Indicators and trends

Monitoring climate change adaptation

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Indicator name				Version
BT9 Disruption risk to railway services as a result of flooding				**31/03/16**

Indicator type:	Risk/opportunity	Impact	Action
	X		

SCCAP Theme	SCCAP Objective	CCRA risk/opportunity
Buildings and infrastructure networks	B1; B2	FL8b Railways at significant risk of flooding

At a glance

- Scotland's rail network is at risk of flooding from fluvial, pluvial and coastal sources.
- Climate change predictions suggest that flooding of rail infrastructure in Scotland will become extensive and more frequent
- The overall flood risk to the rail network is low, and thus the potential for flooding related disruption to the rail network in Scotland is also low
- The highest level of flooding related rail service disruption is posed by pluvial source flooding.
- Geographically, sections of the rail network that are exposed to the highest levels of flooding related rail service disruption are focussed around the central belt of Scotland

Latest Figure

Trend

Flood source	Rail service disruption level*	
	Severe level	All Levels
Fluvial	0.02%	2.62%
Pluvial	0.74%	8.41%
Coastal	0.00%	0.61%
Combined	0.76%	11.64%

*This assessment is based on 0.5% probability (1:200 year) flood events only

Why is this indicator important?

Transport supports many social and economic functions. In 2013/14, 86.3 million passenger journeys were made by rail in Scotland which represents 16% of all public transport journeys. Rail patronage has increased by 35% since 2004/05 and constitutes a growing share of public transport journeys. In contrast, there has been a decline of 8.2% in the amount of freight (tonnes) lifted by rail between 2002/03 and 2012/13. The modal share of freight (in tonne-km) carried by rail in Scotland in 2010 was 7% (Transport Scotland, 2014).

Flooding of rail infrastructure can cause disruption to rail transport with knock-on consequences for these functions – e.g. preventing or delaying people from accessing employment, delaying rail freight etc. Climate change predictions suggest that flooding of rail infrastructure will become more extensive and more frequent. This indicator will provide insight into any changes in such disruption.

Note that BT9 metrics measure the length of rail ***at direct flood risk*** (for a 1:200 year flood), for each of high, medium and low rail traffic volumes. It was not possible during the course of this project to obtain data that would show the length of rail routes that would be ***affected*** by one or more directly flooded sites. It may be possible to address this in the future if additional resources are made available. For example, if the Edinburgh – Glasgow line is flooded then a useful representation of the issue could include one or both of the following:

i) Total Length of the 'Major Route' affected – in this example approx. 40 miles, and
ii) The distance between the two stations separated by the flooding site (ie the length over which a replacement bus service would have to run)

Related indicators:
BT8 Railway network at risk of flooding
BT12 Flood events affecting the rail network
BT16 Rail network benefitting from flood protection measures

What is happening now?

Table 1 shows current figures for expected levels of service disruption from flooding. These are based on the amount of rail traffic carried through a section at flood risk (of a 1:200 year flood event). Thus severe disruption corresponds to a rail section with a high level of rail traffic that is affected by one or more flooded sites, moderate disruption to a flood site on a line with medium traffic load, and so on. The figures represent the proportion (by length) of the rail network that would experience disruption should flooding take place.

Table 1 Proportion of rail network affected by flooding (1:200 year event)

Flood source	Rail service disruption			Disruption (all levels)
	Severe	Moderate	Minor	
Fluvial	**0.02%**	**0.38%**	**2.22%**	**2.62%**
Pluvial	**0.74%**	**1.65%**	**6.01%**	**8.41%**
Coastal	**0.00%**	**0.00%**[1]	**0.61%**	**0.61%**
Disruption (all sources)	**0.76%**	**2.03%**	**8.84%**	**11.64%**

For all three sources of flooding assessed, the potential for disruption to railway services appears to be low as the majority of the rail network exposed to flood hazard serves low volumes of rail traffic. This also means that overall flood risk to the network is lower as well (where flood risk is assessed as a function of the likelihood and consequences of an event).

Figure 1 illustrates the rail network at risk of fluvial flooding. It shows that for fluvial source flooding only 0.02% of the exposed rail network serves high rail traffic volumes compared to 0.38% and 2.22% for medium and low traffic volumes respectively. In essence, whilst 2.62% of the rail network is exposed to a fluvial flood hazard (see BT8 assessment), only 0.02% of the network can be considered at high risk of flooding overall when the rail traffic disruption related consequences of flooding are taken into account. Similarly, the proportion of the rail network at high risk of flooding overall from pluvial and coastal sources is 0.74% and 0.00% respectively. The location of flood risks to the rail network for severe and moderate levels of flooding are shown on Figure 2.

