

Canada Centre for Cadastral Management



Geo-Referencing Requirements on Canada Lands



cccm.nrcan.gc.ca

CHC- NSC 2008, Victoria, B.C.



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Past Geo-Referencing Requirements



- 1 km rule based on conventional connections
- Used pin-pricked photos or Topographic Maps
- CSA Connections
 - Accuracy of cadastral data in CSA < 10 cm
 - Further connections provide little benefit in many cases
- Northern Land Claim Surveys
 - Geo-referenced surveys has provided accurate cadastral data
 - Data in communities and developed corridors < 30 cm
 - Many areas do not need further geo-referencing



Background



- 1999 – Technical, Social and Legal Implications of Using Coordinates-only to Define Boundaries
- 2002 – Integrated Land Surveys
- 2005 – CCOG Resolution on Integrated Surveys
 - NAD83CSRS Connections: Urban 5 cm, Rural 20 cm, Remote 1 m
- GNSS positioning technologies
- New Spatial Applications: Google Earth, Navigation, Municipal Infrastructure GIS
- Users are demanding more accurate spatial data

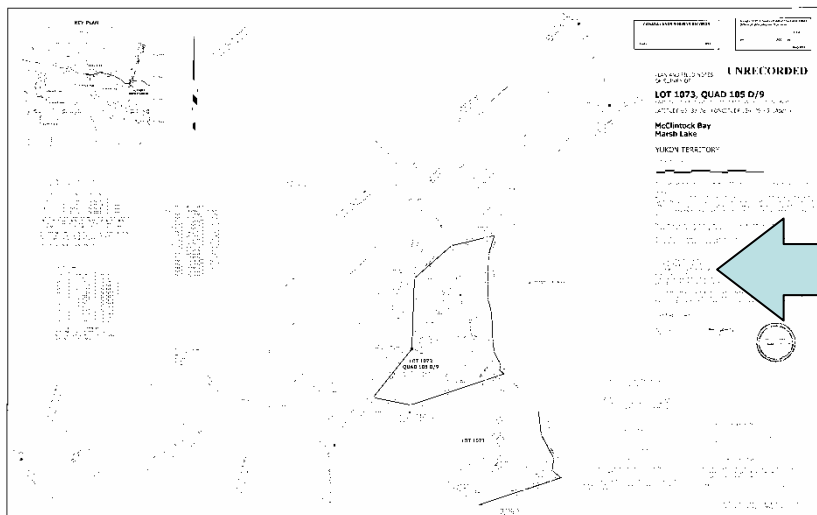
Data Accuracy Demands, e.g. Google Earth



Benefits to CLS System



- Improves Accuracy of Cadastral Data
- Digital Submissions are in consistent reference System
- Efficient Cadastral Data Maintenance
- Transitional Bridge in Using Coordinates to Define Boundaries



Benefits to Surveyor



- Data is consistent with GNSS (GPS)
- Helps search for boundary evidence
- IDs blunders between new survey and cadastral data
- Data is Free to Use for all Geomatics Projects



New Geo-Referencing Standards



- Phased approach towards requiring geo-referencing of all surveys in 2 years
- First phase effective April 1, 2008, Chapter D1 of General Instructions
- Remote Surveys: 1 m at 95%
- GPS Controlled Surveys: 20 cm at 95%

