

Indicator name			Version
CRS12 Number of Community Services at significant risk of flooding			31/03/16
Indicator type:	Risk/opportunity	Impact	Action
	X		
SCCAP Theme	SCCAP Objective	CCRA risk/opportunity	
Climate Ready Society	S2 and S3 B2	FL1/2: Number of people/ vulnerable people at significant risk of flooding FL7/FL24/FL27: Flooding of non- residential property	

### At a glance

- The proportion of community services at risk from flooding is low.
- However, the level of exposure and vulnerability of up to 100 communities in a 10-year return period and as many as 350 communities in a 200-year return period will need further assessment. This should become available during 2016 through the *Local Development Plans* to be produced by lead Local Authorities for each of the 14 *Local Plan District*.
- SEPA's assessment of the overall risk remains very low.

Latest Figure	Trend
2015: Community Services at risk of flooding*: <ul style="list-style-type: none"> <li>• 10-year return period: 100 (1.6% of all Services)</li> <li>• 200-year return period: 350 (5.6% of all Services)</li> </ul> * measured against 6,241 Community Services identified in the appraisal baseline	Appraisal baseline data – no trends available.

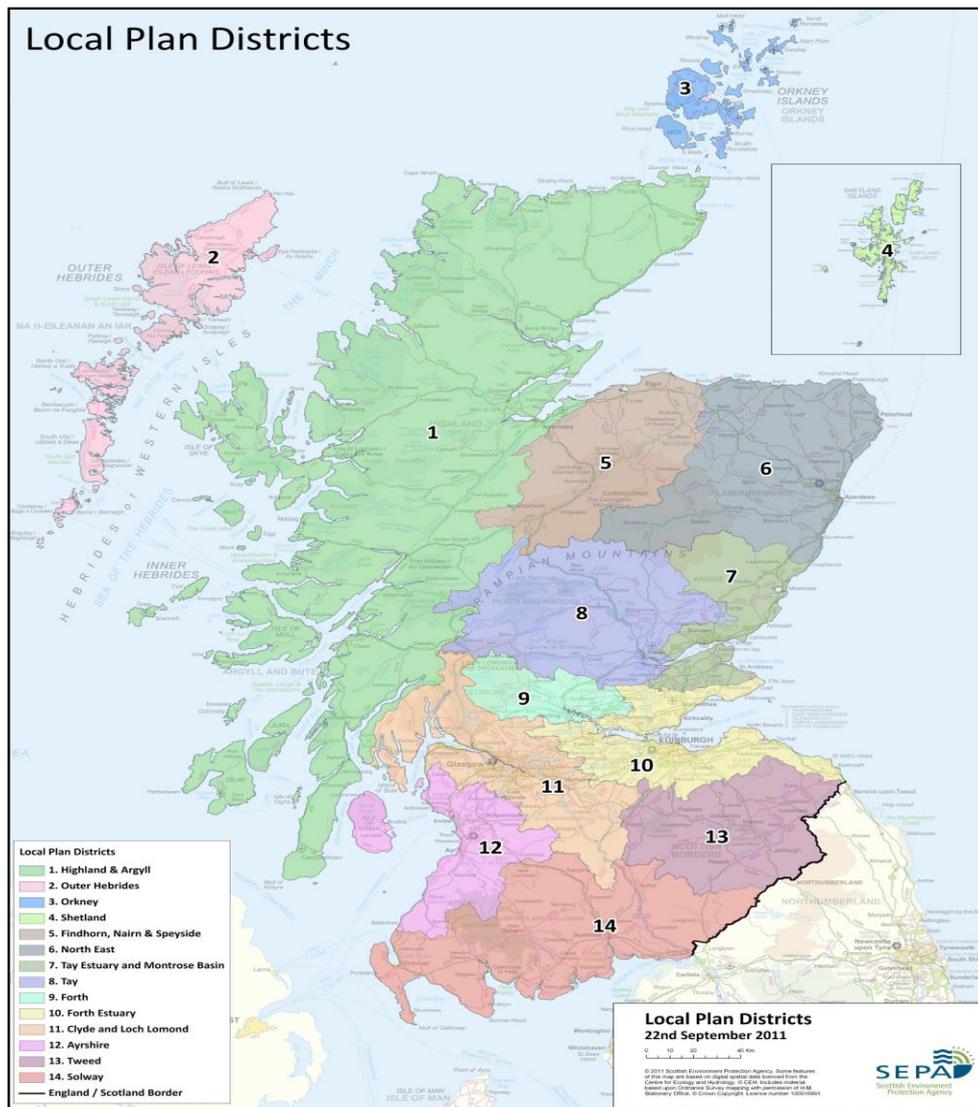
### Why is this indicator important?

