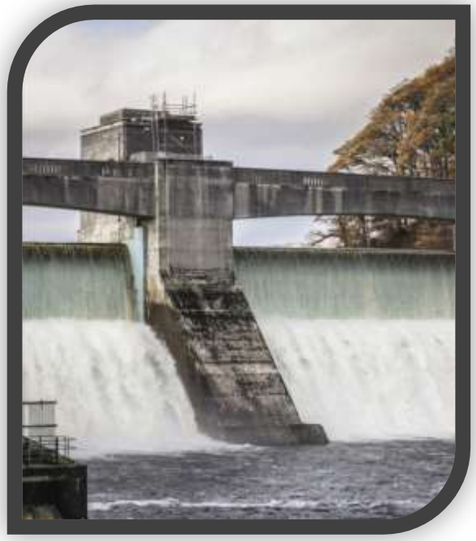

# Renewable and Low Carbon Energy Supplementary Guidance

# SEA Environmental Report

**August 2019**

**Perth & Kinross Council – Housing & Environment Service**

PERTH & KINROSS COUNCIL

in partnership with

The James Hutton Institute

## Acknowledgements

# SEA Cover Note

| Part 1 | |
|---|---|
| To: | SEA Gateway Team<br>2-H (South), Victoria Quay, Edinburgh, EH6 6QQ<br>**Email:** SEA_Gateway@gov.scot |
| **Part 2** | |
| An Environmental Report is attached for the plan, programme or strategy (PPS) entitled:<br>**Perth and Kinross Renewable and Low Carbon Energy Supplementary Guidance** | |
| The Responsible Authority is:<br>**Perth and Kinross Council** | |
| **Part 3** | |
| **An SEA is required** because the Strategy falls under the scope of Section 5(3) of the Act and is likely to have significant environmental effects | |
| **Part 4** | |
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| Date | 19.08.2019 |

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# Maps, Figures and Tables

# 1 Introduction

## 1.1 Requirement for SEA

The Environmental Assessment (Scotland) Act 2005 requires qualifying plans and programmes developed by public bodies to be subject to Strategic Environmental Assessment (SEA).

This Environmental Report covers the environmental assessment of the draft Renewable and Low Carbon Energy Supplementary Guidance. As this guidance deals with the subject matter of town and country planning or land use, it qualifies as requiring a Strategic Environmental Assessment under Section 5(3)(a) of the 2005 Act.

## 1.2 Scope of the Environmental Assessment

Strategic Environmental Assessment (SEA) has a key role to play in ensuring greater consideration of the impact that public plans, programmes and strategies will have on Scotland's environment and by providing an important opportunity for public participation in plan decision making.

SEA is an assessment of the likely effects that a plan will have on the environment if implemented. The findings of the assessment are outlined in an Environmental Report and a public consultation on the plan and the report has to be carried out before the plan can be adopted.

## 1.3 Environmental Report – Renewable and Low Carbon Energy Supplementary Guidance

For this Supplementary Guidance, the Environmental Report stage of the SEA identifies any potential significant positive and negative environmental impacts associated with the guidance for each renewable and low carbon energy technology set out in the SG. The role of the SEA is to also ensure that any negative environmental effects are avoided or mitigated through appropriate measures. The SEA assessment framework will also help identify strategic and cumulative environmental sensitivities thereby assisting the SG to steer renewable and low carbon energy developments to locations where environmental effects will be minimised, as well as provide a framework for the detailed assessment of development proposals.

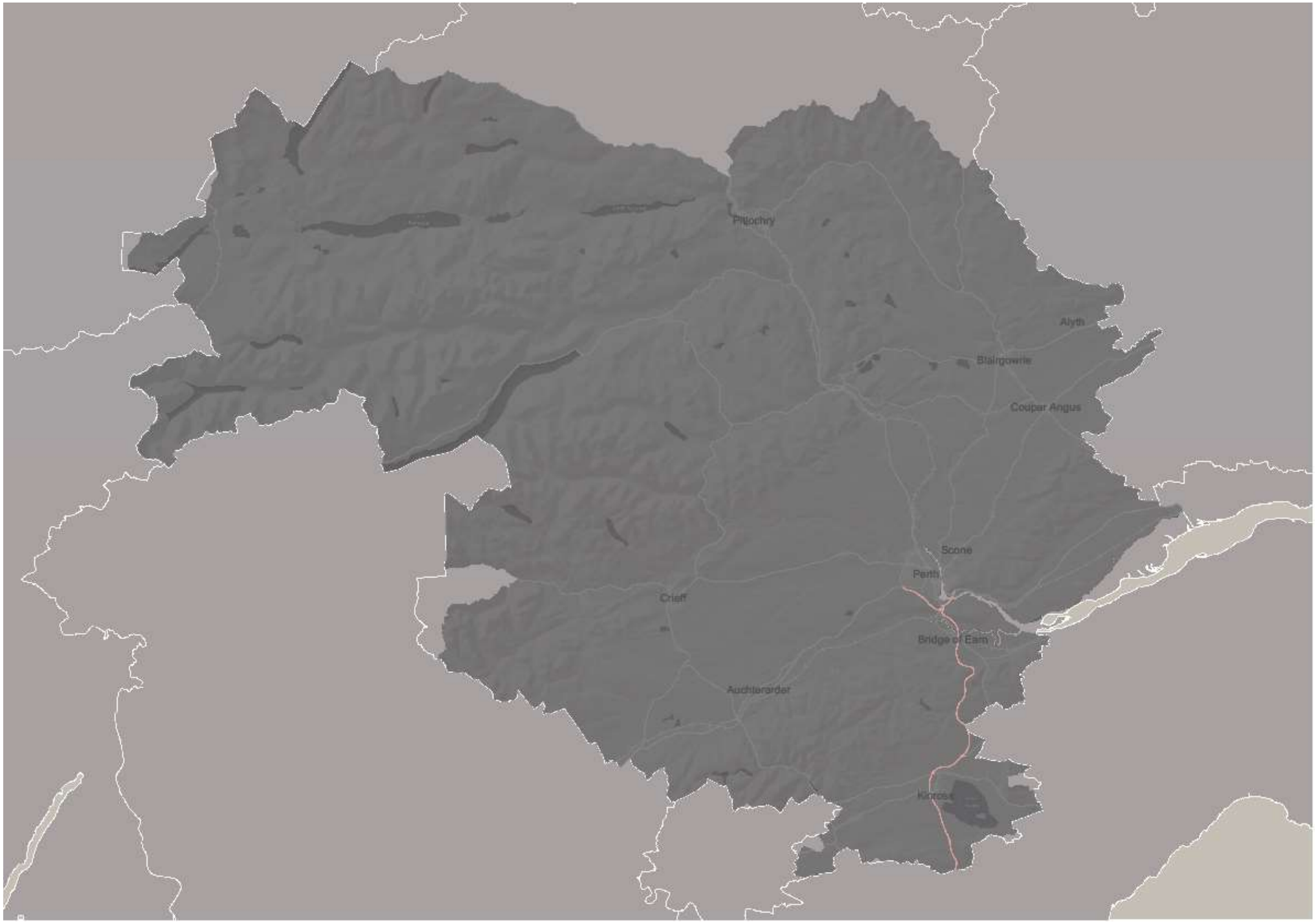
An interactive web map will be published alongside the adopted ~~to~~ Guidance. The searchable map can be used to view the Perth and Kinross Renewables and Low Carbon Guidance 2019. The web map will include policy guidance, landscape capacity, the spatial framework for wind as well as sensitivity mapping for wind, hydro and solar technologies. The web map will help to inform site selection as well as detailed design considerations as part of the application process.

Table 1.1 Key Facts about the Renewable and Low Carbon Energy Supplementary Guidance

| | |
|---|---|
| **Responsible Authority** | Perth & Kinross Council |
| **Title of PPS** | Renewable and Low Carbon Energy Supplementary Guidance |
| **Purpose of PPS** | The purpose of the Guidance is to provide further detailed information on the application of Policy 33: Renewable and Low Carbon Energy Generation of the 2017 Proposed Perth and Kinross Local Development Plan (LDP) as modified, when assessing development proposals for renewable and low carbon energy generation. |
| **What prompted the PPS** | Legislative provision – it will serve as statutory supplementary guidance to the Perth and Kinross LDP. |
| **Subject** | Town and country planning or land use |
| **Summary of nature/content of the PPS** | In addition to supporting the delivery of a diverse range of renewable and low carbon energy technologies the Supplementary Guidance (SG) will also guide development to appropriate locations and provide advice on the issues that will require to be taken into account when specific proposals are being assessed.<br>The document will include the following elements to address key requirements as outlined below:<br>• Scottish Planning Policy SPP **Spatial Framework for Wind** steering wind farms to the least sensitive locations in accordance with SPP Table 1: Spatial Framework for Wind<br>• Landscape Capacity Study (LCS) for Wind Guidance relating to the David Tyldesley Landscape Capacity Study (2010) which identifies the landscape sensitivity and capacity for wind energy development in the Perth & Kinross area<br>• **Spatial Policy Guidance** through Environmental Sensitivity maps and guidance for Wind (Group 3 areas only), Hydro and Solar technologies (developed as part of the Environmental Assessment process) to steer developments – at a strategic scale – to the least sensitive locations. The maps and guidance will inform the decision making process by identifying strategic scale environmental sensitivities and how any impacts can be considered as part of the planning/consenting process.<br>• **Policy Guidance** on a range of environmental, social and economic considerations which should be addressed – where relevant - when preparing renewable and low carbon energy proposals<br>The SG will support the implementation of a range of policies, and will set out a consistent approach to be applied across Perth & Kinross to assist applicants in preparing renewable and low carbon energy development proposals including proposals for repowering and battery storage. Once prepared the SG will form part of the Development Plan as statutory guidance and will be used in the assessment process to help determine the acceptability of development proposals. |
| **Period covered by the PPS** | The Supplementary Guidance focuses on a 5 year period (2019-2024) or until superseded. |
| **Frequency of** | 5 years or sooner if prompted by relevant legislative updates/LDP updates |

| | |
|---|---|
| **updates** | |
| **Area covered** | 4,707 km$^2$ |
| **Map included** | See Map 1.1 |
| **Are there any proposed PPS objectives** | • Yes, to provide a framework for the sustainable development of renewable and low carbon energy proposals within Perth & Kinross including guidance to steer specific developments to the least sensitive locations |

Map 1.1: Area Covered by the Renewable and Low Carbon Energy Supplementary Guidance



# 2 Plan Context

## 2.1 Background to the Renewables and Low Carbon Energy Supplementary Guidance

The Perth and Kinross Proposed LDP as modified, which is currently going through the adoption process, contains Policy 33: Renewable and Low Carbon Energy Generation (see Appendix 8). This Policy is to be applied as a key part of the assessment of development proposals for renewable and low carbon energy generation, and contains a commitment that the Council will produce supplementary guidance (SG) to expand on how proposals for development can comply with the Development Plan and in particular Policy 33. Therefore, the production of the Renewable and Low Carbon Energy Supplementary Guidance is essential in order to meet the terms of Policy 33 and for use in the assessment of future proposals for renewable and low carbon energy developments. Please note that the Examination Report for the Proposed LDP was published on 11 July 2019 which recommended various minor modifications to the Policy however until such time as the Plan is adopted the Proposed Plan as modified (including Policy 33) will be referred to. The adopted SG will incorporate any modifications to the Policy following the adoption of the LDP.

The Supplementary Guidance (SG) is intended to replace the existing guidance for wind energy development issued in 2005 and will support the delivery of a diverse range of renewable and low carbon energy technologies, including wind, solar, hydro, and other forms of renewable and low carbon energy generation. The SG will also include guidance on the expansion and repowering of existing renewable and low carbon energy developments.

## 2.2 Purpose and Scope

In addition to supporting the delivery of a diverse range of renewable and low carbon energy technologies generally, the SG will identify - through a spatial framework for wind, landscape capacity study for wind and the Strategic Environmental Sensitivity mapping for wind (Group 3 areas), hydro and solar – appropriate locations for development proposals. The SG will also provide detailed advice on the key considerations that will require to be taken into account by developers as part of the design and siting process and also when development proposals are being assessed.

The document will include the following elements:

- Spatial Framework for Wind (a requirement of Scottish Planning Policy (SPP) steering wind farms to the least sensitive locations)
- Guidance relating to the David Tyldesley Landscape Capacity Study (2010) which identifies the landscape's sensitivity and capacity for wind energy development in the Perth & Kinross area
- Strategic Sensitivity maps and guidance (developed as part of the Environmental Assessment process) for Wind, Hydro and Solar technologies to steer developments – at a strategic scale – to the least constrained areas. The maps and guidance will inform the decision making process by identifying strategic scale environmental constraints and how any impacts can be considered as part of the planning/consenting process.
- Guidance on a range of environmental, social and economic considerations which should be addressed – where relevant - when preparing renewable and low carbon energy proposals.

The Guidance will support the implementation of a range of policies, and will set out a consistent approach to be applied across Perth and Kinross to assist developers in designing and siting renewable and low carbon energy development proposals. Once formally approved, the SG will form part of the Development Plan as statutory guidance and will be used to assess the acceptability of development proposals.

In addition to the legislative requirement to assess the guidance under the Environmental Assessment (Scotland) Act 2005, in starting out on the process for producing the SG the Council is also mindful of the duty placed on planning authorities under Section 3E of the Planning etc. (Scotland) Act 2006 in relation to carrying out development planning functions with the objective of contributing to sustainable development and the emphasis in both National Planning Framework 3 and Scottish Planning Policy (2014) and Scotland's Second Land Use Strategy (2016 -2021) on applying an ecosystem approach to managing our natural capital. As such Perth & Kinross Council wish to embed ecosystems services alongside other environmental sensitivities within the Renewable and Low Carbon Energy SG and its associated SEA, in line with the Guidance Note on *Integrating an Ecosystems Approach into Strategic Environmental Assessment*.

## 2.3 Scoping Report Consultation

The Scoping Consultation undertaken by the Council in 2019, as well as the Environmental Assessment work previously completed for the previous Draft Guidance published in 2017, has helped to inform the preparation of this Environmental Report. A copy of all the consultation comments received and Council responses to these comments is included in Appendix 1.

## 2.4 Supplementary Guidance – Vision for Renewable and Low Carbon Energy

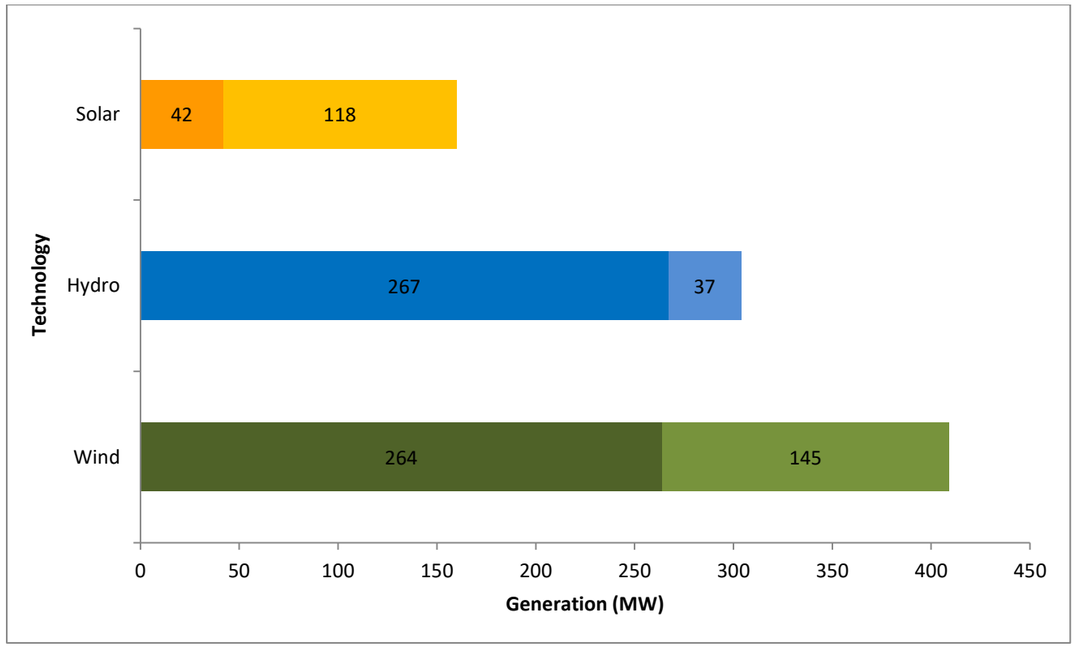
Climate change is a real and serious threat to the environment, the economy and society as a whole. Perth and Kinross has an obligation to act now to protect our natural and built environments including through the reduction of greenhouse gases. Part of the solution is via the deployment of renewable and low carbon energy options such as wind, solar, hydro along with low carbon heating and cooling technologies. Repowering and extending existing facilities will also play a part in supporting our efforts to mitigate against, and adapt to, the effects of climate change. Storage solutions for both electricity and heat can help to address some of the inherent issues with renewable production. The landscape and natural resources of Perth and Kinross provide an opportunity for locally produced clean energy that recognises the unique and valued attributes of the area. The vision is to promote the deployment of renewable and low carbon energy technologies in a way that is environmentally, socially, and economically sustainable.

## 2.5 Renewable and Low Carbon Energy in Perth and Kinross

The Scottish Government has ambitious renewable and low carbon energy targets to generate the equivalent of 100% of gross annual electricity consumption using renewable sources by 2020[1].

The existing installed capacity and potential rate of growth, based on consented and consulted schemes, in the renewables and low carbon sector over the coming years for the Perth and Kinross area is shown below.

Figure 2.1 –Existing/Approved/Consulted Schemes in PKC (MW)[2]




**75** onshore wind schemes with an installed capacity of **264 MW** and **55%** potential increase or further 301 turbines in approved or consulted schemes

**61** hydro schemes with a generating capacity of **267 MW** and further **14%** potential increase in approved/consulted schemes

4 Commercial (>1 MW) solar/PV schemes with a generating capacity of 42 MW and a **280 %** potential increase in approved/consented schemes

It is anticipated that Perth & Kinross Council will continue to experience proposals for a range of renewable and low carbon technologies over the coming years, subject to various factors including funding availability, etc.

[1] Scottish Government (2015) ENERGY IN SCOTLAND 2015
[2] 2017 figures.

# 3 ENVIRONMENTAL BASELINE AND ISSUES

## 3.1 Introduction

The identification of the current environmental baseline conditions and their likely evolution is an important part of the SEA process. A knowledge and understanding of existing conditions and the consideration of their significance helps with identifying those issues which the plan, programme or strategy (PPS), in this case the Renewable and Low Carbon Energy SG, should be addressing, and allows it to be successfully implemented and monitored.

The SEA Directive requires that the likely evolution of the environmental baseline for the area, without the implementation of the PPS, is considered. This is useful in the assessment of significance of effects, particularly in respect of those conditions which may already be improving or worsening, and the rate of that change. The type of data which has been collected for the environmental assessment is largely determined by:

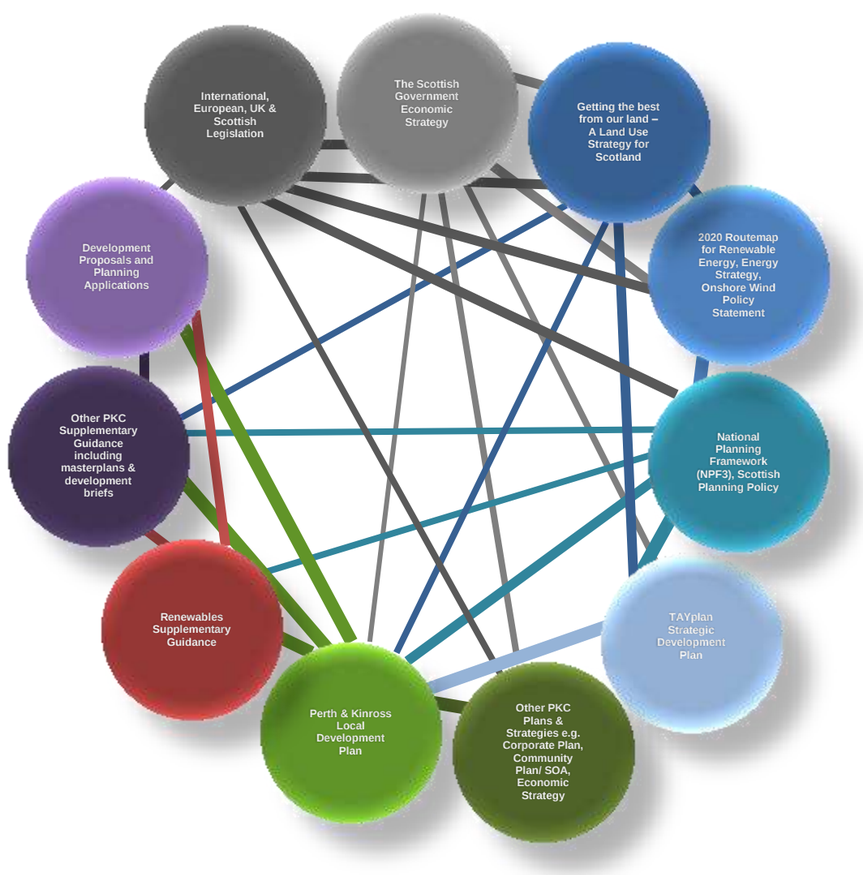
- The environmental topic to which it relates
- The SEA Objectives
- The aspects of each environmental topic chosen for the basis of the assessment
- The level of assessment proposed
- The environmental data available, and
- Responses received to the Scoping Report published in 2015 & 2019 in preparation of this Environmental Report

## 3.2 Relevant Plans, Programmes and Strategies

The review of plans, programmes and strategies (PPS) as part of the SEA process is a useful way of ensuring that the relationship between these documents and the SG is fully explored, and also that the relevant environmental protection and sustainability objectives are taken into account through the SEA.

Reviewing plans, programmes and strategies can also provide appropriate information on the baseline for the plan area and the key environmental and/or sustainability issues. The plans and programmes thought to have an influence on or which will be influenced by the Renewable and Low Carbon Energy SG are set out in Appendix 2 to this document. The SG sits within a hierarchy of plans, programmes and strategies as shown in Figure 3.1. A comprehensive analysis of the relevant PPS was already undertaken for the SEA of the higher level Local Development Plan; the results of that exercise were used to identify the key issues across the Perth and Kinross area, and also to help develop the SEA Objectives used in the assessment of that plan. Therefore, in order to avoid duplication, the analysis in Appendix 2 of this report concentrates on those PPS which are thought to be particularly relevant to renewable and low carbon energy generation. The review of some of these documents has been summarised below.

Figure 3.1: Interrelationship of Supplementary Guidance with Other PPS



**The Climate Change (Scotland) Act 2009**

The Climate Change (Scotland) Act 2009 recognised the need to shift from a dependency on unsustainable fossil fuels in order to reduce emissions. Subsequently, the Scottish Government set ambitious targets to provide by 2020:

- 30% of overall energy demand from renewables;
- 11% of our heat demand from renewable sources; and
- The equivalent of 100% of our electricity demand.

**Climate Change (Emissions Reduction Targets)(Scotland) Bill**

The Climate Change (Emissions Reduction Targets)(Scotland) Bill published in May 2018 has made the provision for raised greenhouse gas emission reduction targets currently associated with the Climate Change (Scotland) Act 2009, including provision for achieving net-zero emissions as soon as possible. The Bill is currently subject to scrutiny by the Scottish Parliament as part of the legislative process and the final outcome(s) are not yet known.

**Climate Change Plan (The Third Report on Proposals and Policies 2018-2032)**

The Scottish Government also recently published the Climate Change Plan (The Third Report on Proposals and Policies 2018-2032) to set out how the emissions reduction targets will be met through existing legislation.

**Energy Strategy**

The Energy Strategy, published in 2017, sets out the Scottish Government's long-term strategy for a flourishing, competitive local and national energy sector, delivering secure, affordable, clean energy for Scotland's householders, communities and businesses. The Strategy sets out two key targets for the Scottish energy system:

- The equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied from renewable sources.
- An increase by 30% in the productivity of energy use across the Scottish economy.

Specifically looking at renewable and low carbon solutions, the Energy Strategy has identified that the Scottish Government will continue to support and explore the potential of Scotland's renewable energy resource in helping to achieve the emissions reduction targets.

**Onshore Wind Policy Statement**

Published in 2017, the Onshore Wind Policy Statement sets out the Scottish Government's legislative and policy framework to support the onshore wind sector, in particular setting out the key aspirations and considerations for issues such as repowering, protecting residents and the environment, community benefits and shared ownership.

**National Planning Framework 3 and Scottish Planning Policy**

Both the National Planning Framework (NPF3) and Scottish Planning Policy (SPP) make it clear that planning has a crucial role to play in facilitating Scotland's transition to a low carbon economy, consistent with national objectives and targets. SPP specifies that in addition to supporting this shift, the planning system should:

- Support the development of a diverse range of electricity generation from renewable energy technologies – including the expansion of renewable energy generation capacity and the development of heat networks;
- Guide development to appropriate locations and advise on the issues that will be taken into account when specific proposals are being assessed;
- Help to reduce emissions and energy use in new buildings and from new infrastructure by enabling development at appropriate locations that contributes to:
    I. Energy Efficiency
    II. Heat Recovery
    III. Efficient energy supply and storage
    IV. Electricity and heat from renewable sources; and
    V. Electricity and heat from non-renewable sources where greenhouse gas emissions can be significantly reduced.

The desire to transition to a low carbon economy is reaffirmed through The Government Economic Strategy (September 2011), which established this as an additional priority to reflect the need for urgency in meeting emission targets and to take advantage of current conditions for adaptation and investment. The Strategy highlights that realisation of this priority will be central to maximising the nation's sustainable economic growth rate, particularly in the long-term.

In respect of 'Heat', 'Onshore Wind' and 'Other Renewable Electricity Generating Technologies and Storage', SPP comments that development plans should:

- Use heat mapping to identify the potential for co-locating developments with a high heat demand with sources of heat supply;

- Support the development of heat networks in as many locations as possible;
- Identify where heat networks, heat storage and energy centres exist or would be appropriate and include policies to support their implementation;
- Set out a spatial framework for identifying those areas that are likely to be most appropriate for onshore wind farms as a guide for developers and communities – indicating a minimum scale of onshore wind development that the spatial framework is intended to apply to, and criteria that will be considered in deciding all applications for wind farms of different scales, including extensions and re-powering;
- Identify areas capable of accommodating renewable electricity projects in addition to wind generation, including hydro-electricity generation (river or tidal flows) or energy storage projects of a range of scales; and
- Identify areas which are weakly connected or unconnected to the national electricity network and facilitate development of decentralised and mobile energy storage installations.

In terms of delivering a low carbon economy, SPP identifies that development plans should seek to ensure an area's full potential for electricity and heat from renewable sources is achieved, in line with national climate change targets, giving due regard to relevant environmental, community and cumulative impact considerations. In addition, LDPs should support new build developments, infrastructure or retrofit projects which deliver energy efficiency and the recovery of energy that would otherwise be wasted both in the specific development and surrounding area. They should also set out the factors to be taken into account in considering proposals for energy developments.

Following on from this the Proposed Perth and Kinross LDP, as modified, includes Policies 33 (Renewable Energy and Low Carbon Energy Generation) and 34 (Sustainable Heating and Cooling) which set out the framework for managing heat and energy use and generation in Perth and Kinross. The Renewable and Low Carbon Energy SG will provide detail and clarity for use in both the preparation of development proposals and the decision-making process, and will also help to ensure that the national priority and targets, in terms of transitioning to a low carbon economy, are translated into and implemented at a local planning policy level. The Sustainable Heating and Cooling SG will provide detail and guidance in relation to development proposals where there are identified heating and/or cooling implications including identifying heat network zones. The SG will also consider the Council's Local Heat and Energy Efficiency Strategy pilot project undertaken in the Perth North area as well as other related energy planning projects that will help to shape and contribute to more sustainable forms of energy use by businesses and communities across the Perth and Kinross area.

## 3.3 Baseline Data and Relevant Aspects of the Current State of the Environment

The inclusion of data helps to build a picture of the social, economic and environmental characteristics of the area, and the key environmental issues which it faces. Prior to producing this Environmental Report a lot of consideration has been given to the question of what information should be included within the assessment; this was in order to ensure that a more relevant and focussed set of data was collated for the range of topics likely to be specifically influenced by the Renewable and Low Carbon Energy SG.

The development of the SEA for the SG relies on a wide-ranging and up to date environmental baseline. Macaulay Research Consultancy Services produced a State of the Environment Report (SoE) for the Perth & Kinross Council area in October 2007, as updated. This report established the environmental baseline of the Perth and Kinross area and is updated on a regular basis as and when new data becomes available. Spatial data has also been compiled from Scotland's Environment Web. Scottish Government Land Use Data Directory, key agencies and various additional sources and can be used to create a comprehensive range of environmental indicator data. Data gaps have been highlighted for environmental issues for which there are no obvious datasets available. Appendix 3 to this report details the data which has been collected in order to inform the development of the environmental baseline, and which will also be used in undertaking the Environmental Assessment.

## 3.4 Key Baseline Facts for Perth and Kinross

The following table provides some key baseline facts for the Perth and Kinross area relevant to renewable and low carbon energy. Figures 5.7 to 5.22 show the spatial distribution of various environmental considerations across the Council area included as part of the spatial assessment of the SEA.

Table 3.1: Ecosystem Services, Associated Key Facts and Relevance of Indicators

| SEA Topic | Associated Key Facts | Relevance of the Indicator |
|---|---|---|
| **Biodiversity, Flora & Fauna** | The Forestry Commission (now Scottish Forestry) identified approximately 57,142 ha of ancient and semi-natural woodland in Perth and Kinross (2006). | The historic character of the environment is important to quality of life and sense of identity, and it is a vital contributor to the economy through the attraction of visitors. As well as this ancient and semi-natural woodland also has a high biodiversity value. Constant change in the environment is a result of natural processes, such as erosion, and human interventions, such as land management, urban and rural development, transportation and pollution. |
| | Protected areas – also known as designated sites – help to ensure that their natural features of special interest remain in good health for all to enjoy, now and in the future. Approximately 36% of Perth and Kinross is designated under national or international legislation to protect habitats and species (including Ramsar, SAC, SPA, SSSI).<br><br>In 2019 75.1% of designated sites were considered to be in favourable condition, with 5.7% in recovering status and 19.2% in unfavourable status. Further information is available on specific sites including details about latest assessed condition, site visits, etc. on the Scotland's Environment website.<br><br>Surveys of the number of breeding waders at several key wader breeding sites in Perth and Kinross have been undertaken by RSPB in 2012. This is of particular relevance to floodplain and other wetland habitats and in-bye farmland, where inappropriate development can have a significant adverse impact on priority bird populations such as breeding waders.<br><br>The Perth and Kinross Council area contains or adjoins 8 IBA's covering nearly 44, 000 ha.<br><br>These key facts also apply to the soil and land use/cover topics. | The diverse wildlife and habitats of the area are highly valued locally, nationally and internationally and are resources that need to be protected. Biodiversity benefits communities and human health through the provision of a high quality environment in which to live. This indicator identifies those areas within the Council Area highlighted for their contribution to the landscape and identified for specific and habitats protection. (It should be noted that designation of an area does not guarantee its quality). |
| **Population, Human Health & Access** | Development should not only contribute towards new green infrastructure as the need arises as a result of individual developments, a contribution should also be made towards existing green infrastructure, by improvement or enhancement and / or by ensuring that there is no adverse impact or fragmentation of existing green infrastructure as a result of development.<br><br>These are requirements are placed on developers through Local Development Plan policy. However there is also a growing demand from the public for developers to create places which are healthier, more attractive and pleasant, more sustainable and better able to withstand the effects of climate change, and which work with nature and the environment rather than against it. | Open space and woodland are valued elements of the landscape. Access to these areas contributes to long term human health and wellbeing.<br><br>Planning authorities should consider the need to strengthen and develop existing access and greenspace networks, and the contribution that these areas might make to improving quality of life and providing opportunities for informal recreation as part of their open space audits and strategies and core path planning. |
| **Soils** | Approx. 11% or 57,000ha of prime agricultural land are located in the south and eastern areas of Perth and Kinross. Most (~ 25%) of large abstractions of water for agriculture are also in these areas. | This information is widely used as a basis of land valuation on the basis of its potential productivity and cropping flexibility – determined by the extent to which the physical characteristics of the land (soil, climate and relief) impose long term restrictions on its agricultural use.<br><br>Total income from farming in Scotland amounts to approximately £600m/year. The relative value of agricultural output is indicated by average Gross Margin for the main farming enterprises (SAC, The Farm Management Handbook, 2011/12, 32nd Edition) for each surface inland water body catchment. The highest value farming takes place in the water body catchments on the east and north east coast which is also where the largest abstractions for agriculture are licensed. Farming also provides employment for people in many remote areas where there is no alternative employment |
| | At 1:250 000 scale, 11.6% (62000ha) of the area is occupied by prime agricultural land (class 2 and 3.1).<br><br>The 50K soil map surveys mapped in more detail identify the most productive soils in the south east fringe. The area of prime agricultural land (class 2 to 3.1) occupied 57,000ha. Land capable of average production excepting high yield of barley, oat and grass (LCA class 3.2) cover another | Pressures from increased development activity have the potential to impact the prime agricultural land resource. Relevant planning policies addressing landscape and environmental issues need to be taken into account when considering development of prime quality agricultural land. |

| | | |
|---|---|---|
| | 45,250ha on the 50K map and 45,000ha on the 250K map.<br><br>Over 50% of the area is occupied by soil class 6 and 7 (rough grazing and soil of limited agricultural values). | |
| | Soil Major sub groups considered to be of national interest occurring in the area include:<br><br>▪ Humus – iron podzols in semi natural settings (associated with native pinewood forests)<br><br>▪ Peat – peatland habitats<br><br>▪ Alluvial soils – associated with river geomorphology (<5%)<br><br>▪ Alpine and subalpine soils – sensitive to degradation (<5%) (SNH, 2013) | Healthy soils provide a range of environmental, economic and social benefits, which include providing the basis of the agricultural and forestry industries.<br><br>Threats to soil functions are erosion and compaction related to land management, contamination, sealing, loss of biodiversity, acidification from acid rain, climate change, and loss of organic matter and capacity to act as a carbon store. |
| | Soil types with potential higher organic content and associated peat store higher quantities of carbon in the soil. The higher this quantity the less CO2 is spread in the atmosphere which would assist with climate change mitigation. Organo-mineral and organic soils are mainly located on the North West fringe of the area and cover around 2000 km2. | |
| | Carbon rich soils, deep peat and priority peatland habitat represent areas likely to be of high conservation value and the Council area contains over 55,000ha of Class 1 and over 54,000ha of Class 2 soils. Class 5 soils are also an important carbon store, all of which are carbon-rich and deep peat. The Council area contains 30,744 ha of Class 5 soils. | |
| | State of Scotland's Soils (2011) - key facts about Scottish soils are:<br><br>• Only 25% of Scottish soils are cultivated for agriculture (including improved grassland); this is much lower than in most European countries. An additional 45% is also used for agriculture for rough grazing;<br><br>• 17% of soils are forested with a target to increase this to 25% by 2050;<br><br>• the majority of Scottish soils have highly organic surface horizons, often over 30% organic carbon in organo-mineral soils (soils with an organic surface layer less than 50 cm), but often over 50% in peats (organic surface layer more than 50 cm thick);<br><br>• these highly organic soils are acidic and have low inherent fertility;<br><br>• Scottish soils store over 50% of the UK's soil carbon and are expected to play a significant role in mitigating greenhouse gas emissions;<br><br>• many Scottish soils are naturally very poorly drained;<br><br>• some Scottish soils support a number of internationally important habitats, for example blanket bog, heather moorland and machair; | |
| **Water** | Currently approximately 160,000 ha or 36% of sub catchments intersecting the Perth and Kinross Planning Authority area provide drinking water services. 97% of drinking water is supplied by Scottish Water with the remaining 3% coming from private supplies. | Drinking water is essential for our survival.<br><br>The service that the water environment provides is volumes of water for abstraction and use in drinking water. This service is provided by lochs, rivers and groundwaters.<br><br>The data we have shows the relative number of people who have access to drinking water. It has been calculated from the abstraction size by assuming that each person requires 300 litres/day. |
| | According to the Scottish River Basin Management Plan (2015), over 80% of water bodies in the | Improving and maintaining the ability of the water environment to support life is a fundamental |

| | | |
|---|---|---|
| | Scottish District achieved good or high status. In the Perth and Kinross area in 2017 a slightly lower percentage, 45%, of the total number of rivers were classified as being of good status or better, with areas in the East and South containing rivers of bad or poor status. | purpose of the Water Framework Directive (WFD). |
| | In the Perth and Kinross area in 2017 82%, of the total number of groundwater bodies were classified as being of good status or better, with areas in the East and South containing groundwater bodies of bad or poor status. The entirety of the Council area is a ground water drinking protected area (SEPA 2014)**.** | |
| | SEPA has identified approximately 14, 660 ha of wetlands in Perth and Kinross (2009). Across Scotland most wetlands within protected sites are in favourable condition, with the exception of lowland raised bogs where 59% of sites are in unfavourable condition.<br>There is little information about wetlands outside protected areas (SEPA, 2016) | |
| **Air** | Carbon dioxide emission estimates per capita in Perth and Kinross have decreased slightly since 2007. In 2012, 8.1 tonnes of CO2, a rise of 0.6 over previous year, were emitted per capita, compared with 6.7 tonnes per capita as an average across Scotland. Of this, 27% were from the Industry and Commercial sector, 31% were from domestic and 42% were from road transport.<br><br>A relatively larger proportion of carbon emitted in Perth and Kinross is taken up by land use, land use change and forestry than at the Scottish level. | The gases that contribute most to the greenhouse effect are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorine compounds. Carbon dioxide from transport, industry and domestic sources (such as heating, lighting and cooking) is the main greenhouse gas emitted in Scotland and Perth and Kinross. |
| | There are currently two Air Quality Management Areas in Perth and Kinross, one in Perth and one in Crieff. Actions are currently being taken forward by PKC and relevant stakeholders to improve air quality issues within the two AQMAs (PKC Air Quality Annual Progress Report, 2016). | Clean air is essential for a good quality of life. Exposure to air pollution can have a long-term effect on health. |
| **Climatic Factors** | In 2015, Perth and Kinross has 3.15% of the nation's installed microgeneration capacity, the second highest in Scotland and the UK. Installed capacity for windfarms in Perth and Kinross has increased by 70 MW since 2011 and in 2015 wass approximately 264 MW. | Wind, solar and hydro power provide clean and renewable sources of electricity which help reduce greenhouse gas emissions. |
| | Since 2003 the total domestic energy consumption per capita (kWh) for the Perth & Kinross area has steadily decreased year on year. In 2014, the Perth and Kinross area recorded a total domestic energy consumption of 1265 GWh. | Energy use, conservation and supply are essential for the long term future of Perth and Kinross. Present levels of energy consumption and the increasing trend in consumption are unsustainable and negatively impact on the environment, through associated carbon dioxide emissions. Reducing carbon dioxide emissions is key in tackling climate change and reducing total domestic energy consumption in the Perth and Kinross area will contribute towards addressing this issue. |
| | Mean annual domestic electricity consumption per meter in Scotland 3,900 kWh. In Perth and Kinross in 2013 the mean domestic was significantly higher at 5577 kwh per household. | Carbon dioxide from transport, industry and domestic sources (such as heating, lighting and cooking) is the main greenhouse gas emitted in Scotland. Reducing carbon dioxide emissions is key to tackling climate change. Energy use, conservation and supply are essential for the long term future of the region. |
| | Scotland had the highest mean domestic consumption of natural gas with 14,300 kWh per meter (median consumption of 12,700 kWh). In Perth and Kinross in 2013 the mean domestic consumption was significantly higher at 15, 822 kwh. | |
| | Scotland's 2014 State of the Environment Report (managed by Scotland's Environment Web Partnership) predicts less overall summer rainfall, and higher autumn/winter rainfall which will lead to higher annual river flows. This along with an increased frequency of extreme precipitation events, a higher temperature in all seasons and sea-level rise is predicted to have an adverse impact on the environment through loss of habitat, increased pollution and increased flooding. This is likely to have a potential impact on the development of renewable and low carbon energy technologies in the Perth and Kinross area. | Water quality has significant implications for human health and for fauna coming into contact with or living within the water environment. A high level driver putting pressure on the inland water environment, primarily through alteration of rainfall and snow cover patterns, is climate change. Local pressures on inland waters include; abstraction and flow regulation including major hydropower and water supply schemes, the building of dams and weirs and the drilling of boreholes to extract groundwater; and morphological pressures including engineering works to channels. |
| | The National Flood Risk Assessment has found that one in 22 of all residential properties and one in 13 of all non-residential properties are at risk of flooding from rivers, the sea or heavy rainfall in urban areas. This could potentially impact on the development of renewable and low carbon energy technologies in the Perth and Kinross area e.g. ground source heat pumps. | Flooding is a complex problem affecting many people in Scotland. Approximately one in 22 homes and one in 13 businesses are at risk of flooding Climate change is likely to make the situation more challenging with heavier rainfall and increases in the frequency of extreme weather events expected. An important part of managing flood risk sustainably is to consider where features of the natural environment can be used to slow the flow of water, store water, or contribute to the transport and deposition of sediment that might otherwise contribute to flooding. Some features of the water environment contribute to natural flood management (NFM) for example, naturally functioning rivers |

| | | |
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| | | (with meanders and flood plains) or coastal wetlands can help to enhance the storage capacity of floodplains and regulate tidal exchange (SEPA)<br><br>Presently the primary force driving the maintenance and improvement of inland water environments is the Water Framework Directive. A significant pressure on inland waters is development of the floodplain. |
| | Carbon dioxide emission estimates per capita in Perth and Kinross have decreased slightly since 2007. In 2012, 8.1 tonnes of $CO_2$, a rise of 0.6 over previous year, were emitted per capita, compared with 6.7 tonnes per capita as an average across Scotland. Of this, 27% were from the Industry and Commercial sector, 31 % were from domestic and 42 % were from road transport.<br><br>A relatively larger proportion of carbon emitted in Perth and Kinross is taken up by land use, land use change and forestry than at the Scottish level. | The gases that contribute most to the greenhouse effect are carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide (N2O), and fluorine compounds. Carbon dioxide from transport, industry and domestic sources (such as heating, lighting and cooking) is the main greenhouse gas emitted in Scotland and Perth and Kinross. |
| | Carbon rich soils, deep peat and priority peatland habitat represent areas likely to be of high conservation value and the Council area contains over 55,000ha of Class 1 and over 54,000ha of Class 2 soils ((Nationally important carbon potentially high conservation value and restoration potential respectively). Class 5 soils are also an important carbon store, all of which are carbon-rich and deep peat. | Healthy soils provide a range of environmental, economic and social benefits, which include providing the basis of the agricultural and forestry industries.<br><br>Threats to soil functions are erosion and compaction related to land management, contamination, sealing, loss of biodiversity, acidification from acid rain, climate change, and loss of organic matter and capacity to act as a carbon store. |
| **Material Assets** | There has been a clear upward trend in woodland cover in Perth and Kinross since 1905. The Scottish Forestry Strategy (2019-2029) sets an aspirational target of 21% woodland cover (previously 25%) in Scotland. In 2010, the Forestry Commission (now Scottish Forestry) completed the National Woodland Inventory (NFI) which shows the extent of all woodland of 0.5 ha or over. The objective is to identify; real woodland gains and real woodland losses. According the NFI 17% of Perth and Kinross is forested, an increase of 1% or over 6500 ha since 2002. (Forestry Commission, 2011). Approximately 6% of this area is native or nearly native woodland according to the Native Woodland Survey of Scotland (Forestry Commission, 2013) | Preservation and enhancement of the distinctive landscape of the Perth and Kinross area is important to maintain community wellbeing, biodiversity and to support the local economy. Woodlands support the region's economy through timber production, and play a key role in the tourist industry, providing recreational opportunities and contributing to the region's unique landscape and ecology. |
| | In 2015, Perth & Kinross Council as a local authority generated 76,187 tonnes of household waste, of which 41,328 tonnes was recycled or prepared for re-use. (SEPA, 2016). In 2014, the total amount of household and non-household waste treated or recovered on sites in PKC was 368,436.58 tonnes, including special waste across various sites. | Presence of waste and provisions of waste management can be utilised for energy from waste technology plants. |
| **Cultural Heritage** | In 2015 there were 42 gardens and designed landscapes covering 11,123 ha representing an increase in area of 68 ha over the previous year.<br><br>There are 4 sites contained on the Inventory of Battlefields: Battle of Duplin Moor, Battle of Dunkeld, Battle of Killiecrankie, and Battle of Tippermuir.<br><br>There are approx. 17,811 undesignated archaeological sites/remains contained within the Council's Historic Environment Record. | Landscape incorporates the environmental and cultural features present in an area. Preservation and enhancement of the distinctive landscape of Perth and Kinross is important in maintaining community wellbeing, biodiversity and supporting the local economy (tourism in particular). |
| | Perth and Kinross contains 734 Scheduled Ancient Monuments and 3069 listed buildings. 96 listed buildings are on the buildings at risk register - a decrease of 27% since 2014. There are 42 historic gardens and designed landscapes covering 11,123 ha. There are 36 conservation areas throughout Perth and Kinross. | The historic character of the environment is important to quality of life and sense of identity, and it is a vital contributor to the economy through the attraction of visitors. Constant change in the historic environment is a result of natural processes, such as climate change and erosion, and human interventions, such as land management, urban and rural development, transportation and pollution. |
| **Landscape,** | There is a clear distinction between scrub, heath and moorland in the upland area in the north west and agriculture in the lowland areas of the south east and river valleys. The main land cover | Land cover as assessed by the Centre for Ecology and Hydrology (CEH) is a parcel-based classification of UK land cover. It uses 23 classes to map the UK, which are based on the UK |

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| **Land Use/ Cover** | categories are montane and heath scrub (36%), grassland (28%) agriculture (10%) and forestry / woodland (17%). Predominantly residential areas account for less than 1% of the total Perth and Kinross area. | Biodiversity Action Plan (BAP).<br>The natural physical influences which originally shaped the landscape of Perth and Kinross and continue to cause it to change are solid and drift geology, hydrology and climate. |
| | The landscape within the Perth and Kinross is divided into two main units: highlands and lowlands, reflecting geology, topography, vegetation and land use. Key landscape character areas are mountains of the highlands and islands (30%), highland and island glens (13%) broad valley lowlands (10%), lowland hills (5%) and upland igneous and volcanic hills (6%). The remaining areas are comprised of a mix of lowland basins and valley, peatlands and inland lochs (The Macaulay Institute, 2001). | Landscape incorporates the environmental and cultural features present in an area. Preservation and enhancement of the distinctive landscape of the Perth and Kinross area is important to maintain community wellbeing, biodiversity and to support the local economy, which is dependent on tourism and maintenance of a healthy environment. |
| | A landscape evaluation, which examined each of the 47 landscape units of the Tayside Landscape Character Assessment in terms of the character and quality criteria including cultural qualities (i.e. landscapes which provide cultural associations such as with literature, music, art or local history or which have spiritual associations).<br><br>The areas scoring highly on this criterion included the Ochil Hills, which have strong literary connections and historic drove roads; the Gask Ridge, being the earliest Roman land frontier in Britain; and Pitlochry, which was a historically important tourist resort and now hosts numerous festivals and events. Fewer cultural qualities were identified in the areas scoring low. | Landscape incorporates the environmental and cultural features present in an area. Preservation and enhancement of the distinctive landscape of Perth and Kinross is important in maintaining community wellbeing, biodiversity and supporting the local economy (tourism in particular). |
| | National Scenic Areas (NSAs) and Wild Land Areas (WLAs) are nationally important landscape designations. Special Landscape Areas (SLAs) are locally designated landscape areas.<br><br>There are 4 NSAs within Perth and Kinross (Loch Rannoch and Glen Lyon, Loch Tummel, River Tay, and River Earn).<br><br>In 2015 there were 42 gardens and designed landscapes covering 11,123 ha representing an increase in area of 68 ha over the previous year.<br><br>There are 5 Wildland areas within or intersecting the area: Breadalbane / Schiehallion; Lyon/Lochay; Ben Lawers; Rannoch/Nevis/Mamores/Alder; Cairngorms. A large proportion of Perth and Kinross (19%) is within the top fifth of overall relative wilderness values. Comparatively, just 5% of Scotland falls within this quintile.<br><br>There are 11 Special Landscape Areas (SLAs) spread across Perth and Kinross, and consist of a range of highland and lowland areas covering 144,400 ha or around 27% of Perth and Kinross. SLAs are landscapes within Perth and Kinross which merit special attention, either because they are of particular value and warrant protection or because they are degraded and require active management or positive restoration, or are under threat from inappropriate development. | Landscape incorporates the environmental and cultural features present in an area. Preservation and enhancement of the distinctive landscape of Perth and Kinross is important in maintaining community wellbeing, biodiversity and supporting the local economy (tourism in particular). This indicator identifies those areas within Perth and Kinross highlighted for their contribution to the landscape and identified for specific protection. (It should be noted that designation of an area does not guarantee its quality).<br><br>Preservation and enhancement of the distinctive landscape of Perth and Kinross is important to maintain community wellbeing, biodiversity and to support the local economy, which are dependent on tourism and maintenance of a healthy environment. The required development of roads associated with forestry, rural development, windfarms and other development pressures can detract from an area's sense of wildness. |
| | The Historic Land Use Assessment (HLA) project identified some 55 individual historic land-use types. The majority of the region has been identified as rough grazing and rectilinear fields. The second largest areas consist of coniferous and woodland plantation and managed woodland (nearly 100,000 ha). | The historic character of the environment is important to quality of life and sense of identity, and it is a vital contributor to the economy through the attraction of visitors. Constant change in the historic environment is a result of natural processes, such as climate change and erosion, and human interventions, such as land management, urban and rural development, transportation and pollution. |

## 3.5 Summary of Potential Environmental Issues

The potential environmental issues, problems and considerations in Table 3.2 were identified as a result of an evaluation of the environmental baseline.

