AbraPlata Diablillos Case History

Drill Hole Collar Verification through a Comparison of Survey Data Sets

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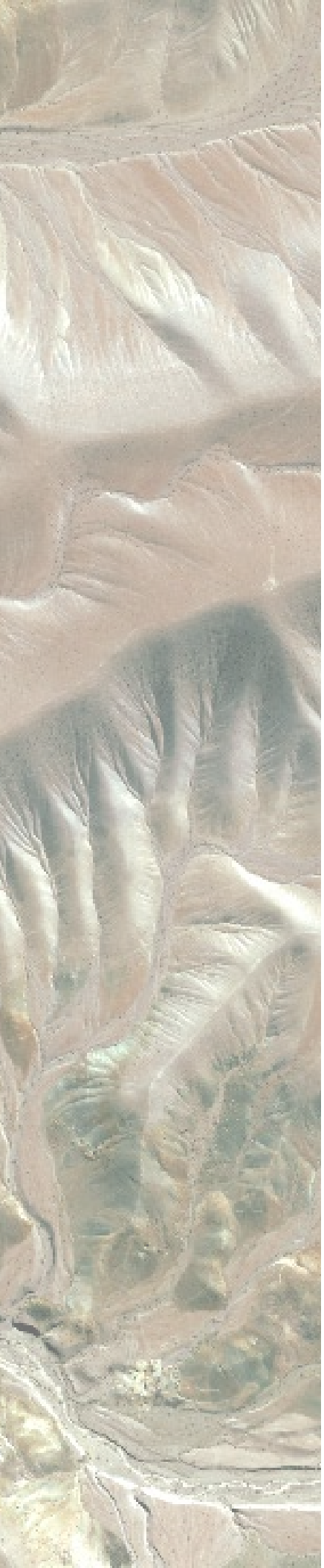

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Abstract

This case history describes the verification of drill hole collar locations by comparing the existing drill collar surveys against an independent PhotoSat satellite survey.

As a result of the comparison, possible or probable errors in the existing drill collar survey data can be identified. This highlights the need for reliable and independent verification of drill collar survey data to identify possible errors or offsets in the surveys of the drill collar locations.

The case study comparison was conducted at the Diablillos project in Argentina. Diablillos is an open pit mining project operated by AbraPlata Resource Corporation. The deposit is an epithermal silver-gold deposit situated 149 km SW of Salta, Argentina.

This case history has been published with the permission of the AbraPlata Resource Corporation. A full report with more detail is also available.

Figure 1: Location of the AbraPlata Diablillos project in Argentina

Introduction

This case history describes the verification of drill hole collar locations by comparing the existing drill collar surveys against an independent PhotoSat satellite survey.

This comparison was conducted at the Diablillos project in Argentina. Diablillos is an open pit mining project operated by AbraPlata Resource Corporation. The deposit is an epithermal silver-gold deposit situated 149 km SW of Salta, Argentina.

Diablillos Ground Survey Data

There were three ground survey data sets for the Diablillos project:

- 39 drill hole collars for the 2017 drilling
- 5 ground reference targets established for the 2017 PhotoSat survey
- 206 drill hole collars for the 2006 drilling