SEPA's *National Flood Risk Assessment* has identified 289 Potentially Vulnerable Areas (PVAs) across 14 Local Plan Districts (Figure 1). These are based on river catchments and therefore cross both administrative and institutional boundaries (SEPA, 2011). SEPA is responsible for producing a *Flood Risk Management Strategy* for each Local Plan District by the end of 2015.

Using this guidance, the lead Local Authorities for each District will then develop *Local Flood Risk Management Plans*, which take the strategies and turn them into *Local Delivery Plans*, with implementation dates and corresponding funding requirements. They will also provide a mechanism

to co-ordinate actions at a local level for the next six years (the flood risk management planning cycle time); interim and final reports are to be produced in 2019 and 2022 respectively (SEPA, 2012).

A significant element of local resilience depends on the services that support communities: GP and dental surgeries, hospitals, schools, emergency services, post offices, etc. (Table 1). The extent to which these (individual) services are at risk needs to be understood to determine the integrity of community resilience as a factor in determining overall flood risk.



**Figure 1** Local Plan Districts identified in the National Flood Risk Assessment (SEPA, 2011)

**Related Indicators:**

- CRS20: Number of flood incidents attended by SFRS each year
- BW4: Wastewater treatment works in areas at flood risk
- BW5: Water treatment works in areas at flood risk

**What is happening now?**

Community Services are an important foundation for community resilience. In order of importance, these services include the following, as shown in Table 1:

**Table 1** Community Services Value Categories

Community Service	Value / Importance	Rationale
Hospitals / Ambulance Depots	4	Potential for large number of people to be affected, highly vulnerable population, 24 hour occupation of building, required in the case of an emergency
Residential Homes (Care, Nursing, Elderly)	3	Potential for large number of people to be affected, high number of vulnerable people located in property with buildings having 24 hour occupation
Education Facilities (Schools, Nurseries, Universities)	3	Potential for large number of people to be affected, high level of community disruption if building closure occurs, some properties may have 24 hour occupation (i.e. boarding schools, halls of residence)
WWTWs & Water Pumping Stations	2	Potential to affect large population if site affected by flooding. <i>Covered by indicators BW4 &amp; BW5</i>
Police Stations	2	Potential for emergency responders to be affected, facility is well placed and better prepared for emergencies
Health Centres / Clinics	2	Potential to cause relatively high levels of disruption to a number of people
Fire Stations	2	Potential for emergency responders to be affected, well placed to deal with flooding (vehicles able to pass through flood water)
GPs / Dental Surgeries	1	Low level community disruption a potential
Post Offices	1	Low level community disruption a potential
Pharmacies	1	Low level community disruption a potential

source: SEPA, 2011

The National Flood Risk Assessment methodology used this *Value* in developing a grid based risk score in order to identify a catalogue of Potentially Vulnerable Areas (PVAs) that warrant further, more detailed investigation (SEPA, 2011).

PVAs have been further assessed using the Appraisal Baseline Methodology, which includes a list of *receptors* (the entity – person, property, habitat - that may be harmed) and corresponding flood risk indicators that it will use in establishing the appraisal baseline<sup>1</sup> (SEPA, 2013). For Community Facilities (note a change of name between the Assessment and the Appraisal) these are presented simply as a count (Table 2), which it further recommends should be assessed on a site-by-site basis at a later stage. This recommendation should inform the development of *Local Delivery Plans*.

Overall risk in proportionate terms is very low, less than 6% of all Services nationally in a 1:200 year return period.<sup>2</sup>

<sup>1</sup> The aim of the method is to set objectives and identify measures for the management of significant flood risks within Potentially Vulnerable Areas. The appraisal is a strategic tool designed to answer the following question: "What is the most sustainable combination of structural and non-structural measures to tackle the significant flood risks that have been identified in Potentially Vulnerable Areas?"

