

3rd UK National Observers Group (NOG) Meeting

Friday, 21 March 2014

Presentation by
Linda Speight

Scottish Environment Protection Agency





Pilot Surface Water Flood Alerting Tool for Glasgow

Linda Speight

Outline

- The Scottish Flood Forecasting Service
 - Current surface water forecasting products
- Glasgow Surface Water Alerting Pilot
 - Overview and focus
 - Forecast data
 - Modelling
 - Understanding impacts

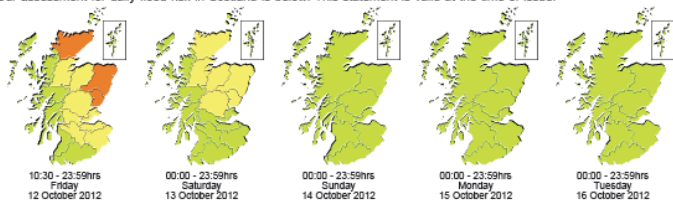
What do we do?



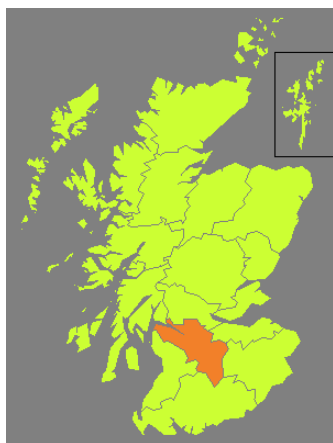
Scottish Flood Forecasting Service
Working in partnership

Flood Guidance Statement 10:30hrs 12 October 2012

Our assessment for daily flood risk in Scotland is below. This statement is valid at the time of issue.



General Overview of Flood Risk



FLOOD ALERT

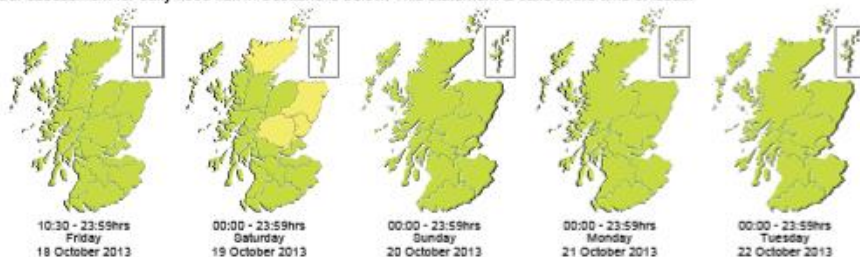
FLOODING IS POSSIBLE. BE PREPARED.

Research
and
Development



Flood Guidance Statement 10:30hrs 18 October 2013

Our assessment for daily flood risk in Scotland is below. This statement is valid at the time of issue.



General Overview of Flood Risk

The flood risk is LOW for areas of eastern Scotland on Saturday. The maps above, and the Area of Concern map below highlights the particular areas at risk.

Weather Situation

Heavy rain coupled with strong southeasterly winds will move north across Scotland on Friday evening and overnight and lasting through Saturday and into Sunday for northern areas. Heaviest rain will be in the south and east. Improving to showers on Sunday and Monday but further rain on Tuesday.

Warnings and Alerts in force in Scotland at 10:30hrs

Flood ([click here](#))
0 Severe Flood Warnings / 0 Flood Warnings / 0 Flood Alerts

Severe Weather (relevant to flood risk) ([click here](#))
Warning - No / Alert - Yes

River Flood Risk

The flood risk is LOW for Dundee and Angus, eastern Tayside and southern Aberdeenshire on Saturday. Rivers rising in the Angus Glens will be most affected. See area of concern maps for the locations affected. Heavy and persistent rainfall from Friday into Saturday across these areas will cause rivers to rise overnight and flooding is possible. There is medium likelihood of minor disruption from the early hours of Saturday morning.

Heavy rain is also forecast for eastern Caithness and Sutherland. River levels in this area will rise rapidly on Saturday and some flooding of low lying areas and roads is possible. There is a medium likelihood of minor impacts, therefore the flood risk is LOW.

Elsewhere across Scotland and for the remainder of the forecast period the flood risk is VERY LOW.

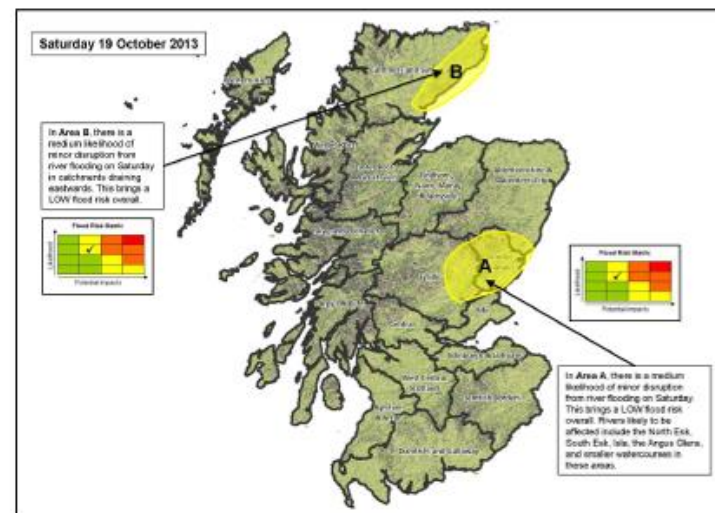
Coastal / Tidal Flood Risk

The coastal flood risk is VERY LOW. Along the east coast there may be some disruption at High Water due to spray overtopping of defences caused by strong south easterly winds during Friday and early Saturday, but impacts are expected to be minimal.

Surface Water Flood Risk

The surface water flood risk is VERY LOW.