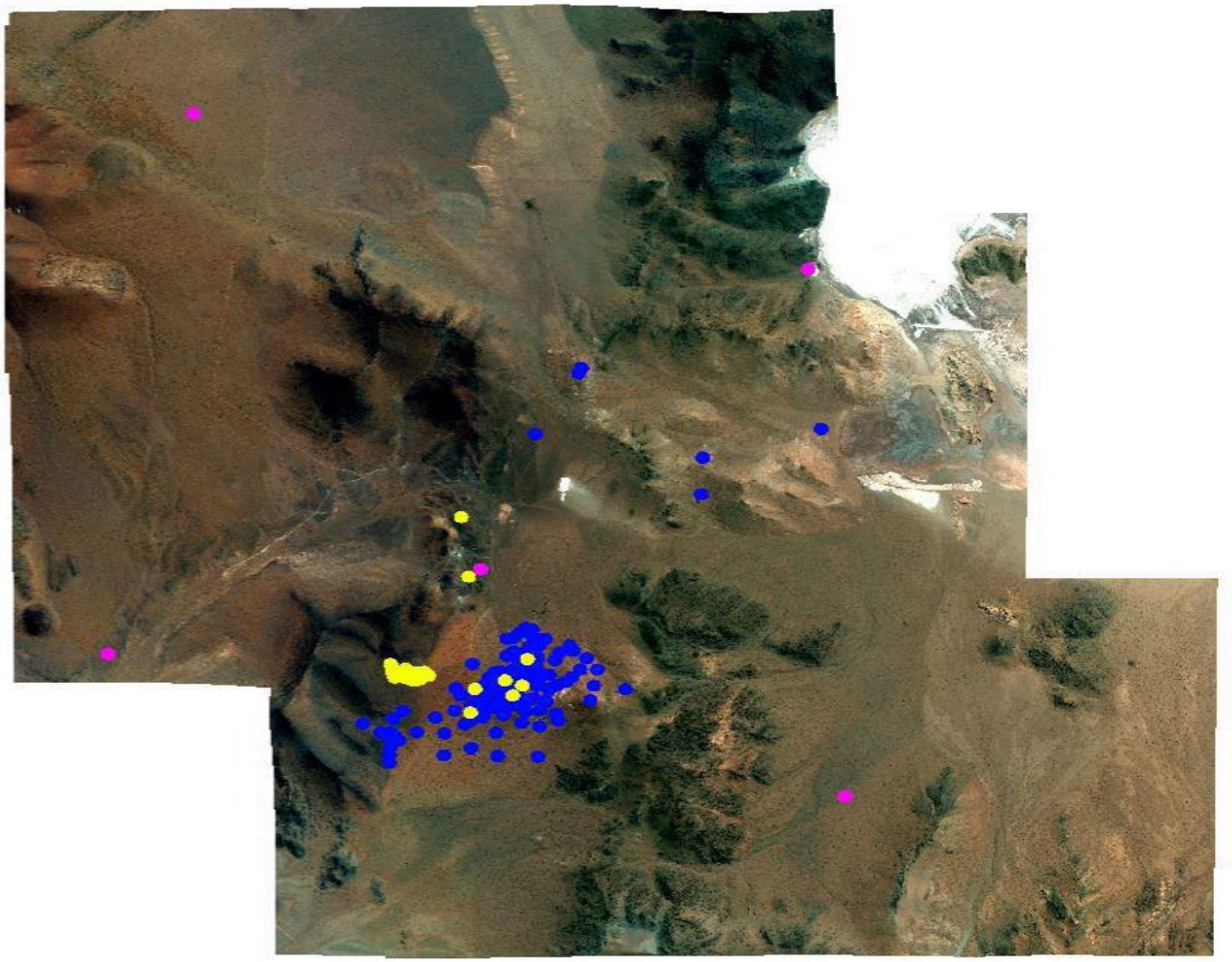


Figure 2: Locations of Diablillos Ground Survey Points

Diablillos Project Projection and Datums

AbraPlata selected UTM Zone 19 South projection (SUTM19), WGS84 horizontal datum and the EGM2008 geoid as the vertical datum for all survey data for the Diablillos project.

Ground Reference Points

The five ground reference points collected by AbraPlata for the Diablillos project were provided in UTM Zone 19 South projection, WGS84 horizontal datum. Heights were given above the WGS84 ellipsoid and the EGM2008 geoid.

2017 Drill Collar Coordinates

The 2017 drill collar coordinates provided by AbraPlata were provided as UTM Zone 19 projection, WGS84 horizontal datum with elevations as heights above the WGS84 ellipsoid. PhotoSat converted the elevations to heights above the EGM2008 geoid.

2006 Drill Collar Coordinates

The 2006 drill collar coordinates were labelled as being in Argentina Zone 3 / POSGAR94 projection. PhotoSat determined that the 2006 drill collars were actually in Argentina Zone 3 / Campo Inchauspe projection. The elevations were heights above the International1924 ellipsoid. PhotoSat converted the data to UTM Zone 19 South, WGS84 horizontal datum, with the elevations as heights above the EGM2008 geoid.

