Section 6

Safety Assessment

6.0 Safety Assessment

"Electric Aviation aim to create products and services that entail no risk to third parties at all, and while a completely risk free state can never be achieved, it is the company's aim to develop products and services that approximate closely to this ideal. Electric Aviation undertake risk management activities such that a policy of continuous risk analysis is undertaken, to establish and manage the minimum set of risks that are acceptable to the company, with a specific product operating within the defined marketplace. Furthermore, Electric Aviation aim to establish the risks inherent within the product and in its deployment and use within the defined marketplace and to adopt a continuous monitoring policy to guard against the introduction of new or hitherto undetected risks."

Electric Aviation – Risk Management Policy ISO13100

The CAA Safety and Airspace Regulation Group's 20200721 – CAA Policy for the Establishment of Permanent and Temporary Danger Areas document states in A3 Process A3.1-5.d that:

Post engagement, the sponsor should submit a Safety Assessment demonstrating how the hazard will be contained within the TDA.

The Safety Assessment is now presented.

6.1 General Safety Assessment

For all non-geographic specific operational risks regarding the operation of the "Hazard" the reader is referred to UAS10937 Operational Safety Case which provides predicate case of how the Hazard will be contained within a Temporary Danger Area.

6.2 Geographic Specific Safety Assessment

The following information should be read in conjunction with UAS10937 OSC Appendix E which provides predicate operations within the geographically bounded TDA as detailed in ACP-2021-002.

6.2.1 Operational Overview

Payloads will be transported between three hospitals, with the RPAS based at one of the hospitals. RPAS will operate between three main hospitals operated by University Hospitals Morecambe Bay NHS Foundation Trust. The hospitals serviced by the RPAS will be:

- Lancaster Royal Infirmary
- Westmorland General Hospital (Kendal)
- Furness General Hospital (Barrow)

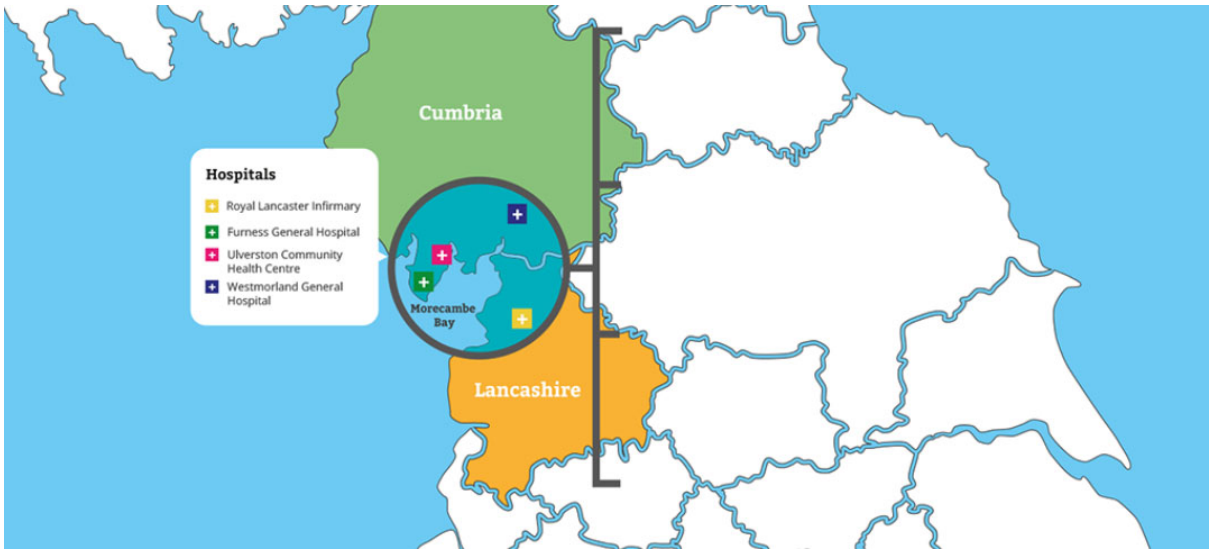

Figure 6.1 The location of the operations

The Sites are located as follows:

Hospital	Lat	Long
Lancaster Royal Infirmary	54.0424797	-2.8022856
Westmorland General Hospital	54.306536	-2.7368717
Furness General Hospital	54.1366241	-3.2113547

Table 6.1: Co-ordinates for the three hospital sites

6.2.2 Furness General Hospital

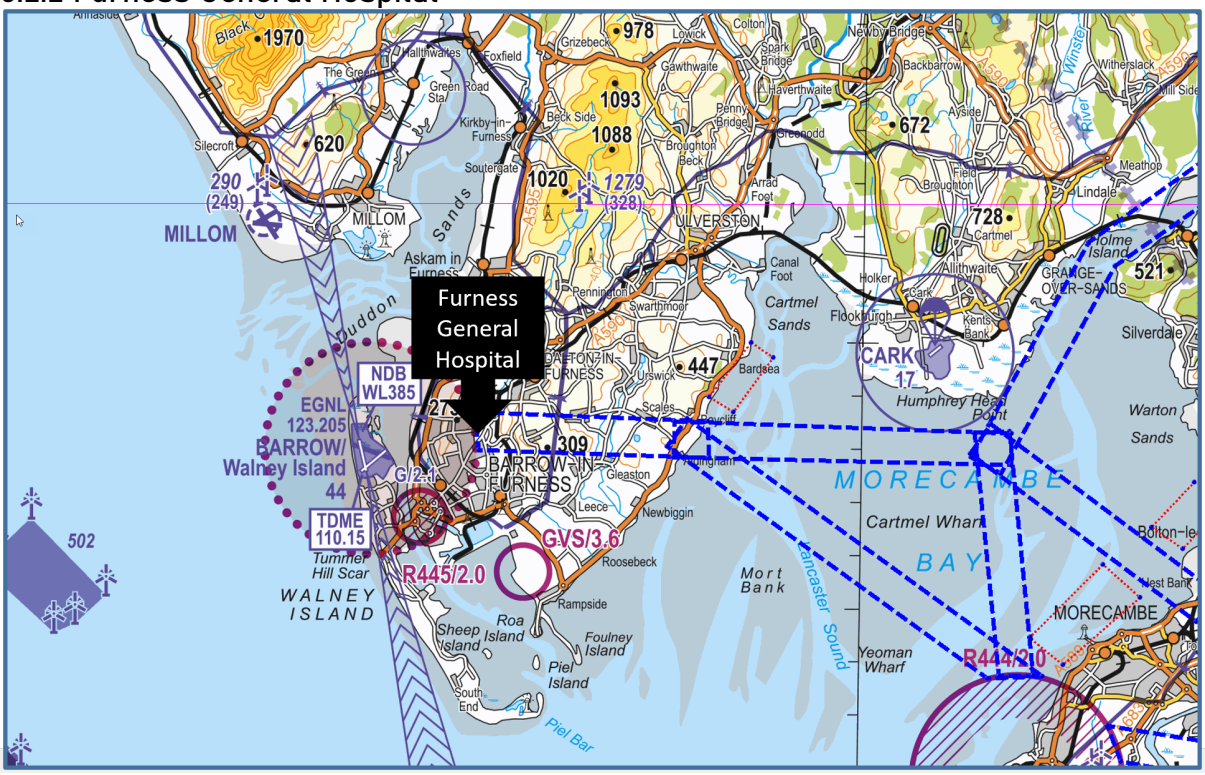

Figure 6.2. Furness General Hospital
Reproduced with permissions from CAA/Ordnance Survey

Furness General Hospital is located such that the two nautical mile boundary of Walney Island Airfield ATZ dissects the hospitals grounds. In agreement with British Aerospace Systems Submarines, who operate Walney Island Airfield, aircraft operating for the Morecambe Bay Medical Shuttle will consider the Hospital to be fully within the ATZ and will be required to call for permissions (01229 474087 or 123.205MHz) to enter the ATZ before making an approach to the proposed landing site.

Please note that whilst an RPZ exists to protect runway 17/35 no RPZ currently protects 05/23.

Whilst there is an established Helipad at Furness General Hospital, it's use requires the closure of the approach road to the hospital as dictated by hospital policy.
As such the utilisation of the existing Helipad is to be discouraged for three key reasons:

1) As RPAS may be making frequent visits to the hospital, the utilisation of the existing Helipad is to be discouraged so as not to impact the hospitals operations and cause congestion upon surrounding roads.
2) As the existing Helipad is there to receive and dispatch critical patients from Furness General Hospital, typically serviced by Northwest Air Ambulance and Great North Air Ambulance services, the provision of a separate landing pad for the RPAS is considered prudent to ensure separation between HEMS rotary and RPAS aircraft.
3) The distance between the Helipad and the access road to the Barrow Cricket Club, as well as the residencies that back on to the Helipad is less than 30m,

thus the site does not allow for suitable contingency and emergency volumes for RPAS operations leads.