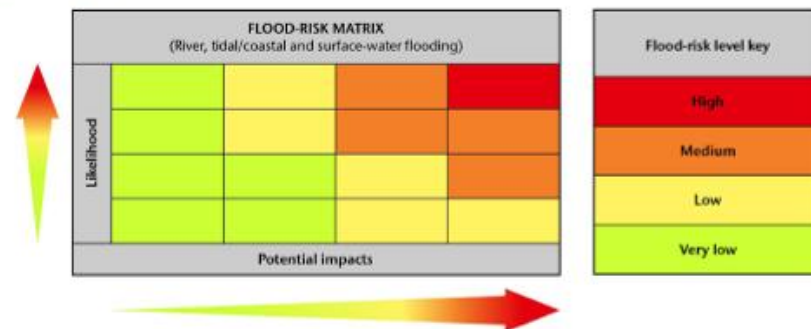
Areas of Specific Concern



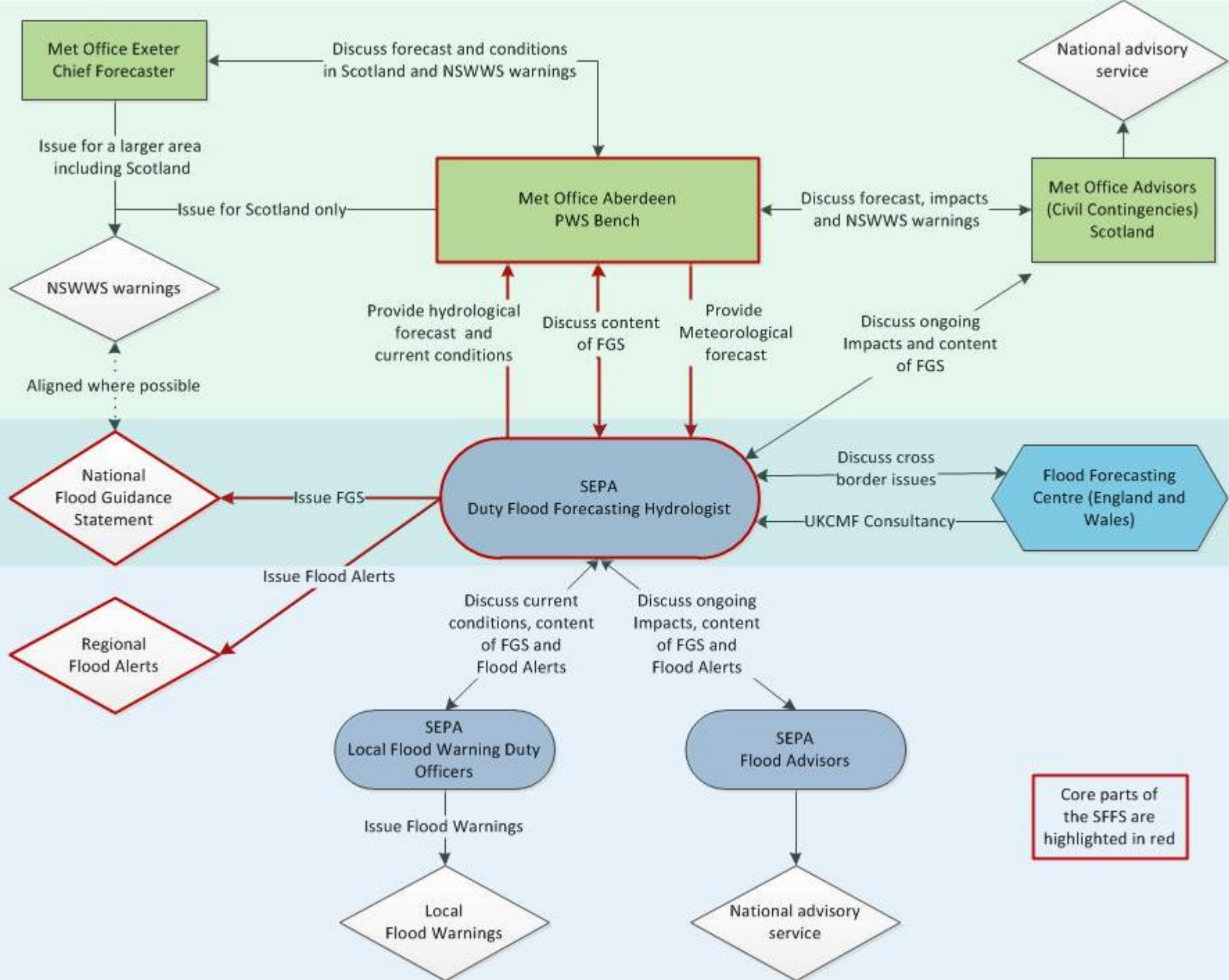
Next Statement Due: 10:30hrs Saturday 19 October 2013

