communication must not be relied upon since these can become over loaded particularly during extreme conditions, or in the event of an incident causing major congestion.

The communication system for all Winter Service Vehicles and the back-up communication system for all Winter Service Vehicles include.

- Internal communication is by mobile telephone.
- The arrangements for backup communications are mobile satellite phones and the airwave radio system.

A comprehensive internal contact list can be found in Appendix A.7.

#### 2.1.2.2 External communication arrangements

EM has established clear lines of communication and agreed contact names and numbers to ensure communication is possible at all times.

The following table indicates the contacts of stakeholders who are important to EM operational effectiveness.

Road	Location	Contact
A66	Area 13 / Area 14 County Boundary	[REDACTED]
M6	Area 13 / Area 10 Boundary	[REDACTED]
A69	Junction 43 / A69 interface	[REDACTED]
M6	Area 13 / Scotland Border	[REDACTED]
Region	Cumbria County Council	See Appendix A.8
Region	Lancashire County Council	See Appendix A.8

A comprehensive external contact list can be found in Appendix A.8.

#### 2.1.2.3 Liaison with major highway schemes

Road	Location (e.g. junction to junction)	Type of scheme	Contact
M6	Tebay Bridge	Deck Refurbishment	[REDACTED]
M6	Junction 34 Heysham Link	Major Improvement	[REDACTED]
M6	Junction 32 Widening	Widening Works	[REDACTED]
A590	Greenodd Roundabout	Major Improvement	[REDACTED]

#### 2.1.2.4 Mutual aid agreements

Mutual aid is where one service provider may have a resource issue, a second or third (etc) service provider will assist in delivering the same goal. Mutual aid can be, from the sharing of resources such as salt, the sharing of facilities that may provide improved resilience of the Area 13 Network, or the provision of a full Winter Service to a particular part of another network. For example, there are local roads that service providers may treat to ensure their own operational effectiveness such as access routes to depots.

It can also be used to provide support to, or obtain support from, other network operators during times of stress, such as during Severe Weather, to the benefit of the road users. The provision of support at such times and capabilities of provision should be discussed and contact details agreed.

The only route that has a pre-determined cross-border arrangement is GS-04, which treats the M55 motorway. Arrangements have been confirmed with Lancashire County Council for the route to be extended westward beyond the agreed boundary (Appendix A.3.8 - M55 Motorway junction 4) to include the junction 4 western exit and entry slip roads and the section of M55 carriageway to the Blackpool Borough Council Boundary.

EM will document all requests for support from, or to, other operators and the subsequent decisions, with reasons, by completing the Mutual Aid Agreement forms. Completed forms can be found in Appendix A.9



EM will submit signed copies of completed forms to the Service Manager for approval with additional copies issued to the provider/recipient of mutual aid. It is noted that mutual aid arrangements do not absolve EM obligations.

#### 2.1.2.5 Cross boundary agreements

Given experiences from the last few severe winters, the critical need for clear and agreed cross boundary agreements has been highlighted.

EM will ensure the cross boundary agreements are in place at the interface of the Area 13 Network and adjacent networks to ensure a consistent service that will not leave potentially important sections of either network untreated.

#### A66 Stainmore

In addition to the above liaison arrangements additional extra efforts have been identified and established for treatment of the A66 trunk road between Brough and Bowes. A brief description of the two routes is given below with the exact route details found in Appendix A.4.

BR-01 ploughing (snow gates open) with identified turning points for Area 13 at the Coach & Horses Farm and Area14 at Augill.

BR-02 ploughing (snow gates closed) with agreed treatments of the eastbound carriageway by Area 13 and westbound by Area 14, including details of snow clearance adjacent to the gates prior to re-opening.

#### Other Cross Boundary Arrangements

No formal protocols have been set-up to cover the boundaries at the northern and southern extremities of the Area 13 Network. Any issues arising at these locations will be dealt with through communications with those persons listed in Annex 8. All key stake holders have been invited to the Area 13 Severe Weather Desk exercise where there will be a dedicated session covering the importance of cross border communications, working on the lessons learnt from the last winter season.

#### CNDR (Balfour Beatty) Treatment Arrangements

A596/A595 Dobies Roundabout – A596 from back of splitter-island to roundabout to be treated by Balfour Beatty.

A66 Ramsay Brow – A66 from start node points (Wilson Street) to A596 Junction to be treated by EM.

A66 Fitz Roundabout – A595 from back of splitter-island to roundabout to be treated by Balfour Beatty.

#### Depot Access

A number of depots are accessed from off the Area 13 network and as such during prolonged and/or severe weather conditions it may be necessary to treat the Local Authority link roads. The identified depots and relevant local authority are as follows:-

Depot	Local Authority	Link Road Treatments
Brough	Cumbria County Council	B6276 from depot to junction with the B6278, then south to A66 Brough Interchange.
Lillyhall	Cumbria County Council	U2332 Pittwood & Joseph Noble Road from depot to junction with A595.
Low Hurst	Cumbria County Council	C1041 from depot to Brisco Crossroads, then east along the C1014 to M6 Junction 42.
Millness	Cumbria County Council	A65 Principal Road from depot to junction 36 Interchange.

EM must take into consideration information contained within AMM 111/09.

#### 2.1.2.6 Abandoned vehicle arrangements

Wherever possible the owners of abandoned vehicles will be contacted and requested to remove the vehicles, but where this is not possible, the specific details of the vehicles, its location and the reason why it needs to be moved will be provided to the Police / Traffic Officer / National Vehicle Recovery Manager (NVRM) and a log of all communications kept. The NVRM will provide an end-to-end vehicle recovery service. **EM must only move vehicles once an instruction from a Police/Traffic Officer has been received for each vehicle.**

Where owners do leave their information, details will be obtained by EM and lodged with the Severe Weather Desk, NTCC and RCC.

#### 2.1.2.7 Incidents involving Winter Service Vehicles

Any incident involving the Highways Agency's own vehicles / any Winter Service Vehicle will be reported to the Service Manager and the National Winter Specialist. The report must be made on form HA 20001 and must be submitted as soon as possible but no later than before 0900 hours the following working day. Where the accident involves a fatality or serious injury the report must be made immediately.

#### 2.1.2.8 Media liaison

In order to facilitate media liaison EM must make available to the Service Manager and/or Highways Agency Press Officers such information as requested. Direct liaison with the media must only take place when directed by the Service Manager.

### 2.1.3 Highways Agency's Crisis Management Manual

The Crisis Management Manual (CMM) provides guidance on managing the Highways Agency's response to crises and emergencies. Severe weather events make up a significant proportion of the events that trigger the CMM escalation steps. The five stages of escalation are as follows:

Routine Operations – HA and service provider resources respond to incidents following standard procedures. Weather forecast and warning services would be continuously monitored and if anything shows up escalation would be considered. If service providers become aware of emerging resilience threats they should inform the Agency immediately.

Regional Alert (RA) – when a significant weather event is expected that potentially could cause disruption on the network a regional alert would be declared. Monitoring will be heightened and telephone conferences will take place to ensure we are as prepared as possible prior to the arrival of the forecast weather. Service providers will be required to provide information and to dial into telephone conferences in line with normal expectations. The regional alert process does not change responsibilities within each service type (i.e. service responders will remain fully responsible for managing and delivering their own service), but will act to better coordinate the individual responses to ensure a more effective combined response as well as to provide the most accurate information to road users.

Regional Crisis – if the SRN is severely affected where sections of the network are closed or road users have become trapped, and are likely to be so for some time or overnight, a Regional Crisis is likely to be declared. The profile of the event is thus raised, a more senior commander will be appointed and the event will be more visible both inside and outside the Agency. During this stage information reporting and the need to dial-in to or attend meetings will be similar to a RA although possibly at an increased frequency but still in line with normal expectations.

National Alert – when more than one region is at Regional Crisis or in advance of a widespread severe weather event the Agency is likely to declare a National Alert. This facilitates coordination across regions as well as providing an accurate national picture of network conditions to inform



road users, DfT and maybe Ministers. Service provider activity would be the same as during a Regional Crisis which would still be operating in the region.

National Crisis – this is for the most extreme of events and incidents. As with a National Alert, service provider activity would be the same as during a Regional Crisis.

A key component in the success of any response is accurate and timely information. Service Providers must have appropriate processes to continuously monitor and manage the effectiveness of their severe weather service. During a severe weather event Service Providers must be able to provide real time network performance and service delivery intelligence and information to support the incident coordination process to enable informed appropriate decisions to be made by HA commander.

During a severe weather event conditions may deteriorate to a point where the continuous and safe operation of the network may be placed at risk. The CMM processes will facilitate an early identification of a potential interruption to the network operation with appropriate responses triggered. Any decision to close a route during severe weather should only be made by the identified HA commander at the time.

The Severe Weather Escalation Process below clearly defines how EM will deal with increasing levels of severe weather. Communication with adjacent authorities and stake holders is essential to the successful delivery of the severe weather service during such times.

## Severe Weather Escalation Process

Alert Level	Forecast Conditions	Strategy	Actions
<b>1</b>	Frost or sub-zero conditions	<i>Business as usual</i>	<ul style="list-style-type: none"> <li>Plan pre-salt or required treatment as required in Severe Weather Plan treatment matrix.</li> <li>Notify stake-holders of planned treatment.</li> </ul>
<b>2</b>	Snow and/or ice	<i>Consult with RCC about warning motorists</i>	<ul style="list-style-type: none"> <li>Plan treatments as required in conjunction with SWP</li> <li>Look to suspend any non-critical activities</li> <li>Liaise with RCC and adjacent authorities</li> <li>Ensure shift numbers are adequate to carry out all planned operations</li> <li>Consider mobilisation of Severe Weather Desk</li> </ul>
<b>3</b>	Prolonged severe weather event effecting most domains	<i>Reduce network activities and liaise with all stake-holders</i>	<ul style="list-style-type: none"> <li>Suspend all proposed works and remove Traffic Management from the network where possible</li> <li>Ensure the shift numbers are enhanced to deploy all extra effort clearance equipment</li> <li>Look to move resources from other depots to deal with potential event</li> <li>Establish Severe Weather Desk and inform Silver Command Officer of forecast conditions</li> <li>Liaise with all stake-holders and advise of likely effects to road-users</li> <li>Relay the message to local media of potential weather event</li> </ul>
<b>4</b>	Extreme severe weather conditions effecting all domains for prolonged period	<i>Look at all resource levels and request mutual aid if required</i>	<ul style="list-style-type: none"> <li>Severe Weather Desk fully operational</li> <li>Silver Command Officer in /NCC</li> <li>Staff and Operative levels enhanced to maximum capacity</li> <li>All non-critical activities suspended</li> <li>All adjacent authorities notified of current and proposed treatments and actions</li> <li>Continuous monitoring of plant, labour and material levels</li> <li>Liaise with adjacent areas with regard to the possible supply of Mutual Aid</li> <li>Continuous liaison with MET Office</li> <li>Prioritisation of treatments depending on hierarchy of carriageway</li> <li>Liaison with RCC/NTCC to notify road users of likely conditions in Area 13</li> </ul>

#### 2.1.3.1 Severe Weather Desk establishment

The Severe Weather Desk must be established prior to the forecasted commencement of Severe Weather that could cause disruption to the Area 13 Network or as soon as possible in the event of un-forecast Severe Weather.

The Severe Weather Desk will be established at Area 13 Maintenance Office, Penrith or at the NWRCC as deemed appropriate. If the Severe Weather Desk is established in the NCC, Penrith, the lead person must ensure that there are clear communications to the TOS Duty Operations Manager.

The Severe Weather Desk/control room will have the ability to communicate directly with motoring organisations and local authorities and to listen to/watch local news/traffic media.

Where decisions, and their implications, require strategic oversight they will be referred to the Service Manager.

If the forecast indicates that the severe weather event is to be for a prolonged period, the decision to introduce continuous 24-hour working will be made by the SWM. When this decision is made, a Severe Weather Desk will be set up to act as the main severe weather control. This will be established in the Network Control Centre (NCC) in the Head Office at Penrith or within the NW RCC, as deemed appropriate by the SWM or SWDO.

The Severe Weather Desk Duty Rota is included at Appendix A.10.

#### 2.1.3.2 Activation of Contingency Plan

This Area 13 Contingency Plan must be activated when a staff member becomes aware of a major or critical incident taking place and they must immediately put in place the actions outlined within the contingency plan. Activation of the plan will be carried out in conjunction with the HA Crisis Management Manual procedures.

#### 2.1.4 Health and Safety

EM intends to fulfil the Health and Safety Policy by considering all activities in advance and determining the best way of carrying these out.

The Management will consider the potential hazards to all persons and property affected by our activities and carry out risk assessments. These will be summarised as a series of briefings and toolbox talks and will form the basis of The Safety Plan. Line Management and the Safety Manager will regularly monitor compliance with these arrangements.

The active participation and co-operation of every person will be required to achieve and maintain the highest practicable standard of safe working.

The Area 13 Commission Health and Safety Plan will be produced to provide clear information on health and safety management in order to avoid accidents and dangerous occurrences and to promote a safe and healthy working environment.

Induction training will be provided for all employees entering the work location and further briefings are given when new work activities are instructed.

Suitable training will be provided to all personnel to ensure they have an adequate level of knowledge and the skills necessary to carrying out the work task required.

Goals are set by EM and Network Boards to ensure safety remains a high profile issue.

In addition drivers will be familiar with their routes and shall be instructed to take all possible precautions to protect their own safety and that of other road users at all times.

Winter maintenance operatives shall wear high visibility clothing incorporating retro-reflective markings at all times when out of a vehicle. EM allows single manning of winter vehicles, all

operatives have contact with the NCC via mobile phone and Airwave. All vehicles are monitored through the Fleet-star system; any violations of speed limits will be dealt with through the disciplinary procedures.

Under the provisions of Section 16(e)(i) of the Motorway Traffic Regulations 1982, the restriction on the use of central reserve crossovers can be relaxed where it is necessary to maintain or clear part of a motorway. However, in practice, this is highly dangerous manoeuvre and drivers of spreading/snowploughing vehicles shall proceed to motorway interchanges rather than use crossovers. The only exceptions are when instructed by the Police or where the crossover is specifically designed for the purpose, including facility for the vehicle to be clear of the carriageway entirely, and appropriate procedures for its use have been agreed by the Highways Agency.

U-turns on APTR's shall be carried out only when there is no risk to spreading / snowploughing vehicle drivers or to other road users.

Risk assessments must be undertaken by Service Providers to ensure the practices expected of operatives and other members of staff on the Network in conditions such as freezing rain are adequately recognised. Completed risk assessments are included within Appendix A.11 for the benefit of others, e.g. Traffic Officer Service.

## **2.2 Reporting**

### **2.2.1 Winter Reporting**

EM will notify the Highways Agency, MET Office, police, adjacent Service Providers, NTCC Embedded Forecaster and local highway authorities of all proposed Winter Service treatments.

EM will, as soon as practicable, notify the Highways Agency, MET Office, police, adjacent Service Providers, NTCC Embedded Forecaster and local highway authorities of other actions including changes to proposed treatments.

The Winter Reporting Form (WRF1) system, provided by the Highways Agency, will be used throughout the Operational Winter Period for the above notifications and for confirmation of treatments. The WRF1 system must be kept up to date with plant, salt and fuel resilience to ensure a true and accurate representation of the current situation.

The internet based reporting system is at [REDACTED] A backup service is available [REDACTED] In case of failure of the internet based facilities standard forms at Appendix A.12 will be used to fax the reports to the back up fax number [REDACTED]

EM has acquired user access for all staff involved in the delivery of the Area 13 Severe Weather Service. All staff has received training and has sufficient experience in the use of the WRF1 system. Records of all training and qualifications can be found on the Area 13 Training Database.

WRF1 reporting will include as a minimum:

- Daily updates by 10:00 hours with salt stock capability, Area Operational Reserve Winter Service Vehicle levels, and fuel status, where there is a possibility of fuel disruption. Additional reports submitted in the event of a change to salt stock capability, status of fuel levels or in the event of an Area Operational Reserve vehicle being used or relocated.
- A "Full" or "No Action" report submitted by 1600 hours each day which details the proposed actions to be undertaken in the following 24 hour period. However, where a decision was made after 1600 hours or a previous decision was changed, the appropriate report must be submitted within 30 minutes of a decision, and no later than the proposed start time of the treatment.

- A "Previous Action" report to confirm all the actions undertaken since the submission of the last "Full" or "No Action" report. This daily report(s) must be submitted by 1000 hours on the following day, but, where possible, submitted within 30 minutes of the treatment being completed.
- An hourly update, when Severe Weather Desk is in operation.

EM will monitor salt stocks (and stocks of other appropriate materials) regularly during the Operational Winter Period and report using the WRF1 electronic reporting system.

EM are to obtain the Salt Capability Spreadsheet (available electronically) from the Service Manager and complete the report detailing salt stocks, salt usage both at route and Area 13 Network level, provide a statement of salt stocks, actual / imminent salt orders, and forecasts of forward usage and risks to the Service Manager.

### **2.2.2 Severe Weather reporting**

EM will notify the Highways Agency, MET Office, police, adjacent Service Providers, NTCC Embedded Forecaster and local highway authorities and other winter stakeholders of all proposed actions. Proposed treatments and actions will be made available to all stakeholders via email alerts and the WRF1 system. During incidents of significant interest updates will also be circulated via the group text message system.

EM will report the number of Severe Weather events that required treatment/actions within the Area 13 Network.

### **2.2.3 Additional reporting**

EM will report on thermal mapping as required.

The report on thermal mapping is to include any changes adjacent to and on the Area 13 Network which will affect the Highways Agency's thermal mapping information, review coverage of thermal maps, and identify areas of improvement.

EM will submit details of all non warranty defects and maintenance for the Highways Agency's winter fleet vehicles for the previous calendar month by the 15<sup>th</sup> of each month. Submissions will be made using the spreadsheet available from the National Winter & Severe Weather Team.

EM will submit vehicle off road (VOR) figures on defect reports for all HA owned winter fleets, to the National Winter & Severe Weather Team. Template spreadsheets are available from the National Winter & Severe Weather Team.

EM will submit an Operational Assessment Report as stipulated in the Service Timetable in Section 1.1.2.

A comprehensive external contact list can be found in Appendix A.8.

Reports will be used for hot and cold de-briefs, as part of developing new research programmes, or identifying areas for review, as part of the lessons learnt process, therefore it is essential that the information is complete and accurate.

### **2.3 Records**

Collection of good quality records covering decisions made together with reasons, and advice and information provided is fundamental especially to defend against liability claims made in respect of Winter Service and any actions taken in the case of Severe Weather.

Information	Record Content	Format	Storage Media	Retention Period
Weather Forecast	24hr & 2-10 day text forecasts	Electronic	Servers & Web Page	Contract Duration + 6yrs MET Office - Indefinitely
Actual Weather Conditions	Morning Summary & Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Reports received	Adjacent Authorities/Areas & Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Decisions made	Decision Methodology Sheet, Incident database WM logs & WRF1	Electronic	Servers & CD	Contract Duration + 6yrs
Instructions made	Action Plan, Incident database WM logs, WMDB & WRF1	Electronic	Servers & CD	Contract Duration + 6yrs
Confirmations	Incident database WM logs & WRF1	Electronic	Servers & CD	Contract Duration + 6yrs
Actions taken	Incident database WM logs, WMDB & WRF1	Electronic	Servers & CD	Contract Duration + 6yrs
Liaison and communications log	Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Telephone conversations	Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Material usage	WMDB	Electronic	Servers & CD	Contract Duration + 6yrs
Fleet breakdowns	Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Times taken to complete treatments	Drivers log sheets and WMDB	Electronic	Servers & Web Page	Contract Duration + 6yrs MET Office - Indefinitely
Use of additional resources (including reserve fleet and mutual aid)	Morning Summary & Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Road Closures/blockages due to weather conditions	Adjacent Authorities/Areas & Incident database WM logs	Electronic	Servers & CD	Contract Duration + 6yrs
Complaints received relating to conditions due to weather	Decision Methodology Sheet, Incident database WM logs & WRF1	Electronic	Servers & CD	Contract Duration + 6yrs
End of season records	Accuracy of weather and forecast information, lessons learnt or Severe Weather Action Plan	Electronic	Servers & CD	Contract Duration + 6yrs

## 2.4 Review

The following reviews are carried out throughout the winter maintenance season.