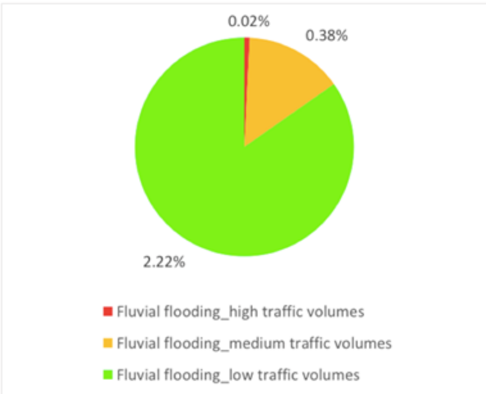

Figure 1. Proportion of rail network at risk of fluvial flooding by rail traffic volume / criticality (1:200 year flood event)

Sections of the rail network exposed to flood hazard carrying high rail traffic volumes are termed 'high criticality lines'. These represent the potential for severe levels of rail traffic disruption as well as higher flood risk overall. Medium criticality lines represent moderate disruption levels.

[1] This figure is correct to two decimal places. In reality 169.2m of the rail network is exposed to coastal flood hazard (1:200 year event) and carries medium volumes of rail traffic. This equates to 0.004% of the rail network as a whole.

Figure 2 Sections of the rail network exposed to severe and moderate levels of rail traffic disruption due to fluvial (LH map) and pluvial (RH map) flood hazards (1:200 year event)

Sections of the rail network that carry high and medium rail traffic volumes are focussed around the central belt of Scotland (e.g. the Glasgow to Edinburgh via Falkirk line; the various Glasgow and Edinburgh commuter lines), reflecting the densely populated nature of the region and the associated high demand for transport. The East and West Coast Mainlines also carry medium levels of rail traffic and are therefore exposed to moderate levels of disruption from flooding (though this assessment doesn't account for the strategic importance of these lines or the number of passengers using these services which may be higher due to the use of higher capacity trains). This is indicated in Figure 2. Areas of pluvial and fluvial flood risk are spread around the region reflecting the spatial distribution of watercourses and their catchments (fluvial flood risk) and impermeable features or sites with poor surface water drainage provision (pluvial flood risk).

What has happened in the past?

Historic flood hazard and rail traffic volume data are not available. However, historic climate data shows how rainfall has changed leading to impacts on biophysical systems (e.g. hydrological response of Scotland's catchments and watercourses) and ultimately changes to the scale and magnitude of the risk of rail network flooding. Overall there is a clear upward trend in winter precipitation as well as increasing heavy rainfall in winter (Sniffer, 2014). It is likely that these climatic changes will have led to increased frequency and extent of pluvial and fluvial source flooding[2]. It is not possible to show how the risk of rail traffic disruption due to flooding has changed without access to historic data on disruption of railway services. Rail service patterns will be driven in part by demand which is subject to change over time due to various drivers (e.g. population distribution, other demographic factors, distribution and type of economic activity, and so on).

[2] A fuller account of historic climate trends is provided in indicator BT2

What is projected to happen in the future?

The UK Climate Change Risk Assessment (HR Wallingford et al, 2012a; Thornes et al, 2012) assessed changes in flood risk to rail infrastructure as a result of anticipated climate changes. Whilst this assessment was only undertaken for England and Wales (due to data availability) it provides a broad indication of what might happen in Scotland in the future given anticipated climate changes. As such, transport specific aspects from the UK CCRA can be used in conjunction with general aspects from the Scotland CCRA (HR Wallingford et al, 2012b) to understand how flooding related impacts to rail infrastructure might change in the future.[3]

In terms of potential future flooding related climate risks to rail infrastructure, the results of the CCRA for England and Wales indicated that the projected length of railway at significant likelihood of flooding (where significant is defined as a 1.3% annual probability) would be between 2,000km and 2,600km by 2020 compared with a baseline of about 2,000km (Thornes et al, 2012). This equates to a possible increase of between 0% and 30% with the range reflecting the different climate change (emissions) scenarios considered in the assessment. The CCRA also highlighted how in addition to an increase in the overall length of infrastructure that could be affected, the frequency of flooding of infrastructure that is already located in the floodplain is expected to increase (ibid). These projections do not account for any actions that could be taken to alleviate flood risk to railways (e.g. flood defence infrastructure, enhanced maintenance regimes, etc) which may help to reduce overall flood risk (see indicator BT16). Whilst these projections are focussed on England and Wales (and therefore the specific regional climate projections and rail network issues and configuration therein), they provide a useful proxy of what may happen in Scotland.