The No.1 AIDU Flight Information Publication – Helicopter Landing Sites – Hospitals (effective 24th March 2022) contains the following entry for Barrow in Furness as:

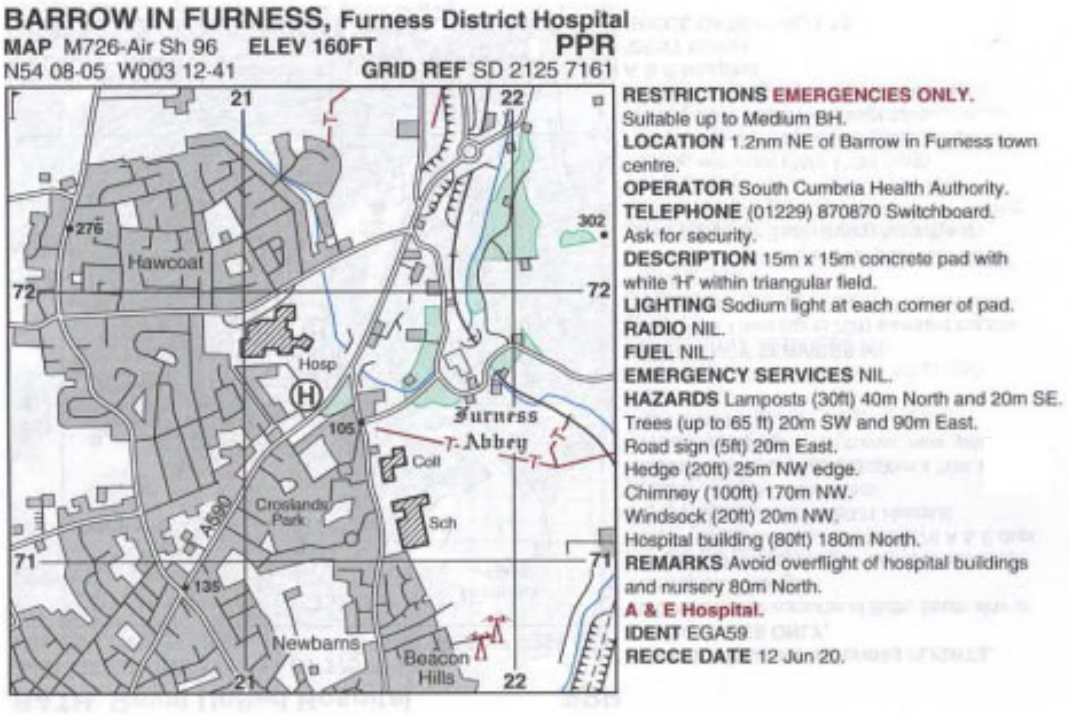

Figure 6.3 Barrow In Furness from No.1 ARDU entry

Figure 6:The Helipad at Furness General Hospital showing the proximity to the permitter access road and the cricket club in the rear.

It is proposed that we utilise the contractor parking and wasteland to the eastern edge of the hospital site, allowing direct access to the Hospital from the Newbiggin coast, requiring zero overflight of hospital infrastructure.
We would propose the installation of a dedicated temporary drone landing structure akin to the one shown in the picture below, such that operations for the RPAS may be achieved externally to the helipad, also allowing visual confirmation for visiting rotary pilots that the RPAS is stationary on its own dedicated pad, should de-confliction be required.

The Drone Landing Pad would be constructed from an anti-slip grating and appropriate foamed Polycarbonate weatherproof landing disc similar to the one shown below:

Figure 5. 6.5 Proposed Dronepad

It would be constructed to comply with CAA CAP1264: Standards for Helicopter Landing Areas at Hospitals. It is anticipated that we would site one container and one portacabin on this site for storage of the RPAS and flight operations.
The drone deck would be situated on the top of the earth bank, with the portacabin and storage container located in the current parking area. Power would be facilitated from either Abbey View Surgery or from the temporary generator supply powering the Briscoe site offices if permitted.

Figure 6.6. Aerial view showing current contractor deployment on waste ground and proposed landing pad location.

Figure 6.7 The Drone Landing Pad would be located on top of the earth bank.

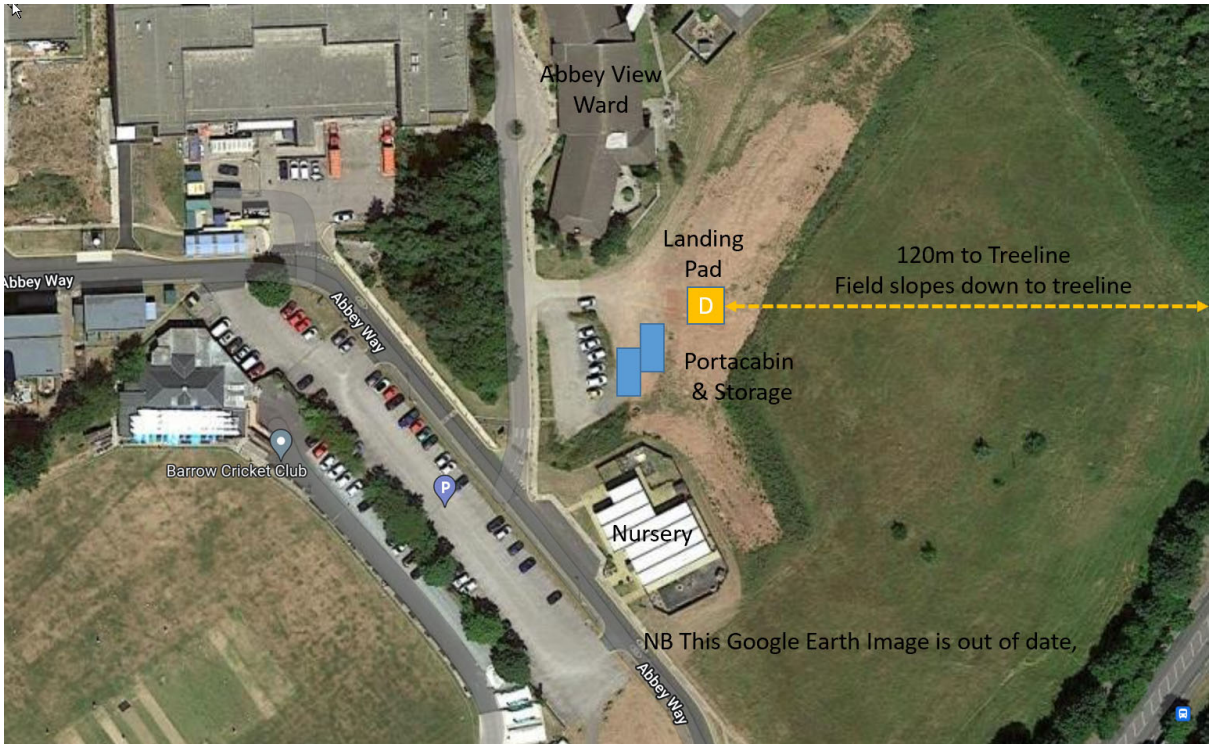

Figure 6.8. Aerial view of proposed Drone pad at FGH.

The main choice for this location is that the landing pad may be temporarily installed on the grass bank allowing for good arrival and departure access.
The site may be closed off from the public at the road leading to Abbey View ward and when not in use there is nothing advertising the sites usage to the public.