Reference Data Set

The 2017 drill hole collar elevations were selected as the elevation reference data set for the Diablillos Project.

The three Diablillos ground survey data sets have slightly different offsets relative to the PhotoSat survey. The 2017 drill hole survey data has the best statistical match to the PhotoSat survey.

The PhotoSat survey was adjusted vertically to match the mean of the 2017 drill hole elevations. After this adjustment, the standard deviation of the elevation differences between 38 of the 2017 drill hole elevations and the PhotoSat survey is 10cm.

Height Adjustments

The height adjustments of the Diablillos survey data to match to the 2017 drill collar elevations are as follows.

The elevations of the five, 2017 ground reference targets were adjusted 17 cm down to match the elevations of the 2017 drill collars.

The 206, 2006 drill collar elevations were adjusted 29 cm down to match the 2017 drill collar elevations. After this adjustment, 195 of the 2006 drill collar elevations match the PhotoSat survey elevations to a standard deviation of 20 cm.

NOTE: The adjusted coordinates for the drill collars and ground reference points are provided as Excel spreadsheets accompanying this report.

2017 Drill Collars

The standard deviation of the difference between the PhotoSat survey grid and the elevations of the 38, 2017 drill holes is 10 cm.

Figure 3: Locations of 2017 drill collars

Source: Orthophoto with overlaid contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

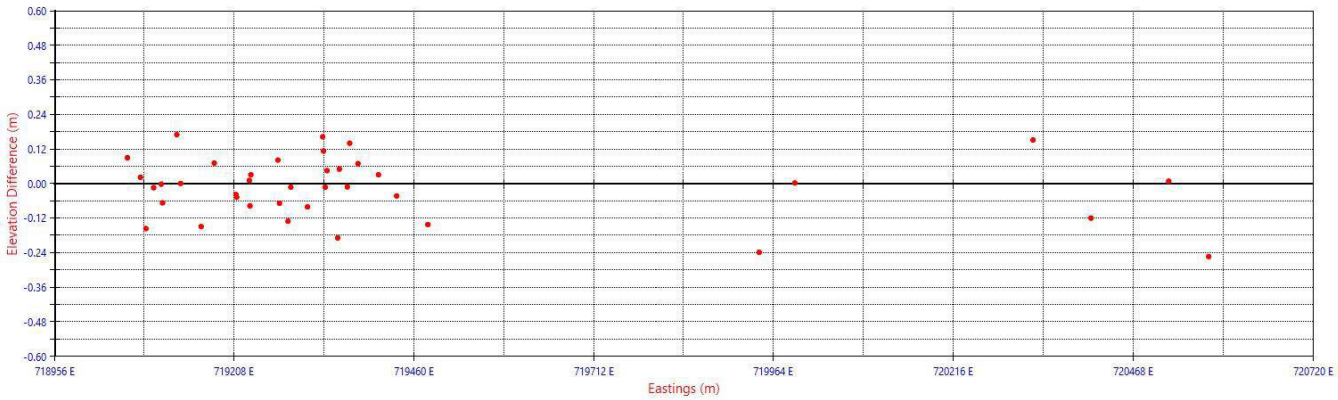


Figure 4: Vertical match between the 2017 drill collars and PhotoSat survey

Source: East-west scatterplot, produced by PhotoSat

Ground Reference Survey Points

The PhotoSat survey was initially matched to these ground reference survey points. Then the elevations were adjusted downward 17 cm to match the elevations of the 2017 drill collars.