In summary the following projected changes are anticipated in future:

- The proportion of the rail network located in areas at risk of flooding is projected to increase
- Rail infrastructure that is already located in the floodplain is expected to be affected by flooding more frequently
- Increased incidence of intense rainfall events may result in more frequent pluvial (surface water) flooding

The assessment above does not account for possible future changes in rail service patterns (e.g. frequency, number, location) which would affect the degree to which the rail network is exposed to flooding related disruption. It has not been possible to collate data on current and future rail service plans so possible future flooding related climate risks to the rail network, as a function of changing patterns of service delivery, have not been assessed.

Patterns of change

No patterns of change have been identified.

Interpretation of indicator trends

No trends identified for BT9 due to lack of historical data.

Limitations

[3] Indicator BT2 provides a more detailed description of the assessment in terms of climate projections and associated impacts on biophysical systems (the precursor of risks and impacts to socio-economic systems).

There are several key limitations to the assessment as summarised below:

1. Major railways located in the floodplain are often raised above the ground surface on embankments. The difference in elevation afforded by these embankments is not always identified in flood modelling and mapping (Thornes et al, 2012). Therefore, flood risk to rail infrastructure may be over-estimated – i.e. where the embankment would raise the railway out of the inundated area and this is not reflected in the modelling due to the granularity of SEPA's flood hazard modelling process.
2. The projections of what might happen in future in terms of flooding related climate risks to the rail network are based on English and Welsh data only from the UK CCRA. This provides a broad indication of possible future risks only. Furthermore, the assessment of future climate risks has not considered any data on rail service plans / possible future changes to service delivery.
3. Network Rail's Network Links Layer which was used in this analysis includes double sections of track at many locations as well as railway siding etc. Thus the total length of track used in this analysis does not correspond with the length of track published by Transport Scotland (2014) which counts one kilometre of single or double-track as one kilometre of route length.
4. Rail outputs from SEPA's Flood Risk Management Strategy Characterisation Data are based on a GIS intersect operation of flood extent polygons and rail network polylines. Within this, flooding of rail infrastructure is considered to occur regardless of flood depth or velocity.
5. Assessment was only undertaken for 0.5% probability (1:200 year) modelled flood events. These are low probability events and are located at the more severe end of the flood event spectrum. Higher probability events (e.g. 1:10, 1:50) can be expected to affect a smaller extent of the network than 1:200 year events but on a more frequent basis. It should also be noted that the flood hazard modelling is based on historic data. As a result of climate change, the magnitude of a 1:200 year event may be greater than represented in this analysis.

References

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Further information

Context and Overview for Transport Infrastructure Indicators (ClimateXChange Report)

Acknowledgements

SEPA provided spatial data on rail network flood risk assessment from an early version of the Flood Risk Management Strategy Characterisation Data (SEPA, 2015)

Network Rail provided spatial data for the Scotland Route.

The analysis and development of this indicator was undertaken by Dr Neil Ferguson (University of Strathclyde) and Dr Peter Phillips (Collingwood Environmental Planning Limited)

Appendix One: Indicator meta data and methodology

Table 1: Indicator meta data

Title of the indicator	BT9 Disruption risk to railway services as a result of flooding
Indicator contact: Organisation or individual/s responsible for indicator	Katherine Beckmann, Heriot Watt University / CXC
Indicator data source	• **Network Rail** – Scotland Route NetworkLinks layer (GIS polyline of the rail network in Scotland) • **SEPA** – early version of their 2015 Flood Risk Management Strategy Characterisation Data
Data link: URL for retrieving the indicator primary indicator data.	Network Rail: data available by arrangement only SEPA: data available by arrangement only