6.2.3 Lancaster Royal Infirmary

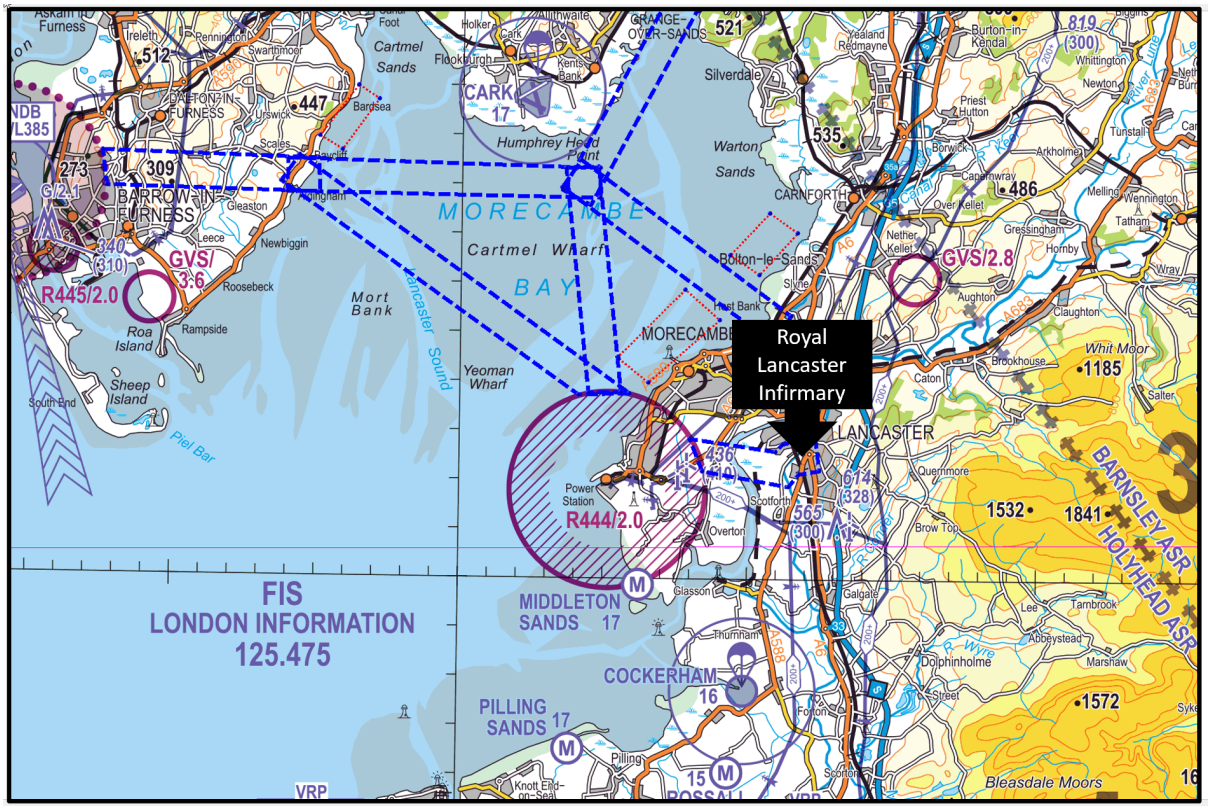

Figure 6.9. Lancaster Royal Infirmary
Reproduced with permissions from CAA/Ordnance Survey

Lancaster Royal Infirmary is located south of the main City of Lancaster and on the westerly side of the A6. The No.1 AIDU Flight Information Publication – Helicopter Landing Sites – Hospitals (effective 24th March 2022) contains the following entry for Lancaster Royal Infirmary as:

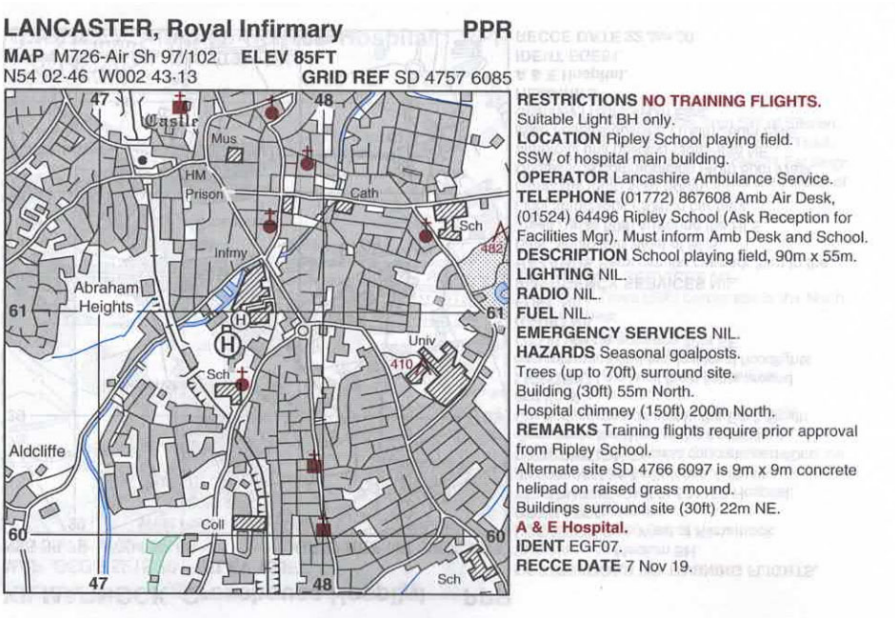

Figure 6.10. LRI from No1 ARDU entry

The 2007 edition of Helicopter Landing Sites – Hospitals details that the best approach is 090 and Electric Aviation Limited concur. We would seek the support and permissions from Ripley School to use their playing field as the Drone Landing Pad. This will require some minor co-ordination with the HEMS services to ensure that the drone is situated on a pad away from the typical put down point for HEMS rotaries.

Figure 6.11 – Ripley School Playing Field

We would seek permissions to site one Portacabin on the Playing field for the 6 week period for operations. Power would be from generator or from supply in LRI-MU2.