<sup>2</sup> Using the current SEPA appraisal baseline dataset. This may in fact be an overestimate by around 4 percentage points (Metadata Table 2: Uncertainties).

**Table 2** Community Services at risk (count) – all sources of flooding

	Local Plan District	10 Year (0.1)	50 Year (0.02)	200 Year (0.005)
	1	12	18	45
	2	3	3	3
	3	3	3	4
	4	0	1	1
	5	4	8	18
	6	8	15	29
	7	2	6	14
	8	2	8	15
	9	2	4	9
	10	8	25	41
	11	31	59	86
	12	5	12	32
	13	11	18	31
	14	9	17	22
	<b>National</b>	<b>100</b>	<b>197</b>	<b>350</b>
	<b>National Community Service assets, all classes</b>			
	<b>6241</b>	<b>1.60%</b>	<b>3.16%</b>	<b>5.61%</b>

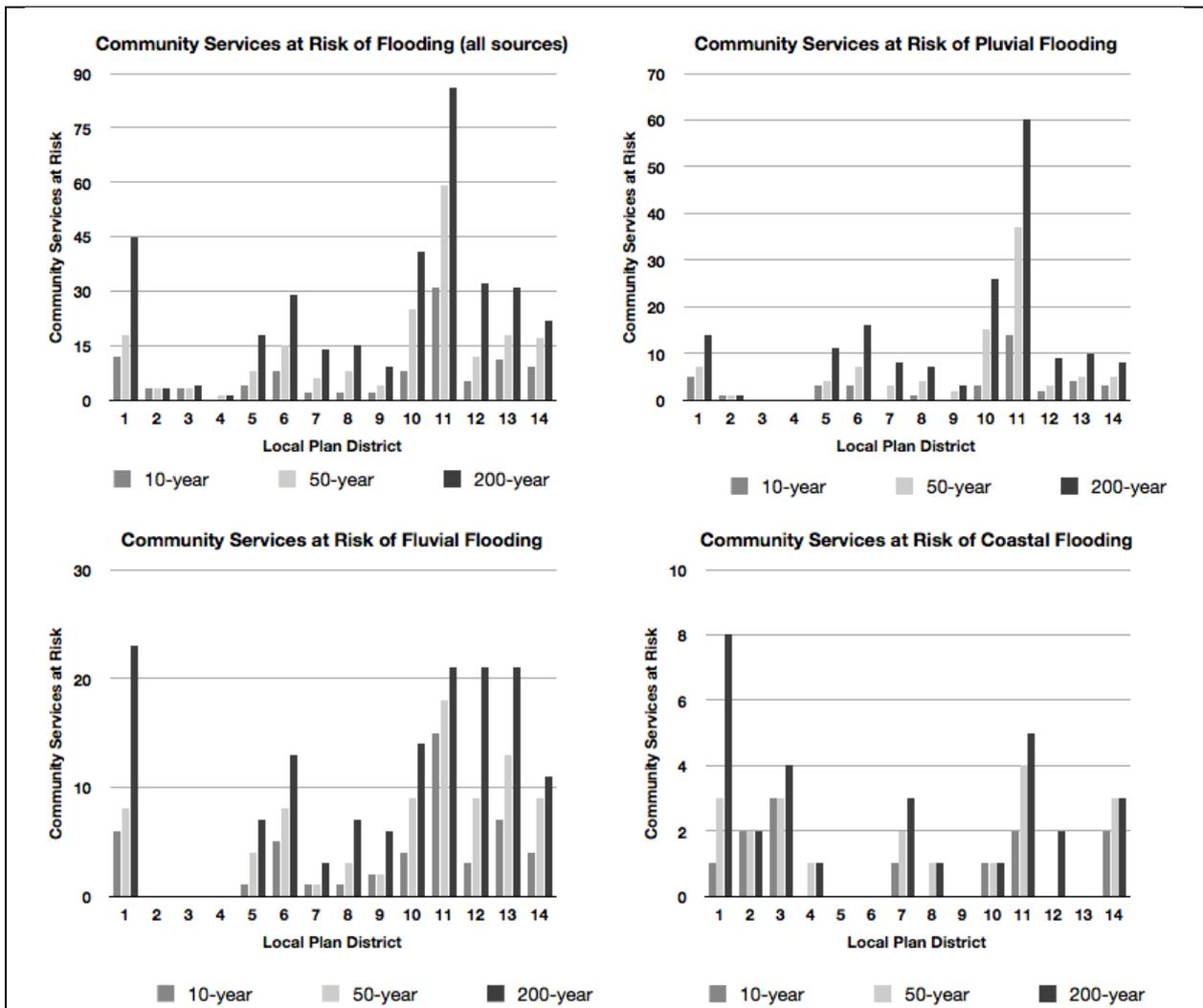
source: derived from appraisal baseline data (SEPA, 2013)