Review Format	Frequency	Details
Action Plan Review	Daily	SWDO Action Plan reviewed by SWM to ensure correct decision making and response/treatment times. 2 to 5 day forecast reviewed to determine resource requirements including fleet readiness/deployment.
Fleet Availability Reports	Daily / Weekly	WMC provides a report to SWM/SWDO's identifying fleet/resource issues.
Network Meeting	As necessary	SWM/SWDO's identify/review operational issues including liaison/communications, health & safety, operative/fleet/material resources.
PMF Scoring	Monthly	Report determines compliance with contract requirements in respect of timeliness of treatment, lane availability and management of severe weather events.
Pre/Mid/End Season Reviews	Once per Season	Review of Area 13 procedures from decision making to treatment including ESS & Forecast Provider service. Scheduled prior to Christmas/New Year period to allow any identified improvements to be made and also to assess resource requirements over this period.
Forecast Provider End Of Season Review	Once per Season	Forecast Provider presents season performance figures and obtains feedback from the SWM/SWDO's.
Hot/Cold Debriefs	As necessary	All severe weather desks are preceded by briefings, with identified actions incorporated into season reviews and plan updates.
Non-compliance	As necessary	Review required immediately after a non-conformance or non-compliance in delivering the severe weather service
Severe weather desk	As necessary	Review following the mobilisation of each severe weather desk.

## 2.5 Weather information

The Highways Agency Weather Information Service (HAWIS) has been developed to provide weather forecasts, the continuous monitoring of actual conditions year round to facilitate winter service operations and support the resilient management of the network during severe weather events. HAWIS obtains environmental weather condition data from meteorological Environmental Sensor Stations (ESS) located on the Area 13 Network. The service is procured by the Highways Agency through the following contracts:

- Highways Agency Weather Central Service (HAWCS)
- Environmental Sensor Station Supply Framework (ESS Supply)
- Environmental Sensor Station Maintenance and Installation (TechMAC/ Regional Technology Maintenance Contractor (RTMC))
- Environmental Sensor Station Communication (NRTS)
- National Weather Forecasts (National Forecast Provider)
- Service Provider Weather Forecasts (MAC/ASC)

The HAWIS website can be accessed at <https://hawcs.dft.gov.uk>

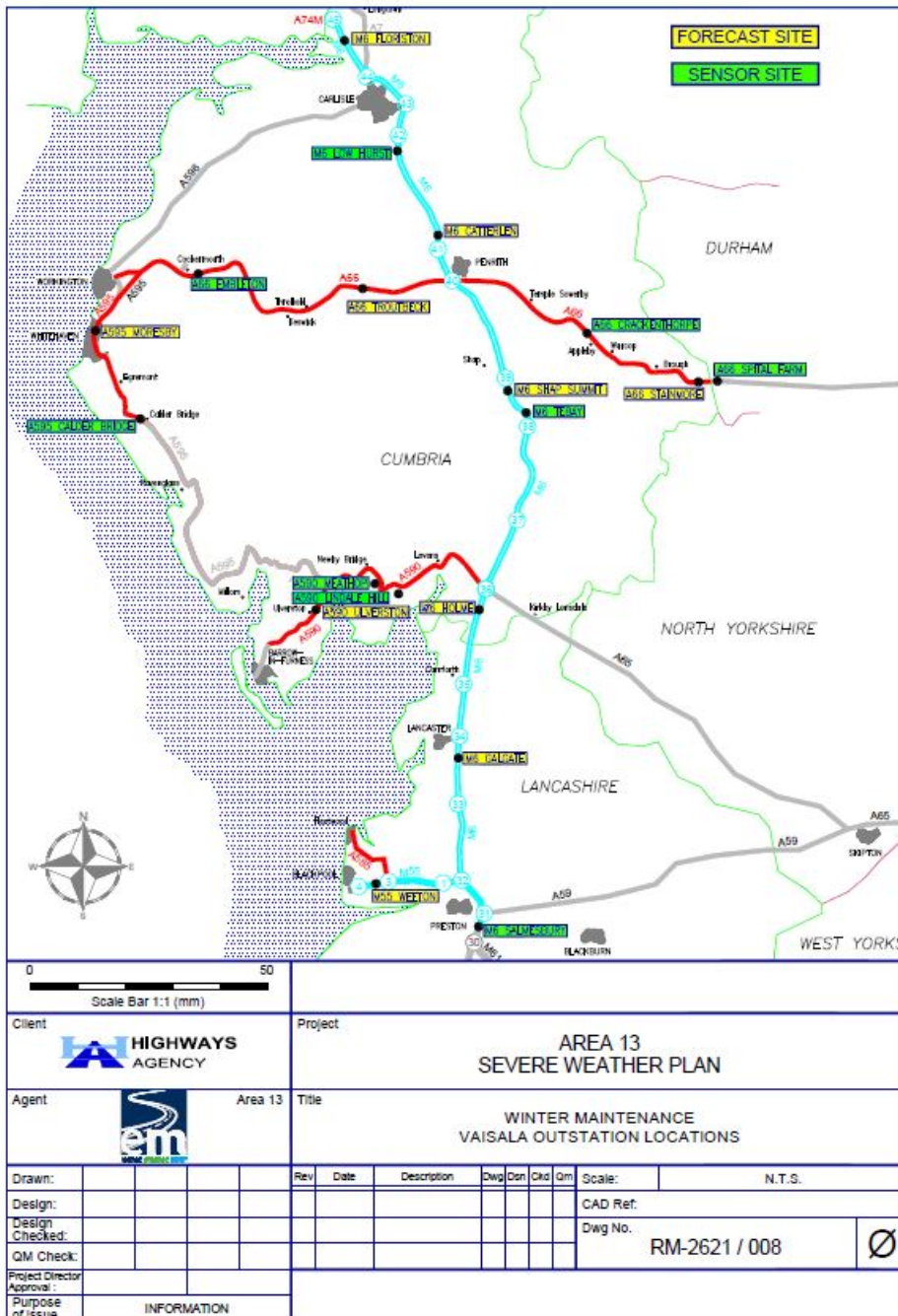
EM has appointed the MET Office to provide the forecast requirement detailed in Appendix B.2. Other forms of weather warning are often received from, The Environment Agency, NILO, Adjacent Authorities as well as the Met Office Alerts/



Faults on HAWIS must be reported as soon as possible to the appropriate maintenance contractor. Contact details can be found in Appendix A.8.

### 2.5.1 National Domain Network of Environmental Sensor Stations

The domain map is shown below.



2.5.1.1 Domain arrangements

Domain arrangements are described in the following table and detailed on the Area Map in Appendix A.3.

OUTSTATION DETAILS								FRONTLINE MAINTENANCE	
Climatic Domain		Road	Location	National Grid Reference		Road Surface	Sensor Status	Telephone No.	Primary Contact
HA	MET								
84	H	M6	Floriston	335833	564442	TSC	Forecast/Camera	All faults are reported to the NCC.	
83	H	M6	Low Hurst	343162	550065	TSC	Sensor/Camera		
82	E	M6	Catterlen	349560	531300	TSC	Forecast/Camera		
82	E	A66	Stainmore	385500	514200	TSC	Forecast/Camera		
82	E	A66	Crackenthorpe	365800	522400	TSC	Sensor/Camera		
85	E	A66	Spittal Farm	390870	512210	TSC	Sensor/Camera		
80	G	A595	Moresby	298968	521416	TSC	Forecast/Camera		
77	G	A595	Calder Bridge	302984	506684	TSC	Sensor/Camera		
81	F	A66	Troutbeck	338540	527390	TSC	Forecast/Camera		
81	F	A66	Embleton	316200	530200	TSC	Sensor/Camera		
78	B	A590	Ulverston	326400	476500	TSC	Forecast/Camera		
78	B	A590	Ayeside	338817	484447	TSC	Sensor/Camera		
78	B	A590	Meathop	343072	481492	TSC	Sensor/Camera		
79	D	M6	Shap Summit	358200	511900	TSC	Forecast/Camera		
79	D	M6	Tebay	361500	505500	TSC	Sensor/Camera		
75	A	M6	Holme	352800	477400	TSC	Forecast/Camera		
75	A	M6	Gaigate	348900	455200	HRA	Forecast/Camera		
75	A	M55	Weeton	339400	434600	HRA	Forecast/Camera		
75	A	M6	Salmesbury	358900	430300	HRA	Sensor Site		

### 3 RESOURCES

This section of the Severe Weather Plan contains details of the resources available for delivery of a Severe Weather Service on the Area 13 Network including reserve / contingency arrangements.

The Highways Agency will make available compounds, vehicles, plant and equipment as appropriate to the form of contractual arrangement and may make available additional reserve resources if the Service Provider requires them due to breakdowns or operational difficulties.

EM is responsible for providing the other resources including staff, materials, and brine production equipment and storage.

EM is responsible for preparing and ensuring that all compounds, equipment and plant operate efficiently.

This section of the severe weather plan contains details of the resources available for delivery of winter services and the alert procedures and actions in the event of severe weather on the Area 13 Network including reserve and contingency arrangements.

#### 3.1 Human resources

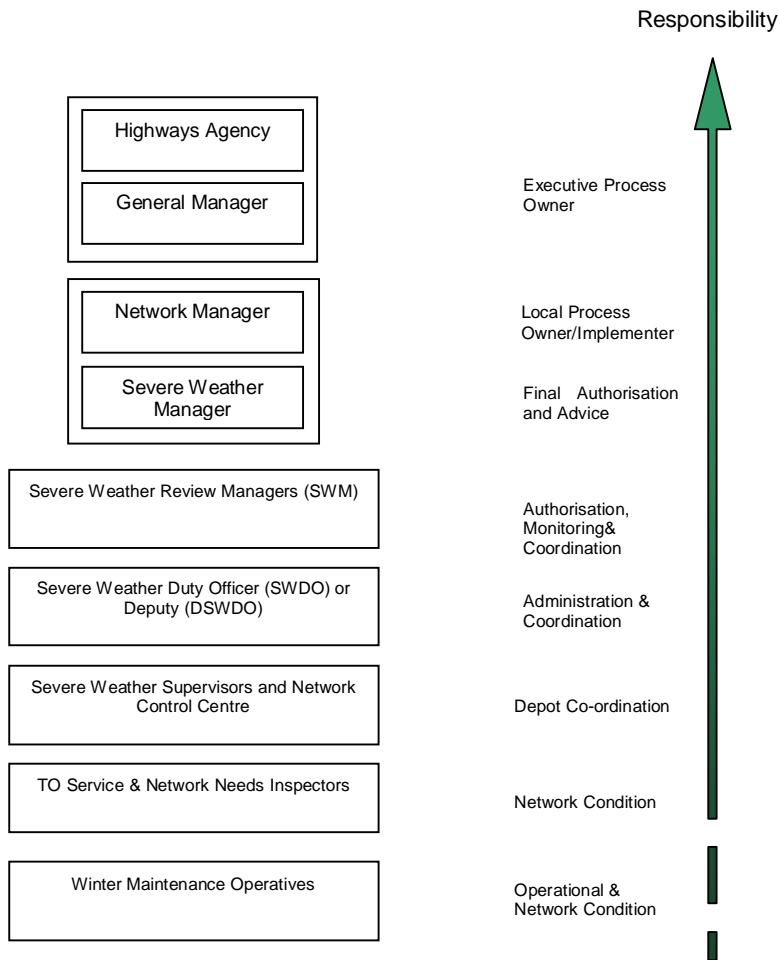
##### 3.1.1 Key personnel

The following table identifies the key personnel responsible for delivery of the services defined within this document.

Function	Title	Name
SP 3.01 Local Process Owner	Network Solutions Manager	[REDACTED]
SP4.01 Local Process Owner	Network Delivery Manager	[REDACTED]
SP3.01 Local Implementation Owner	Severe Weather Manager	[REDACTED]
SP4.01 Local Implementation Owner	Severe Weather Manager	[REDACTED]
Authorisation & Coordination	Severe Weather Manager	[REDACTED]
Monitoring & Decision Making	Severe Weather Duty Officer	[REDACTED]
HA Reporting, Fleet Availability Salt Stock Monitoring & Population of WMDB	Severe Weather Coordinator	[REDACTED]
Operative Deployment & Coordination	Severe Weather Supervisor	[REDACTED]

3.1.1.1 Organogram

**Severe Weather Service Hierarchy**



### 3.1.2 Staffing levels

EM has ■ qualified drivers for Winter Service operations on the Area 13 Network, which will meet the Highways Agency's AMOR requirement to provide an effective Winter Service

EM has a fully operational rota in place that is in operation to cover the winter season (1<sup>st</sup> October to 31<sup>st</sup> April). A specified Decision Making Team work a full week on a rota system starting at midday each Friday. The team includes a Severe Weather Manger (Reviewer), a Duty Officer (Decision Maker) and a Deputy Officer. EM has ■ dedicated teams assigned to the rota throughout the winter season. Alongside this EM operate a 24/7 shift pattern for operatives and supervisors. A copy of the shift pattern and severe weather rota can be found in Appendix A.6.

Due to the nature of the operative shift pattern contingency measures for severe weather events involve the utilisation of operatives on rest.

Operatives are to be listed at Appendix [A.13](#).

#### 3.1.2.1 Training

The SWM and SWDO's will receive HAWIS, WRF1 and Forecast Provider training to ensure that all decision makers have a basic understanding of meteorological conditions and are familiar with all software. The SWDO's will also have previous working experience of severe weather decision making and will be 'shadowed' by a similarly experienced SWM.

"Severe Weather desk" and "Scenario" training will also be carried out for all staff involved in severe weather decision making to ensure that the appropriate treatment/action is instigated for the forecast weather condition.

All other Area 13 staff operatives involved in the delivery of the severe weather service will receive instructions and training to ensure effective operation. This will include an appreciation of the weather forecasting, effective decision-making and operational procedures as appropriate to their duties.

Inductions into the SWP will be carried out to raise general awareness and to highlight any significant changes to the Plan. Presentations/inductions will be carried out for decision makers, coordinators, operatives, TOS, etc. and will be tailored accordingly.

All Area 13 operatives performing winter maintenance operations will hold the appropriate Class C LGV driving license and will be trained and assessed to meet the requirements of the Winter Maintenance Operators Qualification, City and Guilds Scheme 6157.

WM Operatives trained after the 1<sup>st</sup> November 03 will be qualified to the new City & Guilds Scheme 6159. WM operatives will be familiar with all the routes emanating from their depot and trained in basic weather feature recognition and provide feedback information to the duty SWDO.

From the 1<sup>st</sup> October 2013 to the 30<sup>th</sup> April 2014 there will be appropriately qualified staff available to carry out all winter maintenance duties. There will also be sufficient trained and qualified operatives to meet the basic winter maintenance resource requirement on a continuous 24-hour basis and operate the supplementary resource. The above will include training in the use of the pre-wet fleet of spreaders and associated salt saturators in the depots

All training records and certificates will be held by the Human Resources & Training Coordinator, and will be maintained on the Area 13 Training Database. This database will be updated at regular intervals and will highlight any training requirements, to ensure that sufficient numbers of suitably trained staff/operatives are available.

Training records will not be held in the SWP Appendices, as these are subject to frequent/numerous changes throughout the season. The training database will be available for

**Comment [pf2]:** Tim – an additional column in App A13 would be useful so they can tick whether or not the staff listed are sub-contracted

viewing during office hours, and reports can be produced upon request. A training report will be forwarded with the initial/draft Plan to allow the reviewer to assess current training levels.

Training Records are detailed at Appendix A.14.

### **3.2 Compounds and facilities**

An inventory relating to EM compounds and the Area Operational Winter Service Vehicles (including Operational Reserve) plus National Reserve Winter Service Vehicles is stored on an MS Access database held by the Highways Agency. This inventory requires periodic updates to reflect any changes.

EM will review and update the MS Access database inventory at intervals set out in the Service Timetable in Section 1.1.2.

#### **3.2.1 Compounds**

Details of compounds, depots and other facilities covering the Area 13 Network are provided in the compounds, depots and facilities schedule at Appendix A.15.

#### **3.2.2 Fuel**

The fuel type (including grade) and details of supply and storage arrangements including minimum stock levels and supply contingency and pump maintenance arrangements are detailed at Appendix A.16.

EM will monitor fuel stock levels regularly during the Operational Winter Period and report using the WRF1 system as per requirements in Section 2.2.

### **3.3 Treatment materials**

Contextual guidance on treatment materials including storage are contained in Appendix B.3.

EM will utilise the following de-icing/anti-icing materials to deliver an effective Winter Service on the Area 13 network.

- 6mm down salt to BS3247: 2011,
- Brine solution with an optimum and maximum sodium chloride concentration of 23% and no less than 20%,
- 6-8mm sharp sand.

A review of the Area 13 network has been carried out and identified all vulnerable locations. The above mentioned materials are deemed suitable for use on the Area 13 network to deal with the likely conditions at these identified sites.

### 3.3.1 Material storage and brine production

A full itinerary of storage facilities and locations is held within Annex 15. The table below shows the storage capacity for salt and brine across the Area 13 Network.

<b>Material (salt)</b>			
Location	Type	Capacity (tonnes)	Min (tonnes)
Low Hurst	Barn	2500	750
Penrith	Barn	3000	750
Lillyhall	Barn	2000	500
Hardendale	Barn	3500	750
Tebay	Barn	2500	750
Brough	Barn	1000	300
Millness	Barn	1250	500
Garstang	Barn	2500	750
Wesham	Barn	1600	300

<b>Material (brine)</b>			
Location	Type	Capacity (Litres)	Min (Litres)
Garstang	Saturator plus storage	10000	4500
Millness	Saturator plus storage	10000	4500
Tebay	Saturator plus storage	10000	4500
Hardendale	Saturator plus storage	10000	4500
Penrith	Saturator plus storage	10000	4500
Lowhurst	Saturator plus storage	10000	4500
Lillyhall	Saturator plus storage	10000	4500

All Salt stocks are located in barns or similar structures and are therefore protected to prevent contamination and degradation of the materials.

### 3.3.2 Supply arrangements

EM is a contracted customer with [REDACTED] who is a recognised supply chain partner, which guarantees priority delivery service. EM also has arrangements in place with [REDACTED] to



provide salt supplies as a resilience measure. Security of supply is guaranteed by the maintenance of intervention stocks of de-icing materials at supply chain premises via Salt Unions "DMS Wintranet – Stock Management System". This system is updated as necessary by the WMC and contains the locations and stock profiles detailed in the above table to enable automated re-ordering. This stock management system also includes for surveys by Salt Union to accurately determine salt stock levels/quantities at each depot prior to the start of the winter maintenance season.

In addition to this system EM also maintain in Area 13 Winter Maintenance Database (WMDB), which monitors salt usage at each depot and calculates existing stock levels. This will also be backed up by weekly visual stock level assessments by depot staff.

All storage facilities will be managed at depot level to prevent contamination of salt with foreign matter and to ensure that safe working slopes are maintained.

### **3.3.3 Reserve / contingency arrangements**

In the event of Regional or National control of salt supply, alternative suppliers have been approached and supply contracts established to mitigate supply problems should [REDACTED] fail to sustain stock levels. EM has a supply agreement in place with [REDACTED]. Everything reasonably practicable will be done to source these alternative supplies in the event of a shortage. In addition salt stock reserves have been built up on the contract in advance of the winter period.

### **3.4 Vehicles and plant**

EM has in total 28 Area Operational Winter Service Vehicles (including Operational Reserve Vehicles) available for use of which 16 have been allocated as Operational Winter Service Vehicles to cover the planned precautionary Winter Service Routes. The remaining vehicles are designated as Operational Reserve Vehicles detailed in Section 3.4.1.

In addition to the Area Operational Winter Service Vehicles, a further 2 vehicles, which form part of the complement of Winter Service Vehicles within the Area are designated as National Reserve Vehicles. Special conditions, as set out in Appendix B.4, attach to their usage.

Snow Blowers, in number 2, are additional to the Area Operational Winter Service Vehicles. EM shall adopt the procedures for Operational Reserve Vehicles in relation to their use.

The treatment of footways and cycle tracks shall be carried out by the use of pick-ups with the grit-salt being hand spread by operatives.

The schedules of vehicles, plant and equipment are provided in Appendix A.17.

#### **3.4.1 Area Operational Reserve Winter Service Vehicle and contingency arrangements**

EM can use the Area Operational Reserve Winter Service Vehicles allocated to their Area 13 Network without prior approval but must ensure the use is notified up to 8. National procedures for management of the both Area Operational Reserve Winter Service Vehicles and National Reserve Vehicles are in Appendix B.4.

