



Carrigans to Lifford Greenway

UAV Survey Specification

DOC ID: 60784661-ACM-VTO-SW_ZZ_ZZ_ZZ-SP-LS-0001

Revision: P04



Tionscaldal Éireann
Project Ireland
2040



Comhairle Contae
Dhún na nGall
Donegal County Council



AECOM

Quality Information

Prepared by

Luke Jones
Principal Engineer

Checked by

John McBride
Technical Director

Approved by

John McBride
Technical Director

Schedule of Revisions

Report Revision Number	Revision Date	Prepared by	Checked by	Approved by	Paragraphs amended
P01	July 2026	LJ	JMB	JMB	First issue
P02	Aug. 2026	LJ	JMB	JMB	Second Issue
P03	Aug. 2026	LJ	JMB	JMB	Third Issue
P04	Aug 2026	LJ	JMB	JMB	Fourth Issue

Prepared for:

Donegal County Council

Prepared by:

© 2026 AECOM Ireland Limited. All Rights Reserved.

This document has been prepared by AECOM Ireland Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

1.	INTRODUCTION	1
2.	PURPOSE AND SCOPE	2
3.	PROJECT INFORMATION	4
4.	GENERAL REQUIREMENTS	6
5.	PROJECT CONTROL	12
6.	NEW MAPPING	26
7.	PRESENTATION OF DELIVERABLES	30
8.	PRESENTATION OF DIGITAL DATA	32
9.	PRODUCTS TO BE DELIVERED	33
10.	PRICING DOCUMENT	37
	APPENDIX A ACCESS SCHEDULE	38
	APPENDIX B SPECIAL REQUIREMENTS FOR TRAFFIC SAFETY & MANAGEMENT	39
	APPENDIX C GDPR PROCESS AGREEMENT	42
	APPENDIX D PERMANENT GROUND MARKER TYPES	49
	APPENDIX E PERMANENT GROUND MARKER RECORD SHEET	51
	APPENDIX F TABLE OF FEATURE SYMBOLS	52
	APPENDIX G DEFINITIONS OF DIGITAL DATA	54
	APPENDIX H FEATURE CODING SCHEME FOR GEODETIC SURVEY	56

Tables

TABLE 1. SURVEY PROGRAMME	5
TABLE 2. PROJECT EXECUTION PLAN REQUIREMENTS	6
TABLE 3. UAV SURVEY ACCURACY	23

1. Introduction

1.1 Background

Donegal County Council published the Preferred Route Corridor for its proposed Carrigans to Lifford Greenway project in June 2026. It is now necessary to obtain topographical survey data to inform the development of the alignment of the greenway within the Preferred Route Corridor. Given the large area contained within the Preferred Route Corridor, it is proposed to do this by procuring an Unmanned Aerial Vehicle (UAV) LiDAR and Orthographic Survey.

1.2 European Mutual Recognition

Except where the specified standard implements or is technically equivalent to a Harmonised European Standard or to a European Standard adopted for use within the European Communities after 31 December 1985, any requirement for products or materials to comply with an Irish or British Standard shall be satisfied by compliance with:

- i. a relevant standard or code of practice of a national standards institution or equivalent body of any states of the European Economic Area, or
- ii. a relevant international standard recognised in any states of the European Economic Area, or
- iii. a relevant specification acknowledged for use as a standard by a public authority of any states of the European Economic Area, or
- iv. traditional procedures of manufacture of any states of the European Economic Area where these are the subject of a written technical description sufficiently detailed to permit assessment of the goods or materials for the use specified, or
- v. a European Technical Approval (ETA) issued in accordance with the Construction Products Directive 89/106/EEC (or, until procedures are available for the issue of ETAs, a specification sufficiently detailed to permit assessment) for goods or materials of an innovative nature or subject to innovative processes of manufacture and which fulfil the purpose provided for by the specified standard, provided that the proposed standard, code of practice, specification, technical description or European Technical Approval provides in use levels of safety, suitability and fitness for purpose equivalent to those required by the specified standard in so far as they are not inconsistent with the Essential Requirements of the Regulation (EU) No 305/2011.

2. Purpose and Scope

2.1 Aim of the Survey

The aim of the survey is to obtain appropriate data to allow the Client's Representative, to prepare the preliminary design of the Carrigans to Lifford Greenway, and to undertake a detailed archaeological assessment within the Area of Interest (AOI) identified in the drawings included in Part 6 of the Contract.

In addition, topographical survey data is required to inform a Flood Risk Assessment, including the potential need for hydraulic model development.

The Consultant shall carry out an Unmanned Aerial Vehicle (UAV) Survey for the project. This involves surveying the AOI identified in the drawing in Part 6 of the Contract.

2.2 Phased Delivery of the Survey Data

Within the AOI, Area 1 & Area 2 will require full data processing to extract the features outlined in Section 6.

Area 1 is to be prioritised, then Area 2.

The Client's programme for the survey is outlined in Section 3.5.

2.3 Scope

The Consultant shall prepare, carry out and process a detailed LiDAR topographical survey (to include aerial ortho imagery) to develop a three-dimensional ground model to sufficient accuracy to be used by the Designer for the preliminary design of the Scheme. This should be undertaken in accordance with this specification, the relevant sections of the United States Geological Survey (USGS) LiDAR Base Specification, 2020 Rev. A (August 2020) and DMRB (UK) GG 184 referenced within this specification together with any ancillary work required to facilitate the survey.

The total approximate area required for LiDAR survey is illustrated on the drawing included in Part 6 of the Contract.

Feature extraction from the LiDAR and Ortho Imagery is required for the features set out within Section 6.3.

The Consultant shall produce the orthophotography images associated with the photogrammetry survey.

The Consultant shall provide deliverables as outlined in this Specification.

The full scope of the works and the obligations of the Consultant shall be ascertained by reference to the contract as a whole.

2.4 Survey Methods

2.4.1 UAV Survey

The survey shall be undertaken using LiDAR sensor, with multiple return LiDAR to allow for better vegetation penetration for ground levels, and to provide aerial ortho imagery for the AOI.

The survey shall be undertaken by the aerial survey methods necessary to ensure the stated survey control and feature accuracy requirements.

To satisfactorily identify archaeological features, the LiDAR survey should achieve an aggregate nominal pulse spacing of 35mm and a minimum aggregate nominal pulse density of 800pls/m². To penetrate vegetation, multiple return LiDAR shall be used.

Further to these requirements, the Consultant must submit a detailed description to the Client's Representative of the LiDAR survey methods proposed in order to achieve the required pulse density and vertical accuracy, including a list of all equipment to be used for the survey. This shall be provided as part of the Consultant's method statement (see Section 4.12).

Evidence that all equipment is calibrated in accordance with quality assurance procedures must also be submitted by the Consultant to the Client's Representative.

Feature extraction from the LiDAR and Orthophotography is required for the features listed within Section 6.3.

2.4.2 Use of Survey Information

The purpose of the UAV Survey is to obtain appropriate data to undertake and develop preliminary and detailed engineering designs of an alignment within the Preferred Route Corridor. This may also include hydraulic modelling of the area for the purposes of the Flood Risk Assessment for the project.

The survey data will also be used for presentation and analysis purposes.

3. Project Information

3.1 Client

Client: Donegal County Council

Contact: Stephen McCrory

Address: Donegal County Council, County House, Lifford, F93 Y622

Tel: 074 91 53900

Email: smccrory@donegalcoco.ie

3.2 The Project Supervisor Design Process

The PSDP: AECOM Ireland Limited

Address: Level 10, The Clarence West Building

2 Clarence Street West

Belfast, BT2 7GP,

Tel: 028 9060 7200

3.3 Client's Representative

Organisation: AECOM Ireland Limited

Contact: John McBride

Address: Level 10, The Clarence West Building

2 Clarence Street West

Belfast, BT2 7GP,

Tel: 028 9060 7200

Email: john.mcbride@aeacom.com

3.4 Location

The Area of Interest (AOI) is the environs of Lifford and Carrigans in County Donegal, Ireland, as more particularly illustrated on the drawing included in Part 6 of the Contract.

3.5 Client's Programme

Table 1 summarises the Client's programme for the completion of the survey.

Table 1. Survey Programme

Milestone	Maximum number of Calendar Days from Award Date
Preliminaries	
Submission of Project Execution Plan	7 days
Data Capture (incl. Primary Control)	
Commence data capture for Areas 1 to 2 inclusive	14 days
Complete data capture for Areas 1 to 2 inclusive	28 days
Submission of processed survey data (Orthorectified imagery, DTM and DSM) for:	
Area 1 & 2	35 days
Submission of draft extracted topographical detail (linework) to Client's Representative for:	
Area 1	49 days
Area 2	77 days
Completion of final deliverables to Client's Representative for:	
Area 1	56 days
Area 2	84 days

3.6 Contract Drawings

Refer to Part 6 of the Contract Documents.

4. General Requirements

4.1 Project Execution Plan

Within one week of award of the Contract, the Consultant shall provide the Client's Representative with a Project Execution Plan that meets the following requirements.

Table 2. Project Execution Plan Requirements

Requirement	Refer to Section
Delivery Programme	4.2
Method and Safety Statement, along with associated risk assessments	4.3
Confirmation on the use of, and management arrangements for, Subconsultants	4.3
Accepted Certificates of Insurance	4.3
A list of all survey personnel, with evidence of their competence to perform survey operations in line with regulatory requirements in the Republic of Ireland in relation to UAV surveys	4.3
Written proof, where necessary, of approval to enter restricted airspace	4.4
Access requirement drawings and Access Schedule	4.5
Traffic Management and Safety Statement	4.6
GDPR Process Agreement	4.7
Nominated key person(s)	4.10
Calibration certificates for survey equipment	4.12
Proposed Control Network diagram	5.1.4

4.2 Consultant's Delivery Programme

The Consultant shall provide the Client's Representative with a detailed delivery programme. This programme shall meet the timescales of the Client's programme (see Section 3.5) and detail planning and management tasks, survey fieldwork, survey data processing and completion of deliverables. The programme shall clearly indicate dates for third party approvals/consents and indicate dates where access onto third party lands is required. Such dates shall correspond with those identified in the Consultant's completed access schedule (see Section 4.5).

4.3 Safety, Health and Welfare

All activities performed during the course of work undertaken by the Consultant on this Contract shall be in accordance with the requirements of the Safety, Health and Welfare at Work Act 2005, and the Safety, Health and Welfare at Work (Construction) Regulations, 2013, and any amendment thereof as appropriate whilst in the jurisdiction of the Republic of Ireland.