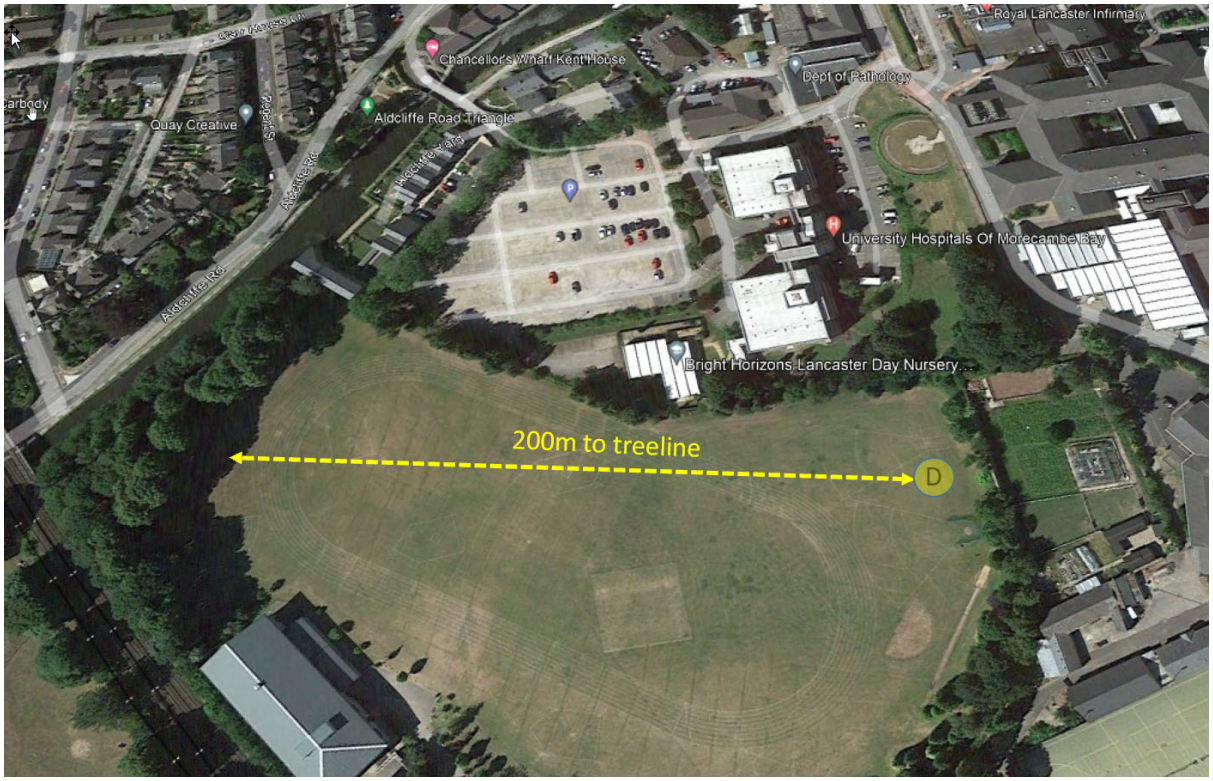

Figure 12 – Ripley School Approach

6.2.4 Westmorland General Hospital

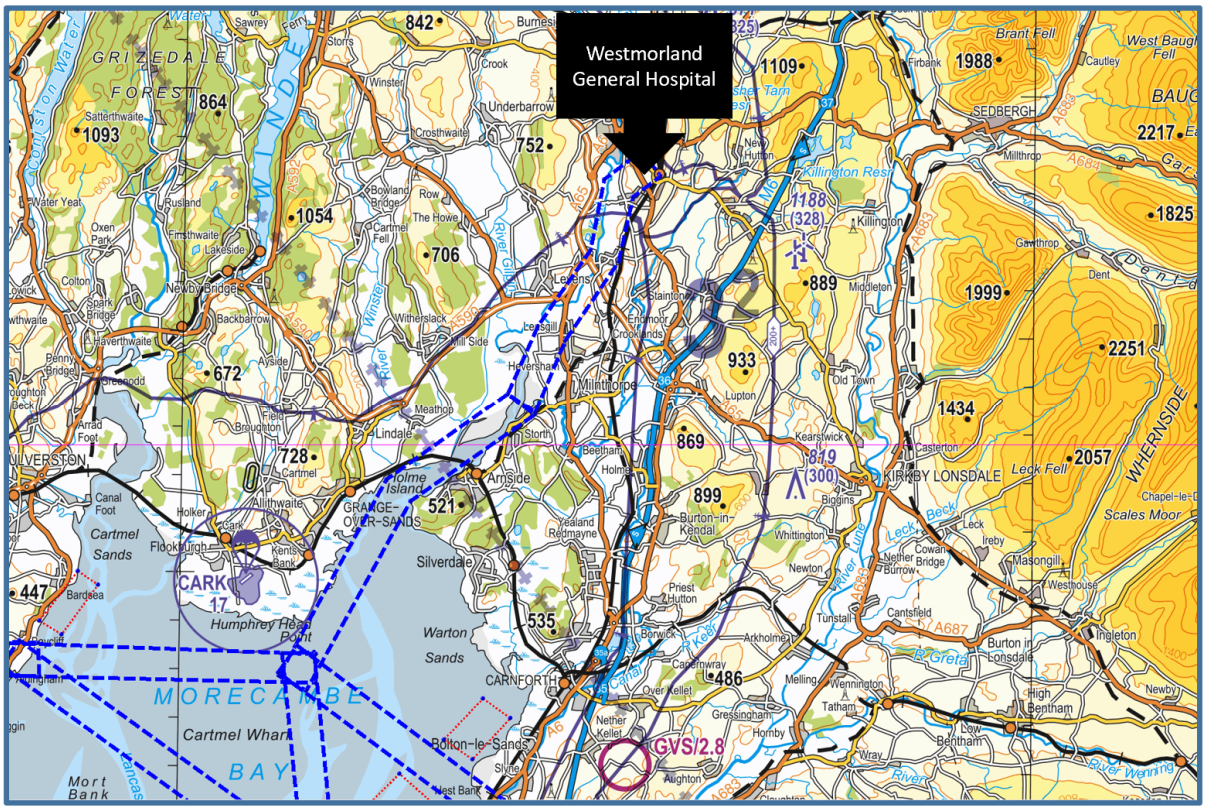

Figure 13 – Westmorland General Hospital
Reproduced with permissions from CAA/Ordnance Survey

There is no current Helipad facility at Westmorland General Hospital. The hospital is surrounded on two sides by farmland and we would look to utilise these fields to provide drone landing facilities.

Figure 6.14 - The approach into Westmorland General Hospital

Having surveyed the site we propose the deployment of a drone landing pad, along with Portacabin and Storage container in the fields either side of the A65 – Burton Road as marked overleaf.

Figure 15 - Proposed locations for the Drone Landing Pads at Westmorland General Hospital (subject to landowner permissions)

Both sites provide good access and approach departure routes for the drone. The one shown on the right hand side of the A65 also has the benefit of a gravelled approach into the field, but has the disadvantage of having a slope angle to the field.

6.3 ROUTES

We now provide an analysis of the routes that the RPAS will operate on.

Over 99% of the proposed routes are over open water/tidal estuary or farmland.

We have highlighted the two areas we believe that UAS will wish to review. We have highlighted these in RED TEXT for easy of identification.

6.3.1 Furness General Hospital to Westmorland General Hospital

Route is displayed as a purple track from Furness General Hospital in the southwest to Westmorland General Hospital in the north in Figure 16.

The track can be found in the KMZ file entitled "FGH-WGH"

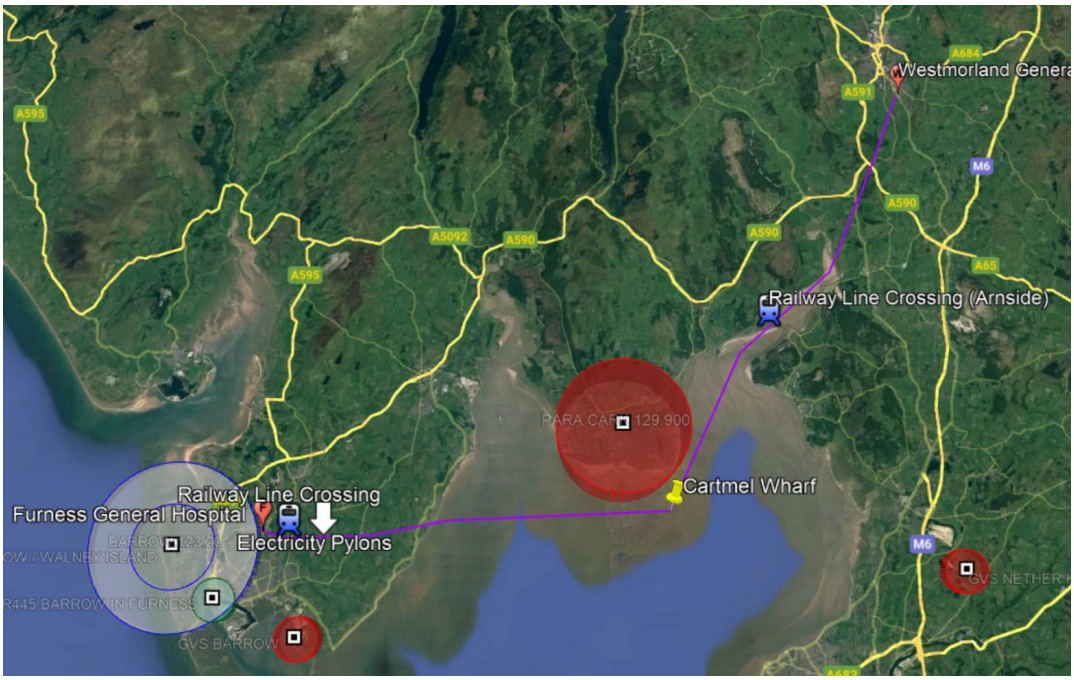

Figure 6.16 – The FGH-WGH Route

Figure 6.17 overleaf details the route leaving Furness General Hospital to the east.

Furness General Hospital is located on the periphery of Walney Island ATZ. The route out to the coast eastwards has the highest undulating ground but contains few features, with the exception of the train line to Barrow and the main powerline feed to Barrow and associated pylons (detailed).

Figure 6.17 – The route from Furness General Hospital to the coast at Aldringham

Figure 18 below details the route as it extends out over the bay to Cartmel Wharf. This is all open water/sand flying and Cartmel Wharf is a waypoint that keeps the path south of the Cark Parachuting dropzone.

Figure 6.18 – The Route over Morecambe Bay to Cartmel Wharf

Figure 19 below details the route turning northwards from Cartmel Wharf and entering the River Kent Estuary crossing the railway line at Arnside viaduct. The route continues to follow the river estuary as far as possible overflying no properties.

Figure 6.19 – the route turns up the Kent Estuary

Figure 6.20 details the final north-eastern leg of the route up to Westmorland General Hospital. The landing site at Westmorland is in a field opposite the hospital on the other side of the A65.

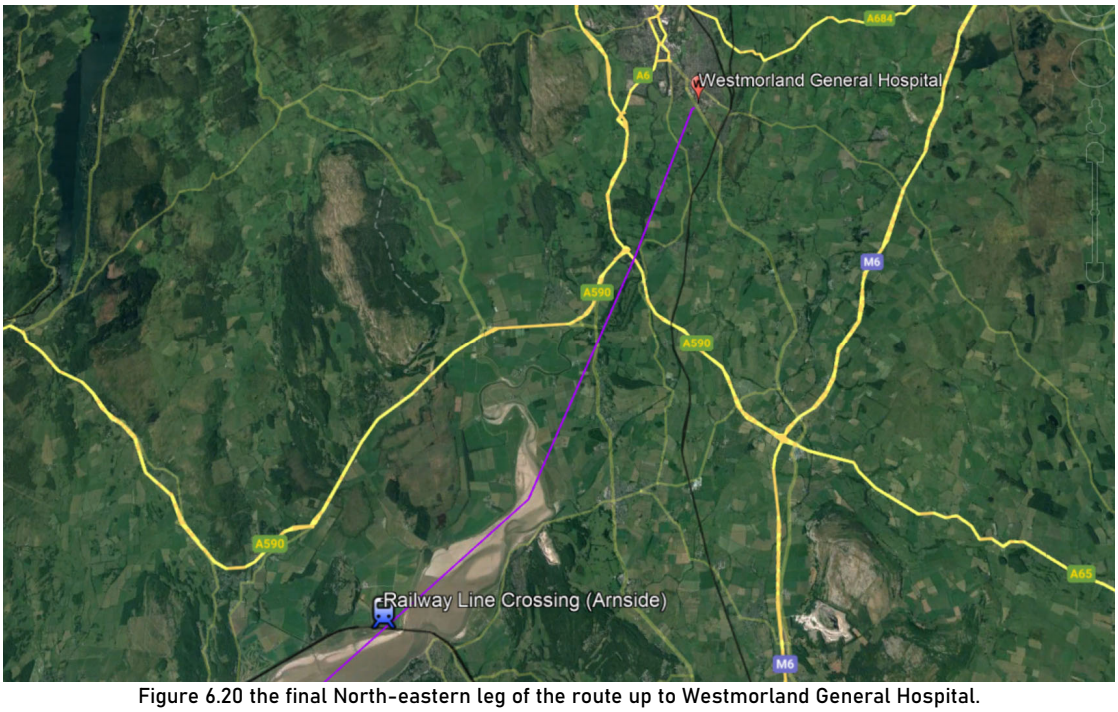

Figure 6.20 the final North-eastern leg of the route up to Westmorland General Hospital.