Contact Details: SEPA Communications Centre - 01738 448414

All Times are Local



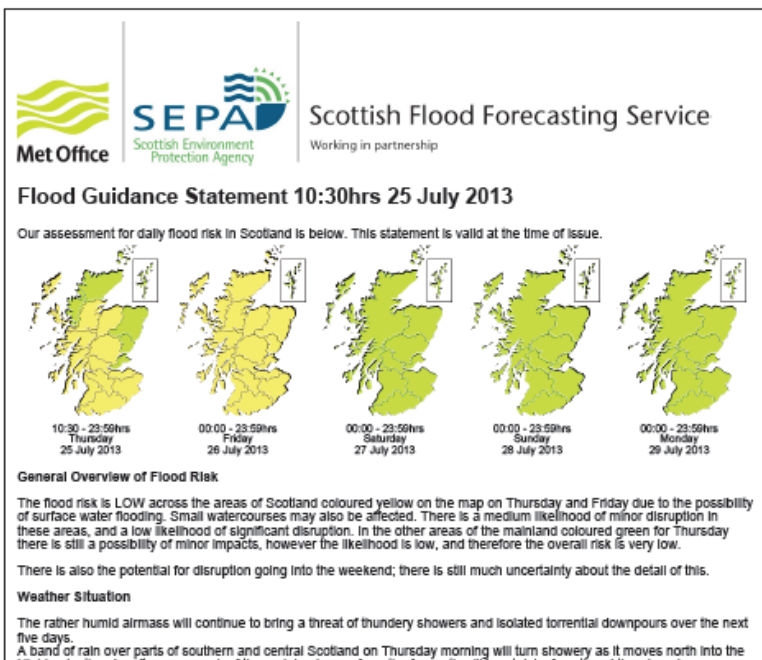
The Flood Guidance Statement





Scottish Flood Forecasting Service
Working in partnership

Current surface water products



Met Office NSWWS



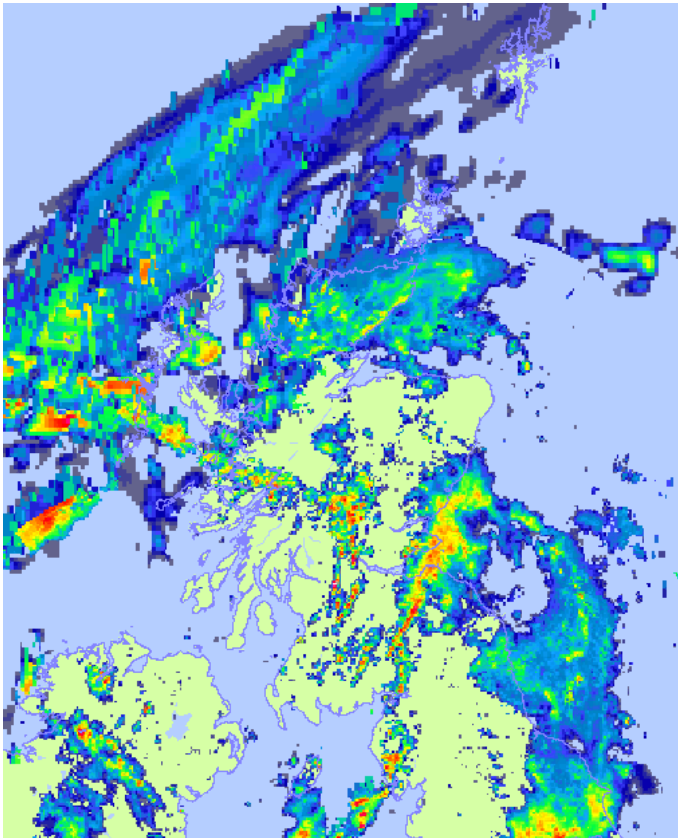
Heavy rainfall on Tuesday afternoon could result in surface water flooding impacts across West Central Scotland. Impacts may include disruption to travel due to flooding of roads in known low points, particularly through Glasgow at rush hour. There is a low probability of some isolated property flooding.

Flood Warning Strategy 2012-2016



1. SEPA will develop the necessary flood detection and monitoring capabilities required to deliver the flood warning service
2. Working with the Met Office, SEPA will develop approaches in forecasting pluvial flooding
3. SEPA will aim to reduce the impact of coastal flooding through the provision of reliable and timely flood warnings
4. SEPA will aim to reduce the impact of river and loch flooding through the provision of reliable and timely flood warnings
5. SEPA will aim to maximise the performance of its flood predictions and manage uncertainty in forecasting through risk-based communication
6. SEPA will provide an effective flood warning service and reduce the impact of flooding from all sources and work with communities and responders to improve their preparedness to flooding
7. SEPA will ensure that it has the required skills, expertise and knowledge to provide an effective flood warning service

Forecasting convective events



- Intense
- Localised
- Short lived
- Could occur anywhere

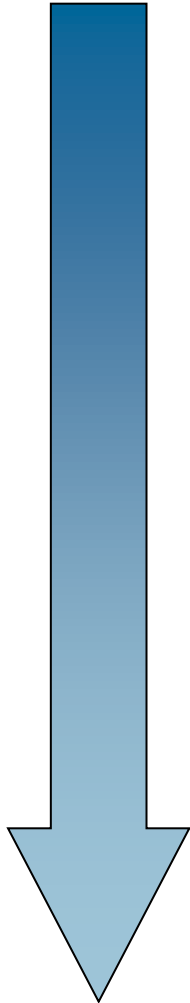
Forecast accuracy

> 150km = Good

< 150km = Some uncertainty

< 50km = Not usually useful for site specific prediction

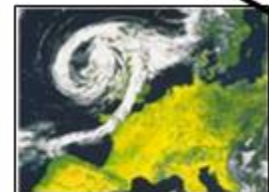
< 10km = Generally unpredictable at +1 hour



Tornado
1km
10 Minutes
30 Minutes



Thunderstorm
10 kms
1 Hour
3 Hours
(2009)



Front
100 kms
12 Hours
36 Hours
(1985)

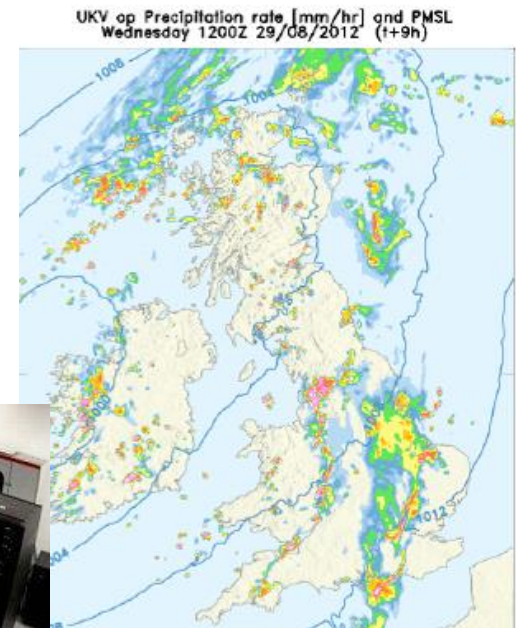


Jet stream meanders
10000 kms
3 days
9 days
(1973)

The next step...



Finer
resolution
weather
forecasts



Detailed flood
mapping



Computational
power

Surface Water Alerting Pilot Study

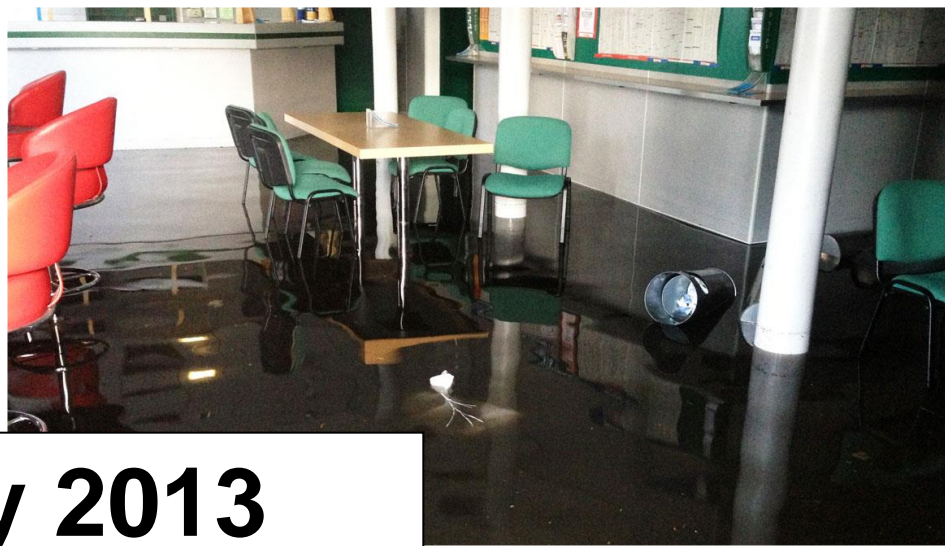
Review the current state of the art in surface water flood forecasting for urban communities and to develop a potential methodology for surface water flood forecasting in Scotland



The Commonwealth Games Pilot

- High profile event to demonstrate science
- Opportunity to share resources / knowledge
- Known flooding issues in Glasgow
- Well established network of responders
- SFRA for Games identified flooding as a risk





25th July 2013

A wake up event?