The Consultant must comply with the following safety rules:

- The Consultant must have a signed written Method and Safety Statement and valid insurances before commencing data capture. The Consultant shall provide a Safety Statement to the Client's Representative prior to commencement of data capture. The Consultant shall detail in the Safety Statement the measures they will put in place for their staff and measures they will apply to protect the public when undertaking and processing surveys. This shall be in line with Government Guidelines and Local Authority Guidelines.
- The Consultant shall provide a copy of the required valid insurances upon receipt of "letter to successful Tenderer" and before Issue of letter of acceptance. Any formal appointment of the Consultant will be subject to satisfactory receipt of valid insurances, the requirements of which may include being listed on the Central Bank of Ireland (CBI) Register'. Any formal appointment of the Consultant will be subject to satisfactory receipt of insurances.
- The Consultant must prepare site specific hazard analysis, risk assessments and safe systems of work before commencing data capture. These shall be submitted to the Client's Representative for review and comment.
- The Consultant's staff must be in possession of valid Safe Pass Cards and relevant CSCS cards for various activities.
- The Consultant must ensure that only trained and competent personnel undertake work on site.

- The Consultant must provide competent workers and competent and adequate supervision of their employees and their activities.
- The Consultant must inform the Client's Representative of any intention to bring Subconsultant personnel onto site.
- The Consultant must ensure that all equipment brought on site is in safe condition and has valid statutory certification, where necessary.
- The Consultant must not use any equipment, or the service of personnel belonging to or engaged by Donegal County Council without prior approval being granted by the Client.
- The Consultant must provide and wear personal protective equipment appropriate to the area/task where they are working.
- The Consultant must ensure that access equipment used by him/her is erected and maintained in accordance with current standards and regulations.
- The Consultant must ensure that all portable electric hand tools are run off 110-volt systems. Step-down transformers must be used.
- The Consultant must take care for their own health and safety and also the safety of others affected by the work they are doing and must observe all statutory safety and health precautions.
- The Consultant must report all accidents and dangerous occurrences immediately to the Client's Representative without delay and must co-operate in any investigation into the circumstances of the incident.
- The Consultant shall comply with the requirements of Section 4.5 in relation to the provision of temporary traffic management as required to facilitate the survey.

4.4 Statutory Permissions and Restrictions

The Consultant shall provide to the Client's Representative, as part of the method statement required under Section 4.3, evidence that it possesses the necessary operational authorisation/registration from the Irish Aviation Authority and Civil Aviation Authority as appropriate to undertake unmanned aerial survey work in the Republic of Ireland.

The Consultant shall also be wholly responsible for securing, if necessary, approvals for entry into control zones or other restricted airspace.

4.5 Access

The Consultant shall consult with the Client's Representative to develop its requirements, if any, for access onto third party lands to facilitate completion of the survey.

To facilitate this consultation, the Consultant shall prepare and submit to the Client's Representative a drawing illustrating where access onto third party owned lands is proposed. Each access area shall be assigned a unique identification number and clearly highlight the working area required.

The Consultant shall also complete in conjunction with the drawing(s) a schedule of similar form to the sample provided in Appendix A. This shall be submitted to the Client's Representative and provide details of the nature of work being performed, the anticipated start and end dates for access and any impacts to the land as a result of the survey, e.g. the installation of permanent ground markers. The Consultant shall take all reasonable steps to avoid damage to property as a result of the survey, and shall make good at its own expense any damage caused. The Consultant shall, in compiling Appendix A, highlight potential damage risks to property that it cannot reasonably avoid.

The Consultant shall conform to the requirements of private or public utility service companies or Statutory Authorities involved as far as access to their facilities is concerned.

The Client and Client's Representative shall confirm permission to enter with all identified landowners prior to the Consultant entering onto such identified lands. The Client shall also provide the Consultant with a letter of authority to facilitate site access and respond to enquiries from landowners, including authorities. This letter of authority shall only have validity in County Donegal.

If access cannot be secured for the Consultant or not secured in the manner requested by the Consultant, the Client's Representative shall advise the Consultant, who shall update and resubmit their proposals accordingly. **The Client and Client's Representative give no assurance to the Consultant that permission to enter onto lands shall be granted and accept no costs or liability in respect of delays or reworking of the survey programme due to access. Such costs and/or liabilities shall be entirely borne by the Consultant and allowed for in their tender.**

Requirements for access onto private lands to undertake the survey shall therefore be minimised, with the Consultant encouraged to utilise lands already in the ownership of the Client and/or public places.

4.6 Traffic Safety and Management

The Consultant shall be responsible for all aspects of traffic management. For details of requirements for traffic safety and management refer to Appendix B.

4.7 General Data Protection Regulation (GDPR)

The Consultant shall enter into a GDPR Process Agreement with the Client, as presented in Appendix C. Two separate data sharing templates are available; one for suppliers based within the European Economic Area (EEA), and one for suppliers outside of the EEA. The

Consultant will be required to demonstrate compliance under GDPR and provide details for managing, storing, and disposing of personal data (landowner details) provided to them. Where personal data is collected or shared during the services it shall be "adequate, relevant and not excessive" for the purpose for which it is required. This means that the data from such processing shall be limited to what is strictly necessary to achieve the specific purpose defined in this specification.

4.8 Control

Refer to Section 5.

4.9 Detail to be Surveyed

Features and details to be surveyed shall be as defined in Section 6.3 of this Specification.

4.10 Liaison and Reporting

The Consultant shall nominate a key person who shall act as the liaison between the Consultant and the Client's Representative.

The Consultant's key person shall liaise continuously with the Client and Client's Representative during performance of the Services, to report progress and to deal expeditiously with queries and problems while the survey team/s are on site.

If replacement of the Consultant's key person becomes necessary, such replacement shall be agreed with the Client's Representative prior to the change taking place.

The Consultant shall provide the Client's Representative with a weekly written progress report until the completion of the contract. The report shall include a summary of the week's progress, a two-week look ahead, with reference to the programme, and a summary of any issues that require further discussion to maintain programme or achieve the required survey quality.

4.11 Working Hours

Normal Working hours shall be as follows:

- Monday to Friday (08:00hrs-18:00hrs) (excluding public/bank holidays)
- Saturday (08:00hrs -16:00hrs)

Should out of hours working be envisaged, the Consultant shall inform the Client's Representative not less than six working days prior to the proposed works being undertaken.

The Consultant shall allow in its total fee all additional costs that it may incur because of out of hours working to meet the survey programme.

4.12 Calibration and Checking of Equipment

The Consultant is responsible for ensuring all equipment is calibrated/verified and checked prior to use and maintained as such throughout the period of survey works, as well as ensuring it is fit for the survey purpose required. The Project Execution Plan shall include copies of calibration certificates for the survey equipment.

4.13 Combination of Surveys and Rectification of Errors

The Consultant shall ensure that all deliverables are provided in the Irish Transverse Mercator (ITM) coordinate system (EPSG:2157). The Consultant shall review all deliverables prior to submission to the Client's Representative to ensure any errors/discrepancies between the various surveys are identified and corrected across all deliverables.

Advance and proof copies of survey data shall be provided to the Client's Representative for review and acceptance before the survey deliverable is finalised.

If inconsistency or discrepancies are identified by the Client Representative the Consultant will be required to amend/correct and verify up to and including possible re surveys any issues identified at no cost additional cost to the Client. The Client does not guarantee access to third party lands for the Consultant for the purposes of the rectification of survey errors/discrepancies.

4.14 Survey Record Retention Period

All source survey information shall be safely held by the Consultant for a period of seven years from the date of completion of the Contract. After this period, it may be destroyed subject to the written approval of the Client's Representative.

5. Project Control

5.1 Project Control Requirements

5.1.1 General

A horizontal and vertical control network shall be established by the Consultant to satisfy the requirements of new mapping as specified in Section 6 of the Specification.

Control points shall be established in such a manner that their location shall allow effective future use and their construction shall be sufficient to withstand at least 5 years of normal usage, considering the surroundings at each location. The types of material used shall be such that their impact upon the environment and any normal activities at each location is minimised. Appendix D details the types of Permanent Ground Markers (PGMs) permitted as control points along with their associated limitations on use.

Connection to the Ordnance Survey of Ireland (OSi) Active Network is required. A survey Control Report shall be produced by the Consultant and submitted to the Client's Representative for review and acceptance.

All survey control stations shall be referenced to the surrounding detail.

5.1.2 Schedule of Control Points

A schedule of control points shall be prepared by the Consultant and submitted to the Client's Representative in both digital and hard copy, giving the following information:

- The control point designation and a description of the mark.
- Control point coordinates in the IRENET95 / Irish Transverse Mercator grid (ITM), coordinate system.
- The calculated scale factors for each Irish National Grid coordinate.
- The control point height value.
- A description of the control point.
- The Ordnance Survey of Ireland Active Network Stations used.

5.1.3 Control Point Location Diagrams

The Consultant shall prepare location diagrams for each control point (using the pro-forma supplied in Appendix E) such that it can be located without the need of survey instrumentation. The diagram shall be accompanied by photographs showing the PGM with some background reference for ease of location.

5.1.4 Control Network Diagram

A simple plan shall be prepared of the Survey Control Network including all baselines observed and connections to the Ordnance Survey of Ireland Active Network in advance of the survey. The plan shall be submitted to the Client's Representative for acceptance as part of the Project Execution Plan (see Section 4.1).

5.1.5 Station Schedule

A schedule shall be supplied, in softcopy of all final values of the survey stations giving at minimum the following details:

- The alphanumeric reference name of each station;
- The Easting and Northing Project Grid co-ordinate values;
- The reduced elevation of each station;
- The local combined scale factor (3D) at each station;
- The horizontal distance of each traverse leg;
- The traverse and levelling misclosures of the control network; and
- The schedule shall also be accompanied by a complete softcopy and hardcopy of GNSS and traverse computations showing, inter alia, appropriate input data, statistical summaries, residuals, error ellipses and network diagrams.

5.1.6 Control Report

On completion of the fieldwork and adjustment, a comprehensive control report shall be prepared detailing the methods used, a full network adjustment report, checks applied and any problems encountered. It should be demonstrated that the results achieved are in compliance with this Specification. The report should also document any anomalies and or errors with the previous survey.

An advance copy of the report, together with copies of the horizontal and vertical control framework diagrams, schedule of points, and point location diagrams shall be submitted to the Client's Representative for approval. On approval, this shall form part of the Final Survey Report.

5.2 Horizontal Control Network

5.2.1 Framework

Control Network stations related to the IRENET95 / ITM grid, each with associated reference numbers, Easting, Northing, Elevation values and scale factors, shall be used by the Consultant as control points for the ground survey. The Consultant shall check and agree the

co-ordinates and elevations of the survey control stations prior to topographical survey field work.

Where existing primary or secondary survey control is not provided by the Client, then, a horizontal and vertical control network shall be established by the Consultant on which the topographical survey shall be based. Connection to the Ordnance Survey of Ireland (OSi) Active Network and related to the ITM is required. All elevations shall be related to the latest Ordnance Survey Ireland Geoid Model (OSGM15).

The horizontal control network shall consist of a framework of PGMs that provides a suitable foundation for the production of a reliable and accurate topographical survey. The framework shall be comprised of the following elements:

- Primary Control Points, directly connected into the Ordnance Survey of Ireland Active Network at 5km intervals;
- Secondary Control Points, tied into the Primary Control Points and located at 1km intervals, and at road crossings;
- Other Minor Control Points shall be established as required for mapping purposes.

