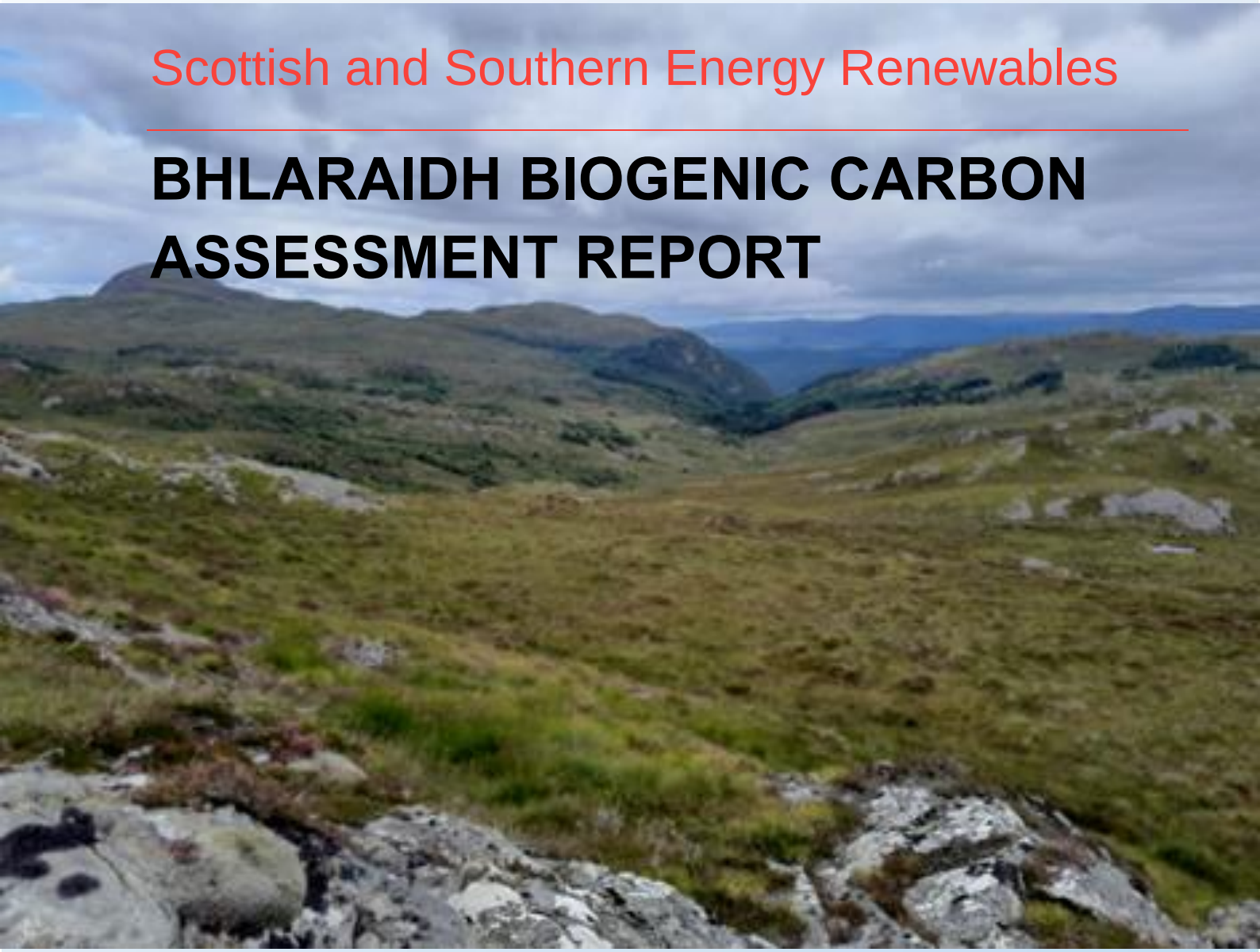
Bhlaraidh Wind Farm Extension Section 36C Variation

Technical Appendix 3.6b: Biogenic Carbon Report

Scottish Government - Energy Consents Unit - Application Details

Scottish and Southern Energy Renewables

BHLARAIDH BIOGENIC CARBON ASSESSMENT REPORT



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BHLARAIDH BIOGENIC CARBON ASSESSMENT REPORT

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EXECUTIVE SUMMARY

WSP was commissioned by Scottish and Southern Energy Renewables (SSER) to undertake a biogenic carbon assessment in relation to the Bhlaraidh windfarm extension (herein referred to as the 'Development'), to complement the existing Biodiversity Net Gain (BNG) assessment. The Development is located at central grid reference NH 39476 20661, located north-west of Invermoriston, and is located within an area dominated by wet heath, blanket bog and wet modified bog.