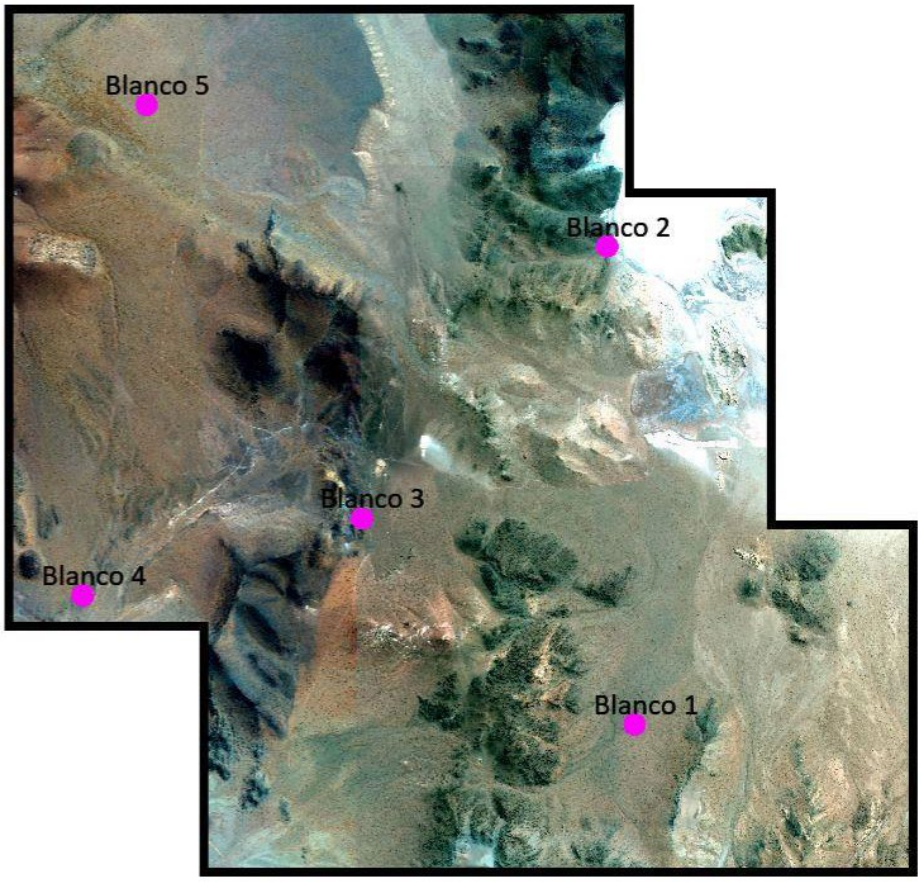


Figure 5: Locations of ground reference survey points

Source: Orthophoto with overlaid contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

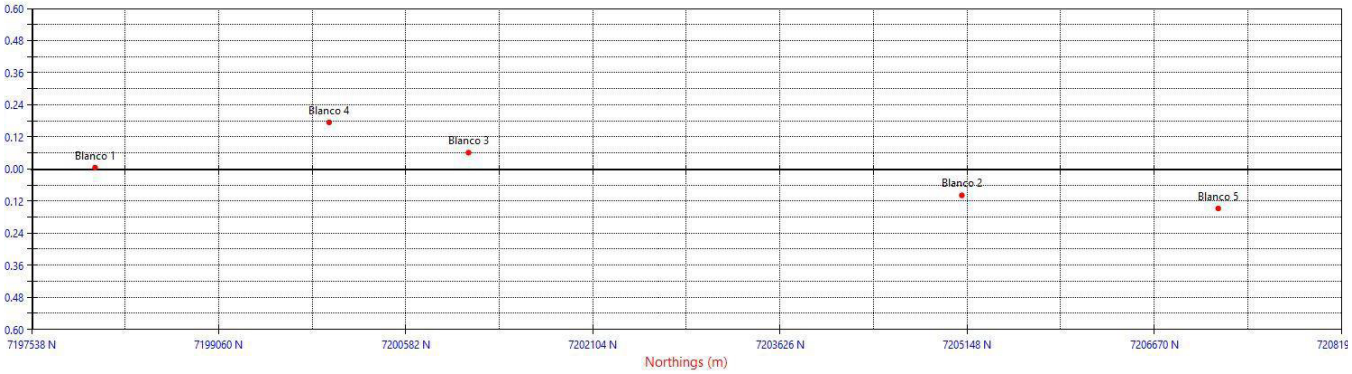


Figure 6: Vertical match between the ground reference points and PhotoSat survey

Source: North-south scatterplot, produced by PhotoSat

2006 Drill Collars

The standard deviation of the difference between the PhotoSat survey grid and the elevations of 195 of the 2006 drill collars is 20 cm.