Table 3.2: SEA Topic and Associated Environmental Issues and Considerations

| SEA Topic | Potential Environmental Issues and Considerations |
|---|---|
| **Biodiversity, Flora & Fauna** | • Consideration of the role of peatland areas which support important habitats and avoid impacts on these areas. Any development or activities in these areas are likely to have an impact on the integrity of peatland dependent habitats.<br>• Biomass production could have negative effects on biodiversity, landscape and also amenity implications as a result of planting, harvesting, transport and processing. However an important consideration is what sort of land-use forestry for biomass is replacing e.g. carbon-intensive agricultural practice.<br>• Preservation and enhancement of the distinctive landscape of the Perth and Kinross area is important to maintain community wellbeing, biodiversity and to support the local economy.<br>• Careful planning will be required in order to avoid potential adverse impacts at the local and potentially strategic scale on biodiversity, soil, water, landscape and cultural heritage through the development of renewable energy proposals and distribution networks.<br>• The redevelopment of existing power stations and projects with carbon capture and storage may impact on biodiversity, air and water.<br>• The safeguarding of nationally important landscapes (National Scenic Areas and National Parks) from large scale wind farms will be beneficial to these landscapes, biodiversity and wider ecosystems.<br>• Potential for the loss of areas of green space and habitat connections, together with the loss and damage of geology and minerals as a result of development.<br>• Potential for disturbance to species and/or damage, fragmentation or destruction to habitats as a result of development and increased access. In addition, habitat fragmentation can restrict the movement of species in response to the effects of climate change. |
| **Population, Human Health & Access** | • Potential for impacts on amenity through noise and localised effects such as shadow flicker.<br>• Renewable energy developments can generate a high volume of public interest, mainly as a result of their perceived visual impacts and on amenity.<br>• Potential for creating and enhancing walking and cycling routes linked to renewable energy proposals.<br>• Preservation and enhancement of the distinctive landscape of the Perth and Kinross area is important to maintain community wellbeing, biodiversity and to support the local economy.<br>• Potential negative human health and air quality impacts arising from particulate matter and other emissions associated with biomass, anaerobic digestion, energy from waste and landfill gas |
| **Soils** | • Healthy and diverse soils are important for crop growth, carbon storage and sustaining biodiversity across a range of habitat types. Human activity, land use and intensity, and global climate effects can be detrimental to soils, reducing their distribution, function and sustainability.<br>• Careful planning will be required in order to avoid potential adverse impacts at the local scale on soils including associated impacts on biodiversity and water resources through the development of renewable energy proposals and distribution networks.<br>• Threats to soil functions are erosion and compaction related to land management, contamination, sealing, loss of biodiversity, acidification from acid rain, climate change, and loss of organic matter.<br>• Renewable energy developments can also lead to a loss of, and impacts on, prime agricultural land, carbon rich soils, deep peat and priority peatland habitats, as well as the capacity of soils to act as a carbon store. |
| **Water** | • Potential impacts from flood risk areas on development proposals and conversely impacts from development proposals which exacerbate existing flood risk areas.<br>• Any developments/proposals that could adversely impact upon the ecological status of the water environment have the potential to impact upon its ability to deliver supporting services.<br>• Careful planning will be required in order to avoid potential adverse impacts at the local scale on biodiversity, soil, water, landscape and cultural heritage through the development of renewable energy proposals and distribution networks.<br>• Potential impacts on Ground Water Dependent Terrestrial Ecosystems (GWDTES), which are particularly susceptible during construction phase of projects and impacts from abstractions and changes in flow. |
| **Air** | • Air quality could be affected (as a localised effect) by increased biomass for heat, or proposals such as energy from waste (EfW), anaerobic digestion, and landfill gas. |
| **Climatic Factors** | • Encouraging an increase in renewable and low carbon energy development (in appropriate locations) can result in positive environmental impacts by helping the area adapt to and mitigate against the effects of climate change.<br>• Increased risk from flooding – as a result of climate change - impacting on the development of renewable and low carbon energy technologies, including any associated adaptation measures required.<br>• Positive contributions are likely to be achieved as a result of encouraging renewable and low carbon energy developments in appropriate locations by making a contribution to meeting the national targets for reducing greenhouse gas emissions.<br>• Consideration should be given to areas of peatland as they perform an important carbon sink role. Any development or activities in these areas are likely to disturb peat resources with subsequent impacts on climatic factors.<br>• Potential transportation effects associated with biomass developments transporting fuels from source to the processing plant. |
| **Material Assets** | • Potential for negative impacts on the area's green networks through development.<br>• Potential for damage and/or temporary obstruction of the core paths, long distance and cycle route network through development.<br>• Wind energy developments can often require the felling of large areas of forestry in order to accommodate turbines and access roads. |

| SEA Topic | Potential Environmental Issues and Considerations |
|---|---|
| | • Felling of trees as a result of wind turbine and hydro-scheme developments can generate a significant amount of waste. |
| **Cultural Heritage** | • Development can directly and indirectly affect cultural heritage including archaeological and historic sites and their settings and may cause irreversible damage. Potential impacts on the historic environment should be considered as proposals are developed. This may involve systematic archaeological survey to identify the location, extent and significance of historic environment features before any works are undertaken. |
| **Landscape, Land Use/ Cover** | • Preservation and enhancement of the distinctive landscape of the Perth and Kinross area is important to maintain community wellbeing, biodiversity and to support the local economy.<br>• Biomass production could have negative effects on biodiversity, landscape and also amenity implications as a result of planting, harvesting, transport and processing. However an important consideration is what sort of land-use biomass planting is replacing e.g. carbon-intensive agricultural practice.<br>• New developments or planting of wood fuel crops may alter the land use, and this may affect cultural heritage e.g. historic landscapes or the wider setting of historic environment features.<br>• Careful planning will be required in order to avoid potential adverse impacts at the local scale on biodiversity, soil, water, landscape and cultural heritage through the development of renewable and low carbon energy proposals and distribution networks; e.g. negative impacts on the setting of settlements, visual amenity and landscape character, both as a result of effects from individual proposals and the cumulative effects of a number of proposals.<br>• Enhancements of electricity grid infrastructure (namely transmission network infrastructure) could result in a range of environmental effects, including landscape change, depending on the extent to which new infrastructure will be required.<br>• The safeguarding of nationally important landscapes (e.g. National Scenic Areas) from large scale wind farms will be beneficial to these landscapes, biodiversity and wider ecosystems.<br>• The location of, and qualifying features associated with, wild land areas (WLAs) will require to be considered for any renewable proposals in close proximity to, or within, WLAs. |

## 3.6 Evolution of the Environmental Baseline

The SEA Directive requires the identification of the baseline conditions of the plan area that would occur without the implementation of the Supplementary Guidance.

Without the SG, renewable and low carbon energy developments proposed in Perth and Kinross will continue to be based on the existing LDP Policy framework and Supplementary Planning Guidance for Wind Energy Proposals (Adopted 2005). As a result development proposals will continue to be assessed without detailed guidance set out in the proposed SG, including the spatial framework for wind and Strategic Environmental Sensitivity mapping for various technologies.

The SG is designed to provide further detail on a wide array of considerations, delivery will be supported by web-based mapping that will form part of the decision-making process, and therefore without this information, proposals will not be subject to the same level of assessment. The SG is also designed to be pro-active in identifying at the initial design stages of development proposals what will be acceptable or not in terms of location, design, etc. In addition, the existing adopted SPG for Wind Energy Proposals (2005) is out of date in terms of National Policy, etc., and therefore fails to accurately reflect the current policy environment for these types of proposals.

## 3.7 Data Gaps and Problems

The Act and the Directive both require the recording of any difficulties encountered in compiling the information necessary for the assessment. This is particularly important as it is essential to describe those measures that will be used to monitor the implementation of the Renewable and Low Carbon Energy SG.

A map based approach, incorporating a range of environmental considerations, alongside a more traditional matrix based approach provided the evidence upon which this assessment was undertaken. The Scottish Government has recognised the benefits to both plan making and SEA of this approach in understanding of the spatial distribution of these considerations, identifying spatially prioritised opportunities and helping engagement with some stakeholders[3]. We acknowledge that it is difficult to predict the significance of effect for renewable and low carbon technologies either individually or cumulatively and note this as a limitation of the assessment approach. For example, as already acknowledged in the Scottish Government's SEA Guidance Note on Integrating Ecosystem Services, there are challenges for an ecosystems based approach in relation to the historic environment.

To assist in addressing limitations and continue to update and improve on information as it becomes available a searchable web map will be available to view the Perth and Kinross Renewables Guidance which will includes policy guidance, wind landscape capacity and spatial framework alongside other environmental sensitivity information for wind, solar and hydro relevant to this assessment[4] to help inform detailed site design/assessment to help avoid, and/or mitigate against, any significant environmental effects arising. The following list highlights the specific areas where data gaps and problems were identified: Biodiversity Action Plan Broad Habitat Change.

[3] Integrating an Ecosystems Approach into Strategic Environmental Assessment (Scottish Government Information note, 2016)
[4] Where possible dependent on license restrictions for data use

# 4 SEA Objectives and Indicators

The SEA Directive does not require the identification of specific SEA objectives but their development is recognised as an effective way in which the environmental effects of the relevant PPS can be described, analysed and compared. Identifying SEA objectives is also a useful way of focusing the collation exercise for the baseline data and assists with the establishment of realistic indicators which can be monitored, in order to help identify any effects as a result of implementing the SG.

Although a comprehensive set of objectives and relevant indicators were developed as part of the SEA process for the higher tier LDP, it is considered that it would be more beneficial to the assessment of the Renewable and Low Carbon Energy SG, and for its future monitoring, to use a set focussed on renewable and low carbon energy.

Table 4.1 below outlines the objectives and relevant indicators that will be used to consider the environmental effects of the Renewable and Low Carbon Energy SG.

Table 4.1: SEA Objectives, Assessment Criteria and Relevant Indicators

| Related SEA Topics | SEA Objective | SEA Criteria | Relevant Indicator(s) |
|---|---|---|---|
| Soils<br>Biodiversity, flora & fauna | Avoid adverse impacts on valuable soil resources e.g. prime agricultural land, carbon rich soils | Will the Renewable and Low Carbon Energy SG…<br>• Promote the conservation of the area's prime agricultural land resource?<br>• Promote the protection and restoration of areas of carbon rich soils through avoidance by development design?<br>• Help to maintain and potentially improve upon the health and diversity of the area's soils?<br>• Help to avoid impacts on valuable soil resources from renewable energy developments such as erosion, compaction, sealing and loss of biodiversity?<br>• Conserve and enhance the integrity of ecosystems? | • Area (ha) of prime agricultural land (Class 2 and 3.1) within Perth and Kinross<br>• Area (ha) of Perth and Kinross containing Class 1, 2 and 5 carbon rich soils (nationally important carbon rich soils, deep peat and priority peatland habitat)<br>• Area (ha) of peat reserves affected by renewable energy development<br>• Area ($km^2$) of Perth and Kinross covered by organo-mineral and organic rich soils |
| Land Use/Cover | Avoid adverse impacts on existing land use/cover | Will the Renewable and Low Carbon Energy SG…<br>• Promote the preservation and enhancement of the distinctive landscape of the Perth and Kinross area in order to help maintain community wellbeing, biodiversity and support the local economy?<br>• Promote renewable energy developments in appropriate locations in order to avoid detrimental impacts on existing land use? | • % change in land cover (broad habitat types) within Perth and Kinross |
| Water<br>Biodiversity, Flora & Fauna | Promote the sustainable management of the water environment | Will the Renewable and Low Carbon Energy SG…<br>• Help to prevent further deterioration of, and promote the protection and enhancement of the ecological status of the water environment?<br>• Help to prevent water pollution as a result of renewable energy developments, including during the construction phase?<br>• Promote sustainable water use based on the long term protection of available water resource?<br>• Help to avoid interference with natural fluvial processes?<br>• Ensure that renewable energy development proposals incorporate climate change adaptation measures e.g. development design to adapt to climatic conditions?<br>• Ensure that renewable energy development proposals do not increase the risk of flooding in the vicinity of the development and/or elsewhere downstream?<br>• Prevent loss of or deterioration in water-based species and habitats? | • % of the total number of rivers within the Perth and Kinross area classified as being of good status or better (ecological quality)<br>• % of the total number of groundwater bodies within the Perth and Kinross area classified as being of good status or better (ecological quality)<br>• Number of applications where enforcement action has been taken due to potential water pollution |
| Biodiversity, Flora & Fauna<br>Landscape<br>Climatic Factors | Promote the important role and potential of forests and woodlands and avoid adverse impacts on their natural heritage value | Will the Renewable and Low Carbon Energy SG…<br>• Promote the preservation and enhancement of the distinctive landscape of the Perth and Kinross area in order to help maintain community wellbeing, biodiversity and to contribute to climate change adaptation and mitigation and support the local economy? | • % area of woodland cover in Perth and Kinross<br>• Area (ha) of native woodland cover in Perth and Kinross<br>• Installed capacity of forest renewable energy (wind and hydro) schemes in Perth and Kinross to identify where there may be particular pressures and/or environmental sensitivities in relation to forests and woodlands. |
| Biodiversity, Flora & | Conserve and enhance the diversity of habitats and species | Will the Renewable and Low Carbon Energy SG… | • Area (ha) of ancient and semi-natural woodland in Perth and Kinross |

| Related SEA Topics | SEA Objective | SEA Criteria | Relevant Indicator(s) |
|---|---|---|---|
| Fauna | | • Prevent loss of priority species and habitats?<br>• Minimise disturbance to and avoid deterioration in populations of priority species and their habitats?<br>• Conserve and enhance the integrity of ecosystems?<br>• Prevent fragmentation of habitats?<br>• Ensure management and development does not create barriers to species movement?<br>• Promote integrated habitat networks? | • Status of Protected Sites e.g. SAC, SPA, etc.<br>• Status and prevalence of protected and priority species. |
| Climatic Factors | Increase the potential of Perth and Kinross in contributing to Scotland's renewable energy resources | Will the Renewable and Low Carbon Energy SG promote…<br>• The area's potential contribution to national renewable energy generation targets?<br>• The development of renewable energy proposals in the most appropriate location(s)?<br>• Maximising the energy efficiency of new development through appropriate siting and the use of sustainable material and construction?<br>• Maximising the energy efficiency of existing infrastructure and new development?<br>• The reduction in emissions contributing to climate change? | • % of the nations installed microgeneration capacity within Perth and Kinross<br>• Increase in installed capacity for renewable and low carbon energy schemes in Perth and Kinross and total capacity (MW)<br>• Total domestic energy consumption for Perth and Kinross (kWh) per capita<br>• Mean domestic consumption of natural gas in Perth and Kinross (kWh)<br>• Mean domestic electricity consumption in Perth and Kinross (kWh) |
| Climatic Factors Material Assets | Support adaptation to climate change and 'future proofing' of new development | Will the Renewable and Low Carbon Energy SG…<br>• Help to reduce consumption of fossil fuels?<br>• Help to reduce emissions contributing to climate change<br>• Promote the sustainable and efficient use of land? | Proportion of planning applications for renewable energy proposals which…<br>• Seek to build in 'future proofing' in the siting, design, construction and management of development proposals |
| Landscape Cultural Heritage | Conserve and enhance the character, local distinctiveness, scenic and cultural value of the area's landscape | Will the Renewable and Low Carbon Energy SG…<br>• Direct renewable and low carbon energy development proposals to the appropriate locations?<br>• Maintain and enhance the area's important landscapes and special qualities<br>• Avoid negative impacts on landscape character?<br>• Avoid negative impacts on the historical and cultural associated with the area's landscapes?<br>• Ensure development is sited and designed to avoid any significant negative effects to landscape character? | • % of Perth and Kinross landscapes most sensitive to windfarm development (medium, high and highest categories) *Note: based on the David Tyldesley Study (2010) it will only be possible to monitor changes in future if the study (or similar) is repeated. |
| Cultural Heritage | Protect and enhance, where appropriate, the historic and cultural environment | Will the Renewable and Low Carbon Energy SG promote the…<br>• Conservation of the area's historic environment, including scheduled monuments, gardens and designed landscapes, historic battlefields, Inventory Battlefields, archaeological sites, historic landscapes and townscapes, and undesignated heritage assets?<br>• Consideration of the historic and cultural environment in the proposal development and decision-making processes for renewable energy development proposals/applications? | • % change in historic land use types in those areas where renewable energy developments have occurred<br>• Area (ha) of Ancient and Long-Established Woodland Inventory and semi-natural woodland sites affected by development<br>• Number of renewable energy development proposals environmental statements identifying where there are potential conflicts between proposals and the protection of the historic environment |
| Population, Human Health & Access | Protect and enhance green infrastructure networks | Will the Renewable and Low Carbon Energy SG…<br>• Prevent the loss and fragmentation of access networks and open space?<br>• Promote the creation of new access opportunities and enhancement of existing networks? | • % of existing green infrastructure resources (access and open space) within Perth and Kinross impacted upon by renewable energy developments<br>• Proportion of renewable energy development proposals which provide for the improvement or enhancement of the area's green infrastructure resource |
| Biodiversity, Flora & Fauna Landscape Cultural Heritage | Safeguard the integrity of designated sites | Will the Renewable and Low Carbon Energy SG…<br>• Safeguard those sites designated under national and international legislation to protect landscape, geodiversity, habitats and species from adverse impacts? | • Proportion of protected nature sites which are in satisfactory condition; or are recovering, with the necessary management measures in place. |
| Air | Protect and enhance air quality | Will the Renewable and Low Carbon Energy SG…<br>• Promote the role of renewable and low carbon energy developments in improving air quality?<br>• Help to reduce greenhouse gas emissions levels within Perth and Kinross? | • Number of planning applications for proposals for biomass, AD, EfW, and landfill gas where Air Quality Impact Assessment has identified potential air quality impacts and these have been addressed. |

# 5 Assessment Framework

## 5.1 Introduction

Perth & Kinross Council (PKC), in partnership with The James Hutton Institute (JHI), has designed a systematic and transparent strategic framework for the development and assessment of the Renewable and Low Carbon Energy Supplementary Guidance. The framework will consider, through spatial mapping and conventional matrix assessment, key environmental effects, and the outputs of the assessment of likely significant environment effects will be integral to the preparation of the Guidance.

## 5.2 Scope and Level of Detail Proposed for the SEA

Scottish Planning Policy (SPP) requires an assessment of spatial plans to support the development of renewable and low carbon energy technologies in locations where the technology can operate efficiently and environmental and cumulative impacts can be addressed (SPP, 2014). Scottish Government renewables planning advice further requires that policies provide clear guidance on safeguarding landscape characteristics, ecological, community and historic environments, planning considerations (e.g. aviation interests) and consider cumulative effects[5].

The Environmental Assessment of the Renewable and Low Carbon Energy Supplementary Guidance is therefore split in to two assessment parts:

- A spatial, map-based assessment of Strategic Environmental Sensitivities, worked up in conjunction with JHI, incorporating a range of environmental considerations. This assessment methodology has been used to identify key spatially-specific environmental sensitivities in relation to the potential deployment of wind, hydro and solar technologies in Perth and Kinross. The resultant cumulative environmental sensitivity maps for the three technologies visualising where there are multiple environmental sensitivities which may require further assessment as well as individual[6] considerations used to develop these maps will be supplied via the web map to inform site design and assessment. See section 5.3 for further detail.
- A policy based assessment, based on a matrix methodology, undertaken to identify and assess key environmental effects arising from the potential deployment of all technologies included in the guidance document. See section 5.4 for further detail.

The assessment framework allows for an assessment of cumulative, secondary, synergistic, and temporal effects, as well as the identification of options for mitigation and enhancement measures. See section 5.5 for further detail.

[5] https://www.gov.scot/publications/renewables-planning-advice-index/
[6] Where possible given data and licensing restrictions

## 5.3 Spatial Assessment

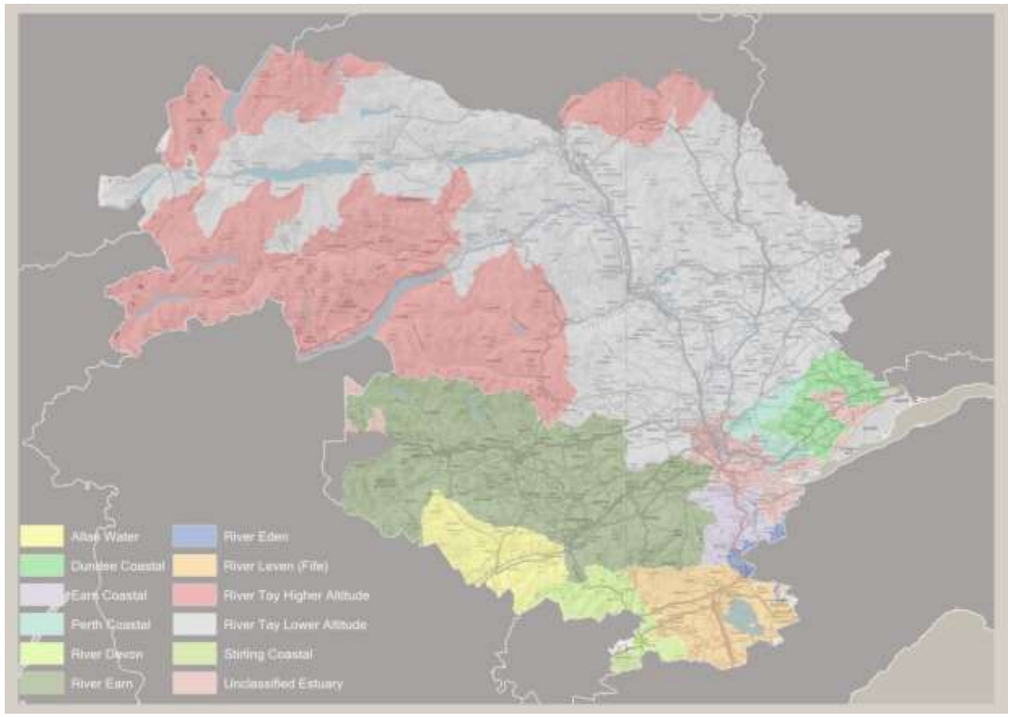
The assessment method will focus on two scales:

- Council Area scale to identify potential cumulative environmental sensitivities and those considerations which are most significant for each technology; and
- At a river catchment scale[7] to identify local level sensitivities

Figure 5.1A provides a map of the catchment areas used in this assessment.

The Guidance will include spatial mapping identifying the strategic environmental sensitivities for wind, hydro and solar energy technologies. The scope of the assessment is focused on these technologies as a result of the increased likelihood for higher significant environmental effects due to the scale at which these technologies are delivered and the larger physical footprint in comparison to other renewable and low carbon energy technologies. The resultant potential significance of the environmental effects therefore necessitates a strategic scale spatial assessment of significant and cumulative environmental effects.

**Figure 5.1A – River Catchment Areas used for Spatial Assessment**




[7] River catchments were used to define a meaningful spatial unit of analysis as there were considered to be more manageable areas, then the more coarse Tay Landscape Character units. Catchments also provide a physical feature with known pressures and will allow for the future monitoring of implementing the SG against the SEA Topics.

**Key Considerations**

As part of the Environmental assessment, the spatial assessment will develop cumulative strategic environmental sensitivity maps to help steer developments to the least sensitive areas and inform the site selection and design process for each of the technologies The maps were developed through an analysis of key environmental considerations, defined by national and local planning advice and policy. The considerations included as part of the spatial assessment are detailed in tables 5.2-5.4 and cover a range of generalised as well as more technology-specific considerations.

The outcome of the analysis will be used to assist in identifying areas for wind, hydro and solar technologies where there are multiple environmental sensitivities which may require further assessment. This in turn will help promote the development of renewable and low carbon energy in the right place. By identifying where there are areas where there are cumulative environmental pressures, the Guidance can steer future developments away from these areas to help inform the site design and assessment process. A web map will be developed to support the communication and delivery of the Guidance.

Strategic Environmental Sensitivity maps are strategic-level indicative mapping that helps identify areas of high environmental sensitivity based on multiple environmental considerations/constraints being present. This strategic mapping does not indicate where permission would be approved/refused – all proposals will be considered in detail at the planning application stage. All proposals will still have to be considered on a case-by-case basis, taking into account all features that may have a limiting effect on the proposal. Further more detailed environmental effects can only be identified and assessed at planning application stage including through the submission of an EIA, where appropriate. Detailed statements regarding location specific impacts (including mitigation measures) are beyond the scope of the strategic framework.

To inform this approach a baseline of relevant environment considerations have been mapped in partnership with JHI using available data from various sources including Perth and Kinross Council, Scottish Government, JHI, SNH, SEPA, and Scottish Forestry (formerly the Forestry Commission), SEWeb and the Landuse directory (Scottish Government). Full details of all considerations included as part of the spatial assessment are included in Appendix 7.

The below considerations have been defined by a review of current policy criteria relevant to each technology[8].

It is now widely recognised in Scotland and internationally that relevant decision making must take account of human dependency on a range of services that ecosystems provide Low carbon and renewable energy development will influence ecosystem structure and processes, as well as affecting the provision of ecosystem services. Incorporating ecosystem services, alongside other environmental sensitivities as part of the SEA

[8] including the Scottish Government's Online Renewables Planning Advice , SEPAs guidance in respect of wetland protection and the Flood Risk Management Planning process, Land Use Planning System – SEPA Development Plan Guidance Note 2e – Development Plan Guidance on Soils (2015), SEPA Planning Background Paper – Renewable Energy,

approach will identify the potential change to services, alongside other economic, social and environmental impacts linked to renewable and low carbon energy development and ultimately will assist in identifying the most sustainable locations for future renewable and low carbon energy development. The ecosystem services used for the assessment (see figure 5.1) have been grouped according to the Common International Ecosystem Services classification (version 4.3). This classification is recommended for use in ecosystem services assessments by the European Environmental Protection Agency under its Mapping and Assessing Ecosystem Services Project and uses three groups of services (regulating and maintaining; provisioning; cultural).

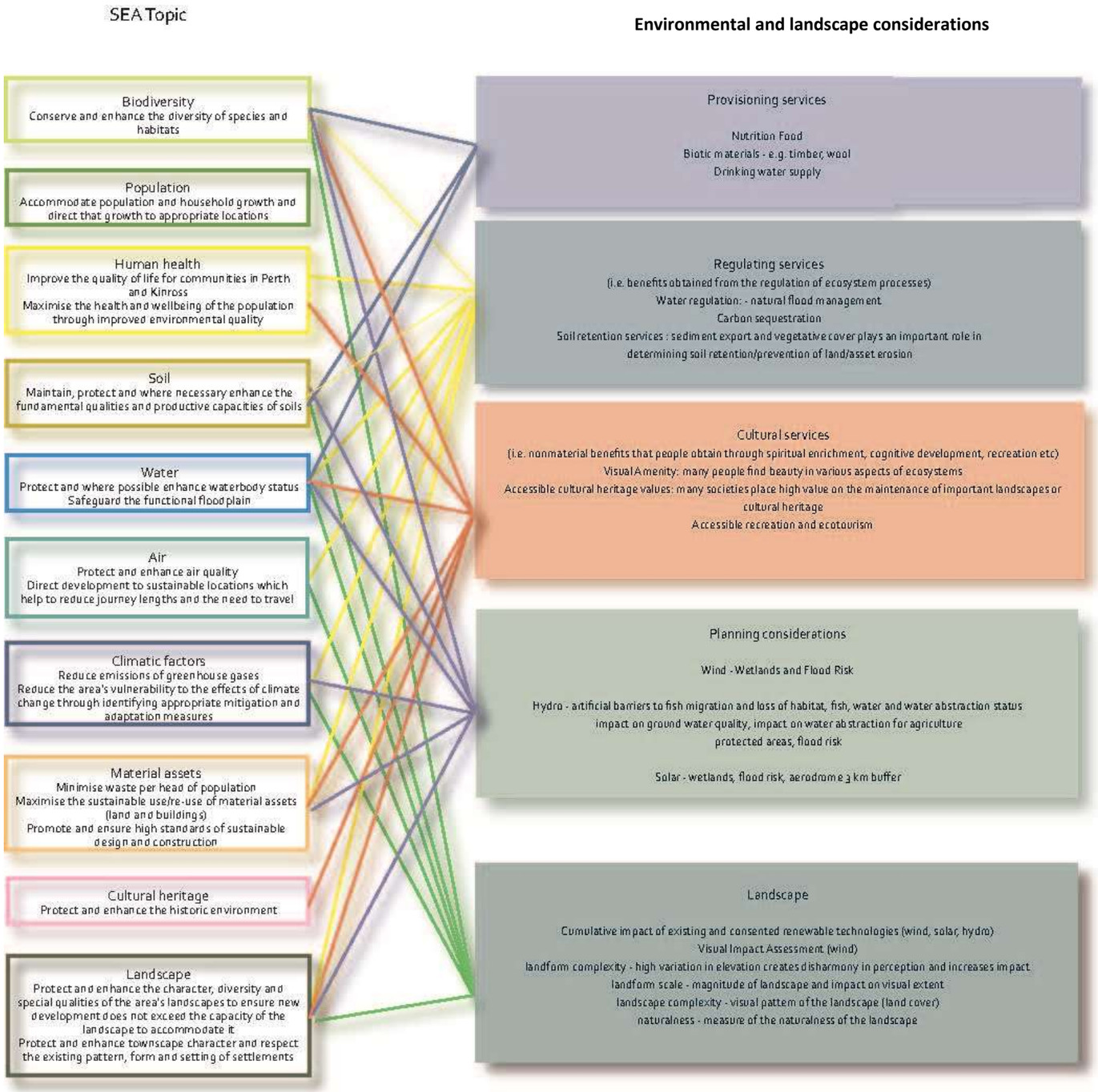
As well as including a range of relevant ecosystem services as part of the spatial assessment, a review of current national policy and planning guidance relevant to each technology was conducted to identify other relevant environmental considerations to be used in this assessment (see figure 5.1) relevant to each technology.

These included Scottish Planning Policy (SPP, 2014), the Scottish Government's Online Renewables Planning Advice for relevant technologies, SEPAs guidance in respect of wetland protection and the Flood Risk Management Planning process, Land Use Planning System – SEPA Development Plan Guidance Note 2e – Development Plan Guidance on Soils (2015), SEPA Planning Background Paper – Renewable Energy, SNH Spatial Planning for Onshore Wind Turbines – natural heritage considerations (2015). Expert advice was additionally provided by JHI.

Existing landscape studies are a well-established tool which can be used to identify the capacity for any type of development and are used to identify landscape sensitivities early in the process including identifying cumulative issues. The selection of the six landscape considerations used in this assessment (see figure 5.1) were informed by existing landscape studies including , 'Study into landscape potential for wind turbine development in East and North Highland and Moray' (2004) and Landscape Study to Inform Planning for Wind Energy in Perth and Kinross (2010) David Tyldesley and Associates . An additional criterion to assess cumulative visual sensitivity was also undertaken by JHI.

Figure 5.1 outlines the important relationship between the SEA Topics and spatial environmental considerations relevant to assessing the deployment of renewable and low carbon technologies. This demonstrates how all of the SEA Topics have been addressed through the spatial assessment element of the SEA and the potential impacts the implementation of the Guidance could have on those SEA topics and considerations. It also identifies the opportunities which exist to protect and enhance these considerations through the development of strategic mapping and policy guidance. Please note the Council considers that all of the environmental considerations included within the Spatial Assessment fall within the remit of the Environmental Assessment (Scotland) Act 2005 as they are considered to be linked to at least one SEA topic and associated SEA objectives.

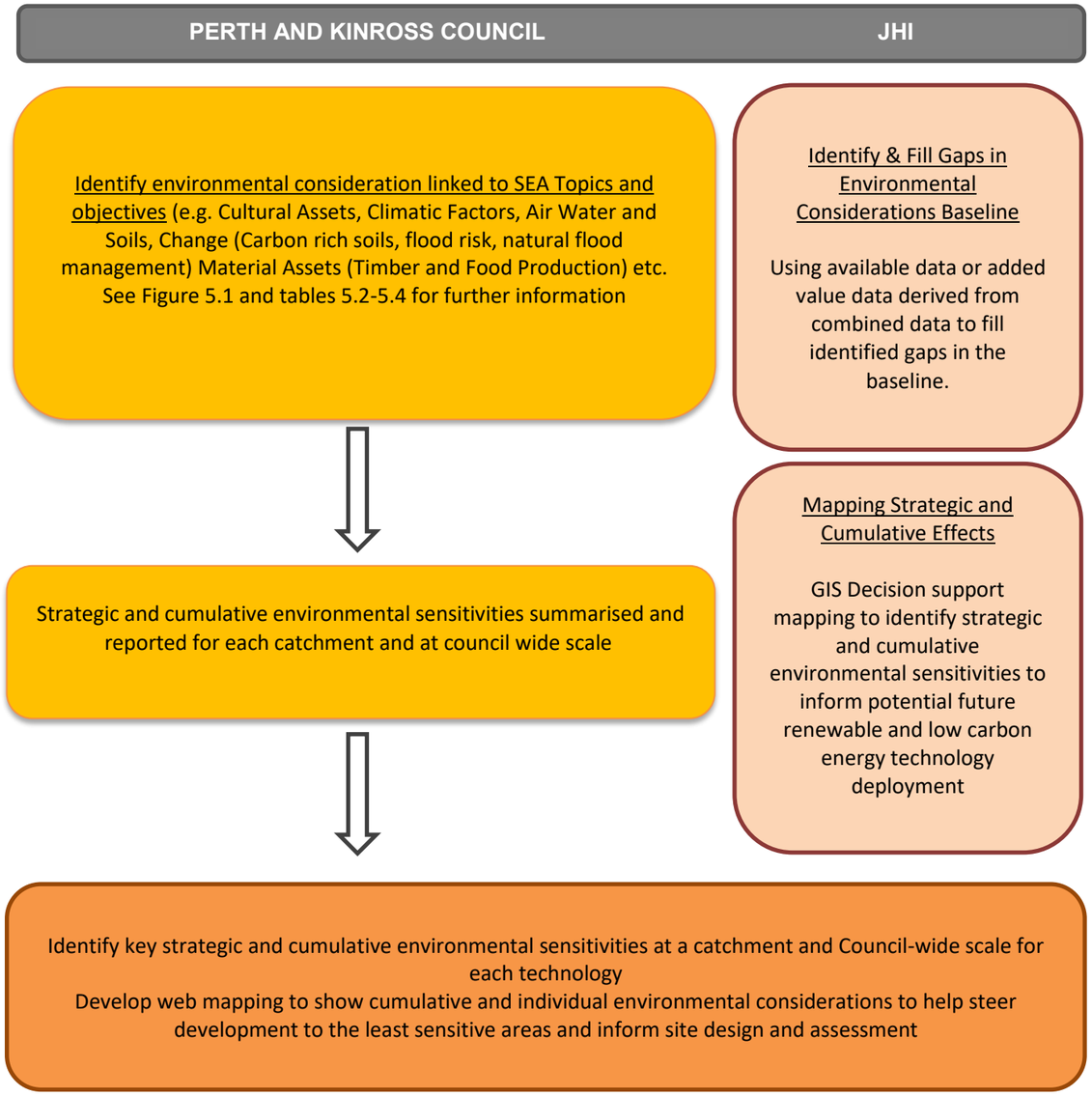
Figure 5.1 - SEA Objectives and Environmental Considerations



**Strategic Environmental Sensitivity Framework**

PAN 01/2010 recognises that *"there is significant … potential for map-based analysis in the SEA of development plans, for example the use of constraints mapping and overlay analysis"*. By overlaying a range of relevant environmental considerations it is possible to identify those areas where cumulative significant environmental effects could occur at a strategic level - and indicates where renewable and low carbon development generally can and cannot be accommodated across Perth and Kinross. The assessment framework combines strategic considerations mapped at a 250 m resolution in an equal weighted multi criteria decision model to accurately identify strategic and cumulative environmental sensitivities; the outputs of this assessment can be used to help inform potential locations for future renewable and low carbon energy technology deployment as well as identifying a range of environmental considerations to assist in the site design and assessment process. The approach is described in Figure 5.2.

Figure 5.2 – Strategic Environmental Sensitivity Assessment Framework



A list of the key data sources used to define relevant environmental considerations to obtain a picture of each catchment and the Council area as a whole are defined in the following figures and tables:

- Wind – Figure 5.3 & Table 5.2
- Hydro – Figure 5.4 & Table 5.3
- Solar – Figure 5.5 & Table 5.4

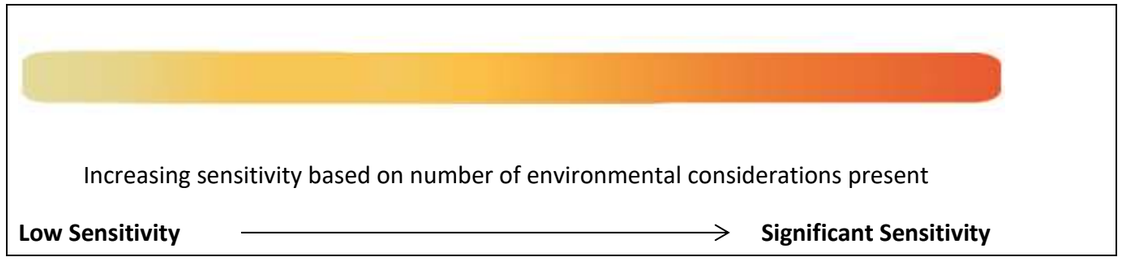
The maps outlined in Figures 5.7 to 5.23 illustrate the considerations relevant to each technology included in the assessment approach. The maps show the extent of these sensitivities and opportunities to maintain SEA objectives. Each map provides detail on a) what the consideration is, b) why the map is important to the assessment and c) how it was created, including underlying datasets. The maps produced incorporate the best suitable present data[9] and substitute in local data where possible. Each consideration has been mapped independently and informed by criteria specified in the relevant planning policy guidance. Additional considerations (e.g. National Parks and National Scenic Areas) have been applied as an additional filter where necessary. For further detail on the data and spatial models used to define these considerations see Appendix 7 - Environmental Assessment Technical Paper.

The approach considers which environmental considerations are most likely to be significantly affected by the three technologies: wind, hydro, and solar.

The assessment will be visualised by a short description and graphic summary of the type, location and extent of the effects of each technology, and will draw out where there may be potential significant effects across the Council area and in each catchment. This enables a comparison of the potential environmental effects of each technology and the areas of highest environmental sensitivity across the Council Area. This in turn enables the Council to steer future developments away from the most environmentally sensitive locations and can be used to help inform site design and assessment, particularly using the web mapping, when available.

The assessment has been applied to each catchment area, but refined to take account of information on sensitivities present and the technologies being considered. Significance of environmental sensitivity has been defined in the maps using the key in Table 5.1:

Table 5.1 - Significance of Effect for Strategic Environmental Sensitivity Maps:




[9] Available at July 2017.