Clockwise from top left a) London Road ([BBC News](#)), b) Bookmakers in Greenock ([STV News](#)), c) East Hamilton Street ([STV News](#)), d) Broughton Road ([BBC News](#))

Who?

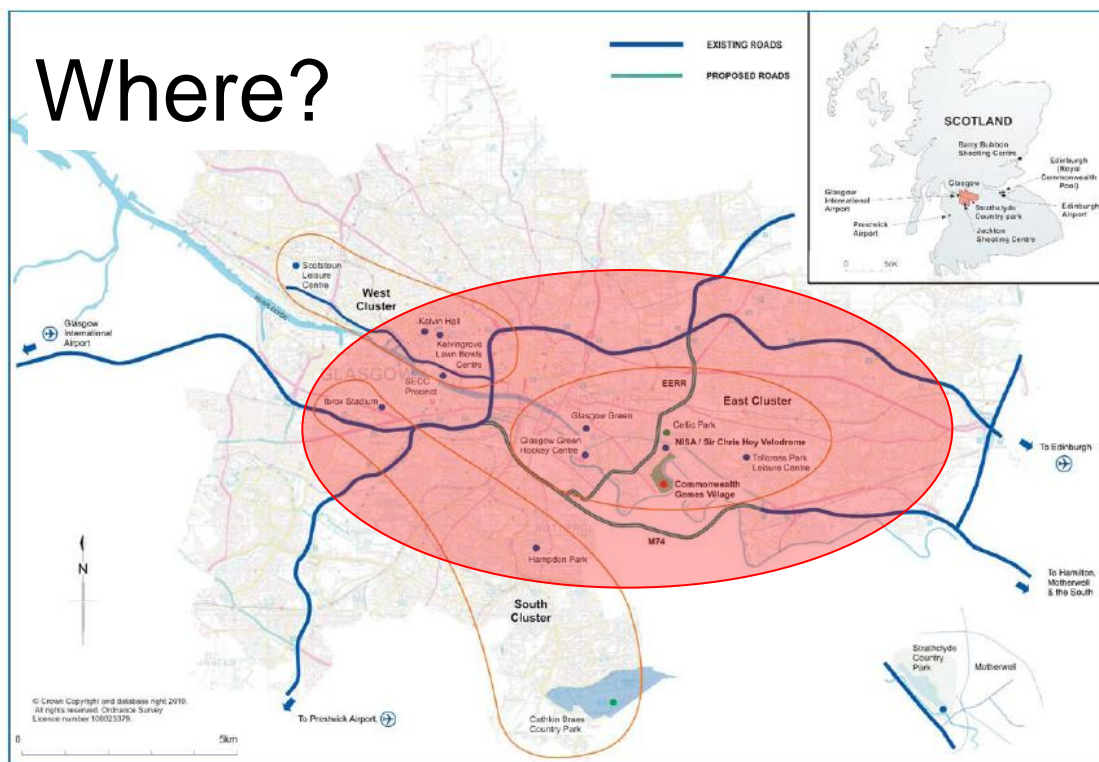


- Met Office, CEH Wallingford, James Hutton Institute

What?

- Tool to enhance our current surface water flood forecasting
- Aimed at responders rather than the public
- Guided by science and steering group

Where?



What's happened

- Project started in May
- Steering group set up – met twice



Steering Group



Scottish
Water
Always serving Scotland



The Metropolitan
Glasgow Strategic
Drainage Partnership



Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL



TRANSPORT **SCOTLAND**
CÒMHDHAIL ALBA



The Scottish
Government



The James
Hutton
Institute

Alerting Requirements

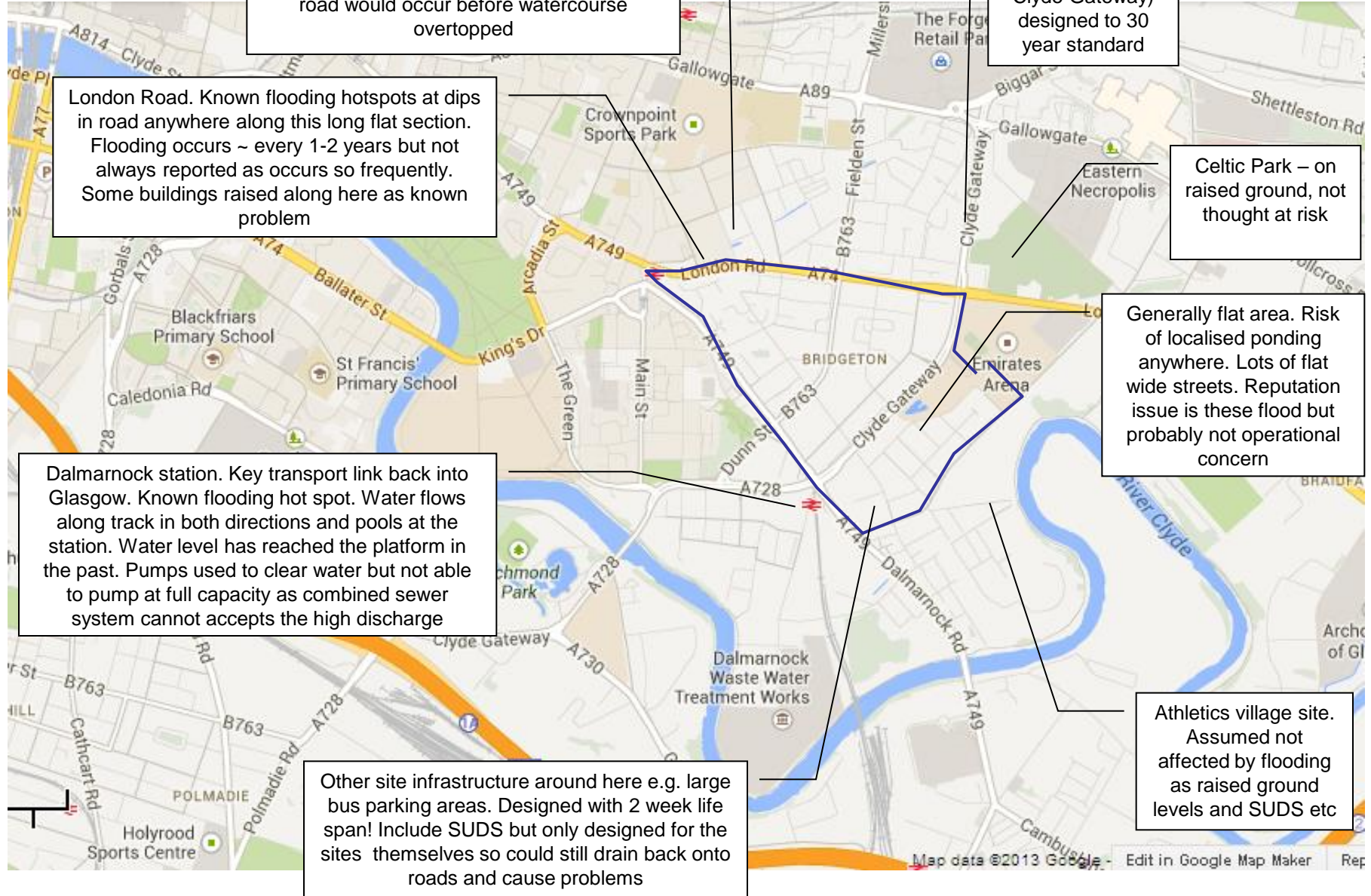
Lead time	Products	Advice	Activity
Planning		Input to exercises	
48 – 24 hours	Not viable to produce new products at this range due to uncertainty in forecast. Existing FGS sufficient (although may need explicit Commonwealth Games info)	Trigger for preparing readiness Need to be aware of what activities / venues are planned to be in use	Calling standby teams into action Get flood risk onto resilience meeting agendas
24 – 12 hours ***crucial stage for proactive preparation***	Possibly “mini FGS” for Commonwealth Games / surface water info	Need to consider timing of advice – FGS at 10:30 likely to be too late for planning events / travel that day. 8 or 9am or the afternoon/evening before. Scenarios – worst and best case Identification of the main points likely to be impacted Timing of event important – if event later in the day more likely to cause problems getting people home	Maintenance and preparation – clearing known trouble spots etc
12 – 6 hours			Moving resources to the right area of the city
Live	Nowcast Demonstration Project (dependent on Met Office Resources) Access to Radar (through Hazard Manager)		Decision on if event takes place
Close off		How is stand down issued? Not just downgrading risk (amber to yellow) but risk completely passed.	