This assessment was undertaken in line with the Scottish National Planning Framework 4 Policy[1], the NatureScot advice on peatland and carbon rich soils[2], the Peatland Carbon Code[3] and the Woodland Carbon Code[4]. A Scottish-specific metric, produced by SSER and named the Biodiversity and Carbon Project toolkit[5], was used to carry out the assessment.

The aims of the biogenic carbon assessments were to:

- Quantify the potential biogenic carbon impacts of the Development by calculating the baseline carbon storage (tCO_2e) and carbon sequestration rates (tCO_2e/5yrs);
- Assess the extent of net loss in biogenic carbon storage and carbon sequestration rates as a result of the Development; and
- Assess the change in biogenic carbon storage and carbon sequestration rates as a result of habitat creation and enhancement which will be undertaken in-line with the Bhlaraidh Habitat Management Plan (HMP)[6], compared to a baseline scenario of no intervention.

This report details the methodology and results of the biogenic carbon assessment for the Development.

This assessment concludes that after an initial loss in land carbon stocks due to construction, the Development and its associated HMP would achieve an increase in biogenic carbon storage and sequestration capacity, predicted to be 89,136 tCO_2e of carbon stored by 2055 (30 years post-development, compared to 96,094 tCO_2e in the no-intervention scenario); and 95,315 tCO_2e of carbon stored by 2085 (60 years post-development, compared to 93,542 tCO_2e in the no-intervention scenario). **It is estimated that scheme-wide biogenic carbon neutrality will be achieved between 50 and 60 years after construction and in the long-term store significantly more carbon than would have happened if no interventions had occurred.**

[1] Scottish Government (2023), National Planning Framework 4
[2] NatureScot (2023), Advising on peatland, carbon-rich soils and priority peatland habitats in development management
[3] Peatland Carbon Code, IUCN (2023)
[4] Woodland Carbon Code, Version 2.2 (2022)
[5] SSEN (2023). Biodiversity and Carbon Project Toolkit V4.0
[6] WSP (2024) Bhlaraidh Habitat Management Plan

INTRODUCTION

1.1 BACKGROUND INFORMATION

1.1.1. WSP was commissioned by Scottish and Southern Energy Renewables (SSER) to undertake a biogenic carbon assessment on a wind farm extension site (Bhlaraidh Extension), constituting 15 new turbines and associated infrastructure, hereafter referred to as 'the Site', located on the Glenmoriston Estate, north-west of Invermoriston, hereafter referred to as 'the Development'. This report complements and should be read alongside SSER's Bhlaraidh Biodiversity Net Gain (BNG) Assessment Report (herein referred to as the BNG report).

1.1.2. A Section 36 application for Bhlaraidh Wind Farm Extension, consisting of 15 turbines with a tip height of up to 180 metres, was approved by the Scottish Government's Energy Consents Unit in August 2022. The application was accompanied by a full Environmental Impact Assessment (EIA) report and other supporting documents and a subsequent Additional Information Report (AIR)[7].

1.1.3. The Development is located west of Loch Ness and the Great Glen, on an area of high rocky plateau. This open, undulating moorland features several rocky outcrops, small hills, many lochs, lochans, watercourses, areas of bog, tracks, hydroelectric infrastructure and turbines of the existing adjacent Bhlaraidh Wind Farm.

1.1.4. A biogenic carbon assessment considers the changes in carbon stored within the biological materials such as habitats or soils as a result of the Development. Carbon accumulates naturally within healthy habitats as they age and therefore disturbance to baseline habitats can result in additional carbon emissions. This assessment type differs from the assessment undertaken within the Scottish Government Carbon calculator[8] which also includes avoided emissions from renewable energy production from the wind farm itself.

1.1.5. This assessment contributes towards SSER's goals to achieve BNG and to restore carbon sinks on new onshore sites. The habitat management prescriptions set out in the Habitat Management Plan are complimentary to both biodiversity and biogenic carbon which is one of the ways SSER are evolving their BNG approach in Scotland to support these overall goals.

1.1.6. This assessment is based on the data and outcomes of the BNG assessment. The BNG assessment took information from a Phase 1 Habitat Survey data collected in May 2020, and UKHab survey data collected in 2023 for areas identified for enhancement as detailed within the Habitat Management Plan (HMP). The Biogenic Carbon Assessment Study Area is the same as the BNG Study Area, i.e. the Site plus the habitat enhancement and creation areas. The biogenic carbon assessment uses the change in habitat which will arise through the HMP (and as per the BNG assessment) to inform the changes in overall biogenic carbon storage and sequestration.

