Land Capability for Agriculture Report

Dupplin Solar

TRIO Dupplin Solar LLP

Prepared by:

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Acronyms and Abbreviations

LCA	Land Capability Classification for Agriculture
NGR	National Grid Reference
AOD	Above Ordnance Datum
SEPA	Scottish Environment Protection Agency
PSMD	Potential Soil Moisture Deficit
FCD	Field Capacity Days
UKSO	UK Soil Observatory
WC	Wetness Class
NPF4	National Planning Framework 4
LDP	Local Development Plan
OSMP	Outline Soil Management Plan

1.0 Introduction

1.1 Background

SLR was commissioned to undertake a detailed level (one observation point per hectare) Land Capability Classification for Agriculture (LCA) survey on approximately 161.49 hectares (ha) of agricultural land located north of the A9 south of Tibbermore settlement, Perth, (National Grid Reference (NGR) NO 04776 21837), hereafter referred to as “the Site”.

The Proposed Development consists of a solar farm and relevant infrastructure. An informed assessment in line with the LCA criteria has been undertaken using a combination of professional judgment, guidance, legislation and statutory policy.

The purpose of this assessment was to inform on the LCA for the Site and provide sufficient Site-specific soil information to inform the LCA report and any associated soil management plans.

1.2 Current Land Use

The Site consists of 161.49 ha of agricultural land under arable use. The cropping rotation includes winter oil seed rape, barley, peas, seed potatoes, ware potatoes, and wheat. Aerial imagery showed horticultural fields in the rotation. Boundaries are delimited with drywalls of shales, tracks, and a ditch.

1.3 Topography

The elevation ranges between 105 and 140 m Above Ordnance Datum (AOD). The Site is located on the north-facing slope of a gentle valley, the average slope runs north-south, with an average slope of 3^{o}.

2.0 Land Capability Classification for Agriculture (LCA) System

2.1 Background

The LCA system was developed by the Macaulay Land Use Research Institute (1991, now James Hutton Institute)[1]. The classification comprises three main categories: the class, the division, and the unit. Land suited to arable production is included in Classes 1 – 4, while land not suited to arable use is limited to Classes 5 – 7. Classes are assigned by assessing the soil physical properties and interrelated factors such as topography and climate; which, when combined, are used to determine the land's suitability for agricultural uses. Capability units specify the main limitation to agricultural production and are designated using letters added after the Class and Division, e.g. 3.1w. The five principal limitations are:

- Climatic limitations – symbol c
- Gradient limitations – symbol g
- Soil limitations – symbol s
- Wetness limitations – symbol w
- Erosion limitations – symbol e
- Limitations can be either direct or indirect.

2.2 Direct Limitations

Agroclimatic data for the Site is used to determine if local climate is a direct limitation to the LCA classification. The direct climatic limitation is assessed using the average annual rainfall and accumulated temperature. It reflects the limitation associated with water supply and energy availability to support photosynthesis and plant growth. Local climate data is also used interactively with soil information to determine wetness and droughtiness limitations.

Gradient forms a direct limitation as it will impact the suitability of land for mechanised farm operations. Microrelief limitations involves complex changes in slope angle and direction over short distances, or the presence of boulders or rock outcrops, which also limits the use of agricultural machinery.

Flooding risk influences the range of crops that can be grown as it poses a risk of direct crop damage and loss. The main factor determining the risk of flooding is topography and can be assessed based on local knowledge and information from the Scottish Environment Protection Agency (SEPA) Flooding Map[2]. Floods which occur in summer are generally more damaging than winter floods because the growing roots of the crops are more sensitive to waterlogging. The flood limitation is therefore assessed separately for a 'winter' and a longer 'summer' period (the latter including spring sowing and autumn cultivation).

Shallow soil depth is a direct limitation as it affects the LCA classification by restricting the range of cultivation methods available and reducing the potential for nutrient uptake and root growth.

[1] Macaulay Land Use Research Institute (now James Hutton) (1991) Land Capability Classification for Agriculture. ISBN 0 7084 0508 8

[2] SEPA Flooding map. Available at: https://map.sepa.org.uk/floodmap/map.htm Accessed December 2025

Stones act as an impediment to cultivation, harvesting and crop growth. A high stone content reduces the potential for certain agricultural crop management, can impact agricultural machinery, and reduce crop quality (i.e., bruising potatoes during harvesting).