Figure 21 overleaf details the final approach to Westmorland General Hospital.

It can be seen that the majority of the route is over farmland.

Figure 6.21 The final leg of the route to Westmorland General Hospital

The route distance is 22.5 Nautical Miles

The highest land elevation is 86m

The still air flight time between the two hospitals is 22.5 mins.

The planned height of the RPAS when flying this route is at least 76m (250 FT) above the highest ground on the route.

The highest ground on the route is 290 FT AMSL (rounded up to the nearest 10 FT)(87.87m).

The following observations were made in the planning of this route:

- Walney Island Airfield ATC, dissects Furness General Hospital site. The hospital site will thus be considered to be 100% within the ATC and approach and departure permissions will be co-ordinated via A/G radio with Walney Tower and deconflicted on site.
- The route crosses the Cumbrian coast railway line twice. Once at Arnside and once to the East of Furness General Hospital.
- The route has been amended to avoid overflight of Furness Abbey
- It is possible to route North from Furness General Hospital, skirt around Furness and cross over to land at Walney Island involving no overflight of persons.
- There is currently no safe haven or hangarage at Walney Island Airfield.

The upper limits of the Flight Volume, Contingency Volume and Emergency Buffer for this route are implemented as per section 5.3

6.3.2 Westmorland General Hospital to Lancaster Royal Infirmary (Short Route)

Route is displayed as a purple track from Westmorland General Hospital in the north-east to Lancaster Royal infirmary in the south-east in Figure 6.22. The track can be found in the KMZ file entitled "WGH-LRI"

Figure 6.22 – The route from Westmorland General Hospital to Lancaster Royal Infirmary passing through R444.

The route proceeds south from Westmorland General hospital across farmland, as shown in Figure 23 to reach the river Kent, whereupon it follows the Kent to the estuary.

Figure 23 – The route from Westmorland Hospital to the River Kent.

The route passes alongside the town of Arnside and then out to the waypoint known as Cartmel Wharf over Morecambe Bay. This can be seen in Figure 24. There is one railway crossing at Arnside Viaduct of the Cumbrian coastline.

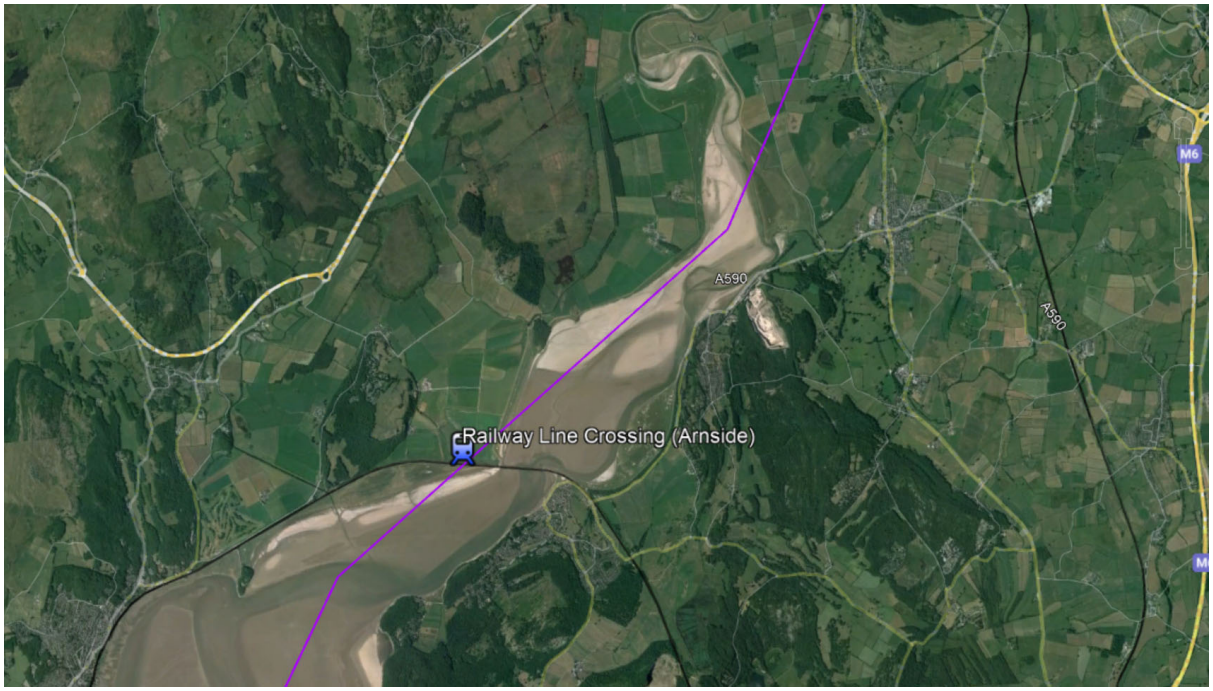

Figure 6.24 The route progressing along the Kent Estuary.

The route turns South East at the Cartmel Wharf waypoint. This can be seen in Figure 25 below. This waypoint is deliberately located here to ensure the minimum airspace is required for the TDA when considering the FGH to WGH route as well. It also keeps the RPAS away from the Cark Drop Zone.

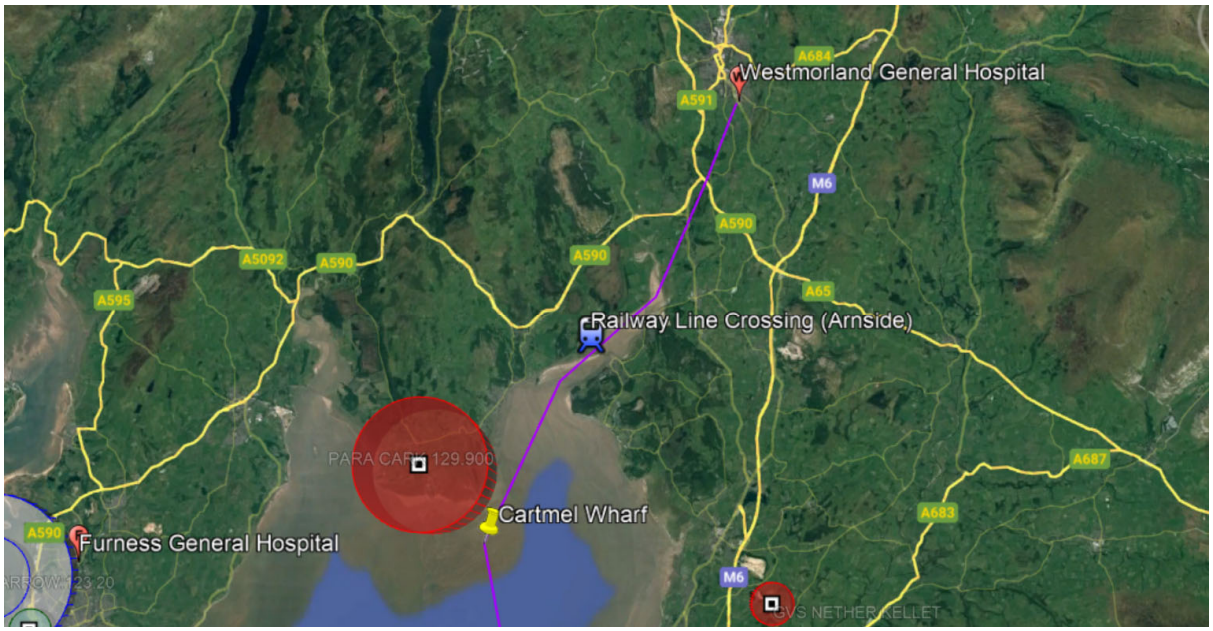

Figure 6.25 The route turning at the Carmel Wharf waypoint.

The route then heads south east to the boundary with the R444 as can be seen in Figure 6.26.