EM's Severe Weather Duty Manager to authorise use of reserves up to threshold. Non-shift Operatives will be responsible for the delivery of any gritters that require transportation to other areas.

The number of Area Operational Reserve Winter Service Vehicles and the agreed Reserve Threshold trigger level is provided in the table below.



<b>Reserve Vehicles</b>	<b>Area 13</b>
Number of Area Operational Reserve Vehicles	10
Reserve Threshold – Number utilised	8

### 3.4.2 Vehicle maintenance arrangements

EM will maintain vehicles in accordance with MAC contract Annex 7.

The Area 13 Fleet Coordinator is responsible for servicing & repair of all Area 13 winter maintenance vehicles, implemented through a programmed schedule of inspections, services, safety checks and calibrations. All plant and equipment will be checked and be in a state of readiness by 30<sup>th</sup> September each year.

The HA vehicles will be maintained by EM dedicated fitters based in Area 13. These fitters are available on call 24-hours a day throughout the winter maintenance period. They are able to perform roadside repairs or call out additional resources when required, for example hydraulic repairs or rock salt spreader unit faults. It is intended that when a vehicle failure occurs out of hours, first call would be to the NCC who will inform the WMDO who will then decide if a reserve vehicle can be used or routes can be staggered. If not, the fitter will be requested to attend site to carry out repairs as necessary and/or instruct recovery. The Duty Fitter will update the NCC of all decisions made on site.

All minor maintenance, [REDACTED] (also detailed in Annex 23 of the contract documents), painting and preservation, tachograph calibration and major maintenance will take place at Millness or Low Hurst depots.

Vehicles will also be inspected and tested (brake test) upon completion of a wash down after an operational run.

EM will rotate use of all Area Operational and Reserve Winter Service Vehicles to balance usage of Area Operational Winter Service Vehicles (including Operational Reserves).

#### 3.4.2.1 Vehicle breakdown and recovery arrangements

HGV breakdown recovery services are available 24hrs/day, through our supply chain, contact details are given at Appendices A.6 and A.7. In the event of a breakdown the details will be passed to the NCC who shall inform the Area 13 Fleet Co-ordinator before requesting breakdown or recovery service.

#### 3.4.2.2 Vehicle preparation

The Area 13 Fleet Coordinator ensures all drivers are inducted into the vehicle defect notification process and each driver carries this process out before the vehicle is used for any winter operations. All drivers must also complete the HA utilisation form which is carried in each winter service vehicle, the driver will also make sure the vehicle is refuelled at the end of his shift ready for the next treatment.

The Service Manager will be informed of all on-going vehicle defects and maintenance issues via the Daily Defect Report.

### 3.4.3 Arrangements with supply chain partners

There are no formal agreements in place with supply chains partners as EM believes they have sufficient resource availability to deliver the current contract requirements. EM have had preliminary discussions with key supply chain partners, including [REDACTED], about the availability of additional plant and resources should there be a requirement.

#### 4 WINTER SERVICE ROUTE PLANNING

This section of the Severe Weather Plan contains details on EM Winter Service Routes (WSR) for use in the delivery of Winter Service on the Area 13 Network.

EM will plan, design and continually review the WSR to ensure they are optimised to be as efficient as possible in terms of treatment lengths and time to undertake treatment.

An effective Winter Service can respond to a change in the forecast in a timely manner. For this reason the initial response is defined as the maximum permitted time taken from the decision to treat until the Winter Service Vehicles are loaded, staffed and ready to leave the depot.

Initial response time is 1-hour

Precautionary treatment is most effective when carried in out advance of and as close to forecast freezing time (to minimise the loss of salt due to trafficking). Therefore, the precautionary treatment and turnaround time is defined as the maximum permitted time for the following cycle: leaving the depot, treating the route, returning to a depot and being ready to leave the depot for the next treatment.

AMOR Precautionary Treatment and Turnaround time is 3-hours

##### 4.1 Winter Service Route design

EM will liaise closely with adjacent Highway Authorities and other stakeholders when designing WSR for precautionary and reactive treatment to ensure consistency and continuity of Winter Service operations on all sections of the Area 13 Network and with adjacent highway networks, including footways and cycle tracks.

For hard shoulder, carriageway marginal strips or emergency refuge areas anti-icing/de-icing material coverage should be 50% at the full rate of spread. The Service Provider should give consideration to the creation of a simple database of start and finish times to enable reports to be quickly generated and provided as required by the Service Manager. Designs of WSR for anti-icing/de-icing precautionary treatment, should allow for full coverage of the specified or instructed rate of spread of anti-icing/de-icing materials over the full width of all areas of carriageway, including LBS1 of a Managed Motorway.

EM will take into consideration the impact from the following, where applicable, when designing the WSR (not exhaustive):

- Physical constraints such as tunnels, over bridges, operations near railways, solid vertical barriers, geometry and traffic calming areas;
- Potential need for different requirements on different lanes of the carriageway;
- Need for variation in anti-icing/de-icing material, application frequency, spread rates, spread patterns, free running and wastage factors;
- Major schemes;
- Route classification;
- Managed Motorways with hard shoulder running;
- Network Features;
- Vulnerable locations;
- Depot constraints
- Depot access problems due to localised congestion caused by severe weather;
- Variation in traffic flow;

Comment [c3]: Added as described below in comments (for discussion C7)

- Poor weather conditions; and
- Carrying snowplough blades on precautionary treatment runs.

#### 4.1.1 Precautionary treatment routes

EM has designed WSR for planned precautionary treatments to meet the precautionary treatment requirement (detailed in the following table). The target treatment time for each route and turnaround time is stated on the route schedule and drawing (Appendix A.18).

**Comment [c4]:** Also see my comments in the route table

**Comment [c5]:** I have suggested that we have a 1) design treatment time (or the target treatment time for MAC) 2) a turnaround time (notional time needed to do this function, and 3) a precautionary treatment time – this would be the latest point a vehicle could return to a depot, be reloaded and achieve the 3 hour target, however the guidance would need to make it clear that it might have to where necessary take into account depot constraints. Would we then need to add a new definition into 4.1?

**Comment [c6]:** Applicable to MAC only but should exclude turnaround times

Precautionary treatment requirement			
Route classification	Red	Amber	Green
Criteria	All lanes (including slip roads) to be kept clear of ice, as far as reasonably practicable		

#### 4.1.2 Snow clearance routes

Snow clearance can take longer than precautionary treatment, therefore snow routes have been designed to achieve the clearance requirement detailed in the following table and mitigate excessive driver hours. The snow clearance plan should be coordinated with the RCC and care taken to ensure consistency across boundaries between Service Providers.

During an area wide snow event EM have a shift pattern in place that will ensure that all 13 pre-salt vehicles and the 3 extra effort vehicles can be fully operational 24/7. Should the conditions deteriorate to a level where the snow cannot be treated effectively by these 16 vehicles then a decision would be made, through liaison with relevant stake holders to deploy vehicles from the green and amber coded routes to concentrate on the red classified routes, the Area 13 Route Classification Plan can be found in Annex 3. In the event of an area wide severe weather event EM will do everything practicable to keep the roads free from snow and ice.

Snow clearance requirement							
Route classification	Red		Amber		Green		Slip and link roads
Number of existing lanes	1 or 2	3 or more	1 or 2	3 or more	1 or 2	3 or more	Not applicable
Criteria	minimum number of lanes to be kept clear of snow, as far as reasonably practicable						
Between the hours of 06:00 - 20:00	1	2	1	2	1	1	1
Between the hours of 20:00 - 06:00	1	2	1	1	1	1	1
Following the cessation of snow all lanes are to be clear of snow within	12 hours		18 hours		24 hours		In accordance with route classification

**Winter Service Route summary**

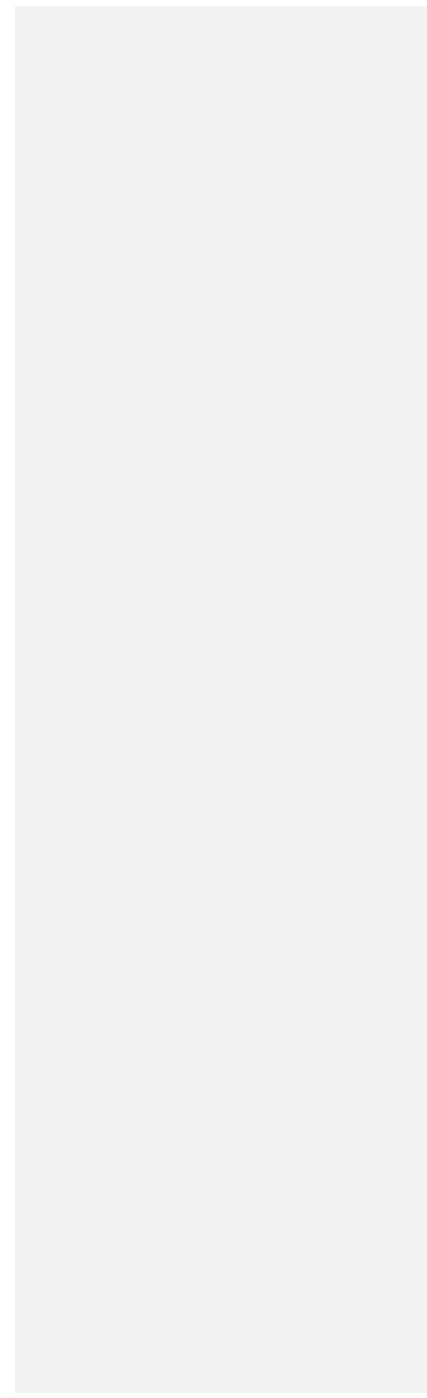
Summary of WSR for carriageways, footways, cycle tracks and other such areas used by pedestrians and cyclists is provided in the following table.

Winter Service Route Summary				
Route Id	Route type	Treatment type	Length (km)	Target / design* treatment time (Turnaround time)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

\*note – all design treatment times have had 25-minutes added to allow for re-fuelling and re-loading, where vehicles have to reload mid-route a there has been an additional allowance of 15 minutes.

The treatment areas for the Footways and Cycle Tracks can be found in the tables below.

The detailed schedules for each WSR including drawings are provided in Appendix A.18.



## **5 ACTIONS FOR WEATHER CONDITIONS**

This section of the Severe Weather Plan contains decision and treatment matrices and EM operational procedures for Winter Service and alert procedures and actions in the event of other Severe Weather on the Area 13 Network.

### **5.1 Winter decision and treatment matrices**

Decisions are made in the interest of service delivery and continuity, and takes account of weather conditions informed by the HAWIS and decision information, where applicable, from adjacent Service Providers and relevant Local Highway Authorities.

#### **SWDO Decision Making**

Area 13 extends over a large geographical area covered by several distinct climatic domains, a synopsis of which and their different weather characteristics is given in Appendix A.3. Unless there are reasons to the contrary all roads within an individual domain will receive the same treatment.

Following receipt of the weather forecasts, the SWDO will determine the winter maintenance action for the following 24-hour period. Where possible a decision on the rates of spread of de-icing material, the time of commencement of the routes and the routes to be covered will be made by 15:00 hours. During normal office hours (08:00 – 17:00 Monday to Friday) the duty SWM will be consulted on the decision and will be available for consultation outside these hours.

Full use will be made of the Road Weather Information System (RWIS) and the Open Road weather prediction service to determine the optimum time to commence precautionary salting. All precautionary salt routes should be completed within the three-hour treatment time. It is advantageous to avoid peak traffic times for precautionary salting and generally morning-salting runs will be completed before 07:00 hours and evening salting should not commence until 19:00 hours.

The decision to treat in the light of unexpected freezing conditions or snow rests upon local experience and judgement. The general weather forecast should be qualified by factors such as local geographical idiosyncrasies, humidity measurements, wind speeds and residual salinity observations. If a meteorological forecast is not available, precautionary treatment shall be carried out when temperatures reach +1 degree Celsius and are falling, providing the prevailing humidity; residual salinity and cloud cover warrant the decision. When rainfall is forecast treatments may be delayed as long as possible to reduce the loss of salt by runoff unless freezing conditions coincide with the rainfall.

All decisions will be subject to continuous monitoring, recording and review.

All Winter Service decisions are evidence based and will be made in accordance with the guidance contained within the following decision and treatment matrices:

During periods of forecast severe weather EM must remain in contact with the MET Office and should also take account of information from staff out on the Area 13 Network, Traffic Officer Service and CCTV when making decisions.

5.1.1 Decision Matrix

		Predicted Road Conditions		
Road Surface Temperature	Precipitation etc.	Wet	Wet Patches	Dry
May fall below 1°C	<u>No</u> rain <u>No</u> hoar frost <u>No</u> fog	Salt before frost	Salt before frost (see note 1)	No action likely, monitor weather (see note 1)
Expected to fall below 1°C	<u>Expected</u> hoar frost <u>Expected</u> fog		Salt before frost	Salt before frost (see note 2)
	<u>Expected</u> rain <u>BEFORE</u> freezing	Salt after rain stops		
	<u>Expected</u> rain <u>DURING</u> freezing	Salt before frost and after rain stops (see note 3)		
	<u>Possible</u> rain <u>Possible</u> hoar frost <u>Possible</u> fog	Salt before frost		Monitor weather conditions
<u>Expected</u> snow		Salt before snow fall (see note 4)		
Freezing Rain	Before rain	Salt before rainfall (see notes 3 and 4)		
	During rain	Salt during rainfall (see notes 3 and 4)		
	After rain	Salt after rainfall (see notes 3 and 4)		
<i>The decision to undertake precautionary treatments should, if appropriate, be adjusted to take account of residual salt or surface moisture.</i>				
Notes:				
<p>1) Particular attention should be given to any possibility of water running across carriageways and such locations should be monitored and treated as required. Where forecasts have low confidence for frost/ice conditions the affected areas should be monitored until such time that a trusted decision can be made. Decisions should be made allowing sufficient time for mobilisation and treatment of routes.</p> <p>2) When a weather warning contains reference to expected hoarfrost considerable deposits of frost are likely to occur and close monitoring will be required. Particular attention should be given to the timing of precautionary treatments due to the possibility that salt deposited on a dry road may be dispersed before it can become effective.</p> <p>3) Under these circumstances rain will freeze on contact with surfaces and full pre-treatment should be provided even on dry roads. This is a most serious condition and should be monitored closely and continuously throughout the danger period.</p> <p>4) The effectiveness of salt decreases as temperatures fall and effective treatments may not be guaranteed with salt towards the lower end of the temperature band. The use of alternative treatment materials must be considered when spreading at (the lower of air or road surface) temperatures below -7°C or below -5°C in low humidity conditions (relative humidity &lt;80%).</p>				



**5.1.2 Guidance for repeat treatments for road surface temperatures expected to fall below 1°C**

Possible need for repeat treatment(s)	Key information	Predicted conditions	Treatment guidance
Rain after treatment but before freezing	<p>The current spread rates assume that little water is likely to be present on road surfaces in winter conditions, and this is normally the case (See Note 1)</p> <p>Water on the surface will reduce the effectiveness of salt by:</p> <ul style="list-style-type: none"> <li>• Dilution of any brine solution formed</li> <li>• Causing salt wash off</li> </ul> <p>As a guide, greater than 2mm will result in salt wash off and require retreatment. Use rainfall radar to determine and treat only effected areas where possible</p>	More than 1mm of rain based on weather station data or radar or forecast	Make repeat treatment after rain stops, allowing as much delay as practicable for water to be dispersed by drainage and traffic before freezing.
		Less than 1mm of rain based on weather station data or radar or forecast	<p>Monitor and carry out repeat treatment after rain stops if required and allowing for water to disperse when practicable.</p> <p>Road sensors can be used after rainfall to determine whether the freezing point of water on the road surface is low enough for the forecast minimum RSTs.</p> <p>Make repeat treatment as soon as practicable where roads are wetter than allowed for in current spread rates (see Note 1)</p>
Rain just before freezing	<p>See Appendix B5 of the Severe Weather Plan template for information on effectiveness of salt after rain</p> <p>Traffic aids the dispersal of water. If a road surface is well drained and has been trafficked for an hour or so after rainfall, relatively little water will be present at the road surface</p> <p>There is a lower rate of loss when salt is in solution than in solid form. Salt will enter solution rapidly when road surfaces are wet</p>	Freezing just after rain (<1 hour)	Make repeat treatment if freezing is forecast just after rainfall and roads are wetter than allowed for in current spread rates (See Note 1)
		Freezing delay after rain (>1 hour but < 3 hours)	<p>Delay initial treatment as long as practically possible after rainfall to enable trafficking to disperse surface water so spray is minimal.</p> <p>Repeat treatment should be considered in poorly drained areas, where there is run-off and where (and when) there is little trafficking (e.g. lightly trafficked areas of slip roads, lightly trafficked roads on Sunday mornings) (See Note 1)</p>
Road wetter than allowed for in current spread rates, heavy hoar frost, freezing fog (See Note 1)	Higher spread rates or repeat treatments are required when more water (and/or less residual salt) is likely to be present than allowed for in the current rates	<p>Heavy rainfall before treatment</p> <p>Inadequate drainage or run-off</p> <p>Heavy hoar frost</p> <p>Freezing fog</p> <p>Lightly trafficked roads</p>	<p>Increase initial spread rate (e.g. to the rate for the next temperature band) or consider making initial treatment at the specified rate and repeat treatment(s) at the same rate.</p> <p>Conditions that are most likely to require repeat treatment(s) include:</p> <ul style="list-style-type: none"> <li>• Poorly drained surfacing or open textured</li> </ul>



Possible need for repeat treatment(s)	Key information	Predicted conditions	Treatment guidance
			<p>surfacing after heavy rainfall</p> <ul style="list-style-type: none"> <li>Lightly trafficked surfaces (e.g. lightly trafficked areas of slip roads, lightly trafficked roads on Sunday mornings, bank holidays etc)</li> <li>Dew point above the road surface temperature: <ul style="list-style-type: none"> <li>(i) by several degrees</li> <li>(ii) for a long period e.g. over long winter nights from late November to mid-January</li> <li>(iii) when there is a light breeze that maintains moist air at the road surface</li> </ul> </li> </ul>
Change in forecast to more severe weather	A repeat treatment will be required when there is a decrease in the forecast road surface temperature and/or the forecast road surface state is wetter than was assumed for the initial treatment	Change in forecast to colder road surface temperatures or wetter road surfaces	<ul style="list-style-type: none"> <li>Make a top-up treatment if the spread rate for the changed forecast conditions is higher than the spread rate for the initial treatment</li> </ul>
Temperatures below freezing spanning at most one peak period	The current spread rates assume a certain percentage loss of salt from road surfaces after spreading. The rates do not allow for loss over long periods.	Freezing occurring after one peak period and for duration less than 12 hours with no precipitation	<p>Monitor conditions and only treat again before next peak traffic period if necessary.</p> <p>Delay initial treatment as long as possible to reduce salt loss before freezing but without compromising dissolution of salt by trafficking etc.</p> <p>Conditions that are most likely to required repeat treatment include when:</p> <ul style="list-style-type: none"> <li>Road surface is wet</li> <li>RST below -5°C</li> <li>Heavy hoar frost forecast</li> <li>When forecast has changed following initial treatment</li> <li>Reports of ice on roads or hard shoulders (from patrols/Police/TSO)</li> </ul>
Temperatures below freezing over up to 2 peak periods	The current spread rates assume a certain percentage loss of salt from road surfaces after spreading. The rates do not allow for loss over long	Freezing from one peak period to just before or after another peak period, with no precipitation in the intervening period	<p>Make repeat treatment before second peak traffic period and within 12 hours of the initial treatment.</p> <p>Consider using a spread rate</p>

Possible need for repeat treatment(s)	Key information	Predicted conditions	Treatment guidance
	<p>periods. In general it should be assumed that a repeat treatment is required if an initial treatment is made just before (or during) one peak traffic period and temperatures will still be below freezing from just before to after the next peak period</p>		<p>for the initial treatment for the road conditions forecast up to the time the repeat treatment has been completed.</p> <p>Where possible, time repeat treatments to avoid spreading when the road surface temperature is less than -5°C</p> <p>It may be possible to either carry out the repeat treatment at reduced rate, or omit the repeat treatment when</p> <ul style="list-style-type: none"> <li>• A number of treatments have been made over two or more days in dry weather and measured residual salt levels are high.</li> <li>• The humidity is such that the road surface is drying, e.g. changing from wet to damp or dry (but see below) and no increase in humidity or precipitation is forecast for the period of the treatments effectiveness</li> <li>• The minimum road surface temperature in the morning is at least one temperature band less than temperature band for the treatment made in the evening.</li> </ul>
<p>Sustained freezing (i.e. temperatures below freezing spanning at least 3 peak periods</p>	<p>Repeat treatments may be required when below freezing conditions are sustained over long periods. Road surfaces can be essentially dry in periods of sustained freezing because of a lack of precipitation and low humidity conditions. In such conditions, repeat treatments may not be required when residual salt levels have built up and/or the road is dry such that the risk of ice formation endangering road users is low. Treatments should be delayed if the salt that is spread will not enter solution. Accumulations of</p>	<p>Freezing spanning at least 3 peak periods, with no precipitation in the intervening period.</p>	<p>Normally make treatments between each peak period so that the time between treatments is no more than 12 hours.</p> <p>Where possible, time repeat treatments to avoid spreading when the road surface temperature is less than -5°C</p> <p>Monitor the dryness/wetness of the road surface and consider reduced rate treatments or treatments more than every 12 hours when residual salt levels are high and/or the road surface is essentially dry.</p>

Possible need for repeat treatment(s)	Key information	Predicted conditions	Treatment guidance
	undissolved salt in sustained freezing can significantly increase chloride levels in water courses when they are dissolved during subsequent rainfall.		