2.3 Interactive Limitations

The physical limitations resulting from the interactions between climate, site and soil characteristics are soil wetness and droughtiness. Soil wetness limitations adversely affect plant growth or agricultural management (e.g., grazing, trafficking by machinery and poaching by livestock). Droughtiness is a significant limitation to crop growth in areas with low rainfall and high evapotranspiration, or where the soil profiles have limited capacity to store reserves of moisture.

For LCA purposes, the soil wetness assessment accounts for the duration of time when soil moisture is at field capacity and the soil's susceptibility to waterlogging based on the following soil profile characteristics: depth to impermeable layer, depth to gleyed features (indicating intermittent waterlogging), and topsoil texture.

Soil erosion from wind and water can limit the LCA classification as a result of the loss of topsoil, seeds, seedlings, and fertiliser. The risk is highest on bare sloping ground with coarse loamy or sandy soils, particularly during high rainfall events.

3.0 Desk Study

3.1 Soil Resources

Information about the soil resource and agricultural land present within the Site and the surrounding area has been obtained from the following published sources:

- National Soil Map of Scotland[3];
- National Scale Land Capability for Agriculture in Scotland[4] 1: 250,000 scale;
- Partial Cover Land Capability for Agriculture[5] Map, 1: 50,000 scale;
- Carbon and Peatland 2016 map[6]; and
- Erosion Risk Map for Scotland[7].

The National Soil Map of Scotland[3] created by the Macaulay Land Use Research Institute indicates that the soils across the Site are brown soils, belonging to the Balrownie Soil Association. The west of the site is covered by the Buchanyill series, consisting of bright-coloured brown soil, whereas the east of the Site is covered by the Balrownie association, characterised by duller colour, imperfect drainage and moderate or slow permeability.

Both the national scale (1:250,000) and the Partial Cover LCA maps indicate that the entirety of the Site consists of Class 3.1, prime agricultural land.

The Carbon and Peatland 2016 Map[6] indicates there is no peat within the Site boundary or within the immediate vicinity of the Site.

[3] National Soil Map of Scotland, Available at https://map.environment.gov.scot/Soil_maps/?layer=1# [Accessed October 2025]

[4] Land Capability for Agriculture of Scotland at a Scale of 1:250 000. Macaulay Land Use Research Institute, Aberdeen. DOI: 10.5281/zenodo.6322608 Available at: https://map.environment.gov.scot/Soil_maps/?layer=1 [Accessed October 2025]

[5] Soil Survey of Scotland Staff (1984-87). Land Capability for Agriculture maps of Scotland at a scale of 1:50 000. Macaulay Institute for Soil Research, Aberdeen. DOI: 10.5281/zenodo.6322760 Available at: https://map.environment.gov.scot/Soil_maps/?layer=1 [Accessed October 2025]

[6] Carbon and Peatland 2016 map. The James Hutton Institute. Available at: https://map.environment.gov.scot/Soil_maps/?layer=1 [Accessed October 2025]

[7] Lilly, A. and Baggaley N.J. 2018. Soil erosion risk map of Scotland (partial cover). James Hutton Institute, Aberdeen. Available at: https://map.environment.gov.scot/Soil_maps/?layer=1 [Accessed October 2025]

4.0 Site Survey

4.1 Survey Details

A detailed LCA survey was conducted between the 30 September and 9 October 2025. The weather had been mostly dry but overcast during the previous weeks and continued during the survey. The conditions on the Site during the survey are shown in **Figure 1.**

In total, the survey consisted of 153 survey observation points, of which 12 were soil pits, as shown in **Drawing 405.065787.00001.0046.0LCA** (**Appendix D**). The complete survey record is provided in **Appendix B.** The Site was divided in seven macro areas which followed the existing field boundaries.

Areas in the south of the Site were excluded from the survey due to the presence of buried water services transecting the southern field extent and along C411 Roman Road. This reduced the survey area down to 153 ha. The survey therefore met the required observation point density of one point per hectare.

Figure 1: View of the Site looking north from Point 151 on the 6 October 2025.

Soil samples of both topsoil and subsoil were taken and sent to a laboratory accredited to UKAS ISO:17025 to confirm soil texture and organic content. The laboratory results are provided in **Appendix A.**

4.2 Drainage and Irrigation

The only drainage feature present on Site is a ~1 m deep and ~2 m wide ditch running through the site between two fields and then along the east boundary (**Figure 2**).

Figure 2: Ditch running along the eastern edge of the Site

Two coils for sprinkler irrigators were parked close to the Site's boundaries (**Figure 3**), confirming that there are droughtiness limitations and a need for irrigation.