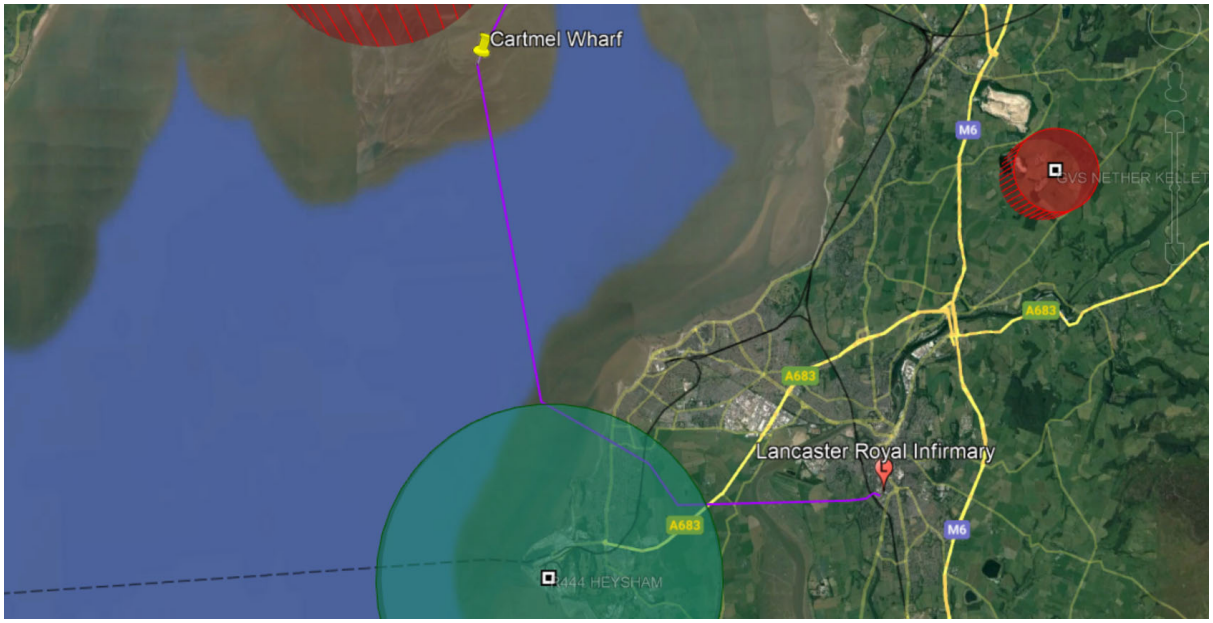

Figure 6.26, the route enters the R444 zone at the north and exits at the east.

The route then exits R444 cross the farmland between R444 and the City of Lancaster and then enters LRI site as shown in Figure 6.27.

Figure 6.27 – The route between R444 and LRI

Whilst inside R444, the RPAS is expected to climb from its normal 250' agl height to 1500' to cross over the Sandylands domestic residences below. Once over the population the RPAS then descends back to 250' before exiting R444. This gives a climb of 1250' over a range of 1500m, a cruise at 1500' for 1 kilometre and a descent of 1250' over a range of 1100m. The detail of the Sandylands domestic residences can be seen in Figure 6.28.

The flight path shown through R444 keeps the aircraft at a range of 3100 from Heysham Nuclear power stations, which is preferable and has been discussed with both the Office of Nuclear Regulation and EDF Energy at Heysham.

The Access protocol to R444 is to be designed with both EDF at Heysham and the Office of Nuclear Regulation and will be accommodated through a temporary security policy.

N.B. A request for exemption from the Air Navigation Regulation (Restriction of Flying) (Nuclear Installations) 2016 form has been submitted to AROps.

Figure 6.28 – Sandlands Domestic Residences between Heysham and Morecambe.

Figure 6.29 below shows the farmland to the east of the R444 Restricted Zone and Lancaster Royal Infirmary. There is one Canal to be crossed and a Railway crossing of the North West Coast mainline before entering the playing field of St Thomas' school where the RPAS will make its deliveries.

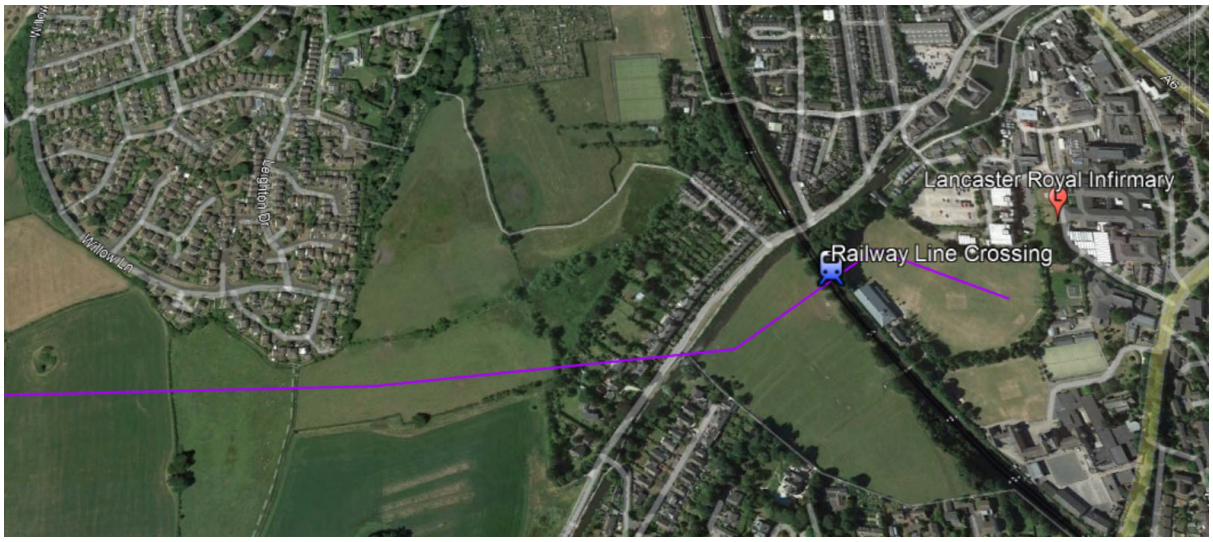

Figure 6.29 – The farmland approach, canal, North West Coast mainline and landing site at LRI

The route does overfly a couple of properties at this point and it is possible CAA-UAS will want to review this, however, this is far less properties than ACP-2021-002 overflew with the same RPAS.

The route distance is 21.4 Nautical Miles

The highest land elevation is 68m

The still air flight time between the two hospitals is estimated at 23 mins.

The planned height of the RPA when flying this route is at least 76m (250 FT) above the highest ground on the route.

The highest ground on the route is 230 FT AMSL (rounded up to the nearest 10 FT)(69.69m).

The following observations were made in the planning of this route:

- The route flies through R444 and permissions from EDF and ONR will need to be finalised.
- The route takes into account a request from the National Trust not to overfly Sizergh Castle south West of Westmorland General Hospital.
- The route crosses the Cumbrian coast railway line once and the North West Coast main line near Lancaster Royal Infirmary.

The upper limits of the Flight Volume, Contingency Volume and Emergency Buffer for this route are implemented as per section 5.3.

6.3.3 Westmorland General Hospital to Lancaster Royal Infirmary – Long Route

Route is displayed as a purple track from Westmorland General Hospital in the north-east to Lancaster Royal infirmary in the south-east in Figure 6.22 but with the route through R444 shown as in Figure 6.31.

The track can be found in the KMZ file entitled "WGH-LRI Long R444"

There is potential that CAA/UAS will not permit the overflight of domestic residences at Sandylands, even at 1500'

As such we propose a secondary route through R444 which avoids the overflight of domestic residences.

Figure 6.30 below details the route around R444 to the south, avoiding the Sandylands residences. The route must negotiate Heysham – Hutton - Penwortham 1 & 2 north and south power circuits. Speaking with National Grid the towers will be around 55m AGL at the peak.

There is a dog leg in the south-east route around R444 to allow for precautionary separation from errant microlights attempting to land at Middleton Sands and illegally entering the R444 zone in their endeavours.

Whilst Middleton Sands is marked on the CAA 1:250,000 chart it encompasses private and crown land that have never granted access, thus any microlight is landing in breach of common trespass. This dog leg reduces the separation distance with Heysham Power Stations down to 2135m. This is detailed in Figure 6.31.