1.1.7. The biogenic carbon baseline value has been quantified using a Scotland-specific metric, produced by SSER and named as the combined Biodiversity & Carbon Project toolkit (hereafter the 'toolkit'). The toolkit was used for both the BNG assessment (reported in the BNG report) and the biogenic

[7] WSP (2021) Bhlaraidh Wind Farm Extension EIAR. Available at: Bhlaraidh Extension | SSE Renewables [Accessed June 2023]

[8] Scottish Government (2022), Carbon calculator for wind farms on Scottish peatlands. Available at: https://informatics.sepa.org.uk/CarbonCalculator/

carbon assessment. The biogenic carbon assessment of the Site was undertaken in line with SSER Habitat Based Carbon Assessments toolkit User Guide[9] (herein referred to as the SSER Guidance).

1.1.8. Recommendations are provided in line with the Scottish National Planning Framework 4 Policy[10], the NatureScot advice on peatland and carbon rich soils[11], the Peatland Carbon Code[12] and the Woodland Carbon Code[13].

1.1.9. This assessment has been completed by a consultant capable in habitat-related carbon assessments.

1.2 SCOPE OF REPORT

1.2.1. This report uses the toolkit and the SSER Guidance to produce an assessment report that:

- Includes a biogenic carbon assessment of the Development and HMP enhancement areas (Biogenic Carbon Study Area) shown in **Appendix A**, following the guidance outlined within section 3.6 of the Guidance;
- Quantifies and compares the baseline biogenic carbon storage and sequestration rates of existing habitats and the proposed post-development to provide an indication of the overall predicted change in carbon storage and sequestration rates; and
- Assesses the change in biogenic carbon storage and sequestration rates as a result of habitat creation and enhancement which will be undertaken in line with the HMP.

1.3 SSER'S CARBON AMBITION

1.3.1. As detailed in SSER's Net Zero Transition Plan,[14] SSER has committed to reducing the carbon intensity of its' scope 1 and 2 emissions 66% by 2030 from a baseline year of 2022/23, and being net zero for scopes 1 and 2 by 2035, and scopes 1, 2 and 3 by 2050.

1.3.2. As part of this Net Zero Transition Plan, SSER is committed to restoration and enhancement of natural carbon sinks in accordance with best practice standards as part of its commitments to Biodiversity Net Gain[14].

[9] SSER (2022) Habitat Based Carbon Assessments Toolkit User Guide, Version 1.2.

[10] Scottish Government (2023), National Planning Framework 4. Available at: www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/02/national-planning-framework-4/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-revised-draft/govscot%3Adocument/national-planning-framework-4.pdf [Accessed January 2024]

[11] NatureScot (2023), Advising on peatland, carbon-rich soils and priority peatland habitats in development management. Available at: https://www.nature.scot/doc/advising-peatland-carbon-rich-soils-and-priority-peatland-habitats-development-management [Accessed January 2024]

[12] Peatland Carbon Code, IUCN (2023). Available at: https://www.iucn-uk-peatlandprogramme.org/peatland-code-0 [Accessed January 2024]

[13] Woodland Carbon Code, Version 2.2 (2022). Available at: https://woodlandcarboncode.org.uk/images/PDFs/Woodland_Carbon_Code_V2.2_April_2022.pdf [Accessed January 2024]

[14] SSER. Net Zero Transition Plan. Available at: net-zero-transition-plan-2023-final.pdf (sse.com) [Accessed February 2024]

2 METHODOLOGY

2.1 CARBON ASSESSMENT OVERVIEW

2.1.1. A summary of the biogenic carbon assessment methodology and the Development specific data sources, assessment limitations and assumptions are provided in this methodology section. This report should be read in conjunction with the toolkit, provided separately.

2.1.2. Any amendments to the Development, HMP enhancement areas or assumptions that were used for this carbon assessment will necessitate re-running the carbon calculations, to provide accurate numbers.

2.1.3. The two values considered in the carbon assessment are carbon storage and carbon sequestration. These are described below, with further information available in the SSER guidance.

2.1.3.1 Carbon storage refers to the amount of carbon that is 'locked up' in biomass, including vegetation and soil. It is referred to as the stock of carbon and measured in tonnes of carbon dioxide equivalent (tCO_2e). Carbon can be locked up for hundreds of years (e.g. in the case of ancient woodlands and peatlands). A positive value represents carbon that has been stored; a negative value represents carbon that has been emitted from storage.