The 14 Local Plan Districts (LPDs) are based on river catchments and therefore cross administrative and institutional boundaries. They are illustrated above in Figure 1. Distributional effects are apparent in that the principal areas of risk exist in Highland & Argyll (LPD1), Tweed (LPD13) and particularly Clyde & Loch Lomond (LPD11), which includes the City of Glasgow.

If the underlying sources – pluvial (ground water), coastal, fluvial - are considered (Figure 2), Community Services in Clyde and Loch Lomond (LPD11) are at most risk from pluvial flooding. Community Services in Tweed (LPD13) and Highland & Argyll (LPD1) are most vulnerable to fluvial events, as might be expected.

It is also worth noting that Community Services in the Forth Estuary (LPD10), which includes the City of Edinburgh, are exposed to 1 in 200 year return events. So too, but to a significantly lesser extent, are Services in the North East (LPD6), which includes the City of Aberdeen.

Vulnerability to coastal flooding is confined primarily to Highland & Argyll (LPD1) and even here is low, perhaps reflecting the fact that Services are generally located away from the coast.



source: derived from appraisal baseline data (SEPA, 2013)

**Figure 2: Community Services at Risk of Flooding by Source**  
 [Note change of scale on y-axes]

**What has happened in the past?**

No comprehensive historical data for Community Services at risk has been identified. Where anecdotal evidence of specific events exists for Services, the data quality is generally too poor to provide any evidence base.

**What is projected to happen in the future?**

In each region, and across the country, the change in winter precipitation since 1961 shows a clear upward trend. Winter has seen the largest increase in average rainfall with an increase of 24% in the East and 45% and 51% in the West and North. In some areas of the west Highlands, winter rainfall has increased more than two-and-a-half times to 200 mm. Eastern areas have had their greatest increases in rainfall in the autumn, but there have been decreases in some areas in this season, including Shetland and parts of North-West Scotland. In spring, South-Eastern Scotland has become drier while western Scotland has become wetter.

Furthermore, there is an increasing trend in heavy rainfall ( $\geq 10\text{mm}$ ) with North and West Scotland

having seen an increase of more than 8 days. The patterns of change are broadly similar to those for total precipitation with a strong east-west gradient in winter months. Most of the west has seen an increase in winter of more than five days of heavy rainfall (Sniffer, 2014).

The main climate projections for Scotland are warmer and drier summers and warmer and wetter autumns and winters. However, convective storms, associated with surface water flooding, are likely to be more intense in summer months. Sea level rises and storm surges are also likely to lead to an increase in flood risk (Met Office, 2009).

The implication of these trends is that “with relatively small increases in sea level, (river) flow and rainfall, the number of properties at risk of flooding could increase substantially, *particularly for the more frequent flood events.*” (Scottish Government, 2014b). More frequent floods would begin to place greater stress on urban centres in particular – Glasgow, Edinburgh and Aberdeen in particular (Figure 2).

### Patterns of change

The *Local Flood Risk Management Plans* developed by the lead Local Authority for each LPD will take the *Flood Risk Management Strategies* and turn them into *Local Delivery Plans* by mid-2016. This should improve data availability and quality relating to Community Services. In particular, an assessment of risk for different asset types should be possible as well as more location specific information allowing for an estimate of the numbers of people affected and a better understanding of the relationships between hazards and Service asset classes.

### Interpretation of indicator trends

As this is the initial appraisal baseline, there are no trends.