What's happened

- Project started in May
- Steering group set up – met twice
- Glasgow site visit



Walking route
shown in Blue



What's happened

- Project started in May
- Steering group set up – met twice
- Glasgow site visit
- Two review reports completed looking at rainfall forecasting and hydraulic modelling
 - Summary report available from the CREW website

<http://www.crew.ac.uk/publications/surface-water-flood-forecasting-urban-communities-review>



What would we like to be able to deliver?

- Daily assessment of surface water flood risk
- Risk based (using existing impact matrix)
- High level identification of potential impacts
- Timely and up to date information
- Targeted guidance for the Commonwealth Games
- Potential to offer parallel consultancy / briefing services

Outline Plan

Forecast

MOGREPS-UK
2km resolution
4 a day
24 hours

*Ensemble
Nowcast*
4 (96) a day
7 hours

Impacts

1. SEPA hazard map data
2. Commonwealth Games specific

Surface
water
flood
risk

Modelling

G2G Model including surface
water runoff component

Existing flood maps

SEPA regional
surface water maps

Probability

X

Impact

=

Mini surface water 'FGS'



Scottish Flood Forecasting Service

Working in partnership

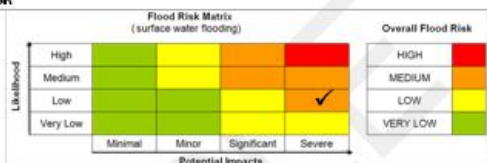
Surface Water Flood Guidance

Commonwealth Games Daily Assessment 08:00hrs 25th July 2014

Headline surface water flood risk

The surface water flood risk for Glasgow for 25th July is MEDIUM.

There is a LOW likelihood of SEVERE disruption due to surface water flooding rain on Friday evening and overnight.



Weather Situation

Mainly dry for the rest of Friday morning. By early afternoon a band of heavy showers will reach Dumfries and Galloway. These will intensify as they move northwards into West Central Scotland and by early evening there is a high risk of heavy and intense thunderstorms across the Central Belt. Thundery showers are possible throughout the night clearing before dawn. Intermittent sunshine and showers will persist throughout Saturday and may be occasionally heavy, although rainfall totals are not expected to be as high as Friday.

Hazard impacts assessment

Our assessment of the highest surface water flood risk for each 1km x 1km assessment cell for 25th July is shown below.



General overview of surface water flood risk in Glasgow

The flood risk for Glasgow for 25th is MEDIUM. Heavy rain on Friday evening and overnight is expected to cause surface water flooding.

Heavy, intense rainfall is expected to reach Glasgow around 17:00hrs on Friday and there is a low likelihood of significant impacts, however given the uncertainty in forecasting the timing of this type of rainfall impacts may be seen from late afternoon.

The intensity of rainfall expected is likely to overwhelm local drainage capacity resulting in flooding of roads and properties in known low points. Transport infrastructure around the Commonwealth Games village is at risk including London Road and Dalmarnock Station.

The heaviest rainfall will move away overnight however the risk of isolated heavy showers remains throughout Saturday and exacerbation of existing impacts or localised flooding of vulnerable roads in other areas of the city is possible.

Expected time of highest risk: 19:00hrs

Potential impacts include (from the above assessment):

