

# Canadian Geodetic Vertical Datum of 2013 and 1928

## Land Surveys Unit, Geodetic Control

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### Introduction

In Alberta there are two official vertical datums; The Canadian Geodetic Vertical Datum of 2013 (CGVD2013) and the Canadian Geodetic Vertical Datum of 1928 (CGVD28). This fact sheet describes both datums and their implementation in Alberta.

### CGVD2013 Implementation in Alberta

The Canadian Geodetic Vertical Datum of 2013 (CGVD2013) is a geoid-based vertical reference frame (i.e., vertical datum). CGVD2013 is a robust vertical datum that works in conjunction with the Canadian Gravimetric Geoid 2013a (CGG2013a). It is a continuous surface defined everywhere on land and at sea without the need for benchmarks. The distinct advantage of CGVD2013 is its direct compatibility with Global Navigation Satellite Systems (GNSS) and elimination of the benchmarks to establish and maintain the datum. The CGVD2013 elevations for Alberta Survey Control Markers (ASCMs) are derived from the 3-dimensional provincial readjustment (completed in August 2020) where the readjustment was constrained to NAD83(CSRs)v7 Epoch2010 coordinates and CGVD2013 elevations at the Priddis Canadian Active Control Station (CACS) and Canadian Base Network (CBN) pillars across Alberta as well as constraining to various benchmarks with CGVD2013 elevations as derived by the Canadian Geodetic Survey, Natural Resources Canada.

### CGVD28 Implementation in Alberta

CGVD28 is a classical spirit levelling based vertical datum (or vertical reference frame) that is defined by five tidal stations and one benchmark included in the 1928 national vertical adjustment for Canada. While this datum has been in use for close to 100 years in Canada, by virtue of its method of establishment

and propagation, there are significant systematic and cumulative errors across the country as well as high maintenance costs, incompatibility with modern space-based positioning systems, and overall difficulty with integrating to NAD83. Of note, at the local level (lines < 20 km) CGVD28 is reasonably accurate provided the control markers and benchmarks used to maintain it are mathematically and physically stable. However, over longer lines, the accuracy of the datum tends to break down resulting in higher than expected systematic and cumulative errors. CGVD28 was implemented and is maintained in Alberta using a combination of spirit levelling, GNSS and other vertical positioning methods.

### Elevation differences between CGVD2013 and CGVD28

Elevation differences between CGVD2013 and CGVD28 vary throughout Alberta. For example, the nominal elevation difference between the two datums in Edmonton is ~ -0.04 m going from CGVD28 to CGVD2013. Conversely, in Calgary the difference between the two datums is ~+0.12 m going from CGVD28 to CGVD2013. Within Alberta as a whole, the elevations differences between CGVD28 and CGVD2013 range from ~-0.35 m in northeastern Alberta to ~ +0.20 m in the eastern slopes of the Rocky Mountains.

### CGVD2013 and CGVD28 data products

Published CGVD2013 referenced elevations for all Alberta Survey Control Markers (ASCMs) are available via the excel format spreadsheet containing NAD83(CSRs)v7 Epoch 2010 coordinate data. This data is available from the Government of Alberta open data portal at [https://open.alberta.ca/publications/nad83-csrs-v7\\_e2010\\_cgvd2013\\_data-xlsx](https://open.alberta.ca/publications/nad83-csrs-v7_e2010_cgvd2013_data-xlsx). Published CGVD28

elevation information is available from the Spatial Information (SPIN) System of Alberta Land Titles (<https://alta.registries.gov.ab.ca/spinii/logon.aspx>) by downloading the appropriate ASCM ID Card.

## Phase-out of CGVD28

Maintenance of CGVD28 in Alberta is being phased out. With implementation of CGVD2013, CGVD28 will be phased out for use for ASCMs by 2025 at the latest. This approach is in-line with the implementation of NAD83(CSRs)v7 Epoch 2010 and the phase-out of NAD83(Original) for ASCMs. See Fact Sheet No.2 for further information.

## Need more information?

This fact sheet is one of a series published by Lands Division, Land Surveys Unit, Geodetic Control. For more information, please visit our web site or contact us at (780) 422-1291.