Note 1. To calculate spread rates, it was assumed a wet road is one where minimal spray is evident and there is no water flowing across the surface. The maximum water film thickness for a well-trafficked road is 0.05mm and for a lightly trafficked road 0.1mm. Where road sensors indicate a wet road this indicates that more water is present than the maximum water film thickness allowed for in current spread rates and the treatment effectiveness will be less than stated in the treatment matrix guide.

### 5.1.3 Treatment Matrix Guide

	Weather Conditions Road Surface Conditions Road Surface Temperature (RST)	Air Temp	Treatment	
			Dry Salting (g/m <sup>2</sup> )	Pre-wetted Salting (g/m <sup>2</sup> ) (see Note 1)
1.	Frost or forecast frost RST at or above -2°C (irrespective of dry, damp or wet conditions)		8	8
2.	Frost or forecast frost RST below - 2°C and above - 5°C and dry or damp road conditions		10	9
3.	Frost or forecast frost RST below - 2°C and above - 5°C and wet road conditions (see Note 4 if lightly trafficked)		16	15
4.	Frost or forecast frost RST at or below - 5°C and above -10°C and dry or damp road conditions (see Note 4 if damp and lightly trafficked and Note 6)		18	18
5.	Frost or forecast frost RST at or below - 5°C and above -10°C and wet road conditions (existing or anticipated) (see Note 4 if lightly trafficked and Note 6)		2 x 15	2 x 15
6.	Light snow forecast <10 mm		20	18
7.	Medium/heavy snow or freezing rain forecast (see Note 5)		2 x 20 (see Note 8)	2 x 18 (see Note 8)
8.	Freezing rain falling		20 (successive)	See Note 3 below
9.	After freezing rain		20	See Note 3 below
10.	Ice formed (minor accumulations)	above -5°C	20	See Note 3 below
11.	Ice formed	at or below -5°C	2 x 20	See Note 3 below
12.	Hard packed snow/ice	above -8°C	20 (successive)	See Note 3 below
13.	Hard packed snow/ice	at or below -8°C	salt/abrasive (successive)	See Note 3 below
<p>The rate of spread for precautionary treatments may, if appropriate, be adjusted to take account of residual salt or surface moisture. It has been assumed that two treatments are required to achieve spread rates at or exceeding 30g/m<sup>2</sup>.</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>1) Spread rates for pre-wetted salt is the combined weight of dry rock salt and brine combined at 70:30 proportions by weight respectively with a maximum brine concentration of 23% salt.</li> <li>2) Pre-wetted salt should always be the preferred treatment for all precautionary treatments whenever possible, including before snowfall.</li> <li>3) When ice has formed or snow is lying dry salting is the preferred treatment unless the road is closed to traffic when pre-wetted salting may be used. Pre-wetted salting is the preferred treatment in advance of such conditions.</li> <li>4) Treatments should be carried out, whenever possible, after traffic has dispersed standing water. Successive half rate treatments (for both pre-wet and dry salt operations) should be considered for lightly trafficked roads, or on more heavily trafficked roads at times of low traffic e.g. Sunday</li> </ol>				

mornings, at the lower end of temperature bands indicated.

- 5) For snow covering forecast to exceed 30mm ploughing should be conducted early enough to ensure snow accumulations do not exceed 10mm. The rates in the table are for precautionary salt treatment prior to snowfall which is essential to form a de-bonding layer and aid snow clearance.
- 6) The effectiveness of salt decreases as temperatures fall and effective treatments may not be guaranteed with salt towards the lower end of the temperature band. The use of alternative treatment materials must be considered when spreading at (the lower of air or road surface) temperatures below -7°C or below -5°C in low humidity conditions (relative humidity <80%).
- 7) The spread rates are not applicable to very wet roads, when there is standing water or spray generated, or for very heavy hoar frosts. In these conditions roads should be closely monitored and consideration given to increasing the spread rate, making successive treatments or both.
- 8) For medium/heavy snow that do not have a high confidence rating the Duty Officer should consider an appropriate primary treatment, such as the 20gm for light snow, to be succeeded by loaded gritter patrols (ploughs fitted) to deal with the onset of the forecast conditions.

**5.1.4 Precautionary Treatment Matrix Guide - Treatments, including alternative materials, when spreading in extreme cold**

Alternative treatments when RST below -7°C at time of spreading (or, especially for dry salt spreading, when RST below -5°C at time of spreading for low humidity conditions)							
Conditions: Frost or Forecast Frost							
Dry rock salt component (% by weight)		Rock Salt (70%)	Rock salt (70%)	Rock Salt (70%)	Rock Salt (70%)	Rock Salt (96%)	Rock Salt (100%)
Liquid component (% by weight)		Magnesium chloride brine (30%)	Calcium chloride brine (30%)	ABP Brine [2] (30%)	Sodium chloride brine (30%)	Alternative liquid [3] added before loading (4%)	
Weather Conditions	Road Surface Temperature (RST)	PRE-WET SPREADING [1] (g/m <sup>2</sup> )				DRY SPREADING (g/m <sup>2</sup> )	
RST at or below -5°C and above -7°C (Only for low humidity conditions <80%)	Dry or damp road	11	11	10	13	14	14
	Wet road	18	19	17	21	22	22
RST at or below -7°C and above -10°C	Dry or damp road	16	17	16	21	20	22
	Wet road	27	28	26	35	34	37
RST at or below -10°C and above -12°C	Dry or damp road	21	22	20	29	26	30
	Wet road	35	36	34	49	43	50
RST at or below -12°C	Dry or damp road	27	29	27	41	33	41
	Wet road	46	48	45	68	56	68

**Notes:**

- ▶ Higher spread rates may require more than one pass to achieve, which Service Providers should make allowance for.
  - ▶ A follow up treatment of 50% of the recommended spread rate should be considered in lightly trafficked areas at the lower end of the temperature bands indicated.
  - ▶ To take account of residual salt during periods of sustained freezing, when surfaces are well drained and there is no melt water or ice present, rates of spread for treatments carried out within 6 hours of previous treatments may be 50% of the rates in the table.
- 1) Spread rates for pre-wet spreading are the weight of the dry salt and brine combined in the ratio 70% dry salt to 30% liquid component.
  - 2) For definition of ABP Brine see Appendix B.3.
  - 3) Alternative liquid means either: magnesium chloride brine; calcium chloride brine; ABP Brine or; magnesium chloride brine plus ABP liquid. See definitions at Appendix B.3.

**Comment [pf7]:** We need a note about two treatments being assumed for higher spread rates, as per previous table

**5.1.5 Precautionary Treatment Matrix Guide - Treatments, including alternative materials, before snow and freezing rain when spreading in extreme cold**

Alternative treatments <u>when RST below -7°C at time of spreading (or, especially for dry salt spreading, when RST below -5°C at time of spreading for low humidity conditions)</u>						
Conditions: Forecast Light Snow or Moderate / Heavy Snow and Freezing Rain <sup>[1]</sup>						
Dry rock salt component (% by weight)	Rock Salt (70%)	Rock salt (70%)	Rock Salt (70%)	Rock Salt (70%)	Rock Salt (96%)	Rock Salt (100%)
Liquid component (% by weight)	Magnesium chloride brine (30%)	Calcium chloride brine (30%)	ABP Brine <sup>[3]</sup> (30%)	Sodium chloride brine (30%)	Alternative liquid <sup>[4]</sup> added before loading (4%)	
Weather Conditions Road Surface Temperature (RST)	PRE-WET SPREADING <sup>[2]</sup> (g/m <sup>2</sup> )				DRY SPREADING (g/m <sup>2</sup> )	
RST at or below -5°C and above -7°C (Only for low humidity conditions <80%)	23	24	22	28	28	28
RST at or below -7°C and above -10°C	33	35	32	40	40	43
RST at or below -10°C and above -12°C	39	41	38	47	47	52
RST at or below -12°C	47	50	47	58	58	70
<b>Notes:</b> ► Higher spread rates may require more than one pass to achieve, which Service Providers should make allowance for. 1) Treatments for moderate / heavy snow and freezing rain are as for light snow plus a follow-up treatment at half the recommended spread rates when no treatments in previous six hours. 2) Spread rates for pre-wet spreading are the weight of the dry salt and brine combined in the ratio 70% dry salt to 30% liquid component. 3) For definition of ABP Brine see Appendix B.3. 4) Alternative liquid means either: magnesium chloride brine; calcium chloride brine; ABP Brine or; magnesium chloride brine plus ABP liquid. See definitions at Appendix B.3.						



5.1.6 Reactive Treatment Matrix Guide - Treatments, including alternative materials, for compacted snow or ice when spread in extreme cold

Alternative treatments <u>when RST below -7°C</u> at time of spreading (or, especially for dry salt spreading, when RST below -5°C at time of spreading for low humidity conditions)							
Conditions: Compacted Snow or Ice							
Dry rock salt component (% by weight)		Rock Salt (70%)	Rock salt (70%)	Rock Salt (70%)	Rock Salt (70%)	Rock Salt (96%)	Rock Salt (100%)
Liquid component (% by weight)	Magnesium chloride brine plus ABP (100%)	Magnesium chloride brine (30%)	Calcium chloride brine (30%)	ABP Brine <sup>[3]</sup> (30%)	Sodium chloride brine (30%)	Alternative liquid <sup>[4]</sup> added before loading (4%)	
Weather Conditions Road Surface Temperature (RST)	LIQUID SPREADING <sup>[1]</sup> (g/m <sup>2</sup> )	PRE-WET SPREADING <sup>[2]</sup> (g/m <sup>2</sup> )				DRY SPREADING (g/m <sup>2</sup> )	
RST at or below -5°C and above -7°C (Only for low humidity conditions <80%)	24	28	29	27	34	28	28
RST at or below -7°C and above -10°C	24	40	42	38	48	40	43
RST at or below -10°C and above -12°C	30	46	49	46	56	47	52
RST at or below -12°C	36	56	61	56	76	58	70

**Notes:**

- ▶ Higher spread rates may require more than one pass to achieve, which Service Providers should make allowance for.
- ▶ As much material as possible should be removed by ploughing before applying de-icers.
- ▶ It may not be possible to treat and de-bond from the road surface ice / compacted snow layers exceeding 20mm thickness. Abrasives should be used until conditions become more favourable for de-icing.
- ▶ Frequent patrols should be made to determine the effectiveness of treatments and when further follow-up treatments are required.
- ▶ If the surface melts and becomes slippery an initial treatment of abrasives should be applied at a rate of 40g/m<sup>2</sup> and successive treatments at 20g/m<sup>2</sup> until an acceptable level of friction is restored. Care should be taken to make further applications where ice or snow melts and refreezes later leaving abrasives beneath the ice surface and therefore ineffective.
- ▶ The use of alternative de-icers can provide effective treatments in a shorter time scale than dry salt and salt pre-wetted with sodium chloride brine.

- 1) Liquid only treatments identified in this table must only be spread from a dribble bar in discrete lines across the carriageway. This treatment may also be used in conjunction with rock salt spread at 20g/m<sup>2</sup>.
- 2) Spread rates for pre-wet spreading are the weight of the dry salt and brine combined in the ratio 70% dry salt to 30% liquid component.
- 3) For definition of ABP Brine see Appendix B.3.
- 4) Alternative liquid means either: magnesium chloride brine; calcium chloride brine; ABP Brine or; magnesium chloride brine plus ABP liquid. See definitions at Appendix B.3.



### 5.1.7 Footway and cycle track treatment snow clearance

Category (see 1.3.2)	Overnight Frost Conditions <i>overnight forecast temperatures below zero but not extending beyond 8am</i>	Daytime Frost Conditions <i>overnight forecast temperatures below zero extending beyond 8am</i>	Extended Frost Conditions <i>forecast temperatures remaining below zero throughout daylight hours</i>	Snow Events
1a	Precautionary treatment		Monitor and further treatment as required	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 12 hours of cessation of snowfall, subject to availability of resources
1	No treatment	Reactive treatment (by 8am of that same day)	Monitor and further treatment as required	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 24 hours of cessation of snowfall, subject to availability of resources
2	No treatment	Reactive treatment (by 8am of that same day)	Monitor and further treatment as required	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 48 hours of cessation of snowfall, subject to availability of resources
3	No treatment	No treatment	Reactive treatment (by noon of that same day)	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 5 days of cessation of snowfall, subject to availability of resources
4	No treatment	No treatment	Reactive treatment not normally undertaken other than in response to specific circumstances	

## 5.2 Treatment/Actions

### 5.2.1 Precautionary treatment

The effectiveness of precautionary treatments can be significantly affected by how the treatment is applied. The following sections cover EM procedures for precautionary treatment using the appropriate treatment material for each part of the Area 13 Network.

Routes used by spreading vehicles will follow the appropriate WSR in Appendix A.18. EM will aim to apply treatment as close, as is practicable, to the forecast time of freezing, while allowing sufficient time for the salt to form brine. In particular applying treatments during the early evening, to protect against a forecast of ice forming in the early hours of the following morning, will be avoided. Where treatment is required the most appropriate treatment type and spreading techniques will be used.

Comment [c8]: Should there be a link back to the decision matrices?

#### 5.2.1.1 Treatment type

The Highways Agency's preferred treatment is pre-wetted salt, though other materials may be appropriate for specific conditions or circumstances.

The use of pre-wetted salt provides the following advantages over dry salting:

- Better salt distribution across and along the carriageway
- Lower salt loss during spreading and due to trafficking after spreading
- Increased dissolution, in particular for colder temperatures

For treatments on very wet roads and when precipitation has occurred after spreading, repeat treatments are required and spreading dry salt in these circumstances will not prevent the need for these repeat treatments.

EM will select the most appropriate material suitable for use across the Area 13 Network taking into consideration the location and forecasted weather condition to maximise the effectiveness of the precautionary treatment as detailed below.

EM will use 6mm salt to BS3247, supplied by Salt Union, pre-wetted with a 30/70 brine solution for all planned winter maintenance operational routes. We will use 6mm salt to BS3247, supplied by Salt Union, for all footway and cycle way treatments. In the event of snow conditions the treatment of carriageways will be undertaken using 6mm rock salt without being pre-wetted. Security of supply is guaranteed by the maintenance of intervention stocks of de-icing materials at supply chain premises.

To be effective, salt should be spread evenly and at rates that suit the prevailing or expected conditions. Care should be taken to ensure that spread widths are neither too wide nor too narrow. The treatment should be spread by automatic machines, the controls of which shall be calibrated and clearly marked for distinct rates of spread, up to a maximum of 40 g/m<sup>2</sup>. Higher spread rates are unnecessary, wasteful, and environmentally harmful and shall be avoided.

De-icing material details are given in Section 3.3, with treatment route details in Appendix A.18. Footways and cycle ways in Area 13 have been categorised in accordance with AMM 50/04.

#### 5.2.1.2 Spreading techniques and operational considerations

For precautionary treatments, the Area 13 Network is split into 14 no treatment routes, with 3 no of these identified as Extra Effort High Altitude routes. Three additional "extra effort" routes have been identified to combat severe and prolonged weather conditions on known local problem areas, as identified at section 1.3.3. All routes have been designed to suit the pre-wet fleet capabilities, network characteristics and to optimise winter maintenance response.

All routes have been designed and trialled to ensure that a precautionary treatment can be completed within 3-hours including a 30-minute turnaround time for re-loading and re-fuelling. Operational spreaders and crews will be assigned to specific routes to promote route ownership and knowledge, but will have a working knowledge of other routes emanating from their depot in case of breakdown or extreme winter conditions compromising the route assignment.

The 4-lane carriageway section of M6 (J30-J32) will be treated in 2 passes of 2 lanes each. To reduce wastage, specific high altitude routes cover the most exposed areas of carriageway at altitudes over 300m.

Additional resources have been allocated across the entire network to ensure snow removal in the critical first half hour of snowfall in the event of blanket coverage. These additional snow-clearing resources will be flexible in responding to areas covered by other depots in the event of extreme weather in individual climatic domains and to allow echelon ploughing as necessary.

Due consideration should be given to traffic conditions and the timing of winter maintenance operations. Wherever possible and without detriment to the effectiveness of treatment, precautionary salting should be undertaken in off-peak periods when disruption to traffic and to proper distribution of the salt will be minimised. If precautionary treatment in heavy traffic is unavoidable it may be necessary to seek TO assistance (including motorway matrix signals) or to consider treatment in two runs (to ensure proper distribution of the salt).

Timing of treatment for hybrid precipitation is critical. Weather forecast information will be monitored by the SWDO, supplemented by information from winter patrols.

Care should be taken at road works, where in addition to areas currently being trafficked, all other areas likely to be opened to traffic are treated. Traffic management equipment, including cones and cylinders, may disrupt distribution of salt; contra-flow systems should be treated in both directions. Liaison with engineering staff responsible for roadwork sites is essential if correct treatment is to be ensured.

EM will, where feasible, treat only targeted areas of the Area 13 Network based on where ice formation is forecast. Experience through previous winter seasons has shown that instructing vehicles to go out on load gritter patrols (LGP's) has proven to be a successful treatment option. LGP's allow vehicles to patrol critical and vulnerable locations on the network to deal immediately with changes to the weather. The drivers provide constant feedback to the Duty Officer and NCC staff, also providing confidence to the travelling public with a visible presence on the network. On marginal nights assigning the treatment of a LGP allows the driver to spot treat isolated cold spots through identification from the temperature sensor on the gritter. It is also beneficial on trunk road sections that are prone to run-off from adjacent land and properties.

### 5.2.2 Reactionary treatment for snow and ice

The effectiveness of treatments of snow and ice can be significantly affected by the method of application of the treatment. The following sections cover EM operational techniques for the removal of snow and ice. The techniques include ploughing, blowing, the use of snow fences and snow gates together with changes to the methods of application of treatment materials when snow or ice is already present on the paved area. Guidance is provided in Appendix B.6.

It is important that all routes are cleared, in accordance with the snow clearance requirement provided within section 4.1.2, and that no area is abandoned for the sake of concentrating resources to one or two problem areas. Any decision for route closure or abandonment can only be made by the HA incident commander, to be advised within the improved coordination process. In all cases therefore the defined treatment routes will be adhered to, and where conditions demand a more intensive treatment in specific areas, this will be achieved by calling out Area Operational Reserve Winter Service Vehicles for those areas.

#### 5.2.2.1 Ploughing and snow clearance techniques

It is important to have a clearing policy that is easily understood; the technique used for multi-lane carriageways should be **'clearance by lane'**.

Due to differences in local weather conditions, snow depth, snow wetness and road topography, it is difficult to be precise on the order of lane clearance. Also local traffic densities and movements vary from day to day and even within a day, and may affect lane clearance priorities.

In prolonged, heavy snowfall the priority will be to maintain a single lane open. In the majority of cases this will be the more heavily trafficked left hand lane (lane 1) and the first operation will be to plough snow from lane 1 to the hard shoulder, with clearance of other lanes continuing as conditions improve.