Table 2: Indicator data

Temporal coverage: Start and end dates, identifying any significant data gaps.	Single point analysis using an early version of SEPA's Flood Risk Management Strategy Characterisation Data (SEPA, 2015)
Frequency of updates: Planned or potential updates	
Spatial coverage: Maximum area for which data is available	Scotland-wide
Uncertainties: Uncertainty issues arising from data collection, data aggregation, data gaps.	SEPA (2015) Flood Risk Management Strategy Characterisation Data [not available online] Network Rail NetworkLinks layer: [n/a online]
Spatial resolution: Scale/unit for which data is collected.	**Network Rail NetworkLinks layer:** +/- 0.5m x and y **SEPA flood data:** 5m
Categorical resolution Potential for disaggregation of data into categories.	By sub-national geography e.g. Local Plan District (LPD), Potentially Vulnerable Areas (PVAs), catchments etc.
Data accessibility: Restrictions on usage, relevant terms & conditions.	The SEPA flood hazard data is available under licence The Network Rail NetworkLinks data is available by arrangement with Network Rail.

Table 3 Contributing data sources

Contributing data sources: Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.
SEPA Flood Risk Management Strategy Characterisation Data: [not available online] Network Rail NetworkLinks layer: [not available online]

Table 4 Indicator methodology

Indicator methodology: The methodology used to create the indicator data
Individual methodologies have been provided for each of the 9 metrics. A separate methodology has been provided for common elements. *Introduction to the approach*

This indicator provides a proxy assessment of the risk of disruption to railway services as a result of flooding. The assessment is based on thresholds for rail traffic volumes (number of trains per hour) which are used by Network Rail to define the criticality of the rail section – i.e. the greater the level of rail traffic the more critical the rail section (in terms of rail transport dependent services and activities) and the more susceptible it is to disruption by any source. This type of criticality approach has also been adopted in the English climate change adaptation indicators (HR Wallingford, 2014) to improve the understanding of risk – i.e. where risk is a function of the likelihood of an event occurring combined with the consequences. Thus, sections of the rail network that are exposed to flood hazard serving high rail traffic volumes will be at greater risk of disruption than sections serving lower traffic volumes, where the probability of flooding is the same.

The assessment is based primarily on SEPA's Flood Risk Management Strategy Characterisation rail output data for fluvial, pluvial and coastal source flooding (SEPA, 2015). These outputs include a 'NO_TRAIN_H' field defining the number of trains per hour for each rail section identified as at risk of flooding through SEPA's modelling and assessment. This field is used to define rail traffic volume / criticality thresholds that in turn are used to identify the proportion of the rail network at risk of flooding (all sources) carrying high, medium and low rail traffic volumes *or* high, medium and low criticality (see Methodology section for more details). High criticality sections are then construed as having the potential for severe levels of disruption as a result of flooding, and so on.

It should be noted that that the rail outputs from the SEPA data are based on a GIS intersect operation of flood extent polygons and rail network polylines. Within the SEPA (2015) Flood Risk Management Strategy Characterisation Data, flooding of rail infrastructure is considered to occur regardless of flood depth or velocity (ibid). This is a key limitation of the assessment.

Crucially, the assessment is based primarily on SEPA's modelled assessment of flood risk to rail infrastructure (ibid). This is a risk indicator based on modelled predictions of flood hazards and risks i.e. it is not based on data from actual flood events / impacts observed on the ground. It should also be noted that given resource constraints and the time taken to run GIS analyses etc, the assessment has been undertaken for 0.5% probability (1:200 year) flood events only.

Metrics assessed

Box 1. Metrics assessed under indicator BT9

- **BT9a:** Proportion of rail network at risk of **fluvial** flooding carrying **high** rail traffic volumes – potential for **severe** disruption
- **BT9b:** Proportion of rail network at risk of **fluvial** flooding carrying **medium** rail traffic volumes – potential for **moderate** disruption
- **BT9c:** Proportion of rail network at risk of **fluvial** flooding carrying **low** rail traffic volumes – potential for **minor** disruption
- **BT9d:** Proportion of rail network at risk of **pluvial** flooding carrying **high** rail traffic volumes – potential for **severe** disruption
- **BT9e:** Proportion of rail network at risk of **pluvial** flooding carrying **medium** rail traffic volumes – potential for **moderate** disruption
- **BT9f:** Proportion of rail network at risk of **pluvial** flooding carrying **low** rail traffic volumes – potential for **minor** disruption
- **BT9g:** Proportion of rail network at risk of **coastal** flooding carrying **high** rail traffic volumes – potential for **severe** disruption
- **BT9h:** Proportion of rail network at risk of **coastal** flooding carrying **medium** rail traffic volumes – potential for **moderate** disruption
- **BT9i:** Proportion of rail network at risk of **coastal** flooding carrying **low** rail traffic volumes – potential for **minor** disruption