The Horizontal Control Network will be designed in such a way as to enable the re-establishment, in terms of the OSI Coordinate Systems, of any or all of the permanent control markers should they happen to be destroyed. As such, the Horizontal Control Network, in terms of geometry, baselines and observation times, will comply with the principles of good network design, and shall be approved by the Client's Representative prior to commencing the survey work on-site.

5.2.2 Location of Permanent Ground Markers

The Consultant is to propose control point locations, which are to be agreed with the and Clients' Representative.

The Consultant shall seek to locate PGMs in hard surfaces on public lands as a priority.

However, the location of each PGM shall be generally determined as follows:

- PGMs which are classified as Primary and Secondary Control Points shall have 80% clear visibility above 10 degrees and be ideally clear of obstructions above 15 degrees elevation. The impact of possible vegetation growth around the site and on the horizon shall also be taken into account. Each point should be at least 20m (and preferably 50m) clear of obstacles such as buildings, electrical supply systems and radio masts that may cause GPS multipath problems.
- PGMs which are classified as Secondary Control Points shall be placed with due consideration given to sky visibility and possible multipath effects. Intervisibility should be considered but not at the cost of the stability, security and sky visibility of the

station. The Secondary Control Points shall be located such that the greenway construction set-out can be undertaken from them.

- Minor control points shall not be permanently marked.

5.2.3 Construction of Permanent Ground Markers

Permanent Ground Markers for Primary and Secondary Control Points shall be stable for a period of 5 years and shall be of a construction that conforms to the types illustrated in Appendix D.

All survey control stations shall be driven, or otherwise constructed, flush or near flush with the ground surface, to avoid becoming trip hazards and being disturbed.

All stations shall have an unambiguous centring point suitable for the acceptance of the ferrule of a centring rod or for optical plumbing.

Stations driven into existing pavement cracks, expansion joints or into soft tarmac shall be avoided where possible.

The Survey Consultant shall be aware of all underground utilities and services when establishing PGM's.

PGM's shall be used to define the position of the control network survey stations in soft ground. Their location shall be selected to provide the strongest possible geometry for the system.

5.2.4 Survey Grid

The coordinate system to be used for the project is IRENET95 / ITM.

5.2.5 Accuracy Acceptance Criteria

The acceptance criteria specified below will relate to each set of control points to the higher coordinate system; as such the Primary Control Network will be directly related to the Ordnance Survey of Ireland Active Network.

Adjacent Control Points shall be observed by direct measurement.

The adjustment of the network will be performed by means of a least-squares network adjustment. The network design must reflect this requirement through the inclusion of redundant observation baselines to each station such that the statistical analysis is a realistic representation of the inherent errors of the network.

The adjusted control coordinates and associated error residuals to be used for comparison to the acceptance criteria, will be those derived from the fully constrained network in terms of the ITM coordinate system. The error residual is a value that represents the uncertainty in the coordinates of the control point in respect of the higher order control network.

The maximum horizontal distance error between permanent survey control stations shall not exceed $\pm 0.5\sqrt{K}$ (mm), where K (M) is the distance in metres between the two points being considered. The height difference between any adjacent permanent ground markers shall not be in error by more than $(10\sqrt{K})$ mm, where K is the distance in Kilometres between the two points being considered.

When comparing coordinates and their associated error residuals, derived from the least squares adjustment, the residuals shall not exceed the following permitted errors:

Primary Control Points:

e = 5 millimetres

p = 0.05

Secondary Control Points:

e = 5 millimetres

p = 3

5.2.6 Control Report

On completion of the fieldwork and adjustment, a comprehensive Control Report shall be prepared detailing the methods used, a full network adjustment report, checks applied and any problems encountered. It should be demonstrated that the results achieved are in compliance with this Specification. The report should also document any anomalies and or errors with the previous survey.

An advance copy of the report, together with copies of the horizontal and vertical control framework diagrams, schedule of points, and point location diagrams shall be submitted to the Client's Representative for approval. On approval, this shall form part of the Final Survey Report.

5.3 Global Navigation Satellite Systems (GNSS)

5.3.1 GNSS Network

All new GNSS control points shall be tied to at least four existing project GPS control points where available. Details of GNSS control shall be discussed and agreed with the Client's Representative prior to commencement of the field survey.

5.3.2 Accuracy Acceptance Criteria

Minimum geometric accuracy shall be 1 part 100,000 for all GNSS control (at a 95% confidence level). Centring accuracy of the GNSS antenna over each station point shall be to $\pm 1\text{mm}$. All centring devices and plumbing devices shall be checked prior to the execution of the GNSS control and on completion. Where possible, checks on plumbing shall accompany the measurement process.

5.3.3 GNSS Report

A final GNSS Report shall be submitted as documentation of the successful completion at the conclusion of the control work. Included as a minimum shall be the following:

- A narrative description of the project which summarises the project conditions, objectives, methodologies and conclusions.

- Details of the observation plan, equipment used, satellite constellation status and observables recorded.
- Description of the data processing performed. Note the software used, the version number and the techniques employed.
- Provide a summary and detailed analysis of the minimally constrained and over constrained least squares adjustments performed. List the observations and parameters included in the adjustment. List the absolute and standardised residuals, the variance of unit weight, and the relative confidence for the coordinates and coordinate differences at the 95% (2-sigma) confidence level.
- Identify any data or solutions excluded from the network with an explanation as to why it was rejected
- Include a diagram for the project stations and control at an appropriate scale. Descriptions for each of the control stations shall be included in hardcopy and digital form.

Data files, including observations (RINEX format), computed baselines, adjustments, and coordinates shall be submitted with the final GNSS report.

Documentation for the procedures and processing validation network shall be included in the final GNSS report.

5.4 Traverse Control

5.4.1 Traverse Network

Traversing shall be carried out with an authorised calibrated and documented electronic total station with all traverse readings recorded electronically.

All secondary control surveys shall be performed by either closed loop or link traverse between pairs of the route primary control stations and shall be measured as a single geometric entity.

The geometric shape of all traverses shall be as strong as possible with the distance between subsequent traverse stations (traverse leg) to be in the range of 100 to 150 metres. Shorter legs shall be avoided. Traverse observation breaks at the end of working days shall be avoided but if unavoidable shall be taken on the longest possible lines with extra care taken with centring instruments and targets from one day to the next.

Constrained centring (aka forced centring) using the three-tripod method shall be utilised for all secondary control traversing. Traverse data shall also be observed and electronically recoded in three dimensions (i.e. instrument heights, target heights, zenith angle and slope distances), providing a minimum of four sets for each traverse setup.

Each traverse leg shall be obtained with a minimum of four sets of observations. Distances shall be measured in both forward and backwards directions with a minimum of four sets for each traverse setup. Angles, both horizontal and vertical, shall be repeated, observing direct and reverse positions (face1 and face2) of the telescope for each target position, providing a minimum of four sets for each traverse setup.

Traverse closing errors shall be adjusted using least squares or a recognised mathematical adjustment procedure, in order to provide maximum sympathy between the route Primary Control Stations.

Combined (3D) local scale factor shall be determined for each traverse control station based on the route Primary Control Stations.

All ancillary equipment including tripods, tribachs, centring systems, carriers/stems, targets/prisms and instrument height measuring devices shall be checked and adjusted before, during and on completion of the control traversing.

5.4.2 Accuracy Acceptance Criteria

Maximum closing error for each traverse control shall not be worse than 1:60,000 prior to adjustment using least squares. Closing errors worse than this shall be notified to the Client's Representative immediately to determine a course of action.

Centring accuracy over each station point shall be to $\pm 1\text{mm}$.

5.4.3 Traverse Report

As part of the Final Survey Report (see section 9.5), the Consultant shall submit a full network adjustment report.

Traverse data shall be submitted in both raw and reduced data formats. The reduced data format shall be suitable for three-dimensional adjustments.

5.4.4 Planimetric Control

The Survey Consultant shall establish plan control at a density sufficient to achieve the specified accuracies.

5.4.5 Level Datum

All elevations shall be related to the latest Ordnance Survey Geoid Model 2015 (OSGM15).

5.5 Levelling Network

Automatic digital levels and bar code staves shall be used for all height determinations. Data shall be electronically recorded and downloaded to a computer.

All levelling throughout the selected routes shall be a closed double level run and in metric units.

Elevations shall be given for all horizontal control stations. Project control stations shall be established on existing stable features which offer a unique level point at distances of not greater than 150 metres along the route.

Control station levelling shall be proven geometrically and independently consistent prior to connection to the project datum.

Each level run shall go through two primary control stations at the start, on to the next primary control station pairing and return to the first two primary control stations. The closed level loop shall include any secondary stations established on both the outward and inward level run.

The use of intermediate sights is not acceptable for survey elevation control. Only backsight and foresight readings shall be permitted.

Instruments shall be checked for adjustment prior to levelling run. Two-peg test or similar instrument manufacture checks shall be employed.

5.5.1 Accuracy Acceptance Criteria

Height misclosures for the purpose of the project levelling networks shall not be greater than $3\sqrt{K}$ millimetres (where K is the length of level run in kilometres), or to $\pm 3\text{mm}$, whichever is the greater. The maximum allowable error between any two adjacent stations shall not exceed 1.5mm.

5.5.2 Levelling Report

A schedule of the route control stations and/or benchmarks used for levelling shall be provided complete with reference diagrams and the source of the data indicated.

A Levelling Report shall be provided which quantifies all assumptions made, approximate length of each level leg and run and should indicate all circuit misclosures with residual differenced after adjustment.

5.6 Vertical Control Network

5.6.1 Framework

The Vertical Control Network will be coincident with the Horizontal Control Network.

5.6.2 Datum

All levels shall be related to Ordnance Survey of Ireland - Malin Head Vertical Datum.

The local datum will be realised by direct observation between the Primary Control Network and the Ordnance Survey of Ireland Active Network. The elevation of each primary control

point will be derived by applying the Ordnance Survey Geoid Model 2015 (OSGM15) model to the ellipsoidal height of the station after the Horizontal Control Network has been constrained in the horizontal plane during the least-squares adjustment process as described in Section 5.2.5

From the fixed elevations of the primary control points, which define the local datum, the secondary control point elevations can be derived. The Survey Consultant is free to choose the levelling methodology that they feel is best suited to achieve the accuracies as defined in Section 5.6.3.

5.6.3 Accuracy Acceptance Criteria

See Section 5.2.5 for more information relating to the Accuracy Acceptance Criteria.

When comparing elevations and their associated error residuals or levelling run mis-closes, they shall not exceed the following permitted errors.

Primary Control Points:

$e = 5$ millimetres

$p = 0.05$

Secondary Control Points:

$e = 5$ millimetres

$p = 4$

Minor Control Points:

Minor Control Points will be levelled in such a way that topographical features observed from them conform with the mapping accuracies as defined in this specification.

5.6.4 Control Report

On completion of the fieldwork and adjustment, a comprehensive control report shall be prepared detailing the methods used, a full network adjustment report, checks applied and any problems encountered. It should be demonstrated that the results achieved are in compliance with this Specification. The report should also document any anomalies and or errors with the previous survey.