Figure 3. Coils for sprinkler irrigation

4.3 Soils Identified During the Survey

The Site consists largely of dark brown / brown (typically 7.5 YR 3, 3 / 7.5 YR 4, 3) sandy loam topsoil, with occasional reddish yellow (typically 7.5/10YR 6, 6) mottling. The topsoil depth ranged between 20 and 60 cm. The structure was generally medium to fine subangular blocky, and of friable consistency.

The subsoils typically consisted of dark reddish brown and reddish brown (5 YR 3, 3 / 5 YR, 4, 3) sandy loams and sandy clay loam. Reddish yellow mottling was present in some areas along with grey and pale ped faces indicating a gleyed horizon. The upper subsoil depths ranged from 40 to 120 cm. Coarser textures were more common in the west of the Site (**Figures 4**). The structure was generally sub angular blocky, medium to coarse sized peds, of moderate to weak development and firm/very firm to friable consistency.

Some points had a lower subsoil present consisting of heavier textured reddish brown/ dark reddish brown (5 YR 3, 3 / 5 YR, 4, 3) heavy clay loam/ sandy clay and clays. These had more occurrence of reddish yellow mottles and grey and pale ped faces showing a gleyed horizon and a wetness limitation for the soils. The lower subsoil depths ranged from 60 to 120 cm.

Figures 4a, 4b and 4c: Soils in the west half of the Site and associated landscape at points 50 and 53

The east of the site (**Figures 5**) showed heavier sandy clays at depth, resulting in a coarser, firmer structure and an increase of mottling and the occasional gleying at depth.

Figures 5a, 5b and 5c: Soils in the east side of the Site (point 83 and 28) and the associated landscape.

Appendix B shows the survey record point by point. The location of each point is shown in **Drawing 405.065787.00001.0046.0LCA** (**Appendix D**).

Soil samples of both topsoil and subsoil were taken and sent to a laboratory accredited to UKAS ISO:17025 to confirm and validate the soil hand texturing carried out during the survey. The laboratory results are provided in **Appendix A**.

5.0 Limitations to LCA Class

5.1 Climate

The nearest reference station to the Site is the Strathearn (station 29 in Table 3 of the LCA guidelines[1]) weather station, located ~13 km away and at a similar altitude. The dataset for this station is almost complete and misses the lower quartile of accumulated temperature. This value was integrated using the second nearest weather station to the site, Mynefield (station 31), 31 km from the Site. The combined climate values are presented in **Table 1** .

Table 1: Combined climate parameters, from Table 3 of the LCA[1] guidelines.

Metric	Altitude (m)	Lower quartile accumulated temperature (°C)	Median PSMD (mm)	Median Field Capacity Days	Limited to Class
Value (weather station)*	122 (S)	1201 (M)	100(S)	150-175	3.1

**S= Strathearn, M=Mynefield weather stations*

According to Figure 6 of the LCA guidelines, the range of the median Field Capacity Days (FCDs) for the Site is 150-175.

5.2 Gradient and pattern

Gradient and pattern limitations primarily relate to the ability of machinery to operate on sloping land. This was assessed on Site and with the UKSO OS Terrain 50 Slope map[8].

Slope gradient does not exceed 3° anywhere on the areas of the Site in agricultural use, therefore there is no gradient limitation to the LCA classification within its boundaries.

5.3 Soil

Soil shallowness limits four points (49, 75, 86 and 88) to LCA Class 3.2 due to soil profile depth being <45 cm. Soil texture, and soil stoniness do not limit the LCA classification in any part of the Site.

5.4 Droughtiness

At the time of the survey, the rotation on Site included barley, wheat, seed potatoes and rapeseed. The droughtiness calculations were therefore based on the requirements for wheat and potatoes provided in the LCA guidelines. Potato has a potential rooting depth of 70 cm, and a suction of 0.05 and 15 bar, Wheat's potential rooting depth reaches 120 cm, consisting of a suction of 0 to 15 bars between 0 and 50 cm and between 0 and 2 bar from 50 to 120 cm, as described in Table 7 of the LCA guidelines. A PSMD of 100 mm has been used (obtained from the Strathearn weather station) for the soil droughtiness calculations, as described in the LCA guidance[1].