Figure 5.3 - Spatial Assessment - environmental considerations by technology type – Wind

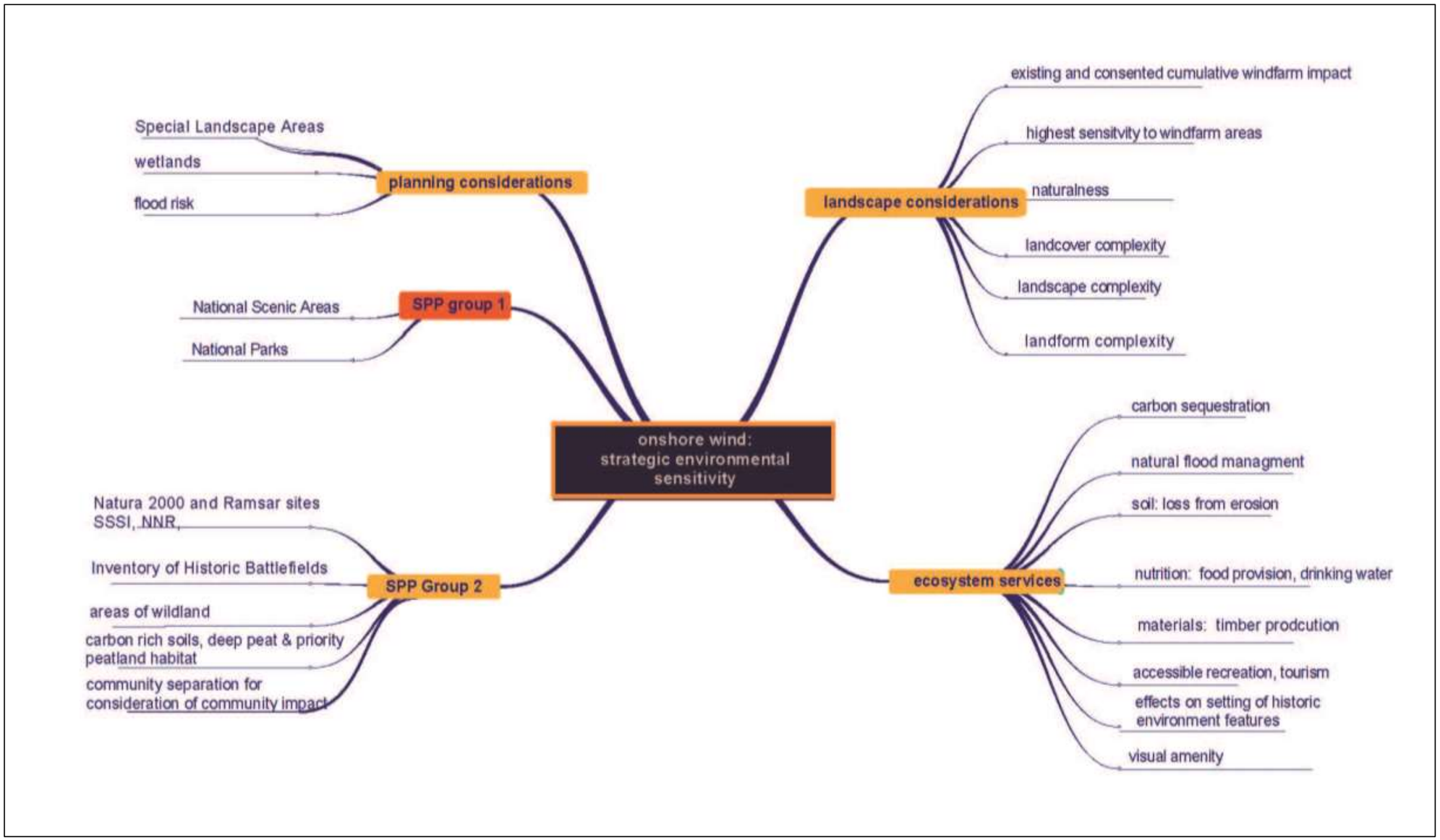


Table 5.2 – Spatial Assessment - Strategic Environmental Sensitivity - Wind

| | Relevant considerations | Data source |
|---|---|---|
| SPP (2014) defined criteria – Spatial Framework for Wind | Group 1: Areas where wind farms will not be acceptable: | National Parks and National Scenic Areas |
| | Group 2: Areas of significant protection:<br>Recognising the need for significant protection, in these areas wind farms may be appropriate in some circumstances | Natura 2000 and Ramsar sites; Sites of Special Scientific Interest; National Nature Reserves; Gardens and Designed Landscapes;<br>Inventory of Historic Battlefields. Wild Land areas; carbon rich soils, deep peat and priority peatland habitat; Community separation for consideration of visual impact - ZTV for 120 m WT within 2km of settlement boundary |
| | Group 3: Beyond groups 1 and 2, wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria. | Strategic Land Use Capacity Assessment – landscape, planning and ecosystem services criteria as outlined in the section below will be used to identify where there are environmental sensitivities and therefore identify where there is strategic land use capacity for windfarms and areas with the greatest potential for wind development. |
| Landscape considerations (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | Cumulative impact of onshore wind energy developments | Consideration of operational and consented wind farm and turbine developments within the landscape character type and in the surrounding area.<br>Defined by 3 criteria for > 30 m existing and consented turbines or groups of turbines within a 10 km extent<br>• Number of visible wind farms<br>• Number of single visible turbines<br>• Proximity to windfarm/turbine (weighted distance buffers (1.5km, 5km, 10 km) |
| | Landscape Sensitivity Study (further detailed in 'Landscape Sensitivity Technical Appendix' 2019) | Landform Complexity: Consideration of the overall shape and the degree of complexity of landform<br>In general the simpler the landform the better the visual relationship with turbines. (Stanton 1996; SNH 2001; Bell 1991). The complexity of the landforms topography was measured by an analysis of variability of the digital elevation model. The analysis used the Digital Elevation Model (DTM) at 50m resolution within 2km radius from each grid cell to represent the variability of the elevation<br>Landform Scale: Assessment of how the development would relate to the scale of the landscape including whether the development would be likely to dominate the scale of other elements. Consideration of how development would affect expansiveness and the sense of distance. In general the larger the scale of the landscape the greater the ability to relate to larger development typologies. Combined multiple viewsheds from all approved and/or built windfarms and wind > 30m (within a 10km radius + hub height offset) and elevation range within 10km<br>Landscape complexity: Consideration of the degree of complexity of land cover pattern and whether pattern is strong or fragmented. Simple, regular, uncluttered landscapes with extensive areas of the same ground cover are likely to be less sensitive to development than areas with more complex, irregular or small scale landscape patterns. The land cover complexity map was obtained by a zonal analysis of the number of different land cover types (LCM 2007) within 10km radius from each pixel.<br>Naturalness: Consideration of the degree of landscape modification by humans (such as roads, settlement, forestry, masts and wind turbines), consideration of how development could affect perceptions of naturalness and the degree of tranquillity experienced. The naturalness of the landscape was determined through a reclassification of semi-natural and human origin land cover types ( SNH (2004)<br>Landscape character: Highly sensitive areas (L.1 to L.3) as classified in "Landscape Study to inform planning for Wind |

| | | |
|---|---|---|
| | | Energy", (David Tyldsley, 2010) considered to be inappropriate for wind development |
| Ecosystem Services<br>(Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | Regulating and maintaining services<br>• Natural flood management, Erosion protection, carbon sequestration<br>Provisioning services<br>• Nutrition: food provision, Drinking water supply, Biotic materials: timber production<br>Cultural services<br>• Accessible recreation, Accessible historic and cultural experience, Visual amenity | • Ecosystem Services (see Figures 5.7 to 5.13 for further details) |
| Planning considerations<br>(Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | • Wetlands<br>• Flood Risk | • Wetland Inventory (SEPA)<br>• 1:200 year medium probability flood risk |

Figure 5.4 – Spatial Assessment – environmental considerations by technology type – Hydro

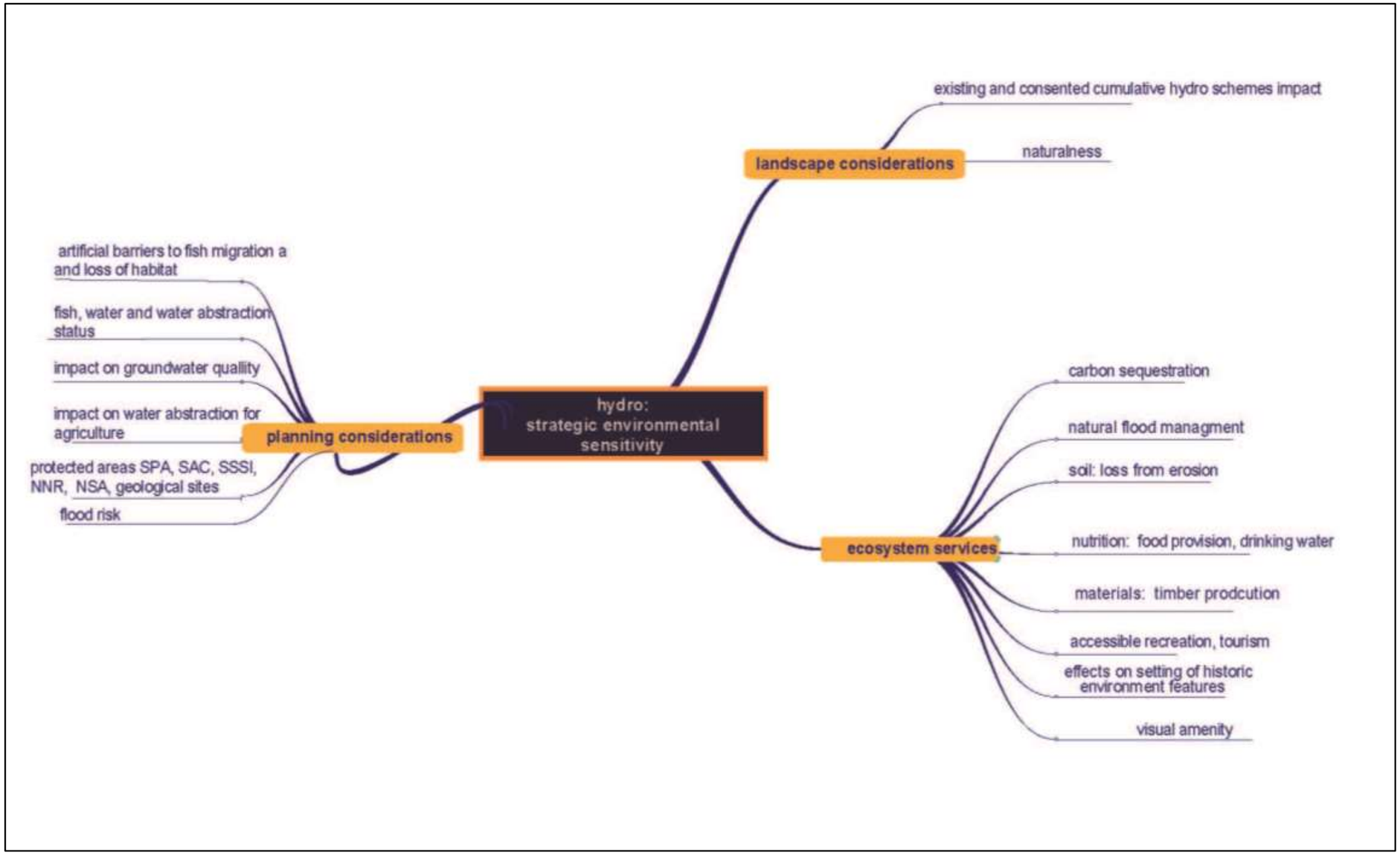


Table 5.3 – Spatial Assessment - Strategic Environmental Sensitivity - Hydro

| | Relevant considerations | Data source |
|---|---|---|
| Landscape considerations (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | Cumulative impact of existing and consented hydro schemes | Consideration of operational and consented hydro developments within the landscape character type and in the surrounding area |
| | Landscape Sensitivity Study (further detailed in 'Landscape Sensitivity Technical Appendix' 2019) | Naturalness: Consideration of the degree of modification by man (such as roads, settlement, forestry, masts and wind turbines), and consideration of how development could affect perceptions of naturalness and the degree of tranquillity experienced. The naturalness of the landscape was determined through a reclassification of semi-natural and human origin land cover types (SNH (2004)). |
| Ecosystem Services (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | Regulating and maintaining services<br>• Natural flood management, Erosion protection, carbon sequestration<br>Provisioning services<br>• Nutrition: food provision, Drinking water supply, Biotic materials: timber production<br>Cultural services<br>• Accessible recreation, Accessible historic and cultural experience, Visual amenity | • Ecosystem Services (see Figures 5.7 to 5.13 for further detail) |
| Planning considerations (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | River Status<br>Flood Risk<br>River Impact<br>Protected Areas | • artificial barriers to fish migration/loss of habitat, fish, morphology, water and overall ecological and hydrological status, water abstraction status<br>• water abstraction for agriculture, groundwater quality<br>• SPA, SAC, SSSI, NNR, NSA, geological conservation, Wild Land Areas |

Figure 5.5 – Spatial Assessment – environmental considerations by technology type – Solar

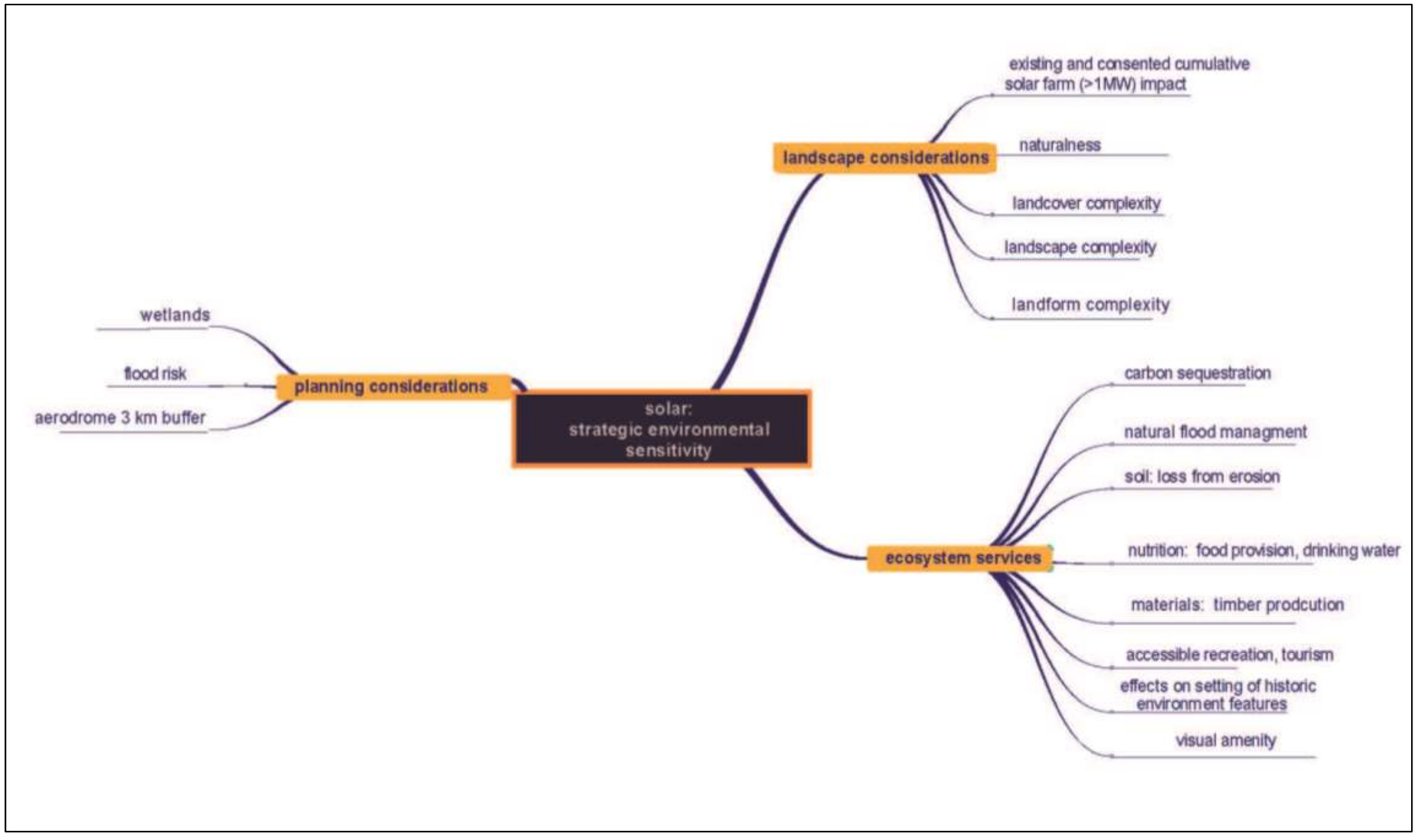
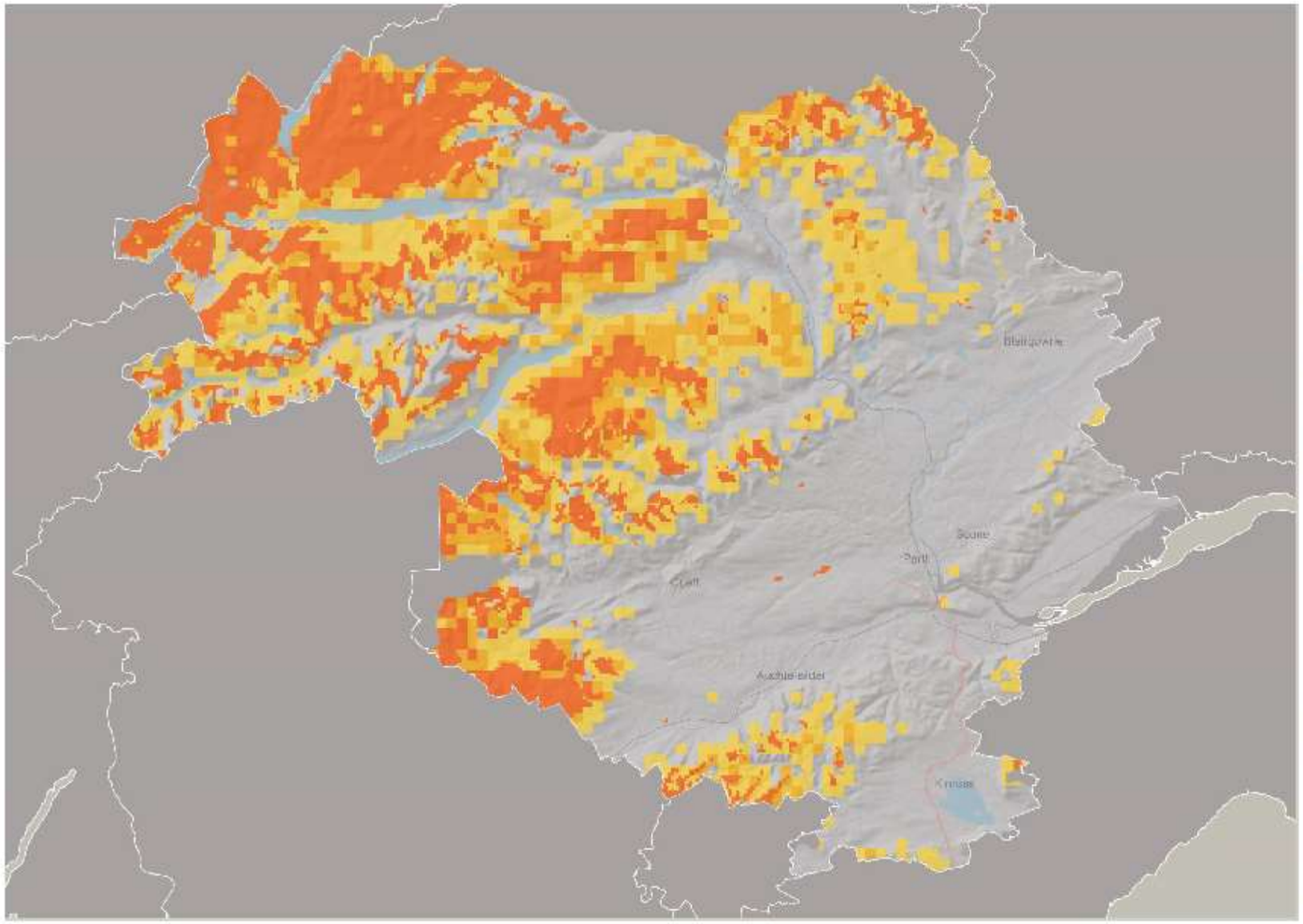


Table 5.4 – Spatial Assessment – Strategic Environmental Sensitivity - Solar

| | Relevant considerations | Data source |
|---|---|---|
| Landscape considerations (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | Cumulative impact of existing and consented solar schemes (>1MW) | Consideration of operational and consented commercial solar schemes ( > 1MW )within the landscape character type and in the surrounding area |
| | Landscape Sensitivity Study (further detailed in 'Landscape Sensitivity Technical Appendix' 2019) | Landform Complexity: Consideration of the overall shape and the degree of complexity of landform<br>In general the simpler the landform the better the visual relationship with turbines. (Stanton 1996; SNH 2001; Bell 1991). The complexity of the landforms topography was measured by an analysis of variability of the digital elevation model. The analysis used the Digital Elevation Model (DTM) at 50m resolution within 2km radius from each grid cell to represent the variability of the elevation<br>Landform Scale: Assessment of how the development would relate to the scale of the landscape including whether the development would be likely to dominate the scale of other elements. Consideration of how development would affect expansiveness and the sense of distance. In general the larger the scale of the landscape the greater the ability to relate to larger development typologies.<br>Landscape Complexity: Consideration of the degree of complexity of land cover pattern and whether pattern is strong or fragmented. Simple, regular, uncluttered landscapes with extensive areas of the same ground cover are likely to be less sensitive to development than areas with more complex, irregular or small scale landscape patterns. The land cover complexity map was obtained by a zonal analysis of the number of different land cover types (LCM 2007) within 10km radius from each pixel.<br>Naturalness: Consideration of the degree of modification by humans (such as roads, settlement, forestry, masts and wind turbines), consideration of how development could affect perceptions of naturalness and the degree of tranquillity experienced. The naturalness of the landscape was determined through a reclassification of semi-natural and human origin land cover types (SNH (2004)). |
| Ecosystem Services (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | Regulating and maintaining services<br>• Natural flood management, Erosion protection, carbon sequestration<br>Provisioning services<br>• Nutrition: food provision, Drinking water supply, Biotic materials: timber production<br>Cultural services<br>• Accessible recreation, Accessible historic and cultural experience, Visual amenity | • Ecosystem Services (see Figures 5.7 to 5.13 for further detail) |
| Planning considerations (Please see Figure 5.1 which identifies how environmental considerations are linked to SEA topics/objectives) | • Wetlands<br>• Flood risk<br>• Aerodrome 3 km buffer | • Wetland Inventory (SEPA)<br>• 1:200 year medium probability flood risk<br>• Aerodrome buffer of 3km to ensure aviation interests are considered. Scottish Government guidance (2013) on Large Photovoltaic Arrays http://www.gov.scot/Resource/0042/00423079.pdf) |

Figure 5.7 - Regulating and Maintaining Services: Carbon Storage

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**How to interpret the map**

This is one of the 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which the soil carbon content is greater.

**Ecosystem Service**

**Soil carbon storage** is the ecosystem service that provides greenhouse gas regulating benefits for people

**What the service is**

This map shows where environment stores high quantities of carbon in the soil. The higher this quantity the less CO2 is spread in the atmosphere resulting in a cleaner air conditions.

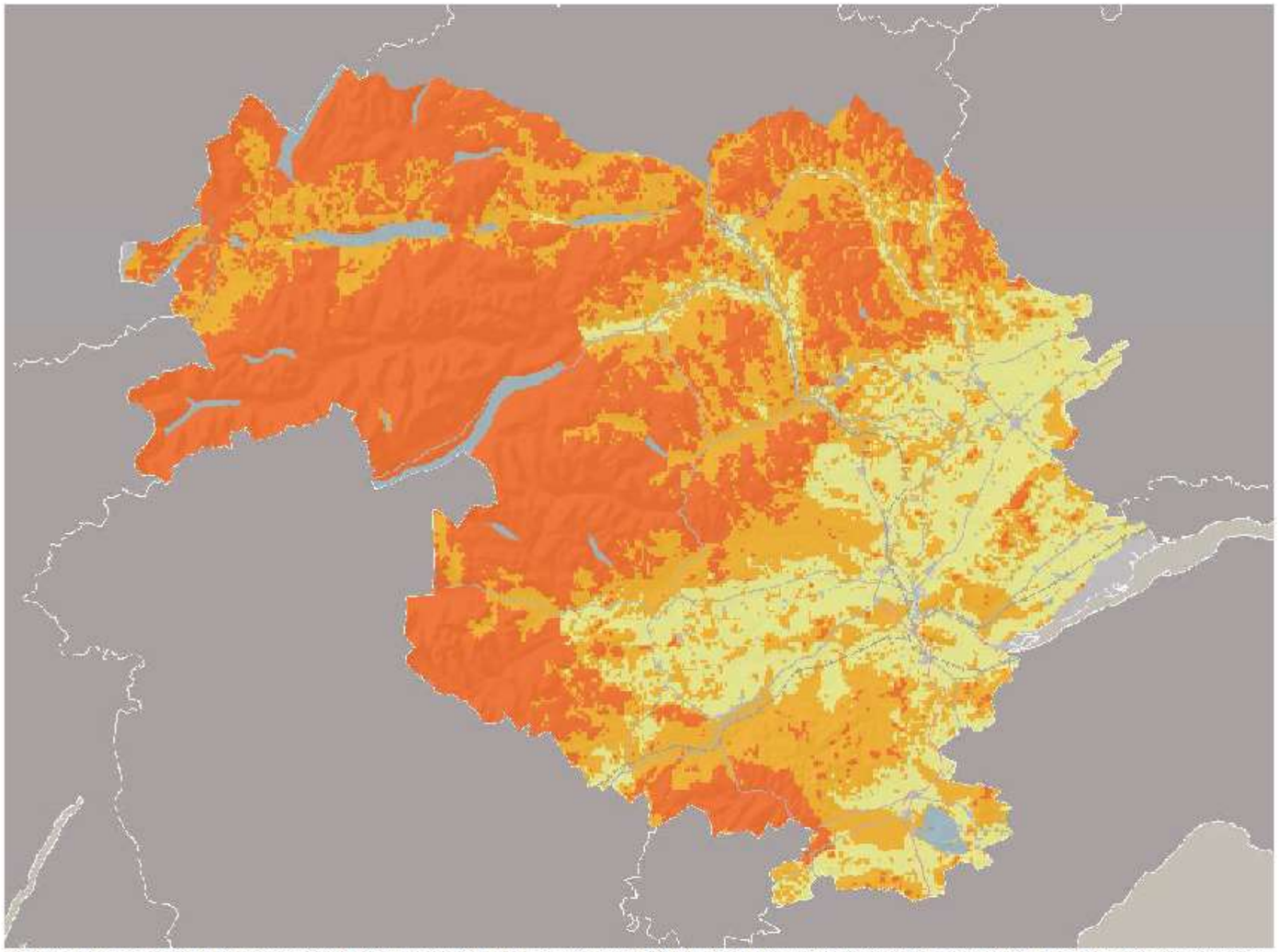
**Why the Services is important**

Ecosystems regulate the global climate by storing and sequestering greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues. Increasing the SOM of degraded soils can simultaneously boost agricultural productivity, sequester CO2 whose emissions might otherwise exacerbate climate change, and enhance water capture.

**How the map was created** The service is represented by a combination of two datasets: the first one was a Soil Organic Content (SOC) GIS dataset produced by JHI using a hybrid GAM-geostatistical 3D model following Poggio and Gimona (2014) and the second dataset is defined by Class 1, 2 and 5 of the Carbon and Peatland map (SNH, 2016) map. A conservative approach was taken to combining the two datasets where the Carbon and Peatland map (Class 1, 2 and 5) soils are given the highest sensitivity (i.e. carbon rich soils) and the more detailed JHI dataset is used to define sensitivity in the remaining areas where further, more detailed information regarding the location of carbon rich soils in known.

**Data: Soil Organic Content (JHI, 2014), Carbon and Peatland (SNH, 2016)**

Figure 5.8 - Erosion Protection (Sediment Retention Index)



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which provide soil retention services preventing erosion.

**What the map shows**

Soil erosion significantly impacts on environmental quality and social economy. Protecting soil from wind and water erosion is one of the fundamental ecosystem services that ensure human welfare.

**Why the map is important**

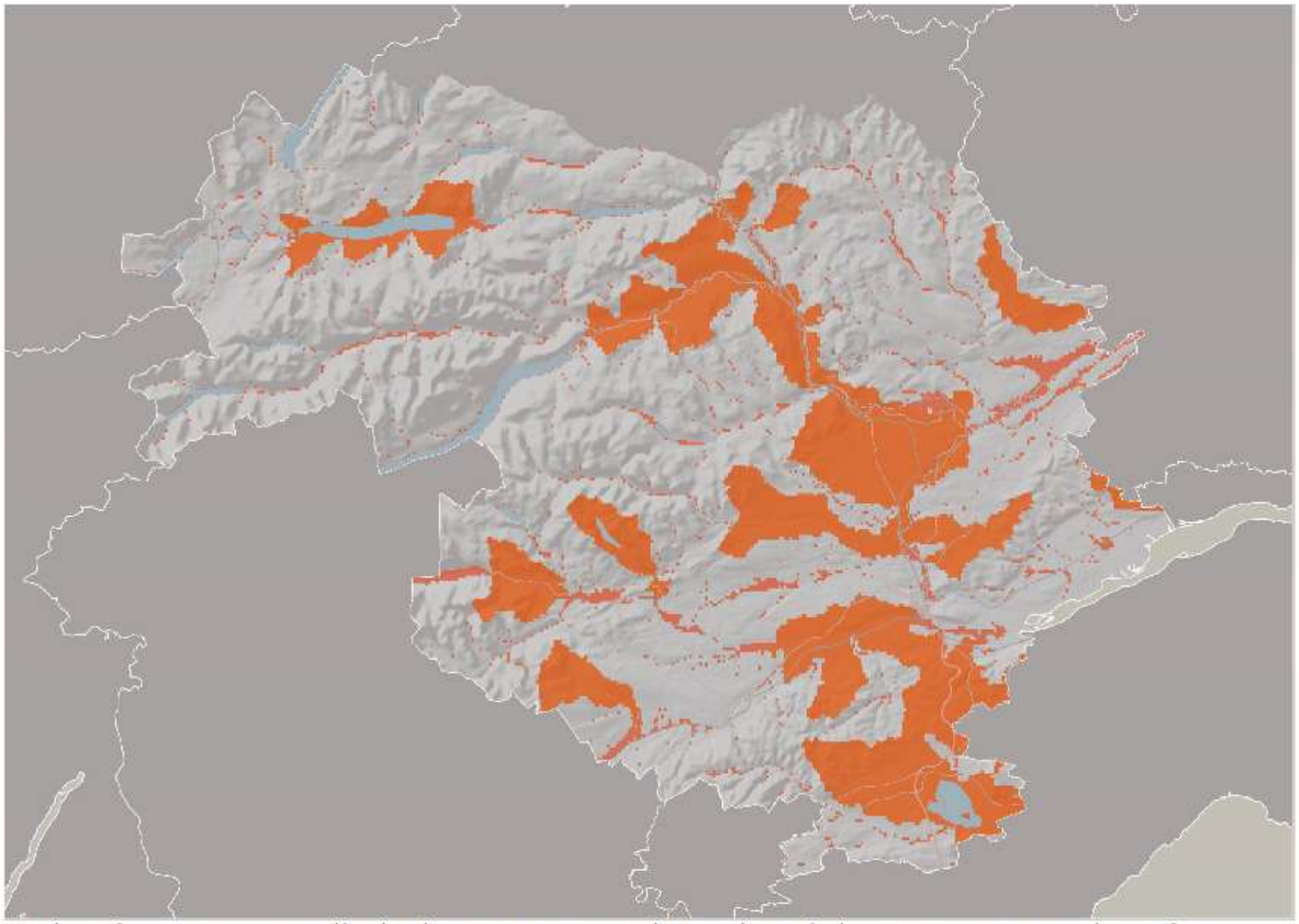
Soil erosion is a land degradation process that impacts a number of functions (biodiversity, food production, carbon stock, ecosystem services).

**How the map was created**

Soil retention services (the ratio of soil retention to potential soil loss) was calculated using the best practice Universal Soil Loss Equation (USLE). Sediment export at the sub-catchment level and vegetation efficiency at a 250m local level were combined to map this service. High levels of service are found where a high potential for soil export coincides with high vegetation filtration ability. The final map combines sediment export, sediment retention, retention efficiency (i.e. land use filtration efficiency) and the erosion index (i.e. total potential soil loss assuming bare soil).

**Data:** Land Cover Map 2007, R-factor (erosivity parameter) and K-factor (erodibility parameter) 10 m Digital Elevation Model, sub-watershed boundary dataset, evapotranspiration (MetOffice) biophysical table, providing an indication of filtration ability for each land cover type (JHI)

Figure 5.9 - Natural Flood Management



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which provide natural flood management services.

**What the map shows**

The contribution made by the water environment to natural flood management on a landscape scale works in combination with land cover, topography, geology and location. Wetlands and flood plains are nonetheless important natural flood management features and their role depends on many factors including their location within a catchment and their vegetation cover (SEPA, 2015)

**Why the map is important**

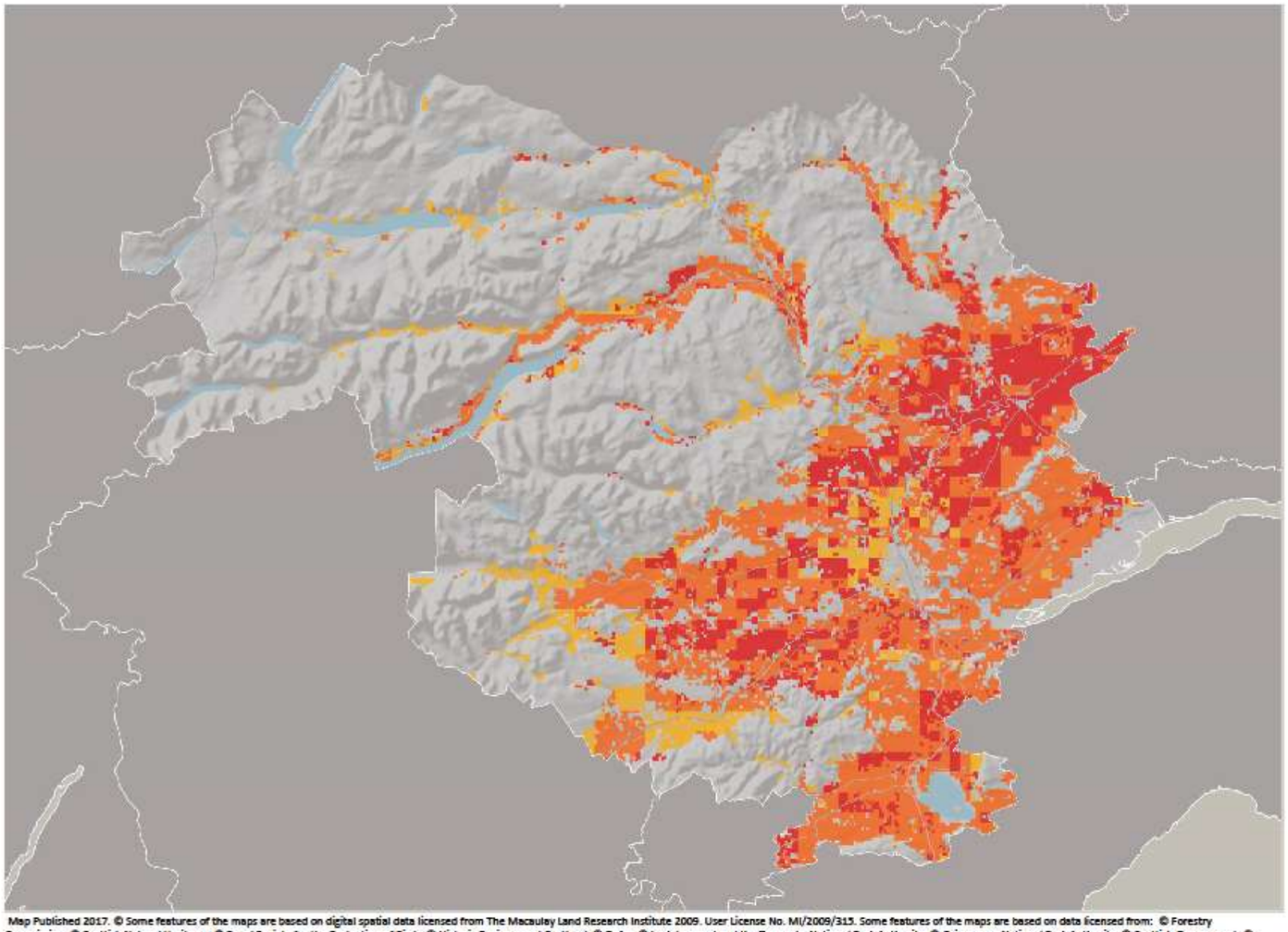
There is a need to manage flood risk where doing so has potential to reduce significant impacts on people and businesses, and/or avoid an increase in flood risk in the future. Use of the water environment to provide natural flood management also generally has a positive impact on benefits that the water environment is able to provide, such as benefits for wildlife habitat and water quality (SEPA, 2015)

**How the map was created**

This map shows which water bodies have more than 50% of their area within a Potentially Vulnerable Area (PVA), areas where more detailed assessments of hazards and impacts associated with flooding and actions to address flooding are being carried out. Water bodies in PVAs have potential to provide more benefits by way of natural flood management than those outside of PVAs

**Data:** SEPA Potentially Vulnerable Flood Areas, Flood Risk areas

Figure 5.10 - Nutrition Food Provision (Provisioning Services)



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which provide food provisioning services.

**What the map shows**

Food production is an important provisioning service agriculture is the most extensive form of land use in the UK, accounting for around 40% of land area and producing around 70% of the UK's food.

**Why the map is important**

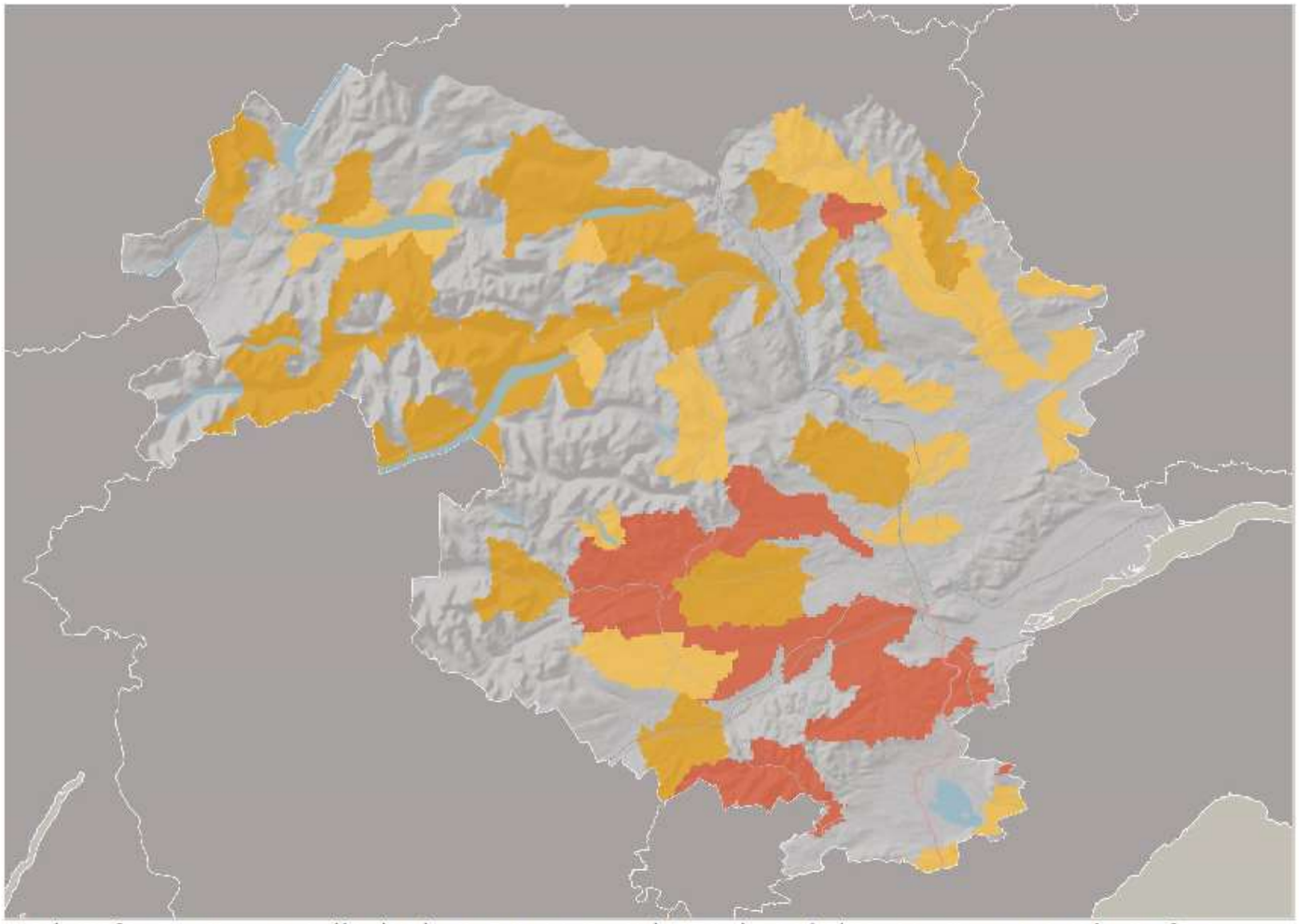
The UK's population is predicted to grow by nearly 10 million in the next 20 years raising major challenges for sustainable intensification of agriculture: increasing food production while decreasing the environmental footprint. Agro-ecosystems also deliver biotic materials for industrial processes and as a source for energy and provide important regulating and maintenance services such as pollination. Some agricultural landscapes are a valuable source of cultural services (UKNAE, 2011)

**How the map was created**

The map shows potential for food production and is the combination of 2 datasets: i) animals distribution ii) land capability for crops. Animal production was determined using agricensus data for cattle and sheep which was resampled at 25 m resolution and distributed using Broad Habitat classes (LCM). Land capability for crops was produced by integrating MODIS net primary productivity means over 12 years with the Land Capability for Agriculture map

**Data**: Landscape Capability for Agriculture, MODIS, Edina Agricensus, LCM 2007

Figure 5.11 - Drinking Water Supply



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which deliver drinking water provisioning services. Approximately 160,000 ha or 36% of sub catchments intersecting the Perth and Kinross Planning Authority area provide drinking water services.

**What the map shows**

One of the provisioning services that the water environment provides is volumes of water for abstraction and use in drinking water. This service is provided by lochs, rivers and groundwaters

**Why the map is important**

Drinking water needs to come from relatively clean supplies. This is particularly the case where private supplies of drinking water are used because they cannot be treated to the same standards as public supplies. If drinking water supplies are not clean and free of pollutants, then costs of treatment for Scottish Water and/or the health of consumers could be affected.

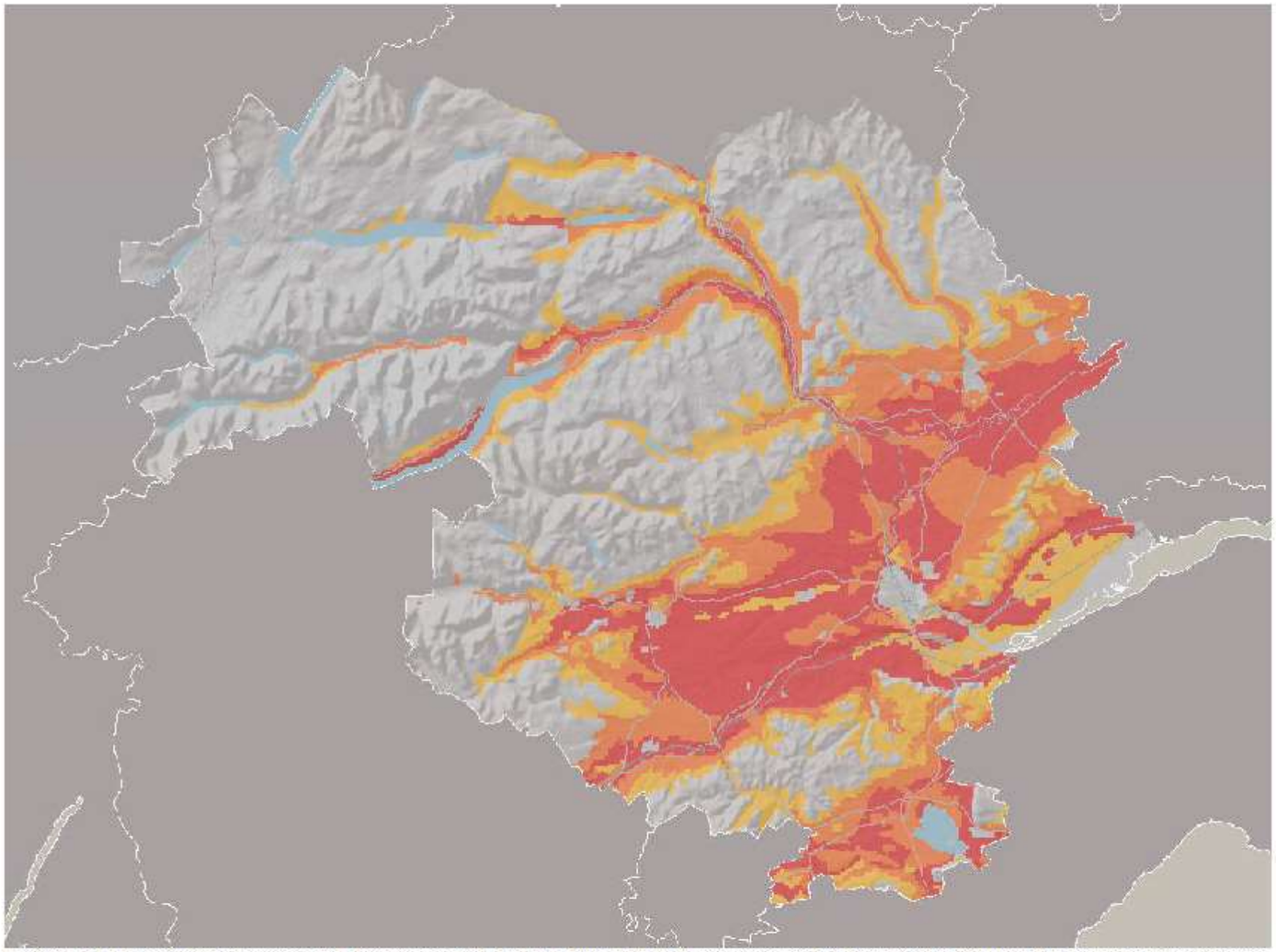
Abstracting water for drinking can impact on river water flows and levels, and therefore on other activities that rely on river water flows, and the habitat that rivers provide. Removal of water could also impact on a water body's ability to dilute other discharges and therefore affect water quality.

**How the map was created**

This map shows the relative number of people served by drinking water areas. It has been calculated from the abstraction size by assuming that each person requires 300 litres/day.

**Data:** Scottish Government Drinking Water Quality department

Figure 5.12 - Biotic Materials – Timber Production



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which provide timber provisioning services.

**What the map shows**

Timber production is an important provisioning service from woodlands.

Domestic production has increased from an estimated 4% in the 1940s to20% of UK consumption of timber, pulp and panel products. Woodlands and forests are also an important backdrop to the tourist industry and provide opportunities for recreation and healthy exercise as well as contributing to the high-quality landscape and woodland-related biodiversity. Carbon sequestration is one of the most important regulating services provided by woodlands

**Why the map is important**

There is a need to manage woodland for a wide range of ecosystem services, including provisioning services, regulating services, supporting services and cultural services The extent to which the service could be attributed exclusively to woodlands,

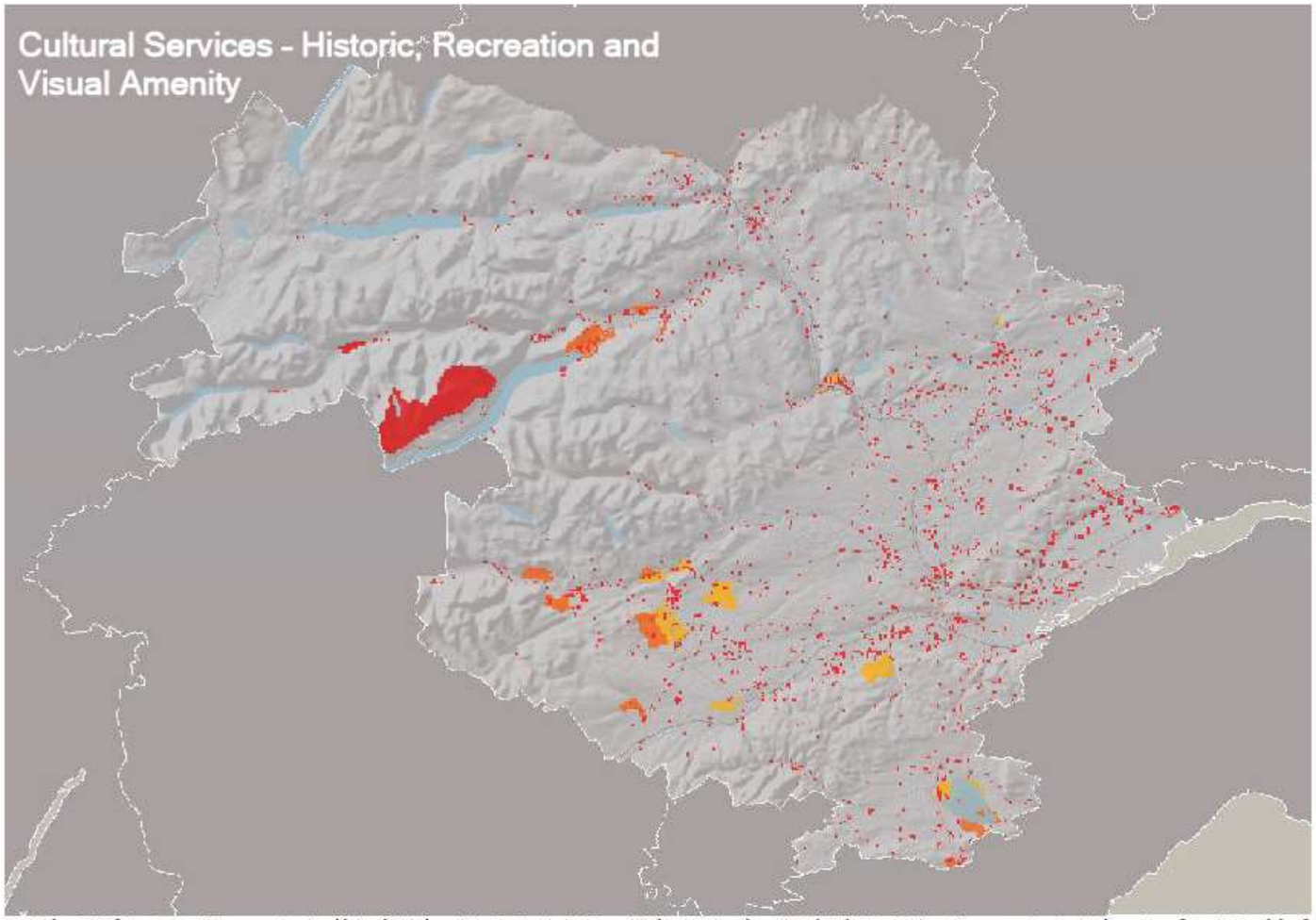
led to the following being prioritised as part of the UK NAE: Wood production (timber and fuel) and carbon sequestration .