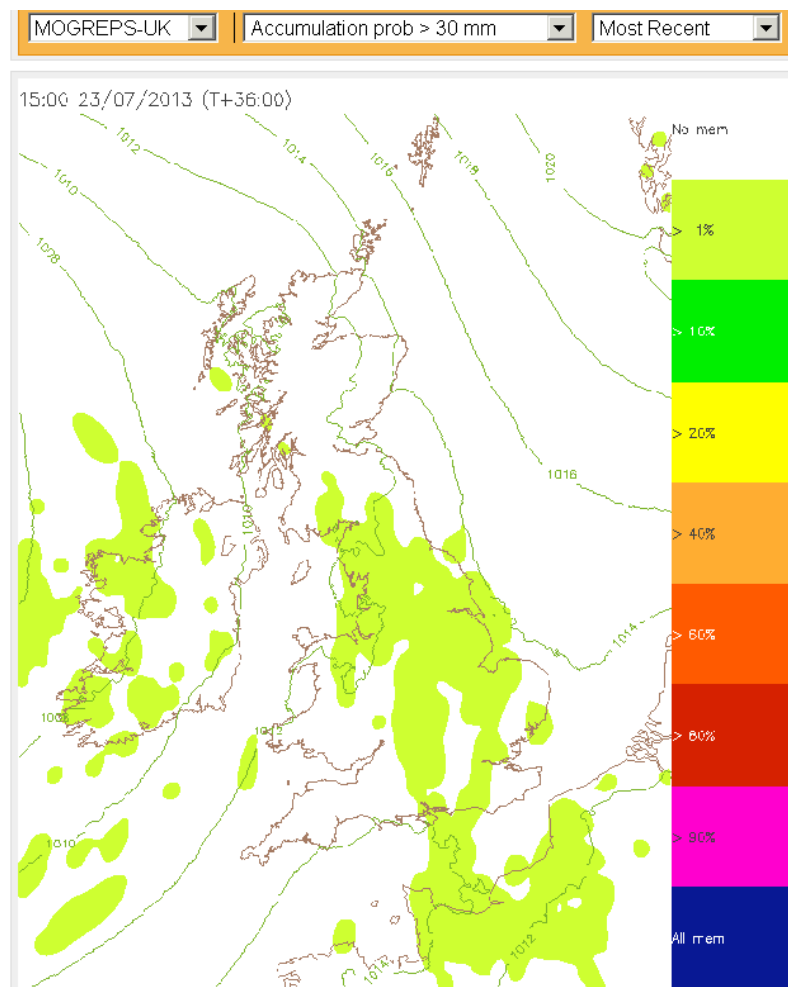
<div> <div> <div>Transport</div> <ul style="list-style-type: none"> B979 London Road Underground in Cathcart </div> <div> <div>Commonwealth Games venues</div> <ul style="list-style-type: none"> Hampden Park </div> <div> <div>Infrastructure</div> <ul style="list-style-type: none"> Glasgow SECC </div> </div>	<div> <div>Residential property</div> <ul style="list-style-type: none"> 50 residential properties in Dalmarnock </div>
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Next Commonwealth Games daily assessment due: 15:00hrs Friday 25th July 2013

Contact Details: SEPA Communications Centre – 01738 443414



Forecast data – Blended Ensemble



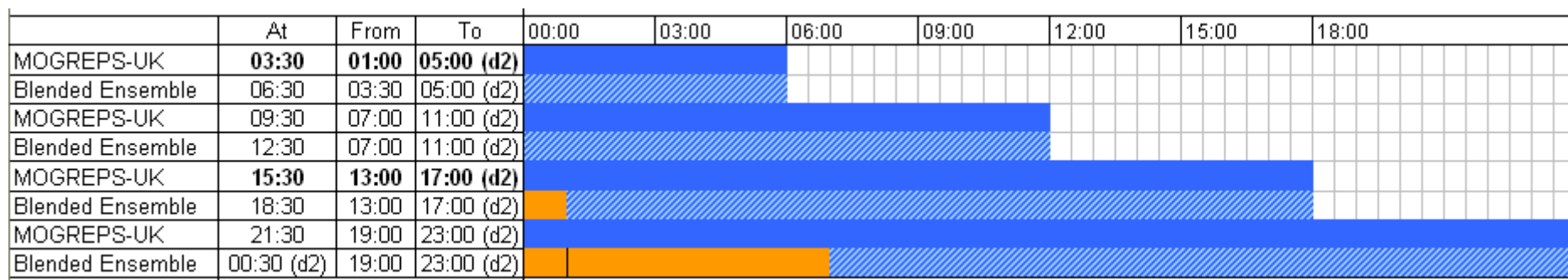
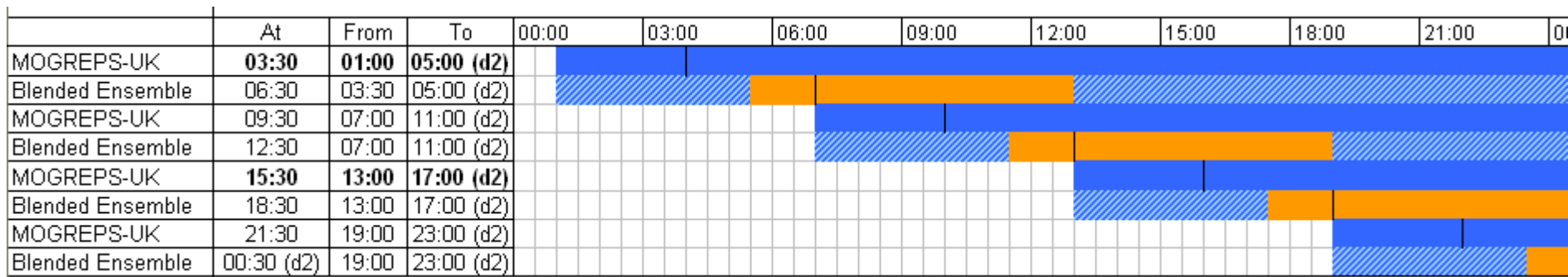
© Crown copyright