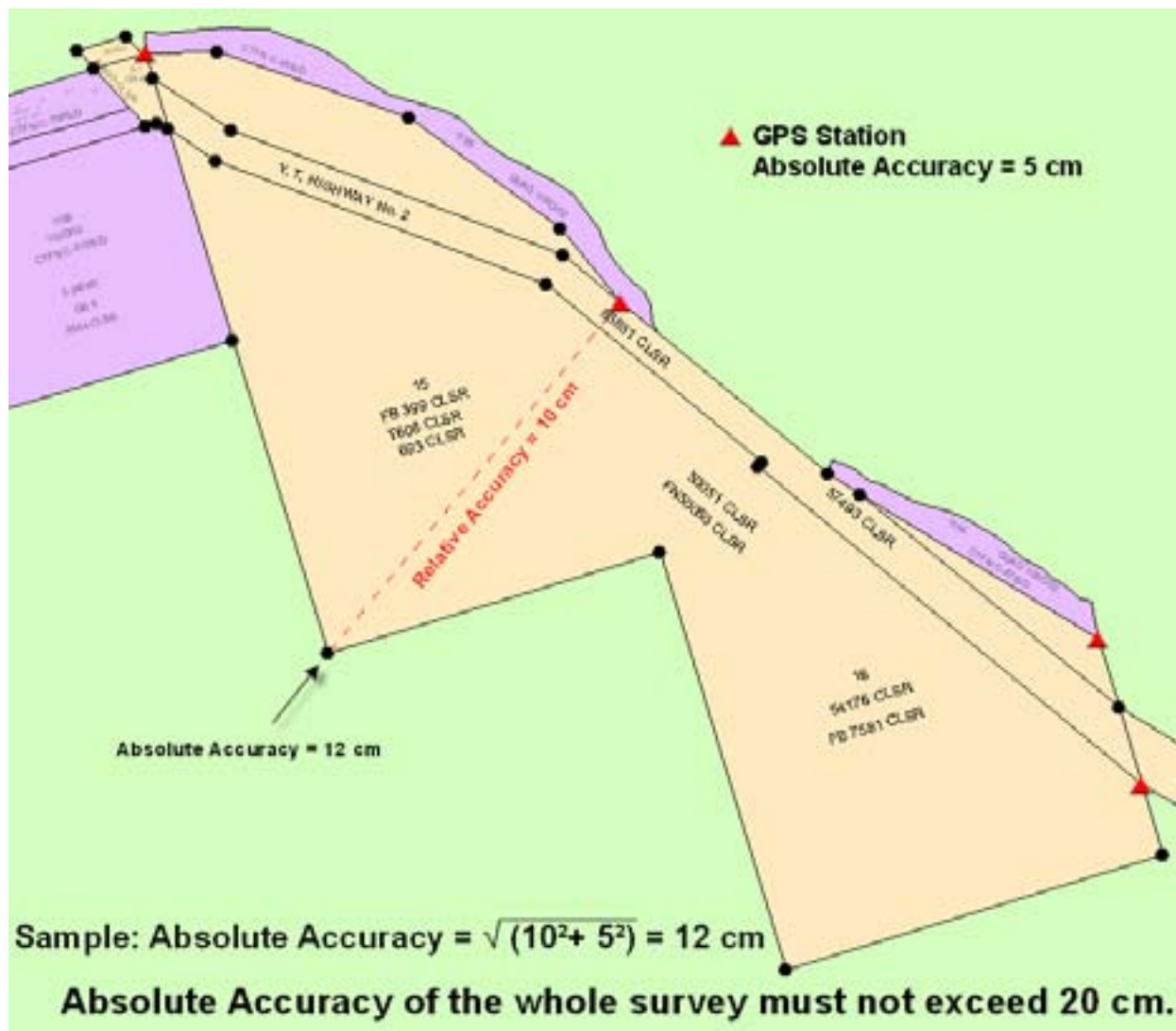


New Geo-referencing standard



- Remote surveys: includes areas outside inhabited urban and rural areas, and small Reserves
- 20 cm requirement applies when survey grade receivers are being used to control or measure the boundaries, e.g. RTK, GPS baselines, bearing control
- Exempt if survey is connected to accurately geo-referenced cadastral fabric
- 20 cm and 1 m accuracies are required for the **entire survey**

Absolute Accuracy of Survey



Why NAD83(CSRS)



