1st Specific Contract No 3436/R0-COPERNICUS/EEA.56731
Implementing Framework Service Contract
No EEA/IDM/R0/16/007/LOT1

Production of Very High Resolution Land cover/Land use datasets. Reference years 2012 (geographic extension) and 2018 (new) including change layer 2012-2018

Lot 1 Urban Atlas

Start date: 03-02-2017
End date: 01-02-2019

UA2012 DHM product – Dublin Quality Check Report

Prepared by:

SIRS
A CLS GROUP COMPANY

1. SUMMARY

Country	IRELAND
City	Dublin
Product name	IE001L1_Dublin_UA2012_DHM
Service provider	GAF AG (Germany)
Project leader	Andreas Uttenthaler
Area [sqkm]	940 sqkm
Delivery date for QC	19/12/2017
External QC provider	SIRS (France)
Technical QC expert	Daphné Scheffter
Reviewer	Sébastien Delbour
Delivery date after QC	09/02/2018

This document summarizes the results of the external Quality Check (QC) performed by SIRS for the high-resolution Digital Height Model (DHM) product covering the core area of the capital city of **Dublin** (IRELAND). A sampling approach has been adopted for performing this task and conformity standards applied are based on Urban Atlas specifications as described in *Annex 8 to the Tender Specifications - Detailed Tasks and Product Specifications* (table 6). Especially height information must be estimated within 3 m accuracy threshold.

Overall product acceptance: **YES**

General comment: ***Good product quality*** *without errors detected which significantly impact building height estimates at building block level*

2. FORMAT CONSISTENCY

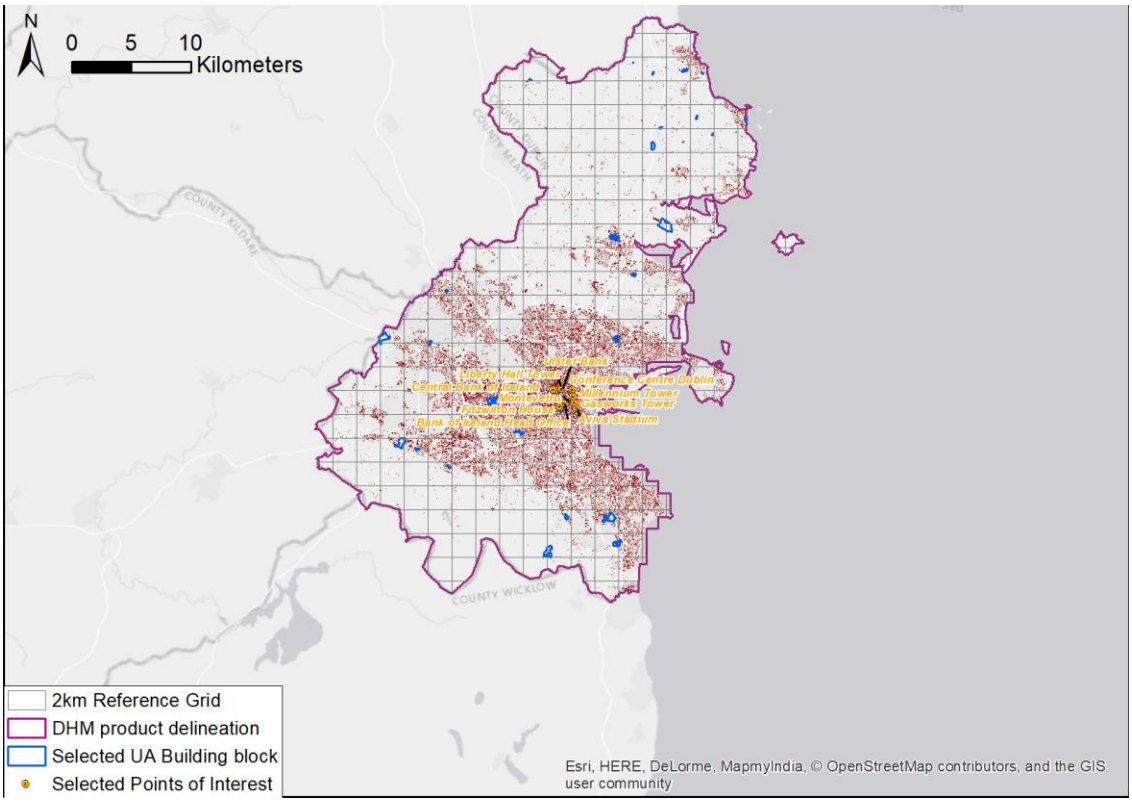
File format	Raster GeoTIFF 16-bit
Coordinate Reference System (CRS)	ETRS 1989 LAEA (Lambert Azimuthal Equal Area) EPSG 3035
Minimum Mapping Unit (MMU)	10 m x 10 m
Mapping area	Compliant
Attribute definition	Compliant
Height value range (m)	0 – 138 meters
Metadata	INSPIRE compliant