[8] UKSO, OS Terrain 50, Available at: https://www.ukso.org/static-maps/ordnance-survey-terrain-50.html [Accessed October 2025]

The entirety of the Site suffers a droughtiness limitation that ranges between Class 2 and 3. Areas represented by points limited to Class 2 slightly outnumber the Class 3 areas, (80 versus 73 points respectively). Generally, soils with a droughtiness limitation to Class 3 were found on the north west portion of the Site where coarser textures were found, whereas soils on the east of the Site showed a limitation to Class 2 for droughtiness, primarily due to deeper soils and heavier texture at depth found in the east of the Site.

5.5 Wetness

The survey record (**Appendix B**) shows the retained water capacity (as per Table 11 and 12 of the LCA guidelines[1]) and wetness class at each data point within the survey.

The topsoils on Site were generally sandy loams and therefore were classified as having a "Low" retained capacity Volume (Table 11[1]). The Wetness Class (WC) largely depended on the texture, structure and presence of mottling or gleying at depth (table 12[1]). Areas where the WC was I or II, were limited to Class 2. Areas represented by points of WC II were limited to Class 3.

Almost two thirds (91 points) of the Site is limited to class 2 by wetness, whereas the remaining area (corresponding to 32 points) is limited to Class 3.

Points limited to Wetness Class 3 are mainly found in the two fields on the east of the Site. Other areas limited to Class 3 occur as isolated points on the south west, and two strips, one on the north boundary of the Site and one in the centre.

5.6 Erosion and flood risk

The LCA guidance states that erosion becomes a limitation when it regularly interferes with the cropping flexibility, reduces yields, or requires extra costs to contain or prevent deterioration of the soil. The guidance however does not provide clear thresholds that allow a precise classification. Moreover, there is no publicly available data for the Site in the format required by the LCA guidance to determine erosion and flood risk limitations. However, data for erosion risk and flooding likelihood is available in other formats that we can infer potential limitations from.

The Erosion Risk Map of Scotland[7] shows a risk ranging between L2 and M3. L2 and L3 classified land is located mostly in the east, close to Cultmalundie Woods, whereas the west is mostly classified as M2, with pockets of M3 land.

According to the SEPA's[2] Flooding map, only the area around the ditch shows a Low to Medium surface flooding risk, corresponding to 0.1% and 0.5% chance of a flooding event happening in any given year respectively.

For the purposes of this assessment, and as the LCA guidance does not provide sufficient information on how erosion and flood risk limit the LCA classes of land, Erosion and Flood risk are not deemed to pose a limitation to the LCA classes within the Site.

6.0 LCA CLASSIFICATION

6.1 Subdivisions

Several limitation factors within the LCA guidance only provide criteria for determining limitation to the Class, and not to Class subdivision. Information to determine the subdivision is taken from a combination of factors causing the land to be limited to that Class, along with observations made on the cropping system that the land is capable of supporting during the survey and from historical aerial imagery.

The limitations of Wetness and Droughtiness have no criteria for subdivision. Areas on the Site where wetness and droughtiness limitations are both LCA Class 3 are vulnerable to a wider array of conditions, resulting in a narrower window of productivity. The assessment on whether the points are 3.1 or downgraded to 3.2 will be made based on how the Site is currently manged with a review of the cropping rotation.

As detailed in section 2.3, the current crop rotation includes but is not limited to arable crops, potatoes and rapeseed. This would meet the criteria for Class 3.1 – "*Land in this division is capable of producing yields of a narrow range of crops (Principally cereals and grass) and/or moderate yields of a wider range (including potatoes, field beans and other root crops). Short term grass leys are common."*

Another criterion listed for subdivision 3.1 is that "*it should not be more than slightly droughty*". Where points are limited to Class 3 for droughtiness, they have a moderate droughtiness, however the cropping evidence shows that the wider range of crops is supported on this land and should not be downgraded to 3.2 if droughtiness is the only interactive limitation to Class 3. Where there is a combination of Class 3 for both droughtiness and wetness, the points are downgraded to subdivision 3.2 due to the potentially narrower window of effective productivity. This downgrades 28 points to Class 3.2.

6.2 LCA Classes

The LCA Classification of the Site consists of Prime Class 3.1 agricultural land, with smaller areas of non-Prime Class 3.2 land. Class 3.2 areas were characterised by either shallow soils (< 45 cm) or a combination of Wetness and Droughtiness limitation to Class 3.

As there are no detailed survey data for the southern parts of the Site where a water main was located, this area has been mapped as 3.1 to match both the national scale (1:250,000) and the Partial Cover LCA maps, along with the grading of the adjacent survey points.