2.1.3.2 Carbon sequestration refers to the movement of carbon dioxide from the atmosphere to living plants. The term 'carbon flux' can also be used, to refer to movements between the atmosphere and living plants (i.e. sequestration and emission) – however, for clarity this report refers to sequestration rates. Carbon dioxide absorbed by living plants is presented as a negative value and represents an overall sequestration of carbon while positive values show overall net emissions to the atmosphere. It is measured in tonnes of carbon dioxide equivalent sequestered or absorbed per X number of years (tCO_2e/Xyrs).

2.2 CARBON CALCULATIONS AND ASSOCIATED ASSUMPTIONS

2.2.1. To undertake the carbon assessment, the carbon section of the toolkit was completed using the data and outcomes of the BNG assessment. The carbon assessment uses the baseline and change in habitat data from the BNG assessment to inform the baseline and changes in overall carbon storage and sequestration rates. The BNG assessment took information from a Phase 1 Habitat Survey data collected in May 2020, and UKHab survey data collected in 2023 for areas identified for enhancement as detailed within the HMP. For more information about the data collection process and related limitations and assumptions, please see the BNG report's methodology (Section 2, 'Methodology').

2.2.2. In order to estimate the carbon storage and sequestration rates from the different habitats within the Biogenic Carbon Study Area, the areas of individual habitats were considered along with appropriate values for carbon storage and sequestration rates using best practice taken from the literature, outlined in the SSER Guidance. All habitats within the Biogenic Carbon Study Area were considered as part of the baseline with post-development habitats divided into retained, enhanced or created habitats.

2.2.3. The calculations were undertaken in the toolkit following the methodology outlined in Section 3, 'Project Carbon Assessment Toolkit' in the SSER Guidance. The carbon values of the habitats within the Site were quantified in terms of tonnes of carbon dioxide equivalent (tCO_2e) for carbon

storage, and tonnes of carbon dioxide equivalent per 5-year period (tCO_2e/5yrs) for sequestration rates. This is in line with current best practice and guidance from Natural England[15].

2.2.4. The values were calculated using the toolkit. These were based on:

- The data auto-populated from the BNG section of the toolkit (for the Calculation Units, Habitat type, Area columns for pre-development; Area Retained column for during works; and After work action, Habitat Type, Area and Time to target condition for post-development);
- Our understanding of the Site and HMP (for Woodland known to be planted on Peat or Bog, Woodland planting on Peatland, Peatland Condition pre- and post-restoration - see section 2.2.5); and
- Assumptions made (for age and peatland depth - see Section 2.2.6).

2.2.5. Based on our understanding of the Site and HMP, it is known that no woodland planting has occurred on the existing peatland in the baseline. The peatland condition pre-development is also known to be modified, based on feedback from the project team and survey data. Furthermore, it is known that the woodland habitats to be created post-development will not be planted on blanket bog. Based on the bog enhancements detailed in the HMP, it is likely that peatland condition of these habitats post-restoration will be Near Natural (as defined in the toolkit).

2.2.6. Age of habitats was not known and was presumed to be 30 years. This is the tool default value as outlined in the SSER guidance. Peatland depth was not known and was presumed to be between 0.5 meters and 2 meters. This is the tool default value as outlined in the SSER guidance, because it is the most common value found in Scottish Peat bogs by SSER.

[15] Natural England (2021) The Natural England Report: Carbon Storage and Sequestration by Habitat (NERR094). Available at: https://publications.naturalengland.org.uk/file/6257983284838400 [accessed January 2024]

3 RESULTS

3.1.1. This section provides a summary of the carbon quantitative assessment.

3.1.2. Details about each habitat is provided in the BNG report and the HMP.

3.2 BASELINE CARBON

3.2.1. **Overall, the Biogenic Carbon Study Area has a baseline carbon storage value of 98,645 tCO_2e, and baseline sequestration rate of +425 tCO_2e/5yrs, meaning it is at present a net-emitter.** Breaking this down further, the Site (within the infrastructure footprint) has a baseline carbon storage value of 16,655 tCO_2e, and baseline sequestration rate of +33.89 tCO_2e/5yrs. The majority of carbon storage and sequestration occurs in the baseline habitats where HMP enhancements will be delivered, which has a baseline carbon storage value of 81,989 tCO_2e and baseline sequestration rate of +391.31 tCO_2e/5yrs.