An advance copy of the report, together with copies of the horizontal and vertical control framework diagrams, schedule of points, and point location diagrams shall be submitted to the Client's Representative for approval. On approval, this shall form part of the Final Survey Report.

5.7 UAV Survey Control

5.7.1 UAV Survey General

A UAV survey is required to obtain georeferenced orthorectified aerial imagery of the full extents of the scheme. The extents of the survey area are shown on the provided drawing file. A UAV survey is also required to survey areas of land that are likely to be inaccessible to the surveyor, such as, positions of fence lines surrounded by dense vegetation, etc.

5.7.2 Health and Safety, Permissions & Access

The surveyor is to provide a method statement and risk assessment for the UAV survey, to include the proposed location from where the surveyor's UAV pilot is to operate the UAV (e.g. from public land or private property, etc). The surveyor will also be required to provide confirmation that the surveyor has the requisite registrations and approval of the relevant aviation authority for UAV operations, along with written permission to enter any controlled airspace.

The Consultant's price shall include for all aspects of obtaining the necessary flight permissions and production of the necessary flight plans to carry out any elements of the survey scope.

5.7.3 UAV GDPR Process Agreement

The surveyor shall enter into a GDPR Process Agreement with Donegal County Council – refer to Appendix C of this Specification.

The data that is collected shall be "adequate, relevant and not excessive" for the purpose for which it is collected. This means that the data from such processing shall be limited to what is strictly necessary to achieve the specific purpose defined in this specification.

Drones equipped with different technologies for data collection (camera, thermal imaging, GPS, altimeter, motion, radio frequency equipment and other sensors) shall only collect information that is necessary for achieving the purpose pursued by this collection.

Where personal data is likely to also be captured by sensor equipment, operators shall take reasonable measures to limit unnecessary capture and processing.

In order to ensure individuals are adequately and clearly informed before and during the flight, the surveyor shall provide the following information to Donegal County Council sufficiently in advance to allow any public notification.

- Proposed dates and times of the flights
- Flight path
- Types of personal data (e.g. imagery, radio, geometry, location etc) that is proposed to be collected

- Contact details of the Operator and the Data Controller.

The surveyor shall include the dates and times of the data capture in the final survey report. At all times UAV should be visible and identifiable visually.

5.8 LiDAR

5.8.1 UAV Survey Accuracy

The tolerance values stated in the below table for the LiDAR survey are root mean square values, and the following conditions have to be satisfied:

- At least 67% of all readings must be correct to or better than the root mean square error (r.m.s.e);
- At least 90% of all readings must be correct to or better than 1.65 times the r.m.s.e;
- All readings must be correct to or better than 3 times the r.m.s.e; and
- All readings not complying with the above 3 conditions including consequential errors shall be corrected by the Survey Consultant at their own expense.

The levels and coordinates of recorded points shall be correct to within the following r.m.s.e tolerances when checked from the nearest survey control points.

Table 3. UAV Survey Accuracy

Accuracy Level	Tolerances:	
	Vertical	Horizontal
Hard Surfaces	± 0.075m	± 0.050m
Soft Surfaces	± 0.100m	± 0.075m

5.8.2 LiDAR Pulse Spacing and Density

LiDAR surveying shall have a minimum Quality Level QL0 to Table 1 of USGS LiDAR Base Specification, 2020 Rev. A:

- Aggregate Nominal Pulse Spacing of 35mm.
- Minimum Aggregate Nominal Pulse Density of 800 pls/m².

Multiple return LiDAR must be used in order to penetrate vegetation.

5.8.3 LiDAR Accuracy Acceptance Criteria

LiDAR surveying shall have a minimum Quality level QL0 to Table 4 of USGS LiDAR Base Specification, 2020 Rev A:

- Root Mean Square Error Z direction (RMSEz) (Non-Vegetated) ≤ 0.05m.
- Non-vegetated vertical accuracy at 95-percent confidence level ≤ 0.098m.

- Vegetated vertical accuracy at 95-percent confidence level $\leq 0.15\text{m}$.

Dependent on the survey methodology proposed, if relevant, it is noted that the LiDAR survey must also meet the following criteria:

- A minimum of 20% overlap between adjacent flightlines.
- A minimum of one cross-track flightline.

5.8.4 LiDAR Co-ordinate System

The coordinate system to be used for the surveys and project shall be ITM Coordinate System (EPSG:2157).

5.8.5 LiDAR Datum

All Levels shall be in terms of the Ordnance Survey of Ireland – Malin Head Vertical Datum (OSGM15).

5.8.6 Control Report

On completion of the data capture and processing to be submitted with the key deliverables, the Consultant shall provide an electronic copy of the Final Survey Report (see Section 9.5) that shall be submitted to the Client's Representative for approval. This shall include a description of the data collection and processing methods followed together with the checks/validations applied. It should also include conditions encountered, quality control, assurance procedures and demonstrate accuracy level achieved and in compliance with this specification together with the general metadata for all datasets. In addition it shall also specify in the Final Survey Report how data voids, if any, were treated.

The required LiDAR metadata deliverables shall be delivered in accordance with the United States Geological Survey (USGS) LiDAR Base Specification, 2020 Rev. A (August 2020), and should include (note – please see Section 9.1 which provides further, and more specific details required for the deliverables):

- Raw/Classified point cloud.
- Aerial Ortho Imagery.
- Digital Surface Model (DSM).
- Digital Terrain Model (DTM).
- A Survey Report detailing the collection of all ground survey data.
- A Collection Report detailing mission planning and including detailed flight logs.

- A Processing Report detailing calibration and instrument settings by lift and by the lift ID, classification methods, and product generation procedures including methodology used for break line collection and hydro-flattening.
- A QA/QC Report detailing compliance with the stated accuracy requirements.
- A georeferenced, polygonal representation of the detailed extents of each LiDAR swath collected, as a GIS layer. The purpose is a set of polygons that define the area actually covered by the swaths, not merely the points collected in the swaths.
- A georeferenced, digital spatial representation of the detailed extents of each deliverable dataset.
- A .xml file for each deliverable including classified point data, bare-earth DEM's, break lines, digital surface models, intensity images, height above ground surface and others.
- A block of LiDAR-related metadata tags specified by the USGS shall be included in the CSDGM. A masked model is to be provided as part of the deliverables to show where the specification for the data could not be met.

6. New Mapping

6.1 Surveys to be Undertaken

The Consultant is required to undertake a detailed LiDAR survey, to include Aerial Ortho Imagery for the AOI shown within Part 6 of the Contract. The AOI has been split into two sub-areas, Areas 1 and 2. The two sub-areas have varying requirements for timescale for delivery, as described in Section 3.5.

Please refer to Section 9.1 for how the data should be provided.

6.2 Scale

LiDAR survey shall be performed to produce new mapping at a scale of 1:500 in digital data format.

6.3 Features/ Detail to be Surveyed

6.3.1 Requirements for AOI Areas 1 and 2

6.3.1.1 Control Points

- Primary control stations.
- Secondary control stations.

6.3.1.2 Building/Structures

- The plinth (or roof) line of all permanent buildings.
- Outbuildings.
- Sheds.
- Covered passages and archways.
- Internal property divisions between abutting buildings where visible externally.
- Boundary Features.
- Ruins or partially demolished buildings or foundations – by the walls and masonry visible at the time of the survey.
- Buildings under construction.
- Bridges.
- Overhangs and canopies.

6.3.1.3 Boundary Features

- Fences.

- Gates.
- Stiles.
- Hedges – showing type, height and width.
- Walls – showing type, height and width.
- Boundary markers.

6.3.1.4 Roads, Tracks and Footpaths

- Kerb line or edge of surfacing to carriageway.
- Tracks and bridle paths.
- Rides and drives.
- Footway.
- Paths in public ground.
- Paths in private ground.
- Tunnels and/or underpasses.
- Changes of paved surface materials.
- Verge edge.
- Hard-shoulder/Hard-strip.
- Carriageway centreline.

6.3.1.5 Street Furniture and Visible Services Features

- Call boxes – type identified.
- Letter boxes.
- Bus stops.
- Lamp posts.
- Telecommunication poles.
- Electricity poles.
- Road signs.
- Traffic signal and control boxes.
- Vehicle detection loops.
- Drains and gullies.

- Chambers and inspection covers.
- Barrier.
- Bollards.
- Marker posts.

6.3.1.6 Water and Drainage Features

- Watercourses and Ditches.
- Lakes.
- Reservoirs.
- Ponds.
- Canals and towpaths.
- Wells.
- Sluice gates.
- Weirs.
- Waterfalls.
- Mooring post.
- Fountains.
- Sewer outfalls.
- The direction of flow of all rivers, streams and water courses.
- Top of water level (date & time of survey to be recorded as Foyle is tidal).

6.3.1.7 Slopes and Earthworks

- Cuttings and embankments.
- Terraced slopes.
- Retaining walls.

6.3.1.8 Woods, Trees and Recreation Areas

- Playgrounds and sports facilities.
- Parks and open spaces.
- Individual trees.
- Groups of trees (by perimeter).

6.3.1.9 Industrial

- Filter beds.
- Transformers (boundary fences only).
- Electricity sub-stations and switch boxes (boundary fences only).
- Pylon bases and reference number.
- Overhead lines and cables.
- Flag staffs and masts.
- Gas storage vessels and pipes.

6.3.1.10 Spot Levels

- Pavements, kerbs, channels and centreline of roads at 5m intervals between cross-sections.
- Corners of buildings and other structures.
- Top and bottom of embankments.
- Ditches, outfalls, stream, culverts and drains, including top of bank level.
- Water levels (with date of survey) of rivers, stream, water courses, canals, ponds, lakes and reservoirs and where applicable flood water levels.
- Storm water gullies, chambers, inspection covers, ducts and conduits.
- Height of overhead cables.

6.4 Presentation

The presentation of surveyed information shall be as defined in Section 7 of the Specification.

7. Presentation of Deliverables

7.1 General

The final drawings shall show all the surveyed details specified. Where digital data is specified, the final drawings shall be produced entirely from the digital data file.

All survey information shall be presented in a format and manner which allows for ease of use and permits additional copies to be made as necessary, excepting any limitations which may be imposed in respect of the copyright of data from third parties.

All final products from the source data shall be supplied on stable media. All products supplied shall be intelligible and usable for the purpose specified.

7.2 Drawing Format

The drawings shall be in digital format suitable for AutoCAD 2018.

Adjoining drawings shall have an appropriate overlap.

Final drawings shall be drawn in metres with an insertion scale of unitless. Precision shall be to three decimal places.

7.3 Grid

The grid shall be shown on all drawings at 100 metre intervals by symmetrical crosses at grid intersections and with ticks at the sheet edges.

The grid values shall be shown at the sheet edges.

Control stations shall be shown and identified including coordinates in term of the drawing coordinates system.

7.4 New Mapping

All surveyed detail specified in Section 6 shall be represented as specified in Section 8 of the Specification.

Features shall be represented in accordance with the feature symbology in Appendix F. Each feature type will be presented in a separate drawing layer as detailed according to the level structure, line types, weights, and text formats unless otherwise agreed with Client Representative prior to the works commencing. The Consultant shall utilise the feature coding scheme set out in Appendix H.