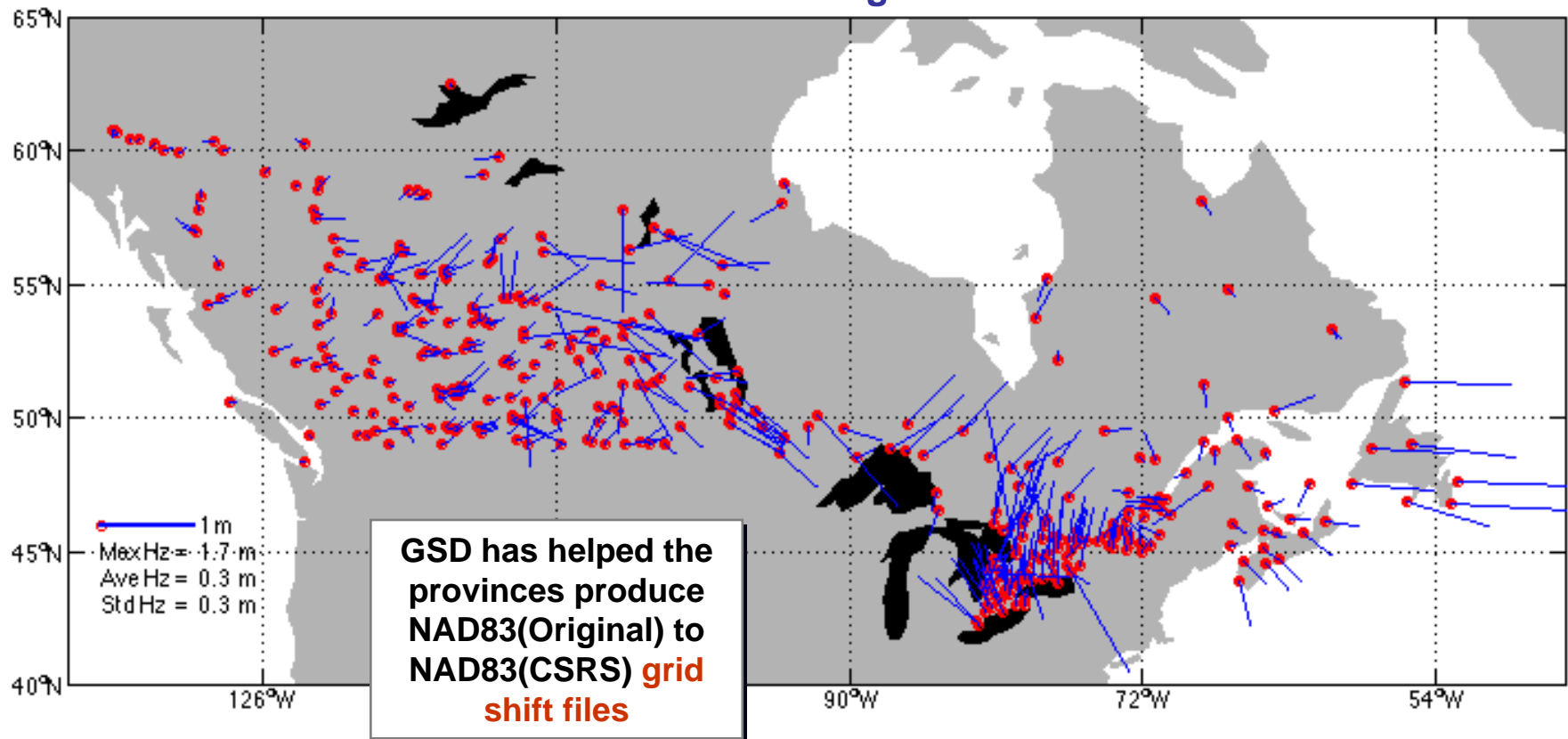
- National Reference System as is CLS system
- Distortion “Free”; removed errors in NAD83
- Directly linked to Global Reference Frame (ITRF); aligned with GNSS observations
- Uses Higher Precision Markers and GNSS
- Source Coordinates have known accuracies
- Access to ground control is NOT required
- NTv2 Models available to convert NAD83 databases
- Adopt now rather than playing catch-up later with distorted cadastral data

NAD83: One datum, two realizations



NAD83(Original) and NAD83(CSRS)

NAD83(Orig.) stations re-observed with high-order GPS
Difference between Original and CSRS