3.2.2. **If no interventions were to take place, it is predicted that the amount of carbon stored within the Biogenic Carbon Study Area will consistently decrease with time.** Every 30 years, an estimated 2,551 t of stored CO_2e would be lost. This means that total carbon storage in 30 years would be 96,094 tCO_2e, in 60 years would be 93,542 tCO_2e, and so on. **The loss of stored carbon is a result of the modified condition of peatland habitats** at the Site and HMP areas; the other habitats are not predicted to gain anymore stored carbon with time since they are assumed to be mature. This results in a predicted net decrease in biogenic carbon present throughout the Biogenic Carbon Study Area with time.

3.2.3. Table 1 provides a summary of the baseline carbon storage by habitat:

Table 1 – Baseline carbon storage by habitat type (Phase UK and UKHab)

Habitat type	Area (ha)	Carbon Storage (tCO_2e) – Baseline, 0yrs	Carbon Storage (tCO_2e) – Baseline, 30yrs	Carbon Storage (tCO_2e) – Baseline, 60yrs
E1.6.1: Bog: Blanket Bog	0.98	1,978	1,904	1,831
D2: Wet Dwarf Shrub Heath	30.53	11,205	11,205	11,205
E1.7: Bog: Wet Modified Bog	1.72	3,472	3,343	3,213
Heathland and shrub –Mountain Heaths and Willow Scrub	11.10	5,890	5,890	5,890
Heathland and shrub – Upland Heathland	35.79	13,135	13,135	13,135
Wetland – Blanket Bog	31.18	62,948	60,600	58,252
Wetland – Purple Moor Grass and Rush Pastures	0.19	17	17	17
TOTAL	**111.49**	**98,645**	**96,094**	**93,542**

3.3 POST-DEVELOPMENT CARBON

3.3.1. **During construction, the Biogenic Carbon Study Area is predicted to lose the carbon stored in the 33ha of the Site as well as its carbon sequestration capacity**, due to habitats beings removed permanently within the development footprint and habitats being temporarily removed to facilitate construction but that will be reinstated. This consists of a carbon storage loss of 16,655 tCO_2e.

3.3.2. **Post-development, it is predicted that after an initial drop due to construction, carbon storage will increase over the longer term.** Overall, post-construction carbon storage of the Biogenic Carbon Study Area is 76,481 tCO_2e on the year following construction which is a 22% decrease compared to the baseline. This will then increase to 89,136 tCO_2e (7% decrease compared to the non-intervention scenario), 30 years after construction; and 95,315 tCO_2e (2% increase compared to the non-intervention scenario), 60 years after construction.

3.3.3. **The change in carbon stored can be broken down as follows:**

- **In the Site, Built features are replacing 2.7ha of bog, and 7.2ha of wet dwarf shrub heath** The toolkit calculates this as an upfront loss of 8,108 tCO_2e of biogenic carbon, however this is a conservative estimate as in reality the removed peatland will be used for reinstatement and restoration purposes elsewhere on site. This reinstatement and repurposing is not captured in the calculations.
- **In the Site, the remaining ~23ha of wet dwarf shrub heath, will be reestablished**. This will progressively reinstate the carbon stored and sequestered in the wet dwarf shrub heath habitat to its original values.
    - Quantitatively, this represents no change in carbon storage and sequestration rates after 30 and 60 years.
- **In the HMP area, peatland (specifically blanket bog) habitats will be enhanced** from a “Modified” to a “Near Natural” state. This improved condition reduces the emissions from this habitat and thus the carbon sequestration values improve. Whilst there is no immediate change in carbon stocks, the change in carbon sequestration rates results in greater carbon stocks in 30 and 60 years time, compared to a non-intervention scenario.
    - Quantitatively, this represents an overall gain of 2,049 tCO_2e carbon stored compared to a non-intervention scenario after 30 years; and a gain of 4,097 tCO_2e after 60 years.
- **In the HMP area, the creation of native pine woodland** will, long term, result in higher carbon storage and sequestration rates than in a non-intervention scenario. This is because woodland has higher carbon storage and sequestration capacities than the pre-development upland heathland. However, in the near term (30 - 60 years) there is a reduction in carbon stocks as the newly established trees will be young and growing.
    - Quantitatively, this represents an immediate loss in carbon storage of -8,676 tCO_2e, and after 30 years -3,089 tCO_2e compared to a non-intervention scenario, but by 60 years an increase in carbon storage of 3,389 tCO_2e.
- **In the HMP area, enhancement of upland heathland into mountain heaths and willow scrub** will store more carbon than in a non-intervention scenario. **Other enhanced habitats (purple moor grass and rush pastures, and mountain heaths and willow scrub)** will not store further

carbon, based on the toolkit assumptions. This is because other than peatland, the toolkit does not apply differing carbon storage and sequestration rates to different habitats in different conditions. In reality, extensive extra planting is taking place across the mountain heath habitats which will result in enhanced biogenic carbon storage and carbon sequestration which is not captured here.