Drawing 405.065787.00001.0046.0LCA (**Appendix D**) provides the visual representation of the mapping units of LCA Class. A breakdown of the areas is available in **Table 2.** LCA Class and area breakdown**.**

Table 2. LCA Class and area breakdown

LCA Class	Area (ha)
3.1	138.98
3.2	22.51
Total	**161.49**

7.0 Policy and Guidance

7.1 National Planning Policy

The National Planning Framework

The National Planning Framework 4 (NPF4)[9], published in February 2023, is the national spatial strategy for Scotland. It sets out the spatial principles, regional priorities, national developments, and national planning policy.

Policy 5 (a) states development proposals will only be supported if they are designed and constructed: i) in accordance with the mitigation hierarchy by first avoiding and then minimising the amount of disturbance to soils on undeveloped land; and ii) In a manner that protects soil from damage including from compaction and erosion, and that minimises soil sealing.

Policy 5 (b) states development proposals on prime agricultural land, or land of lesser quality that is culturally or locally important for primary use, as identified by the Local Development Plans (LDP), will only be supported where it is for: iv) The generation of energy from renewable sources or the extraction of minerals and there is secure provision for restoration; and in all of the above exceptions, the layout and design of the proposal minimises the amount of protected land that is required.

Policy 5 (c) states that Development proposals on peatland, Carbon-rich soils and priority peatland habitat will only be supported for essential infrastructure where there is specific location need, to support renewable energy or fragile rural communities or to restore peatland habitats.

Getting the best from our land - A land use strategy for Scotland[10]

The document provides a broad context for planning authorities on Government policies relevant to land use. Planning authorities are expected to have regard to the Strategy in preparing development plans. The principal policy framework, however, continues to be provided by NPF4, and decisions should be made in accordance with the development plan unless material considerations indicate otherwise.

7.2 Local Planning Policy

The Perth and Kinross Local Development Plan (LDP2)[11] adopted in 2019, sets out the land use plans and proposals that the Council uses to guide development across the area up to 2029 and beyond. Soil and agriculture are addressed separately according to the environmental services the land is providing.

Policy 50 – Prime Agricultural Land

Policy 50 states that “Outside the identified settlements, development on prime agricultural land will not be permitted, unless it is necessary to meet a specific established need, such as

[9] Scottish Government (2023) National Planning Framework 4. Available at: https://www.gov.scot/publications/national-planning-framework-4/pages/3/. Accessed November 2025.

[10] Scottish Government (2021) Land use - getting the best from our land: strategy 2021 to 2026. Available at: https://www.gov.scot/publications/scotlands-third-land-use-strategy-2021-2026-getting-best-land/. Accessed November 2025.

[11] Perth and Kinross Local Development Plan (2019), Available at: https://www.pkc.gov.uk/ldp2 Accessed December 2025.

a major infrastructure proposal and only when there is no other suitable site available on non-prime land."

Policy 51 -Soils

Policy 51 seeks to protect soils from loss and damage, including compaction and erosion. The policy states that development on areas of good quality land (LCA Classes 1 to 3.2 land) will only be supported if the best management practices, along with the mitigation hierarchy are adopted.

8.0 Conclusion and Recommendations

The soil on Site mainly consists of dark brown / brown sandy loam topsoil with typically medium to fine subangular blocky, and of friable consistency. These sit over dark reddish brown and reddish brown sandy loam and sandy clay loam subsoils. Coarser textures were more common in the west of the Site. The structure was generally sub angular blocky, medium to coarse sized peds, of moderate to weak development and firm/very firm to friable consistency. Evidence of impermeable layers with gleying present within this horizon showing a wetness limitation.

Areas of heavier textured reddish brown/ dark reddish brown heavy clay loam/ sandy clay and clay lower subsoil was also present. These had greater evidence of a wetness limitation and were typically found in the east of the site

The Soils are limited either by climate, wetness or droughtiness. Where there is a combined wetness and droughtiness limitation to Class 3, the soils have been downgraded to LCA Class 3.2. Some areas of the Site were limited to Class 3.2 by soil depth (<45 cm).

The Site consists of 138.98 ha (86.1%) Class 3.1 land (Prime Land) and 22.51 ha (13.9%) Class 3.2 land (Non-Prime Land). The Site therefore consists mainly of Prime, LCA agricultural land, with smaller areas of non-Prime land. For Perth and Kinross Council, the entirety of the site is to be considered “good agricultural land”, as this classification includes LCA Class 3.2 land.