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Source: Geodetic Survey Division



Geo-Referencing Methods



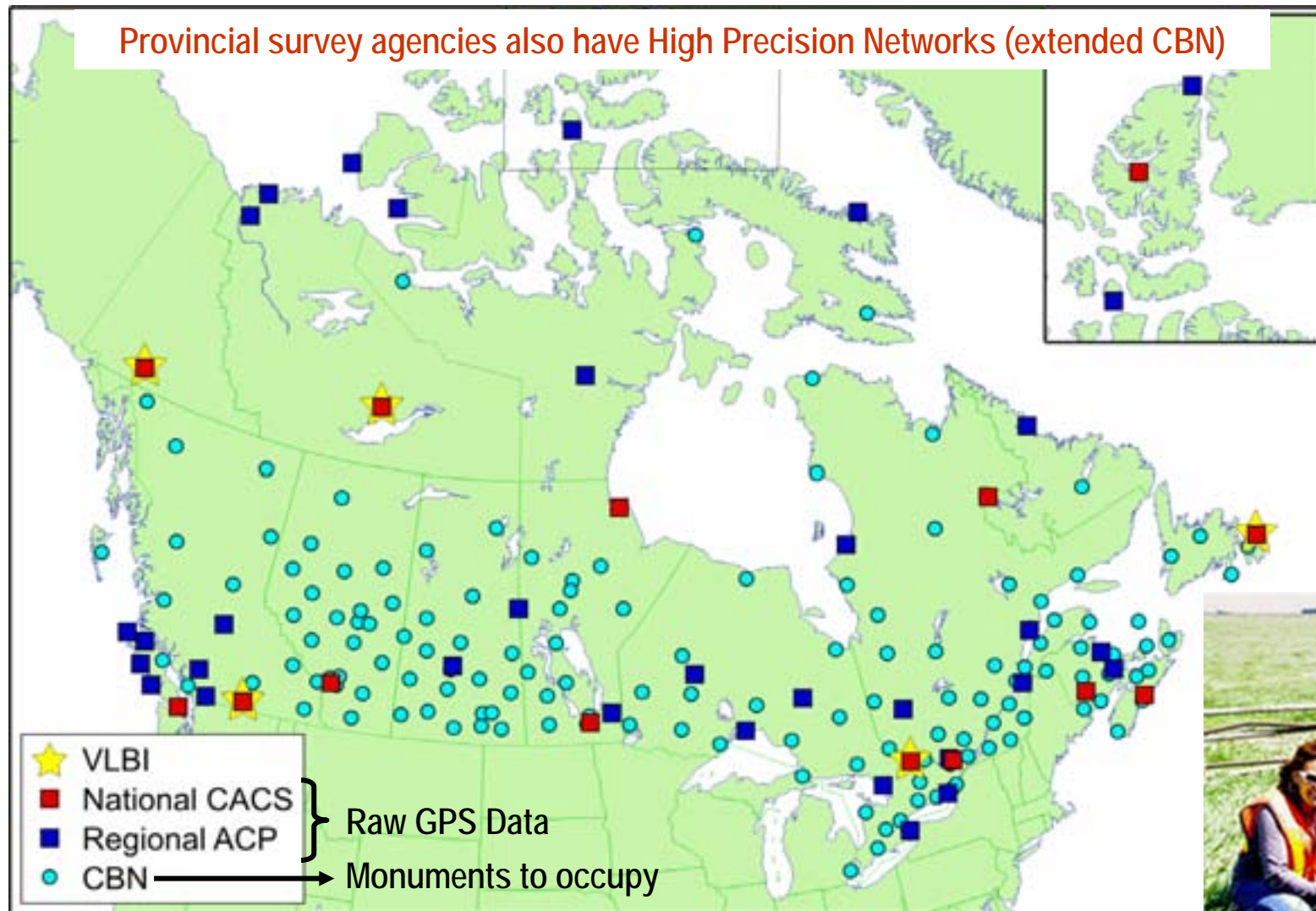
- CSRS-PPP solutions
- Fed/Prov. High Precision Control Markers
- Legal Survey Control Markers with known accuracies
- Active Control Stations (CACS, BCACS)
- Metropolitan Reference Station RTK Suppliers (Cansel CAN-NET, Sokia PowerNET, GVRD)
- Other Reference Station Suppliers