3. SAMPLING DESIGN

Overall classification and height value accuracy assessment is based on sampling units randomly selected. However, the mapping area is split using a reference grid with 2 km unit cell beforehand to set the condition not to select more than one sampling unit per grid cell. This ensures homogeneous spatial distribution of samples over the whole mapping area. Otherwise, another condition must be respected: sampling units must correspond to Urban Atlas features which are identified as built-up area, also called building blocks. Therefore, sampling units are selected on restricted areas, i.e. polygon features from the following classes:

11100	Continuous Urban Fabric (S.L. > 80%)
11210	Discontinuous Dense Urban Fabric (S.L.: 50% - 80%)
11220	Discontinuous Medium Density Urban Fabric (S.L.: 30% - 50%)
11230	Discontinuous Low Density Urban Fabric (S.L.: 10% - 30%)
11240	Discontinuous Very Low Density Urban Fabric (S.L. < 10%)
11300	Isolated Structures
12100	Industrial, commercial, public, military and private units
12230	Railways and associated land
12300	Port areas
12400	Airports
14100	Green urban areas
14200	Sports and leisure facilities

The number of selected sampling units (or building blocks) for Dublin is **28**.



4. ACCURACY ASSESSMENT AT BUILDING LEVEL

Reference input data

- DHM product
- Building footprints from Open Street Map (OSM) or extracted by means of visual interpretation from Google Earth imagery in case of OSM data unavailability
- Google Earth Pro using 3D buildings and Street View mode

Methodology

- Selection of OSM building footprints with area > 100 m² and edge length > 10 m
- Detection of omissions/commissions and critical geolocation accuracy issues regarding building height information by means of visual comparison of DHM product with building footprints and Google Earth VHR imagery
- Measurement of maximum building height with 3D Google Earth Pro tool and/or Street View mode by counting the number of building floors
- Evaluation of building height information itself (vertical accuracy) by means of comparison of DHM product and reference height values previously estimated with Google Earth Pro tools

Results

The number of sampling units covered by OSM data for Dublin is **9** (building number mentioned in **BLUE**), while the remaining ones (**11**) have been evaluated based on building footprints manually extracted (**PURPLE**). **6** Samples with insufficient OSM or missing important buildings may have been extracted by CAPI.

Sample ID	Sample UA class	No of buildings	Omissions	Commissions	Geolocation accuracy	Vertical accuracy	Quality Level
162-IE001L1	11100	1+3	0	0	✓	✓	✓
3437-IE001L1	11210	17	1	1*	✓	✓	✓
6037-IE001L1	11210	1+1	1	0	✓	✓	✓
6945-IE001L1	11210	5	0	0	✓	✓	✓
7096-IE001L1	11210	2	0	1*	✓	✓	✓
7397-IE001L1	11210	91+ 4	0	0	✓	✓	✓
7898-IE001L1	11210	2	0	0	✓	✓	✓
8042-IE001L1	11210	3	1	0	✓	✓	✓
11082-IE001L1	11220	3+3	3	0	✓	✓	≈
12195-IE001L1	11220	3	1	0	✓	✓	✓
15048-IE001L1	11220	2	0	1*	✓	✓	✓
15160-IE001L1	11220	4	0	0	✓	✓	✓
15464-IE001L1	11220	7	0	1*	✓	✓	✓
15520-IE001L1	11220	7	0	0	✓	✓	✓
29265-IE001L1	11300	2	0	1	✓	✓	✓
42321-IE001L1	12100	11	0	0	✓	✓	✓
43833-IE001L1	12100	1	0	1*	✓	✓	✓
44056-IE001L1	12100	37+ 4	1	1	✓	✓	✓
45061-IE001L1	12100	10 + 1	1	0	✓	✓	✓
46605-IE001L1	12100	3	0	1	✓	✓	✓

46669-IE001L1	12100	4	0	1	✓	✓	≈
47081-IE001L1	12100	6	0	0	✓	✓	✓
47127-IE001L1	12100	3	0	1	✓	✓	✓
49064-IE001L1	12400	4	0	1	✓	✓	✓
54214-IE001L1	14200	2	0	0	✓	✓	✓

* Commission of elements like trees or gardens.