Approach for defining criticality thresholds

Criticality thresholds are used to define sections of the rail network exposed to flood hazards that are high, medium and low risk in terms of their potential for rail traffic disruption. In essence, rail sections exposed to flooding serving high rail traffic volumes are considered to be high criticality and therefore high risk overall, etc. The following approach to defining criticality thresholds has been adopted (noting that this is based on ArcGIS functionality):

1. Redefine the symbology for the SEPA Appraisal fluvial flooding rail outputs layer to the 'NO_TRAIN_H' field (number of trains per hour) using the 'quantities' option.
2. Use the 'Natural Breaks' (Jenks) classification option defined to 3 classes.
3. Make a note of the 'NO_TRAIN_H' (number of trains per hour) thresholds within each band.

The methodology outlined above has been undertaken for fluvial flooding rail outputs data. The volume thresholds identified at (3) have then been applied to pluvial and coastal source flooding also. The volume thresholds applied in the remainder of the methodology (detailed below) are based on rail traffic volume data incorporated in an early version of SEPA's Flood Risk Management Strategy Characterisation Data as supplied in April 2015.

Methodologies adopted in the assessment of metrics

This section provides details of the methodology adopted to assess each metric. The methodologies include steps that are undertaken in a GIS indicated in pale green and steps that are undertaken in Microsoft Excel indicated in dark green. A separate metric calculation template has been created in Microsoft Excel.

Assessment methodology for Metrics BT9a to BT9c – risk of rail traffic disruption from FLUVIAL flooding	
Step	**Method**
1	Sum the SHAPE_LEN field from Network Rail NetworkLinks layer
2	Select flooded rail sections from the SEPA Baseline Appraisal **fluvial** output that carry **high** rail traffic volumes (i.e. high criticality sections) using the following query: NO_TRAIN_H VOLUME > 10
3	Select flooded rail sections from the SEPA Baseline Appraisal **fluvial** output that carry **medium** rail traffic volumes (i.e. medium criticality sections) using the following query: NO_TRAIN_H > 2 AND NO_TRAIN_H ≤ 10
4	Select flooded rail sections from the SEPA Baseline Appraisal **fluvial** output that carry **low** traffic volumes (i.e. low criticality sections) using the following query: NO_TRAIN_H ≤ 2
5	Sum the FL_Length field from the output of Assessment Step **No.2** to identify the total length of flooded (fluvial) rail sections that are **high** criticality
6	Sum the FL_Length field from the output of Assessment Step **No.3** to identify the total length of flooded (fluvial) rail sections that are **medium** criticality
7	Sum the FL_Length field from the output of Assessment Step **No.4** to identify the total length of flooded (fluvial) rail sections that are **low** criticality
8	Divide the output of Assessment Step **No.5** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9a: *Proportion of rail network at risk of* ***fluvial*** *flooding carrying* ***high*** *rail traffic volumes – potential for* ***severe*** *disruption*
9	Divide the output of Assessment Step **No.6** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9b: *Proportion of rail network at risk of* ***fluvial*** *flooding carrying* ***medium*** *rail traffic volumes – potential for* ***moderate*** *disruption*
10	Divide the output of Assessment Step **No.7** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9c: *Proportion of rail network at risk of* ***fluvial*** *flooding carrying* ***low*** *rail traffic volumes – potential for* ***minor*** *disruption*

Assessment methodology for Metrics BT9d to BT9f – risk of rail traffic disruption from PLUVIAL flooding	
Step	**Method**
1	Sum the SHAPE_LEN field from Network Rail NetworkLinks layer
2	Select flooded rail sections from the SEPA Baseline Appraisal **national pluvial** output that carry **high** traffic volumes (i.e. high criticality sections) using the following query: NO_TRAIN_H VOLUME > 10
3	Select flooded rail sections from the SEPA Baseline Appraisal **national pluvial** output that carry