NAD83(CSRS) Federal geodetic control

<http://www.geod.nrcan.gc.ca>



Provincial survey agencies also have High Precision Networks (extended CBN)



Observing at a CBN monument



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Source: Geodetic Survey Division

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Post-Processing CSRS-PPP

<http://www.geod.nrcan.gc.ca>

FREE for GPS users
WORLDWIDE

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- CSRS-PPP
- Users' Guide
- Latest News
(last updated
December 05, 2006)

CSRS-PPP

CSRS-PPP is an on-line application for GPS data post-processing that allows GPS users to submit observation data over the Internet and recover, using precise GPS Orbit and Clock information, enhanced positioning precisions in the Canadian Spatial Reference System (CSRS) and the International Terrestrial Reference Frame (ITRF).

Select one RINEX File:

(Compression: none or zip (.zip), gzip (.gz) or UNIX Compress (.Z))
(Format: RINEX or Compact RINEX (Hatanaka))

Select Mode of Processing: ☒ Static ☐ Kinematic

Select Reference System: ☒ NAD83-CSRS ☐ ITRF

Enter/Change E-Mail to which results will be sent:

File Upload/Processing:

(Note: Processing will start once the upload is completed which may take a few minutes)

Precise
Point
Positioning



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Source: Geodetic Survey Division

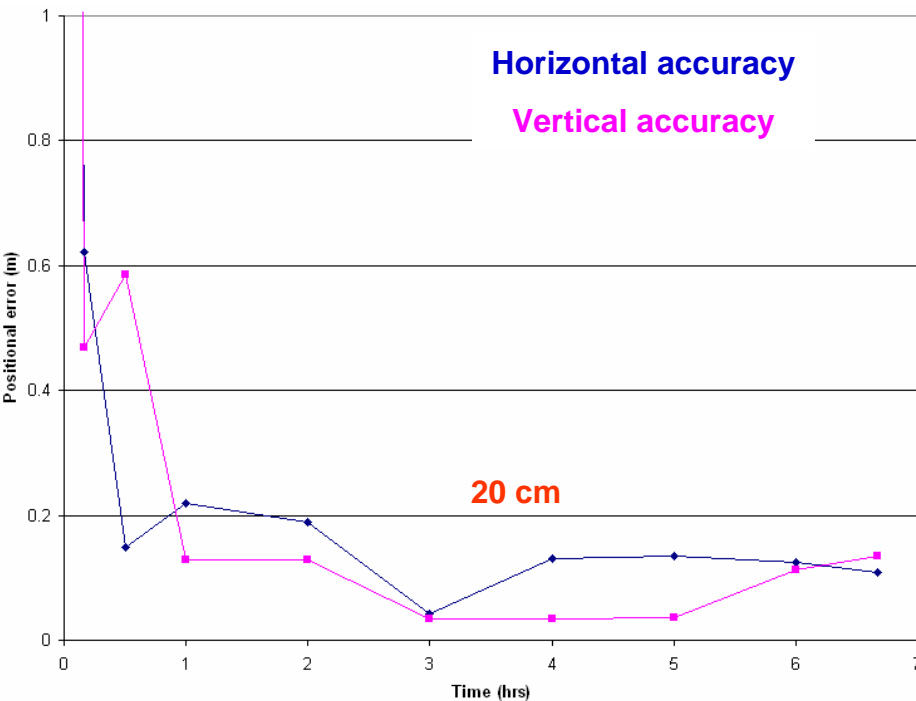
Canada

CSRS-PPP (Static)