- Quantitatively, this represents an additional 1,988 tCO_2e carbon stored compared to a non-intervention scenario within the first few years. Table 2 provides a summary of the post-development carbon storage by habitat, on the year following construction and after 30 years and 60 years:

Table 2 – 1 year, 30 years, and 60 years post-development predicted carbon storage by habitat type

Habitat type	Area (ha)	Carbon Storage (tCO_2e) – 1 Years post-dev	Carbon Storage (tCO_2e) – 30 Years post-dev	Carbon Storage (tCO_2e) – 60 Years post-dev
D2: Wet Dwarf Shrub Heath	23.29	1,425	8,547	8,547
J5: Other habitat (Built Structures)	9.94	0	0	0
Heathland and shrub – Mountain Heaths and Willow Scrub	23.25	12,337	12,337	12,337
Wetland – Blanket Bog	31.18	62,948	62,649	62,349
Wetland – Purple Moor Grass and Rush Pastures	0.19	17	17	17
Woodland and Forest – Native Pine Woodlands	23.64	54	5,587	12,065
TOTAL	**111.49**	**76,780**	**89,136**	**95,315**

3.4 SUMMARY OF CARBON CHANGE

3.4.1. **Plate 3-4** shows the dashboard results from the toolkit and summarises the changes in carbon storage generated for the combination of the Proposed Development and HMP enhancements within the Biogenic Carbon Study Area.