**How the map was created**

This map shows potential for timber commercial productivity and was created using the Land Capability Classification for Forestry in Britain which is based on an assessment of the degree of limitation imposed by the physical factors of soil, topography and climate on the growth of trees and on silvicultural practices. Reclassification was untaken where classes F1 and F2 were grouped together into a "Very Good" class; the class F3 represents the "Good" areas; F4 was labelled as "Moderate" and F5-F6-F7 were aggregated together in the "Poor class".

**Data**: Landscape Capability for Forestry

Figure 5.13 - Cultural Services (Accessible Recreation, Accessible Historical and Cultural Experience, Visual Amenity)




**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which deliver cultural services

**Ecosystem Service:**

Cultural services are the environmental settings that give rise to the cultural goods and benefits that people obtain from ecosystems

**What the map shows**

This map shows environmental settings where people interact with nature including paths, historic and natural features, visual amenity and recreation sites.

**Why the map is important**

Environmental settings have been one of the most enduringly popular locations for recreation, leisure and tourism and can contribute to a wide range of health goods by providing places where people can undertake physical activity and interact with nature

**How the map was created**

The map is a combination of 3 components

Historical – total number of features in the landscape unit .

Recreation - total number of features in the landscape unit

Visual Amenity - performing visual impact analysis using viewsheds from the most used landscape points based on (i) the historical and recreational areas (previous analysis) and (ii) a series of viewsheds from the points identified by the roads and the PROW and (iii) results from viewshed analyses from settlements and protected areas.

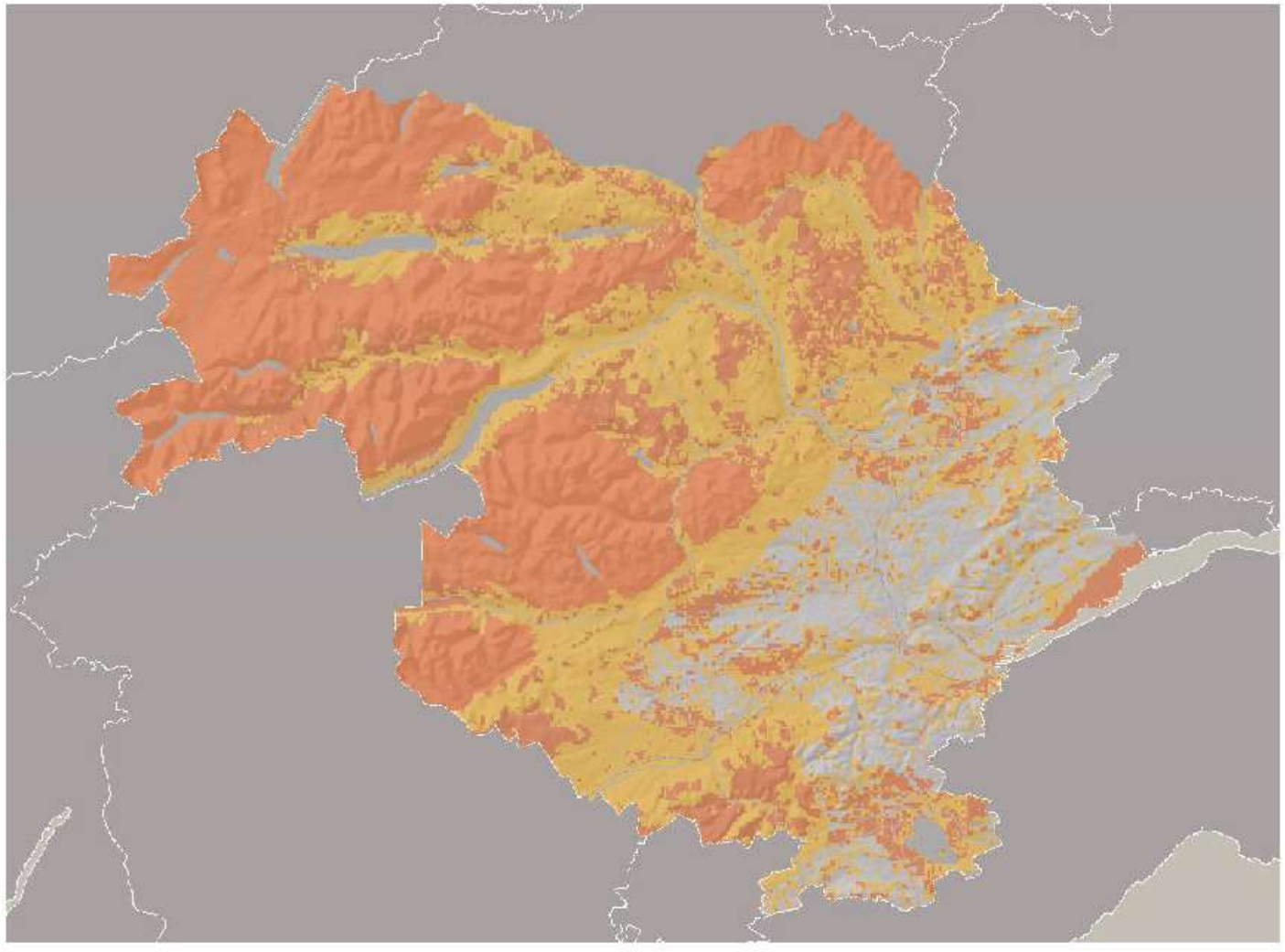
An accessibility model was used to weight the results by demand for services. The model predicts the accessibility of the landscape estimated by a cost-distance analysis, from population centres using landcover permeability (LCM) roads, paths and PROW. Pictures from Panoramio were extracted and used as a proxy of the most visited areas

Data[1]: Listed buildings, scheduled monuments, Battlefields, NFE recreation areas, GDL, NNR, Open space areas, parks, PROW, paths, LCM




[1] Selected data sources informed by "Cultural Ecosystem Services – towards a common framework for developing policy" , Working Paper (2015, SNH which develops a common framework for considering cultural ecosystem services in policy and practice in Scotland. It has been prepared through discussion the aim of enabling these services to be integrated more systematically into decisionmaking. Where datasets would result in double counting (i.e. wild areas) they have been excluded from the assessment.

Figure 5.14 – Wind: Landscape, landform, land character complexity, naturalness and areas of high sensitivity to wind farm development (LCS, 2010)



**How to interpret the map**

This is one of the * maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas of landscape sensitivity.

**What the map shows**

The assessment process uses a range of sensitivity criteria based on **key landscape and visual characteristics and visual effects**. There are 5 criteria: Landform complexity, Landform scale, Land cover complexity and Naturalness of land cover and a subset of Landscape Character Areas defined as areas of highest sensitivity in the Landscape Study to Inform Planning for Wind Energy (2010), which shows where wind energy would be inappropriate.

The purpose and scope of the strategy is to provide a strategic framework for the development of renewables in Perth and Kinross detailed statements regarding specific impacts (including mitigation measures) are beyond the scope of this Strategy.

**Why the map is important**

The impact of a development will depend on how, and from where, it is experienced; for example, from inside a residence, while moving along a road, or from a remote mountaintop. These factors are taken into account through our model when determining the sensitivity of the landscape and visual resource, and the people that will be affected by the development.

**How the map was created**

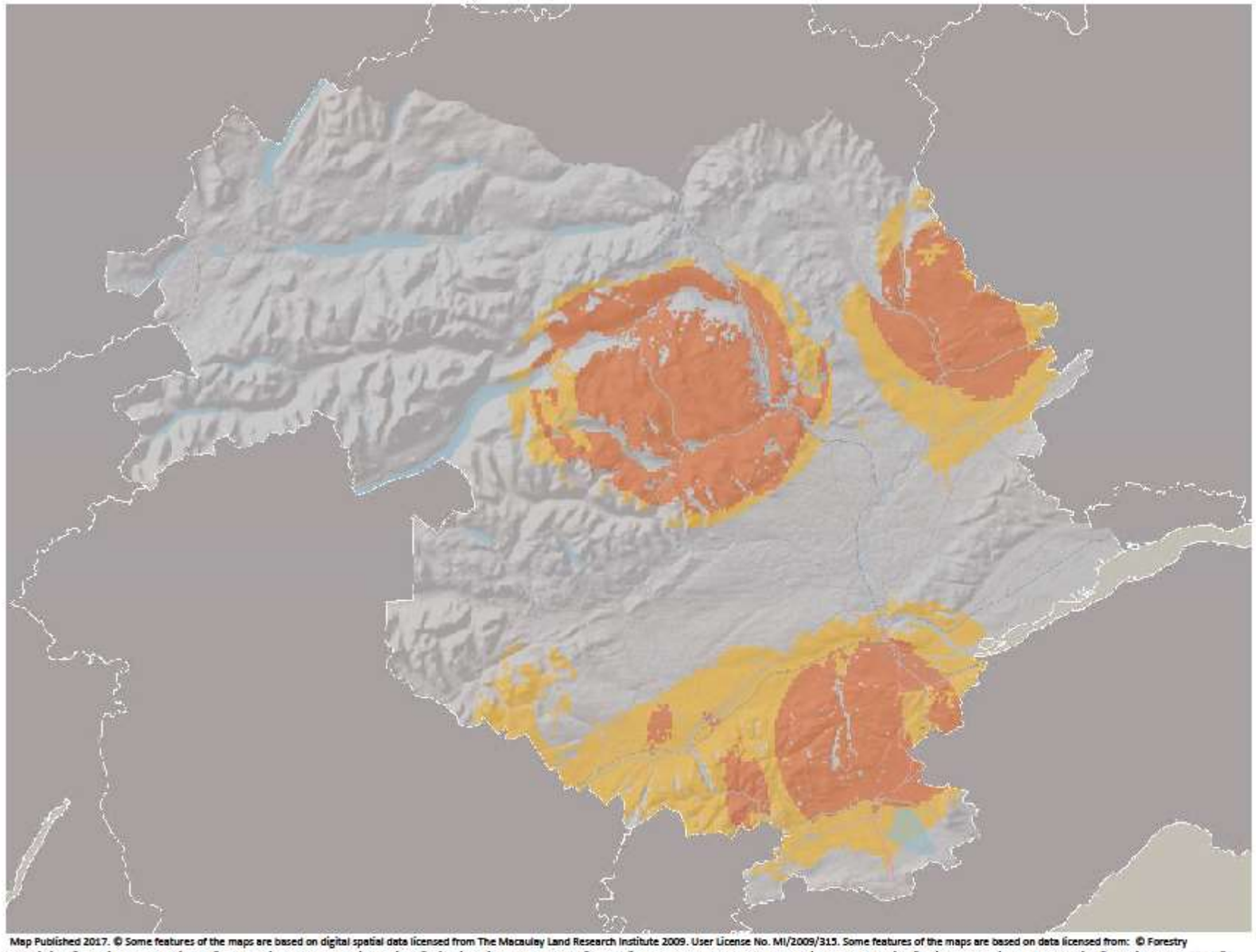
Our approach has been informed by guidance on the potential impacts and landscape sensitivities associated with energy development and on the practical application of methodologies used in recent landscape capacity studies we have undertaken for wind energy development. The study has been carried out in accordance with SNH guidance on good practice in relation to landscape capacity studies[1]. The analysis used a digital elevation model at 50m resolution and a land use map (LCM2007) at 25m resolution.

**Data: Digital Elevation Model, LCM 2007, Landscape Character Assessment.**




[1] http://www.moray.gov.uk/downloads/file82571.pdf

Figure 5.15 – Wind: Cumulative Visual Impact of Existing and Consented Wind Turbines



**How to interpret the map**

This is one of the 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas which define Cumulative Visual Impact.

**What the map shows**

The Cumulative Landscape and Visual Impact Assessment (CLVIA) is to describe, visually represent and assess the ways in which a proposed windfarm would have additional impacts when considered in addition to other existing, consented or proposed windfarms. The analysis considered all the installed and approved wind turbines taller than 30m of height. Visual sensitivity of the landscape was determined according to the following

(i) The number of wind farms the observer is able to see from each pixel; (ii) The number of individual wind turbines in a visible wind farm;

(iii) The distance of the observer from each wind turbine.

**Why is the map important**

Cumulative impacts should be assessed where a proposed development involves:

- a new development in combination with one or more existing or approved but unbuilt development;
- an extension to an existing or approved but unbuilt development;
- more than one development proposed at the same time within an area; or
- any combination of the above.

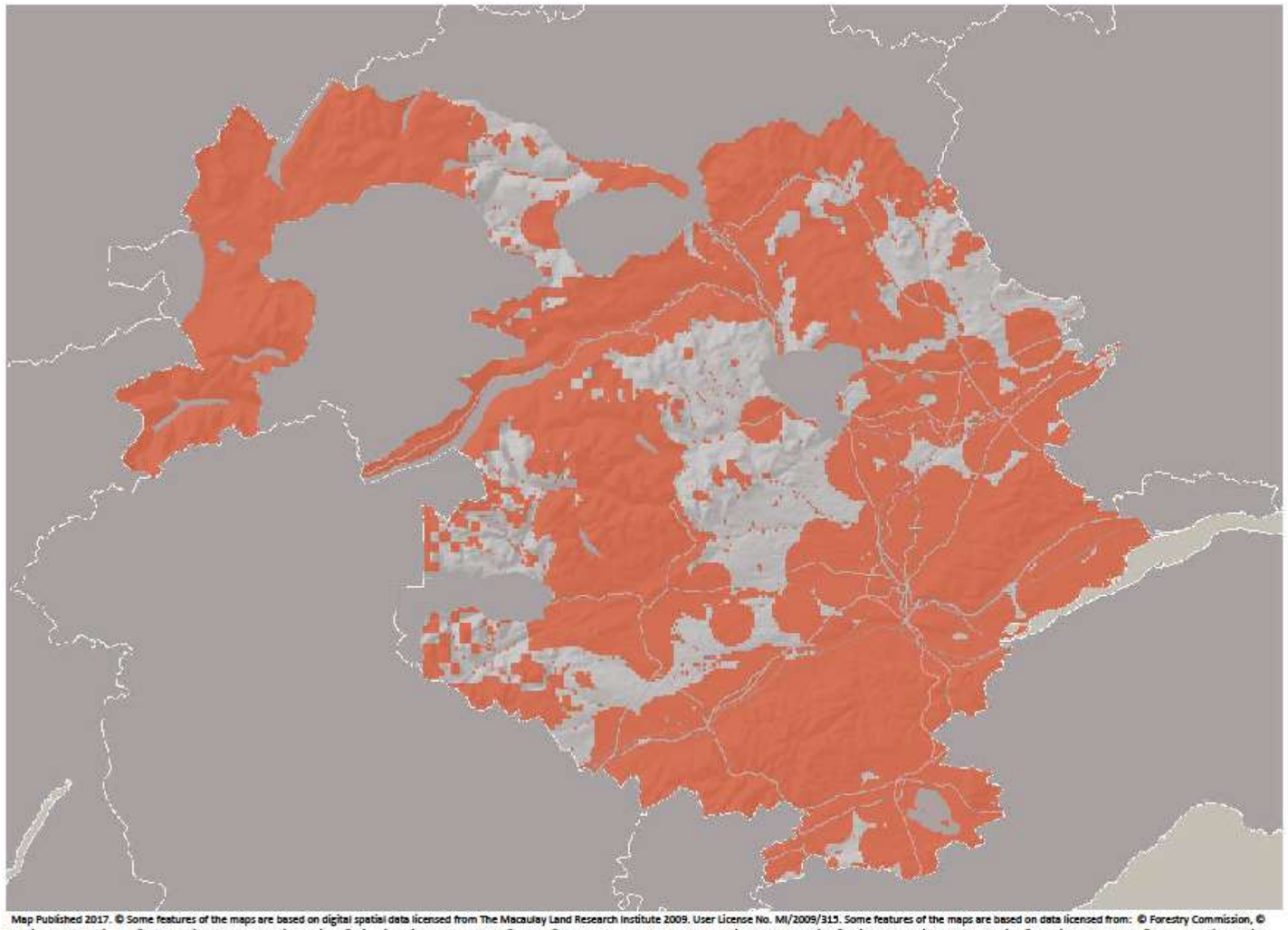
In areas approaching their carrying capacity the assessment of cumulative effects is likely to become more pertinent in considering new installations. In other cases, where proposals are being considered in more remote places, the thresholds of cumulative impact are likely to be lower and in fact, may offer opportunities in terms of colocation The impact of individual proposals is best assessed at ta site specific level

**How the map was created**

A model counting how many turbines are seen by each grid cell in the landscape was used, weighted by distance. The rationale is that distant objects weigh less than close ones. Viewshed analysis from each pixel was used to quantify point (i) above. The viewshed analysis took in consideration the height of each WT as the offset parameters with a visible radius of 10km distance. For point (iii) we used distance intervals with d<=1.5, 1.5-5, 5-10 km

**Data: DEM 50, approved and consented turbines**

Figure 5.16 – Wind: Areas considered sensitive under Scottish Planning Policy (Spatial Framework for Wind: Groups 1 and 2), priority wetlands and flood risk areas (1:200 year)



**How to interpret the map**

This is one of the 17 maps to show landscape sensitivity and maintain SEA objectives. The purpose of the map is to indicate areas which are considered **sensitive under SPP (2014)[1] and related planning guidance** for onshore wind turbines[2].

**What the map shows**

In line with Scottish Planning Policy, the Council is required to prepare a spatial framework for wind energy developments. The Spatial Framework sets out three groups to identify spatial constraints to wind energy development Group1 – areas where windfarms will not be acceptable (dark grey). Group 2- Areas of significant protection and Group 3 – Areas with potential for windfarms. The SEA approach has further defined these Group 3 areas using a strategic landscape capacity assessment.

Additional planning considerations are: the Wetland Inventory and areas at risk of flooding. The first layer is a proxy representation of the GWDTE (groundwater dependant terrestrial ecosystems). SEPA Planning Guidance The second dataset used is an indicative flood outline based on a 0.5% or greater (or 1 in 200 chance) annual probability of fluvial flooding (SEPA).

**Why the map is important**

The Spatial Framework identifies spatial constraints and is intended to assist prospective developers in finding less constrained sites or sites with no significant constraints. In addition we would seek policies in the Plan to ensure that windfarm proposals are supported where they can demonstrate that they will not have an unacceptable impact on:

- the water environment;
- flood risk;

**How the map was created**

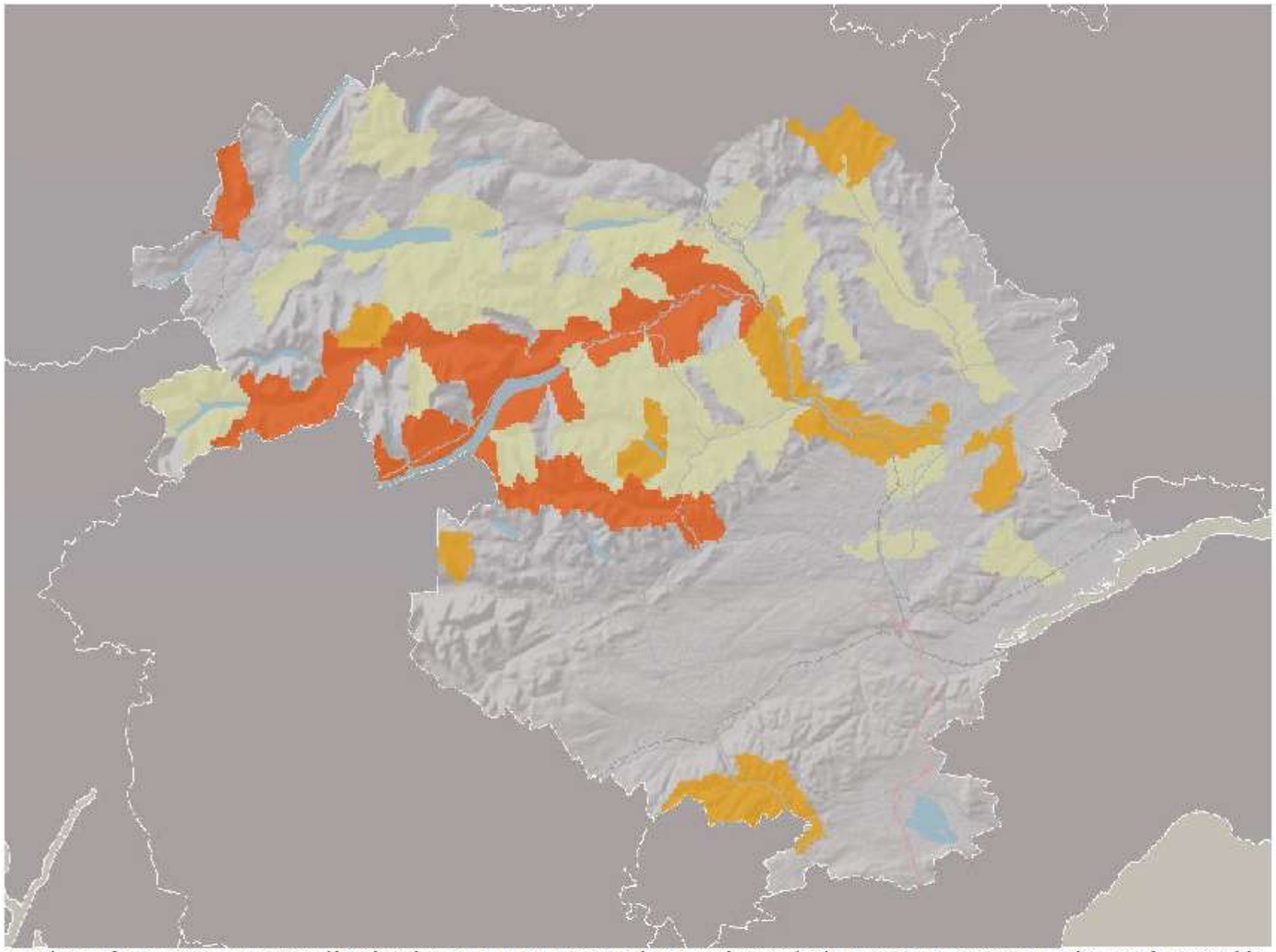
Therefore the layers were classified in two classes (1 = low sensitivity = absence of planning criteria and 4 = high sensitivity = presence of planning criteria). The combination of the two layers produced the maps beside which identify the most sensitive planning areas.

**Data: SEPA, SNH, Historic Environment Scotland**




[1] http://www.gov.scot/Publications/2014/06/5823/6
[2] http://www.gov.scot/Topics/Built-Environment/planning/Policy/Subject-Policies/Utilities/Delivering-heat-electricity/renewables-advice

Figure 5.17 – Hydro: Cumulative impact of Existing and Consented Hydro Schemes



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas where **hydro specific planning considerations** related to **cumulative impact** are present.

**What the map shows**

The map shows planning considerations associated with impacts related to the cumulative impact of hydro schemes.

**Why the map is important**

The development of multiple hydroelectric schemes in close proximity to one another i.e. within one or more neighbouring catchments has potential cumulative effects. These effects could be on the habitats, and species in and around watercourses. There may also be cumulative landscape effects from multiple access tracks, development infrastructure and power lines. The increasing number of smaller-scale hydroelectric developments has increased the potential for cumulative effects. Care should be taken in the planning of hydroelectric proposals, to account for nearby schemes.

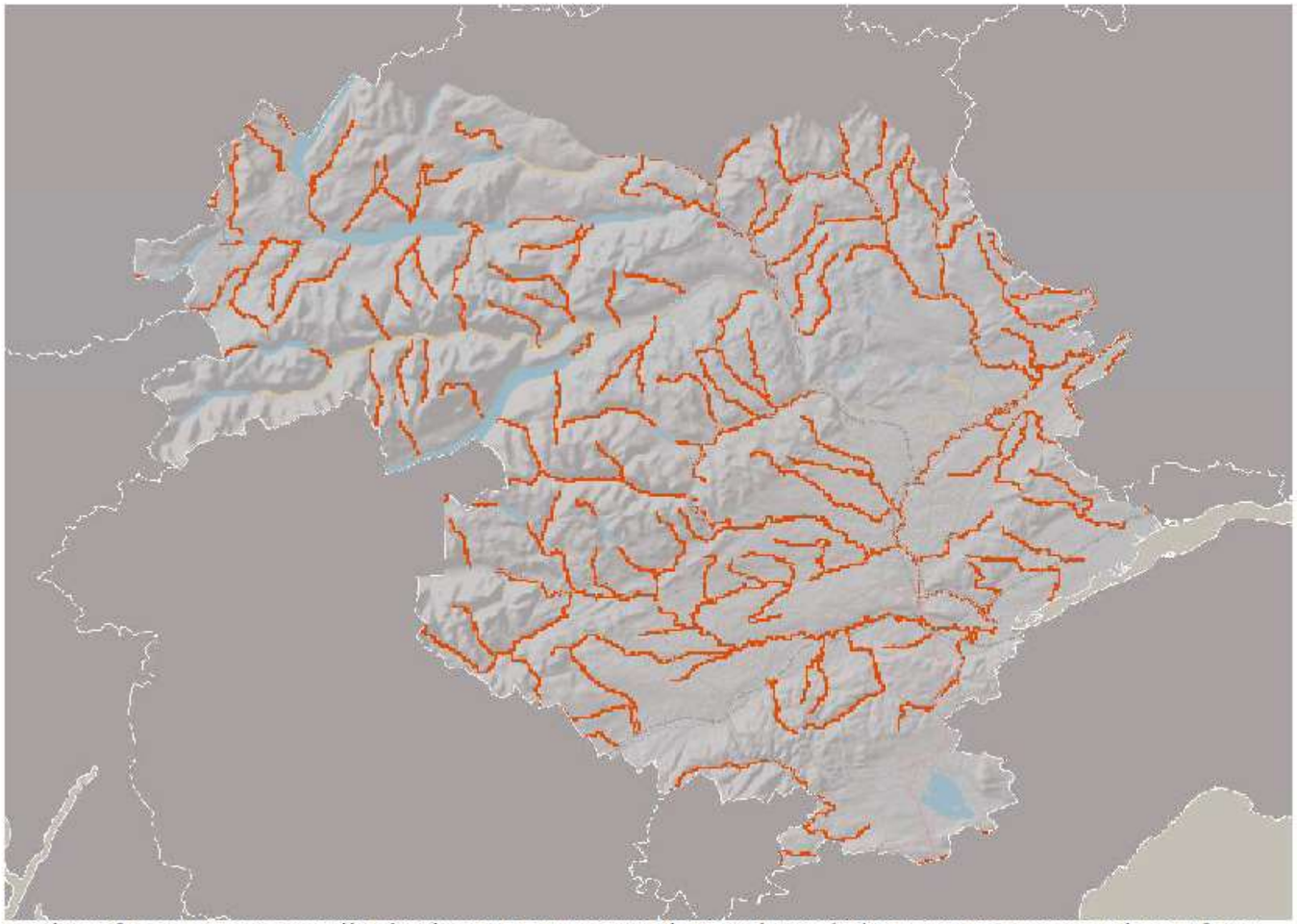
**How the map was created**

The data shows the count of existing and consented hydro schemes per 250m grid cell in Perth and Kinross. The count is considering all the hydroelectric structures already present along the rivers as well as the structures along the secondary streams.

**Data: Perth and Kinross Council**

Low level of service 1 — High level of service 4

Figure 5.18 – Hydro: Artificial Barriers to Fish Migration and Loss of Habitat



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas where **hydro specific planning considerations related to artificial barriers to fish and resultant loss of habitat** are present.

**What the map shows**

The map shows hydro specific planning considerations associated with artificial barriers to fish migration.

**Why the map is important**

The objective of the Water Framework Directive is for all water bodies to improve to good ecological status and for deterioration in status to be prevented. This map shows whether the main migratory fish species in Scotland are likely to be able to pass a barrier. It then uses this information to assess the impact of each barrier in terms of the amount of habitat which would be available to migratory fish under reference conditions, but which has been rendered unusable by artificial barriers to migration.

**How the map was created**

The limits for classifying impact of barriers on river continuity have been set by UKTAG as high severe impairment of fish movement and or or draining 1% of the upstream river), good (draining 5%), moderate (draining 20%) and poor draining (draining greater than 20%).

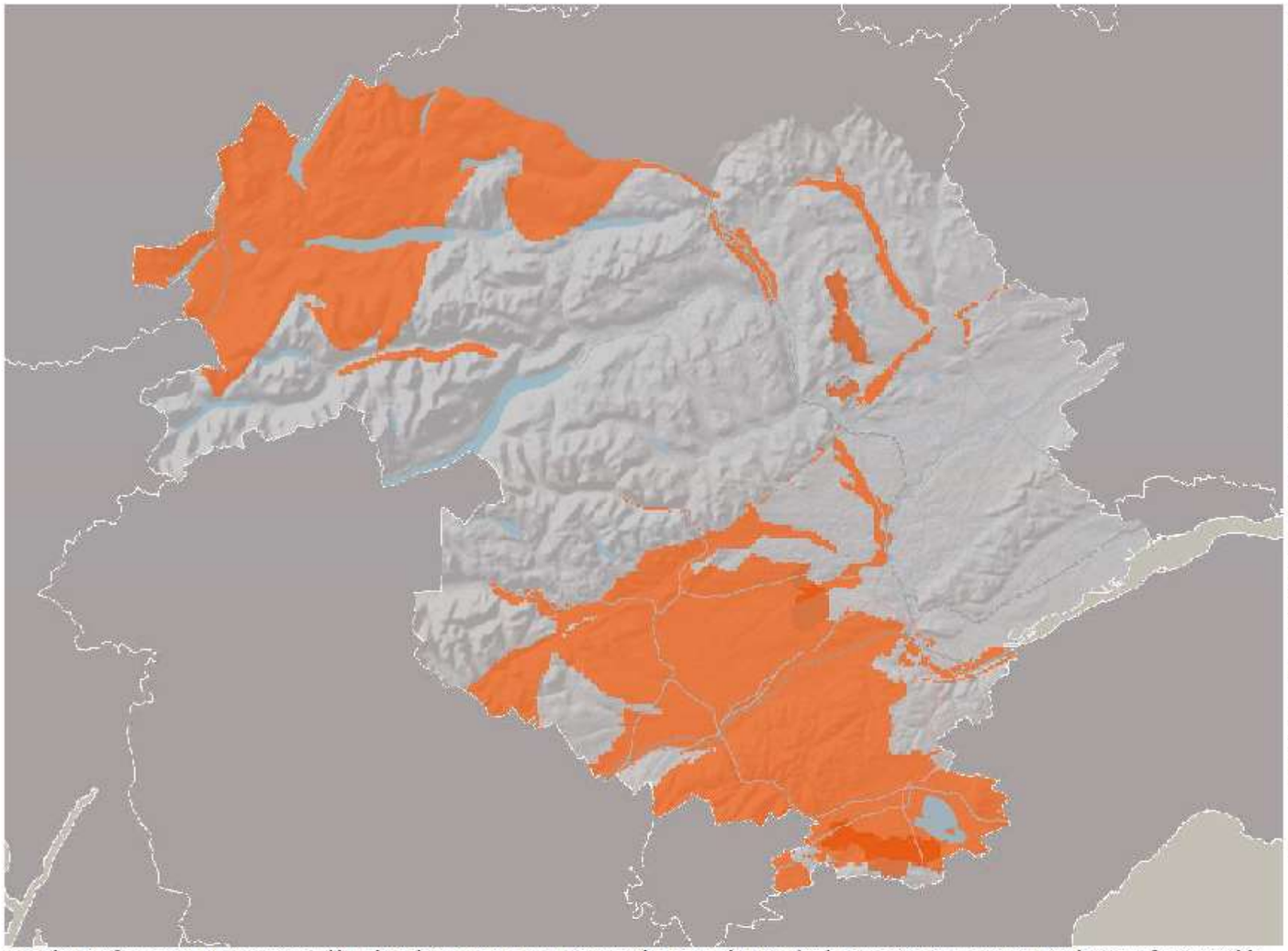
A severe impairment of fish movement is defined as more than 80% of fish that would otherwise be able to move upstream or downstream from the river or part concerned of are unable to do so because of man-made barriers (UKTAG River Assessment Method River continuity, WFD, UKTAG, 2015), SEPA[1]).

**Data: SEPA**




1 https://www.wfdss.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Methods%20Statements/Barrier%20to%20Fish%20Migration%20Section%20SEPAMethod%20Statement.pdf

Figure 5.19 – Hydro: River impact



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas where **hydro specific planning considerations** related to **impact** are present.

**What the map shows**

The map shows hydro specific planning considerations associated with impacts related to **water abstraction for agriculture and groundwater quality.**

**Why the map is important**

Farmers may take water directly from water bodies including surface and ground water bodies for crops and/or livestock. All abstractions are controlled by SEPA registrations and licences for abstractions of >50 cubic metres/day. The data shows the size of abstractions for agriculture from the water environment that SEPA has licensed assigned to surface water body catchments but may also come from groundwater. The data shows the maximum licensed volume for abstraction at any one time.

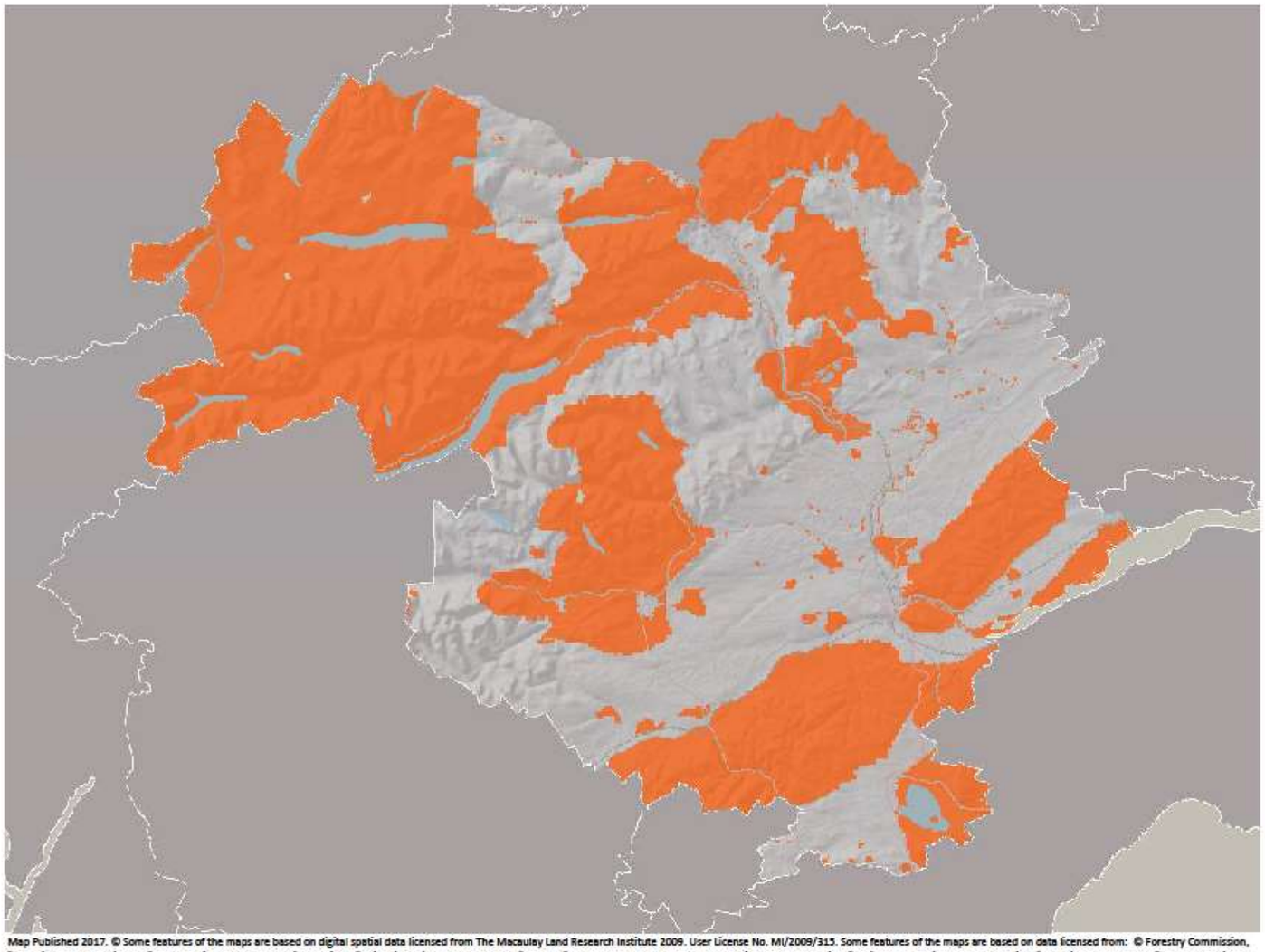
The groundwater dataset represents the individual groundwater water bodies in Scotland. These have been defined by the Scottish Environment Protection Agency in line with the requirements of The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013

**How the map was created**

The data shows the size of abstractions for agriculture from the water environment that SEPA has licensed, these have been assigned to surface water body catchments although some are taken from groundwaters.

**Data: SEPA**

Figure 5.20 - Protected Sites



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas where hydro specific planning considerations related to protected sites are present.

**What the map shows**

The map shows hydro specific planning considerations associated with protected sites.

**Why the map is important**

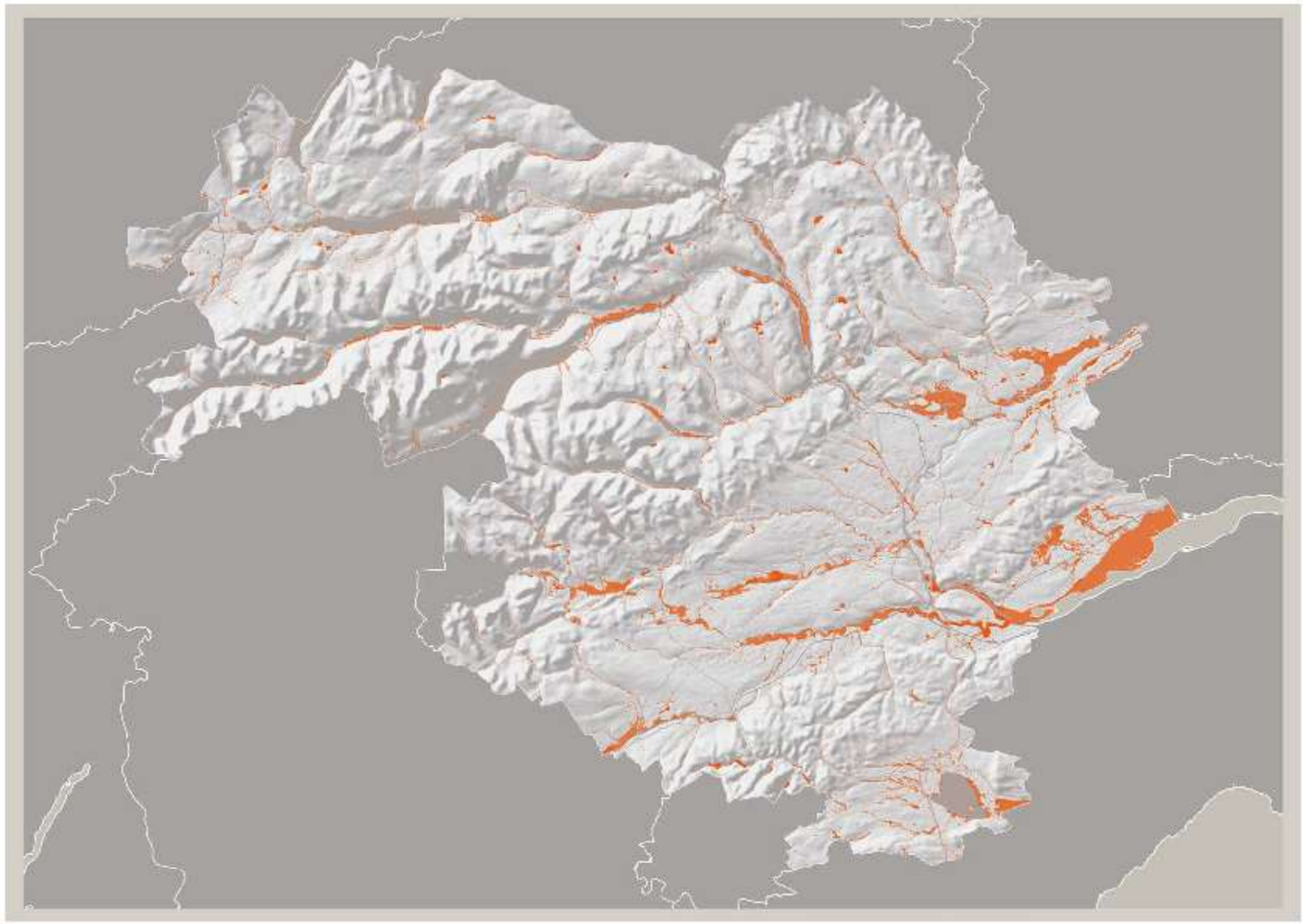
Hydroelectric developments should assess if their proposal is likely to affect any protected area. These sites include: – Special Protection Areas (SPAs), Special Areas of Conservation (SACs) (including candidate sites), and Ramsar sites; – Sites of Special Scientific Interest (SSSIs); – National Nature Reserves (NNRs); – Geological Conservation Review sites; – National Scenic Areas, Wildland areas (Hydroelectric Schemes and the Natural Environment, SNH, 2015).

**How the map was created**

The maximum sensitivity score was assigned to cells containing the protected areas listed above.

**Data: SNH**

Figure 5.21 – Hydro – Flood Risk



**How to interpret the map**

This is one of 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas where **hydro specific planning considerations** related to **flood risk** are present.

**What the map shows**

The map shows planning considerations associated with impacts related to flood risk impact of hydro schemes.

**Why the map is important**

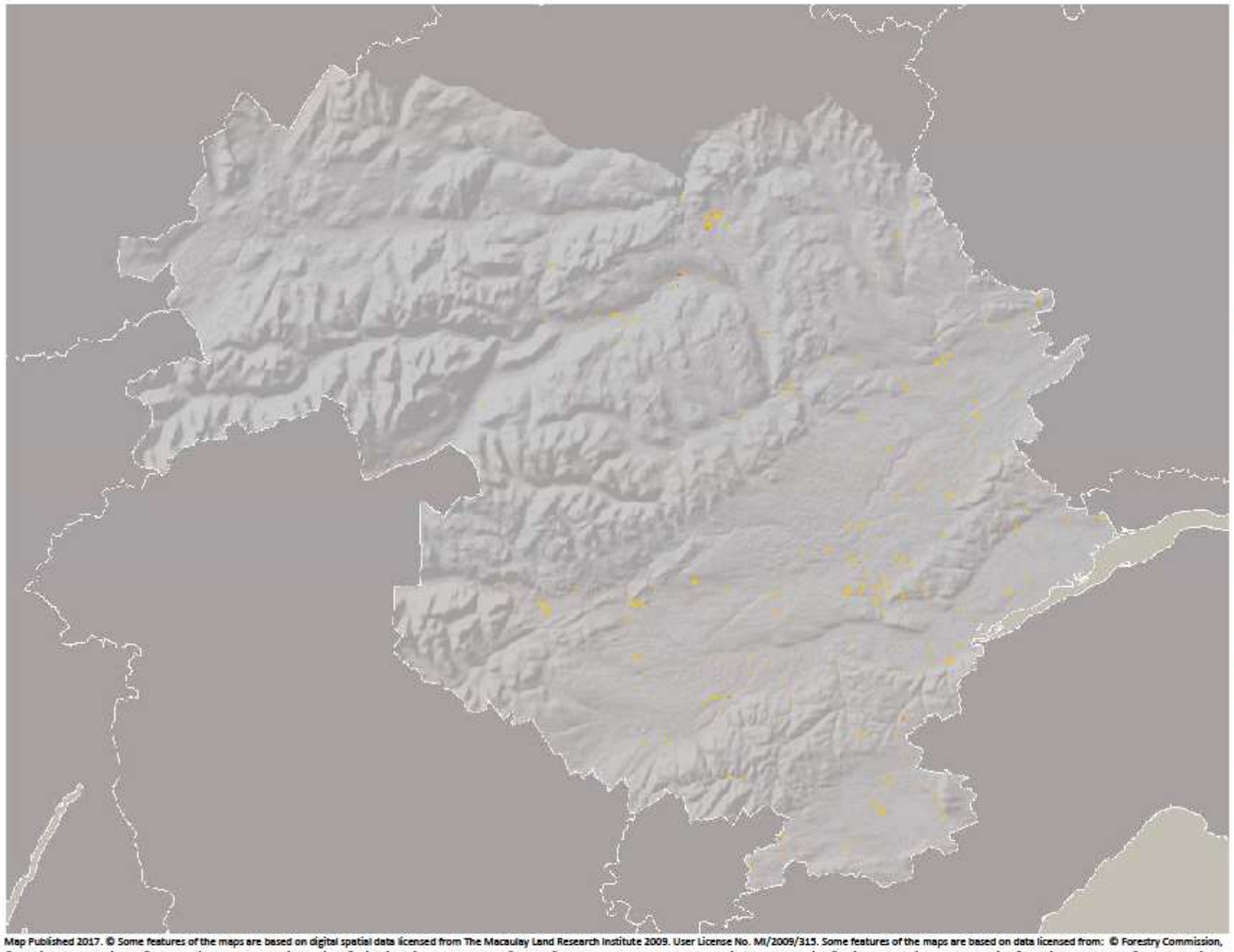
The National Flood Risk Assessment is the first step of the new risk-based approach to managing the impacts of flooding, introduced by the Flood Risk Management (Scotland) Act 2009.
Hydro submissions should demonstrate that in-river engineering can cope with extreme rainfall, and powerhouses and other dry land infrastructure is designed and sited to minimise risk.
A Flood Risk Assessment may be required where there is potential increased risk to dwellings or Potentially Vulnerable Areas in Local Flood Risk Management Plans.