MOGREPS-UK

- 24 member ensemble
- 2km grid
- 4 times a day

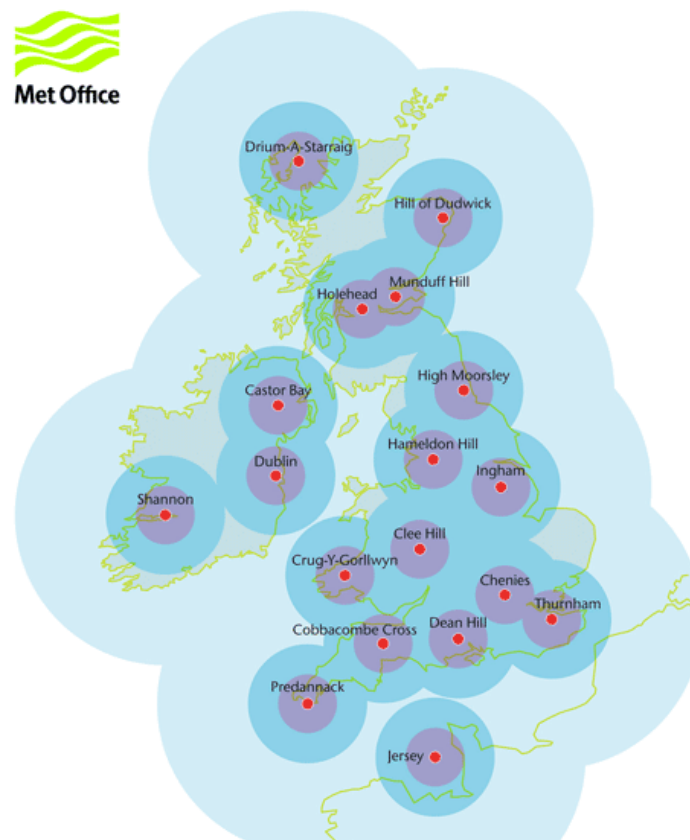
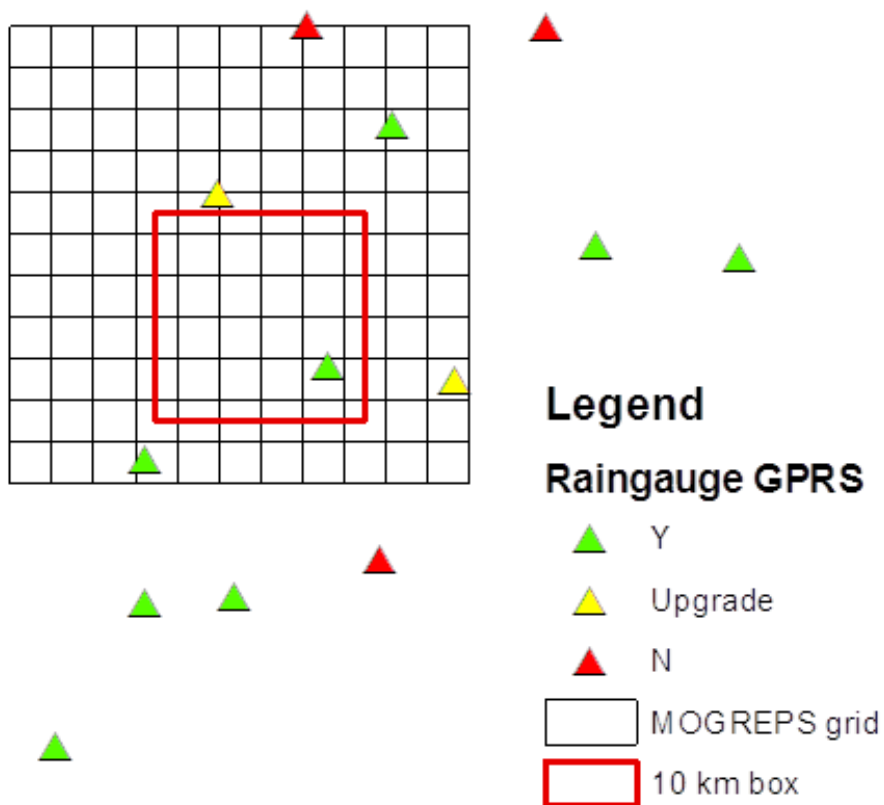
Data time	Available
0100	0330
0700	0930
1300	1530
1900	2130

Forecast data – Ensemble Nowcast

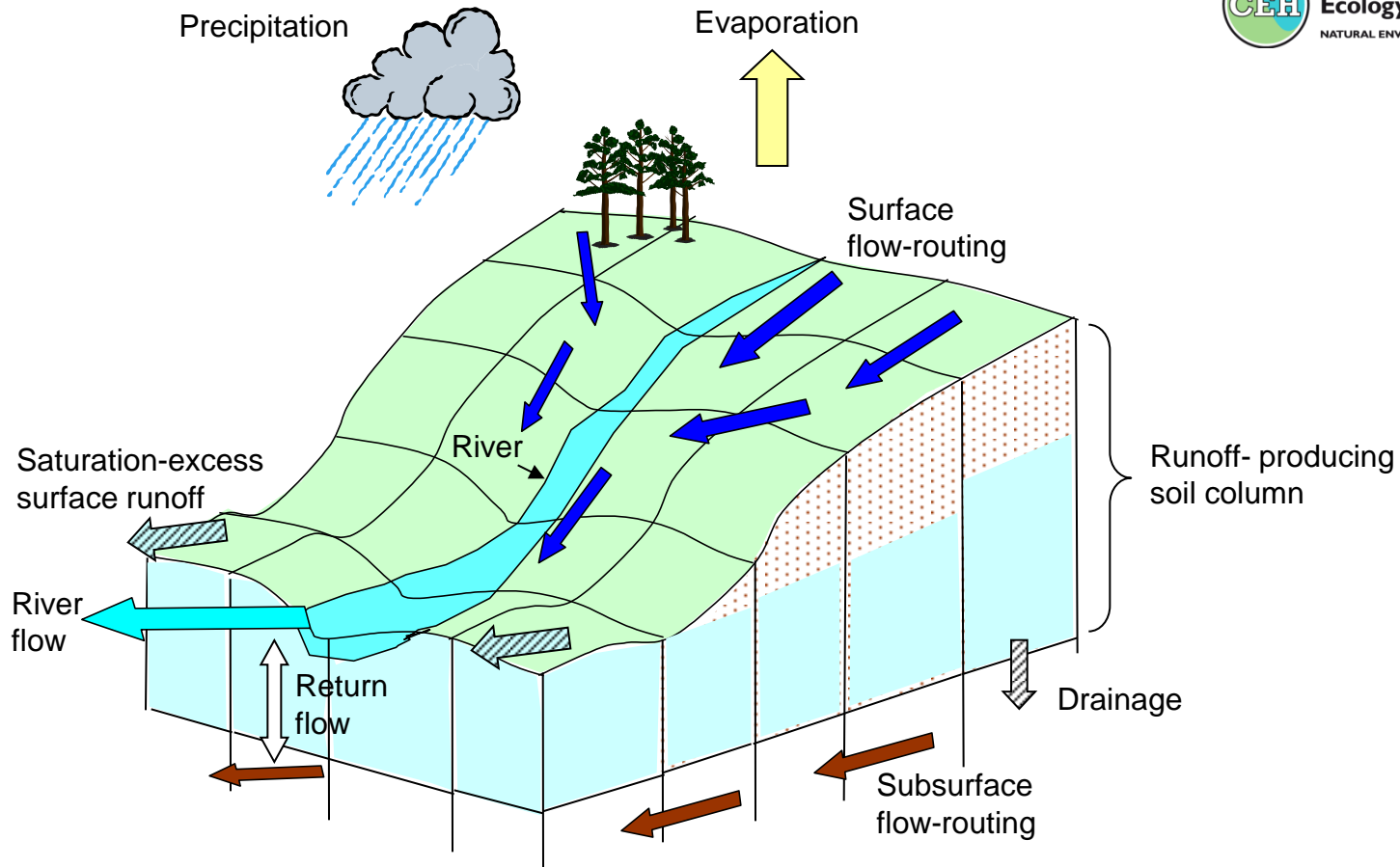


- 28 hours of data (24 useable)
- 7 hours updated Nowcast

Model initial states



Grid-to-Grid (G2G) Distributed Model



- Uses spatial datasets on **terrain, soil/geology, land-cover**
- Responds to **spatial variation of rainfall input**
- Already **used countrywide** by **FFC** and **SFFS**