As the Proposed Development is on Prime agricultural land, it is recommended that an Outline Soil Management Plan (OSMP) is submitted in support of the proposal. The OSMP would set out the best management practices to prevent soil damage and loss.

Appendix A Soil Sample Laboratory Results

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Appendix B Survey Record

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Appendix C Droughtiness Calculations

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Appendix D Drawing 405.065787.00001.004 6.0LCA - Land Capability for Agriculture

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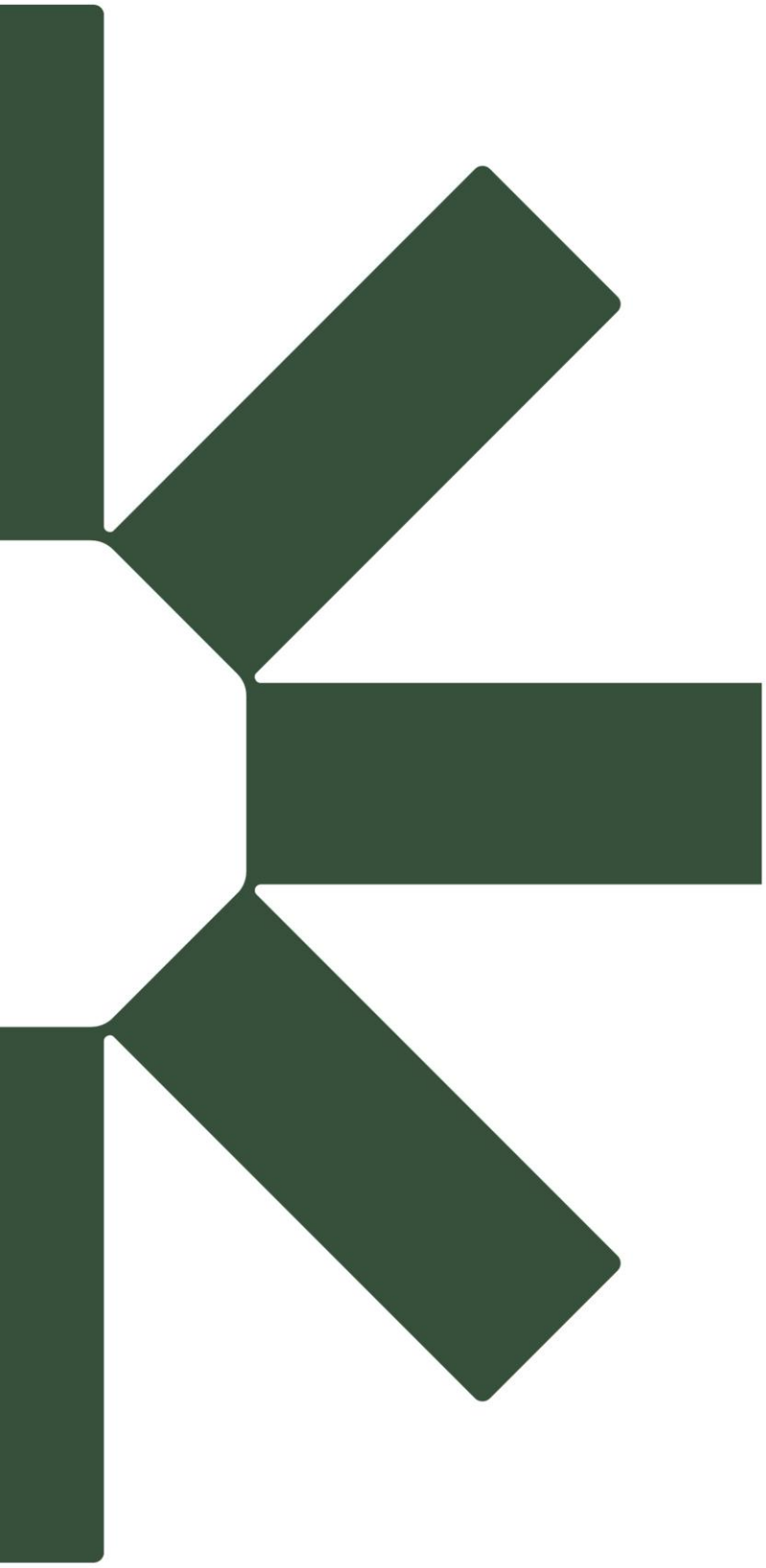

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