Contours shall be plotted at 0.5 metres vertical intervals with every 2.5 metres contour shown as a double thickness line. The value of the contour shall be shown at distances along the contours of not more than 50 metres. Where contours are very close together, values shall

only be shown on thickened contours. Contour text shall be displayed above the contour line. Contour lines shall not be broken/gapped to display associated text.

Spot levels along paved road surfaces shall be shown at 10 metre intervals along the road for each of the required string lines.

In flat areas where the horizontal distance between contours exceeds 50 times the specified vertical contour interval the Consultant shall provide supplementary spot levels at intervals not exceeding 20 times the specified vertical contour interval.

7.5 Format of Survey Data

Please refer to Section 9.1.

The Survey Consultant is to produce a 3D DSM and DTM in Autocad .dwg format from the survey. The data provided shall delineate all surface discontinuities over the area of the survey, e.g. channel lines, top of kerbs, back of footpaths etc. The integrity of this data to form the 3D model is critical, since this data shall be used to generate cross sections and other derived information.

Traverse data shall be provided in a format suitable for adjustment in 3D (Star*Net, or similar). Data shall include the weighting and projections used for traverse adjustment.

Survey station descriptions sheets shall be provided in Microsoft Word Document and Adobe Acrobat PDF format.

8. Presentation of Digital Data

8.1 Introduction

Definitions used in this Section are set out in Appendix G. Feature codes used by the Consultant that vary from that shown in Appendix H will only be used with the agreement of the Client's Representative.

8.2 Data Classification

The basic requirements of survey models and the associated record definition are described in Appendix G .

The transfer set shall be a single logical data set containing all features.

8.3 Digital Data for Digital Ground Modelling (DGM)

Please refer to Section 9.1 for detailed information on how this information should be provided.

Structure of Survey Data

- The 3D model file and 2D model files compatible with Autodesk Civil3D shall not contain crossing break lines, duplicate XY co- ordinates with different elevations or 2D points within a 3D string. All 3D strings shall be 3D continuous polylines or similar. Any variations on the standard feature coding/symbology convention (see Appendices G and I) shall be proposed to, discussed with, and agreed upon with the Client's Representative in advance of changes being made.
- Contours shall be drawn as continuous polylines or similar and shall not cross.
- All survey features shall be represented as either continuous polylines or point entities. Blocks/symbols shall not be used to represent linear features, such as hedges, fences, gullies, inspection covers etc. Combinations of linear and point feature representation is not permitted on the same level/layer in CAD unless agreed in advance with the Client's Representative.
- Elevation and feature text must be displayed for all manholes, inspection covers, road edge, road centreline, building corners, walls, and fence lines, etc. There shall be sufficient text annotation to permit the use of the drawing on film/paper plots at a plot scale of 1:500. Services such as manholes, gullies, telecommunication covers, etc.
- All feature text annotation, including feature name, description, attribute information etc. shall be placed on the appropriate “_FTR” level/layer. Feature text shall not be placed on the feature/object's level/layer.
- It is a condition of this contract that the Consultant demonstrates the ability to input the survey results into AutoCAD Civil 3D on the Client's Representative computer system.

9. Products to be Delivered

9.1 Supply of Digital Data

The following Digital Data should be delivered to the Client's Representative as per the Client's programme in Section 3.5. The completed survey, including all digital data deliverables and survey control report should be delivered in accordance with this Specification. This should be read in conjunction with Schedule B within the Form of Tender and Schedule.

- Survey Control Report (see Sections 5.1.6, 5.2.6, 5.3.3, 5.5.2, 5.6.4, 5.8.6)
- Final Survey Report and Schedules (see Section 9.5)
- Raw Point Cloud (.las format) and as a series of comma delimited text files in the sequence x,y,z and intensity limited to a maximum of 500,000 points per file.
- Classified Point Cloud (.las format) with 2m, 5m and 10m grid and as a series of comma delimited text files in the sequence of x,y,z, intensity limited to a maximum of 1 million points per file.
- Digital ortho-rectified colour photography with a maximum of 0.050m per pixel resolution. The photography is to be supplied in 2km x 2km geo-referenced ECW (enhanced compression wavelet) files for Irish Transverse Mercator (ITM). The data shall be accompanied by an AutoCAD format reference drawing, in ITM. Re-sampling of lower resolution imagery is not permitted. The ortho-rectified colour photography must be based on imagery taken no earlier than 2026. The tiled orthophotography shall be supplied in geo-referenced tiles, each covering an area of 2 sq.km and shall match seamlessly without gaps or overlaps. The image files shall be supplied uncompressed containing a project index in geodatabase format suitable for loading into ArcGIS.
- Digital Surface Model (DSM) in industry standard, GIS compatible, floating point raster format, with minimum 0.5m resolution. The DSM shall be supplied in geo-referenced tiles, each covering an area of 1sq.km and shall edge match seamlessly without gaps or overlaps. The DSM shall also be provided in a 2018 Autocad .dwg, CSV, ESRI ASCII and .laz formats. This model shall consist of unbroken feature strings and contour strings in 3D.
- Digital Terrain Model (DTM), i.e. bare earth model in industry standard, GIS compatible, floating point raster format, with minimum 0.5m resolution. The DTM shall be supplied in geo-referenced tiles, each covering an area of 1sq.km and shall edge match seamlessly without gaps or overlaps. DTMs shall be supplied as 3D triangulation models with unexploded 3D faces. The DTM shall also be provided in a

2018 Autocad .dwg, CSV, ESRI ASCII and .laz formats. This model shall consist of unbroken feature strings and contour strings in 3D.

- A separate 2018 Autocad .dwg model of DTM string contours at 0.5m intervals.
- Separate 2D and 3D 2018 Autocad .dwg format drawings of the survey results. A separate 'paper space' window including the Consultant's title block shall be included. The 3D drawing shall exclude any features with a zero or null level.
- Separate 3D Triangulation Model of the entire survey, in digital format suitable for AutoCAD 2018 (e.g. LandXML or .dwg)
- Separate 2D and 3D 2018 Autocad .dwg format drawings of extracted building footprints.
- Any other deliverables outlined within this Specification.

No paper copies of the above data are considered necessary.

Any variation to the above requirements proposed by the Consultant shall be agreed in writing with the Clients' Representative prior to the commencement of data processing.

9.2 Phased Delivery Approach

The Consultant shall note the requirement for a phased delivery of the contract deliverables, as outlined in Section 2.2.

9.3 Data Compliance

All digital data supplied shall conform to the same standards of accuracy specified in Section 5.

Digital data shall be supplied in tiles georeferenced to the IRENET95 / Irish Transverse Mercator (ITM) coordinate system.

Individual electronic files shall not be more than 2GB in size.

9.4 3D File

The Survey Consultant is to produce a 3D Digital Surface model and Digital Terrain Model from the survey CAD drawing. The data provided shall delineate all surface discontinuities over the area of the survey, e.g. channel lines, top of kerbs, back of footpaths etc. The integrity of this data to form the 3D model is critical, since this data shall be used to generate cross sections and other derived information.

Traverse data shall be provided in 3D StarNet format, suitable for adjustment in 3D. Data shall include the weighting and projections used for traverse adjustment.

Survey station descriptions sheets shall be provided in Microsoft Word Document and Adobe Acrobat PDF format.

9.4.1 Media Type

Data shall be supplied on the following:

Medium: USB Flash Drive/Secure Online File Transfer

Compatible with operating system: Microsoft Windows 10

9.4.2 Coverage

When writing data sets to the medium, the files shall comply with the following:

If the files are too large to fit onto one media volume, then it can span several volumes with the media sequentially numbered.

9.4.3 Annotation

Where multiple media and/or multiple data sets are supplied, the Survey Consultant shall supply a list of all media, stating individual contents.

Each media item shall be individually labelled with the Project title, reference number, and date. In addition, each item shall be uniquely referenced in the form 'Item 1 of 9'.

9.5 Final Survey Report and Schedules

The Final Survey Report shall be typed and provided in an electronic format compatible with Microsoft Word. It shall describe the methods, techniques and equipment used in the survey, the dates of the survey, the parameters used in the transformation from the National Grid and the closing errors in both the plan and level nets and in the connections to Ordnance Survey control. Where the Ordnance Survey control is proved to be out of tolerance the course of action agreed with AECOM shall be stated.

The Final Survey Report shall include the following:

- A brief project report recording planned and actual delivery dates and costs, any problems encountered and any changes or variations to the original contract requirement.
- Describe the methods, techniques and equipment used in the survey,
- The dates of the different survey types, the parameters used in the transformation from the National Grid and the closing errors in both the plan and level nets and in the connections to Ordnance Survey control.
- A schedule of all drawings produced.
- Information of all survey equipment used including equipment listing, specification and calibration certificates.
- A description of safety incidents, and landowner/occupier incidents.

- A list of external factors affecting the survey.
- Signed self-certification check lists
- Certificate confirming that the survey control and drawings have been validated by the Consultant and conform to the specification and all service requirements
- The Control Report.
- The UAV Survey Control Report.
- The UAV Survey Collection Report.
- The UAV Survey Processing Report.
- The UAV Survey QA/QC Report.

The Final Survey Report shall be provided upon completion of processing of survey data for Areas 1 and 2.

10. Pricing Document

Refer to separate Pricing Document.

Appendix A Access Schedule

Identifier:	Access required for:	Access requirements:	Residual impact / damage to lands:
<i>e.g. A-001</i>	<i>Installation of PGM</i>	<i>10/08/2026, daytime for 1-2 hours between 9am and 5pm, for PGM installation and subsequent GNSS recording.</i>	<i>Installation of PGM</i>

Appendix B Special Requirements for Traffic Safety & Management

B.1 For Operations in the Republic of Ireland

The Consultant is required to provide and maintain adequate traffic safety and management measures to safeguard the public and Consultant's personnel during the execution of the survey works.

Any traffic management required for the survey shall be in accordance with Chapter 8 of the latest issue of Traffic Signs Manual published by Department of Transport and shall be provided to Donegal County Council or their agent. The form of the "Guidance for the Control and Management of Traffic at Road Works" shall be used.

The Consultant shall provide details to the Client's Representative of his programme requirements with respect to traffic management prior to the date for commencement.

All costs associated with traffic management shall be deemed to be included in the Consultant's price.

The Consultant shall design and implement a series of discrete consecutive detailed Temporary Traffic Management Schemes for each survey area. Traffic Management Operations shall be arranged to minimise disruption in all cases.

The Consultant shall not change its TTMS, once implemented, without the approval of or unless directed by the Client's Representative.

The Consultant shall submit a Traffic Safety and Management Method Statement to the Client's Representative for Client approval prior to implementing the TTMS. This shall be submitted within two weeks of contract award and include:

- i. Proposals for Traffic Management Operations including diversions of traffic routes, details of all specially constructed routes, details of temporary or alteration to existing road markings, details and locations of safety barriers.
- ii. Traffic safety and management proposals including sign details and positions and other controls to be implemented, including details of any traffic signal alterations proposed.
- iii. Allowances and contingencies for access by the public, deliveries, emergency service vehicles, public transport and access for users, including breakdowns and breakdown recoveries.
- iv. The details, date and duration envisaged for road or lane closures/diversions including partial closures and details of works sequencing affecting traffic flows on any part of the public roads.
- v. Incorporation of any public relations issues arising from the traffic safety and management measures.