An alternative technique for a 3 lane carriageway with hard-shoulders, particularly suited to echelon ploughing (2 or more vehicles moving in the same direction, one behind the other, in different lanes), is clearance in the following sequence:

First: plough lane 2 snow to lane 1;  
Second: plough lane 1 to hard-shoulder;  
Third: plough lane 3 snow to central reserve;  
Fourth: plough hard-shoulder snow to verge.

With clearance for a 4 lane carriageway with hard-shoulders as follows:-

First: plough lane 2 snow to lane 1;  
Second: plough lane 1 to hard-shoulder;  
Third: plough lane 3 snow to lane 4;  
Fourth: plough lane 4 snow to central reserve;  
Fifth: plough hard-shoulder snow to verge.

The majority of the central reserve on the four lane motorway section in Area 13 is wide enough to accept snow ploughed from lanes 3 and 4 in both directions. However this will be dependant on severity/quantity of snow and the associated problems with drifting and melt water. When weather conditions prevent this method of clearance the escalation and severe weather desk procedures detailed in Section 2.1.5.1 will be implemented.

Irregular windrows caused by ploughing passes, especially those that weave from one lane to another, are dangerous, as they may tempt drivers to overtake by squeezing into the partly cleared lane. Lanes should be completely cleared, and the windrows of snow remaining should form a smooth and continuous line with no sudden encroachments into the cleared path. On motorways, windrows can be left on hard-shoulders, but there should be intermittent clearings to provide refuge for broken down or abandoned vehicles.

Speeds of ploughing vehicles should be regulated, particularly at features such as under-bridges where snow could be thrown over the bridge parapet and adjacent to the central reserve where snow could be pushed into the opposing carriageway.

The aim is to clear all lanes and hard-shoulders as soon as conditions permit. Clearance work shall therefore proceed continuously, since a pause during a snowfall could lead to a build-up, which would take a disproportionately long time to clear. Packed snow, glazed by the wind, can be particularly difficult to remove.

Care must be taken to avoid damage to road surfaces, road studs, roadside furniture and structures. At roadwork's, traffic management equipment must not be disrupted. An accumulation of ploughed snow creating a ramp adjacent safety fences and concrete barriers should be avoided.

When ploughing, motorway warning signals can be displayed, so TO co-operation is essential. It is not always possible to keep these signals free of snow, but every effort should be made to advise motorists of the snowploughing vehicles ahead.

A prior agreement exists for use of existing emergency crossovers during ploughing operations on the M6 Motorway between junctions 38 and 39. The use of these emergency crossovers must be strictly in accordance with EM written procedure (Appendix A.10), which has been jointly agreed with the Highways Agency and Cumbria Constabulary.

In the event of prolonged and/or severe weather on the A66 trunk road between Brough and Bowes the additional extra effort routes BR-01 or BR-02 will be instructed. In the event of closure of the snow gates the ploughing route from Brough depot (BR-02) will be instructed. This route includes mutual aid arrangements i.e. treatment of the eastbound carriageway by Area 13 and westbound by Area 14. The arrangements/procedures for clearance of snow adjacent to the gates prior to re-opening are also detailed.

#### Snow Gates

Permanent snow gates are provided to enable physical closure of the A66 over Stainmore during adverse weather conditions. The gates are located on the A66 at Augill, just beyond Brough

interchange (Eastbound C/W) and Bowes (Westbound C/W); variable message signs advising of closure of the A66 are located on the M6 adjacent to junction 40 at Penrith and on the A1 adjacent to Scotch Corner. The operation of the gates and associated variable message signs are controlled by Cumbria, North Yorkshire and Durham police forces along with EM [A66 East of Brough – Severe Weather Procedure](#) and [A66 Snow Gates Closed Daily Review Protocol](#).

The snow gates have been classified as part of the electrical asset and are inspected, tested and repaired accordingly.

Road	Location	Type
A66	Augill E/B	Secured single bar barrier

#### Snow Fences

Snow Fences (chestnut paling) are located on the northern side of the A66 on both the Cumbria and Durham sides of Stainmore, inspection and maintenance of the snow fences is the responsibility of Area 13 and Area 14 respectively.

Powers to erect fences, and to ensure easements, are provided in the Highways Act 1980 where sections 102, 249, 251 as modified, 291 and 292 as amended are relevant. EM shall undertake negotiations of terms for the gathering of easements by landowners and tenants in consultation with the Highways Agency. Cases where agreement cannot be reached shall be referred to the District Valuer.

For guidance in the design and location of Snow Fences, refer to the Highways Agency's WMRM.

Road	Location	Type
A66	Stainmore Land Adjacent to E/B C/way	Chestnut Paling Fence

#### Snow clearance and solid vertical barriers

Numerous major maintenance schemes require the installation of lengths of vertical concrete/other solid barrier throughout the motorway and trunk road network, which can pose problems regarding snow clearance. New guidance provided in AMM 89/07 or the Network Management Manual as appropriate provides the relevant information for dealing with snowfall in circumstances where traditional ploughing techniques may not be applicable due to the presence of a vertical concrete barrier.

EM should consider whether any lanes may need to be abandoned during periods of prolonged heavy snowfall due to the problems associated with ploughing adjacent to vertical concrete barriers.

When conditions dictate it is recognised that it is acceptable to plough snow from lane 2 to the right and sacrifice one or more running lanes to stack snow whilst keeping the maximum number of lanes available to traffic for each route classification and maintaining access and egress.

EM clearance plan for each SVB location is given in Appendix A.19. This schedule should also be cross referenced to Appendix A.18 – Winter Service route schedules and drawings.

##### 5.2.2.2 Spreading techniques

See section 5.2.1.2

#### 5.2.2.3 Aftercare and follow up treatments

The prescribed treatments apply to the main carriageways only, additional areas such as crossovers, lay-bys, junction bell mouths, etc will be treated re-actively and coordinated by the NCC/SWDO. Following the cessation of a snow event all areas will be targeted for clear up in priority with instruction issued to clearance vehicles via the SWDO. All clearance works will be carried out to achieve the targets set in section 4.1.2.

#### 5.2.2.4 Arrangements for use of blowers

EM can use snow blowers allocated to their Area 13 Network without prior approval but must ensure the use is notified up to the National Winter Specialist. National procedures for management of the both Area Operational Reserve Winter Service Vehicles and National Reserve Vehicles are in Appendix B.4.

Area 13 has two Rolba snow blowers located at Tebay depot. When prolonged snowfall/severe weather forecasts are received these will be deployed to the nearest operational depot prior to the event i.e. A66 Stainmore – snow blowers relocated to Brough Depot. Due to the low speeds of these vehicles and the associated risks with travelling on high speed roads transportation will be via low loaders.

Where the equipment is to be brought in from another area the Service Delivery Manager will liaise, as necessary, with the National Winter Specialist and other relevant parties.

EM has 12 operatives qualified to operate snow blowers as detailed at Appendix A.13.

### 5.2.3 Freezing rain / rain falling on extremely cold surfaces

#### 5.2.3.1 Operational considerations

EM must give special consideration to the treatments required before during and after freezing rain and must take account of the information contained in AMM 120/09 or the Network Management Manual.

EM has enlisted the services of the MET Office to provide the forecast information for Area 13. The MET Office has successfully forecast freezing rain events through their Route Based Forecasting (RBF) service in previous years with services provided to other customers. EM has opted to purchase the Route Based Forecast service for the 2013/14 season.

SWDO's will be made aware that freezing rain tends to occur/fall on very localised stretches of carriageway rather than complete routes, and that the effectiveness of precautionary treatment is very limited. Treatment will not continue if ice forms on the carriageway as a result of freezing rain. In these instances operational vehicles in live lanes will pose a greater risk to both the public and operational staff, and as such treatment will be interrupted and/or delayed until the vehicle speeds are controlled by either use of road closures, rolling blocks, VMS or a combination of all of these. In the freezing rain event of February 2012 the use of 20mph speed limit on the M6 motorway helped prevent many further incidents.

#### 5.2.3.2 Hazard mitigation

The nature of freezing rain means that treatments will have virtually no effect initially and ice will form on the carriageway. Rain falling on extremely cold surfaces can produce similar effects. Mitigation of the hazard is therefore a significant aspect of the actions taken in response to freezing rain or rain falling on extremely cold surfaces. The main action is to inform road users of the hazard where available fixed or mobile Variable Message Signs (VMS) will be used as detailed in Appendix B.5.

More proactive measures such as closing the road as the rain arrives and holding the traffic (rather than diverting) until such times as it is deemed safe to proceed may be considered. Such considerations will need to be made on a local basis taking into account local circumstances.

EM will liaise with Police Control Offices (PCOs) and / or RCCs to provide advance warning to recovery companies when any incidents occur as a result of the freezing rain or rain falling on extremely cold surfaces.

#### **5.2.4 High winds (including Severe Gales and Storms)**

High winds/severe gales can occur at any time of year but are most likely from September through to June.

##### **5.2.4.1 Operational Considerations**

Network damage/defects as a result of high winds/gales will be dealt with by the existing Primary & Secondary Response service. However the following restrictions will apply:

- Wind speeds in excess of 35mph (near gale) – provision/erection of traffic management may cease.
- Wind speeds in excess of 50mph (severe gale) – deployment of primary & secondary response may be suspended.

High risk wind sites are identified in the Contingency Plan Box of Reference – Section 03 RID – 06 High Wind Sites. The 5 locations on the M6 between Junction 37 and 40 & Junction 42 and 43 now have wind activated portable VMS installed at permanent sites in advance of the high risk area. These signs are activated when wind speeds exceed 30mph and display the message “STRONG WINDS SLOW DOWN”, to warn road users. These signs revert to a blank screen when wind speeds drop below the trigger level.

The high altitude section of the A66 at Stainmore has been subject to high winds for many years and permanent VMS are installed at Kemplay & Brough. These signs can be activated by the NW RCC and are normally used in conjunction with the permanent gantry VMS on the M6 & A66 in the vicinity of Junction 40, Skirsgill. In extreme conditions the “snow gates” can also be used to physical restrict road users.

EM NCC will inform the NW RCC of any instances of high winds on the network and record all subsequent actions on the Incident database. EM will comply with the requirements of the [North West Traffic Officer High Wind Strategy](#).

#### **5.2.5 Heavy rain**

##### **5.2.5.1 Pumping, jetting and clearance techniques**

High risk flood sites are identified in the Contingency Plan Box Of Reference – Section 03 RID – 07 Flooding Blackspots & Section 01 Stakeholder Plans – 02 Others – 03 Cumbria Flooding Plan. The Multi Agency Response Plan (MARP) held in this folder also contains details of notification, roles & responsibilities, coordination, response, etc.

When prolonged periods of heavy rainfall are forecast and/or EA flood warnings are issued “flood patrols” will be instructed via the NCC. These vehicles will patrol routes or areas and will primarily relay information back to the NCC, and to erect “flood boards” to warn road users. However they will also be equipped to undertake small scale drainage clearance/flood alleviation works i.e. clearing gullies, cutting grips, etc.

Treatment of flooded areas will be dealt with by the existing Primary & Secondary Response service, with all works carried out in accordance with our operational and health & safety procedures. In addition to EM resources there are a number of specialist drainage sub-contractors that are available via the NCC on a 24/7 callout basis.

Alleviation of flooded sections of carriageway will be achieved through clearance and/or “over pumping” of highway drainage blockages, however if this is not possible then water will be

pumped into the nearest available ditch, drain, watercourse, etc. using powers under the Highways Act 1980. This Act also allows owners or occupiers of any land that suffers damage to be reasonably compensated. Our third party claims process will deal with any resultant compensation claims.

Drainage systems are inspected and maintained in accordance with the contract requirements, with any identified faults/defects repaired as part of the roads capital works programme. An extensive CCTV drainage survey programme is also currently underway to allow population of the Highways Agency Drainage Data Management System (HADDMS). This programme has initially been targeted at known problem areas to assist in the promotion and value management of large drainage replacement/repair schemes.

The Off Network Diversion Route Cards produced by EM also identify high risk flood areas on the LHA routes. This will highlight potential issues if a tactical diversion route is activated as a result of flooding on our network.

#### 5.2.5.2 Operational considerations

Small pumps are provided as part of the Secondary Response service, with all works carried out in accordance with our operational and health & safety procedures.

Jetting equipment and larger pumps are provided by specialist drainage sub-contractors, and are operated in accordance with their own operational and health & safety procedures. These procedures are reviewed initially as part of our sub-contractor procurement process, with continuous monitoring undertaken via our supplier performance review process.

#### 5.2.5.3 After care and follow up treatments

All flooding incidents will be recorded on the Area 13 incident database, which will allow location, frequency, severity and root cause of these events to be monitored. Use of the database as an "intelligence" tool will allow EM to identify any necessary remedial measures/actions, such as:

- Additional survey/investigation work – CCTV surveys, trial holes,
- Changes to operational procedures i.e. sweeping of hard shoulders after grass cutting to prevent blockage of gully grates with clippings,
- Increased maintenance frequencies,
- Promotion and value management of drainage replacement/repair schemes.

#### 5.2.6 Fog

EM will undertake the following specific measures as appropriate to mitigate the hazard:

- Where available fixed or mobile VMS should be used to warn road users of the hazard. The existing established procedures for requesting VMS settings to be made should be followed well in advance. The following legend is currently the most appropriate to use – 'FOG SLOW DOWN'. This will require arrangements and protocols to be established with the appropriate RCC.
- National Incident Liaison Officer (NILO) and/or Highways Agency Press Officer should be contacted in order that the local media can be advised as necessary.
- Where available use of variable mandatory speed limits should be considered. This will require arrangements and protocols to be established with the appropriate Police Control office or RCC as part of the advance planning procedures.

The EM NCC will inform the NW RCC of any instances of fog on the network and record all subsequent actions on the Incident database.



### **5.2.7 High temperatures**

In the event of high temperatures where vehicles and occupants are static on the motorways and trunk roads for long periods of time, EM will provide support and assistance to the RCC and the Police as requested.

The Area 13 network is made up of Hot Rolled Asphalt & Thin Wearing Course running surfaces generally overlaying bituminous bound lower layers. This type of road construction is not subject to catastrophic failure i.e. melting during prolonged periods of high temperatures. TRL working papers indicate that in order for surface deformation to occur road surface temperatures (RST) would need to exceed 45°C for over 4 hours. Interim reports have shown that the RST's will exceed 44.5°C for 1 hour in 20 years and 3.5 hours once in 100 years.

Even if this threshold were met or exceeded it is likely that surface deformation would be limited to minor rutting/wheel tracking. Defects of this nature will not require any reactive works, and would be recorded, promoted and delivered as part of the roads capital forward programme.

## **APPENDICES & SCHEDULES**

### **NOTE:**

To reduce the size of the Severe Weather Plan, the Service Provider may include certain appendices within a box of reference and not append these directly to the plan. Where this is applicable a note has been added at the start of the Appendix. The Service Provider must agree an acceptable approach with the Service Manager and confirm the location of the box of reference.

## A.1 DEFINITIONS AND ABBREVIATIONS

<b>The National Severe Weather Warning System (NSWWS) – Providing warnings, mainly for Category 1 and 2 responders (as defined in the Civil Contingencies Act 2004), of Severe Weather.</b>	
Regional advisory of severe or extreme weather warning (Advisory)	Advisories are issued by 1300hrs daily as routine and indicate confidence of expected Severe Weather (or unusual extreme weather). Early and flash warnings supersede advisories when confidence levels are 60% or greater.
UK Advanced warning of Severe Weather (early warning)	An early warning of Severe Weather will normally be issued up to several days in advance whenever the overall risk of widespread disruption in any UK region is 60% or greater.
Regional Severe Weather warning (flash warning)	Flash warnings of Severe Weather are issued when confidence of an event reaching the Severe Weather criteria is above 80%, and should give a minimum of two hours notice. Warnings are issued for every affected county or unitary authority.
<b>Flood Forecasting Centre (EA/MET Office) – Alerting emergency responders in England and Wales to the possibility of urban surface water flooding as a result of extreme rainfall.</b>	
Extreme Rainfall Alert (ERA)	Alert issued when there is a 20% or greater probability of exceeding the following extreme rain thresholds: 30mm per hour; 40mm in three hours or; 50mm in six hours.
<b>The Environment Agency Flood Warning System – warnings of river and coastal flooding.</b>	
Flood watch	Flooding of low lying land and roads is expected. Be aware, be prepared, and watch out.
Flood warning	Flooding of homes and businesses is expected. Act now!
Severe flood warning	Severe flooding is expected. There is extreme danger to life and property. Act now!
All clear	Flood Watches or Warnings are no longer in force for this area.
<b>MET Office Severe Weather Warnings – Flash warnings for a range of weather conditions which are not unusual. The conditions below, defined by the MET Office, give guidance concerning the weather likely and the criteria for issue of the flash warnings.</b>	
Heavy rain	Expected to persist for at least 2 hours and to give at least 15mm of rain within a 3 hour period or:- More than 25mm per day on already saturated ground.
Fog	Warnings of fog are issued when visibility is expected to fall below 50 metres, at which severe disruption to transport can be expected.
Heavy snow	Snow falling at a rate of 2cm/hour or more expected for at least 2 hours.
Very heavy snow	Heavy snow which accumulates to 15cm or more
Blizzards	Moderate or heavy snow combined with winds of 30mph or more with visibility reduced to 200 metres or less; or drifting snow giving rise to similar conditions.
Severe blizzard	Heavy snow accompanied by winds of 30mph or more, reducing visibility to near zero.
Widespread icy roads, glazed frosts and freezing rain	Icy roads occur when the road surface temperature of wet roads drops below zero and ice is formed. Freezing rain occurs when rain becomes 'super-cooled' and when it hits a cold surface it freezes immediately and forms a layer of clear ice.
Severe gales	Repeated gusts of 70mph or more over inland areas, with a risk to high-sided vehicles being blown over.
Storms	Repeated gusts of 80mph or more over inland areas, which could cause cars to be blown out of their lane on the carriageway, which may cause traffic collisions.

<b>MET Office Heat-Health Watch – this system identifies four levels of response based upon thresholds</b>	
High temperatures, Heat wave	The temperature thresholds vary by region, but an average threshold temperature is 30°C by day and 15°C by night on at least two consecutive days and the intervening night.
<b>Reserve Winter Service Vehicles</b>	
Reserve Threshold	The Reserve Threshold is the point at which the number of Area Operational Reserve Winter Service Vehicles available to be utilised are reduced to a point which could make it difficult to maintain the optimum level of Winter Service on the Area Network. This threshold level is proposed by the Service Provider for agreement with the Service Manager.
Critical Incident	A Critical Incident is when the reserve winter fleet situation / reserve winter fleet availability reaches a level that seriously impacts upon the Highways Agency and its ability to maintain a safe Area Network during.
Area Operational Reserve	An Area Operational Reserve is all Winter Service Vehicle assigned to a particular Area that may be in rotation and not currently designated a specific precautionary treatment route. It will be required to carry out treatments on the Area Network when a vehicle that has been designated a particular treatment route is unavailable or becomes the Operational Winter Service Vehicle as part of the rotation. These vehicles may be designated to a specific snow clearance route or vulnerable location to support Operational Winter service vehicles. The use of an Area Operational Reserve does not require specific approval from the Highways Agency.
National Reserve	A National Reserve is a Winter Service Vehicle that is held in a particular Area, but may be transferred to any part of the Highways Agency's strategic road Network to help manage Severe Weather incidents. The use of National Reserves requires specific approval from the Highways Agency.
Extra Effort Vehicles	Additional <del>non-Highways Agency owned</del> vehicles required to supplement the allocated operational, reserve vehicles and national reserve vehicles that may be required during sustained periods of snowfall or extreme cold
<b>Salt Stock</b>	
Operational Salt Stock	Is the salt that the Service Provider purchases, manages and uses to provide the lump sum routine Winter Service as defined in the AMOR or within the RWSC / NMM.
Current Maximum Storage Capability (CMSC)	This is the total storage capacity currently available in storage facilities provided by the Highways Agency under the contract.
Operational Salt Stock at Start of Season	Is the minimum volume of salt required to be in place within the Area concerned by 1st September each year. If this figure exceeds storage capacity as defined by the CMSC, the service provider will be required to provide the additional storage capacity.
Minimum Contractual Salt Stock Level	Is the minimum operational salt stock level that must be maintained from 1st October each year to 1st April of the following year.
Minimum Capability	Is the capability level, in days, assuming all salt storage facilities are at the Minimum Contractual Stock Levels
Reporting Threshold	Is the capability level at which point salt supplies will be considered to be approaching critical and will be the threshold for the automatic re-ordering of salt. This definition, which now relates directly to acquiring immediate salt supplies, should be considered in detail by Service Providers to ensure they set an appropriate reporting threshold profile.