**How the map was created**

The data shows the presence of flood risk for the Perth & Kinross area. The dataset was produced by SEPA and maps a range of predicted fluvial and coastal flood events for mainland Scotland and the Islands. The dataset used is an indicative flood outline based on a medium annual probability of fluvial flooding. This layer was reclassified to identify predicted non-risk and risk areas.

**Data:** SEPA

Figure 5.22 – Solar - Cumulative Impact of Existing and Consented Large PV Arrays



Map Published 2017. © Some features of the maps are based on digital spatial data licensed from The Macaulay Land Research Institute 2009. User License No. MI/2009/315. Some features of the maps are based on data licensed from: © Forestry Commission, © Scottish Natural Heritage , © Royal Society for the Protection of Birds, © Historic Environment Scotland, © Defra, © Loch Lomond and the Trossachs National Park Authority, © Cairngorms National Park Authority, © Scottish Government, © General Register Office Scotland, © SNIFFER, © DECC, © TACTRAN, © National Biodiversity Network, © NAEI. © Met Office Some elements © Data reproduced under licence from the Royal Yachting Association (RYA recreational sailing and cruising route data). Reproduced by permission of Ordnance Survey on behalf of HMSO. Includes mapping data based on Ordnance Survey 1:50, 000 maps with permission of HMSO Crown copyright and/or database right 2006. Licence100017572© Crown copyright and database right 2017. All rights reserved. 100016971. © Crown copyright [and database rights] 2017 OS 100016971. Use of this data is subject to terms and conditions.

**How to interpret the map**

**This is one of the 17 maps to show opportunities to promote ecosystem services and maintain SEA objectives. The purpose of the map is to indicate areas where there is a high Cumulative Visual Impact.**

**What the map shows**

**The Cumulative Landscape and Visual Impact Assessment (CLVIA) is to describe, visually represent and assess the ways in which a proposed large PV array would have additional impacts when considered in addition to other existing, consented or proposed commercial scale schemes It should identify the significant cumulative effects arising from the proposed scheme**

**Why is the map important**

**Large PV arrays of sited in open sensitive landscapes have the potential to create significant visual impact by virtue of their number, site coverage or layout, the effect they have on the colour of the landscape and degree of reflection, together with access tracks, security fencing and ancillary components such as substations and power lines. The ability of the landscape to absorb development often depends on the inherent characteristics of the landscape such as landform, ridges and vegetation. A cautious approach is necessary in relation to particular landscapes which are rare or valued, such as National Scenic Areas and National Parks, together with designed landscapes and the settings of the historic environment. Cumulative effects are considered**

**where progressively more large arrays of PV are proposed in the area (Scottish Government, Large PV arrays, In areas approaching their carrying capacity the assessment of cumulative effects is likely to become more pertinent in considering new installations. In other cases, where proposals are being considered in more remote places, the thresholds of cumulative impact are likely to be lower and in fact, may offer opportunities in terms of colocation The impact of individual proposals is best assessed at ta site specific level**

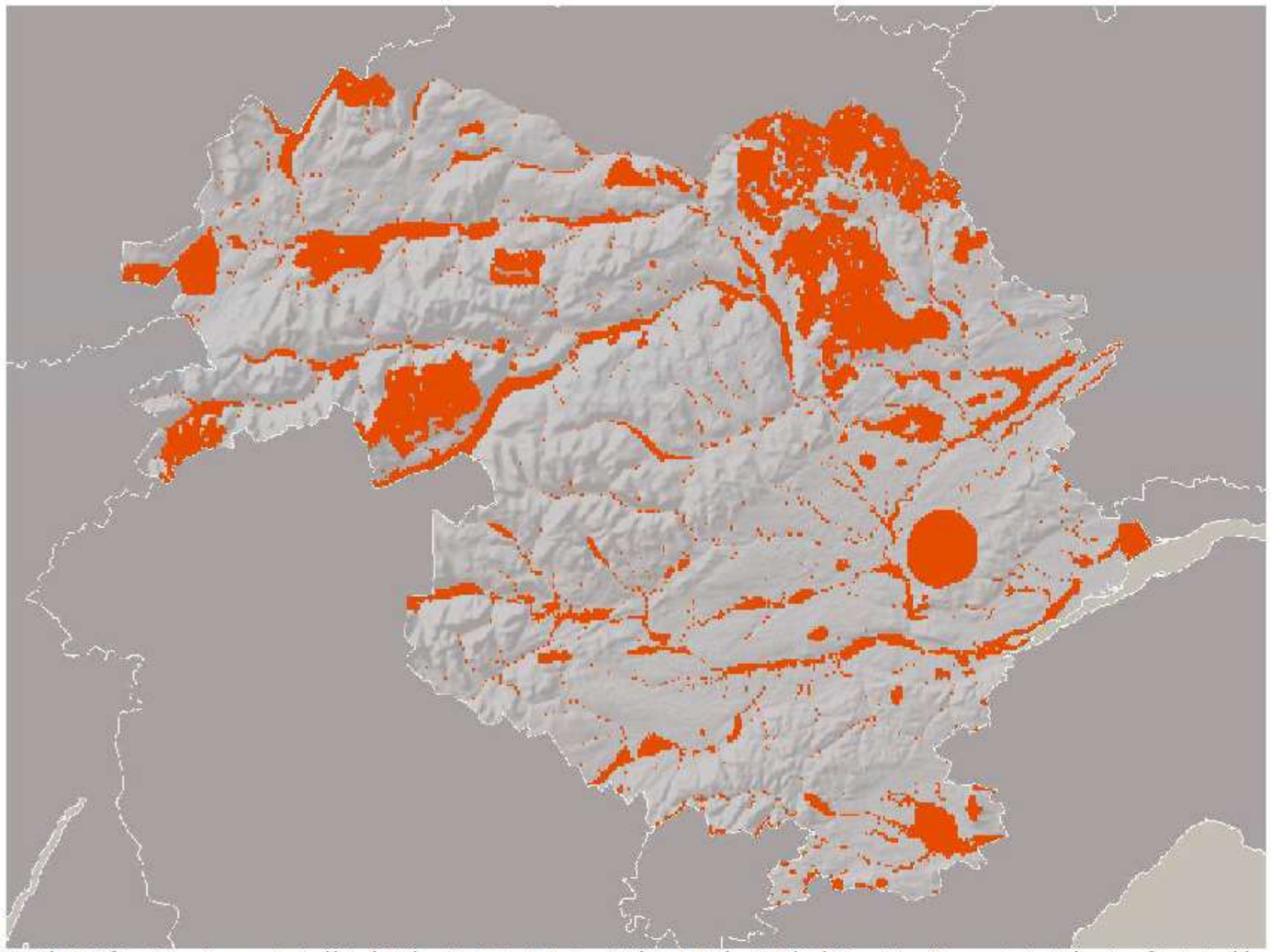
**[http://www.gov.scot/Resource/0042/00423079.pdf](http://www.gov.scot/Resource/0042/00423079.pdf)**

**How the map was created**

**A model counting how many commercial solar farms (defined by PKC as > 1MW) are present in each grid cell in the landscape was used and then classified where highest sensitivity occurs with most number of panels**

**Data: Perth and Kinross Council existing and consented solar/large PV farms (>1 MW)**

Figure 5.23 – Solar: Wetlands, flood risk and 3km exclusion zones around aerodromes (separate considerations)



**How to interpret the map**

This is one of the 17 maps to show landscape sensitivity and maintain SEA objectives. The purpose of the map is to indicate areas which are considered sensitive under planning guidance for large photovoltaic arrays (SG, Large PV arrays, http://www.gov.scot/Resource/0042/00423079.pdf

**What the map shows**

Additional planning considerations are: the **Wetland Inventory, areas at risk of flooding, 3km exclusion zone around aerodromes**. The first layer is a proxy representation of the GWDTE (groundwater dependant terrestrial ecosystems). SEPA Planning Guidance The second dataset used is an indicative flood outline based on a 0.5% or greater (or 1 in 200 chance) annual probability of fluvial flooding (SEPA).

**Why the map is important**

The Spatial Framework identifies spatial constraints and is intended to assist prospective developers in finding less constrained sites or sites with no significant constraints. In addition we would seek policies in the Plan to ensure that windfarm proposals are supported where they can demonstrate that they will not have an unacceptable impact on:

- the water environment;
- flood risk;

Scottish government online planning advice for large PV arrays further requires that spatial frameworks identify 3 km exclusion zones around aerodromes.

**How the map was created**

Wetland and flood risk areas were classified in two classes (1 = low sensitivity = absence of planning criteria and 4 = high sensitivity = presence of planning criteria). The combination of the three layers produced the maps beside which identify the most sensitive planning areas.

**Data: SEPA, SNH**

## 5.4 Policy Assessment

The second part of the assessment involves a policy-based assessment, using a conventional matrix methodology.

The assessment for each technology against the SEA Objectives is collated into one table. Potentially significant effects for each technology have been identified and reported under the most relevant SEA Objective. Recommendations for mitigation and opportunities for enhancement have been identified. Figure 5.6 below shows an example of the proposed format for this part of the assessment, and the assessment has been classified using the symbols and descriptions in the Figure.

Figure 5.6 - Assessment Classification

| Class | Symbol | Description |
|---|---|---|
| Significant Positive Effect | ++ | A measure very likely to lead to an overall large improvement<br>Effects are widespread across the catchment and/or<br>Effects are likely to improve an ecosystem that is in less than good condition |
| Positive Effect | + | A measure very likely to lead to an overall moderate or small improvement a noticeable positive effect that does not meet the above description |
| Mixed | +/- | An measure not likely to effect<br>The effect is likely to be a combination of positive and negative effects, particularly where effects are considered on sub-issues, areas or criteria |
| Negative Effect | - | A measure very likely to lead to an overall moderate or minor reduction<br>A noticeable negative effect that does not meet the description below |
| Significant Negative Effect | - - | A measure likely to lead to overall severe reduction<br>Effects are widespread across the catchment and/or<br>Effects are likely to cause a significant adverse effect on an environmental issue |
| Uncertain | ? | The effect is not known, or is too unpredictable to assess.<br>Further assessment may be made or required at site assessment stage |
| Cumulative | | A measure, when combined with other actions in the guidance or with other existing actions is very likely to lead to a positive or negative effect. Includes synergies and interactions |
| Timescales | S/M/L | Effects are short (S), medium (M) or long (L) term |

## 5.5 Secondary, Synergistic and Cumulative Effects

Under SEA legislation, the assessment must consider secondary, cumulative and synergistic effects associated with the implementation of the guidance. These interactions are assessed in a number of ways:

**Secondary and synergistic effects** are assessed by considering effects on multiple environmental considerations (as part of the spatial assessment) as well as across the range of technologies (as part of the policy-based assessment) against SEA objectives;

**Cumulative effects** are considered by taking account the extent of all environmental considerations in the catchment and identifying where the deployment of each technology would potentially lead to cumulative environmental effects. The cumulative assessment combines data to examine, characterise, and quantify the combined effects of potential low carbon and renewable development on multiple environmental considerations. Assessment of Strategic Environmental Sensitivity was undertaken by overlaying spatially-based environmental considerations in a GIS model to produce a cumulative environmental sensitivity map. Relevant considerations were combined using an equal weight additive GIS model and summarised by catchment. The effects arising from the development of renewable and low carbon energy technologies within each catchment area has been evaluated based on the defined environmental characteristics of the area. As part of the policy-based assessment, cumulative effects are also considered across the range of technologies included within the SG, as required under the Environmental Assessment legislation.

Results from both the spatial and policy-based assessments are used to inform and shape the Renewable and Low Carbon Energy Guidance including the formulation of Strategic Environmental Sensitivity maps for wind, hydro and solar technologies. Strategic Environmental Sensitivity maps assist in identifying cumulative environmental sensitivities and complement the approach for identifying those areas that are likely to be most appropriate for development as set out in SPP (2014). These maps will be made available through web mapping alongside the individual environmental considerations used to the develop the maps to assist in the delivery of the Guidance provide an indicative spatial plan to help steer future low carbon and renewable energy in the area by enabling a strategic assessment of potential significant environmental effects complemented by EIA at the planning application stage, where applicable.

Resulting outputs will be used to;

- Provide further supporting information relevant to development management and for planning policy related to a range of environmental considerations.
- Assist in planning future renewable and low carbon energy in the area
- Identify environmental effects arising from a range of renewable and low carbon technologies

## 5.6 Assessment of Alternatives

Part 2 Section 14(2) of the Environmental Assessment (Scotland) Act 2005 requires the responsible authority (in this case Perth & Kinross Council) to identify, describe and evaluate within the Environmental Report the likely significant effects on the environment of implementing the Supplementary Guidance and reasonable alternatives, taking into account its objectives and geographical scope.

The Guidance is the final tier of the policy hierarchy and as such it accords with a number of more strategic plans and policies and the range of alternatives is therefore limited. It encourages renewable and low carbon energy developments to be located in preferred locations, and to minimise potential adverse environmental effects. The alternative of not seeking to support renewable and low carbon energy development and trying to reduce and minimise the adverse effects of such development is not considered to be a realistic or appropriate policy option. The aims of the land use planning system (sustainable development and environmental protection), and national and international commitments to reduce the emission of greenhouse gases all support the development of low carbon and renewable energy sources, and for these to be located in the most environmentally sustainable locations

The Guidance also aims to assist applicants and developers in the preparation of applications for a range of renewable and low carbon energy developments, and to help members of the public and communities understand the requirements of the planning process in relation to development proposals. To this end the Guidance provides links to other sources of information and advice that are considered relevant for proposed renewable and low carbon energy development proposals. This information will be used to assist the Council in identifying preferred areas where the Council could support proposals for renewable and low carbon technologies, as specified in Scottish Planning Policy and Local Development Plan policy, as well as to identify key environmental issues that will inform the site design and application process.

# 6 Environmental Assessment of Supplementary Guidance

## 6.1 Introduction

Section 5 of the Environmental Report details the assessment methodology used to identify and assess the environmental effects, and significance of these effects, associated with the adoption and implementation of the Renewable and Low Carbon Energy Supplementary Guidance. As noted above, the Environmental Assessment of the SG is split in to two parts:

- Firstly, a spatial, map-based assessment to identify key strategic and cumulative environmental sensitivities in relation to the deployment of wind, hydro and solar technologies. This assessment is detailed in Sections 6.2-6.3.
- Secondly a policy-based assessment has been undertaken to identify and assess the key environmental effects arising from the deployment of all technologies included in the guidance document. Section 6.5 includes the policy-based assessment of environmental effects, with further detailed assessment work included in Appendix 4.
- The overall assessment framework will consider cumulative, secondary, synergistic, and temporal effects, as well as the identification of options for mitigation and enhancement (see Sections 6.6 & 6.7).

Together the two assessment methodologies provide a comprehensive framework to enable the planning authority to identify the significance of any environmental effects arising from the development of a range of renewable and low carbon energy technologies within the Council area, both spatially and at a policy-level.

## 6.2 Strategic & Cumulative Environmental Sensitivities – Spatial Assessment

This section focuses on a spatial, map-based assessment considering the strategic and cumulative environmental sensitivities relevant to the three technologies: wind, hydro, and solar. The assessment includes consideration of 1) strategic environmental sensitivities and 2) cumulative environmental sensitivities at catchment and council-wide scales. Strategic environmental sensitivities are those environmental considerations which are present across the Council Area. Environmental sensitivities have been identified in each catchment and at a council-wide scale, and further assessment work has been undertaken to identify where there are cumulative environmental pressures i.e. areas where there are multiple environmental sensitivities present. Section 6.2 has been structured using the following format:

- Catchment scale – assessment of strategic and cumulative environmental sensitivities for each technology (see Section 6.3)
- Council-wide scale – assessment of strategic and cumulative environmental sensitivities for each technology (see Section 6.4)

## 6.3 Strategic & Cumulative Environmental Sensitivities – Catchment Assessment

The following section includes the SEA assessment that has been undertaken to identify the strategic and cumulative environmental sensitivities within each catchment. The identification of these sensitivities highlights which environmental characteristics will likely require further assessment at the planning application stage for each of the technologies, and identify where there are cumulative environmental pressures which will help to inform where it may or may not be appropriate to deploy further renewable and low carbon energy technologies: As noted above the outputs of the spatial assessment are at a strategic level for the study area.  No

judgement has been made within the study as to the desirability or otherwise of installations, and detailed statements regarding location specific impacts (including mitigation measures) are beyond the scope of the strategic framework. It is not applicable without the use of additional data and analysis work at the individual proposal/site specific scale. At that level more detailed investigations, such as those required by LDP policies and Environmental Impact Assessment, are likely to be necessary. The following pages identify the key strategic and cumulative environmental sensitivities for each catchment across the three technologies. The results demonstrate that there is a significant variation across the catchments in terms of the environmental sensitivities present as well as the levels of cumulative environmental sensitivity i.e. significant to low sensitivity. This helps to identify where there may be strategic opportunities for further development of wind, hydro and solar across the Council Area, as well as identifying those environmental sensitivities that may require further consideration at the site level. The SG will help inform decision-makers where further information will be required and include details on how environmental sensitivities can be addressed, where relevant, at the application stage.

The following pages will be set out in the following format so an assessment of all three technologies can be made for each catchment, including both strategic and cumulative environmental sensitivities:

- Tree map of strategic environmental sensitivities (figures 6.1 -12): the tree maps will show by cell size and colour the level of each environmental consideration with each catchment[10].
    - Pie-chart showing cumulative environmental sensitivity: the charts will show the levels of environmental sensitivity by catchment and council-wide; and
    - Analysis of catchment results

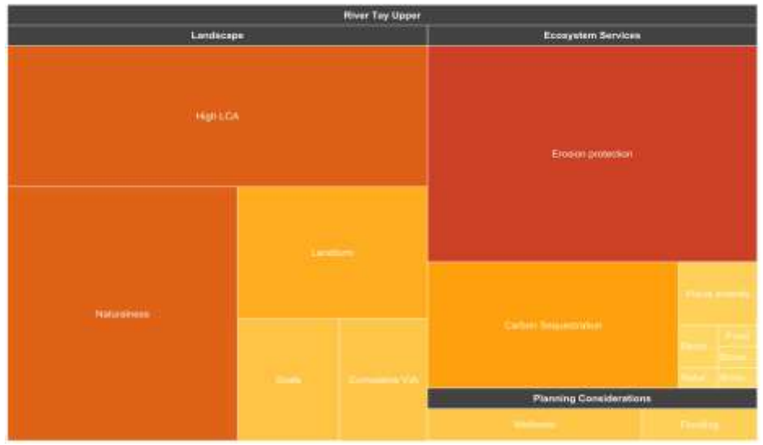
This will be set out for wind, hydro and solar technologies for the catchments in the following order:

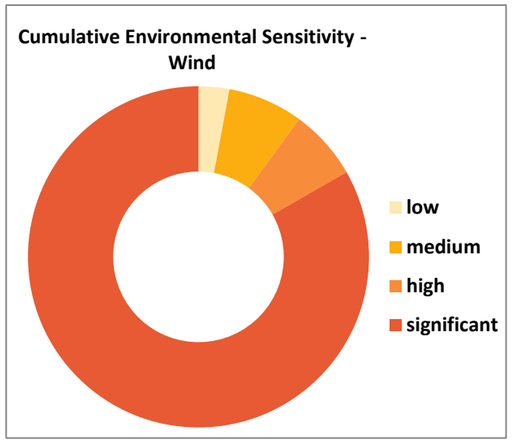
- River Tay (Upper)
- River Tay (Lower)
- Earn Coastal
- River Eden
- Perth Coastal
- River Leven
- Dundee Coastal
- River Earn
- River Devon
- Allan Water
- Stirling Coastal
- Unclassified Estuary

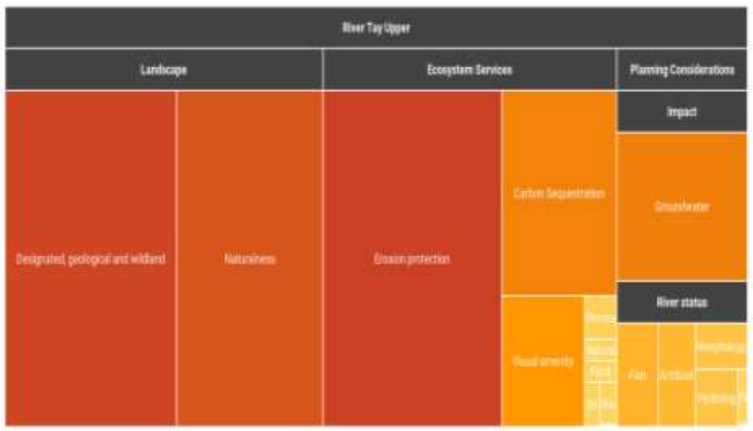
Please note that the catchment assessment for wind includes separate figures (see Table 6.1) for the 'significant' classification of sensitivity as this classification dominates across most catchments. In addition, the tree map diagrams for the wind assessment include the SPP spatial framework for wind groupings (see Appendix 7 for further) and therefore there may be slight variation compared to hydro and solar where the same environmental sensitivities apply.

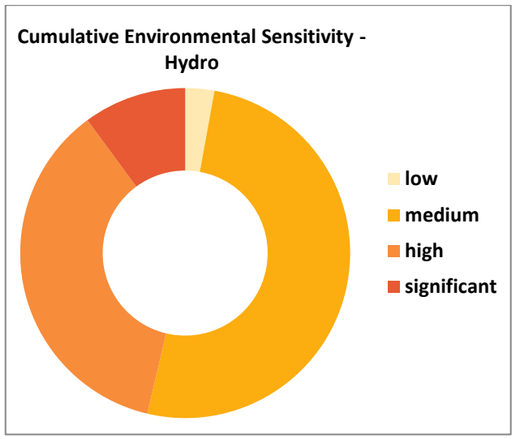
[10] Treemaps are used to visualize the hierarchical structure of environmental considerations displaying quantities for each category via area size. Each category is assigned a rectangle area with their subcategory rectangles nested inside of it. When a quantity is assigned to a category, its area size is displayed in proportion to that quantity and to the other quantities within the same category (i.e. e.g. various components of landscape). Treemaps are commonly used to compare proportions between categories via their size.

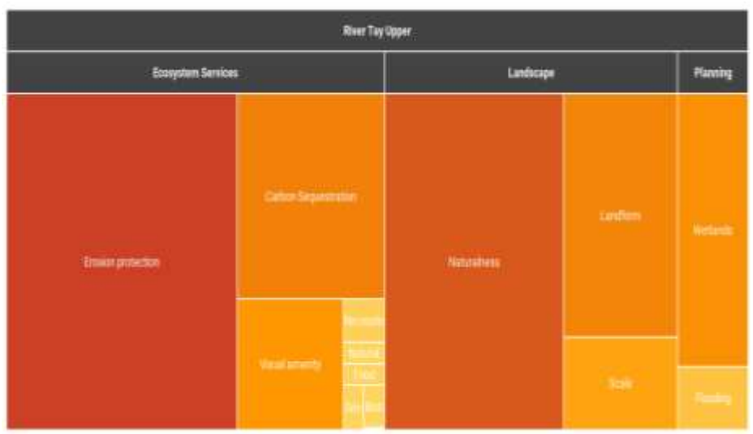
Figure 6.1 – River Tay (Upper Altitude)

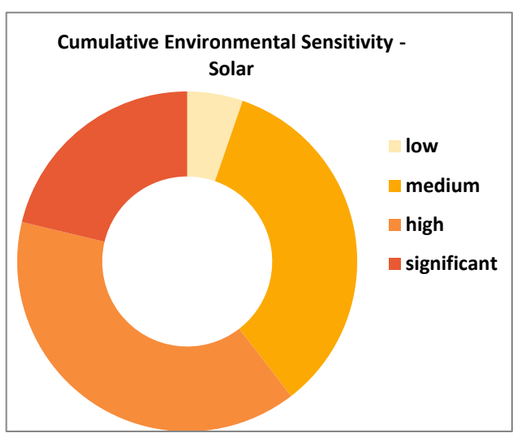



## River Tay (Upper Altitude) –Strategic & Cumulative Environmental Sensitivities - Wind

The highest scoring environmental sensitivity is the ecosystem service of **erosion protection** (86%). Landscape is also a key consideration in this catchment, where nearly three quarters of the landscape (71%) has been classed as the **highest level of sensitivity for wind energy development** (Tyldesley, 2010). This is followed closely by the landscape consideration of **naturalness** (70%), and other landscape considerations including **landform complexity** (30%), scale (15%) and potential cumulative visual impact (13%). Other notable considerations include large areas of **carbon rich soils, deep peat and priority peatland habitats** (38%), wetlands (13%) and areas at risk from flooding (7%). Based on the above assessment, key SEA objectives for this catchment include: Soils, Water & Landscape.

The cumulative level of sensitivity to wind energy development in the low and medium categories is relatively low compared with the other catchments with figures of 3% and 7% respectively. 83% of the catchment is classified as a Group 2 significant sensitivity (areas of significant protection where wind farms may be appropriate in some circumstances).

## River Tay (Upper Altitude) –Strategic & Cumulative Environmental Sensitivities - Hydro

The key ecosystem services in the River Tay Upper Altitude Catchment are **erosion protection** (90%), **carbon sequestration** (35%) and visual amenity (16%). In terms of planning considerations, the most notable consideration is **groundwater** (37%) with the remaining planning considerations scoring below 10%. Two considerations score highly from landscape considerations – **designated, geological and wildland areas** (86%) and **naturalness** (73%). Overall, there is a range of different considerations scoring highly within this catchment. Based on the above assessment, key SEA objectives for this catchment include: Soils, Climatic Factors, Water, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

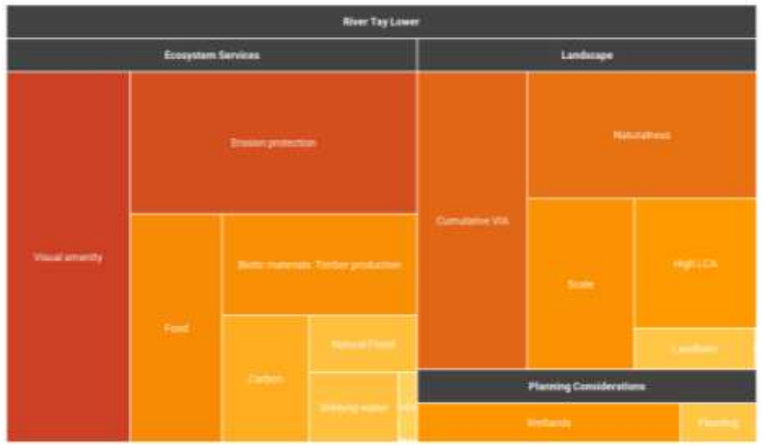
Nearly half of the River Tay (Higher Altitude) catchment falls within the significant (10%) and high (36%) classifications of environmental sensitivity. This is the second highest score across all catchments for the classification of high and significant environmental sensitivity. The catchment also has the lowest score (3%) falling within the 'low' environmental sensitivity classification, which identifies that this area of Perth and Kinross has high levels of environmental sensitivity in terms of future hydro energy development.

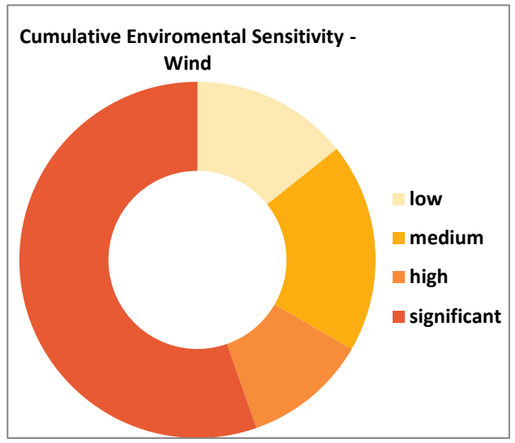
## River Tay (Upper Altitude) –Strategic & Cumulative Environmental Sensitivities - Solar

The key ecosystem service is **erosion protection (90%)**, followed by **carbon sequestration (35%)** and visual amenity (16%). In terms of landscape, the catchment has higher than average scores for **naturalness (70%), landform (32%),** and scale (12%). With respect to planning considerations, the catchment has a relatively high score for wetlands (22%) compared to other catchments, with flooding (5%) also scoring. Based on the above assessment, key SEA objectives for this catchment include: Soils, Climatic Factors, Landscape and Water.

The majority of the River Tay (Higher Altitude) catchment falls within the medium (34%) and high (39%) classifications of environmental sensitivity. The percentage of land falling within the high classification is the second highest across all catchments. The catchment also has the second lowest score (5%) falling within the 'low' environmental sensitivity classification as well as the third highest score in the significant (21%) classification, which identifies that this area of Perth and Kinross has potentially high levels of environmental sensitivity in terms of future solar energy development.

Figure 6.2 –River Tay (Lower Altitude)



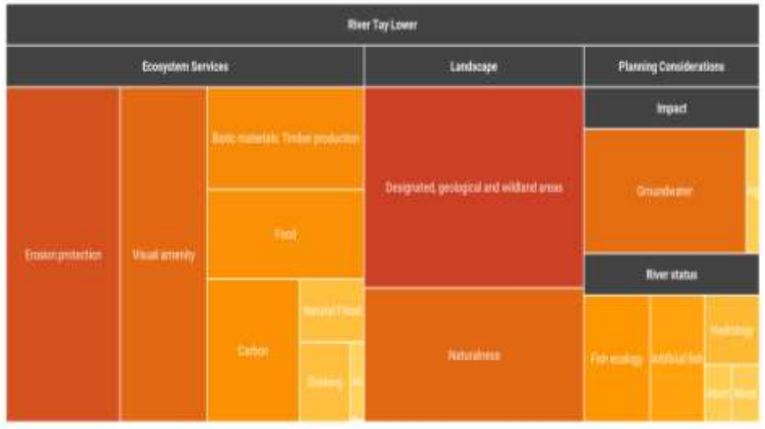



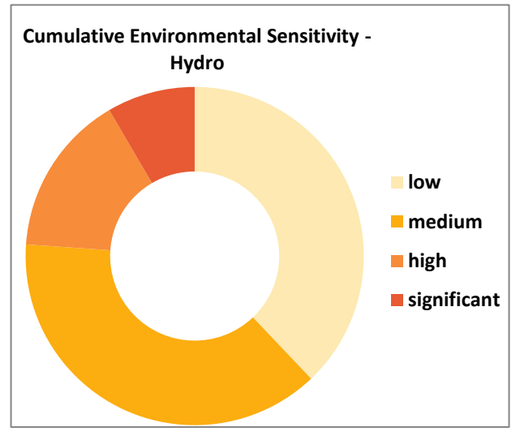

## River Tay (Lower Altitude) – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key considerations for wind energy development in this catchment in terms of ecosystem services are **erosion protection** (33%), food production (17%), timber production (16%) and carbon sequestration (9%). Various landscape considerations are also important for the catchment, namely potential **cumulative impact from existing and consented turbines** (27%), naturalness (24%) and scale (15%) as well as recognition of areas defined as the highest level of sensitivity (13%) in the Tyldesley study (2010). Other considerations include wetlands which cover approximately 14% of the catchment land area. Based on the above assessment, key SEA objectives for this catchment include: Soils, Material Assets, Climatic Factors, Landscape and Water.

The cumulative level of sensitivity to wind energy development in the low and medium sensitivity classifications is relatively high across all catchments with figures of 14% and 19% respectively. 55% of the catchment is classified as a significant sensitivity – the second lowest across all catchments - where wind energy development may be acceptable in some circumstances subject to further consideration and demonstration that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.



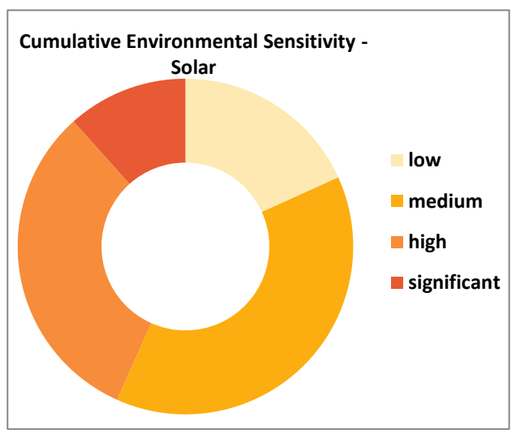




## River Tay (Lower Altitude) – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services in the River Tay Lower Altitude Catchment are **erosion protection** (38%) and **visual amenity** (29%), with various other considerations scoring below twenty percent. In terms of planning considerations, **groundwater** (27%) and fish ecology (11%) are the highest scoring with various other considerations scoring below ten percent. Two landscape considerations score in this catchment – **designated, geological and wildland areas** (44%) and **naturalness** (29%). With no considerations scoring above fifty percent and generally low scores across all considerations this catchment is strategically less sensitive than others in terms of the methodology. Based on the above assessment, key SEA objectives for this catchment include: Soils, Cultural, Water, Biodiversity, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

Over 20% of the catchment falls within areas classified as ‘significant’ and ‘high’ sensitivity, with scores of 8% and 15% respectively. The remaining two thirds of the catchment are split evenly between low (38%) and medium (38%) classifications. The catchment has the fourth lowest score within the ‘low’ environmental sensitivity classification indicating that there are various environmental sensitivities present.

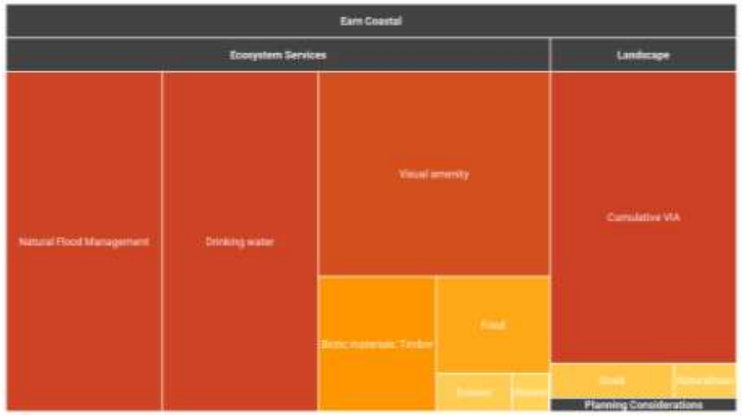

## River Tay (Lower Altitude) – Strategic & Cumulative Environmental Sensitivities - Solar

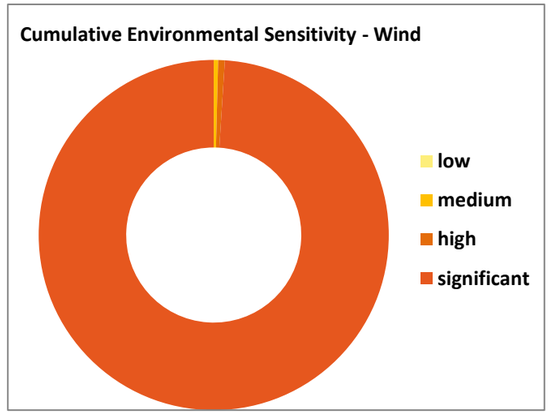
Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services are **erosion protection (38%), visual amenity (29%)** and timber production (16%) with all other services scoring below 15%. In terms of landscape, naturalness (24%) and scale (18%) are the predominant considerations in the catchment, with landform also scoring 7%. Wetlands (15%) and flooding (8%) are the highest scoring planning considerations albeit with relatively low scores. Based on the above assessment, key SEA objectives for this catchment include: Soils, Cultural, Material Assets, Landscape and Water.

This catchment has the fifth highest scores of significant (12%) and high (32%) environmental sensitivity respectively across all catchments. A large percentage (38%) of the catchment is classified as medium sensitivity, with the third lowest score within the low environmental sensitivity classification (18%) across all catchments.

Figure 6.3 – Earn Coastal



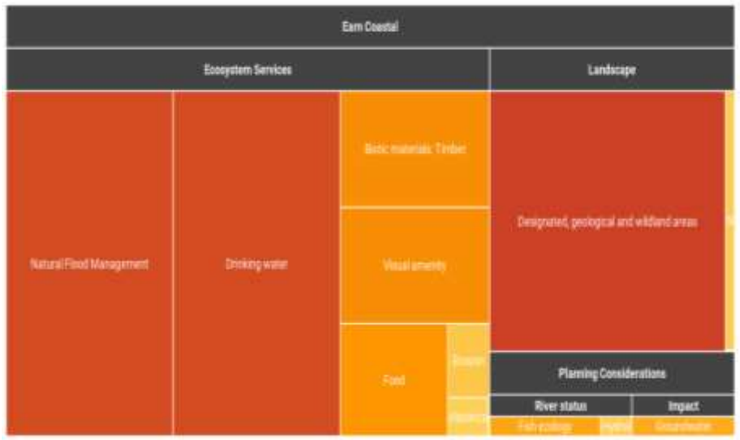



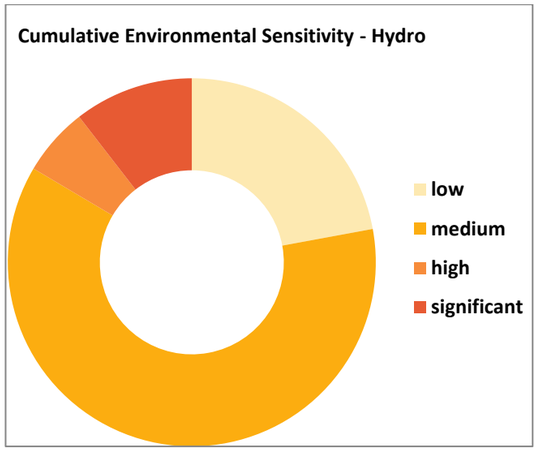

## Earn Coastal –Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key considerations of wind energy development in the Earn Coastal catchment are **natural flood management** (77%) and **drinking water** (77%), as well as timber production (23%) and food production (16%). Landscape is also a key consideration in the catchment, where over three quarters of the landscape (79%) has been identified as sensitive in terms of potential **cumulative impact from existing and consented wind turbines**. A small percentage of the catchment has also been identified as sensitive to other landscape considerations including scale (6%) and naturalness (3%). Based on the above assessment, key SEA objectives for this catchment include: Water, Material Assets, and Landscape.

The cumulative level of sensitivity to wind energy development in areas classed as low and medium sensitivity is the lowest of all catchments, with no area (0%) identified within either category. 99% of the catchment is identified as a significant sensitivity (joint highest across all catchments) with the remaining 1% falling with the high classification of sensitivity.



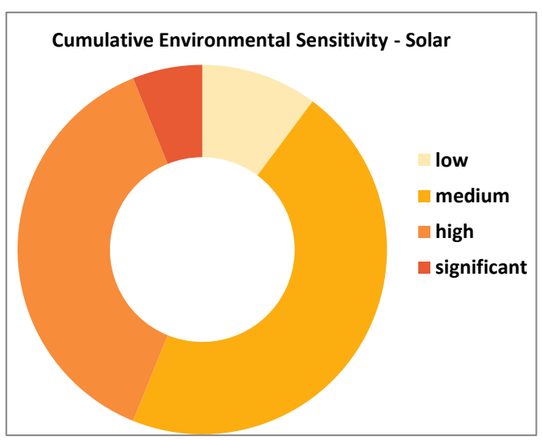




## Earn Coastal –Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services considerations in this catchment are **natural flood management** (77%), **drinking water** (77%), timber production (23%), visual amenity (23%) and food production (16%). In terms of planning considerations, these score low with the highest consideration being fish ecology (11%) and groundwater (10%). The key landscape consideration is **designated, geological and wildland areas** (85%) with naturalness low scoring with a figure of 3%. Based on the above assessment, key SEA objectives for this catchment include: Water, Material Assets, Cultural, Biodiversity and designated sites across a range of themes e.g. biodiversity, landscape.

The Earn Coastal catchment has less than 20% of its land classified as either significant (10%) or high (6%), with the majority of the catchment falling within land classified as medium sensitivity (61%) – the highest across all catchments. The catchment also has the third lowest (22%) level of land classified as 'low' sensitivity across the catchments.

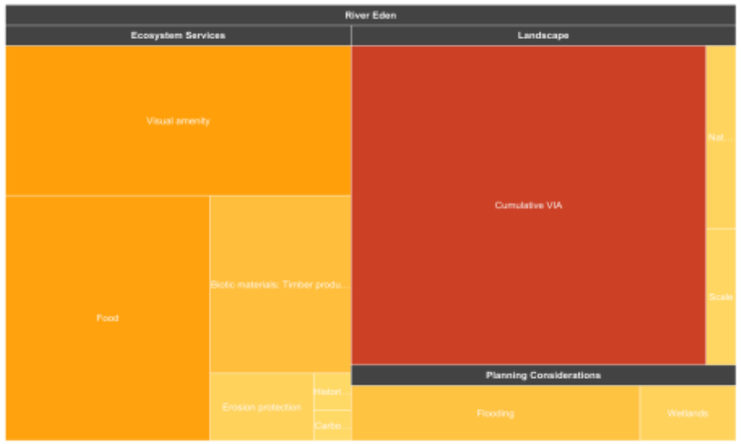

## Earn Coastal –Strategic & Cumulative Environmental Sensitivities - Solar

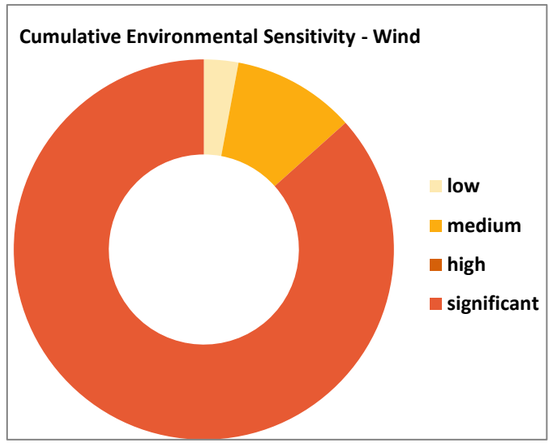
Commentary on potential significant effects / level of cumulative environmental sensitivity

There are two key ecosystem services in the catchment – **natural flood management (77%)** and **drinking water (77%)**, with other ecosystem services scoring below 25% - timber production (23%), visual amenity (23%) and food production (16%). Landscape considerations do not score highly in this catchment, with scale (6%), naturalness (3%) and potential cumulative visual impact (3%) the only considerations scoring. Only one planning consideration (flooding) scores within the catchment, with a low figure of 3%. Based on the above assessment, key SEA objectives for this catchment include: Water, Material Assets, and Cultural.

The Earn Coastal catchment has the vast majority of its area within the medium (46%) and high (38%) classifications of sensitivity. The score within the high classification is the third highest across all catchments. In terms of significant environmental sensitivity, the catchment has the second lowest score (6%), and in terms of low environmental sensitivity, the catchment has the third lowest score (10%).

Figure 6.4 – River Eden



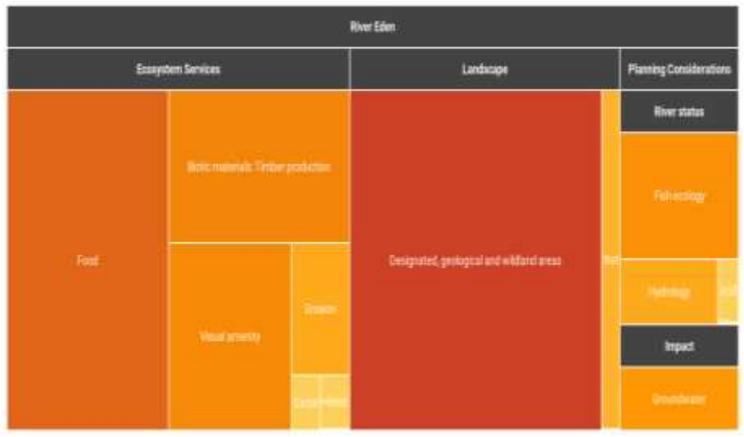



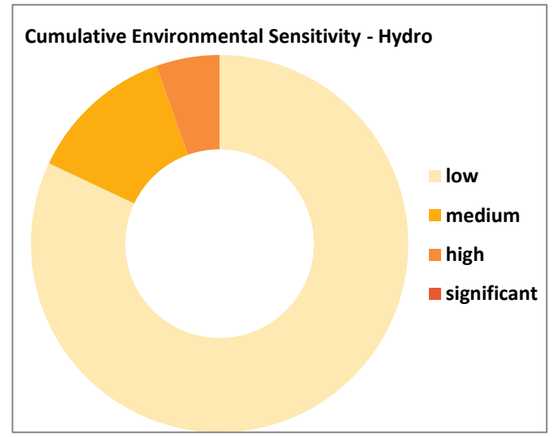

## River Eden – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The most significant consideration for wind energy development in the River Eden catchment is potential **cumulative impact from existing and consented turbines** (82%). Other notable considerations include production services where **food production** (36%) and **timber production** (18%) combine to cover over 50% of the catchment land area. Areas at risk from flooding (15%) are also present within the catchment. Based on the above assessment, key SEA objectives for this catchment include: Landscape, Material Assets and Water.