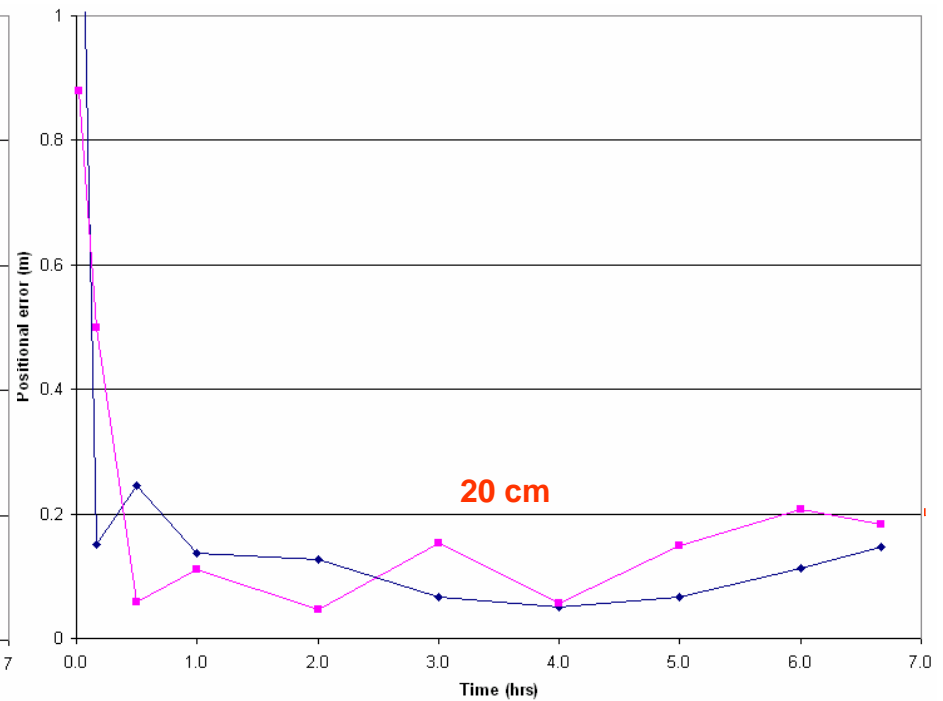
Single-frequency mapping-grade receiver



20 cm accuracy in 2 hours



05/02/01



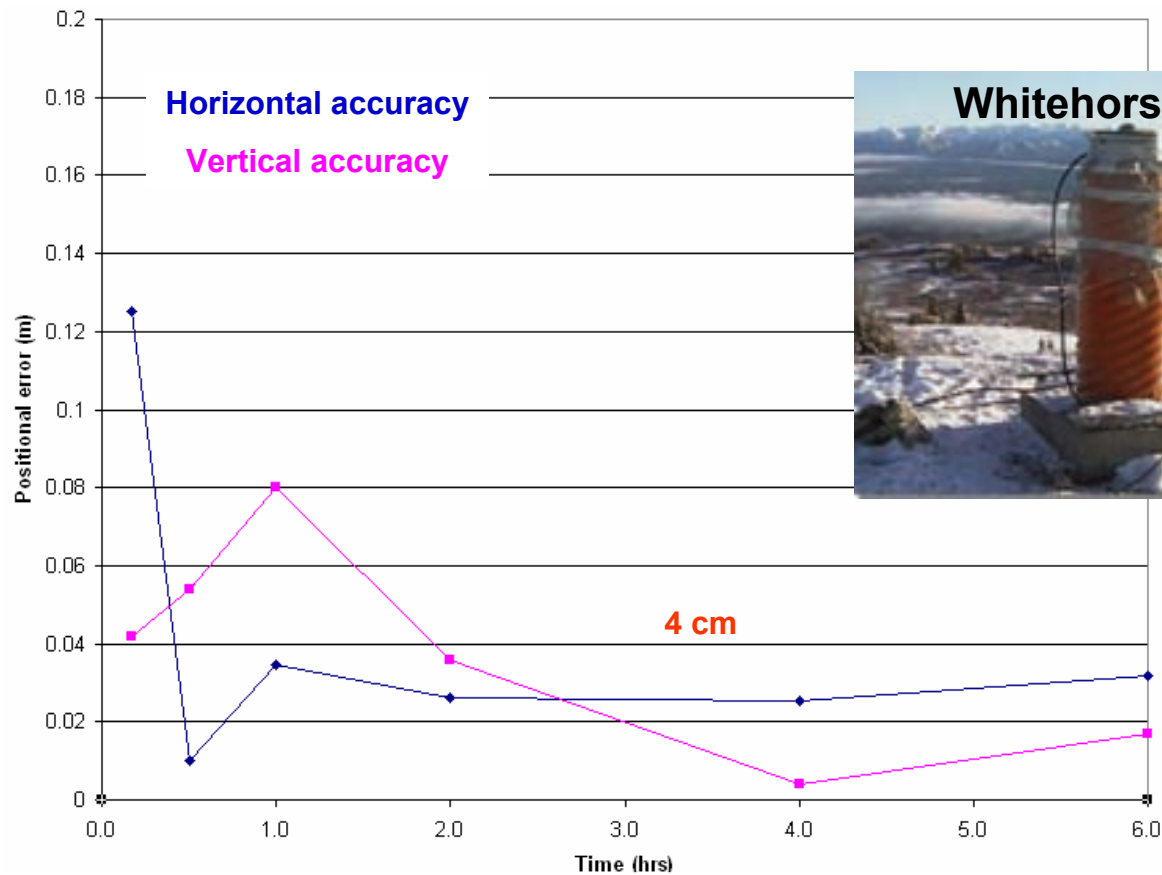
05/04/13

Shirley's Bay Tests, open sky

CSRS-PPP (Static)

Dual-frequency geodetic receiver

4 cm accuracy in 2 hours



30-sec Active Control Point raw data

Geo-referencing Reporting



- List the Coordinates / Heights of the Source Control, Established Control and Key Monuments on the plan
- Show the GPS Control Stations and Network Sketch on the plan
- Accuracy Report; specify the absolute accuracy of the control stations and of the survey

UTM COORDINATES NAD 83(CSRS), ZONE 8, 135° WEST

STATION	NORTHING	EASTING	ORTHOMETRIC ELEVATION	COMBINED SCALE FACTOR
43809	*6672042.82	*516681.02	*693.84	0.999494
43Y052	**6669759.33	**516300.94	657.89	0.999499
1875	6670707.90	516369.66	660.91	0.999499
1874	6670103.07	516432.83	663.55	0.999498
2404	6669778.47	516867.78	657.94	0.999499
2405	6669788.74	517027.92	657.95	0.999499

Coordinates are derived from a least squares adjustment of GPS observations and compass rule adjustments of conventional observations holding the CCCM supplied coordinate values for 43809 fixed in 3D and the CSRS published coordinate values of 43Y052 fixed in 2D.

Elevations are orthometric heights derived from the orthometric height of Geodetic Control Monument "43809".