- vi. Copies of completed applications, notifications or agreements made with any authority with respect to the arrangements for the temporary removal/diversion of traffic signs and signals, street lighting, roads, utilities, telecommunication etc.
- vii. Timing of operations and
- viii. Risk Assessments.

The Traffic Safety and Management Method Statement shall also include drawings showing each traffic management phase for the works in all areas including works in adjacent areas, including (where appropriate):

- i. Position and phasing of traffic signals, subject to the consent of Donegal County Council;
- ii. Position of traffic signs;
- iii. For each movement, number and widths of lanes proposed, identifying which movements are exclusive and shared;
- iv. Extent of working areas and safety zones;
- v. Extent of lane closures;
- vi. Signing and coning or barrier details for the lane closures required to set up and take down the traffic management scheme;
- vii. The times when these lane closures will be set up and removed;
- viii. Crossovers, including construction details and geometric details;
- ix. Temporary traffic signs and positioning of traffic cones and road/pedestrian safety barriers;
- x. Details of any locations where the works may impact on existing traffic management equipment and their communications;
- xi. Proposals for alternative communications to equipment including temporary ducting cabling or other means;

Drawings shall be to a scale sufficient to adequately show the detail required. It is likely that 1:1000 scale with details at 1:50 scale will be required.

Accesses to private and business properties shall be maintained at all times.

The Consultant shall ensure that his actions in carrying out the Works, and the actions of his employees, sub-Consultants and their employees, are not executed in such a manner as to constitute hazards or safety risks to personnel or traffic.

In the event of poor visibility due to fog or spray from vehicles travelling on the road, the Consultant may need to immediately remove or alter the TTMS until visibility is improved.

The erection of Traffic Management Equipment shall only be carried out in the direction of normal traffic flow on the carriageway affected. Dismantling of Traffic Management Equipment shall only be carried out in the direction opposite to the normal traffic flow on the carriageway affected.

The Consultant shall not commence any Works or temporary works until the relevant TTMS has been accepted by the Client's Representative.

All Traffic Management Equipment shall be in accordance with the requirements of the UK Traffic Signs and General Directions, BS EN 12899-1 and the Road Traffic (Signs) Regulations.

No personnel shall be permitted to work within the approach taper of a coned area or within the safety zone, except for Traffic Management Operations.

All temporary signs shall be weighed down with sandbags or similarly approved measures as necessary.

All hazards within a coned off area within the minimum lateral clearance to a traffic lane are to be clearly delineated with barriers, cones and flashing lamps unless protected by a safety fence. Hazards shall not be placed in the safety zone.

Upon completion of a TTMS, works are to be substantially complete within the relevant site area and able to be open to public use.

Before any Traffic Management Operations take place, the Consultant shall, if necessary, arrange a meeting with the Client, the Client's Representative and any affected parties to discuss and agree his proposed method statement for establishment of the traffic management system and emergency procedures.

All works on public roads, including traffic management, may incur timing restrictions that are at the sole discretion of Donegal County Council as the relevant authority.

The acceptance of the Consultant's traffic management proposals be at the sole discretion of Donegal County Council as the local authority and the Consultant shall indemnify the Client against all losses or liability in respect of delays or failure to secure such approvals.

Appendix C GDPR Process Agreement

DATA SECURITY AND PERSONAL DATA PROTOCOLS

This document sets forth the protocols that <Insert Data Processor> and Donegal County Council (Council) will follow with respect to maintaining the security and privacy of Council Data made available to <Insert Data Processor> pursuant to the protocol, comprising of Personal Data (as such term is defined in relevant Data Protection Laws) and non-Personal Data including Confidential Council Information (“**Data**”). For the avoidance of doubt, Data includes Production Data and Test Data which is made available to <Insert Data Processor>. The Council shall retain all ownership rights in and title to Council Data.

1. DATA ACCESS SECURITY

- 1.1. During the Term of the Agreement, <Insert Data Processor> will keep the Council Data and <Insert Data Processor> Data secure through implementing the security safeguards, administrative, technical, physical, organisational, safety and security measures set out in the Protocols described in this Schedule and shall only process, transmit and store the Council Data in accordance with these Protocols.
- 1.2. Where <Insert Data Processor> are accessing Council Data, <Insert Data Processor> will comply with the Council's Policies and Procedures in Annex 1.
- 1.3. <Insert Data Processor> will not make copies of Council Data.
- 1.4. <Insert Data Processor> shall limit access to Council Data to those <Insert Data Processor> Personnel who need access to this Council Data, stored on <Insert Data Processor> systems, including enterprise data stores, file shares, email systems and end-user computing devices, for the performance of the Services. Permission levels should meet the minimum requirement to permit <Insert Data Processor> Personnel to fulfil their role in the provision of the Services to the Council and meet the approved Council business requirements under the principle of least privileged access.
- 1.5. <Insert Data Processor> Personnel with access to Council Data will undertake regular training on security practices and safeguards to ensure the security, care and handling of Council Data in accordance with this Schedule and Applicable Law. <Insert Data Processor> shall maintain records to confirm that all <Insert Data Processor> Personnel involved in connection with performance of the Services have received adequate data security and privacy training.
- 1.6. <Insert Data Processor> shall promptly notify the Council of changes to <Insert Data Processor> Personnel who have access to the Council Data.
- 1.7. <Insert Data Processor> shall ensure that <Insert Data Processor> Personnel working remotely from the Council's premises and working remotely from the <Insert Data Processor>'s Service locations are in compliance with these Protocols.

2. DATA STORAGE & RETENTION SECURITY

- 2.1. <Insert Data Processor> shall return all Council Data, including hard copy Council Data, which has been provided to <Insert Data Processor> by the Council, upon termination of the Agreement or delete or return the Council Data upon request from the Council, and provide evidence of the return or deletion. This includes any Council Data held at <Insert Data Processor> Premises in connection with the purpose of this agreement.

3. DATA TRANSMISSION SECURITY

- 3.1. <Insert Data Processor> and the Council shall only use secured and encrypted storage devices or secured and encrypted Data transfer mechanisms as agreed by the Parties from time to time. Where encryption keys are used these will be shared between both parties through a different channel.

- 3.2. <Insert Data Processor> Personnel that have been provided the Council email accounts for the purpose of the provision of the Services will only use the Council provided email accounts in the course of the performance of the Services and when such <Insert Data Processor> Personnel are communicating for the purpose of performing the Services by email with other <Insert Data Processor> Personnel that have been provided the Council Corporate email accounts such email communications shall be transmitted using the Council Corporate email accounts.

4. PERSONAL DATA AND DATA SUBJECT ACCESS RIGHTS

- 4.1. <Insert Data Processor> will, in the manner set out in these Protocols, comply with its obligations under Data Protection Laws applicable to a Data Processor, including the EU General Data Protection Regulation (REGULATION (EU) 2016/679) and the Irish Data Protection Act 2018 in the course of providing the Services to the Council, including all laws, applicable to <Insert Data Processor> in its capacity as a Data Processor, of the countries in which processing of the Personal Data takes place save that in the event of any conflict in the requirements of those laws, the requirements of the law of Ireland shall prevail.
- 4.2. <Insert Data Processor> will not transfer the Personal Data to a country which does not provide adequate protection, as determined by the Data Protection Laws, without the prior written consent of the Council except where such transfers are inherited from the Council.
- 4.3. The parties agree that on the Effective Date (the date that this agreement is entered into), they shall complete all relevant details in, and enter into, the standard contractual clauses for the transfer of personal data from the European Union to processors established in third countries (controller to processor transfers). <Insert Data Processor> shall procure that any SubConsultant where such SubConsultant Process Council Data outside the EEA enters into standard contractual clauses directly with the Council. <Insert Data Processor> shall remain liable for any Processing carried by such SubConsultants.
- 4.4. <Insert Data Processor> will notify immediately the Council if <Insert Data Processor> receives any complaint, notice or communication which relates directly or indirectly to the processing of Council Data or to either party's compliance with Data Protection Laws and provide the Council with full cooperation and assistance in relation to such complaint, notice or communication.
- 4.5. <Insert Data Processor> will notify the Council within two (2) Working Days if it receives a request from a Data Subject of the Council Personal Data, for access to that person's Personal Data in line with Data Subject Access Rights as defined in the EU General Data Protection Regulation. The information requests that are likely to be received from Data Subjects include:
- a) Right of Access;
 - b) Right to Rectification;
 - c) Right to Erasure (sometimes referred to as the Right to be Forgotten);
 - d) Right to Restriction of Processing;
 - e) Right to Data Portability;
 - f) Right to Object to Direct Marketing;
 - g) Right to Object to Automated Decision Making, including Profiling.
- 4.6. <Insert Data Processor> must ensure that the information in response to a request is provided to the Council in a concise, transparent, intelligible and easily accessible form, using clear and plain language. The information provided to the Council in response to Data Subject Requests must be supplied free of charge, in a timely manner.

- 4.7. <Insert Data Processor> shall provide the Council with full and timely co-operation and assistance in relation to any request made by a Data Subject of the Council Personal Data to fulfil Data Subject Access Requests.

5. SERVICE LOCATIONS, DATA INVENTORY, AND RECORD OF PROCESSING

- 5.1. <Insert Data Processor> shall provide to the Council on an annual basis (and as when reasonably requested by the Council) an inventory of all <Insert Data Processor> Premises involved in the access, transmission, processing and/or storage of any Council Data, including any <Insert Data Processor> Premises that ceased to access, transmit, process and/or store Council Data in the previous 12 month period.
- 5.2. <Insert Data Processor> shall maintain an up-to-date inventory of Council Data stored at each <Insert Data Processor> Premises and stored by any Sub-Consultants and provide this inventory to the Council upon request.
- 5.3. <Insert Data Processor> shall ensure that any SubConsultants with access to the Council's Data shall also be included in the Council's record of processing.
- 5.4. <Insert Data Processor> shall support the Council in maintaining, in an electronic format, a record of processing activities under the Council's responsibility. That record shall contain all of the following information:
- a) the name and contact details of the controller and, where applicable, the joint controller, the controller's representative and the data protection officer;
 - b) the purposes of the processing;
 - c) a description of the categories of data subjects and of the categories of personal data;
 - d) the categories of recipients to whom the personal data have been or will be disclosed including recipients in third countries or international organisations;
 - e) where applicable, transfers of personal data to a third country or an international organisation, including the identification of that third country or international organisation and, the documentation of suitable safeguards in place to protect Council Data;
 - f) the envisaged information retention and disposal schedule (time limits for erasure) of the different categories of data;
 - g) a general description of the technical and organisational security measures in place to ensure secure processing of Council Data e.g. the ability of a network or an information system to resist, at a given level of confidence, accidental events or unlawful or malicious actions that compromise the availability, authenticity, integrity and confidentiality of stored or transmitted Council Personal Data, and the security of the related services offered by, or accessible via, those networks and systems;
- 5.5. <Insert Data Processor> shall maintain, in an electronic format, a record of all categories of processing activities carried out on behalf of a Council, containing:
- a) the name and contact details of the processor or processors and of each controller on behalf of which the processor is acting, and, where applicable, of the controller's or the processor's representative, and the data protection officer;
 - b) the categories of processing carried out on behalf of the Council;
 - c) Where applicable, transfers of personal data to a third country or an international organisation, including the identification of that third country or international organisation and the documentation of suitable safeguards.