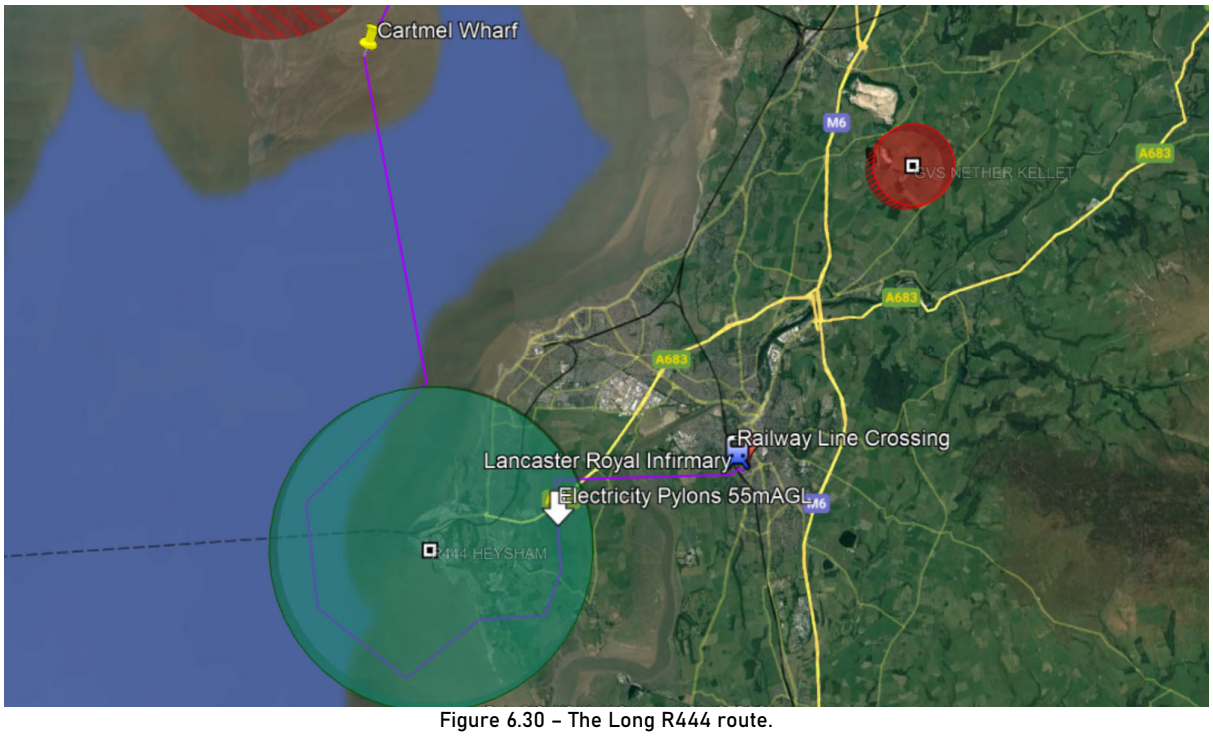

Figure 6.30 – The Long R444 route.

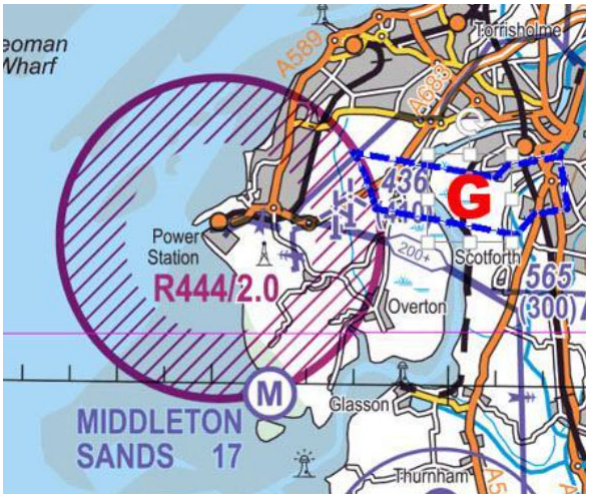

Figure 31 – Middleton Sands Microlight Site

The route distance is 28 Nautical Miles (an increase of 6.6 Nautical Miles from the direct R444 route)

The highest land elevation is 68m

The still air flight time between the two hospitals is estimated at 28 mins.

The planned height of the RPA when flying this route is at least 76m (250 FT) above the highest ground on the route.

The highest ground on the route is 230 FT AMSL (rounded up to the nearest 10 FT)(69.69m).

The following observations were made in the planning of this route:

- The route takes into account a request from the National Trust not to overfly Sizergh Castle south West of Westmorland General Hospital.
- The route crosses the Cumbrian coast railway line once and the North West Coast main line near Lancaster Royal Infirmary.
- The route flies through R444 and permissions from EDF and ONR will need to be finalised.
- The route must negotiate Heysham – Hutton - Penwortham 1 & 2 north and south power circuits. Speaking with National Grid the towers will be around 55m AGL at the peak.

The upper limits of the Flight Volume, Contingency Volume and Emergency Buffer for this route are implemented as per section 5.3.

The Access protocol to R444 is to be designed with both EDF at Heysham and the Office of Nuclear Regulation and will be accommodated through a temporary security policy.

N.B. A request for exemption from the Air Navigation Regulation (Restriction of Flying) (Nuclear Installations) 2016 form has been submitted to AROps.

6.3.4 Lancaster Royal Infirmary to Furness General Hospital

Route is displayed as a purple track from Lancaster Royal infirmary in the south-east to Furness General Hospital in the north-west in Figure 6.32. The track can be found in the KMZ file entitled "LRI-FGH"

Figure 6.32 – The route from LRI to FGH

The route starts by departing the playing field next to LRI to the west, crossing the North West Coast main line and Lancaster Canal before exiting over farmland to the west as detailed in Figure 6.33.

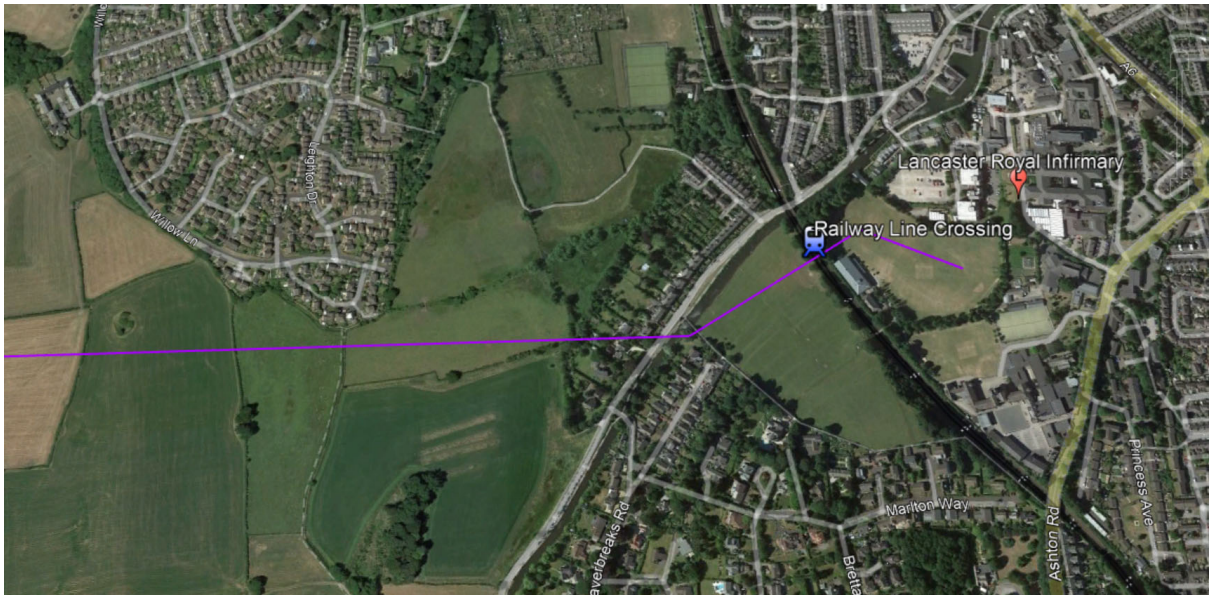

Figure 6.33 – The westerly exit from LRI

The route continues westerly until it enters R444 – The Heysham Nuclear Power Station Restricted Zone as depicted in Figure 34.

Figure 6.34 – Entering the R444 Restricted Zone.

Once entered R444 the route heads north climbing to 1500' to overfly the domestic residences at Sandylands as depicted in Figure 6.35.

Figure 6.35 - The internal path through R444 climbing to 1500' to overfly Sandylands

The Route then exits R444 towards the northern end of the zone and then heads North West across Morecambe Bay at a cruise height of 250' before making landfall at Aldringham as depicted in Figure 6.36.

The Access protocol to R444 is to be designed with both EDF at Heysham and the Office of Nuclear Regulation and will be accommodated through a temporary security policy.

N.B. A request for exemption from the Air Navigation Regulation (Restriction of Flying) (Nuclear Installations) 2016 form has been submitted to AROps.

Figure 36 – The Route across Morecambe Bay from R444 to Aldringham.

Once overland the route follows mainly farmland crossing one set of Electricity pylons and the Cumbrian Coast railway line before reaching Furness General Hospital as depicted in Figure 6.37.