### Limitations

- i. No breakdown data was available of the risk associated with the different types of Community Services, each of which has a different value (importance), evaluated against the potential disruption to a community, and according to criteria defined in the National Flood Risk Assessment (SEPA, 2011).
- ii. Unlike residential and non-residential (commercial) properties, no estimate of indirect economic impact is available for Community Services. This is at odds with the general statement that the appraisal assessment will consider direct and indirect damage (to receptors) and with the specific objective of reducing indirect economic damages to emergency services (SEPA, 2013).
- iii. In determining grid risk scores the NFRA took account of 40 of the 113 formal flood prevention schemes listed in the Scottish Flood Defence Asset Database (SFDAD), applying them to residential and non-residential (commercial) properties in ‘benefitting areas’. The appraisal baseline methodology also takes account of flood defences. However, the mitigating effect of these schemes on the risk to Community Services cannot be quantified.
- iv. Furthermore, there is no data on the defensive measures deployed to protect Community Services although there might be an expectation that higher ‘value’ assets would be defended first.

## References

Met Office (2009) *UK Climate Projections 2009 Key Findings*, available at <http://ukclimateprojections.metoffice.gov.uk/21708>

Scottish Government (2014a) *Scottish Government Urban/Rural Classification 2013-14*, available at: <http://www.gov.scot/Resource/0046/00464780.pdf>

Scottish Government (2014b) *Assessing the Flood Risk Management Benefits of Property Level Protection. Technical and economic Appraisal Report Draft v2*. September 2014. JBA Consulting for Scottish Government, available at: <http://www.gov.scot/Resource/0046/00466212.pdf>

SEPA (2011) *The National Flood Risk Assessment: Methodology*, available at: [http://www.sepa.org.uk/media/99914/nfra\\_method\\_v2.pdf](http://www.sepa.org.uk/media/99914/nfra_method_v2.pdf)

SEPA (2012) *Flood Risk Management Planning in Scotland: Arrangements for 2012-2016*, available at: [https://www.sepa.org.uk/media/42107/sepa-02-12-flood\\_risk\\_management\\_planning\\_in\\_scotland.pdf](https://www.sepa.org.uk/media/42107/sepa-02-12-flood_risk_management_planning_in_scotland.pdf)

SEPA (2013) *Flood Risk Management (Scotland) Act 2009. Appraisal Method for Flood Risk Management Strategies*. SEPA.

Sniffer (2014) *Scotland's Climate Trends Handbook*, available at: [http://www.environment.scotland.gov.uk/climate\\_trends\\_handbook/index.html](http://www.environment.scotland.gov.uk/climate_trends_handbook/index.html)

## Further information

EU Flood Action Programme: [http://ec.europa.eu/environment/water/flood\\_risk/key\\_docs.htm](http://ec.europa.eu/environment/water/flood_risk/key_docs.htm) in particular *Directive 2007/60/EC* on the assessment and management of flood risk <http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%203618%202007%20INIT>

*Flood Risk Management (Scotland) Act, 2009*  
<http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAct> and  
[http://www.legislation.gov.uk/asp/2009/6/pdfs/asp\\_20090006\\_en.pdf](http://www.legislation.gov.uk/asp/2009/6/pdfs/asp_20090006_en.pdf)

Local Plan District Summary Tables:

North [https://www.sepa.org.uk/media/47632/lpd\\_summary\\_tables\\_my\\_area\\_north.pdf](https://www.sepa.org.uk/media/47632/lpd_summary_tables_my_area_north.pdf)

South-West [https://www.sepa.org.uk/media/50414/lpd\\_summary\\_tables\\_my\\_area\\_south\\_west.pdf](https://www.sepa.org.uk/media/50414/lpd_summary_tables_my_area_south_west.pdf)

South-East [https://www.sepa.org.uk/media/50414/lpd\\_summary\\_tables\\_my\\_area\\_south\\_east.pdf](https://www.sepa.org.uk/media/50414/lpd_summary_tables_my_area_south_east.pdf).