The level of 'low' sensitivity is relatively low (second lowest) across all catchments, with a figure of 3%. A tenth (10%) of the area falls within the medium classification of sensitivity. The remaining 87% falls within the significant classification, indicating there are a range of environmental constraints to be overcome at the planning application stage.



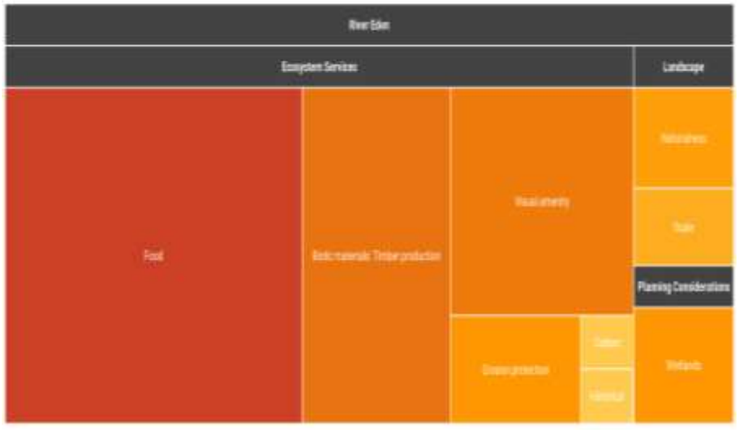



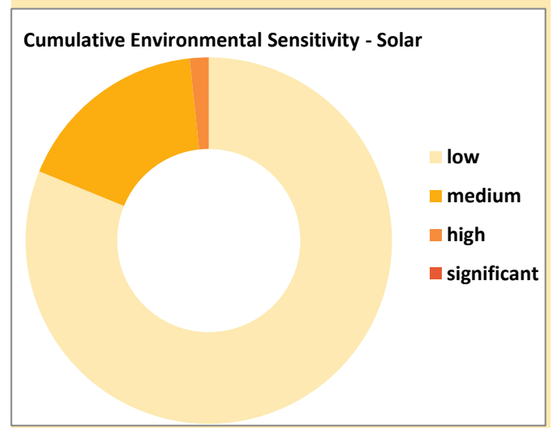

## River Eden – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services considerations in this catchment are **food production** (36%), timber production (18%), and visual amenity (15%). In terms of planning considerations, these generally score low with the highest consideration being fish ecology (12%) and groundwater (8%). The key landscape consideration is **designated, geological and wildland areas** (56%) with naturalness low scoring with a figure of 4%. Based on the above assessment, key SEA objectives for this catchment include: Material Assets, Cultural, Biodiversity, Water and designated sites across a range of themes e.g. biodiversity, landscape.

The River Eden catchment has the highest % of land falling within the 'low' sensitivity classification across all catchments, with a score of 82%. The catchment also has one of the lowest combined % of land falling within the 'significant' and 'high' classifications (5%), identifying that this catchment may be one of the most preferred for future hydro energy development in terms of environmental sensitivity, subject to detailed site assessment.



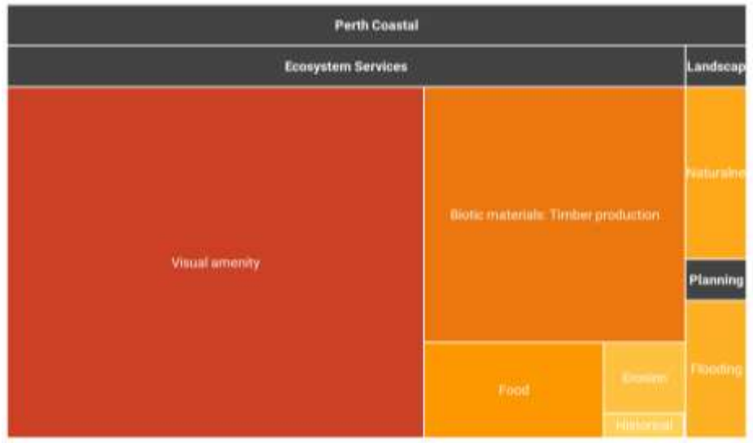

## River Eden – Strategic & Cumulative Environmental Sensitivities - Solar

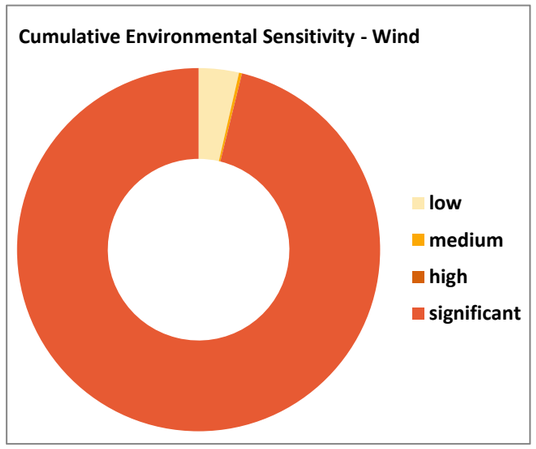
Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services in the River Eden catchment are **food production (36%),** timber production (18%) and visual amenity (15%). In terms of landscape, only two considerations score within the catchment – naturalness (4%) and scale (3%). Wetlands are the only planning consideration scoring in the catchment, with an insignificant total of 5%. Based on the above assessment, key SEA objectives for this catchment include: Material Assets, Cultural, Landscape and Water.

The majority of the River Eden catchment falls within the low environmental sensitivity classification (81%), the second highest across all catchments. The catchment also has scores of 17% and 2% in the medium and high classifications respectively. Similar to other catchments, the River Eden catchment has a 0% score within the significant classification.

Figure 6.5 – Perth Coastal



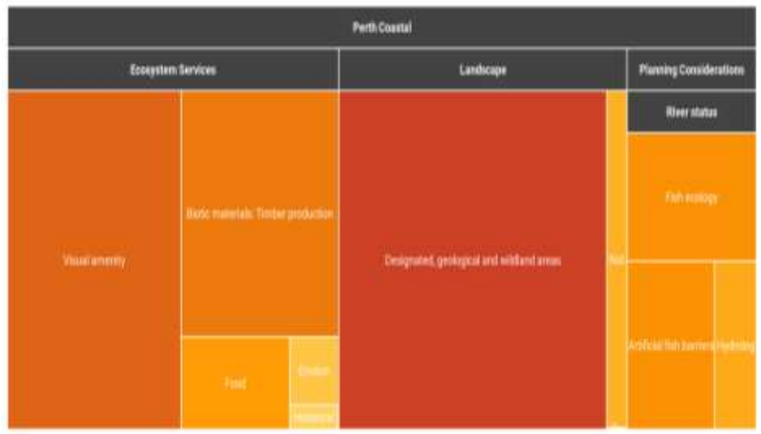



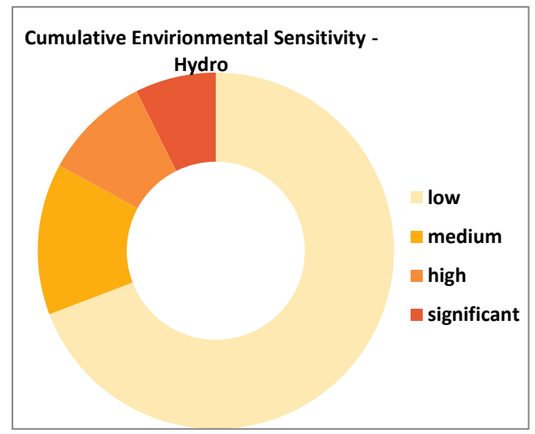

## Perth Coastal –Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The highest ecosystem services – **visual amenity** and **timber production** – cover 77% and 35% of the land area respectively. The high score for visual amenity in particular suggests that there is considerable sensitivity to future wind development in this catchment in terms of various visual amenity factors. Other considerations include food production (9%), naturalness (6%), and flooding (5%). Landscape considerations have a low scoring for this catchment in relation to some of the other catchments. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Landscape and Water.

The vast majority of the catchment (96%) falls within the significant classification indicating that there are significant environmental constraints within this area. The remaining 4% falls within the low classification of sensitivity where there will likely be less environmental sensitivities to be addressed or overcome.



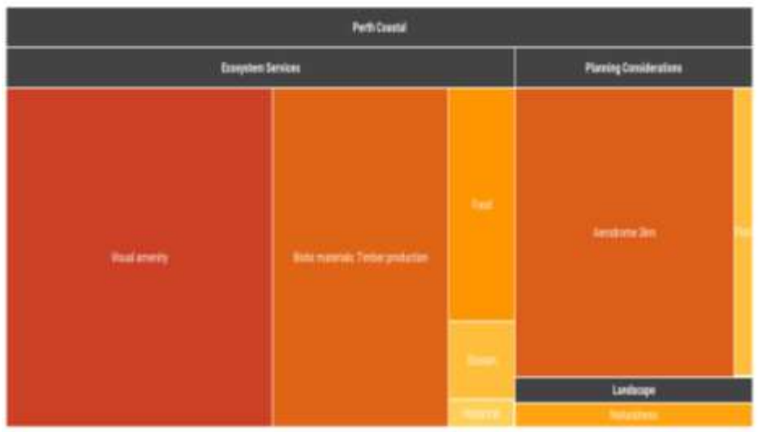



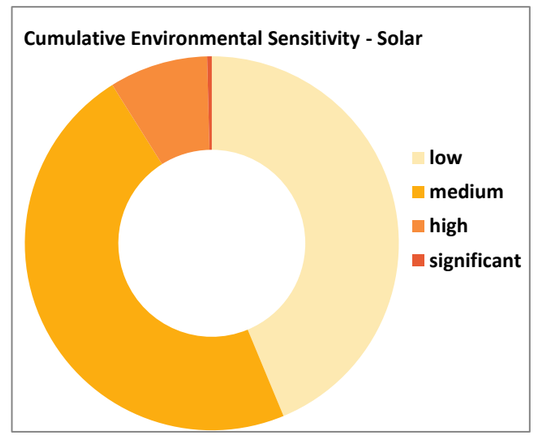

## Perth Coastal – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services considerations in this catchment are **visual amenity** (53%), and **timber production** (35%), with the remaining ecosystem services scoring below ten percent. In terms of planning considerations, these generally score low with the highest consideration being fish ecology (17%) and artificial fish barriers (15%). The key landscape consideration is **designated, geological and wildland areas** (82%) with naturalness covering a low area with a score of 4%. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Biodiversity, and designated sites across a range of themes e.g. biodiversity, landscape.

Perth Coastal catchment has a large majority of its area classified within the 'low' classification with a score of 69%. Similar to a number of other catchments, the % of land classified as high or significant scores below 20% with respective totals of 10% and 7%.



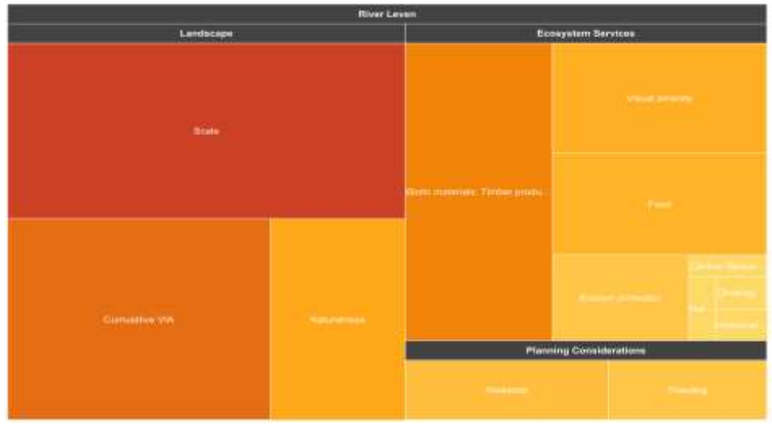

## Perth Coastal – Strategic & Cumulative Environmental Sensitivities - Solar

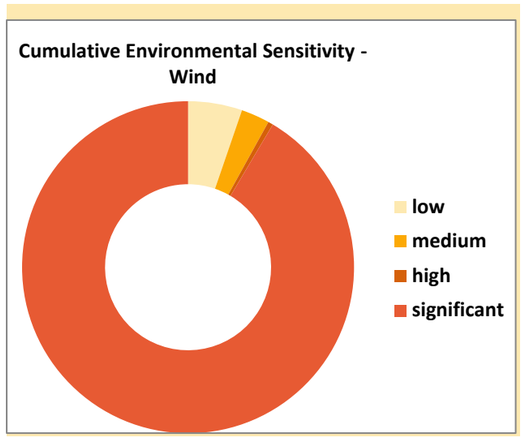
Commentary on potential significant effects / level of cumulative environmental sensitivity

There are two ecosystem services that score considerably within the Perth Coastal catchment – **visual amenity (53%)** and **timber production (35%).** All other ecosystem services score below 10%. In terms of landscape, only naturalness scores in the catchment with a figure of 6%. The key planning consideration in the catchment is the aerodrome and its 3km buffer, which covers 38% of the catchment. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, and Landscape.

Perth Coastal catchment has the highest score across all catchments within the medium classification (47%) of environmental sensitivity, and a relatively high score (44%) within the low sensitivity classification. A small area of the catchment (9%) falls within the high classification and the catchment does not score within the significant classification (0%).

Figure 6.6 – River Leven



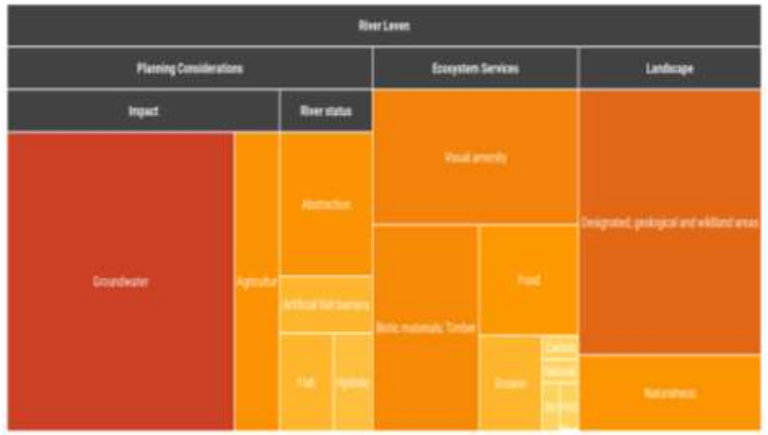



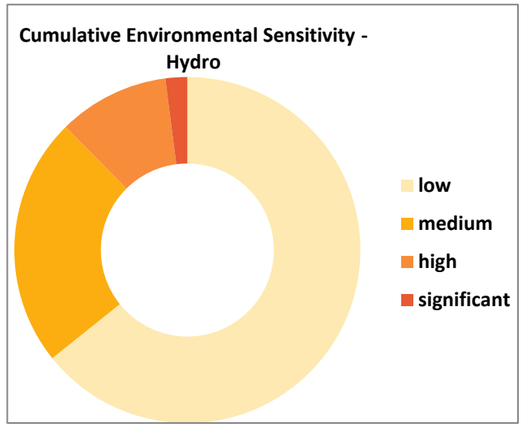

## River Leven – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key considerations for this catchment are landscape-related, namely **scale** (41%), potential **cumulative impact from existing and consented turbines** (31%) and naturalness (16%). Other notable considerations include **timber production (26%)**, visual amenity (14%), and food production. Planning considerations feature relatively prominently in this catchment with wetlands (9%) and flooding (7%) score above-average. Based on the above assessment, key SEA objectives for this catchment include: Landscape, Material Assets, Cultural, and Water.

Over 90% of land within the catchment is classified as a significant sensitivity where wind energy development may be acceptable in some circumstances subject to further consideration and demonstration that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation. The remaining 9% falls within the low (5%) and medium (3%) classifications indicating that there are considerable environmental constraints within this catchment.



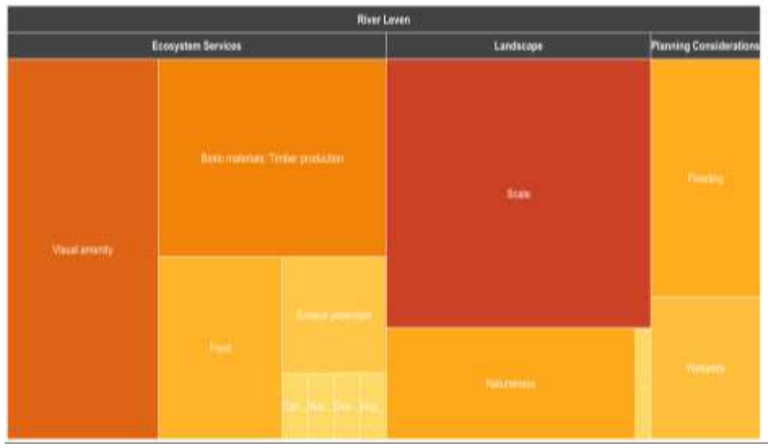



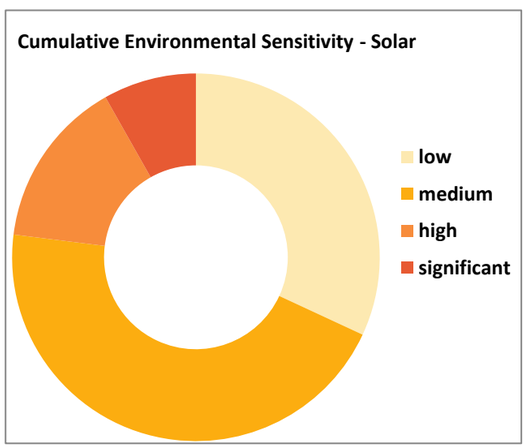

## River Leven – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

All ecosystem services considerations score below 35% with the key considerations being **visual amenity** (33%), **timber production** (26%), and food production (13%) with the remaining services scoring below ten percent. In terms of planning considerations, **groundwater** scores very highly with a score of 92%; agriculture and abstraction also score, both with figures of 18%. The key landscape consideration is **designated, geological and wildland areas** (57%) with naturalness covering an above average area with a score of 16%. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Water, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

The River Leven catchment has one of the lowest scores (2%) across all catchments within the 'significant' environmental sensitivity classification. The majority of the catchment falls within the classifications of low (64%) and medium (23%) sensitivity, with the remaining 10% of land defined as 'high' sensitivity.



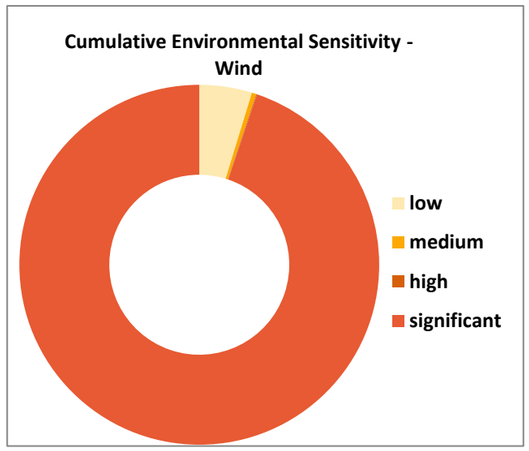

## River Leven – Strategic & Cumulative Environmental Sensitivities - Solar

Commentary on potential significant effects / level of cumulative environmental sensitivity

**Visual amenity (33%)** and **timber production (26%)** are the two highest scoring ecosystem services, with food production (13%) also scoring above single figures in the catchment. The key landscape consideration in the catchment is **scale (41%)**, with other considerations including naturalness (16%) and potential cumulative impact (1%). In terms of planning considerations, flooding (15%) and wetlands (9%) score relatively modestly. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Landscape, and Water.

The River Leven catchment has a significant proportion of land classified within either low (32%) or medium (45%) environmental sensitivity classifications – one of the highest combined scores within these classifications across all catchments. The catchment also has nearly a quarter of the land area within the high (15%) and significant (8%) classifications of sensitivity combined.

Figure 6.7 – Dundee Coastal

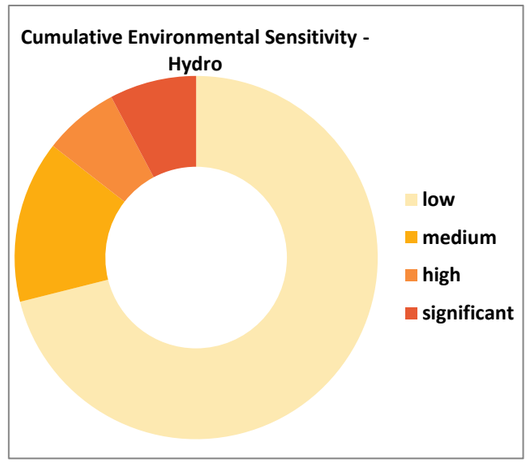




## Dundee Coastal – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

All considerations have a low score for this catchment, the highest being **visual amenity (28%), timber production (25%)** and food production (16%). Various other considerations score below 5% including erosion protection (4%), flooding (3%) and naturalness (3%). Landscape considerations in particular score very low in this catchment in comparison to other catchments. Based on the above assessment, key SEA objectives for this catchment include: Cultural and Material Assets.

95% of the catchment is classified as significant sensitivity where wind energy development may be acceptable in some circumstances subject to further consideration and demonstration that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation. This score is the third highest across all catchments. The remaining 5% of the catchment is classified as low sensitivity.

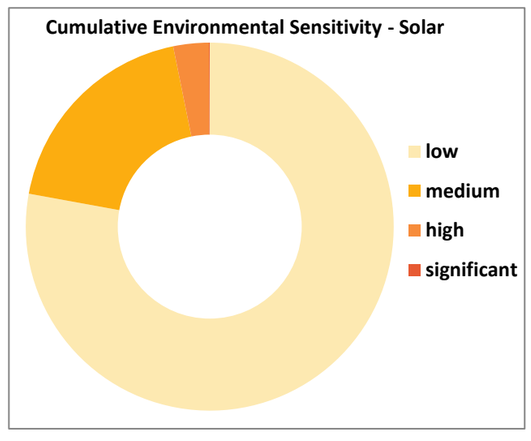




## Dundee Coastal – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

All ecosystem services considerations score at or below 25% with the key considerations being **timber production** (25%), and food production (16%) with the remaining services scoring below ten percent including visual amenity which has an under-average score of 5%. In terms of planning considerations, **groundwater** scores highly with a score of 67%; artificial fish barriers and fish ecology also score, both with figures of 15%. The key landscape consideration is **designated, geological and wildland areas** (67%) with naturalness scoring low with a figure of 3%. Based on the above assessment, key SEA objectives for this catchment include: Material Assets, Cultural, Water, Biodiversity and designated sites across a range of themes e.g. biodiversity, landscape.

The Dundee Coastal catchment has one of the highest scores (71%) within the 'low' sensitivity classification therefore is more likely to be suitable for hydro energy development in terms of environmental sensitivity, subject to detailed site assessment. The remaing area of the catchment falls within medium (14%) and high (7%) sensitivities, with a low score of 8% falling within the 'significant' classification.

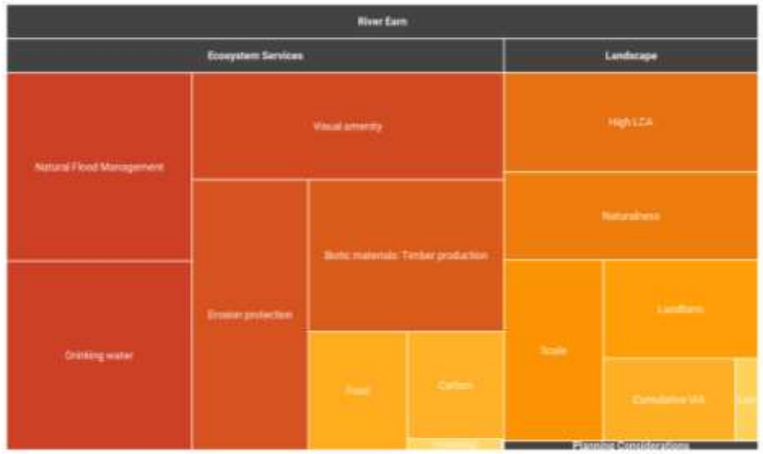

## Dundee Coastal – Strategic & Cumulative Environmental Sensitivities - Solar

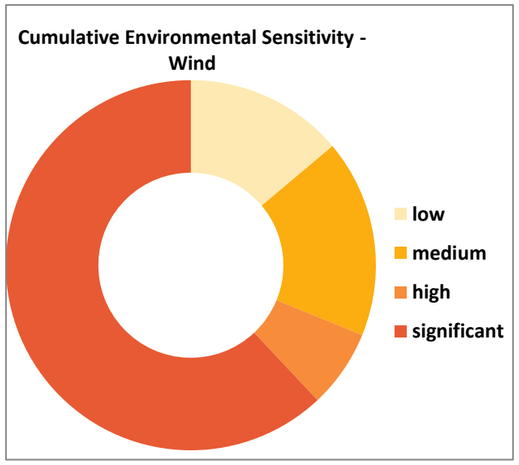
Commentary on potential significant effects / level of cumulative environmental sensitivity

The key ecosystem services in the catchment are **timber production (25%)** and food production (16%), with other services below 5%. Landscape considerations score very low in the catchment, with only naturalness scoring with an insignificant figure of 3%. In terms of planning considerations, all three score within the catchment, however with totals at or below 5%. Based on the above assessment, key SEA objectives for this catchment include: Material Assets.

The Dundee Coastal catchment has the majority of its area (78% )falling within the low classification of environmental sensitivity. The remaining 22% of land includes 19% within the medium classification and 3% within the high classification. The catchment therefore has one of the lowest environmentally sensitive areas in terms of the sensitivities included within the assessment.

Figure 6.8 – River Earn



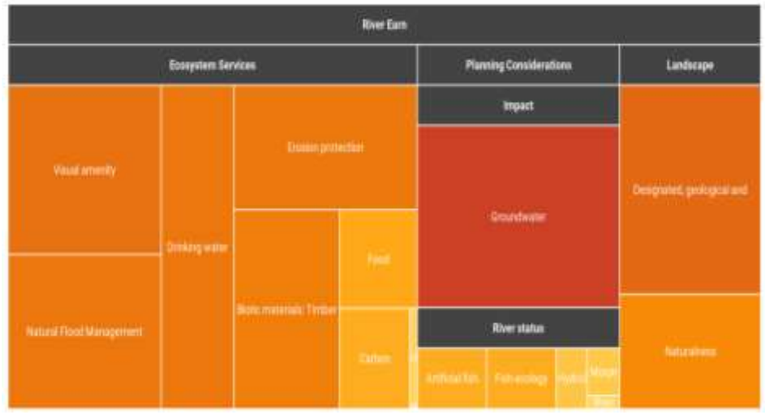



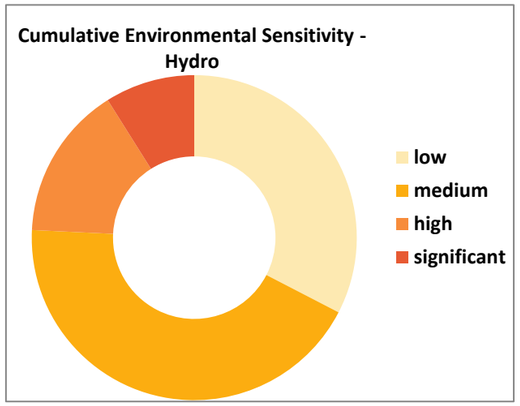

## River Earn – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The River Earn catchment scores consistently across various ecosystem services including **natural flood management** (39%), **drinking water** (39%), **visual amenity** (37%), **erosion protection** (35%) and **timber production** (35%). Key landscape considerations in the catchment include areas classed as the **highest level of sensitivity for wind energy development** (28%) in the Tyldesley study (2010), **naturalness** (25%), scale (20%) and landform (17%). Planning considerations do not feature highly in the catchment. Based on the above assessment, key SEA objectives for this catchment include: Water, Cultural, Soils, Material Assets, and Landscape.

The cumulative level of sensitivity to wind energy development in areas classified as low and medium sensitivity is one of the highest across all catchments with figures of 14% and 17% respectively, covering nearly a third of the catchment land area. Just under two thirds (62%) of the catchment is classified as a significant sensitivity – the third lowest total across all catchments.



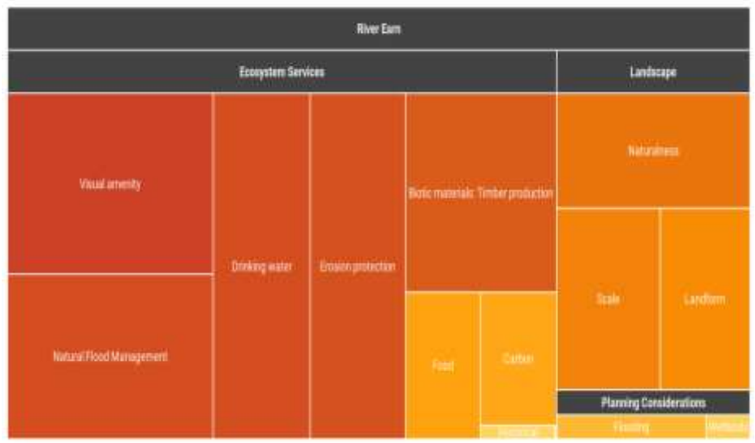



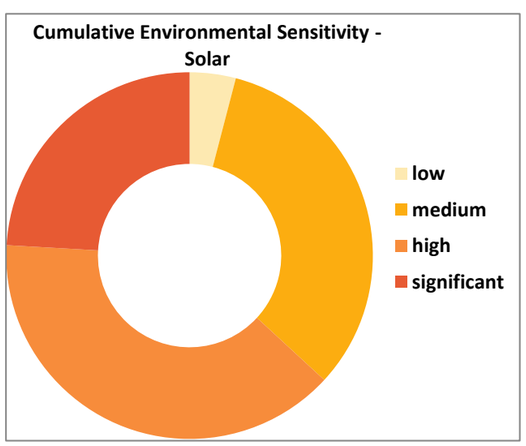

## River Earn – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

Generally, ecosystem services collectively score above average within this catchment with 5 services scoring above 32%. The key ecosystem services comprise **visual amenity** (41%), **drinking water** (37%), **natural flood management** (37%), **erosion protection** (36%) and **timber production** (33%). In terms of planning considerations, **groundwater** scores highly with a score of 71%; artificial fish barriers and fish ecology also score, both with figures of 11%. The key landscape consideration is **designated, geological and wildland areas** (46%) albeit with a below-average score, with **naturalness** scoring with an above-average figure of 25%. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Water, Soils, Material Assets, Biodiversity, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

The River Earn catchment has the majority of its area within the low (33%) and medium (43%) classifications of environmental sensitivity combined. In terms of the high classification of sensitivity, the catchment has the joint third highest total (15%) across all catchments.The catchment has the joint fourth highest total of land falling within the significant classification (9%).



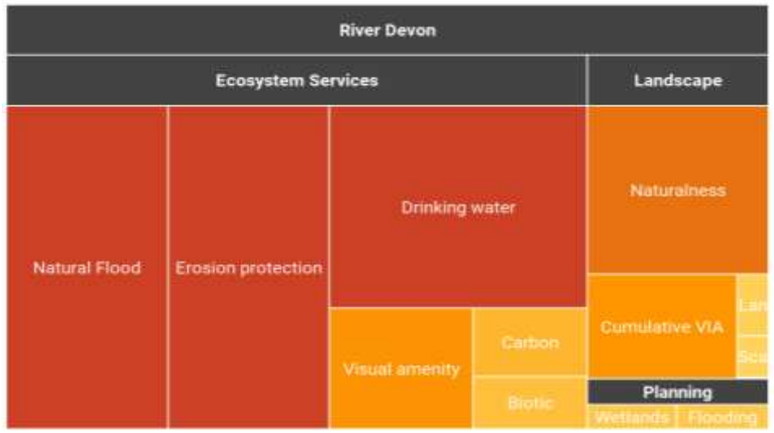

## River Earn – Strategic & Cumulative Environmental Sensitivities - Solar

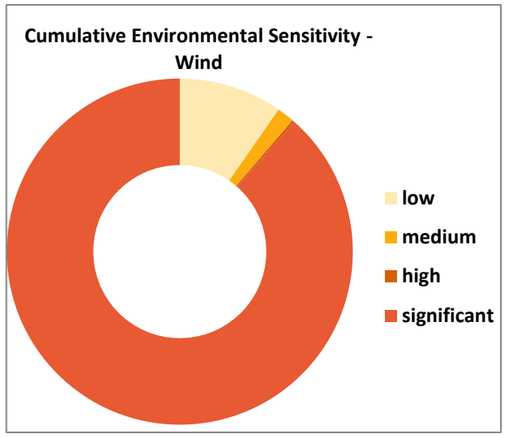
Commentary on potential significant effects / level of cumulative environmental sensitivity

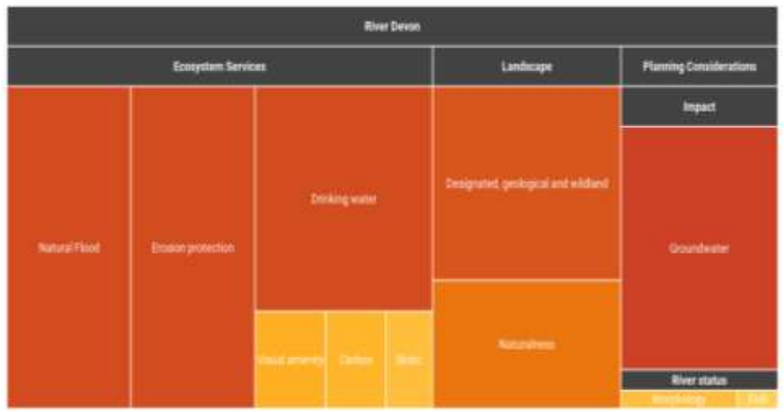
Ecosystems services score generally quite consistently in this catchment with five services scoring relatively highly - **visual amenity (41%), natural flood management (37%), drinking water (37%), erosion protection (36%),** and **timber production (33%).** The catchment also scores higher than average compared to other catchments for landscape considerations, with **naturalness (25%)**, scale (21%), and landform (18%) scoring. In terms of planning considerations, there are respective scores of 7% and 2% for flooding and wetlands considerations. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Water, Soils, Material Assets, and Landscape.

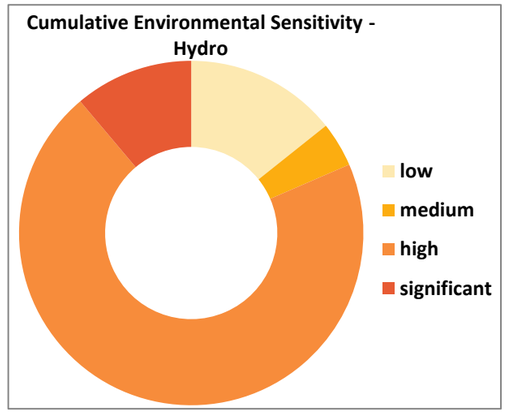
The River Earn catchment has a relatively even spread of the majority of its area across the medium (33%), high (39%), and significant (24%) classifications of environmental sensitivity combined. In terms of the significant classification of sensitivity, the catchment has the second highest total across all catchments. Within the low classification, the catchment has the lowest total across the catchments with a score of 4%, indicating that there is a relatively high presence of environmental sensitivities within the catchment.

Figure 6.9 – River Devon

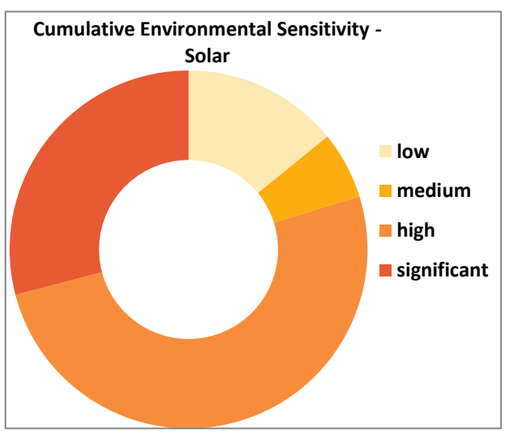







## River Devon –Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key considerations for wind energy development in this catchment are the ecosystem services of **natural flood management** (82%), **erosion protection** (82%), and **drinking water** (82%) – all three services covering over three quarters of the catchment area. Carbon sequestration scores above-average with a figure of 12%. Notable landscape considerations include **naturalness** (49%) and potential **cumulative impact from existing and consent turbines** (25%). Planning considerations do not score highly in this catchment. Based on the above assessment, key SEA objectives for this catchment include: Water, Soils, and Landscape.

The cumulative level of sensitivity to wind energy development in areas classified as low and medium sensitivity is general average across all catchments with respective figures of 10% and 2%. Nearly 90% of the catchment is classified as a significant sensitivity, where wind energy development may be acceptable in some circumstances subject to further consideration and demonstration that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.

## River Devon –Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

Three ecosystem services score very highly within this catchment - **drinking water** (82%), **natural flood management** (82%), and **erosion protection** (82%). Various other ecosystem services score above 5% - carbon sequestration (12%), visual amenity (14%) and timber production (9%). In terms of planning considerations, **groundwater** scores very highly with a score of 91%; fish ecology and morphology also score, with respective figures of 3% and 9%. The key landscape consideration is **designated, geological and wildland areas** (75%) with **naturalness** scoring with an above-average figure of 49%. Based on the above assessment, key SEA objectives for this catchment include: Water, Soils, Climatic Factors, Cultural, Material Assets, Biodiversity, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

The River Devon has a significant proportion (81% combined) of its land area falling within the high (70%) and significant (11%) classifications of environmental sensitivity, indicating that this catchment is particularly environmentally sensitive to future hydropower development at the strategic scale. The catchment also has the second lowest scores within the medium (4%) and low (14%) classifications.

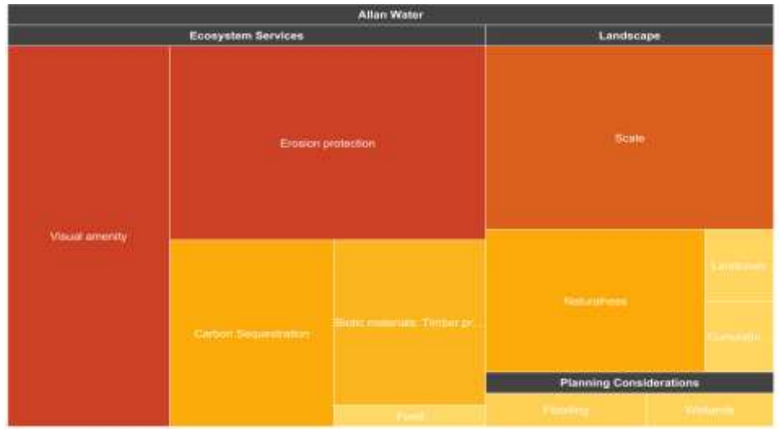
## River Devon –Strategic & Cumulative Environmental Sensitivities - Solar

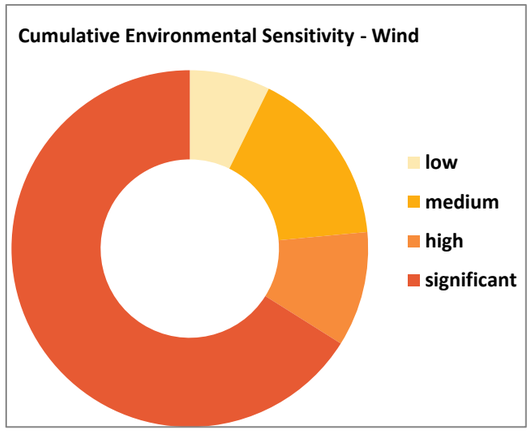
Commentary on potential significant effects / level of cumulative environmental sensitivity

Three ecosystem services score significantly in the catchment – **natural flood management (82%), erosion protection (82%),** and **drinking water (82%)**, with other services scoring including visual amenity (14%), carbon sequestration (12%) and timber production (9%). In terms of landscape considerations, **naturalness (49%)** covers almost half of the catchment, with scale (2%) and landform (3%) also scoring. Wetlands (6%) and flooding (5%) are the only planning considerations scoring in the catchment. Based on the above assessment, key SEA objectives for this catchment include: Water, Soils, Cultural, Climatic Factors, Material Assets, and Landscape.

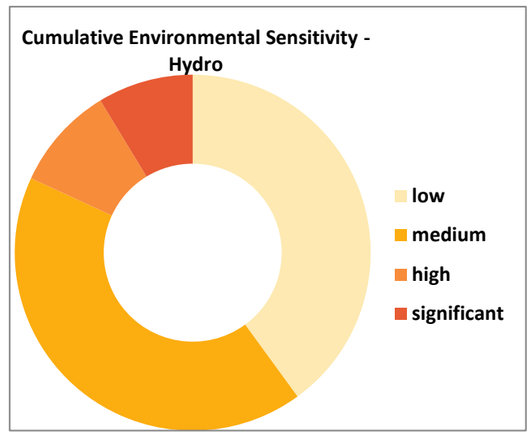
The River Devon catchment has over three quarters of its area within the high (51%) and significant (29%) classifications of environmental sensitivity. This is the highest combined score of high and significant classifications across all the catcments. The catchment also has a fifth of its area within the medium (6%) and low (14%) classificationd of sensitivity, which is the lowest combined score across all catchments.

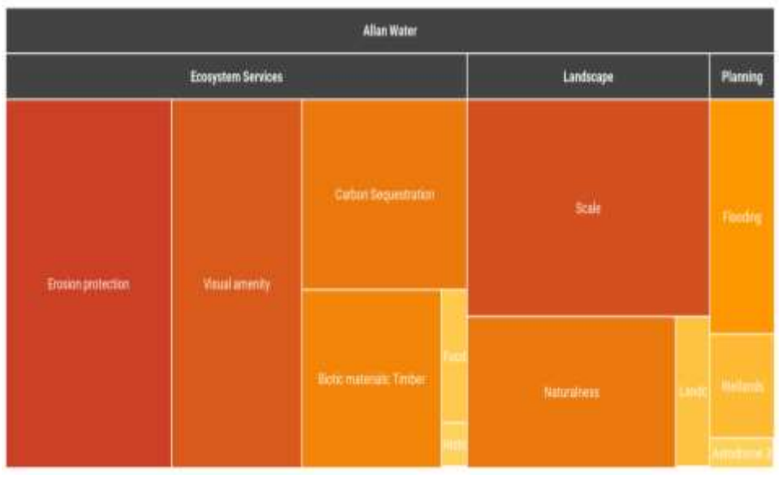
Figure 6.10 – Allan Water

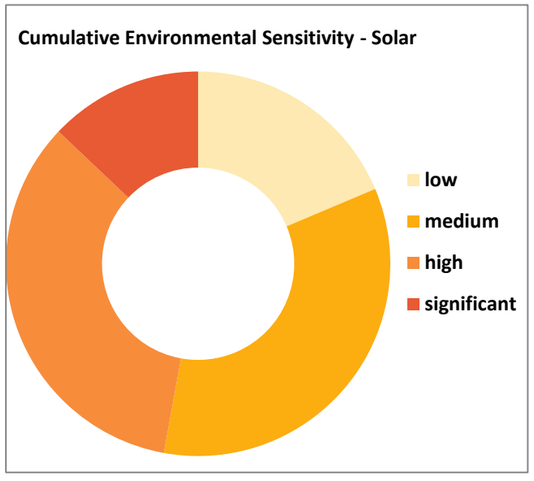







## Allan Water – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

In the Allan Water Catchment, none of the considerations score above 40% with **erosion protection** and **visual amenity** having the highest scores of 37%. In terms of landscape, **scale** (32%) and naturalness (19%) are the highest scoring considerations for the catchment. Other recognised sensitivities include carbon sequestration (19%), timber production (15%) as well as the planning considerations of wetlands (4%) and flooding (5%). Based on the above assessment, key SEA objectives for this catchment include: Soils, Cultural, Landscape, Climatic Factors, Material Assets and Water.

The cumulative level of sensitivity to wind energy developments in areas classified as low and medium sensitivity is one of the highest combined across all catchments, with figures of 7% and 16% respectively – which amounts to nearly a quarter of the catchment area. Two thirds of the catchment is classified as a significant sensitivity, which is the third lowest total across all catchments.

## Allan Water – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

None of the ecosystem service considerations in this catchment score above 40% with notable services including: **erosion protection** (37%), **visual amenity** (29%), carbon sequestration (19%) and timber production (15%). In terms of planning considerations, **groundwater** has a moderate score of 45%; fish ecology, artificial fish barriers and hydrology also score, with respective figures of 12%, 6% and 11%. The key landscape consideration is **designated, geological and wildland areas** (32%) with a moderately low score for naturalness with a figure of 19%. Based on the above assessment, key SEA objectives for this catchment include: Soils, Cultural, Climatic Factors, Material Assets, Water, Biodiversity, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

The Allan Water catchment has the majority (82%) of its area within the low (40%) and medium (42%) classifications of environmental sensitivity. The remaining 18% of the catchment is split evenly in to high (9%) and significant (9%) classification, which is one of the lowest combined scores for combined high and significant figures.

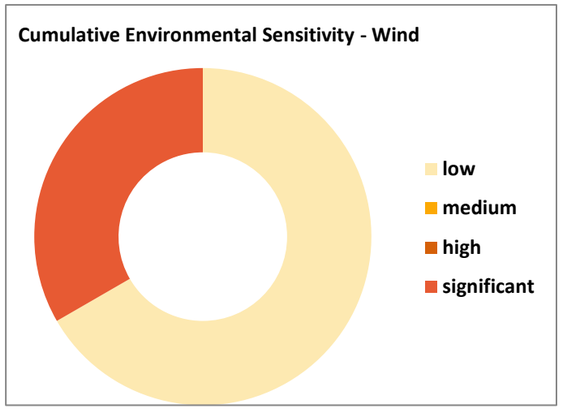
## Allan Water – Strategic & Cumulative Environmental Sensitivities - Solar

Commentary on potential significant effects / level of cumulative environmental sensitivity

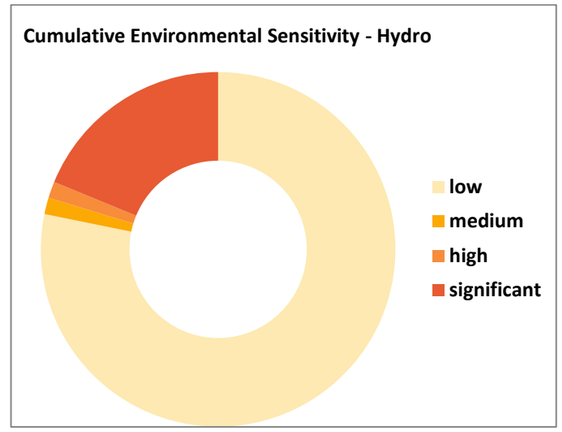
The key ecosystem services in the catchment are **erosion protection (37%), visual amenity (29%),** carbon sequestration (19%) and timber production (15%). In terms of landscape considerations, **scale (32%)** and naturalness (19%) are the key considerations, with landcover also scoring with a figure of 3%. Wetlands (4%) and flooding (6%) score relatively similarly on average with other catchments within planning considerations. Based on the above assessment, key SEA objectives for this catchment include: Soils, Cultural, Climatic Factors, Material Assets, Landscape, and Water.