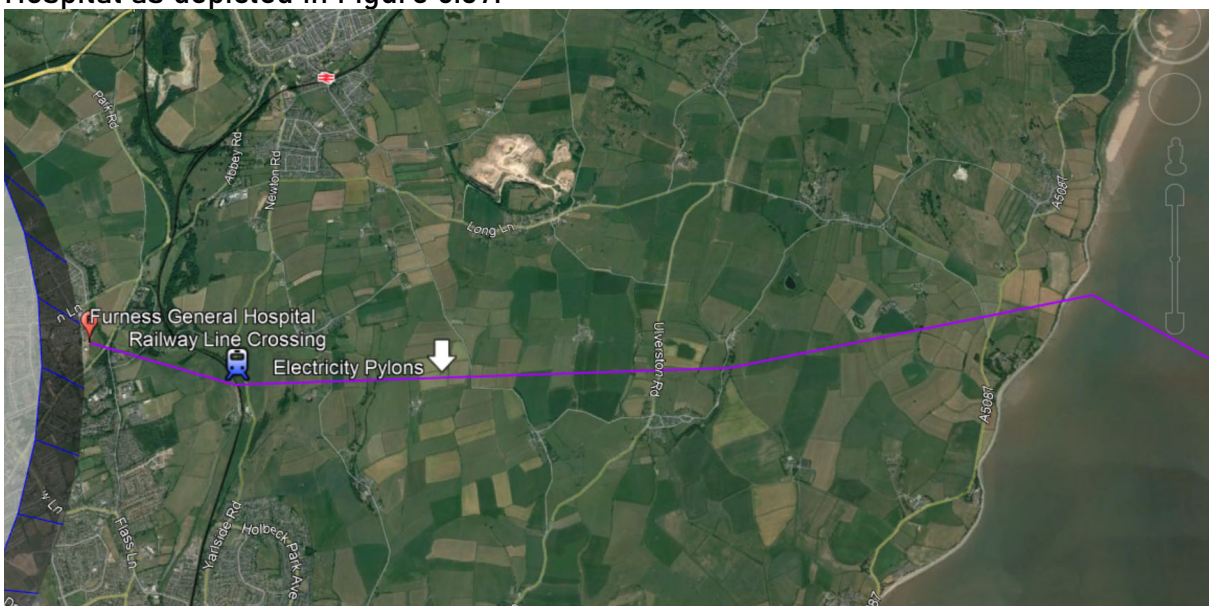

Figure 6.37 – Aldingham to Furness General Hospital.

The route distance is 16.2 Nautical Miles

The highest land elevation is 82m

The still air flight time between the two hospitals is estimated at 18 mins.

The planned height of the RPA when flying this route is at least 76m (250 FT) above the highest ground on the route.

The highest ground on the route is 270 FT AMSL (rounded up to the nearest 10 FT)(81.81m).

The following observations were made in the planning of this route:

- Walney Island Airfield ATC, dissects Furness General Hospital site. The hospital site will thus be considered to be 100% within the ATC and approach and departure permissions will be co-ordinated via A/G radio with Walney Tower and deconflicted on site.
- The route has been amended to avoid overflight of Furness Abbey
- It is possible to route North from Furness General Hospital, skirt around Furness and cross over to land at Walney Island involving no overflight of persons.
- There is currently no safe haven or hangarage at Walney Island Airfield.
- The route crosses the Cumbrian coast railway line once to the east of Furness General Hospital and the North West Coast main line near Lancaster Royal Infirmary.
- The route flies through R444 and permissions from EDF and ONR will need to be finalised.

The upper limits of the Flight Volume, Contingency Volume and Emergency Buffer for this route are implemented as per section 5.3

6.3.4 Lancaster Royal Infirmary to Furness General Hospital – Long R444 Route.

Route is displayed as a purple track from Lancaster Royal Infirmary in the south-east to Furness General Hospital in the North-west of Figure 38. The route through R444 routes to the south to avoid overflight of Sandylands.

The track can be found in the KMZ file entitled "LRI-FGH Long R444"

There is potential that CAA-UAS will not permit the overflight of domestic residences at Sandylands, even at 1500' As such we propose a secondary route through R444 which avoids the overflight of domestic residences.

Figure 6.38 below details the route around R444 to the south, avoiding the Sandylands residences. The route must negotiate Heysham – Hutton - Penwortham 1 & 2 north and south power circuits. Speaking with National Grid the towers will be around 55m AGL at the peak.

There is a dog leg in the south-east route around R444 to allow for precautionary separation from errant microlights attempting to land at Middleton Sands and illegally entering the R444 zone in their endeavours. This dog leg reduces the separation distance with Heysham Power Stations down to 2135m. This is previously detailed in Figure 31.

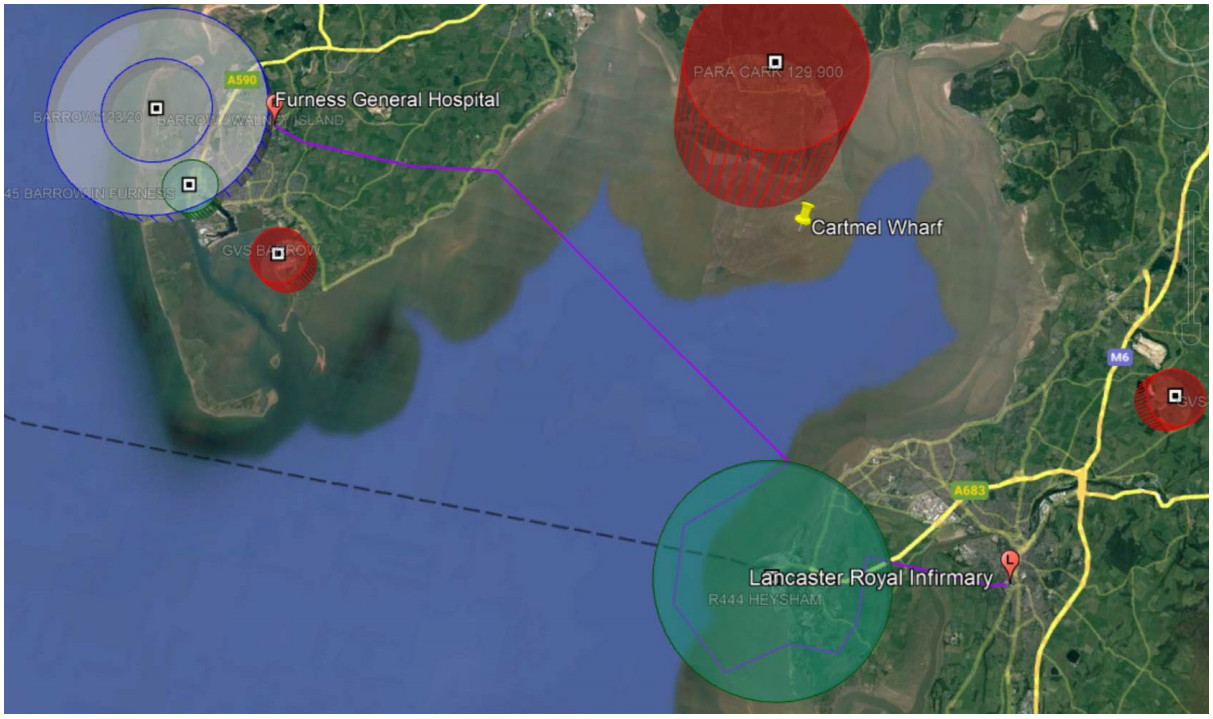

Figure 6.38 The Long Route around R444 to avoid Sandylands

The route distance is 22.8 Nautical Miles (an increase of 6.6 Nautical Miles from the direct R444 route)

The highest land elevation is 82m

The still air flight time between the two hospitals is estimated 23 mins.

The planned height of the RPA when flying this route is at least 76m (250 FT) above the highest ground on the route.

The highest ground on the route is 270 FT AMSL (rounded up to the nearest 10 FT)(81.81m).

The following observations were made in the planning of this route:

- Walney Island Airfield ATC, dissects Furness General Hospital site. The hospital site will thus be considered to be 100% within the ATC and approach and departure permissions will be co-ordinated via A/G radio with Walney Tower and deconflicted on site.
- The route has been amended to avoid overflight of Furness Abbey
- It is possible to route North from Furness General Hospital, skirt around Furness and cross over to land at Walney Island involving no overflight of persons.
- There is currently no safe haven or hangarage at Walney Island Airfield.
- The route crosses the Cumbrian coast railway line once to the east of Furness General Hospital and the North West Coast main line near Lancaster Royal Infirmary.
- The route flies through R444 and permissions from EDF and ONR will need to be finalised.

The upper limits of the Flight Volume, Contingency Volume and Emergency Buffer for this route are implemented as per section 5.3.

The Access protocol to R444 is to be designed with both EDF at Heysham and the Office of Nuclear Regulation and will be accommodated through a temporary security policy.

N.B. A request for exemption from the Air Navigation Regulation (Restriction of Flying) (Nuclear Installations) 2016 form has been submitted to AROps.