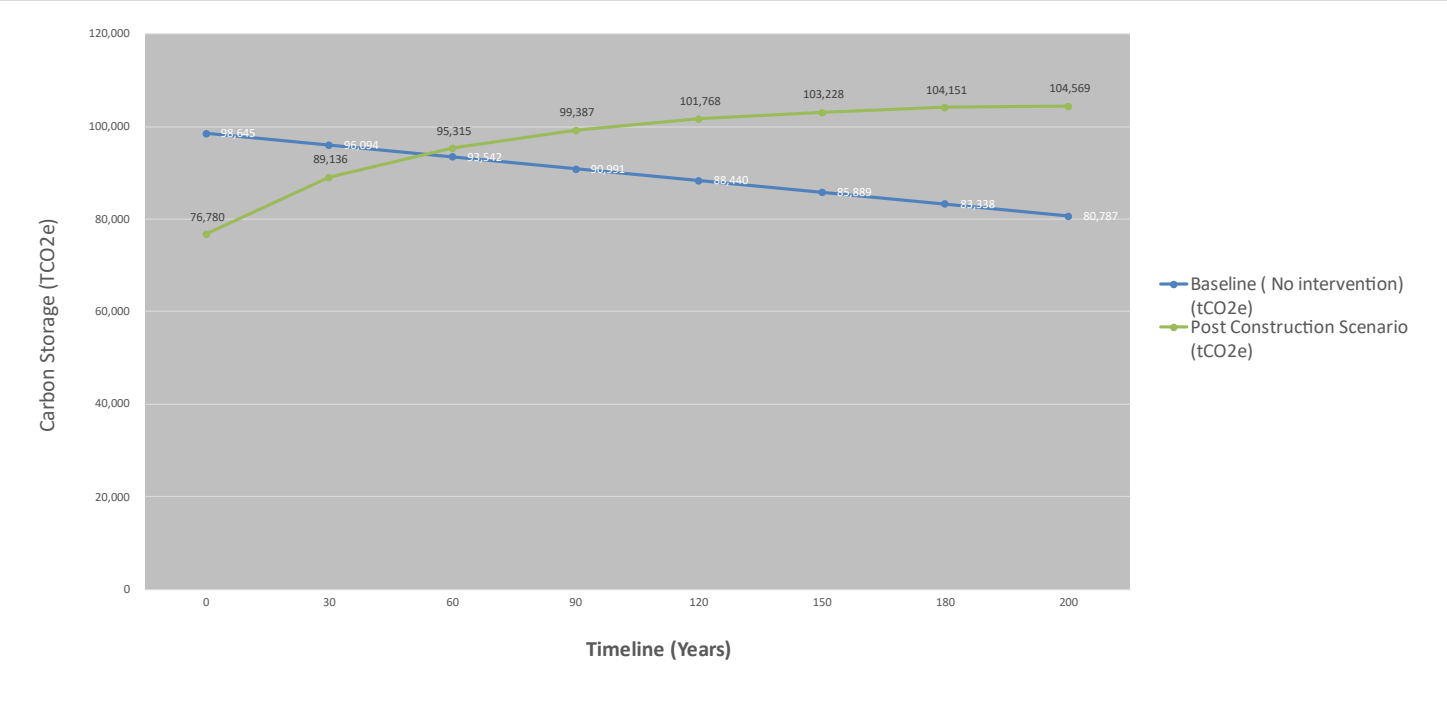


Plate 3-4: Toolkit dashboard for combined Proposed Development and HMP Enhancements

Overall, it is predicted that the project will **achieve biogenic carbon neutrality between 50 and 60 years after construction.**

3.4.2. **It is predicted that in the long term, this project will store significantly more biogenic carbon than what would have happened if no interventions had occurred.** By year 200 post construction, a non-intervention scenario is estimated to store 80,787 tCO_2e whereas a post-construction scenario is estimated to store 104,569 tCO_2e. This represents an additional 23,782 tCO_2e stored, which is an increase

of 29% compared to a non-intervention scenario. The Bhlaraidh Extension wind farm permission is for 50 years and SSER will actively manage the land for that time-period, setting the conditions for long term improvements and establishing a road to recovery for these habitats.

4 DISCUSSION AND CONCLUSIONS

In conclusion, the carbon assessment recorded a baseline carbon storage value of 98,645 tCO_2e in the Biogenic Carbon Study Area. The construction works is expected to reduce this to a post-development value of 76,780 tCO_2e carbon, corresponding to a net loss of 21,865 tCO_2e. However, due to the improvement of peatland condition and planting of pine woodland, this net loss of biogenic carbon stock will decrease over time to 6,958 tCO_2e after 30 years, until by 60 years these works may have resulted in a net increase in biogenic carbon stocks of 1,773 tCO_2e. Figures 1 and 2 representing an overall summary of change in carbon storage and sequestration rates are available in Appendix A. **Thus, it is estimated that scheme-wide land carbon neutrality will be achieved between 50 and 60 years after construction.**

4.1.1. **In the long term, it is predicted that the project will store more carbon than would have happened if no interventions had occurred.** Should management of the HMP habitats continue, by year 200 after construction, an additional 23,782 tCO_2e stored, which is an increase of 29% compared to a non-intervention scenario.

4.1.2. As noted in the BNG report, the assessment does not capture all the positive enhancements which will arise from habitat creation and restoration. Improvements in biodiversity more widely may have a positive impact on carbon storage and/or sequestration, such as the possibility of further woodland establishment as a result of grazing reduction, reinstatement of removed peat, and improved condition of upland heathland. Similarly to the BNG calculations, these benefits cannot be captured within the toolkit due to the impossibility of accurately predicting the extent of change that may occur.

4.1.2.1 Taking the above into account, it is considered that the Development and associated HMP meet with the recommendations of the NatureScot advice on peatland and carbon rich soils, including the assessment of sensitivity and of direct and indirect impacts on peatland, the application of the mitigation hierarchy, and the enhancement of already existing peatland.

Appendix A

FIGURES

Figure 1 – Overall summary of change in carbon storage *(available on tab '6. Carbon DASHBOARD' of the SSER Biodiversity and Carbon Project toolkit)*