** denotes values provided by CCCM*

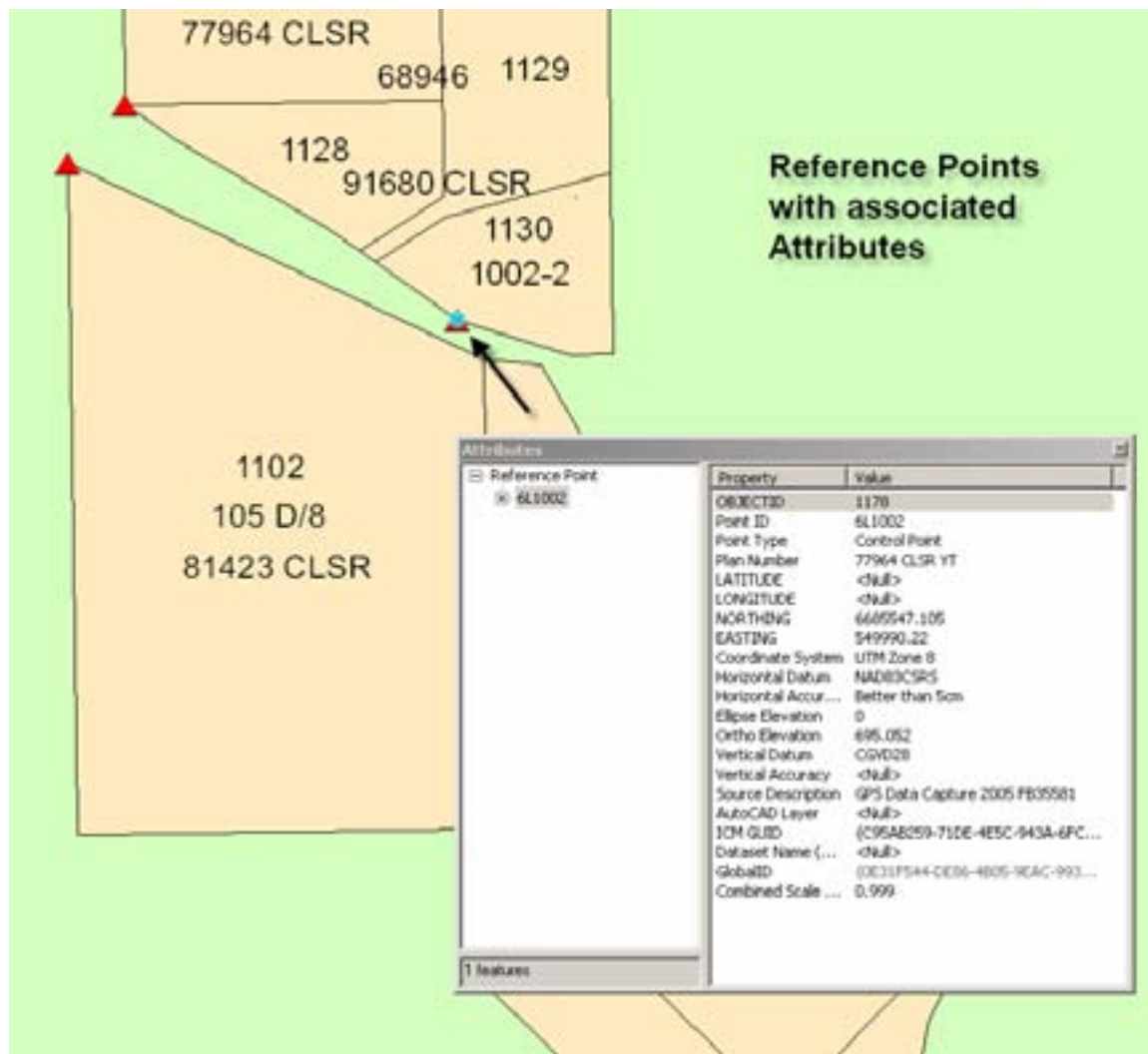
*** denotes published values*

STATION	NORTHING	EASTING	COMBINED SCALE FACTOR
"2L1151,L1008,2007"	6670647.26	516559.95	0.999499
"L1009,R,1981"	6670254.60	516468.86	0.999499
"1L1151,R,2007"	6670306.58	516441.42	0.999499
"L1008,L1009,R,1981"	6670641.02	516389.43	0.999499

Cadastral Data Maintenance



- Input Control Stations as Reference Points in the Cadastral Data
- Reference Points are used to control the cadastral data and track the accuracy of data.



Cadastral Data Maintenance



Improving the cadastral data by:

- Requiring geo-referenced surveys
- Data updates attempt to preserve the relative accuracy of the new survey and existing data while improving the absolute accuracy of the data
- Developing new adjustment techniques and looking at measurement-based systems
- Doing re-builds when there are large updates
- Assess and document the accuracy of the data
- Requiring Digital Spatial Files of Surveys as per New Appendix E5 (Oct 1 effective date)

More Details and Questions?



- Procedural Guide being developed by CCCM; available May 31. Contact any CCCM Office for a Copy of the Guide; also will be on CCCM web site