✓ **Good** (i.e. no or very few errors)

≈ **Medium** (i.e. several errors but not critical in terms of value or amount)

✘ **Poor** (i.e. several critical errors in terms of value or amount)

5. ACCURACY ASSESSMENT AT BUILDING BLOCK LEVEL

Reference input data

- DHM product
- Google Earth Pro using 3D buildings and Street View mode

Methodology

- Report in the attribute table of sampling units (UA building blocks) of the maximum height value from the DHM product by computing zonal statistics (excluding outliers)
- Conversion of the sampling unit layer in 3D shapefile
- Import in Google Earth Pro and visualization of those UA building blocks in 3D mode
- Vertical accuracy assessment by means of visual comparison of 3D UA building blocks with the top of 3D buildings in Google Earth or using Street View mode for estimating the average building height if no 3D buildings available

Results

Sample ID	Sample UA class	Maximum height value from DHM product [m]	Estimated height value from Google Earth [m]	Absolute height difference [m]	Quality Level
162-IE001L1	11100	11	11	0	✓
3437-IE001L1	11210	17	14	3	✓
6037-IE001L1	11210	11	11	0	✓
6945-IE001L1	11210	8	7	1	✓
7096-IE001L1	11210	9	9	0	✓
7397-IE001L1	11210	11	11	0	✓
7898-IE001L1	11210	11	11	0	✓
8042-IE001L1	11210	9	8	1	✓
11082-IE001L1	11220	11	10	1	✓
12195-IE001L1	11220	11	10	1	✓
15048-IE001L1	11220	7	7	0	✓
15160-IE001L1	11220	8	6	2	✓
15464-IE001L1	11220	8	10	2	✓
15520-IE001L1	11220	8	8	0	✓
29265-IE001L1	11300	7	7	0	✓
42321-IE001L1	12100	34	34	0	✓
43833-IE001L1	12100	24	26	2	✓
44056-IE001L1	12100	13	13	0	✓
45061-IE001L1	12100	17	15	2	✓
46605-IE001L1	12100	12	10	2	✓
46669-IE001L1	12100	7	7	0	✓
47081-IE001L1	12100	18	18	0	✓
47127-IE001L1	12100	7	7	0	✓
49064-IE001L1	12400	11	11	0	✓
51152-IE001L1	14100	-	-	-	-*
52966-IE001L1	14100	-	-	-	-*
53904-IE001L1	14200	-	-	-	-*
54214-IE001L1	14200	9	9	0	✓

* No building within the sample unit

6. ACCURACY ASSESSMENT FOR LANDMARK BUILDINGS

Reference input data

- DHM product
- Google Earth Pro using 3D buildings and Street View mode

Methodology

Vertical accuracy assessment of a series of landmark buildings by means of comparison of height information from DHM product with the one from 3D buildings in Google Earth or using Street View mode for estimating the building height if no 3D buildings available

Results

Landmark Building	WGS84 coordinates	Height value from DHM product [m]	Estimated height value from Google Earth [m]	Absolute height difference [m]	Quality Level
Conference Centre Dublin	53 20,88498N 006 14,38124W	50	51	1	✓
Liberty Hall Tower	53 20,90416N 006 15,31554W	59	62	3	✓
Montevetro	53 20,37301N 006 14,20474W	67	67	0	✓
Ulster Bank	53 20,80639N 006 15,19611W	59	57	2	✓
Central Bank of Ireland	53 20,68470N 006 15,77693W	43	45	2	✓
Aviva Stadium	53 20,11570N 006 13,75990W	43	41	2	✓
Gasworks Tower	53 20,33399N 006 14,01925W	28	25	3	✓
Fitzwilton House	53 19,99362N 006 15,04563W	37	41	4	≈
Bank of Ireland Head Office	53 20,17605N 006 14,79767W	40	41	1	✓
Millennium Tower	53 20,56809N 006 14,20294W	47	49	2	✓

✓ **Good** (i.e. compliant with the technical specification which is 3 m vertical accuracy)

≈ **Medium** (i.e. out of the technical specification with error between 3 and 6 m)

✘ **Poor** (i.e. out of the technical specification with error superior to 6 m)