Comment [c9]: Point added for clarity over definition

<b>Abbreviations</b>			
CCTV	Closed Circuit Television	NTCC	National Traffic Control Centre
CMM	Crisis Management Manual	NVRM	National Vehicle Recovery Manager
DBFO	Design Build Finance & Operate	RCC	Regional Control Centre
DfT	Department for Transport	SP	Service Provider
ESS	Environmental Sensor Station	TOS	Traffic Officer Service
HA	Highways Agency	VMS	Variable Message Sign
HAWCS	Highways Agency Weather Central Service	VRN	Vehicle Registration Number
HAWIS	Highways Agency Weather Information Service	WMO	Winter Maintenance Officer
NILO	National Incident Liaison Officer	WRF1	Winter Reporting Form

A.2 AUDIT CHECKLIST



Safe roads, Reliable journeys, Informed travellers

Activity	August	September	October	November	December	January	February	March	April	May	June	July
Submit Severe Weather Plan	<input type="checkbox"/> by 21st											
Severe Weather Plan approved by HA		<input type="checkbox"/> by 18th										
Completion of Severe Weather Desk exercises and briefings			<input type="checkbox"/>									
Feedback and action planning from exercises and briefings					<input type="checkbox"/> by 18th							
Complete and submit Salt Capability Spreadsheet			<input type="checkbox"/> by 1st	<input type="checkbox"/> by 1st	<input type="checkbox"/> by 1st	<input type="checkbox"/> by 1st	<input type="checkbox"/> by 1st	<input type="checkbox"/> by 1st	<input type="checkbox"/> by 1st			
Complete and submit Non warranty defect report spreadsheet			<input type="checkbox"/> by 15th	<input type="checkbox"/> by 15th	<input type="checkbox"/> by 15th	<input type="checkbox"/> by 15th	<input type="checkbox"/> by 15th	<input type="checkbox"/> by 15th	<input type="checkbox"/> by 15th			
WRF1 reporting requirements met			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Review and update the winter service and severe weather infrastructure inventory database							<input type="checkbox"/>				<input type="checkbox"/>	
Finalise list of key issues to feed into winter lessons learnt								<input type="checkbox"/> by 31st				
Winter & severe weather review										<input type="checkbox"/>		
Winter & severe weather report to HA (Operational Assessment Report)											<input type="checkbox"/>	
Effectiveness of Sensors Inspection Report		<input type="checkbox"/>					<input type="checkbox"/>					
Submit Salt Restocking Plan										<input type="checkbox"/> by 31st		
Salt Restocking Plan approved by HA											<input type="checkbox"/> by 30th	
Salt Restocking Plan in place												<input type="checkbox"/>
Vehicle maintenance schedule activities met	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## B.1 SEVERE WEATHER DESK EXERCISES AND BRIEFINGS

### Severe Weather Desk Exercises

Service Provider to plan and deliver a Severe Weather Desk exercise. This will primarily be to test the delivery and resilience of the Winter Service element of this Severe Weather Plan. Planning for the exercise **must** be in consultation with Service Manager, Emergency Planning Managers and the National Winter and Severe Weather Team.

Details for each season's Severe Weather Desk exercise will be issued by the National Winter & Severe Weather team during August. This will be in the form of a guidance note. This will provide the mandatory national objectives, and include objectives identified from the previous season –

Service Provider will plan exercises to test critical and vulnerable points in their winter response, and identified objectives, and strive to identify areas for improvement. Exercises are to be delivered by the end of October.

### Severe Weather Briefings

Service Provider to hold Severe Weather briefing sessions with representatives from key stakeholders, including Traffic Officer Service, RCC, Local Highway Authorities, Emergency Services and Highways Agency Regional Press Officers in the Area 13 Network.

Full details will be provided within a guidance note to be issued by the National Winter & Severe Weather team during August. Briefings to be delivered by the end of November.

A PowerPoint presentation briefing template will be made available within the guidance note.

Service Provider to submit the list of attendees at the Severe Weather briefings to the National Winter and Severe Weather Team via email [REDACTED]. An example of the attendance register is shown below.

Register of Attendees – Severe Weather Briefings			
Date of Briefing:			
Briefing Carried Out By:			
Name	Signature	Organisation	Position Held

### Feedback and Action Planning from Exercises and Briefings

Service Provider must capture the outputs and actions from exercises and briefings into action plans / reports and return to the National Winter and Severe Weather Team via email [REDACTED]. This will ensure issues can be considered for inclusion in the National Severe Weather Programme. A sample template for the 'Summary of Actions' is provided below.

Service providers may capture this information within a Severe Weather Action Plan (SWAP) as an alternative document, and make this available for review.

Summary of Actions – Severe Weather Briefings					
Ref	Category	Summary of Issue / Finding	Proposed Action required	Owner	Date to Action

## B.2 WEATHER INFORMATION

The Service Provider requires a robust information system to provide it with accurate real-time data on both weather forecasts and actual road conditions. The road weather forecasting service to be procured by the Service Provider, is detailed below.

### Weather forecasting

For the avoidance of doubt, there will be no bureau, transmission, service or data management fees incurred by organisations sending, receiving or viewing data provided via HAWCS.

The name of the forecast provider, forecaster, the date and the time of issue must be recorded with all forecasts. All forecasts shall advise validity as a start date/time and end date/time.

### Frequency and intensity of forecast information

Field	Frequency	Data Intensity
Morning Summary	06:00 Daily	Single Field
24 Hour Forecast (Text)	Operational Winter Period: 06:00, 12:00 and 18:00 Daily Operational Summer Period: 06:00 Daily	Single Field
24 Hour Forecast (Domains)	Operational Winter Period: 06:00, 12:00 and 18:00 Daily Operational Summer Period: 06:00 Daily	For each domain, daily.
2-10 Day Forecast	12:00 Daily Operational Summer Period: 06:00 Daily	Day 2 to 5 – Area based, daily Day 6 to 10 – Single Field
Site Specific Forecast	Operational Winter Period: 12:00 Daily Operational Summer Period: None	For each domain, hourly.

The parameters forecast will vary between the Operational Winter and Summer Periods. The table below details which forecast parameters are to be provided.



Forecast Parameter	Winter	Summer
Minimum road surface temperature	✓	✗
Maximum road surface temperature	✗	✓
Minimum air temperature	✓	✗
Maximum air temperature	✗	✓
Dew point / Relative humidity	✓	✗
Surface state	✓	✗
Wind speed (various)	✓	✓
Wind direction	✓	✓
Accumulations of snow (depth)	✓	✗
Visibility	✓	✓
Pollen count	✗	✓
UV factor	✗	✓
Snow level (ht above sea level)	✓	✗
Hazard – Ice	✓	✗
Hazard – Heavy Rain	✓	✓
Hazard – Freezing Rain	✓	✗
Hazard – High Temperature	✗	✓
Hazard – Hoar frost	✓	✗
Hazard – Fog	✓	✓
Hazard – Snow	✓	✗
Alert Level	✓	✗

### **24 Hour Forecast**

The 24 hour forecast consists of two parts; a 24 hour text forecast and a domain forecast in tabular format. During the Operational Winter Period a detailed 24-hour text forecast and a domain forecast should be updated and delivered at 06:00, 12:00 and 18:00.

During the Operational Summer Period a detailed 24-hour text and domain forecast shall be updated and delivered daily at 06:00 covering the 24-hour period from 06:00 to 06:00.

Additional optional elements can be included at the request of Service Providers. These may include:

- Extension of forecast periods from the forecast issue time up to thirty six hours ahead;

- Addition of a 00:00 text forecast;

### ***Text Forecast***

The 24 hour text forecast will be valid for the ensuing 24 hour period from the prescribed issue time.

The text of this forecast must include:

- **Headline weather description**
- **A general synopsis, with timings, over the following 24 hours, including:**
  - Summary of the meteorological synoptic situation with timings of significant meteorological changes during the forecast period with particular reference to hazards such as snow, ice, hail, hoarfrost, freezing rain (including super-cooled and rain falling on frozen surfaces), wind, fog, lightning and rain/showers which are expected to affect any of the agreed HAWIS forecast domains.
  - Expected road surface conditions indicating whether roads are likely to be dry or wet.
  - Onset, duration and intensity of hazards such as rain, hail, sleet, snow, rain falling on frozen surfaces and freezing rain, including potential accumulations of snow on road surfaces described in centimetres (assuming no treatment has been undertaken).
  - Relative humidity and dew point, including a warning of any predicted combination of low temperature and low humidity conditions (less than 60%).
  - The likelihood and timing of any precipitation or deposition on road surfaces and the likelihood of surface water on the carriageway.
  - If snow is forecast, its timing, amount and type and the direction from which the snow will develop, the likelihood of drifting and the height above which accumulation is likely.
  - Visibility – danger of thick fog (<1000 m visibility) or freezing fog formation, the location and timing.
  - UV factor and pollen count.
- **Average wind speed, direction and maximum gust speed at six hour intervals from the time of forecast.**
- **General confidence level in the forecasts (low, medium or high as per following table)**
- **General alert level**

Level 0 (Green)	There are no expected hazards on the road surface and road surface temperatures are expected to be above +1°C when confidence is high or above +2°C for all other occasions.
Level 1 (Amber)	<ul style="list-style-type: none"> <li>• Road surface temperatures are expected to be between +1°C and +2°C when the confidence is low.</li> <li>• Road surface temperatures less than or equal to +1°C and greater than or equal to zero.</li> <li>• Road surface temperatures below zero but road surfaces are expected to remain dry.</li> </ul>
Level 2 (Red)	Road surface temperatures are expected to be below zero and road surface hazard(s) exist. Road surface hazard include ice, snow, freezing rain and hoar frost.

**Domain Forecast**

The domain forecast will have a variable validity period as follows:

Winter Operational Period

- 0600 domain forecast validity period will be 1200 to 0600
- 1200 domain forecast validity period will be 1200 to 1200
- 1800 domain forecast validity period will be 1800 to 1200

Summer Operational Period

- 0600 domain forecast validity period will be 0600 to 0600

By domain, the following information shall be provided, where appropriate including an indication of confidence level as High, Medium and Low and the period of occurrence (including zero crossing point):

- Minimum and maximum road surface temperature
- Minimum and maximum air temperature
- Accumulation of snowfall on road surfaces and height above sea level
- Occurrence of ice, heavy rain, high wind, freezing rain, high temperatures, hoar frost and fog
- Alert level

Additional optional elements can be included at the request of Service Providers. These may include:

- Urban/rural road surface temperatures
- Bridge deck temperatures

**2-10 Day Forecast**

A 2-10 day forecast must be obtained with the 24-hour forecast. The first element of this forecast must detail anticipated conditions in 24-hour periods for days 2-5. The 24 hour periods must be 1200 to 1200 during the Winter Operational Period and 0600 to 0600 during the Summer Operational Period. The parameters to be forecast will differ between the Summer and Winter Operational Periods and should comply with the table on page B.2-2. The forecast must include:

- A general synopsis and anticipated trends over the period with particular emphasis on the following hazards: Hoar frost, ice, snow, drifting, freezing rain, rain falling on frozen surfaces, heavy rain, fog and strong wind.
- Daily general alert level
- Maximum and minimum road surface temperatures
- Maximum and minimum air temperature
- Occurrence of snow, ice, heavy rain, high wind, freezing rain, high temperatures, hoar frost and fog
- UV Factor
- Pollen count
- Confidence level in the forecasts (low, medium or high)

A second, text element of this forecast must also include a general synopsis and anticipated trends over the 6-10 day period with particular emphasis on the following hazards: Hoar frost, ice, snow, drifting, freezing rain, rain falling on frozen surfaces, heavy rain, fog and strong wind.

#### ***Site Specific Forecasts***

Detailed 24-hour site specific forecasts must be delivered between 12:00 and 14:00 for all primary environmental sensor stations. These forecasts apply for the Operational Winter Period and must include on an hourly basis:

- Road surface temperature
- Air temperature
- Dew temperature
- Surface state

Additional optional elements can be included at the request of Service Providers. These include:

- Wind speed
- Rain state
- Cloud state
- Cloud amount
- Textual site specific forecasts

#### ***Further Updates of Forecasts***

Forecast updates apply to 24-hour forecasts and site specific forecasts. Whenever a change to any forecast occurs the text forecast will also be re-issued with explanatory notes in the headline along with any other associated changes to the forecast.

In the event of the update criteria being met the procedure shall be to notify the client immediately whenever the change will have an impact on proposed salting operations then re-issue the amended forecasts as appropriate. Notice shall be provided by telephone to the client no more than 1 hour following the criteria being met and the updated forecast shall be issued within a further hour. Updates should only be issued between 18:00 and 06:00 or during the overall hazard period; however the following shall apply in all cases:

The forecast provider shall take note of proposed Service Provider actions and in the event of a weather forecast changing or actual weather occurring that could result in a change of action by the Service Provider, the Forecast Provider shall take appropriate action to inform the Service Provider in advance of the changed weather forecast.

The suggested standard update criteria are as follows:

- A change in the forecast or an actual event occurring that could result in a change in the action taken by the client. This includes changes such as:
  - When hazardous conditions are sufficiently more intense or the timing has changed by two or more hours which, in the forecast provider's opinion, may impact on salting operations.
  - When road state changes or snow, ice, heavy rain, high wind, freezing rain, high temperatures, hoar frost and fog are present when they have not previously been forecast.
  - A road surface temperature crossing either the 1°C or 0°C threshold two hours earlier than previously forecast or when not previously forecast to do so.
  - A significant difference in any precipitation forecast which, in the forecast provider's opinion, may affect the salting times, e.g. showers lasting later into the evening than originally forecast.
  - A significant change in any snow forecast, e.g. a change in timing, intensity, accumulations or the level to which it will fall.
  - When the actual road surface temperature is between plus 5°C and 2°C or 0°C and minus 5°C, if the forecast and actual road surface temperature deviates by 2°C or more for a sustained period of more than 1 hour.
  - When the actual road surface temperature is between plus 2°C and 0°C, if the forecast and actual road surface temperature deviates by 1°C or more at any point.

In addition, exceptions to normal practice are as follows:

- In the event of forecast winter hazard, such as frost, ice or snow, during the Operational Summer Period the 24-hour forecast, domain forecast and site specific forecast will revert to that of the Operational Winter Period

In the event of a primary forecast site failing for a period of over a month, the Forecast Provider shall transfer forecast provision to the secondary environmental sensor stations within the climatic domain.

### **Morning Summary**

A morning summary must be issued between 05:00 and 06:00. The text of this report should include:

- A brief summary of weather experienced over the previous 24 hours
- Notification of any suspected faults in the Highways Agency Weather Information Service.

### **Traffic Officer Service Requirements**

*Some mandatory and optional elements of the service may be required by the TOS in the delivery of their duties. This information will be provided, where available, through HAWCS. The Service Provider shall therefore liaise with the TOS to identify any optional requirements they need for the Service Manager to consider.*

**Comment [c10]:** Comment from Wm community working group could this be 07 00 instead as this would tie in with latest forecasts? Any impact on HAWIS?

### **24 Hour Consultancy Service**

The Service Provider shall ensure that the Forecast Provider is available by telephone 24 hours a day, 7 days a week, 365 days a year (including leap years) for consultation on the weather conditions and details of forecasts. The Service Provider should ensure that the Forecast Provider provides a response within five minutes of any Service Provider enquiry.

### **End of Season Analysis**

At the end of each Operational Winter Period, the Service Provider must ensure that the Forecast Provider produces an Operational Assessment Report. This report will include details on the accuracy of forecasts based on information contained in HAWIS. For each forecast site, this analysis must include:

- A graphical representation of actual versus forecast minimum road surface temperatures
- A graphical representation detailing the frost prediction accuracy by comparing forecast frost against actual frost conditions (i.e. frost/frost, frost/no frost, no frost/frost or no frost/no frost)
- The bias and root mean square error in the forecast of minimum road surface temperature.
- Outline of lessons learned and particular successes from the previous season.

The Service Provider will retain copies of the analysis and make them available to the Highways Agency if required.

### **Level of Accuracy**

The accuracy of weather forecasts is fundamental to their usage in road weather forecasting, especially when applied to the Operational Winter Period. This section defines the measures that should be recorded and target results. The responsibility for ensuring the forecast supplier is meeting accuracy targets is with the Service Provider.

The terms below should be used as defined terms for the purposes of measuring accuracy consistently:

- $e$  = Error between the coldest actual road surface temperature and the associated forecast road surface temperature
- $n$  = Number of nights within the forecast period
- $FF$  = Number of occasions where a frost was forecast and frost occurred (accurate)
- $FNF$  = Number of occasions where a frost was forecast and no frost occurred (potential wastage)
- $NFF$  = Number of occasions where no frost was forecast and frost occurred (potential risk)
- $NFNF$  = Number of occasions where no frost was forecast and no frost occurred (accurate)
- A critical night is a night where the actual road surface temperature in degrees centigrade falls within the range:  $-5 \leq T \leq +5$
- A frost on this occasion is deemed to occur when the forecast or actual road surface temperature is at or below 0°C.
- The final forecast is either the 18:00 forecast, or any ad-hoc forecast prior to 00:00.

The accuracy measures shall be:

- Percentage of forecasts not delivered before the target time, including ad-hoc forecasts within prescribed timescale for delivery following identification.
- Number of phone calls not answered by a forecaster within 5 minutes
- Route Mean Square Error
  - The Route Mean Square Error (RMSE) is to be assessed on all nights based on initial forecast and final forecast.

$$\left[ \frac{1}{n} \sum_{i=1}^n e_i^2 \right]$$

- The equation for calculating the RMSE is:
- Performance should be as close to 0 as possible, and should generally be less than 2.
- Bias
  - The bias is to be assessed on all nights based on initial forecast and final forecast.

$$\left[ \frac{1}{n} \sum_{i=1}^n e_i \right]$$

- The equation for calculating the bias is:
- Performance should be as close to -0.25 as possible, and should generally be in the range +1 to -1.
- Probability of Detection
  - Probability of Detection (PoD) is to be assessed on all nights, and also just critical nights. PoD should be assessed on initial forecast and final forecast.

$$\left[ \frac{FF}{(FF + NFF)} \right]$$

- The equation for calculating PoD is:
- Performance should be as close to 100% as possible, and should not be less than 87%.
- False Alarm Rate
  - False Alarm Rate (FAR) is to be assessed on all nights, and also just critical nights.

$$\left[ \frac{FNF}{(FF + FNF)} \right]$$

- The equation for calculating FAR is:
- Performance should be as close to 0% as possible, and should not be more than 30%.
- FAR should be assessed on initial forecast and final forecast.

- Accuracy
  - Accuracy is to be assessed on all nights, and also just critical nights. Accuracy should be assessed on initial forecast and final forecast.

- The equation for calculating accuracy is:  $\left[ \frac{(FF + NFNF)}{(FF + NFNF + FNF + NFF)} \right]$

- The accuracy of road weather forecasts should be no less than 90%.

Occasions where less than one observation per hour for ten out of twelve hours between 18:00 and 06:00 will not be included in calculations. For periods where a potentially faulty sensor has been identified these may be discounted from the calculations providing a fault report has been raised with the HAWCS Provider.

### ***Precipitation Radar, Satellite Images and Forecast Mapping***

HAWIS will make the following services available to all users. The information has been procured centrally via the MET Office.

- Precipitation Radar
  - Actual (current and historic) radar will be available for the previous 2 hours with images at 5 minute intervals. Forecast radar images will be available for the coming 6 hours with images at 1 hour intervals. The images will show the intensity of precipitation and provide an indication of whether the precipitation will fall as rain, freezing rain, snow or sleet.
- Satellite Images
  - Visible light and infrared images for the entire UK, displayed on a mapping system. The images from the previous 2 hours will be available at fifteen minute intervals.
- Forecast Mapping
  - Synoptic charts / forecast mapping showing pressure (including an indication of weather fronts and areas of low or high pressure), precipitation, wind speed/direction and fog risk. Visibility, wind speed and wind direction forecast maps will be available at 3 hour intervals for the upcoming 36 hours, updated every 6 hours. Surface pressure / weather front forecast maps will be available at 12 hourly intervals for the upcoming 84 hours.

