



Technical specifications for the acquisition of 20 centimetre colour orthophoto images for portions of the National Capital Region.

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## TERMS OF REFERENCE

### ORTHOPHOTO ACQUISITION

#### SCOPE OF PROJECT

Supply the National Capital Commission with 345 rectified orthographic image files in uncompressed internally geo-referenced TIFF format to cover the defined contract area of 1,380 square kilometres (see Exhibit 'A'). The image files must provide a **seamless mosaic** of orthophoto mapsheets in which all seam-lines (edges) between the individual orthophotos are made invisible. The contractor must supply the aerial photography (see Mandatory Photographic Criteria, page 4). All orthographic image files must be in colour.

- 1.) Each image file must have 20 centimetre pixel resolution.
- 2.) Each image file must not exceed 320 megabytes in size.
- 3.) Each image file must have a 'common' 2 metre (10-pixel) overlap with all adjacent image files.
- 4.) One (1) DEM file for each of the above files, in ASCII format (see Exhibit 'C') of sufficient quality and density to meet the map accuracy standards.

**If inclement weather prohibits the acquisition of acceptable spring photography, the contract will be rendered null and void. The NCC will not accept photography taken in the fall.**

All products must be delivered to:

National Capital Commission  
202-40 Elgin Street  
Ottawa, Ontario K1P 1C7

Attention: Rand Collins, 4<sup>th</sup> floor

## Requirements

The work consists of producing digital orthophoto image files in uncompressed internally geo-referenced TIFF format. All orthophoto processing must be on the 3 degree Modified Transverse Mercator projection, zone 9; using co-ordinate values expressed in metres, based in NAD83. In areas of tall buildings (see Exhibit 'A') supplemental flight lines must be provided (see Mandatory Photographic Criteria, page 4).

The image rectification must be re-sampled to 20 centimetres using the Cubic Convolution Algorithm or better. A Bi-linear Convolution Algorithm or Nearest Neighbour Algorithm is not acceptable. Each delivered TIFF tile will be a mosaic of multiple processed aerial photographic images. The images selected for each TIFF file must have their differential tone and contrast adjustments performed by an autododging process and the join line between the selected images must be unobtrusive.

Horizontal accuracy standards relate to the NCC 1:2000 scale digital topographic mapping database and are as follows: Ninety percent of all well defined features must be located within 0.50mm of their true position at a designated map scale of 1:2000 (or 1 metre at ground scale).

The contractor is responsible for providing the necessary aerial photography (see Mandatory Photography criteria, page 4) and the vertical and horizontal ground control necessary to achieve the accuracy standards. The photographic product used to create the final orthophoto image must originate from an aerial digital camera with forward motion compensation capability. All digital aerial images must be sharp in detail and of high radiometric quality. Excluding references to specific items of film based analog photography, the photography must conform to the 'Specification for Aerial Survey Photography' published by the INTERDEPARTMENTAL COMMITTEE ON AIR SURVEYS (see Exhibit 'D').

All TIFF files must have the TIFF tag RowsPerStrip set so that each strip approximates 24 kilobytes. All TIFF files must have a 24-bit RGB bit depth. The TIFF files must not be compressed and must not contain 'null' data. Each TIFF file must have a 'common' 2 metre (10-pixel) overlap with each adjacent image file in order to eliminate the banding that sometimes appears at the junction of image files when plotted on media.

### **Mandatory Photography Criteria**

- 1.) **Photography must be acquired in the spring.**
- 2.) Terrain must be snow-free and leaf-free.
- 3.) Photography must be taken under conditions of minimum haze.
- 4.) Solar altitude must be at least 25 degrees.
- 5.) Cloud and/or cloud shadow must not be present in the photography.
- 6.) Skies must be clear.
- 7.) Wind turbulence must be at a minimum.
- 8.) The minimum forward overlap must be no less than  $65\% \pm 4\%$  and the minimum lateral overlap must be no less than 35%.
- 9.) In areas of tall buildings there must be supplemental flight lines. These supplemental flight lines must run parallel to the direction of the streets and of sufficient forward overlap and lateral overlap to ensure that **tall buildings must not cover the edge of pavement.**
- 10.) The principal point of one photograph at each end of a flight line must be outside of the border of the contract area. This ensures full stereoscopic coverage.
- 11.) The target Ground Sampling Distance of the aerial digital camera must not be greater than 18cm .
- 12.) The photography produced by the bidder's digital camera must meet or exceed the results produced from traditional film based aerial cameras.
- 13.) **A camera calibration report from the specific camera manufacturer must be attached to the bid. This calibration report must have been issued within two (2) years of the date of imagery.**
- 14.) Any and all re-flights must be according to the original flight lines, with an overlap of at least two (2) photographs, within 5 days and using the same camera.

### DEM Collection

The digital elevation model (DEM) of x,y,z point values suitable for this project must be dense enough to prevent visual warping around bridges and freeway overpasses. Break line points from cultural and other surface features (ridges, swales, bridges, freeway overpasses, and other points of elevation change) must supplement the DEM where necessary. The DEM must have 90% of the points vertically accurate to within 1metre. The contractor must verify any existing elevation points that they desire to utilize.

### Material supplied to contractor

The NCC will supply the following digital files only:

|                                 |                                  |
|---------------------------------|----------------------------------|
| Contract area boundary (vector) | Existing 2009 Orthophoto DEM     |
| Major routes (vector)           | Existing 2007 Orthophoto DEM     |
| Major hydrography (vector)      | Existing 2001 Orthophoto DEM     |
| Area of tall buildings (vector) | Existing LiDAR ground elevations |

The data sets identified above will be provided in ESRI shapefile format only. All files are in NAD83 and 3degree MTM projection, Zone 9.