Scottish Government (2011) *The Flood Risk Management (Scotland) Act 2009: Delivering Sustainable Flood Risk Management*, available at: <http://www.gov.scot/Resource/Doc/351427/0117868.pdf>

Scottish Government (2014) *Benefit Cost Analysis of Options to Manage Surface Water Flooding*, available at <http://www.gov.scot/Resource/0046/00467485.PDF>

SEPA (2015) *Strategic Flood Risk Assessment: SEPA technical guidance to support development planning*, available at: <https://www.sepa.org.uk/media/143351/lups-gu23-strategic-flood-risk-assessment-sepa-technical-guidance-to-support-development-planning.pdf>

## Acknowledgements

Lead author: Mike Bonaventura (Crichton Carbon Centre)

Data provided by SEPA.

## Appendix One: Indicator metadata and methodology

**Table 1: Indicator metadata**

	Metadata
<b>Title of the indicator</b>	CRS12 - Number of Community Services at significant risk of flooding
<b>Indicator contact:</b> Organisation or individual/s responsible for the indicator	ClimateXChange
<b>Indicator data source</b>	SEPA FRM Strategies dataset
<b>Data link:</b> URL for retrieving the indicator primary indicator data.	Data extract provided by SEPA 15 <sup>th</sup> September 2015.

**Table 2: Indicator data**

	Indicator data
<b>Temporal coverage:</b> Start and end dates, identifying any significant data gaps.	Appraisal baseline, initial snapshot 2015.
<b>Frequency of updates:</b> Planned or potential updates	In line with the flood risk management planning cycle – currently every 6 years.
<b>Spatial coverage:</b> Maximum area for which data is available	Scotland
<b>Uncertainties:</b> Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	<p>Uncertainties in the Sub-Catchment Unit assessment used in the National Flood Risk Assessment are discussed in SEPA (2011) §11.</p> <p>Data quality: although drawn from the Ordnance Survey Points of Interest dataset (SEPA, 2011), the absolute number of Community Service assets is far fewer than those in that original dataset: the OS PoI identifies 19,289 Services, of all classes, while SEPA identifies 6,241. For consistency, SEPA data has been used in developing this indicator. This may provide therefore an <i>over-estimate</i> of risk in proportional terms.</p>
<b>Spatial resolution:</b> Scale/unit for which data is collected	Local Plan District for all sources, pluvial, coastal, fluvial.

	Pluvial and fluvial data is also collected for individual hydrological areas.
<b>Categorical resolution:</b> Potential for disaggregation of data into categories	Local Plan District. Community Service asset types.
<b>Data accessibility:</b> Restrictions on usage, relevant terms & conditions	The data populating this indicator was provided directly by SEPA on request from ClimateXChange. SEPA sets terms and conditions on re-use of its data. Further information about these and the use of SEPA's Data is available from: <a href="mailto:dataenquiries@sepa.org.uk">dataenquiries@sepa.org.uk</a> or from the Information Management Unit, SEPA, Erskine Court, The Castle Business Park, Stirling, FK9 4TR

**Table 3 Contributing data sources**

<b>Contributing data sources</b>
Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.
SEPA Appraisal baseline data

**Table 4 Indicator methodology**

<b>Indicator methodology</b>
The methodology used to create the indicator data
<p>Community services are defined as education facilities, healthcare facilities, emergency services (police/fire and ambulance services), post offices, wastewater treatment works and water pumping facilities<sup>3</sup>. These services have been considered due to the community disruption that may occur if impacted (SEPA, 2011). Community Services derived from OS Points of Interest dataset.</p> <p>The <i>value</i> (or importance) of a community service has been determined with respect to the potential disruption that the lack of the service would cause to a community, including the number of people likely to be affected, and the type of organisation affected (i.e. whether the service is an emergency responder etc.). <i>Value</i> is also determined from the location of the service in the Urban-Rural classification (Scottish Government, 2014a). Services in remote locations are considered to be of higher value due to the fact that there are fewer facilities available geographically, and therefore travel distances become much longer - the 'value' score is upgraded by one category for remote or very remote locations.</p>

<sup>3</sup> Wastewater and water treatment works are considered in indicators BW4 and BW5 respectively.

The indicator is based on a count of community services in each Local Plan District as outlined in the Appraisal Method for Flood Risk Management Strategies (SEPA, 2013). The Lead Local Authorities for each LPD are provided in the Local Plan District Summary Tables.