The Allan Water catchment has the majority of its area within the medium (34%) and high (34%) classifications of environmental sensitivity. The catchment has also one of the lowest (19%) scores within the low classification, as well as one of the highest (13%) scores within the significant classification.

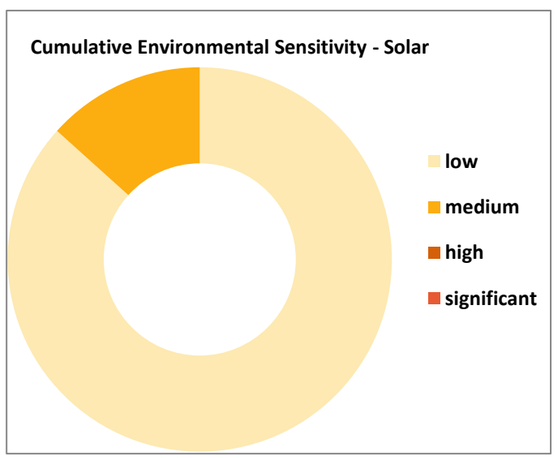
Figure 6.11 – Stirling Coastal










## Stirling Coastal –Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

The key considerations for wind energy development are the ecosystem services of **timber production** (41%) and **food** (31%), which cover over two thirds of the catchment combined. Other considerations in the catchment include planning considerations of flooding (9%) and wetlands (3%). The only landscape consideration which scored was naturalness (2%). Based on the above assessment, key SEA objectives for this catchment include: Material Assets and Water.

This catchment has the highest amount of land falling within the low classification of sensitivity, with a figure of 67%. This total is more than 50% higher than any other catchment and is indicative of the fact that this catchment has less strategic sensitivities present. The remaining 33% of the catchment falls within the significant classification of sensitivity.

## Stirling Coastal –Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

Only two ecosystem service considerations score in this catchment - **timber production** (41%) and **food production** (31%) – suggesting that this catchment is particularly valuable in terms of material assets. In terms of planning considerations, **groundwater** scores very highly with a figure of 97%; fish ecology, artificial fish barriers and hydrology also score, with respective figures of 20%, 19% and 20%. Landscape considerations almost have no coverage in this catchment with naturalness scoring with a very low figure of 2% and designated, geological and wildland areas scoring 0%. Coupled with a zero figure for the visual amenity consideration, this catchment does not demonstrate a high level sensitivity of landscape and visual sensitivity in relation to the sensitivities considered, but this may require investigation at the site assessment stage. Based on the above assessment, key SEA objectives for this catchment include: Material Assets, Water, and Biodiversity.

The vast majority (78%) of the Stirling Coastal catchment falls within the lowest environmental sensitivity classification, the second highest across all catchments. The remaining land area falls predominantly within the significant (19%) classification of environmental sensitivity. The area of land identified as significant is the highest across all catchments.

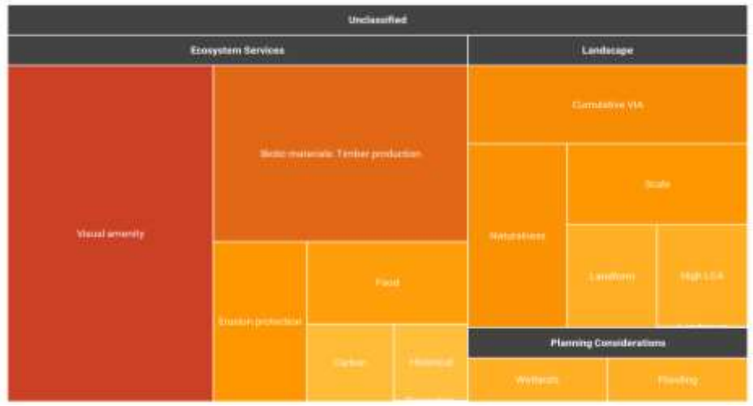
## Stirling Coastal –Strategic & Cumulative Environmental Sensitivities - Solar

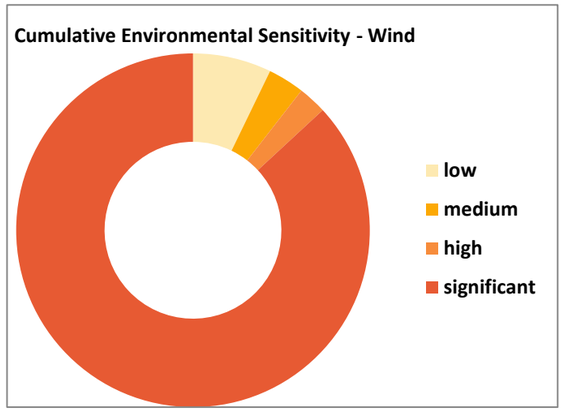
Commentary on potential significant effects / level of cumulative environmental sensitivity

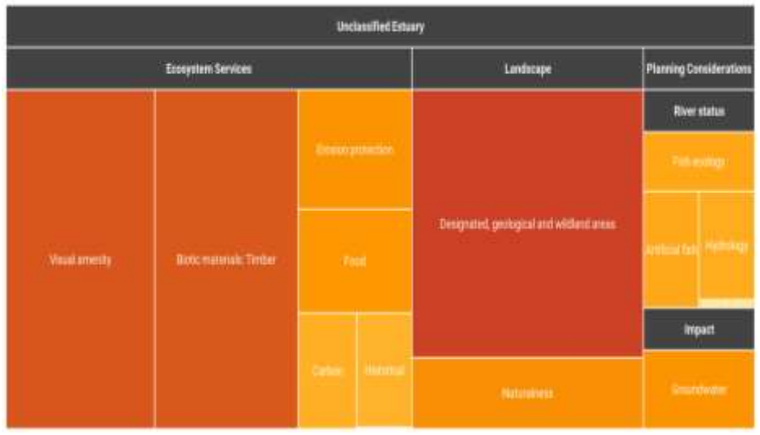
There are two ecosystems services that score moderately in the catchment – **timber production (41%)** and **food production (31%).** In terms of landscape, naturalness scores with a total of 2%, with all other landscape considerations scoring 0%. In terms of planning considerations, wetlands (3%) and flooding (4%) score in the catchment. Based on the above assessment, key SEA objectives for this catchment include: Material Assets.

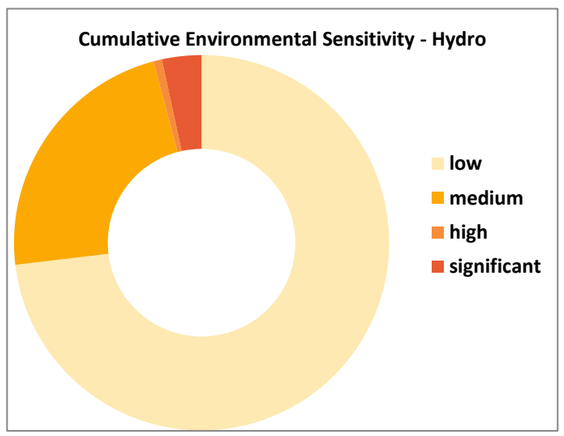
The vast majority (87%) of the Stirling Coastal catchment falls within the low environmental sensitivity classification, the highest total across all catchments. The remaining land area falls wholly within the medium (13%) classification of environmental sensitivity, with no area within the catchment identified as high or significant sensitivity which is the highest combined score across all catchments.

Figure 6.12 – Unclassified Estuary

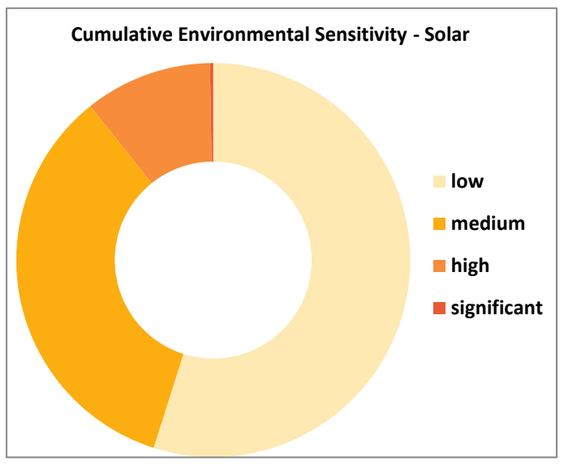







## Unclassified Estuary – Strategic & Cumulative Environmental Sensitivities - Wind

Commentary on potential significant effects / level of cumulative environmental sensitivity

Generally, the scoring of considerations is low in the Unclassified Estuary catchment, with exception to **visual amenity** (37%). The other most notable considerations include timber production (24%), potential cumulative impacts from existing and consented turbines (12%), naturalness (10%), erosion protection (8%), scale (8%), and food production (7%). Planning considerations have a low score in this catchment. Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Landscape, and Soils.

The cumulative level of sensitivity to wind energy development in areas classified as low (7%) and medium (3%) sensitivity amounts to a combined total of 10%. Nearly 90% of the catchment is classified as a significant sensitivity where wind energy development may be acceptable in some circumstances subject to further consideration and demonstration that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.

## Unclassified Estuary – Strategic & Cumulative Environmental Sensitivities - Hydro

Commentary on potential significant effects / level of cumulative environmental sensitivity

Two ecosystem service considerations score with figures approximately covering between a third and a quarter of the catchment including **visual amenity (30%)** and **timber production (29%).** In terms of planning considerations, all of these score very low with only one consideration scoring above 5% - groundwater (8%). Landscape considerations include **designated, geological and wildland areas** (37%) and naturalness (10%). Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Water, Landscape and designated sites across a range of themes e.g. biodiversity, landscape.

The Unclassified Estuary catchment has the highest combined percentage total of land area falling within the low and medium classifications of environmental sensitivity across all catchments, with respective scores of 73% and 23%. The remaining 4% is split in to the high (1%) and significant (3%) classifications of sensitivity.

## Unclassified Estuary – Strategic & Cumulative Environmental Sensitivities - Solar

Commentary on potential significant effects / level of cumulative environmental sensitivity

Two ecosystem service considerations score with figures approximately covering between a third and a quarter of the catchment including **visual amenity (30%)** and **timber production (29%).** In terms of landscape, the key consideration is naturalness (10%), followed by scale (8%), landform (5%) and potential cumulative impact (1%). The planning considerations generally score higher on above compared to other catchments with respective scores of 9%, 5% and 3% for flooding, wetlands, and aerodrome (3km). Based on the above assessment, key SEA objectives for this catchment include: Cultural, Material Assets, Landscape, and Water.

The Unclassified Estuary catchment has one of the highest combined figures for land area falling within the low and medium classifications of environmental sensitivity across all catchments, with respective scores of 55% and 34%. The remaining land falls within the high classification of sensitivity, with a score of 0% for the significant classification.

**WIND**

Looking specifically at wind energy, Table 6.1 below identifies the % of each catchment area contained within 'significant' classification of environmental sensitivity. This figure assists in identifying where there are cumulative environmental pressures and where development proposals will be expected to consider a range of environmental issues at the planning application stage. Table 6.1 demonstrates that areas classified as having 'significant' environmental sensitivity dominate across all catchments, with exception to Stirling Coastal, which is the only catchment with a score under 50%. All almost catchments score well over 60%, with various catchments showing near 100% coverage of 'significant' environmental sensitivity.

Table 6.1 – Wind: Level of Catchment Area Classified as 'Significant' Sensitivity

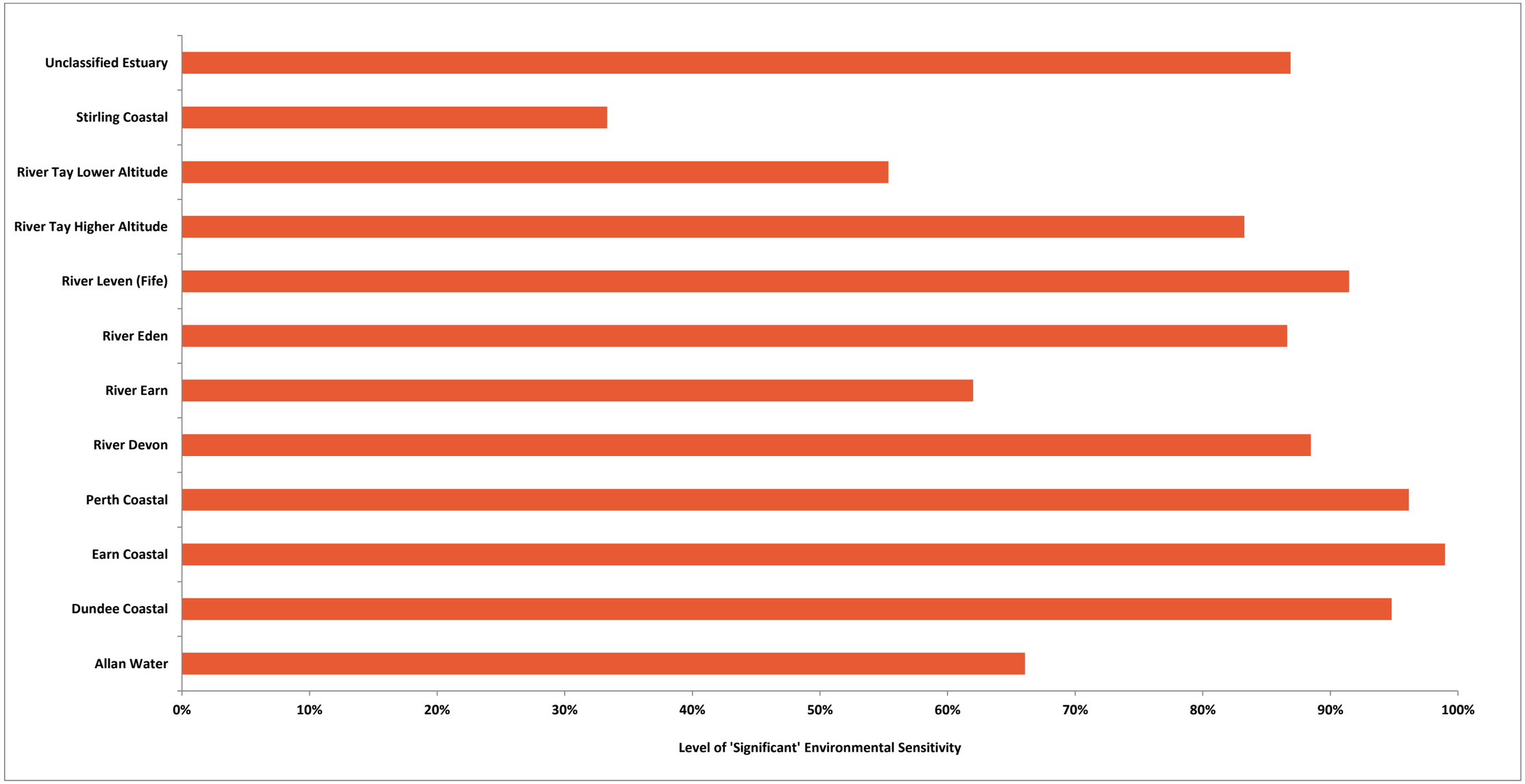
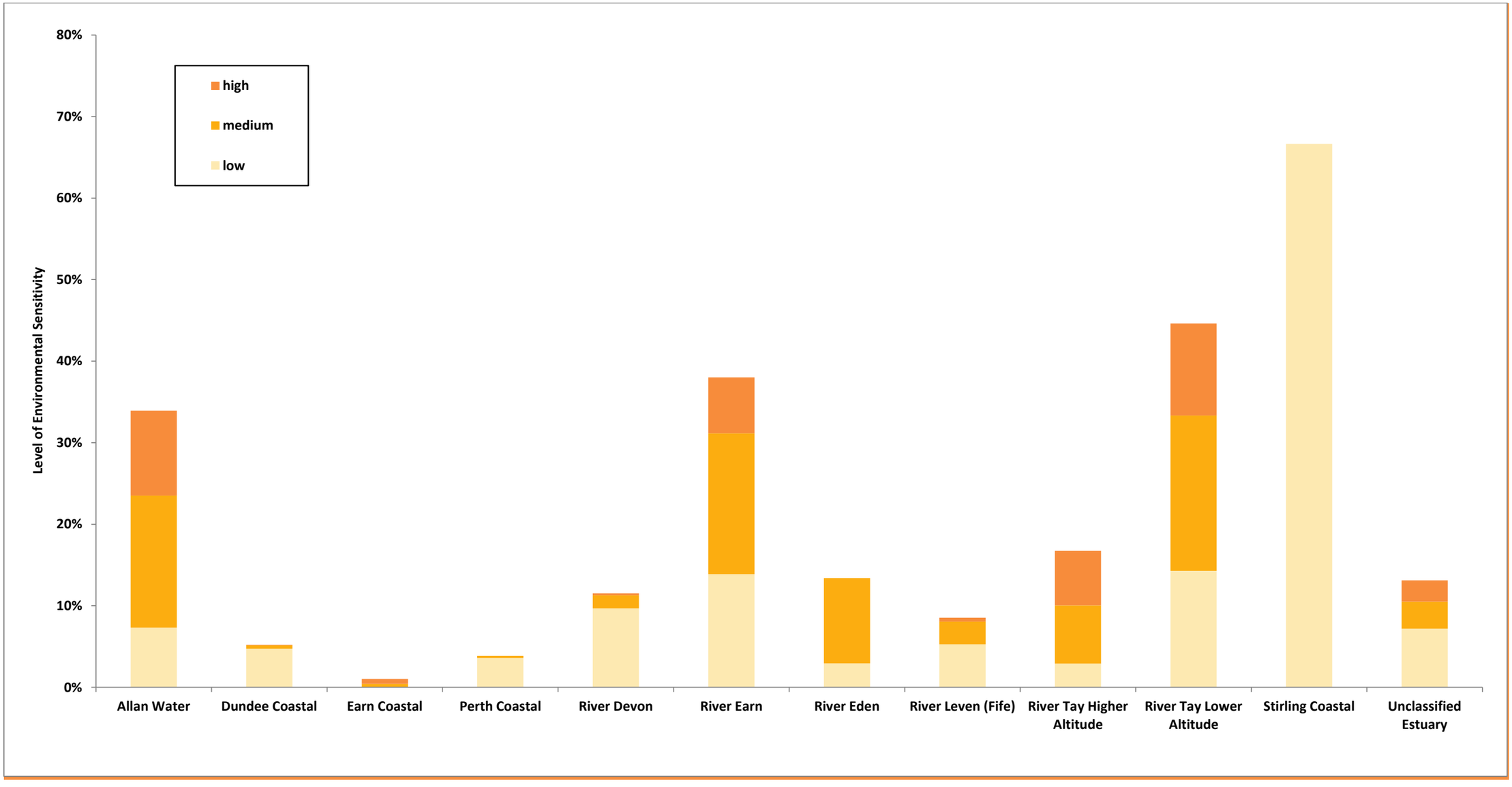


Table 6.2 below illustrates that for wind energy developments there is considerable variety in the level of cumulative environmental sensitivity – high, medium and low – across the catchments when areas of significant environmental sensitivity are excluded. Some catchments score considerably in the medium and low classifications where there are fewer strategic environmental sensitivities identified. Stirling Coastal, River Tay (Lower), River Earn and Allan Water particularly stand out in terms of low and medium environmental sensitivity to wind development.

Table 6.2 – Wind: Catchment Sensitivity

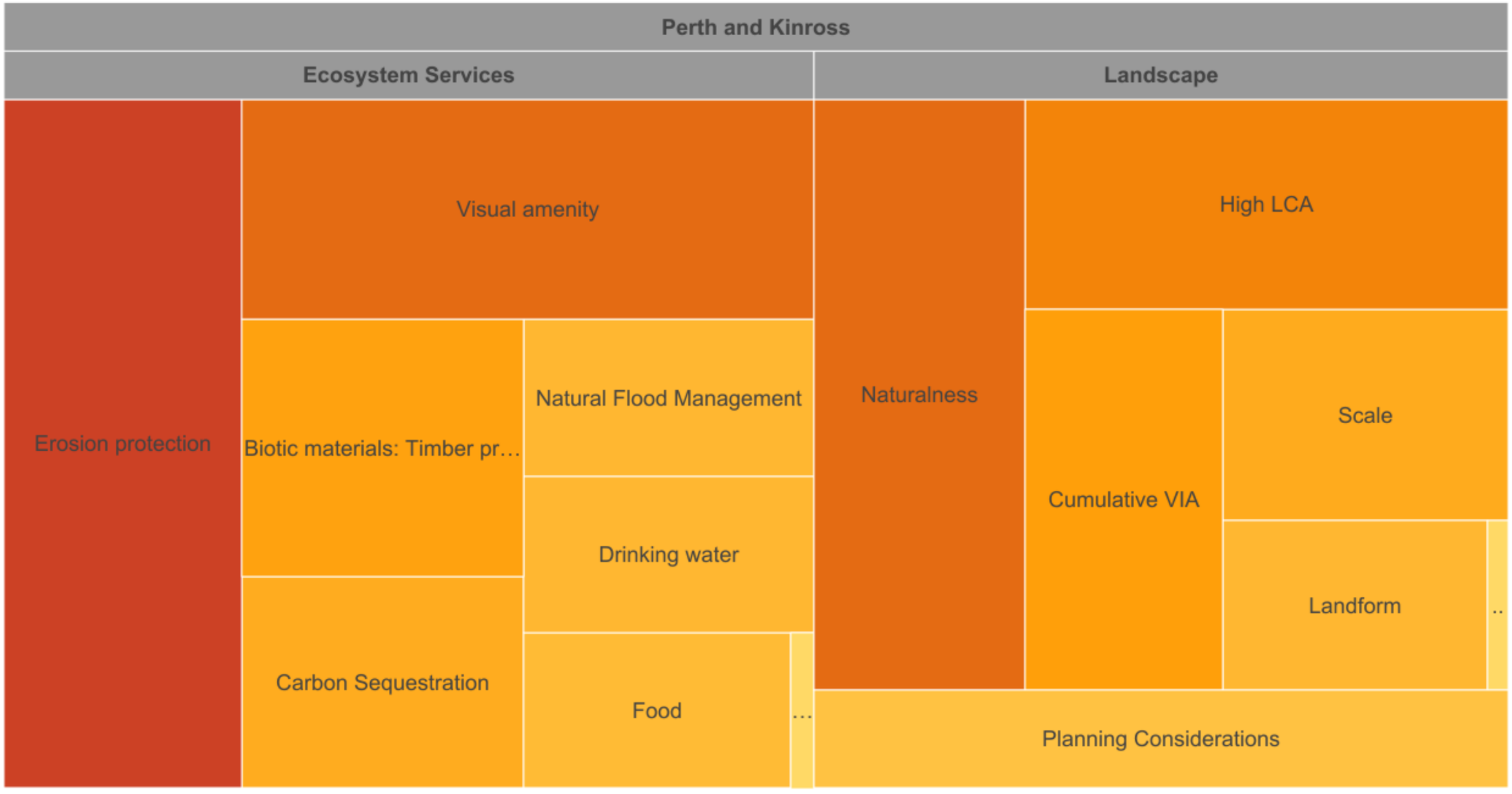


## 6.4 Strategic & Cumulative Environmental Sensitivities – Council-wide Assessment

The following section will detail the SEA assessment that has been undertaken to identify the strategic and cumulative environmental sensitivities at the council-wide level. The identification of these sensitivities highlight which environmental considerations will likely require further assessment at the planning application stage for each of the technologies, and identify where there are cumulative environmental pressures which will help to inform – at a strategic level - the future deployment of renewable and low carbon energy technologies.

Figures 6.13 to 6.15 identify the key strategic environmental sensitivities at the council-wide level for each of the three technologies across the range of technology-specific environmental considerations. Figures 6.16 to 6.18 illustrate the cumulative environmental sensitivities for each technology at the Council-wide level. The levels of sensitivity indicate where there are cumulative environmental pressures and will help steer development towards the least sensitive areas at a strategic level. The outputs of the SEA assessment will help inform decision-makers to identify where there are individual/multiple sensitivities and supported by the content of the SG will include details on how environmental sensitivities can be addressed, where relevant, at the application stage.

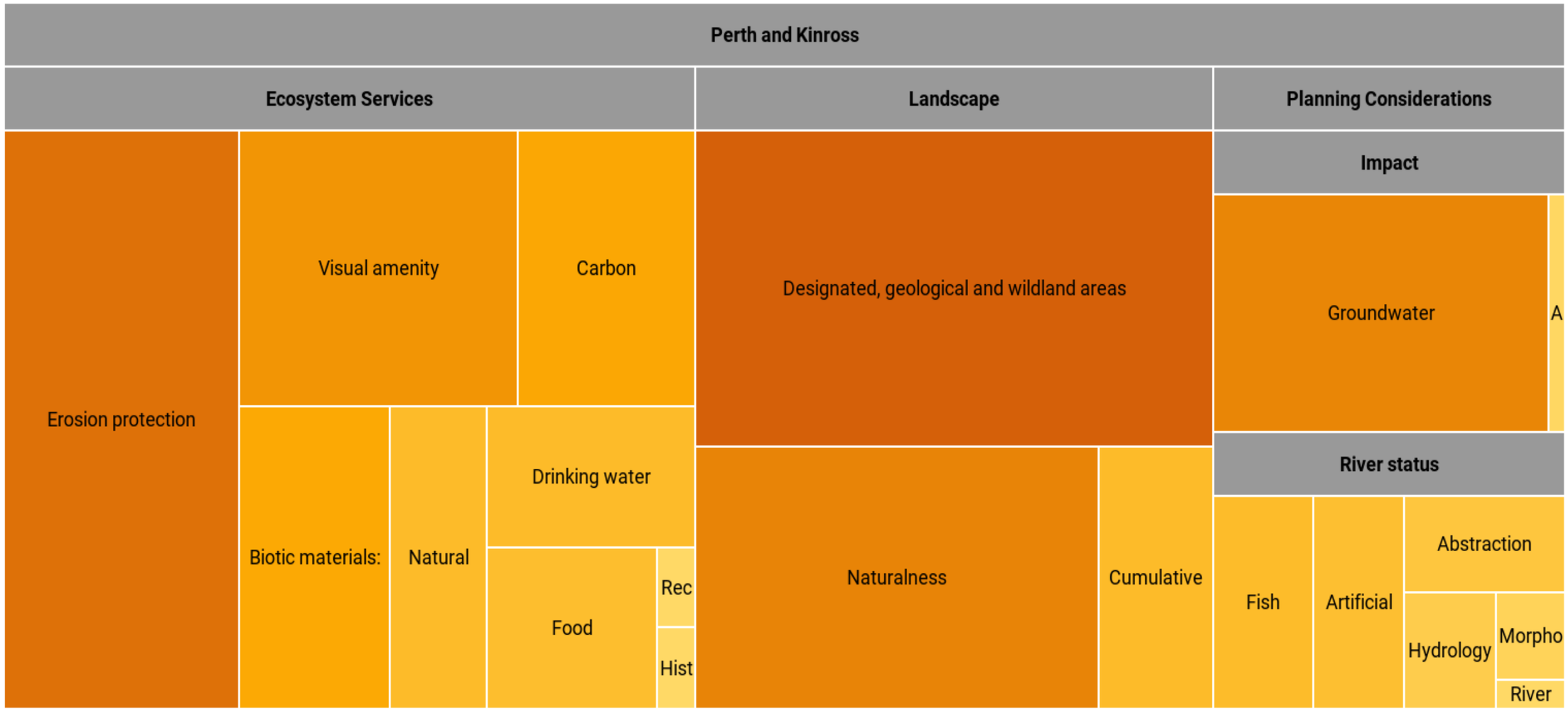
Figure 6.13 –Wind: Council-wide Strategic Environmental Sensitivities




Commentary on potential significant effects

Looking at Figure 6.13 above, Council-wide, the key environmental sensitivities for wind energy proposals to consider include Soils, Climatic factors - **erosion protection (43%) and** carbon sequestration (16%), Cultural and landscape factors - **visual amenity (33%) and Material Assets -** timber production (19%). Other notable sensitivities include Water and Climatic factors - natural flood management (12%), drinking water (12%) and Material Assets - food (11%). In terms of landscape factors, the key considerations for wind energy proposals include **naturalness (33%), highest level of sensitivity for wind energy development (27%)** and potential cumulative visual impact (20%). In terms of wetlands and areas at risk from flooding, these score relatively modestly with respective scores of 10% and 7%. Based on the above assessment, key SEA objectives across the council area include: Soils, Cultural, Material Assets, Climatic Factors, Landscape, and Water Overall, this diagram helps to identify the key strategic environmental sensitivities that fall within Perth and Kinross, with the SG identifying the information requirements to assess each of these sensitivities at the site assessment level. Further consideration of environmental effects associated with wind energy is detailed in section 6.5 of the Report.

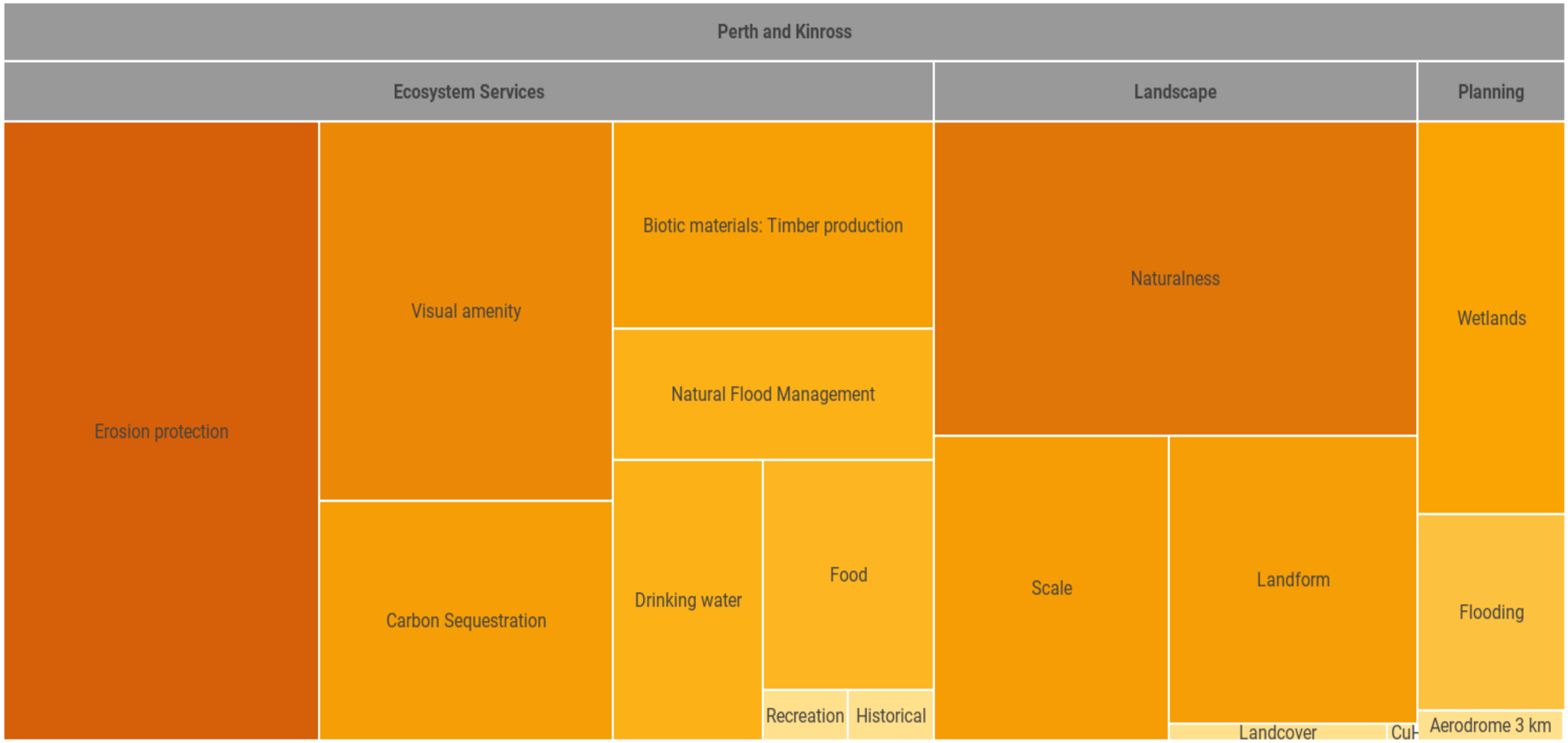
Figure 6.14 –Hydro: Council-wide Strategic Environmental Sensitivities




Commentary on potential significant effects

In terms of Figure 6.14 above, Council-wide, the key environmental sensitivities for hydro energy proposals to consider include **erosion protection (48%)**, **visual amenity (27%),** carbon sequestration (17%) and timber production (16%). Other notable sensitivities include natural flood management (10%), drinking water (10%) and food (9%). In terms of landscape-based considerations, the key considerations for hydro energy proposals are **designated, geological and wildland areas (57%), naturalness (37%),** and potential cumulative visual impact (10%). Relatively high scores for landscape–based considerations, particularly designated, geological and wildland areas, indicate that this is an issue that will likely require detailed consideration at the site assessment level. In terms of planning considerations, these are separated in to considerations of impact and river status. For river impact, the key consideration for hydro energy proposals is **groundwater (36%)**. For river status, the considerations generally have lower scores with fish ecology (10%), artificial fish barriers (9%) and abstraction (7%) the most notable. Based on the above assessment, key SEA objectives across the council area include: Soils, Cultural, Climatic Factors, Material Assets, Water, Landscape, Biodiversity and designated sites across  a range of themes e.g. biodiversity, landscape. Overall, this diagram helps to identify the key strategic environmental sensitivities that fall within Perth and Kinross, with the SG identifying the information requirements to assess each of these sensitivities. Further consideration of environmental effects associated hydro energy is detailed in section 6.5 of the Report.

Figure 6.15 –Solar: Council-wide Strategic Environmental Sensitivities




Commentary on potential significant effects

Looking at Figure 6.15 above, the key Council-wide environmental sensitivities for solar energy proposals to consider include **erosion protection (48%)**, **visual amenity (27%),** carbon sequestration (17%) and timber production (16%). Other notable sensitivities include natural flood management (10%), drinking water (10%) and food (9%). In terms of landscape-based considerations, the key considerations for solar energy proposals are **naturalness (37%),** landform (17%) and scale (17%). In terms of planning considerations, the three considerations score relatively modestly - wetlands (14%), flooding (7%) and aerodromes (1%). Based on the above assessment, key SEA objectives across the council area include: Soils, Cultural, Climatic Factors, Material Assets, Water, and Landscape. Overall, this diagram helps to identify the key strategic environmental sensitivities that fall within Perth and Kinross, with the SG identifying the information requirements to assess each of these sensitivities. Further consideration of environmental effects associated with wind energy is detailed in section 6.5 of the Report.

**PKC Cumulative Environmental Sensitivities**

Figures 6.16-6.18 below highlight the levels of cumulative environmental sensitivity relevant to the three technologies – wind, hydro and solar. The assessment has identified at the Council-wide level environmental sensitivity, individually as well as cumulatively, across the three technologies. The levels of sensitivity across the Council Area assist steering future renewable and low carbon energy development to the least sensitive locations at a strategic scale and in identifying potential environmental considerations to be taken in to account as part of any application process including areas identified as 'high' or 'significant' where there are multiple environmental sensitivities present, raising issues regarding potential significant cumulative effects. This will help to inform decision-makers to consider the most sustainable land management options, as well as options for mitigation or where environmental effects will be too significant for any development to take place, as supported by detailed site assessment.

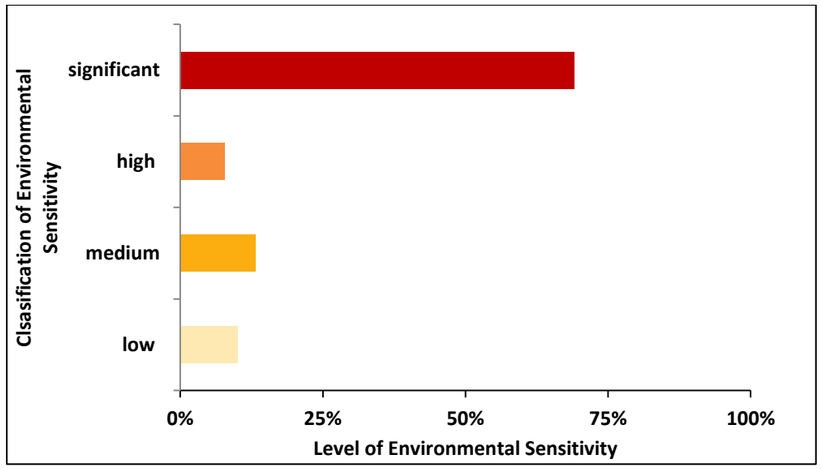



**Figure 6.16 – Wind: Cumulative Environmental Sensitivity**

Out-with Group 1 areas (SPP – Spatial Framework for Wind), a large majority of the Council Area (69%) is classified as being of significant sensitivity. As part of the assessment, these areas are defined as 'areas of significant protection' where wind farms may be appropriate in some circumstances, subject to further consideration of any significant effects on the qualities of these areas and that significant effects can be substantially overcome by siting, design or other mitigation. The remaining 25% of the area is split in to high (8%), medium (13%) and low (10%) levels of sensitivity. These areas are classified within the Group 3 (SPP) category, namely that these areas are considered to be acceptable for wind farms subject to detailed site consideration. Splitting the Group 3 areas in to further levels of sensitivity will assist decision-makers in considering a range of spatial environmental sensitivities at the application stage informed by the web based mapping. Figure 6.16 demonstrates that generally, Perth & Kinross Council encompasses high levels of environmental sensitivity (within the context of SPP and the Spatial Assessment) in terms of wind energy development.

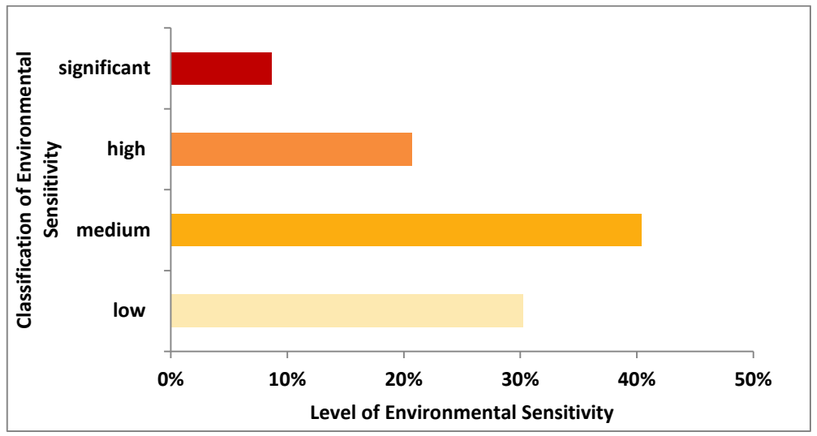



**Figure 6.17 – Hydro: Cumulative Environmental Sensitivity**

For hydro developments, Figure 6.17 identifies that levels of significant environmental sensitivity (9%) are considerably lower in comparison to wind energy. Additionally, a large majority of the Council area falls within either medium (40%) or low (30%) sensitivity. Areas that fall within the medium and low levels of sensitivity generally possess a lower number of environmental sensitivities and as such may possess a greater opportunity for hydro development in terms of potential environmental impact, subject to detailed site assessment Incorporating the range of environmental considerations within the assessment identifies where there are cumulative environmental pressures and will help to inform developers and decision makers what potential impacts may require to be considered, and where hydro developments should potentially be avoided. Whilst hydro schemes are limited to watercourses, the whole environment has been included for the hydro assessment as the ecosystem services model deals with the environment as an intrinsic connection of environmentally-related processes that take in the wider area. Taking in to account the wider area also enables any ancillary development and/or works e.g. operational tracks that are associated with hydro schemes to be considered within the assessment, as well as smaller water-courses which would be potentially suitable for smaller schemes.

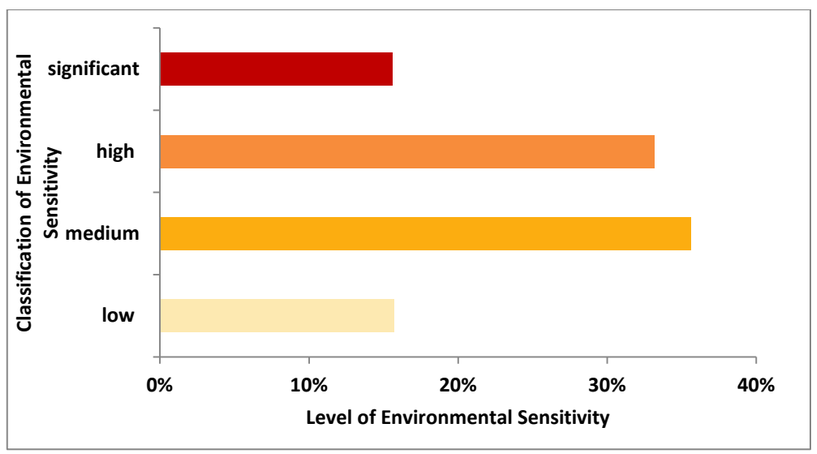
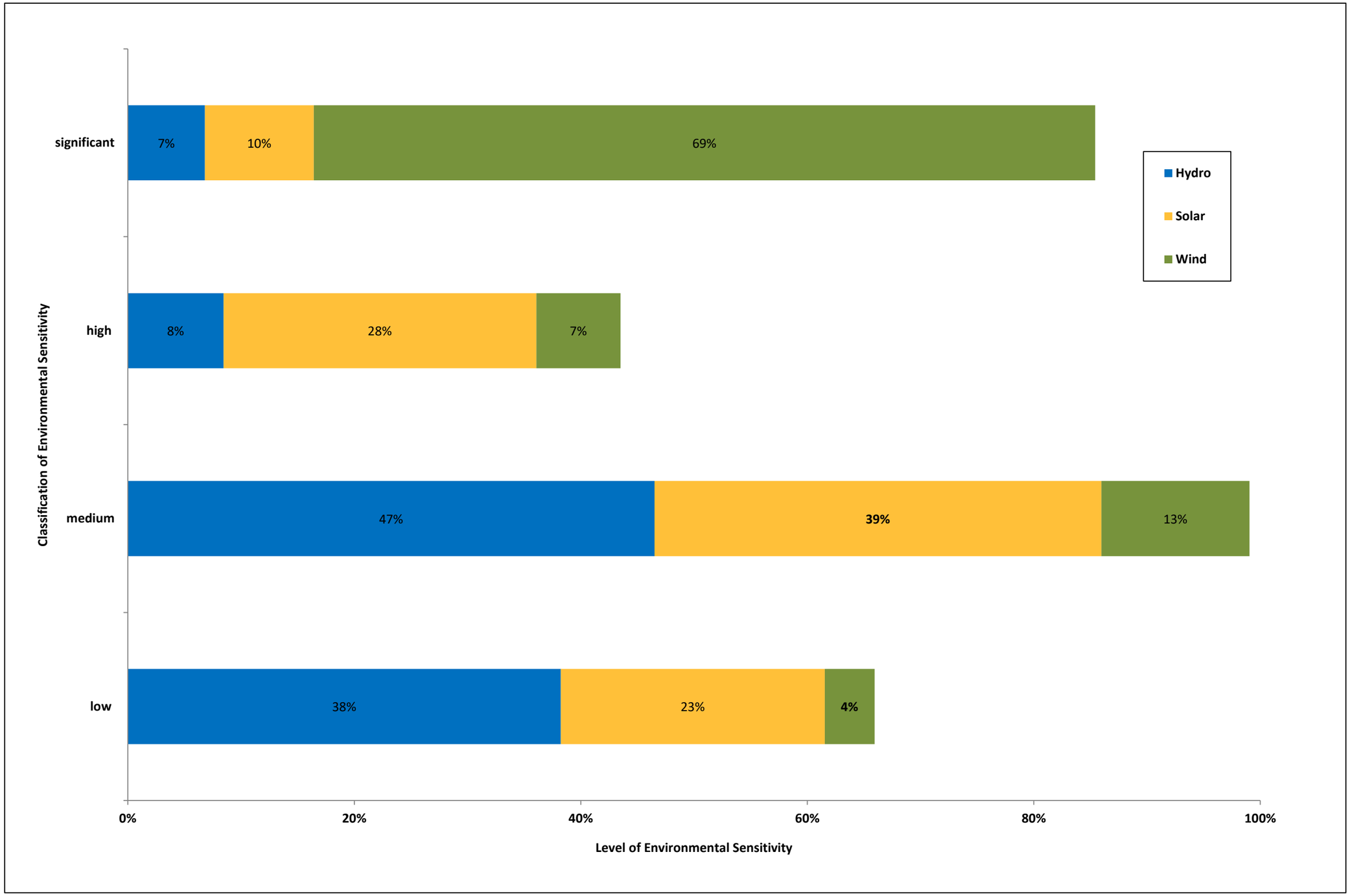



**Figure 6.18 – Solar: Cumulative Environmental Sensitivity**

Figure 6.18 illustrates that the spatial assessment framework for solar incorporates a more-rounded range of environmental sensitivity levels. Similar to hydro energy, the level of areas classified as a 'significant' sensitivity is low in comparison to wind (16% compared to 69%), whereas within the 'high' sensitivity classification the council-wide total for solar (33%) is considerably higher than the comparative figure for hydro (21%). Just over 50% of the Council area is classified as having 'medium' or 'low' levels of sensitivity. Based on the spatial assessment, these are the areas that possess a lower number of environmental sensitivities which the Council would ordinarily indicatively target for new developments based on anticipated environmental impact at a strategic level, notwithstanding any individually-significant environmental sensitivities that would require further consideration at the application stage. As noted above, there would be a requirement for all proposals to undertake a full assessment at a site specific scale to enable detailed consideration of all relevant environmental effects.