The above descriptions are the minimum information to be provided. The Service Provider will consider the information available via HAWIS and if more detailed, or alternative, information is required this should be procured by the Service Provider. Any additional forecast imagery will not be displayed via HAWIS therefore arrangements will be required to access it via the forecaster provider's website.

### ***Network Based Forecasting***

Network (or route) based forecasting is an emerging technology in highway forecasting. As a tool it provides a facility similar to thermal mapping, however as forecasts are generated at a far greater intensity (typically every 50-100m) the level of detail provided to decision makers is far greater.

Service providers may procure network based forecasting however all standard forecast requirements must still be met. Not all aspects of network based forecasting can be displayed by HAWIS. Where a Service Provider procures a network based forecast service, the domain forecast will be populated with each route as a separate domain. Arrangements should be made to access the remaining network based forecast information via the forecast provider's website.

Forecast Providers shall continue to provide weather forecasts for primary environmental sensors sites to enable data accuracy assessments.

### ***Forecast Resilience***



To provide resilience in the unlikely event of HAWIS being unavailable, the Service Provider will ensure they have arrangements in place to receive forecasts by alternative means. This may be via email, fax or the forecast provider's own website.

### **B.3 ANTI-ICING/DE-ICING MATERIALS**

Whatever anti-icing / de-icing material is selected the Service Provider must ensure Area Operational Winter Service Vehicles (including Reserve Vehicles) are calibrated for the anti-icer / de-icer to be spread, taking into account the moisture content and grading. Checks of both spread rate and profile (skew / distribution) throughout the Operational Winter Period are encouraged to confirm that Winter Service Vehicles are spreading correctly.

#### **Salt**

Although pre-wetted salting is the Highways Agency's preferred treatment dry salting still provides an effective reactive treatment should ice have formed or snow settled. It is also considered an acceptable treatment where Winter Service Vehicles capable of pre-wetted salting are not available.

Rock salt should be treated with an anti-caking agent before delivery and comply with the current British Standard (BS 3247:1991). 6.3mm down is the preferred gradation for use on the Area 13 Network for pre-wet or dry treatments. If salt of that grading is not available either 10mm rock salt or 6-8mm marine salt make for effective alternatives, although Service Providers should remain mindful that the latter may contain stones exceeding 10mm that might pose a problem.

Trials have shown that an acceptable distribution can be achieved for both the 10mm salt and the 6-8mm marine salt using the standard settings for 6.3mm rock salt, although calibration for the different gradation is recommended. Standard spread rates may be utilised. Although the Schmidt and Romaquip spreaders have a controller option to spread 6-8mm marine salt this has not been calibrated. Although the marine salt is purer than indigenous rock salt, meaning more sodium chloride (NaCl) is delivered to the road, reductions to spread rate are not considered appropriate.

#### **Salt storage**

Salt should be stored in barns or covered in protective sheeting in a manner that avoids the ingress of moisture into the material as far as is practicable. Salt must not be stored within 4.5m of hedges or within the rooting area of trees. The Service Provider must ensure salt stockpiles do not become contaminated with foreign matter likely to cause damage to other road users and / or the Winter Service Vehicles.

The Service Provider will monitor the moisture content and gradation of particles in the stockpile on a regular basis to confirm that the salt remains in an acceptable condition. Details of such monitoring must be recorded. Salt handling during storage must be minimised as it can cause salt loss and particle breakdown.

As salt is removed from stockpiles a safe slope on the material must be maintained to protect operatives from the risk of collapse of the stockpiles. Exposed outdoor stockpiles should be formed into the shape of long rectangles.

Careful consideration will be given to drainage to prevent pollution. Guidelines on this are available within the Environment Agency's "Pollution prevention guidelines highway depots: PPG10". The Service Provider must consider using any recycled wash water, salt laden drainage and other salt containing liquids as part of a pre-wet or liquid brine treatment regime.

#### **Salt Stock**

Under the AMOR, Minimum Contractual Salt Stock Levels have been calculated for each Area, these are summarised in the following table. If AMOR specification is not in place, either through tender or negotiated route for the area concerned, salt stocks will be proposed by the Service Provider for acceptance by the Service Manager. Regular completion and submission of the Salt Capability Spreadsheet, which calculates Minimum Capability, will facilitate early identification and appropriate escalation of any difficulties that emerge in individual areas relating to the supply



of salt on the carriageway is reduced by 13%, compared to spreading a brine concentration of 23%. It is thus recommended that brine of the 23% optimum concentration is used.

The ability of the pre-wet spreaders to spread brine, without modification to the spinner, is limited by the capacity of their brine pump meaning a maximum spread rate of approximately 40g/m<sup>2</sup> to a single 3.6m wide lane or 20g/m<sup>2</sup> to two lanes of total width 7.2m. Assuming a brine concentration of 23%, this equates to a nominal dry salt spread rate of 9.2g/m<sup>2</sup> and 4.6g/m<sup>2</sup>, respectively. Table 5.5.1 illustrates the length of route that can be treated with brine using pre-wet spreaders, assuming a carriageway width of 3.6m.

**Table 5.5.1 Approximate length of route that can be treated with brine using pre-wet spreaders**

Spreader	Length of treatment (km) assuming 3.6m wide carriageway			
	Nominal spread rate = 20g/m <sup>2</sup>		Nominal spread rate = 40g/m <sup>2</sup>	
	1 Lane	2 Lanes	1 Lane	2 Lanes
6x4 pre-wet	50	25	25	12.5
4x4 pre-wet	33.3	16.7	16.7	8.3

Brine spreading is likely to be more susceptible to the effects of wind than pre-wetted salting. It is essential that careful consideration be given to the surface condition as the presence of moisture will dilute the brine application or the residual salt present on the surface. After rainfall, untrafficked areas are likely to remain wetter for longer than trafficked areas. Furthermore, many hard shoulders are on the low side of crossfalls so large areas of carriageway can drain over them.

Consideration must be given to possible differences in temperature between LBS1 of a Managed Motorway and the running lanes of the carriageway. The temperature in Lane 3 of a three lane motorway can be up to 3°C lower than Lane 1 because of the lighter traffic flows. Without the traffic the temperature difference can be even greater such that an untrafficked hard shoulder can be up to 5°C lower than Lane 1; this is particularly evident on concrete carriageways. Similar temperature differences may be evident on slip roads.

Where accurate information is available on surface temperature and surface conditions appropriate brine spread rates may be determined using Table 5.5.2 below. It shows the minimum road surface temperatures at which freezing will not occur for brine spread rates of 20g/m<sup>2</sup> and 40g/m<sup>2</sup>. It should be noted that the accuracy of spread, when using pre-wet spreaders for brine spreading, reduces when treating two lanes and the table accounts for this.

**Table 5.5.2 Effectiveness of brine treatments**

Water Film Thickness (mm)	Lane(s) Spread and Nominal Brine Spread Rate		
	1 at 40g/m <sup>2</sup>	1 at 20g/m <sup>2</sup>	2 at 20g/m <sup>2</sup>
	Minimum road surface temperature at which freezing will not occur (°C)		
0.05 (Damp)	-5.9	-3.6	-2.9
0.1 (Wet)	-3.6	-2	-1.7

The water film thicknesses in Table 5.5.2 apply when a road is lightly trafficked. If there is no traffic, the water film thickness may be higher in frost conditions and after rainfall. A doubling of the water film thickness will approximately halve the minimum road surface temperatures shown above. However, if more water is present solid de-icers from previous treatments are more likely to dissolve to work with the brine to help prevent ice formation. Where accurate information is not available, especially if ice formation is suspected, it is recommended that top-up treatments are made at the maximum spread rate that can be achieved with pre-wet spreaders, namely 40g/m<sup>2</sup> for one-lane spreading and 20g/m<sup>2</sup> for two-lane spreading.

### Brine Storage

Brine may be obtained and delivered pre-mixed from suppliers and stored in an appropriate tank or manufactured on site using a saturator or salt station. The use of a pure white salt (typically greater than 98.5% NaCl, e.g. marine salt) within saturators is recommended. The optimum, and recommended maximum, concentration for sodium chloride brine is 23%. Lower concentrations in excess of 20% are acceptable for pre-wetting treatments. To avoid variations in concentration due to stratification in the storage tanks the solution must be mixed thoroughly. Service providers are recommended to drain and flush the brine tanks on spreading vehicles to prevent segregation and crystallisation, which may occur if tanks are left full for some time.

It is prudent to make regular checks of brine concentration, for example by checking the density of the solution calculated by simple weighing of a known volume or by using a measurement instrument (salinity refractometer or salt hydrometer) to give a specific gravity, to ensure the concentration is as required. For a concentration of 23% the density at 15°C will be 1176 kg/m<sup>3</sup> (or specific gravity of 1.176). Slight adjustments are required for densities measured at temperatures other than 15°C.

### Pre-wetted salt

Pre-wetted salt is accomplished by wetting dry salt (at a ratio of 30% pre-wetting agent to 70% dry salt, by weight) before application to the road surface. The pre-wetting agent is usually a solution of Sodium Chloride although a solution of Calcium Chloride (CaCl<sub>2</sub>), Magnesium Chloride (MgCl<sub>2</sub>) or a Sodium Chloride brine with ABP additive may be alternatives for extreme temperatures (see below).

### Alternative Anti-icing/De-icing Materials

Alternative anti-icing/de-icing materials are usually more expensive than salt. It is anticipated that any use of an alternative anti-icing/de-icing material will be restricted to isolated, specific circumstances (e.g. structures susceptible to corrosion) or when salt treatment are not fully

effective (e.g. during extreme cold conditions – see Appendix B.5). Alternative anti-icing/de-icing materials that may be considered are summarised in the table below.

National Winter Service Research Group (NWSRG) has developed guidance for the use of alternative treatments in extreme cold. Pertinent parts of that guide have been included within the Severe Weather Plan for ease of reference including treatment matrices for spreading materials in conjunction with rock salt. (see 5.1.2, 5.1.3, 5.1.4 and 5.1.5)

Material	Cost*	Action/Effectiveness	Environmental Effects	Health & Safety
Calcium Chloride (Solid or Solution)	X20	Effective down to -31°C, but can leave oily residue resulting in slippery surfaces.	Corrosive to steel and aluminium. Damaging to vegetation	Potential irritant to skin eyes and respiratory tract Special storage requirements due its hygroscopic nature
Magnesium Chloride (Solid or Solution)	X20	Effective down to -15°C	Potentially damaging to concrete. Damaging to vegetation.	Potential irritant to skin eyes and respiratory tract
Calcium Magnesium Acetate (Solid)	X50	Effective down to -9°C, but less effective than salt below -5°C and requires a greater application rate.	Effectively non-corrosive compared to salt Relatively environmentally benign	Gloves and eye protection are recommended
Potassium Formate (Solution)	X20	Effective down to -15°C	Moderately corrosive to galvanised steel. Slightly lower Biological Oxygen Demand (BOD) than acetates less harmful to groundwater than salt	Overexposure may cause skin or eye irritation or skin rash
Propylene Glycol (Solution)	X40	Effective down to -15°C May have slight adverse effect on skidding resistance	Moderately corrosive to galvanised steel. High BOD and Chemical Oxygen Demand (COD) can be damaging to water systems	Ensure adequate ventilation; avoid breathing vapour, mist or gas; avoid contact with eyes, skin and clothing; and wash after handling
Potassium Acetate (Solution)	X20	Immediate action Effective for up to 48 hours to -15°C in suitable weather conditions	Effectively non-corrosive compared to salt Safe to aquatic life Biodegradable	Gloves and eye protection are recommended Solutions are safe to handle
Urea (Solid)	X25	Requires agitation by traffic Effectiveness: 10% solution to -3°C 25% solution to -7°C Little worthwhile effect below -7°C and ineffective below -11.5°C Remains effective for up to 12 hours in fair weather but repeat applications need to be more frequent in rain or strong winds.	Non-aggressive, but may produce ammonia and carbon dioxide. Ammonia is toxic to aquatic life. Ammonia further decomposes to nitrate which, promotes growth of vegetation, and creates an oxygen demand. Urea solutions may be detrimental to steel, plastics and concrete in some circumstances. Vehicles should not be left full of urea for any length of time, and thoroughly washed down after use.	Ventilation, due to ammonia Safe to handle but the pellets break into powder easily which becomes very slippery due to its high hygroscopic nature. Face masks and eye protection are recommended When heated to melting (i.e. fires) urea decomposes to form toxic substances. Only trained fire fighters, properly equipped with breathing apparatus should attempt to deal with fires in urea stores. Local fire fighting services should be informed of urea stock sites.

\*Approximate cost compared to rock salt

The use of urea on the Area 13 Network has generally been phased out due to the associated safety and environmental considerations. However, urea dampened sharp sand may be considered for use in the event of a salt crisis. If sand is used the treated section should be swept and the drainage gullies emptied, as soon as reasonably practicable.

#### **B.4 DEPLOYMENT OF RESERVE WINTER SERVICE VEHICLES**

1. Service Providers are required to monitor the issue of Area Operational Reserve Winter Service Vehicles within their respective Area 13 Network.

Service Providers may use 100% of the Area Operational Reserve Winter Service Vehicles allocated to their Area 13 Network to cover for breakdowns EE Vehicles etc without approval from the HA but must ensure they are notified. They are therefore required to record the issue of each Operational Area Reserve Winter Service Vehicle on the WRF1 System (Near to Real-time – within 30 minutes).

2. If the Area Reserve Threshold has been reached the Service Provider must consider whether the situation requires National Reserve Winter Service Vehicles to be deployed to the Area 13 Network.
3. The Service Provider must notify the National Winter Co-ordinator by e-mail at [REDACTED] if the situation is not considered to require the deployment of National Reserve Winter Service Vehicles. The Service Provider and National Winter Co-ordinator should then continue to monitor the situation in-case it escalates to a level that requires the deployment of National Reserve Winter Service Vehicles.
4. The Service Provider must notify the National Winter Co-ordinator by text or phone on [REDACTED] if it is felt that the situation requires the immediate deployment of National Reserve Winter Service Vehicles. The National Winter Co-ordinator will also be available out of hours, but should not be contacted by phone unless it is felt that the situation will require the deployment of National Reserve Winter Service Vehicles. Should the National Winter Co-ordinator not be available, National Reserve Winter Service Vehicles may be used in an emergency situation, with all details recorded via email to the National Winter Co-ordinator, together with attempted time and method of contact.
5. The National Winter Co-ordinator will make a decision on the logistics for deployment of National Reserve Winter Service Vehicles based on discussions with the Service Provider(s) and Regional Performance Manager(s).
6. If the situation becomes a Critical Incident, the National Winter Co-ordinator will liaise with the appropriate regional/national incident commander (under the improved coordination process) to ensure that any emerging incident is governed appropriately.
7. National Reserve Winter Service Vehicles that are no longer needed are returned to their operational centre and the WRF1 Reporting System updated accordingly. National Reserve Winter Service Vehicles are issued for specific tasks and may be withdrawn for re-deployment elsewhere should the need be greater.
8. National Reserve Winter Service Vehicles are also available to DBFO Cos, but must be operated by drivers that have received certified training. When National Reserve Winter Service Vehicles are required, contact must be made with the National Winter Co-ordinator who will then arrange for their deployment. The service provider that normally holds the deployed National Reserve Winter Service Vehicles in their Area 13 Network is responsible for recording the issue on the WRF1 system.





## **B.5 SPECIAL CONSIDERATIONS**

Network Features or surfacing that has a thermal response that is very different to the majority of the road network may require special consideration with regard to Winter Service. In addition, certain weather conditions require special consideration. This annex highlights some Network Features and the effects of various weather conditions on Winter Service treatments which Service Providers must be mindful of.

### **Network Features**

#### ***Negatively textured surface courses***

Carriageways with negatively textured surface courses require special consideration with regard to residual salt, as much of the salt is retained in the voids 'negative texture'. The brine trapped in the pavement voids is reliant upon the action of tyres over the surface to withdraw it to the road surface which is influenced by traffic levels. On a heavily-trafficked carriageway, a reasonable degree of residual salt will be "plucked" out so as to remain on the surface of the carriageway to combat the formation of ice. On lightly-trafficked carriageways the brine is retained in the voids.

Operational experience has indicated that negatively textured surface courses do not benefit from an increase in dosage above that required for hot rolled asphalt. Negatively textured courses should be treated with caution and residual material should not be relied upon to provide protection.

#### ***Porous asphalt***

Porous asphalt has different thermal characteristics, meaning it cools more rapidly and warms slower, than dense surfacing. Compared with that of dense road surfaces it will typically fall below freezing point an average of half an hour earlier and rise above freezing point an average of an hour later. In extreme weather conditions (little winds, clear skies) the surface temperature is about 1°C lower than that of comparable dense surfacing.

For heavily trafficked roads the behaviour of porous asphalt surfacing barely differs from that of dense road surfaces. At low traffic intensities the loss of thawing agent into the voids of porous asphalt results in a greater likelihood of freezing of light precipitation (condensation, freezing fog) and greater quantities of treatment material being required to treat heavy precipitation. Target spread rates for porous asphalt are recommended to be plus 25% of the selected treatment.

Care needs to be taken at interfaces between porous asphalt and dense road surfacing because the horizontal transport of the treatment material is limited from the porous asphalt. The initial length of dense surfacing can have a reduced amount of treatment material as a consequence.

#### ***Poorly drained areas with the potential to re-freeze***

Particular attention must be paid to lengths of road that are known to be susceptible to 'run-off' water from verges or central reserves and at joints between porous and impermeable surfacing. Efforts should be focussed on addressing the drainage problems, given very significant quantities of salt are required to prevent ponded water from freezing. Although the road itself may be dry, accumulations of snow may melt then run onto the road and re-freeze.

Similarly, care must also be taken when considering stockpiling snow adjacent to solid vertical barriers. There is the risk of melt water running across the carriageway with the possibility of it re-freezing.

#### ***Solid Vertical Barriers***

The presence of solid vertical barriers (SVBs) can present operational difficulties to snow ploughing which will potentially result in snow being stacked on lanes adjacent to them. The Service Provider must consider whether any lanes may need to be abandoned during heavy

snow whilst keeping the maximum number of lanes available to traffic and maintaining access and egress. Stacked snow must be removed at the earliest opportunity.

### ***Traffic calming features***

Caution must be exercised when planning ploughing operations in the vicinity of traffic calming features. The range of traffic calming measures that may be of concern to ploughing operations include:

- Speed cushions
- Two-way chicanes
- Central refuges
- Traffic islands
- Road narrowing
- Over-run areas
- Rumble strips

### ***Low Temperature / Low Humidity Vulnerable sites***

The location of vulnerable sites must be plotted on a map of the Area 13 Network using data compiled of past incidents where the conditions were considered a contributing factor to the incident and / or other network intelligence (including sites identified as being at risk of problems – see 1.3.4) and the associated location, Information comprising the following elements must be recorded for each site:

- Site location (slip road, main carriageway, sharp bend)
- Accident record (highlighting weather related events)
- Surfacing type and condition
- Climatic, geographical or other features which may affect the temperature relative to the surroundings or the performance of the anti-icing agent (e.g. the site is sheltered, in a hollow, North facing, elevated, shaded by trees, in a cutting, has a high cross fall, low traffic volumes, lanes that are not trafficked for parts of the day)
- Spreading route length affected

### **Weather Conditions**

#### ***Cross-winds***

Cross-winds can affect the distance over which treatment is spread and to compensate it may be necessary to spread from a lane upwind (if appropriate) from that normally chosen. In exceptionally strong winds, it may be necessary to undertake a second treatment run with the spreader set asymmetrically into the wind.

#### ***Effectiveness of Salt after Rain***

Spreading salt while the road surface is wet will dilute the brine formed meaning it may not be sufficiently concentrated to prevent ice forming. Table B.1 illustrates this showing how much the freezing point of water can be depressed with an 8g/m<sup>2</sup> precautionary pre-wetted salt treatment for various water film thicknesses.

Table B.1 Effect of 8g/m<sup>2</sup> Pre-Wetted Salt Treatment on Freezing Point

WATER FILM THICKNESS (mm) [Surface Condition]	FREEZING POINT (°C)
0.03 [Dry / damp – well trafficked]	-4.7
0.05 [Wet – well trafficked]	-2.9
0.1 [Wet – lightly trafficked]	-2.0

Treatments should be delayed as long as practically possible after rainfall to enable trafficking to disperse surface water, which it can quickly do after rainfall ceases especially on well drained surfaces, so spray is minimal. If freezing is forecast after heavy rainfall, where trafficking cannot significantly reduce the water at the road surface successive treatments must be conducted.