- 5.6. <Insert Data Processor> shall maintain and shall make the record available to the Council and the relevant supervisory authority on request.

6. INFORMATION RISK MANAGEMENT

- 6.1. <Insert Data Processor> will engage with the Council for undertaking Data Protection Impact Assessments (DPIA) of <Insert Data Processor> environments, maintaining an Information Risk Register relating to Council Data and managing Information Risk within their areas of responsibility. DPIA's must also be performed periodically to address changes in the security requirements and in the Information Risk situation, e.g. in the information assets, threats, vulnerabilities, business impacts, the risk evaluation.
- 6.2. <Insert Data Processor> shall perform regular Information Risk Assessments for target <Insert Data Processor> environments, including not limited to, business environments, information processing processes, business applications and unstructured data repositories.
- 6.3. <Insert Data Processor> shall make the outputs of these Information Risk Assessments available to the Council on request.

7. PHYSICAL SECURITY

- 7.1. <Insert Data Processor> shall implement physical security controls in the locations where Council Data is accessed, transmitted from, processed and/or stored.

8. SECURITY ASSURANCE

- 8.1. <Insert Data Processor> shall establish and monitor business line quality control and quality assurance testing against the Council Data Policies and Procedures.
- 8.2. <Insert Data Processor> shall monitor the Key Risk Indicators (KRIs), Key Performance Indicators (KPIs) and required compliance reports established in accordance with these Protocols. The aim of this monitoring and oversight activity is to maintain the security and privacy of Council Data, made available to <Insert Data Processor>, pursuant to the Schedule, comprising of Personal Data (as such term is defined in relevant Data Protection Laws) and non-Personal Data including Confidential Council Information.
- 8.3. <Insert Data Processor> shall establish and operate a process for regularly testing, assessing and evaluating the effectiveness of technical and organisational measures for ensuring the security of the processing of Council Data.
- 8.4. <Insert Data Processor> shall establish and maintain a reasonable system of record that enables the Council to readily identify <Insert Data Processor>'s Controls and Assurance testing processes and reports. The Council and its authorised representatives shall have the right to audit, to examine, and to make copies of or extracts from this system of record and related records (in whatever form they may be kept, whether written, electronic, or other) relating to or pertaining to this Schedule kept by or under the control of the <Insert Data Processor>.

9. SECURITY INCIDENT AND DATA BREACH MANAGEMENT

- 9.1. <Insert Data Processor> shall have and maintain clear written procedures to be followed in the event of an actual or suspected unauthorised or unlawful exposure, access, unauthorised disclosure of, use, communication, deletion, revision, encryption, reproduction, transmission, processing, alteration, loss, damage, corruption or destruction of any Council Data by <Insert Data Processor> or its Sub-Consultants (a "Security Incident").
- 9.2. <Insert Data Processor> shall **immediately** notify the Council upon becoming aware of any suspected or actual Security Incident and <Insert Data Processor> shall provide such assistance and co-operation as the Council may reasonably require in order to support any and all related investigations and remediation of potential damages. In particular, this

requirement shall apply if <Insert Data Processor> becomes aware of any security breach or any communication which relates directly or indirectly to the processing of Council Personal Data or either party's compliance with Data Protection Laws. In such circumstances, <Insert Data Processor> shall provide the Council with as many details as are known by <Insert Data Processor> at that time and <Insert Data Processor> shall regularly update the Council thereafter setting out such further details as may be reasonably required by the Council.

- 9.3. The notification referred to in Section 9.2 above shall at least:
- a) describe the nature of the personal data breach including where possible, the categories and approximate number of data subjects concerned and the categories and approximate number of personal data records concerned;
 - b) communicate the name and contact details of the <Insert Data Processor> data protection officer/data incident manager or other <Insert Data Processor> contact point where more information about the data breach can be obtained;
 - c) describe the likely consequences of Council Personal Data being breached as part of the Security Incident;
 - d) Describe the measures taken or proposed to be taken to address the Security Incident/ Data breach, including, where appropriate, measures to mitigate its possible adverse effects.
- 9.4. <Insert Data Processor> shall keep the Council informed of all assessments and plans of action taken by <Insert Data Processor> in response to any Security Incident. The Council may participate in any <Insert Data Processor> investigation involving the Council Data and shall at <Insert Data Processor>'s cost, be promptly provided by <Insert Data Processor> with any related reports prepared by or for <Insert Data Processor> relating to such Security Incident.
- 9.5. The Council shall at its sole discretion determine whether to provide notification to customers, employees, agents and any related or required third parties or any appropriate government authorities and/or Regulators unless such disclosure by <Insert Data Processor> is required by Data Protection Laws. <Insert Data Processor> shall make all relevant information available to the Council and <Insert Data Processor> shall provide any further assistance in order to facilitate the Council in complying with Data Protection Laws and the rights of Data Subjects. The Council shall approve all notifications to third parties which it determines are required or appropriate.
- 9.6. The <Insert Data Processor> shall implement all measures to restore the security of the compromised Data which resulted in the Security Incident and <Insert Data Processor> shall identify, document and implement modifications to its security control environment to prevent similar occurrences in the future and shall provide the Council with a copy of such modifications for review and approval.

10.0 OTHER

- 10.1 Governing Law - this Agreement, and any dispute, claim or controversy arising out of or relating to this Agreement or the breach, termination or validity thereof, is governed by the laws of Ireland. The parties hereby submit to the exclusive jurisdiction of the Courts of Ireland.
- 10.2 If any provision of this Agreement shall be found by any Court of competent jurisdiction to be invalid or unenforceable, the Parties hereby waive such provision to the extent that it is found to be invalid or unenforceable. Such provision shall, to the maximum extent allowable by law, be modified by such Court so that it becomes enforceable as close to the original provision as possible, and, as modified, shall be enforced as any other provision hereof, all the other provisions hereof continuing in full force and effect.
- 10.3 This Agreement shall be binding upon and inure to the benefit of the Parties and nothing in this Agreement, express or implied, shall constitute any rights or remedies to any third parties under this agreement. Any attempt without permission to assign, transfer, delegate or sub licence any rights, duties, or obligations that arise under this Agreement shall be void.

Subject to the foregoing, and except as otherwise provided herein, this Agreement and the rights and obligations of the parties hereunder, will be binding upon and inure to the benefit of their respective successors, assigns, heirs, executors, administrators and legal representatives".

10.4 This agreement constitutes the entire agreement between the parties and supersedes all previous discussions, correspondence, negotiations, arrangements, understandings and agreements between them relating to its subject matter.

10.5 <Insert Data Processor> shall indemnify and hold the Council harmless from all claims and all liabilities, costs, proceedings, damages and expenses (including legal and other professional fees and expenses) awarded against, or incurred or paid by, the Council as a result of or in connection with any alleged or actual breaches of the requirements of Data Protection law and/or any provision of this Agreement, by the < Insert Data Processor>.

Signed on behalf of the Data Controller:

(Donegal County Council)

Date:

Signed on behalf of the Data Processor:

<Insert Data Processor>

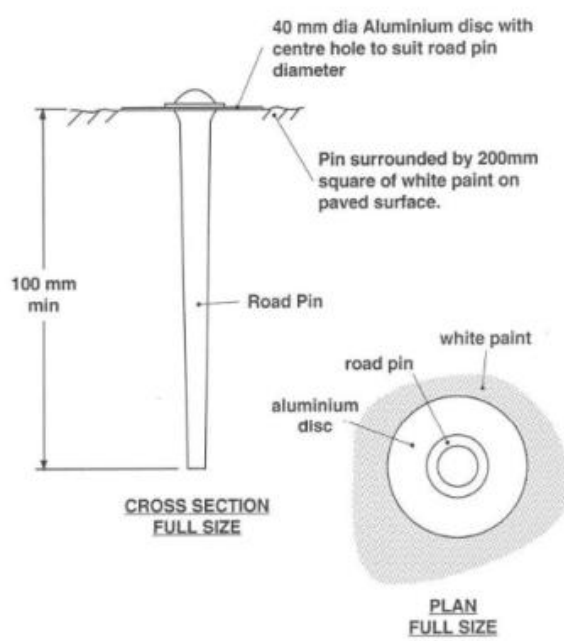
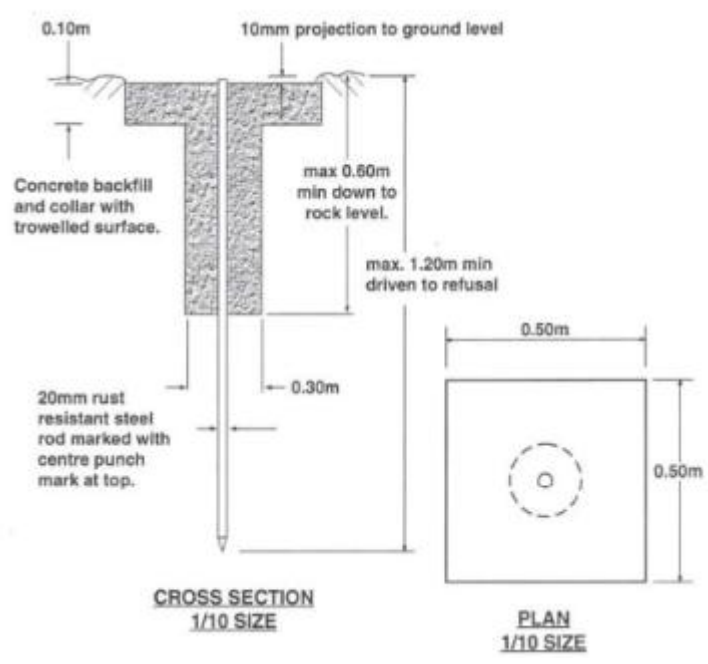
Date:

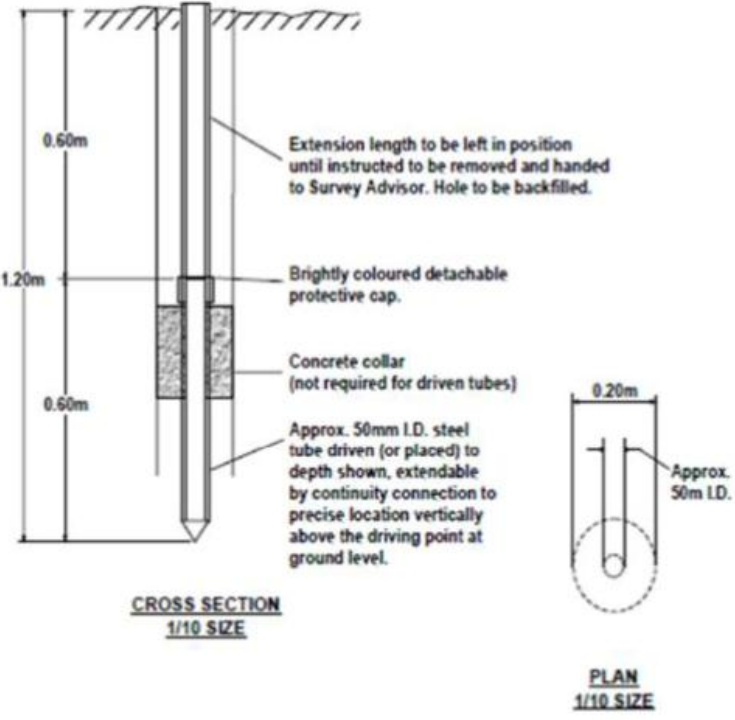
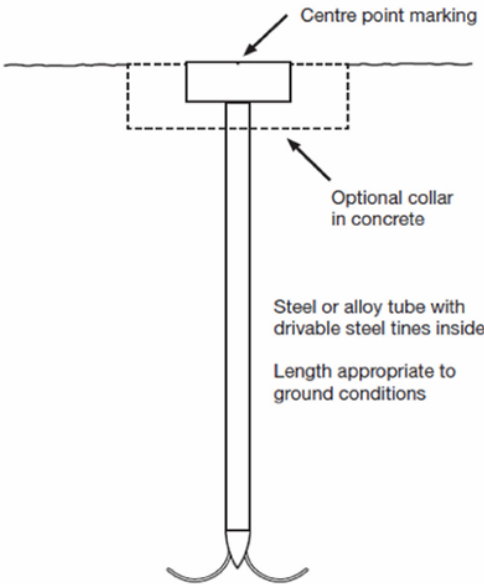
Annex 1

Data Protection Policies and Procedures

Donegal County Council Data Protection Policy

Appendix D Permanent Ground Marker Types

Permanent Ground Marker Type	Permitted Use	Construction Details
Type 1	For dense, very stable paved surfaces	 40 mm dia Aluminium disc with centre hole to suit road pin diameter Pin surrounded by 200mm square of white paint on paved surface. 100 mm min Road Pin CROSS SECTION FULL SIZE white paint road pin aluminium disc PLAN FULL SIZE
Type 2	For non-agricultural sites and unpaved surfaces	 0.10m 10mm projection to ground level Concrete backfill and collar with trowelled surface. max 0.60m min down to rock level. max. 1.20m min driven to refusal 20mm rust resistant steel rod marked with centre punch mark at top. 0.30m 0.50m 0.50m CROSS SECTION 1/10 SIZE PLAN 1/10 SIZE

Permanent Ground Marker Type	Permitted Use	Construction Details
Type 3	For agricultural sites	 CROSS SECTION 1/10 SIZE PLAN 1/10 SIZE
Type 4	For soft surfaces	 Centre point marking Optional collar in concrete Steel or alloy tube with drivable steel tines inside Length appropriate to ground conditions This illustration is indicative only – various types of proprietary marker are available in one piece or extendable units.

Appendix E Permanent Ground Marker Record Sheet

Example of typical permanent ground marker sheet. Sheet details to be typed with location diagram in CAD format.

Note sheet to include photograph with some background reference for ease of location.

PERMANENT GROUND MARKER RECORD SHEET			Page of
Location:			Contract No:
PGM No./ Name			
Description of PGM			
Arbitrary/ N.G. Coords	E	N	Ht
Detailed Location Diagram			
Marker Established by.....		Date.....	
Record Prepared by		Date.....	
Revisited by		Date.....	
Remarks			

Appendix F Table of Feature Symbols

Feature Symbols

Street furniture & Services

Over Head Wires - Pylon ESB	Sign	RS	Road Sign	PBOX	Phone Box
Flowerbed	BS	Bus Stop		Duct	
Pipe	BO	Bollard		GAS	Gas Cover
Lift	BEA	Beacon	GY	Gully	CPBox
Barrier	CH	Coalhole Cover	U/G Vent	U/G Car Park Vent	
Pump	BH	Bore Hole	BIN	Waste Bin	
Trial Pit	EP	Electricity Pole	HY	Hydrant	
Bus/Tram Shelter	TP	Telegraph pole	FH	Fire Hydrant	
Postbox	OCS	OCS Pole	EBOX	ESB Box	
Valve - General	CP	CCTV Camera Pole	ICE	ESB Inspection Cover	
Water Valve	LP	Lamp Post	TFB	Traffic Control Box	
Gas Valve	FMH	Foul Manhole	LUAS		
Sluice Valve	SMH	Surface Water MH		Ticket Vending Machine	
Air Valve	MH	Manholes	WM	Water Meter Cover	
Stop Cook	AC	Air Conditioning Vents	ICT	Telecom Inspection Cover	
C P Post	ICU	Services Inspection Cover		Monument / Toilets	
Marker Post	ICTC	Traffic Inspection Cover		Tank Storage	
Traffic light	ICTV	Cable TV Inspection Cover		Basement: MH, Cover & Pipe	
Parking Meter	ICES	ESAT Inspection Cover	DAM	Dished Aerial Mark	
Plane Aerial Mark	ICNC	NTL Inspection Cover	STAY	Stay for pole	
	ICEM	Eircom Inspection Cover	PP	Pipe Protection	
Unknown Valve	FE	Rodding Eye	WC	Washout	

Natural Features

Surface Change	WLVL	Water Level
Land Drain	CRWN	Crown Level
Bottom of Slope	IL	Invert level
Top of Slope	BL	Bed Level
Ditch	S	Spotheight
Water Edge / Lake / Pond		
Hedge / Trees Drip Line / Vegetation		
Tree Coniferous		
Tree Deciduous		

Contour

0.5m contour
5.0m contour

Other

S1	Survey Station
	Photo point
TOT	Top of Tree

Built Features

Roads & Road Markings

Building	Fence	FL	Floor Level
Edge of Road	Gate	APX	Apex Height
Hardshoulder/Hardstrip		EV	Eaves Height
Road centreline	Road Centreline	PAR	Parapet Height
Kerb Bottom	Top of Wall	SOFF	Soffit Elevation
Kerb Top	Hoarding	STPL	Step Level
Bridge Abutment	Property Line	CONC	Concrete Pad
Bridge Deck	Road Scar		Track
Bridge Parapet	Top of Fence		
Building Façade			
Footpath / Platform	Wall / Retaining Wall		
Damp Proof Course / Verge			
Bridge Pier / Wall & Gate Pillar			
Cycleway / Private Landing Area	Building Canopy / Roof / Overhang		

Appendix G Definitions of Digital Data

This Appendix concerns the transfer of digital data from the Consultant's system. To avoid ambiguity, the following definitions shall apply.

Attribute

Characteristics and/or descriptions attached to a feature. A feature may have none, or many attributes.

Cartographic Model

A data set, the primary requirement of which is to produce a graphic output. Coding is often limited to information for drafting purposes, such as line or symbol type, and often includes data such as grid and border, titles etc.

Clean Data

A data set with unique junction points.

Data Set

A part of a transfer set which may be homogeneous (i.e. a noise survey data set), or a geographical subset.

Digital Ground or Terrain Model (DGM or DTM)

A data set usually representing the ground surface (i.e. 'base earth', excluding buildings). The model is most often defined by a regular grid of 'posts', each of which has a height. Additional data may include break lines to record heights for definite changes of slope.

Feature

A point or line defined by two or three dimensional coordinates. By definition, a point has no dimensions but may require an orientation and/or scale attribute for output as a symbol. Curves are features defined by a series of straight lines, or a series of points with a regular or complex curve attribute.

Field

A field is a unique unit of data, e.g. a height coordinate field.

Headers and Terminators

The first and last records of a data set. They usually contain information to explicitly identify the start and finish of a data set.

Null Height

A height entry which is interpreted as no value. Usually an impossible value such as -999m.

Record

A logical group of fields which is written with a terminator character.

Symbol

A graphic representation of a feature (usually a point). Not usually inherent in the data themselves, but a result of interpretation by the processing software and/or definition by the user.

Transfer Set

The complete data for the project, including supporting information.

Unique Junction Points

Clean data occur when any junction point has only one set of co-ordinates (2 or 3-D as appropriate): i.e. in graphic terms there are no under- or over-shoots. Normally, points will only be added to create a 'crossing' or 'T' junction where one would sensibly occur to complete a polygon (such as a fence and wall etc). A junction would be illogical between a river and fence, or an overhead line and road.

Volume

A physical item of media. A transfer set may be written to several volumes.

Appendix H Feature Coding Scheme for Geodetic Survey

Control points

Permanent survey stations	PSST	point
Station text	STXT	text

Buildings and Structures

The plinth line of buildings	BLDG	line
Building	BG	line
Ruins	RUIN	line
Foundations	FNDN	line
Bridges	BRID	line

Boundary features

Fences	F	line
Gate	G	line
Hedge face	HF	line
Hedge centre line	HC	line
Wall face	WF	line
Wall centre line	WC	line
Boundary feature other	BFO	line
Boundary feature text	BFT	text
Kerb	K	line
Verge	V	line
Filter drain	FD	line
Edge of carriageway	EC	line
Hardshoulder/Hardstrip	H	line
Carriageway	CW	line
Carriageway centreline	CC	line
Carriageway text	CT	text

Street furniture and visible service features

Lamp post	LP	circle
Telecommunications pole	TP	circle

Electricity pole	EP	circle
Overhead telecom cable	OTC	line
Overhead electricity cable	OEC	line
Road sign	RS	line/circle
Traffic signals	TS	box
Utility cabinets	UC	box
Gullies	G	box
Fire hydrant	FH	box
Stop valves	SV	box
Air valves	AV	box
Chambers circular	MC	circle
Chambers rectangle	MR	box
Bollards	B	box
Marker post	MP	box
Street furniture text	SFT	text

Water, Drainage

Edge of lake, pond, reservoir	LE	line
Edge of river, stream, ditch, watercourse	RE	line
Bottom of river, stream, ditch, watercourse	RB	line
Well	WE	circle
Spring	SP	circle
Edge of marsh, bog	EM	line
Culvert, headwall	C	line
Water level	WL	line
Water feature text	WFT	text

Slopes, earthworks, surface model

Top and bottom of cuttings	TBC	line
Top and bottom of embankments	TBE	line
Ground break lines	GBL	line

Edge of rock outcrop	ERO	line
Contours 0.5m	C05	line
Contour 5.0m	C50	line
Spot level	SL	point
Slope and earthwork feature text	ET	text

Wood, trees and recreation areas

Tree trunk	TT	point
Tree and wood canopy	TWC	line
Other wood, tree features	OWF	line
Wood, tree feature text	WTT	text

Cartographic

Flow arrows (downstream)	FA	arrow
Marsh symbols	MS	line
Gradient tadpoles	GT	line
Survey extend	SE	line