### Deliverables

- 1.) One (1) uncompressed image file in TIFF format for each tile. Each file must have 20 centimetre pixel resolution and must not exceed 330mb in size.
- 2.) One (1) ASCII DEM file (for each of the above image files) of sufficient quality to meet NCC map accuracy standards (format must comply as shown in **Exhibit 'C'**).
- 3.) If using ground control, a complete aerial triangulation report, citing equipment and software utilized, total number of models used, and number of tie points per model. If using airborne GPS control, photo centre co-ordinates, deviation and a breakdown of the bundle adjustment.
- 4.) Two copies of the flight indexes of the photography used. These flight indexes must be produced on colour 1:50,000 scale N.T.S. maps produced by Natural Resources Canada.

Items 1, 2 and 3 must be delivered on standard CD or DVD. All file names must be in lower case only. File names must conform to the following naming convention:

3625033.tif  
3625033.dem

Item 4 will encompass the entire project.

### **Review of specifications**

The successful Contractor must be prepared to attend three meetings at his own expense, if required, during the course of the contract. All meetings will be held in Ottawa.

### **Inspection and Examination**

The NCC may at any time inspect any or all of the equipment utilized for the work.

### **Schedule and delivery**

The National Capital Commission must receive all deliverables for the contract no later than October 22, 2011. The contractor is responsible for all deliverables in transit. The contractor is responsible for all transportation costs associated with the deliverables.

### **Subcontracts**

Aside from the acquisition of the aerial photography and the horizontal & vertical control, no other aspect of this project shall be subcontracted. The successful Contractor must provide proof that they have the necessary equipment & software to perform the required work.

### Acceptance of Finished Deliverables and Payment

The Director of the Information Technologies and Geomatics Services Division or their duly appointed representative will be the sole judge as to the quality of the work, equipment and materials. They will have the authority to order the proper re-execution of any work which, in their opinion, is not in accordance with the specifications or instructions. The Contractor will carry out any rework at the contractor's own expense.

The Contractor may be asked to present to the NCC's Inspector at any time during the course of the contract, satisfactory evidence that the instruments used are in proper calibration.

The NCC will perform visual checks of all image tiles for acceptable mosaics, contrast, exposure, building lean, smearing, and skewing. The NCC's Control & Engineering Surveys section will perform extensive checks for positional accuracy of the image files. The contractor is responsible for all errors and omissions in the image files and all rejected image files must be corrected and resubmitted at the contractor's expense.

The NCC will select the standard digital orthophoto file from the contract image tile layout. The contractor must submit in the first delivery the following items:

- 1) The standard image file plus its eight surrounding adjacent image files (nine files in total).
- 2) Four high resolution ( $\geq 600$ dpi.) 1:2000 scale hardcopy plots. Each plot will be centred on a corner of the standard image file and display the standard image file and the appropriate adjacent image files (four plots in total).
- 3) The camera calibration report.
- 4) The two flight indexes produced on the colour NTS 1:50000 map series.

In order to derive data quality and precision standards for the project, the NCC will inspect the standard image file for image quality, mosaics, contrast, exposure, building lean, smearing, skewing, positional accuracy, edge matching and pixel overlap. The four hardcopy plots delivered by the contractor will be the only hardcopy plots required. **Only after receiving approval, in writing, from the NCC to proceed**, shall the contractor produce the remaining image files.

The NCC has up to 30 (thirty) calendar days to perform its quality control process on each image file. The NCC has up to one (1) year from October 22, 2011 to accept all the image files. Once all the image files have been accepted, the performance security will be released to the contractor.



### **Ownership of Products**

All products resulting from the work and all materials supplied to the Contractor will be the property of the National Capital Commission. The Contractor will store all materials under suitable atmospheric conditions until the completion of the work, then he will ship them to the National Capital Commission properly identified and packaged.

### **Copyrights**

The National Capital Commission will have sole ownership of the copyrights of all work produced. Reproduction of any document is forbidden, without written permission from the National Capital Commission.

### **Additional Information**

|             |  |
|-------------|--|
| Exhibit 'A' | Tile layout.<br>Area of tall buildings.  |
| Exhibit 'B' | Existing DEM points (2001)<br>Existing DEM points (2007)<br>Existing DEM points (2009)<br>Existing LiDAR ground elevations.  |
| Exhibit 'C' | Sample DEM file format.  |
| Exhibit 'D' | I.C.A.S. Specifications.   |
| Exhibit 'E' | DVD containing the following data sets in ESRI shapefile format<br>(all NCC data is NAD83, 3degree MTM projection, Zone 9)<br>Exhibit 'E' is only available upon request.<br><br>National Capital Commission Boundary<br>Major routes<br>Major hydrography<br>Contract area<br>Area of tall buildings<br>Sample 2001 Orthophoto DEM<br>Sample 2007 Orthophoto DEM<br>Existing 2009 Orthophoto DEM<br>Sample LiDAR Ground Elevations. |

**EXHIBIT 'C'**

Every record in each DEM file must consist of the following items in the following order:

Easting, Northing, Elevation.

Ex.: 362000.00,5035990.00,89.03  
362000.00,5035998.00,89.15  
362000.00,5036006.00,100.25  
362000.00,5036014.00,99.78

Each item must be comma delimited, spaces are not permitted. The use of commas other than as delimiters is not permitted.