The definitions of what constitutes a wet or damp road for Winter Service are:

- a wet road is one where minimal spray is evident and there is no water flowing across the surface
- a damp road is one where water is present that clearly darkens the road surface, but there is no spray or water flowing across the surface

Re-treatments must be considered after rainfall given salt can be washed from the road, reducing any residual salt effect.

### **Freezing Rain**

Freezing rain in this country is a rare, but exceptionally dangerous phenomenon. It occurs when rain falls through a layer of very cold air, where it becomes super cooled (remaining a liquid below the usual freezing temperature). The rain freezes immediately on contact with a surface forming “black ice”. The black ice can build up very quickly completely covering the road surface (since freezing on contact does not allow run-off). Service providers must ensure their forecast provider uses the term “freezing rain” for such super cooled rain, rather than to describe cold rain falling on frozen surfaces – although such cold rain can result in rapid icing (especially when surfaces are extremely cold), pre-treatments provide for a more effective treatment for that condition.

The nature of freezing rain means that ice will form on the carriageway and that preparations for the freezing rain will not prevent incidents occurring. Rain falling on extremely cold surfaces can produce similar effects. It is therefore important to prepare for the onset of the conditions and the likely resulting collisions. Measures for dealing with the conditions fall into three main areas: advance planning, operational arrangements and hazard mitigation.

#### *Advance planning*

Risk assessments must be undertaken by Service Providers to ensure the practices expected of operatives and other members of staff on the Area 13 Network in such conditions are adequately recognised.

#### *Operational arrangements*

Specific measures that must be considered by the Service Provider include:

1. A Severe Weather Desk/Silver Command must be established in advance of the anticipated freezing rain or rain falling on extremely cold surfaces. For a particularly widespread or severe forecast it may be necessary to establish a Gold Command Contact with the Police, RCC / Traffic Officer Service, adjoining service providers and local authorities and to inform them of proposed action.

2. Prior to the arrival of the rain a pre-treatment is to be made in the same manner as would be made prior to snow falling. Where road surfaces are extremely cold and salt may not provide for an effective treatment, alternative treatment materials must be considered. See Appendix B3 and Treatment Matrices 5.1.3, 5.1.4 and 5.1.5.
3. Constant monitoring of the situation is to be made and an additional treatment is to be carried out immediately the rain commences and continued, subject to the Service Provider's risk assessment confirming that the risk level of staff operating be tolerated, until such time that the rain has ceased or the temperature of the road has risen above freezing.
4. Freezing rain usually occurs along the line of an incoming warm front. If possible, to ensure maximum effectiveness of the salt or alternative treatment material as appropriate, the advance treatment should be made in the same direction and immediately in advance of the weather front. Use should be made of weather radar where available to help determine the time of treatment. Consideration must be given to positioning vehicles on the point of the route where the weather front will first hit in order that timely treatments can be undertaken
5. Some treatment material will inevitably be lost during and following treatment and therefore careful consideration needs to be given to the requirement for continued successive treatments.

#### *Hazard mitigation*

Informing road users of the hazard is paramount and Service Providers must implement proactive measures for example closing the road as the rain arrives and holding the traffic (rather than diverting) until such time as it is deemed safe to proceed. Such considerations will need to be made on a case by case basis taking into account local circumstances.

Where available fixed or mobile Variable Message Signs (VMS) should be used to warn road users of the hazard. The existing established procedures for requesting VMS settings to be made must be followed well in advance. This will include advising the RCC where and when messages are required, what message is to be set and advising when the message may be cleared.

The most appropriate for use in these circumstances, defined in the "Policy and procedures for the use of variable message signs by the Regional Control Centres" are:

<p style="text-align: center;"><b>Nn J*- J*</b> <b>RISK OF ICE</b></p>	<p>This message must only be used when an incidence of ice on the carriageway, which presents a significant road safety hazard due to slippery conditions combined with lack of road surface treatment, is <b>confirmed</b> between two junctions upon the named road, e.g. freezing rain.</p>
--	--

to	<p style="text-align: center;"><b>RISK OF ICE</b> <b>SLOW DOWN</b></p>	<p>This message must only be used when a section of carriageway(s) is subject weather conditions that are known to form ice, e.g. a wet surface combined with freezing temperatures, and it has not been possible to re-treat said carriageway (post rain washing original treatment away) in time to prevent ice forming.</p>
----	--	--

It should be noted that the previously recommended 'SKID RISK SLOW DOWN' message is not a weather related message and therefore should not be used to advise of freezing rain or ice.

National Incident Liaison Officer (NILO) and/or the Highways Agency Press Officer must be contacted in order that the local media can be advised as necessary.

Where available use of variable mandatory speed limits must be considered. This will require arrangements and protocols to be established with the appropriate Police Control office or RCC as part of the advance planning procedures.

Consideration should be given to the use of rolling blocks and convoy arrangements to either hold or slow traffic down both just prior and during the event. This will require arrangements and

protocols to be established with the appropriate Police authorities or RCC as part of the advance planning procedures.

### ***Low Temperature combined with Low Humidity Conditions***

Such conditions may occur at any time during the winter period though are most likely to occur in December and January at about the time of the winter solstice. Although not such a problem for pre-wetted salt treatments spreading dry salt can be of limited effectiveness in preventing the formation of ice when low temperatures and low humidity conditions combine. This is because dry salt requires moisture to 'activate' the dissolution process, and the formation of brine from dry salt takes increasingly longer as temperatures fall below -5°C. The effectiveness of salt decreases as temperatures fall and effective treatments may not be guaranteed with salt towards the lower end of the temperature band. The use of alternative treatment materials must be considered when spreading at (the lower of air or road surface) temperatures below -7°C or below -5°C in low humidity conditions (relative humidity <80%). Under low temperature and low humidity conditions it is important to ensure the anti-icing agent is wetted so that it will adhere to the road surface and be able to enter into solution even in the event that moisture is not available from the road surface or the atmosphere.

If low humidity is considered a high risk to brine formulation, Service Providers must consider supplementary measures on previously treated routes to increase the moisture content at the road surface. Such measures may include the:

- Application of additional brine solution (max 23% salt solution) through a dedicated liquid sprayer or a brine-only treatment using a pre-wet vehicle. Arrangements with adjacent areas can be considered for those areas that do not have pre-wet vehicles.
- Provision of an additional preventative treatment earlier in the day than standard treatment times to utilise the generally higher humidity levels, higher temperatures and increased traffic flows. (Note that additional treatments should not replace standard pre-wet / dry salt treatments).
- Use of alternative anti-icing / de-icing materials such as potassium acetate or pre-wet salt with a calcium chloride brine, magnesium chloride brine or sodium chloride brine with ABP additive rather than sodium chloride brine.

### ***Sustained low temperatures***

Salt is generally effective at preventing the formation of ice during sustained low temperatures, provided it has time to form a brine, which is helped where traffic is reasonably heavy. The time taken to form brine becomes increasingly lengthy as temperatures fall and can be a significant time for extreme cold temperatures. As a result, salt becomes less effective at preventing the formation of ice during extreme cold with there being a point when alternative treatments must be considered and be available for use. There is no definitive temperature at which salt becomes ineffective, as it is dependant upon the dissolution process and therefore local conditions, e.g. time available to form brine, available moisture and traffic levels, though the [National Winter Service Research Group \(NWSRG\)](#) consider alternative treatment materials may be justified when temperatures fall to minus 7°C or below.

NWSRG have developed guidance for the use of alternative treatments in extreme cold. Pertinent parts of that guide have been included within the Severe Weather Plan for ease of reference including treatment matrices for spreading materials in conjunction with rock salt. (See 5.1.2, 5.1.3, 5.1.4 and 5.1.5)

### ***Snow drifts and build-up of snow***

Heavy snowfall, drifting and ploughing operations may result in a build up of snow in the carriageway and hard shoulders. If snow depths reach 120mm or when tackling drifts, or when working on gradients, it may be preferable to plough without spreading, since the weight of the treatment load will aid vehicle traction. Snow blowers are particularly suited to the clearance of

blockages and for the removal of accumulations from the hard shoulder and carriageway where snow may be safely directed onto the verge (or possibly a wide central reservation).

Ploughing or snow blowing is not practical in built up areas given the snow is ploughed or thrown to aside respectively. Repeated applications of de-icer can remove heavy accumulations, but this type of treatment is not recommended as it is likely to provide an unacceptable surface for traffic. In such situations, consideration should be given to the use of a snow blower with the snow being directed into an accompanying lorry, followed as soon as possible by salt spreading.

## **B.6 TREATMENT OPTIONS/TECHNIQUES**

This annex provides instructions and guidance on treatment techniques and refers to precautionary treatment, treatment of settled snow/ice and treatment of footways and cycle tracks. To be most effective, precautionary treatments should be applied before ice forms or snow settles on the road.

### ***Techniques for Precautionary Treatments***

Dry salt used to prevent ice or frost formation must first form a solution (brine) to become effective, resulting in a time lag following spreading. Therefore, pre-wetted salting is the Highways Agency's preferred precautionary treatment.

A decision to treat will depend upon many factors generally if road surface temperatures are predicted to fall below plus 1°C a precautionary treatment should normally take place unless:

- no moisture is on or is expected to be on the road; or
- there is sufficient residual salt on the road to deal with the expected conditions.

Opportunities to conserve salt may be realised on marginal nights, by considering:

- the introduction of patrols to direct focused treatment or
- delaying the decision to treat until there is greater certainty of need, other potential impacts, e.g. rain, are better known, whilst ensuring sufficient time is allowed to treat prior to ice forms or snow settles.
- 'Standby in depot'.

Selective treatment of parts of a route may be considered provided the Service Provider complies with the Technical Requirements. Identification of problematic areas can be informed by route based forecasting or thermal mapping to ensure these areas are treated appropriately.

For forecasts of significant accumulations of snow it is essential that sufficient treatment is applied before the snow starts to stick to the road as the treatment will melt the initial snowfall and provide a debonding surface beneath subsequent snow making the work of snowploughs much easier.

Due consideration must be given to traffic conditions and the timing of Winter Service operations. Wherever possible without detriment to the effectiveness of treatment, precautionary treatment should be undertaken in off-peak periods when disruption to traffic and to proper distribution of the treatment agents will be minimised. If precautionary treatment in heavy traffic is unavoidable it may be necessary to seek assistance from the Police, Traffic Officer Service and RCC (including motorway matrix signals and variable message signs) or to consider treatment in two runs (to ensure proper distribution of the anti-icing/de-icing agents).

To be effective, anti-icing/de-icing agents should be spread evenly and at rates that suit the prevailing or expected conditions. Care should be taken to ensure spread widths are neither too wide nor too narrow. The treatment should be carried out using automatic machines, the controls of which should be calibrated and clearly marked for distinct rates of spread, up to a maximum of 40g/m<sup>2</sup>. Higher spread rates are unnecessary, wasteful and environmentally harmful and should be avoided.

Care must be taken at road works so that, in addition to areas currently being trafficked, all other areas likely to be opened to traffic are treated. Traffic management equipment, including cones and cylinders, may disrupt distribution of anti-icing/de-icing agents. Contra-flow systems should be treated in both directions.

### ***Top up precautionary treatments***



Brine is effective immediately after spreading and unlike solid de-icers can reduce the risk of ice formation without the need for trafficking. Therefore, brine may be considered for an additional top-up treatment, to help activate solid de-icers, for areas with little or no traffic such as lightly trafficked slip roads.

Although pre-wet spreaders are able to spread brine this may require modification of the current software to bypass the solid de-icer distribution on some vehicles. Service Providers should contact the spreader manufacturer for instructions on how to set up pre-wet spreaders to spread brine with solid de-icer in the hopper.

Two lane slip roads may be spread with brine asymmetrically to the right, i.e. driving in Lane 1 and spreading to Lanes 1 and 2. A one lane slip road may be spread with brine by driving in the lane to be treated. In both cases, the standard spinner settings for pre-wetted salting one lane symmetrically or two lanes asymmetrically to the right can be used. Tests have shown that it is not possible to spread brine asymmetrically to the left, i.e. to a hard shoulder from Lane 1, with the standard settings for pre-wetted salting.

If brine treatments replace, rather than supplement, pre-wetted treatments the salt concentration of the brine has a greater influence on the amount of salt on the carriageway. This is because pre-wet comprises a 70:30 ratio of dry salt: brine therefore; the dry salt component is the major contributor to the salt on the carriageway. For a brine only treatment a brine concentration of 20% means the amount of salt on the carriageway is reduced by 13%, compared to spreading a brine concentration of 23%. It is thus recommended that brine of the 23% optimum concentration is used for brine-only treatments.

The ability of the pre-wet spreaders to spread brine, without modification to the spinner, is limited by the capacity of their brine pump meaning a maximum spread rate of approximately  $40\text{g/m}^2$  to a single 3.6m wide lane or  $20\text{g/m}^2$  to two lanes of total width 7.2m. Assuming a brine concentration of 23%, this equates to a nominal dry salt spread rate of  $9.2\text{g/m}^2$  and  $4.6\text{g/m}^2$ , respectively.

### ***Treatment of Snow and Ice***

The effectiveness of treatments of snow and ice on the paved areas can be significantly affected by the method of application of the treatment. The following advice covers the operational techniques for removing snow and ice from paved areas. The techniques include:

- snow ploughing
- snow blowing

In addition, snow fences can be located to prevent snow drifting on to the carriageway and snow gates utilised to close a road when it is impassable due to snow.

During snow clearance operations, any build-up of snow across rail, bridges, gateways and along fences should be promptly removed and measures taken to avoid further build up. Throughout any operation to remove snow and ice, periodic situation reports should be provided for the Service Manager and road users.

It is important to continually monitor the air temperature during clearing and, as the temperature drops, spread rates should be increased, up to  $40\text{g/m}^2$  if necessary. Although current vehicle mounted infrared thermometers offer reasonably high accuracy levels Road Weather Information Systems or thermometers at suitable open sites in compounds, or similar systems are generally preferred.

The density of fresh un-trafficked snow is about one-tenth of that of ice and the action of traffic assists in the process of melting and dispersal. However, even light snowfalls may call for ploughing where local drifting has occurred, or where snow has not been dispersed by traffic. This may occur where the traffic is reluctant to use lanes 2 or 3, or at night when traffic flows are light. During prolonged falls of snow, ploughing should be continuous to prevent build-up.

Particular attention must be paid to lengths of road that are known to be susceptible to 'run-off' water from verges or central reserves. Although the road itself may be dry, accumulations of snow may melt, run onto the road and then re-freeze.

#### *Snow ploughing*

The Service Provider should commence snow ploughing operations early enough to ensure snow accumulations do not exceed 10mm in any lane. If road surface temperatures are at or forecast to fall below 1°C the initial pass of the plough should be supplemented by salt spread at up to 20g/m<sup>2</sup> to prevent the compaction of any remaining snow and to aid dispersal by traffic and subsequent ploughing. Otherwise ploughing without continuous salting must be considered and after an area wide treatment drivers may be instructed to salt as and when required (spot salting).

The ploughs provided by the Highways Agency are designed to operate at zero height setting. The Service Provider must ensure plough heights are set in accordance with the manufacturers recommendations. Care must be taken to avoid damage to road surfaces, road studs, roadside furniture and structures. At road works, traffic management equipment must not be disrupted.

If snow depths reach 120mm or when tackling drifts, or when working on gradients, it may be preferable to plough without spreading, since the weight of the treatment load will aid vehicle traction. When conditions permit, spreading must be resumed. Use of a snow blower may also be considered for the removal of deep snow.

Ploughing or snow blowing is not practical in built up areas. Repeated applications of de-icer can remove heavy accumulations, but this type of treatment is not recommended as it is likely to provide an unacceptable surface for traffic. In such situations, consideration must be given to the use of a snow blower with the snow being directed into an accompanying lorry, followed as soon as possible by salt spreading.

The formation of hard packed snow and ice should be a rare occurrence if the performance requirements are achieved. If it does occur, provided it is no more than 20mm thick and the air temperature is above minus 5°C, removal is possible by using successive treatments of salt at rates given in the Treatment Matrix Guide.

NWSRG have developed guidance for the use of alternative treatments in extreme cold, this includes guidance on how these may be used to clear hard packed snow and ice. See NWSRG's Practical Guide for Winter Service Delivery.

Great care must be taken as the use of de-icing agents on snow or ice can produce an uneven and slippery surface. If there is any danger that the surface will become unacceptably slippery as a result of using de-icing agents, then the addition of abrasives must be considered. Application of the initial treatment technique should be resumed as soon as possible since abrasives contribute little to the removal of snow/ice and may block drains and gullies upon thawing. Abrasives should not be used on structures where there is any danger of blockage to drains. If abrasives are used the treated section must be swept and drainage gullies emptied as soon as reasonably practicable.

The technique used for multi-lane carriageways should be 'clearance by lane'.

In prolonged, heavy snowfall the priority will be to maintain lanes open in accordance with the red amber green performance requirements. In the majority of cases this will be the more heavily trafficked left hand lane (lane 1) and the first operation will be to plough snow from lane 1 to the hard shoulder, with clearance of other lanes continuing as conditions improve.

An alternative technique for a 3 lane carriageway with hard shoulders, particularly suited to echelon ploughing (2 or more vehicles moving in the same direction, one behind the other, in different lanes), is clearance in the following sequence:

- First: plough lane 2 snow to lane 1

- Second: plough lane 1 to hard shoulder
- Third: plough lane 3 snow to central reserve
- Fourth: plough hard shoulder snow to verge.

More than 2 lanes ploughed onto the central reserve could be hazardous to traffic by inviting drifting and melt water problems later. When clearing 4 or more lane carriageways consideration should be given to abandoning the outermost lane(s) rather than creating problems of excess snow on the central reserve.

Irregular windrows caused by ploughing passes, especially those that weave from one lane to another, are dangerous, as they may tempt drivers to overtake by squeezing into the partly cleared lane. Lanes must be completely cleared, and the windrows of snow remaining must form a smooth and continuous line without sudden encroachments into the cleared path. On motorways, windrows can be left on hard shoulders, but there should be intermittent clearings to provide refuge for broken down or abandoned vehicles, and these should be cleared as soon as lanes 1, 2, and 3 are cleared and should not be left indefinitely.

Under no circumstances will windrows be created across off and on slip roads where they diverge/converge with the main carriageway.

Speeds of ploughing vehicles must be regulated, particularly at features such as underbridges, where snow could be thrown over the bridge parapet, and adjacent to the central reserve, where snow could be pushed into the opposing carriageway.

The objective is to clear all lanes and hard shoulders as soon as conditions permit. Clearance work should therefore proceed continuously, since a pause during a snowfall could lead to a build-up, which would take a disproportionately long time to clear. Packed snow, glazed by the wind, can be particularly difficult to remove.

Where clearing single carriageway roads, particularly those which have more than two lanes, snow clearing operations will be carried out so as to avoid any build up of snow in the centre of the road.

Following normal snow clearing efforts carried out during snow fall, echelon ploughing to the left whilst spreading salt is an option to clear snow from those lanes sacrificed at cessation of snowfall providing sufficient resources can be made available. This will provide, when combined with a rolling road block, a relatively rapid method of removing the stored snow. Service providers must consider the training of operatives in echelon ploughing.

A phased approach may be required for 4 or more lane carriageways. Resources may need to be diverted from other areas of the Network where clearance work is complete or considered a lower priority in order to undertake such echelon ploughing.

Assistance must be sought from Traffic Officers or the Police to provide a rolling block when clearing snow from lanes which have been abandoned during heavy snow fall.

When ploughing, motorway warning signals can be displayed, so liaison with the RCC is essential. It is not always possible to keep these signals free of snow, but every effort must be made to advise motorists of the snowploughing vehicles ahead. Suitable advance warnings must be posted to inform motorists if lanes are not available for use. Variable Message Signs or Mobile Variable Message Signs should be utilised.

Special consideration needs to be given to ploughing in areas of contra-flow or other temporary traffic management where normal techniques and equipment may not be suitable.

#### *Snow Blowing*

Heavy snowfall, drifting and ploughing operations may result in a build up of snow in the carriageway and hard shoulders. Snow blowers are particularly suited to the clearance of

blockages and to the removal of accumulations from the hard shoulder and carriageway where snow may be safely directed onto the verge (or possibly a wide central reservation).