	medium traffic volumes (i.e. medium criticality sections) using the following query: NO_TRAIN_H > 2 AND NO_TRAIN_H ≤ 10
4	Select flooded rail sections from the SEPA Baseline Appraisal **national** **pluvial** output that carry **low** traffic volumes (i.e. low criticality sections) using the following query: NO_TRAIN_H ≤ 2
5	Select flooded rail sections from the SEPA Baseline Appraisal **regional** **pluvial** output that carry **high** traffic volumes (i.e. high criticality sections) using the following query: NO_TRAIN_H VOLUME > 10
6	Select flooded rail sections from the SEPA Baseline Appraisal **regional** **pluvial** output that carry **medium** traffic volumes (i.e. medium criticality sections) using the following query: NO_TRAIN_H > 2 AND NO_TRAIN_H ≤ 10
7	Select flooded rail sections from the SEPA Baseline Appraisal **regional** **pluvial** output that carry **low** traffic volumes (i.e. low criticality sections) using the following query: NO_TRAIN_H ≤ 2
8	Sum the FL_Length field from the output of Assessment Step **No.2** to identify the total length of flooded (**national** pluvial) rail sections that are **high** criticality
9	Sum the FL_Length field from the output of Assessment Step **No.3** to identify the total length of flooded (**national** pluvial) rail sections that are **medium** criticality
10	Sum the FL_Length field from the output of Assessment Step **No.4** to identify the total length of flooded (**national** pluvial) rail sections that are **low** criticality
11	Sum the FL_Length field from the output of Assessment Step **No.5** to identify the total length of flooded (**regional** pluvial) rail sections that are **high** criticality
12	Sum the FL_Length field from the output of Assessment Step **No.6** to identify the total length of flooded (**regional** pluvial) rail sections that are **medium** criticality
13	Sum the FL_Length field from the output of Assessment Step **No.7** to identify the total length of flooded (**regional** pluvial) rail sections that are **low** criticality
14	Sum the output of Assessment Steps **No.8** and **No.11** to identify the total length of flooded (pluvial) rail sections that are **high** criticality
15	Sum the output of Assessment Steps **No.9** and **No.12** to identify the total length of flooded (pluvial) rail sections that are **medium** criticality
16	Sum the output of Assessment Steps **No.10** and **No.13** to identify the total length of flooded (pluvial) rail sections that are **low** criticality
17	Divide the output of Assessment Step **No.14** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9d: *Proportion of rail network at risk of **pluvial** flooding carrying **high** rail traffic volumes – potential for **severe** disruption*
18	Divide the output of Assessment Step **No.15** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9e: *Proportion of rail road network at risk of **pluvial** flooding carrying **medium** rail traffic volumes – potential for **moderate** disruption*
19	Divide the output of Assessment Step **No.16** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9f: *Proportion of rail network at risk of **pluvial** flooding carrying **low** rail traffic volumes – potential for **minor** disruption*

Assessment methodology for Metrics BT9g to BT9i – risk of rail traffic disruption from COASTAL flooding	
Step	**Method**
1	Sum the SHAPE_LEN field from Network Rail NetworkLinks layer
2	Select flooded rail sections from the SEPA Baseline Appraisal **coastal** output that carry **high** rail traffic volumes (i.e. high criticality sections) using the following query: NO_TRAIN_H VOLUME > 10
3	Select flooded rail sections from the SEPA Baseline Appraisal **coastal** output that carry **medium** rail traffic volumes (i.e. medium criticality sections) using the following query: NO_TRAIN_H > 2 AND NO_TRAIN_H ≤ 10
4	Select flooded rail sections from the SEPA Baseline Appraisal **coastal** output that carry **low** traffic volumes (i.e. low criticality sections) using the following query: NO_TRAIN_H ≤ 2
5	Sum the FL_Length field from the output of Assessment Step **No.2** to identify the total length of flooded (coastal) rail sections that are **high** criticality
6	Sum the FL_Length field from the output of Assessment Step **No.3** to identify the total length of flooded (coastal) rail sections that are **medium** criticality
7	Sum the FL_Length field from the output of Assessment Step **No.4** to identify the total length of

	flooded (coastal) rail sections that are **low** criticality
8	Divide the output of Assessment Step **No.5** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9g: *Proportion of rail network at risk of **coastal** flooding carrying **high** rail traffic volumes – potential for **severe** disruption*
9	Divide the output of Assessment Step **No.6** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9h: *Proportion of rail network at risk of **coastal** flooding carrying **medium** rail traffic volumes – potential for **moderate** disruption*
10	Divide the output of Assessment Step **No.7** by the output of Assessment Step **No.1** and multiply by 100. This produces a figure for BT9i: *Proportion of rail network at risk of **coastal** flooding carrying **low** rail traffic volumes – potential for **minor** disruption*