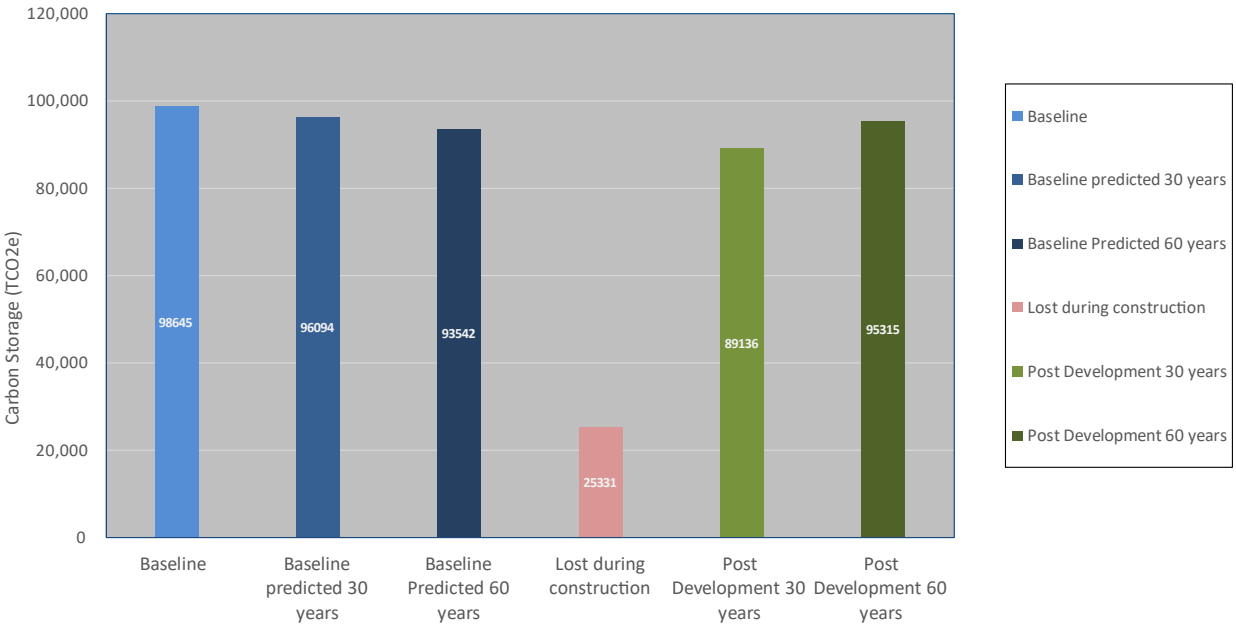
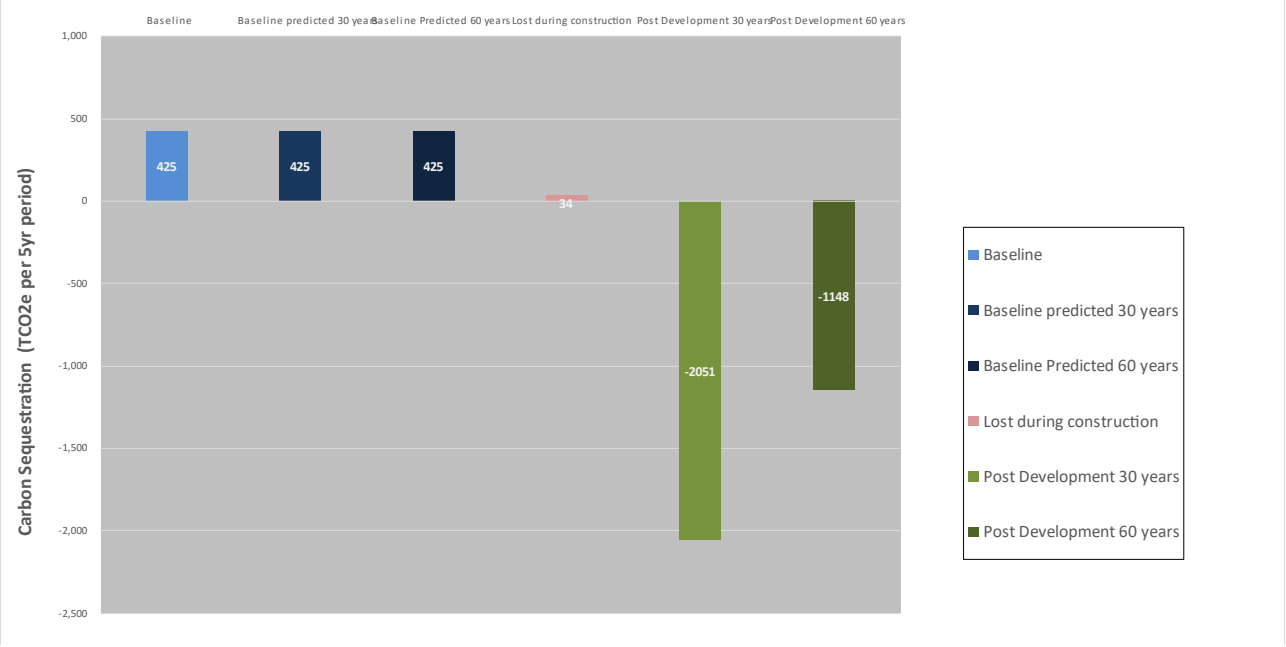


Figure 2 - Overall summary of change in carbon sequestration rates *(available on tab '6. Carbon DASHBOARD' of the SSER Biodiversity and Carbon Project toolkit)*



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