Figure 6.19 – Comparative Levels of Environmental Sensitivity for Each Technology at a Council-wide scale



**Cumulative Environmental Sensitivity – All technologies**

Figure 6.19 identifies the comparative levels of cumulative environmental sensitivity (low to significant) across all three technologies. The figures provide - at a strategic level – an indication where developments should be avoided, where further assessment of environmental effects will be required (informed by the web mapping) and areas where specific technologies may be more environmentally acceptable, subject to detailed consideration.

The hydro assessment has the highest figures in the 'low' and 'medium' classifications of cumulative environmental sensitivity, indicating at a strategic level that these areas are likely to have a lesser cumulative environmental impact (subject to detailed site assessment). There is a current installed capacity for hydro schemes of 267MW and with relatively low cumulative environmental sensitivity identified at the strategic level, it is considered there is potential capacity for further small and medium-scale hydro developments in Perth and Kinross, subject to detailed site assessment. It is important to note that the majority of watercourses fall within areas classified as 'significant' or 'high' sensitivity, as watercourses – by their nature – are environmentally sensitive so will almost always require detailed site consideration. For solar energy, the majority of the Council area falls within the 'low' and 'medium' sensitivity classifications indicating at the strategic level that there is scope for further solar energy development, subject to detailed consideration. For wind energy, areas within the 'significant' sensitivity classification cover a large majority of the Council area, reflecting the various strategic environmental sensitivities included in the assessment including potential landscape and cumulative impacts. Wind, in comparison to hydro and solar, therefore has likely more limited opportunities for further development, therefore the need for detailed assessment of environmental effects at the site level will be important, including mitigation measures where required. It is considered that the advocacy of wind energy proposals will continue given national policy and guidance promoting onshore wind opportunities; the strategic environmental sensitivity assessment will assist in identifying the key strategic environmental considerations (using the web map to be taken into account as part of any application, as well as more generally across all technologies.

**Spatial Assessment – Summary of findings**

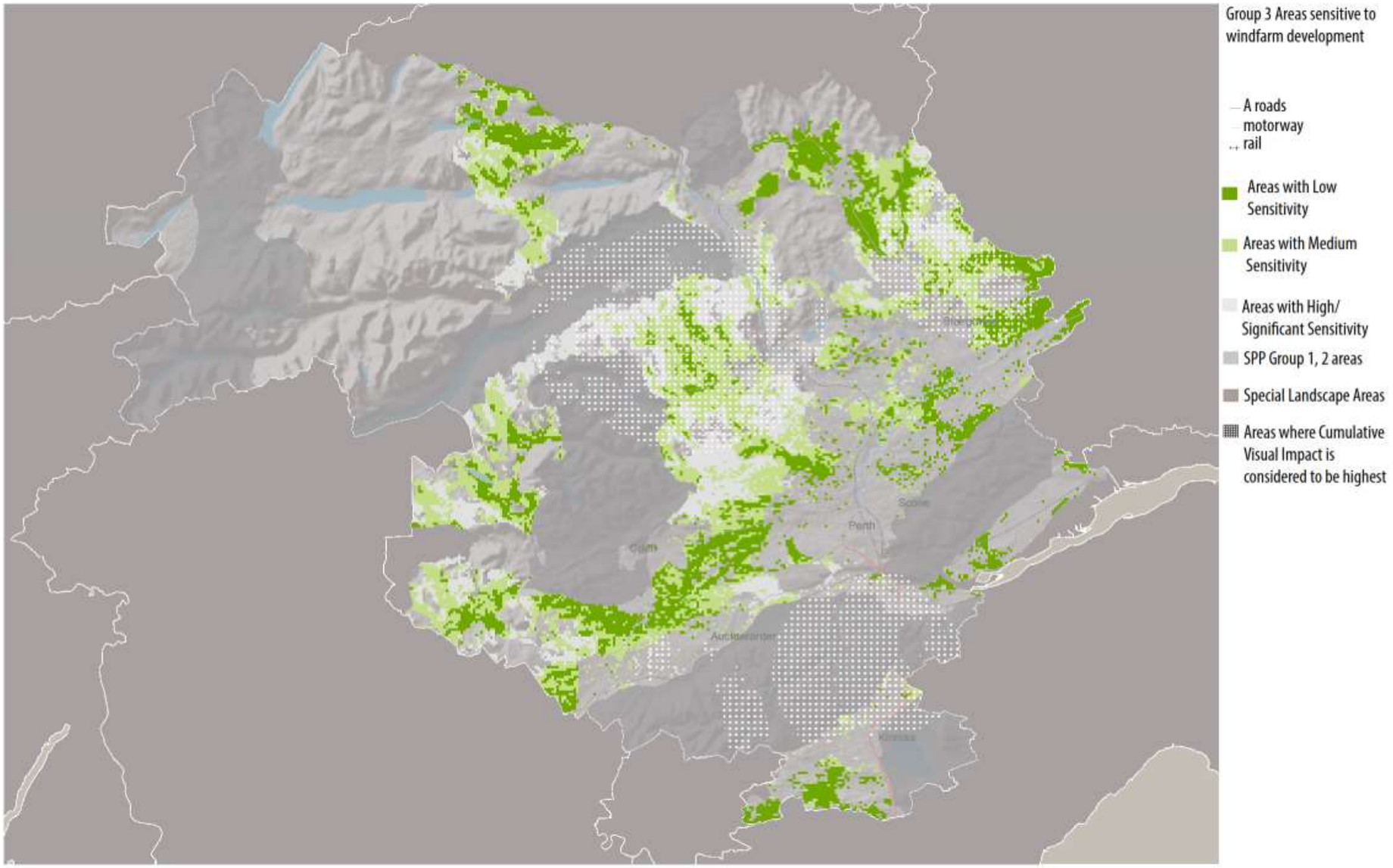
The spatial assessment has identified the prevalence and extent of key environmental sensitivities at a catchment and Council-wide scale. Those strategic environmental sensitivities that score highly within either the catchment or Council-wide assessment are considered to be important considerations to be explored further at the site assessment level. In addition, the spatial assessment has identified where there are cumulative environmental sensitivities i.e. the presence of multiple environmental sensitivities, again at both catchment and council-wide scales. At the council-wide scale, the levels of cumulative environmental sensitivity help steer deployment of renewable and low carbon energy to towards areas of indicative capacity at a strategic scale and avoid areas of cumulative sensitivities that will require consideration at the planning application stage. At the catchment scale, the analysis helps to show at a more localised scale the extent and presence of the range of environmental sensitivities as well as comparative levels of sensitivity to assist in identifying where future development may be suitably located subject to further consideration at the site level.

**Strategic Environmental Sensitivity**

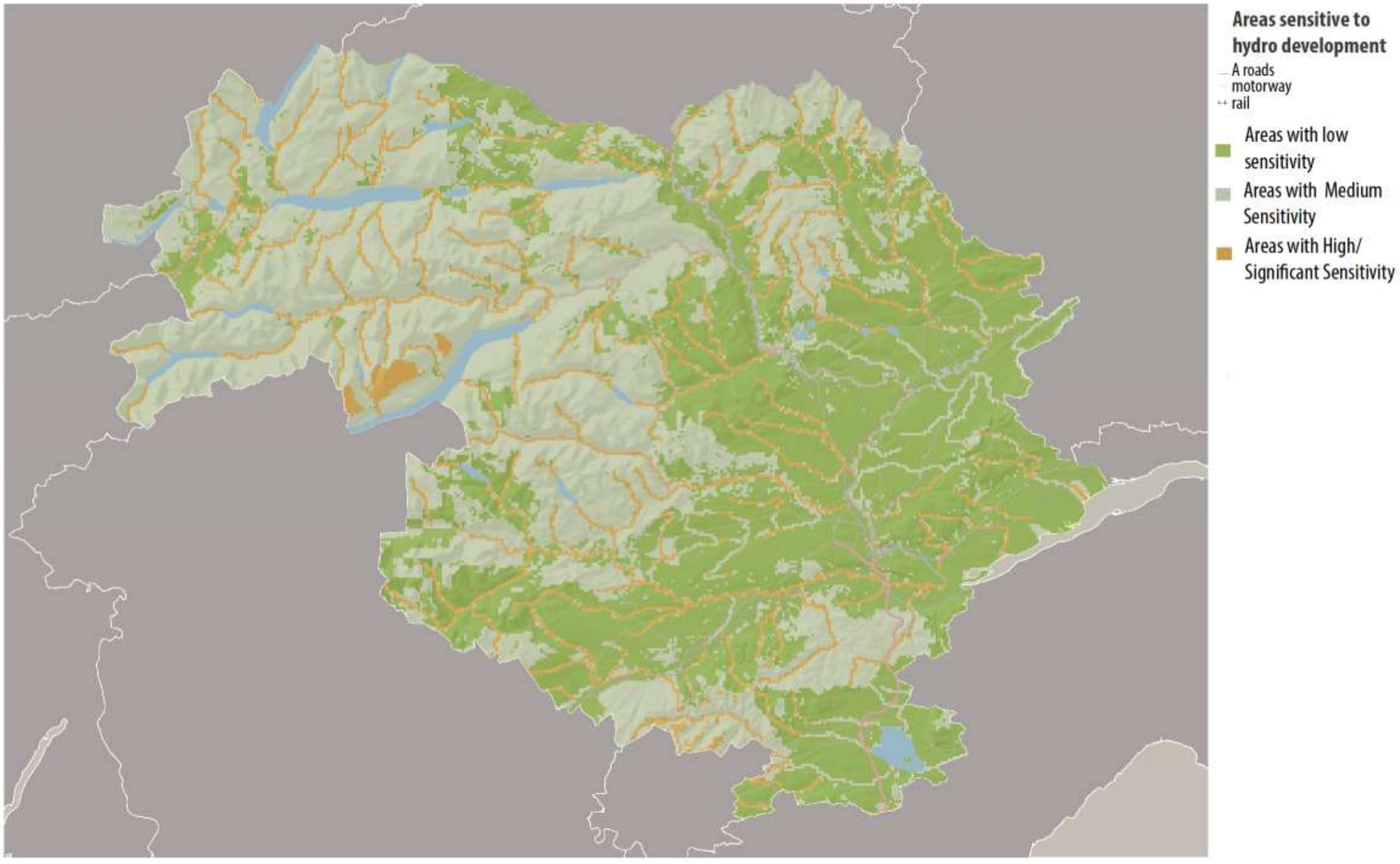
The following Strategic Environmental Sensitivity maps – based on the sensitivity key below - indicate at a strategic level where there is potential capacity for future development. The maps have been prepared using the methodology identified in Section 5 – and will be available via the web mapping alongside individual considerations to help deliver the draft Guidance and to help steer development to the least sensitive areas and shape the site design and assessment process.

| | |
|---|---|
| Significant Sensitivity (Special Landscape Areas for Wind only) | Proposals will need to substantially overcome significant impacts on identified sensitivities |
| High Sensitivity | Proposals are likely to need to address impacts on a wide range of sensitivities |
| Medium Sensitivity | Proposals may need to address impacts on a number of sensitivities |
| Low Sensitivity | Proposals are likely to have fewer sensitivities to address |

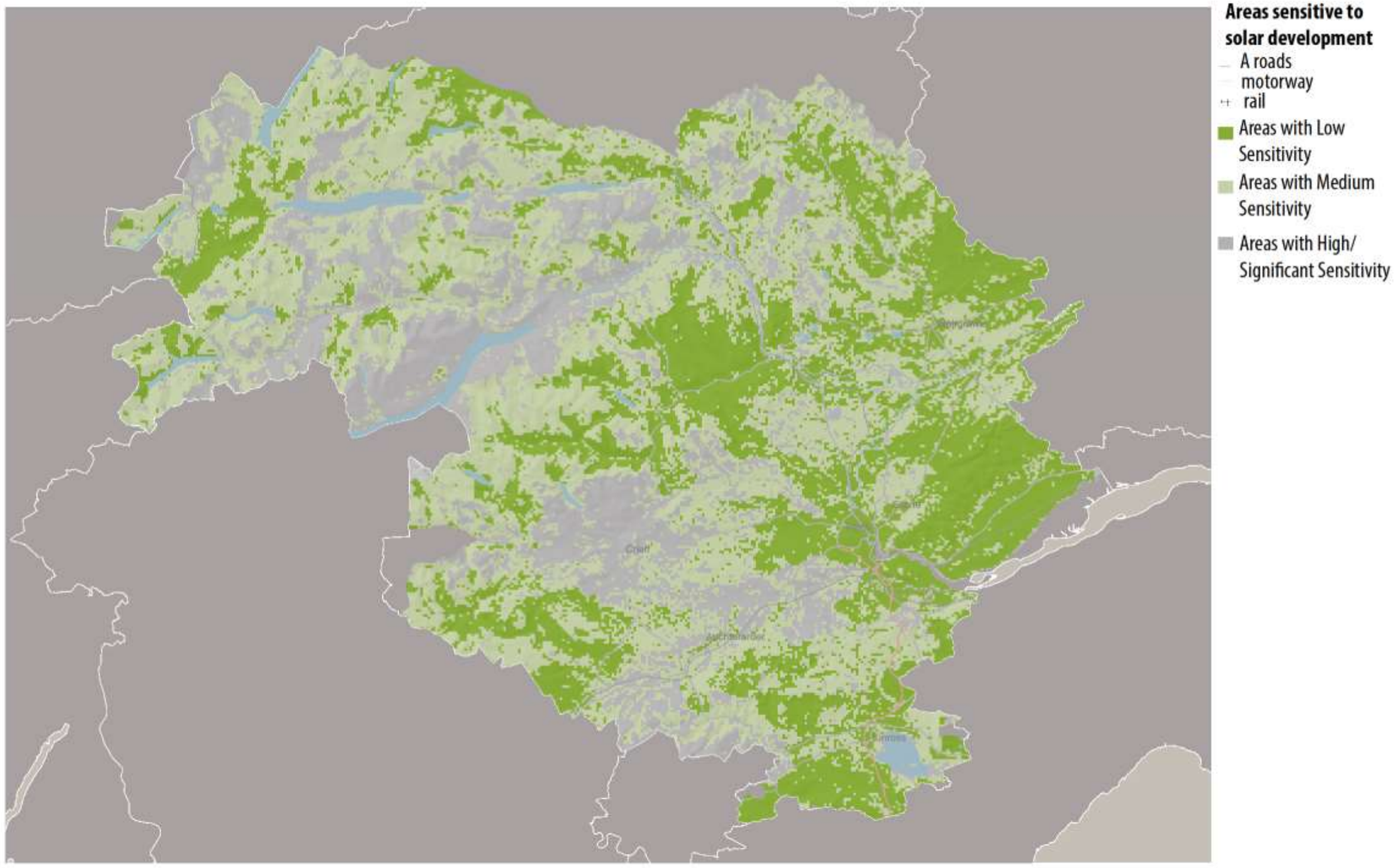
Map 6.1: Strategic Environmental Sensitivity – Wind



Map 6.2: Strategic Environmental Sensitivity – Hydro



Map 6.3: Strategic Land Use Capacity – Solar



## 6.5 Assessment of Environmental Effects by Technology

This section of the report details the policy-based SEA assessment of the SG. It comprises a summary of the matrix assessment of each renewable and low carbon energy technology included within the SG. The matrix has assessed the potential for any significant environmental effects arising, in the context of the identified SEA Objectives. The matrix assessment includes consideration of any temporal, cumulative and synergistic effects across the range of technologies, as required under the Environmental Assessment legislation and these are detailed in Table 6.3 below. The below assessment approach acknowledges the difficulty in predicting the significance of cumulative and significant effects for each of these technologies either individually or cumulatively and these limitations should be noted when ascribing confidence levels to these results. The detailed matrix assessments, including scores, are included in Appendix 4.

Table 6.3 – Summary of key environmental effects per technology

| | |
|---|---|
| **Onshore Wind** | |
| Population & Human Health | Onshore wind energy developments have the potential to contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. Onshore wind energy developments also have the potential to negatively effect on green infrastructure and networks e.g. loss of woodland corridors, predominantly from the construction of associated infrastructure. |
| Biodiversity, Flora & Fauna | Onshore wind energy developments have the potential to negatively affect biodiversity, flora and fauna and associated habitats (including protected species and designated sites), where inappropriately sited through both the siting of turbines and associated infrastructure such as tracks, during the construction, operational and decommissioning phases. Key identified effects include impacts on biodiversity such as turbine strike, or impacts such as hydrological or habitat changes, or forest/woodland loss. |
| Soil | Onshore wind energy developments have the potential to result in the direct loss of prime agricultural land and/or carbon rich soils where these fall within areas considered to be technically feasible for wind, primarily during the construction phase. |
| Water | Onshore wind energy developments have the potential to significantly impact on the water environment, including direct impacts on natural hydrological processes from the siting and installation of turbines and the construction and operation of access tracks. Impacts can be during construction, operational and decommissioning phases. |
| Climatic Factors | Onshore wind energy developments have the potential to contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. Onshore wind energy developments can also result in the direct loss of woodland/forest cover and/or carbon rich-soils which may have negative implications in terms of climate, particularly when considered cumulatively, although this would be mitigated against through requirements for replanting. |
| Material Assets | Onshore wind energy developments have the potential to significantly alter existing land uses/cover, which currently directly or indirectly benefit society. In addition, onshore wind energy developments have the potential to contribute to Scotland's renewable energy resources. |
| Cultural Heritage | Onshore wind energy developments have the potential to negatively affect cultural heritage, including designated and non-designated sites, features and buildings, during construction, operational and decommissioning phases. |
| Landscape | Onshore wind energy developments have the potential to significantly, negatively impact on landscape, including the inappropriate siting of turbines and associated infrastructure such as access tracks. Landscape impacts can be associated with both designated and non-designated sites. |
| Air | Onshore wind energy developments have the potential to significantly contribute to Scotland's renewable energy resources, with resultant improvements to air quality. Onshore wind energy developments also have the potential to result in localised negative air quality impacts particularly during the construction phase. |
| **Hydro** | |
| Population & Human Health | Hydro energy developments have the potential to contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. Hydro energy developments also have the potential to negatively effect on green networks – particularly riparian zones – through the construction, operation and decommissioning phases |

| | |
|---|---|
| | of schemes. |
| Biodiversity, Flora & Fauna | Hydro energy developments have the potential to negatively affect biodiversity, flora and fauna and associated habitats (including protected species and designated sites), during the construction, operational and decommissioning phases. Key identified effects include direct impacts on biodiversity such as hydrological or habitat changes, or forest/woodland loss. |
| Soil | Hydro energy developments have the potential to result in the loss of important soil resources, particularly carbon rich soils located close to existing water bodies which could be removed and/or degraded through the construction of infrastructure such as tracks and pipes. |
| Water | Hydro energy developments – by their nature - have the potential to significantly affect the water environment, either directly or indirectly. Negative effects could take place during construction and decommissioning (e.g. construction waste/soil disturbance) as well as during the operation of schemes. |
| Climatic Factors | Hydro energy developments have the potential to contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. Hydro energy developments can also result in the direct loss of woodland/forest cover and/or carbon rich-soils which may have negative implications in terms of climate, particularly when considered cumulatively. |
| Material Assets | Hydro energy developments have the potential alter existing land uses/cover, particularly where large-scale proposals are proposed. In addition, inappropriately designed and/or managed schemes could have resultant negative effects on water quality/abstraction. Also, hydro energy developments have the potential contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. |
| Cultural Heritage | Hydro energy developments have the potential to negatively affect cultural heritage, including designated and non-designated sites, features and buildings, during both construction and operational phases. |
| Landscape | Hydro energy developments have the potential to negatively impact on landscape, particularly where large-scale proposals are proposed. Landscape impacts can be associated with both designated and non-designated sites. |
| Air | Hydro energy developments have the potential to contribute to Scotland's renewable energy resources, with resultant improvements to air quality. Hydro energy developments also have the potential to result in localised negative air quality impacts particularly during the construction phase. |
| **Solar** | |
| Population & Human Health | Solar energy developments have the potential to significantly contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. Solar energy developments also have the potential to negatively effect on green networks and corridors – particularly the removal of existing field boundaries. |
| Biodiversity, Flora & Fauna | Solar energy developments have the potential to negatively impact on biodiversity, flora and fauna through changes to land cover and impacts from construction/decommissioning processes. Conversely, solar energy developments have the potential to have positive impacts through temporary cessation of intensive agricultural processes which may otherwise limit biodiversity allowing the land to be rested and creating opportunities for further beneficial land management such as wildflower meadows. |
| Soil | Solar energy developments have the potential to result in the loss of valuable soil resources, including carbon rich soils and/or prime agricultural land, particularly during the construction phase of associated infrastructure and any subsurface works. |
| Water | Solar energy developments have the potential to negatively affect the water environment, particularly during the construction and decommissioning phases, and where surface run-off is not adequately addressed. |
| Climatic Factors | Solar energy developments have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. Solar energy developments can also result in the direct loss of carbon rich-soils and/or prime agricultural land which may have negative implications in terms of climate, when considered cumulatively. |

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| Material Assets | Solar energy developments have the potential to result in the loss of prime agricultural land with resultant loss of food production. In addition, solar energy developments have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. |
| Cultural Heritage | Solar energy developments have the potential to negatively affect cultural heritage, including designated and non-designated sites, features and buildings, during construction, operational and decommissioning phases. |
| Landscape | Solar energy developments have the potential to negatively impact on landscape, particularly where large-scale proposals are proposed and visible sites are utilised. Landscape impacts can be associated with both designated and non-designated sites. |
| Air | Solar energy developments have the potential to significantly contribute to Scotland's renewable energy resources, with resultant improvements to air quality. |
| **Biomass** | |
| Population & Human Health | Biomass energy developments have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, however there are potential negative impacts to air quality from inappropriately managed biomass developments from particulate matter emissions. |
| Biodiversity, Flora & Fauna | Biomass energy developments have the potential to result in significant negative effects as a result of the planting of large areas of monoculture biomass, which have low biodiversity value and are difficult for species to move through. The planting of existing vacant and derelict sites for biomass crops could also have significant negative effects as these areas can be rich in biodiversity. As such any new planting proposals will be required to consider and be sensitive to existing habitats and species both within the site and those out-with it but which move through it. Potential for secondary negative impacts on biodiversity, particularly in respect of particulate emissions, due to diminished air quality as a result of the widespread adoption of biomass. However, woodfuel is, at least in theory, carbon neutral, and has the potential to displace fossil fuels. |
| Soil | Sensitive soil types should be identified and avoided, and the SG should also promote the avoidance of new planting of biomass crops on deep peat soils and promote the application of the UK Forestry Standard and Guidelines and sustainable forest management practices. In addition, it should seek the targeting of the right tree in the right place in order to avoid potential significant negative environmental effects. |
| Water | The measures used to increase biomass yields from existing woodland and forests e.g. extraction of harvesting residues could contribute to increased soil and water acidification. In addition a range of threats are associated with the growing pressure to harvest tree stumps for woodfuel. These include: increased risk of ground damage leading to erosion and siltation, with potential secondary negative effects on water quality. |
| Climatic Factors | Biomass energy developments have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change. There is the likely potential for negative impacts on air quality as a result of any biomass development, due to particulate matter emissions, the significance of the effect will be dependent on management practices and the location of the development which will be considered in detail at the planning application stage. |
| Material Assets | Biomass energy developments have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, however there are potential negative impacts to air quality from inappropriately managed biomass developments. |
| Cultural Heritage | No significant effects identified. |
| Landscape | No significant effects identified. |
| Air | Biomass energy developments have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change. However there are potential negative impacts to air quality from inappropriately managed biomass developments from particulate matter emissions, particularly where there are multiple developments and there may be cumulative effects on population and human health. |
| **Heat Pumps** | |
| Population & Human Health | Heat pump technologies have the potential to significantly contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. |
| Biodiversity, Flora & Fauna | Medium and large-scale water source heat pump schemes have the potential to negatively affect water-based species and associated habitats including designated and non-designated species and sites, during both construction and operation phases. |

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|---|---|
| Soil | No significant effects identified. |
| Water | Medium and large-scale water source heat pump schemes have the potential to negatively affect the water environment, in terms of species and habitats as well as hydrological processes, during construction, operational and decommissioning phases. |
| Climatic Factors | Heat pump technologies have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. |
| Material Assets | Heat pump technologies have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. |
| Cultural Heritage | Heat pump technologies have the potential for direct and indirect negative effects on designated and non-designated buildings, sites and features where sited inappropriately. |
| Landscape | No significant effects identified. |
| Air | No significant effects identified. |
| **Other Renewables** | |
| Population & Human Health | Other renewable technologies and processes have the potential to significantly contribute to Scotland's renewable energy resources and mitigation against the effects of climate change, with resultant improvements to air quality. However, anaerobic digestion, energy from waste and landfill gas technologies have the potential to result in negative air quality impacts from emissions. |
| Biodiversity, Flora & Fauna | Hydro micro-generation schemes have the potential to negatively affect water-based habitats and species, during construction and phasing, including designated and non-designated sites and species. |
| Soil | No significant effects identified. |
| Water | Hydro micro-generation schemes have the potential to negatively affect water-based habitats and species, during construction and phasing, including designated and non-designated sites and species. Potential pollution to the water environment from Anaerobic Digestion and Energy from Waste. |
| Climatic Factors | Other renewable technologies and processes have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. The use of waste heat from various technologies may have a positive effect as it reduces resource use. However, anaerobic digestion, energy from waste and landfill gas technologies have the potential to result in negative air quality impacts from emissions. |
| Material Assets | Other renewable technologies and processes have the potential to significantly contribute to Scotland's renewable energy resources and adaptation to climate change, with resultant improvements to air quality. |
| Cultural Heritage | Micro-generation and other renewable technologies may enhance designated historic buildings by providing affordable heating and energy, which may allow them to become more affordable to repair, maintain and use. There may also be negative impacts on some designated historic buildings due to inappropriate design and siting. |
| Landscape | No significant effects identified. |
| Air | Other renewable technologies and processes have the potential to significantly contribute to Scotland's renewable energy resources, with resultant improvements to air quality. However, anaerobic digestion, energy from waste and landfill gas technologies have the potential to result in negative air quality impacts from emissions. |

## 6.6 Secondary, Synergistic & Cumulative Effects

As noted above, the potential for secondary, synergistic and cumulative effects on the local environment has also been considered. Table 6.4 below summarises the potential secondary, synergistic and cumulative effects that may arise from the deployment of renewable and low carbon energy technologies. Detailed assessment of identified secondary, synergistic and cumulative effects can be found in Appendix 5.

Table 6.4 – Summary of Potential Secondary, Synergistic & Cumulative Effects

| SEA Topic | Summary of Cumulative, Temporal & Synergistic Effects |
|---|---|
| Population & Human Health | The SG promotes and supports the reduction in the reliance of fossil fuels through the deployment of renewable and low carbon energy technologies. It is considered that there will be benefits to population and human health from the associated positive air quality impacts and wider climate benefits. However, biomass, anaerobic digestion, energy from waste and landfill gas technologies have the potential to result in negative air quality impacts from particular matter and other emissions. |
| Biodiversity, Flora & Fauna | The SG promotes the protection of biodiversity, flora and fauna, including designated and non-designated species and sites. Across all renewable and low carbon energy technologies, there is the potential for cumulative negative impacts on biodiversity, flora and fauna, however, the SG will require all development proposals to appropriately consider any impacts individually and in context of other development proposals, including guidance on appropriate mitigation measures. |
| Soil | Across all renewable and low carbon energy technologies, there is the potential for cumulative effects on the loss of valuable soil resources, and on soil quality and erosion of river banks. The SG will require all developments to take due cognisance of guidance on soils including mitigation measures, where required. The spatial framework for wind will also assist in protecting valuable soil resources. |
| Water | There is potential for cumulative effects on the water environment across all renewable and low carbon energy technologies. The SG will protect the water environment and its assets through enforcing national and local guidance and providing guidance on where mitigation measures will be required and how issues can be considered as part of the planning application. Cumulatively, hydrological impacts from hydro energy proposals and ground water impacts from wind energy proposals have potential to significantly affect the environment. Potential pollution to the water environment from Anaerobic Digestion and Energy from Waste is also noted. The SG will ensure these issues are considered in detail, including appropriate mitigation measures where necessary. |
| Climatic Factors | The SG promotes and supports the reduction in the reliance of fossil fuels through the deployment of renewable and low carbon energy technologies. It is considered that there will be climatic benefits and associated positive air quality impacts and deploying a range of different technologies will help to deliver these climatic benefits. However, biomass, anaerobic digestion, energy from waste and landfill gas technologies have the potential to result in negative air quality impacts from particular matter and other emissions. |
| Material Assets | The SG promotes the efficient use of land and buildings, including opportunities for utilising recreational and greenspace areas, and maximising access provision across the Council area. These improvements contribute towards achieving reductions in greenhouse gas emissions across the Council area, improving health and community well-being. |
| Cultural Heritage | There is potential for cumulative negative impacts on cultural heritage across all renewable and low carbon energy technologies, including on the setting of buildings and features. The SG will require guidance on how to avoid and/or minimise any impacts on cultural heritage, both individually and cumulatively. |
| Landscape | Cumulatively, there is the potential for significant adverse landscape impacts across the technologies, with clusters of wind energy proposals likely to have the most significant cumulative impacts. The SG will safeguard against any significant adverse cumulative impacts through detailed guidance and requirements for applicants to submit detailed surveys and/or assessments to ensure that a sufficient assessment can be undertaken. The Strategic Land Use Capacity mapping will also assist in identifying suitable locations for the deployment of wind, hydro and solar technologies, taking in to account potential cumulative impacts. |

## 6.7 Mitigation & Enhancement

A key aspect of the Environmental Assessment process is to identify where mitigation measures are required to address any significant environmental effects. In addition, the assessment process allows the planning authority to identify where it may be reasonable to explore opportunities for enhancement of the environment. Tables 6.5 and 6.6 below summarise the key mitigation and enhancement measures identified to address any potential significant environment effects arising. Both tables also detail where the mitigation/enhancement measures have been incorporated into the SG, which demonstrates the transparency of the decision-making process and the benefits from undertaking the environmental assessment process in informing the guidance. The mitigation and enhancement measures relevant to each of the technologies assessed against the relevant SEA objectives are included in Appendix 4. This assists to identify where mitigation measures will be specifically relevant to certain technologies. The following identified mitigation measures are considered under the mitigation hierarchy i.e. avoid, reduce, remedy or compensate (for negative effects). Mitigation measures may include making changes to the guidance, as well as proposing more detailed measures to be implemented as the objectives of the guidance are delivered.

Table 6.5 – Key Mitigation Measures

| SEA Objective | Mitigation Measure | Proposed Action(s) | Key SG Section | Residual Effects Post-Mitigation |
|---|---|---|---|---|
| SEA 1 – Avoid adverse impacts on valuable soil resources e.g. prime agricultural land, carbon rich soils | Minimise effects on valuable soil resources from all renewable and low carbon energy technology developments, including associated infrastructure. | The SG will require that the appropriate guidance (inc. SEPA's Regulatory Position Statement) for the protection of valuable soil resources is given due cognisance. In addition, the SG will provide spatial guidance and advice on siting/location to help developers avoid/minimise impacts.<br><br>The SG will require relevant information e.g. Peat Management Plan, to be prepared where mitigation measures are needed to protect valuable soil resources.<br><br>Lead Partner(s): Planning Authority / SEPA/ SNH | Section 4F | No significant residual effects identified post-mitigation. |
| SEA 2 - Avoid adverse impacts on existing land use/cover | Minimise negative effects on existing beneficial land uses/cover from all renewable and low carbon energy technologies. | The SG will include general guidance on land use and planning for renewable and low carbon energy technologies and this should be taken into account. In relation to land use and land cover, mitigation measures may include post-construction or where applicable, post-decommissioning reinstatement of land cover.<br><br>Lead Partner(s): Planning Authority / SNH | Whole document | No significant residual effects identified post-mitigation. |
| SEA 3 – Promote the sustainable management of the water environment | Minimise negative effects on the water environment from all renewable and low carbon energy technologies (particularly hydro), including during construction, development and operational and decommissioning phases. | The SG will require that the appropriate guidance for the protection of the water environment is given due cognisance, including guidance on:<br>- mitigation of negative effects on the water environment of developments through avoidance of disturbance of GWDTE and abstraction through development design<br>- the design and siting of proposals (e.g. buffer strips between construction and storage areas and the water environment)<br>- potential pollution to the water environment from Anaerobic Digestion and Energy from Waste<br>- construction impacts on water abstraction (in particular borrow pits and turbine bases)<br>- direct impacts on the water environment (e.g. installation of hydro/water source heat pump technologies)<br>- the requirement for SUDS (in particular for large-scale solar)<br><br>The SG will require the following information to be submitted for consideration, where applicable:<br>- Assessment on potential impacts on Ground Water Dependent Terrestrial Ecosystems (GWDTES), where these are likely to be affected by the development [pre-decision]<br>- Ecological Survey including assessment on the impact on fish fauna and other water-based protected species [pre-decision]<br>- Construction Method Statement (template available) detailing how construction and development phases will be controlled to avoid any negative impacts on the water environment [pre/post-decision]<br>- Water Quality Management Plan detailing how water quality will be monitored and any negative impacts avoided [pre/post-decision]<br>Lead Partner(s): Planning Authority / SEPA / SNH | Section 4A.5 | There is the potential for residual effects on the water environment arising as a result of synergistic effects combining to change hydrological and other associated processes.<br><br>However, it is considered that if the assessments, statements and plans required by the SG are submitted, and the measures contained therein followed, then the potential for any residual effects on the water environment will be minimised/avoided. |

| SEA Objective | Mitigation Measure | Proposed Action(s) | Key SG Section | Residual Effects Post-Mitigation |
|---|---|---|---|---|
| | | | | |
| SEA 4 - Promote the important role and potential of forests and woodlands and avoid adverse impacts on their natural heritage value. | Minimise negative effects on existing forests and woodlands through avoidance and compensatory planting for all renewable and low carbon energy technologies (particular wind). | The SG will require that the appropriate guidance on managing impacts on existing forests and woodlands will be given due cognisance, including the submission of details for compensatory planting where this is considered necessary as well as details of the sourcing of wood fuels for biomass technologies.<br><br>Lead Partner(s): Planning Authority / SNH | Section 4A.2 | No significant residual effects identified post-mitigation. |
| | Where there will be forest or woodland loss, ensure forestry waste is disposed of appropriately during construction phase, particularly for wind energy developments. | The SG will require that the appropriate guidance for the disposal of forestry waste is given due cognisance and SEPA's Regulatory Position Statement is adhered to.<br><br>Lead Partner(s): Planning Authority / SEPA / SNH | | No significant residual effects identified post-mitigation. |
| SEA 5 - Conserve and enhance the diversity of habitats and species | Minimise negative effects on habitats and species from all renewable and low carbon energy technologies. | The SG will require that the appropriate guidance for the conservation and protection of habitats and species is given due cognisance.<br><br>The SG will require relevant surveys and/or assessments e.g. Ecological Survey, to be prepared, where applicable, including details of mitigation measures to conserve and protect habitats and species.<br><br>Lead Partner(s): Planning Authority / SNH | Section 4A.1 | There is the potential for residual effects on the water environment arising as a result of synergistic effects combining to change hydrological and other associated processes, which may impact on water-based habitats and species.<br><br>However, it is considered that any such effects may be minimised/avoided if the appropriate surveys are submitted as part of any planning applications and measures contained therein adhered to/implemented. |
| SEA 6 – Increase the potential of Perth and Kinross in contributing to Scotland's renewable energy resources | No mitigation measures identified. | The overall strategy of the SG is to promote the deployment of renewable and low carbon technologies to reduce the reliance on fossil fuel usage. The SG will provide strategic land use capacity mapping for various technologies to identify the most suitable locations for their deployment – at a strategic level – as well as policy based guidance to allow proposals to be considered fully and with greater certainty and transparency.<br><br>No mitigation measures identified.<br><br>Lead Partner(s): Planning Authority | N/A | N/A |
| SEA 7 – Support Adaptation to climate change and 'future proofing' of new development | No mitigation measures identified. | The overall strategy of the SG is to promote the deployment of renewable and low carbon technologies to reduce the reliance on fossil fuel usage. The SG will provide policy based guidance including guidance to support developments to adapt to climate change e.g. heat source pumps. In terms of future-proofing, the SG will include guidance on flooding and drainage, and how developments can secure long-term benefits through alleviating and/or mitigating flooding and drainage concerns. | N/A | N/A |

| SEA Objective | Mitigation Measure | Proposed Action(s) | Key SG Section | Residual Effects Post-Mitigation |
|---|---|---|---|---|
| | | No mitigation measures identified.<br><br>Lead Partner(s): Planning Authority | | |
| SEA 8 – Conserve and enhance the character, local distinctiveness, scenic and cultural value of the area's landscape | Minimise negative impacts on the character, local distinctiveness, scenic and cultural value of the areas' landscape. | The SG will require that the appropriate guidance for landscape considerations (including National Scenic Areas, Special Landscape Areas, etc) is given due cognisance, including the capacity mapping for Wind, Hydro and Solar where relevant, and guidance on the design and siting of proposals.<br><br>The SG will require assessments e.g. Landscape Visual Impact Assessment, to be prepared and submitted for all renewable and low carbon energy developments, where appropriate.<br><br>Lead Partner(s): Planning Authority / SNH / Historic Environment Scotland | Section 4A.3 | There is potential for residual effects on landscape and visual amenity arising from the deployment of wind energy schemes. The SG and Spatial Framework/SLUC mapping will support the development of sensitive schemes in the most appropriate locations however there is the possibility that significant landscape/visual effects still arise.<br><br>Further detailed investigative work will be required at project level to help avoid any significant landscape/visual effects arising as a result of individual proposals. |
| SEA 9 – Protect and enhance, where appropriate, the historic and cultural heritage | Minimise negative effects on historic and cultural heritage, including impacts on setting, from all renewable and low carbon energy technologies. | The SG will require that appropriate guidance for protecting historic and cultural heritage is given due cognisance.<br><br>Where applicable, the SG will require a relevant survey or assessment to be prepared to identify where mitigation measures are needed to protect historic and cultural heritage, including impacts on setting. For example, an archaeological survey.<br><br>Lead Partner(s): Planning Authority / Historic Environment Scotland | Section 4A.4 | No significant residual effects identified post-mitigation.<br><br>Further detailed work will be required at application level where proposals have the potential to impact upon an asset or assets. |
| SEA 10 – Protect and enhance green infrastructure and networks | Minimise negative effects on green infrastructure and networks from all renewable and low carbon energy technologies. | The SG will require that the appropriate guidance for protecting green infrastructure and networks is given due cognisance, including avoiding and mitigating impacts on recreational use and access.<br><br>Lead Partner(s): Planning Authority / SNH | Section 4G | No significant residual effects identified post-mitigation. |
| SEA 11 - Safeguard the integrity of designated sites | Minimise negative effects on the integrity of designated sites from all renewable and low carbon energy technologies. | The SG will require that proposals demonstrate there will be no significant adverse effects on the integrity of designated sites, in accordance with Policy NE1 of the LDP.<br><br>The SG will require the submission of relevant assessment or survey where relevant, including the identification of mitigation measures needed to protect the integrity of designated sites.<br><br>Lead Partner(s): Planning Authority / SNH / Historic Environment Scotland | Whole document including specifically box diagram (4A.1) | No significant residual effects identified post-mitigation. The HRA will identify in greater detail where mitigation measures will be required to offset the effects of any renewable or low carbon energy technology on designated sites. |
| SEA 12 – Protect and enhance air quality | Minimise negative air quality effects from emission of particulate matter from biomass, biofuels and other renewables. | The SG will refer to draft Supplementary Guidance on Air Quality which sets out the Council's planning policy on air quality issues, including guidance on siting and design to avoid and mitigate adverse impacts. | Section 4A.6 | Whilst the aim and purpose of the SG is to promote and encourage the deployment of renewable and low carbon energy technologies, there is the potential for residual air quality |

| SEA Objective | Mitigation Measure | Proposed Action(s) | Key SG Section | Residual Effects Post-Mitigation |
|---|---|---|---|---|
| | | Lead Partner(s): Planning Authority / SEPA | | effects from various technologies such as biomass, AD, EfW and landfill gas.<br><br>Where there are significant effects anticipated, these will either be avoided or minimised through the imposition of appropriate planning conditions that include proposals for monitoring, where applicable. |

Table 6.6 – Enhancement Measures

| SEA Objective | Enhancement Measure | Proposed Action(s) | SG Section |
|---|---|---|---|
| SEA 2 - Avoid adverse impacts on existing land use/cover | For solar energy developments, opportunities exist to positively influence existing land use and land cover through improved land management practices such as cessation of intensive agricultural processes and the establishment of land cover types e.g. wild flower meadows, to allow land to be rested. | The SG will identify relevant planning guidance where there may be opportunities for solar energy developments to incorporate beneficial land management practices such as land resting. | Section 4F |
| SEA 4 - Promote the important role and potential of forests and woodlands and avoid adverse impacts on their natural heritage value. | Across all renewable and low carbon energy developments (particularly for wind energy developments), opportunities may exist to enhance existing woodland/forestry through enhanced planting of native species, and to promote recreational opportunities within existing and new forested areas. | The SG will identify suitable opportunities for, and generally encourage, enhancement planting for renewable and low carbon energy developments, including opportunities for enhanced recreational activities. The SG will identify that this should be prepared and submitted as a Habitat Management Plan, identifying the extent of replanting and/or enhancement planting as well as details of the phasing and species to be planted, as well as details of identified recreational benefits. | All technologies. |
| SEA 5 - Conserve and enhance the diversity of habitats and species | Opportunities exist to enhance the diversity of habitats and species within and adjacent to renewable and low carbon energy development sites. | The SG will identify suitable opportunities for biodiversity (habitats and species) enhancement, including requirements for the submission of a relevant Management Plan informed by an Ecological Survey. | Section 4A.1 |
| SEA 9 – Protect and enhance, where appropriate, the historic and cultural heritage | Opportunities exist to enhance and promote public awareness and access to historic and cultural heritage, including both designated and non-designated sites, buildings and features. | The SG will identify suitable opportunities where interpretative material can be incorporated as part of the development proposal to facilitate promotion awareness and education of historic and cultural heritage. | Section 4A.4 |
| SEA 10 – Protect and enhance green infrastructure and networks | Opportunities exist to enhance existing green infrastructure and networks, including opportunities for recreational activities and access provision. | The SG will identify suitable opportunities for enhancing green infrastructure and networks, including potential improvements to recreational and access provision. | Section 4G |
| SEA 11 - Safeguard the integrity of designated sites | Across all renewable and low carbon energy developments, opportunities exist to safeguard and augment the integrity of designated sites. | The SG will require applicants to demonstrate that their application will have no significant adverse effects on designated sites. Where it is applicable, the SG will identify relevant planning guidance which may identify opportunities for developments to enhance the integrity of designated sites through various land management strategies. | Whole document including specifically box diagram |

| SEA Objective | Enhancement Measure | Proposed Action(s) | SG Section |
|---|---|---|---|
| | | | (4A.1) |

## 6.8 Monitoring

Monitoring of the environmental performance of the SG during its life is a key requirement of SEA legislation and is undertaken to avoid plans generating unforeseen adverse environmental effects. The legislative requirements for monitoring are set out in Schedule 3 (para 9) of the Act. The monitoring measures proposed are based on the key environmental issues identified in the draft Environmental Report. The framework to be used for monitoring the environmental impact of implementing the SG is included in Appendix 6.

**SEA Post-Adoption Statement**

As part of monitoring the SG, the SEA Post-Adoption Statement will be published after the adoption of the SG. The Post-Adoption Statement sets out how environmental considerations have been integrated in to the SG, how consultation responses have been addressed and will confirm the framework for continued monitoring of the environmental effects arising from implementing the SG.

## 6.9 Consultation

How to Comment on the Environmental Report

We would welcome your comments on this Environmental Report. The Environmental Report of the SEA for the draft Renewable and Low Carbon Energy Supplementary Guidance was published for consultation on 19 August 2019, and comments are requested by 30 September 2019. The draft Renewable and Low Carbon Energy Supplementary Guidance is also being consulted on and we would also welcome comments on this document.

**Where can I find information?**
**Online:** go to http://www.pkc.gov.uk/ldp2renewables
**Paper copies:** The Environmental Report is available for viewing at the Council's Principal Office at Pullar House, Perth, or available for purchase by contacting the team using the details below.

**How can I respond to this Consultation?**
Responding electronically helps us process your comments quickly, and saves paper.

- Email comments to DevelopmentPlan@pkc.gov.uk
- Post to: Planning & Housing Strategy, Perth & Kinross Council, Pullar House, 35 Kinnoull Street, Perth PH1 5GD

## 6.10 Next Steps

The draft SG and Environmental Report have been made available to the public, Consultation Authorities and all other interested parties for consultation, in accordance with the Environmental Assessment (Scotland) Act 2005 and Planning etc. (Scotland) Act 2006, as amended.

The consultation will run for a period of 6 weeks from 19 August 2019 to 30 September 2019. Following the consultation closing, all comments received within the consultation period will be considered before being finalised and presented to the Council for approval for prior submission to Scottish Ministers. The proposed timetable for the SG and associated SEA actions is detailed below.

Table 6.7 - Proposed Consultation Timetable

| Timescale | SG | SEA |
|---|---|---|
| 19 August – 30 September 2019 | Consultation on Draft SG | Consultation on Draft ER / Submit to SEA Gateway |
| Autumn 2019 | Consider Responses | Consider Responses |
| Autumn/Winter 2019 | Council Approval - Finalised SG | Council asked to note content of Finalised ER |
| Winter 2019 | Submit SG and Participation Statement to Scottish Ministers | Submit ER to Scottish Ministers |
| Winter 2019 / Early 2020 | Adopt SG | |
| 2020 | | Post-adoption Statement |
| 2020 onwards | Ongoing Monitoring | Ongoing Monitoring |

## Contacts & Team Credits


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|---|---|
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# Appendices

Appendix 1 – Scoping Report Comments & PKC responses

Appendix 2 – Plans, Programmes & Strategies Relevant to SG

Appendix 3 – Environmental Baseline

Appendix 4 – Detailed SEA Assessment Table – All Technologies

Appendix 5 – Detailed SEA Assessment Table – Cumulative Effects

Appendix 6 – SEA Monitoring Framework

Appendix 7 – Environmental Assessment Technical Paper

Appendix 8 – Policy 33 of the Proposed Local Development Plan as modified