SEPA regional pluvial flood maps



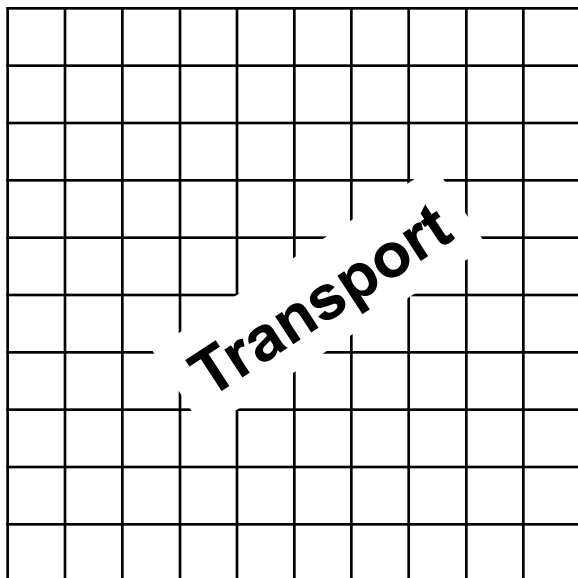
JFlow+
2m LiDAR Grid
'Stubby buildings' 0.3m

Return Period	Loss	Blanket Storm Duration (hours)
10	1 in 5yr	1&3
30	1 in 5yr	1&3
30CC	1 in 5yr	1&3
50	1 in 5yr	1&3
100	1 in 5yr	1&3
200	1 in 5yr	1&3
200CC	1 in 5yr	1&3

Assessing risk - impacts

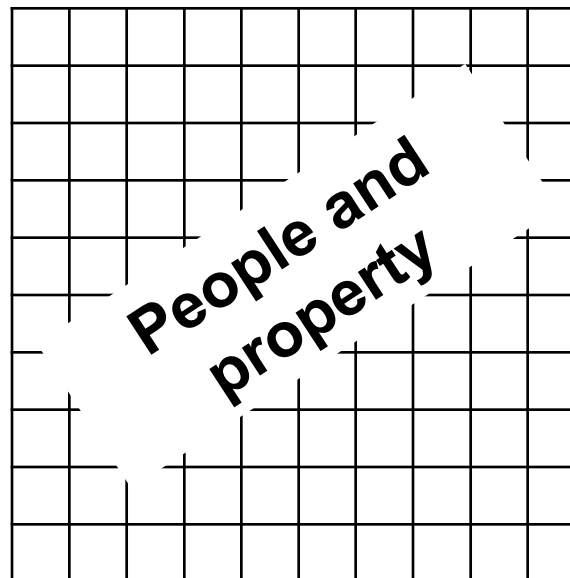
FLOOD RISK MATRIX GUIDANCE ON IMPACTS				
	Very Low	Low	Medium	High
Typical Impacts	Minimal Disruption Generally no impact, however there may be: <ul style="list-style-type: none"> Isolated and minor flooding of low-lying land and roads Isolated instances of spray/wave overtopping in coastal roads and promenades 	Minor Disruption <ul style="list-style-type: none"> Localised flooding of land and roads – risk of aquaplaning Localised flooding affecting individual properties Localised disruption to key sites on floodplains Individual properties in coastal locations affected by spray and/or wave overtopping Local disruption to travel 	Significant Disruption <ul style="list-style-type: none"> Flooding affecting parts of communities Damage of buildings/structures is possible Possible danger to life due to fast flowing/deep water/ wave overtopping/ wave inundation Disruption to infrastructure Small scale evacuation of properties may be required 	Severe Disruption <ul style="list-style-type: none"> Widespread flooding affecting whole communities Collapse of buildings/structures is possible Danger to life due to fast flowing/ deep water/ wave overtopping/ wave inundation Widespread disruption or loss of infrastructure Large scale evacuation of properties may be required
Expected Partner Response Level	Business as usual	Single agency operational response	Multi-agency response likely to be needed at tactical level. SGoRR may be considered.	Multi-agency strategic response likely at SCG level or regional level. Mutual aid likely with perhaps national co-ordination. SGoRR convened.
Implications for public	Generally no impact; however there may be some isolated and minor flooding. Little or no disruption to travel although wet road surfaces could lead to difficult driving conditions.	Localised flooding possible. Wet road surfaces and possibility of ponding water, especially in known trouble spots. Local disruption to travel – longer journey times.	Flooding of land and roads and property is likely. Disruption to travel and infrastructure.	Widespread flooding of property. Severe disruption to travel. Loss of gas, electricity, water supplies. Significant disruption to communities.

Publically available output



Probability of 5m of either roads or railway being flooded between 0400 Tuesday to 0400 Wednesday

	Negligible		Medium
	Very low		High
	Low		Very high



Probability of severe population and property impacts occurring between 0400 Tuesday to 0400 Wednesday

	Negligible		Medium
	Very low		High
	Low		Very high

Assessing risk - likelihood



Flood Risk Matrix
(surface water flooding)

Likelihood	High				
	Medium				
	Low				
	Very Low				
		Minimal	Minor	Significant	Severe
		Potential Impacts			

Overall Flood Risk

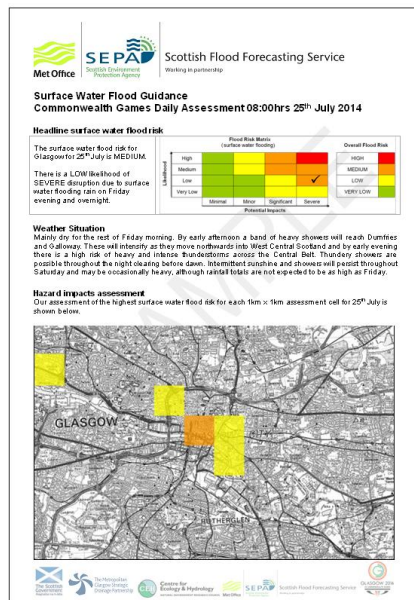
HIGH	
MEDIUM	
LOW	
VERY LOW	

Timeline

Project started		May 2013	
Stage 1	Literature review of best available science for forecasting and urban inundation modelling	Sep 2013	
	Develop recommendations for surface water alerting pilot model and future development of surface water flooding	Sep 2013	
Stage 2	Development of pilot model and configuration into SEPA systems	March / April 2014	In progress
Stage 3	Operational testing of pilot model	May / June 2014	
Stage 4	Demonstrate new capabilities during Commonwealth Games	July 2014	

Summary

- Operational pilot for a real time surface water impact model
- End user focused
- Linking forecasts with static maps / impacts



It's challenging but we have to start somewhere!

Summary reports: <http://www.crew.ac.uk/publications/surface-water-flood-forecasting-urban-communities-review>

SFFS blog: www.floodforecastingservice.net

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Visit our new SFFS blog: www.floodforecastingservice.net