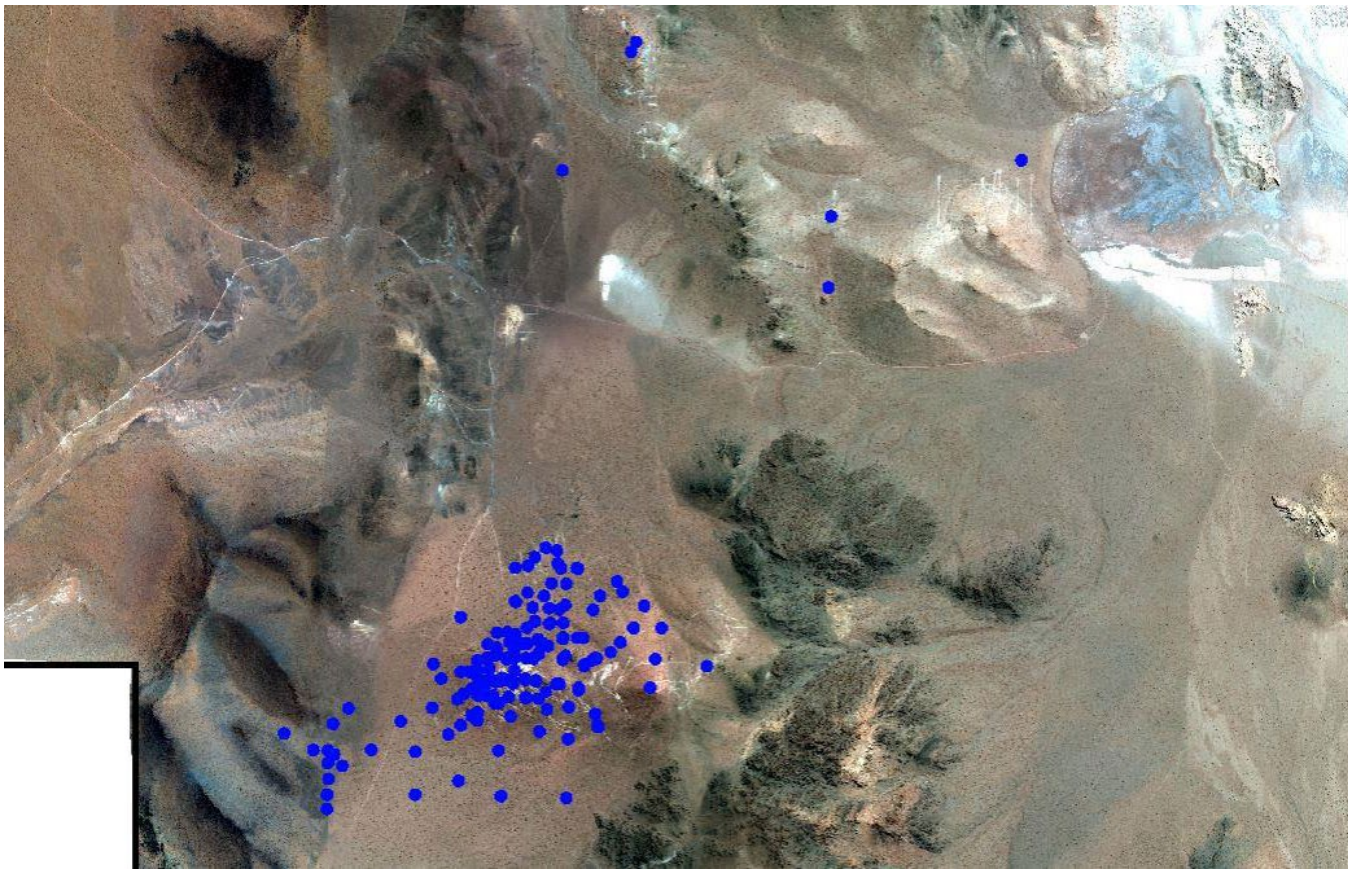


Figure 7: Locations of 2006 drill collars

Source: Orthophoto with overlaid contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

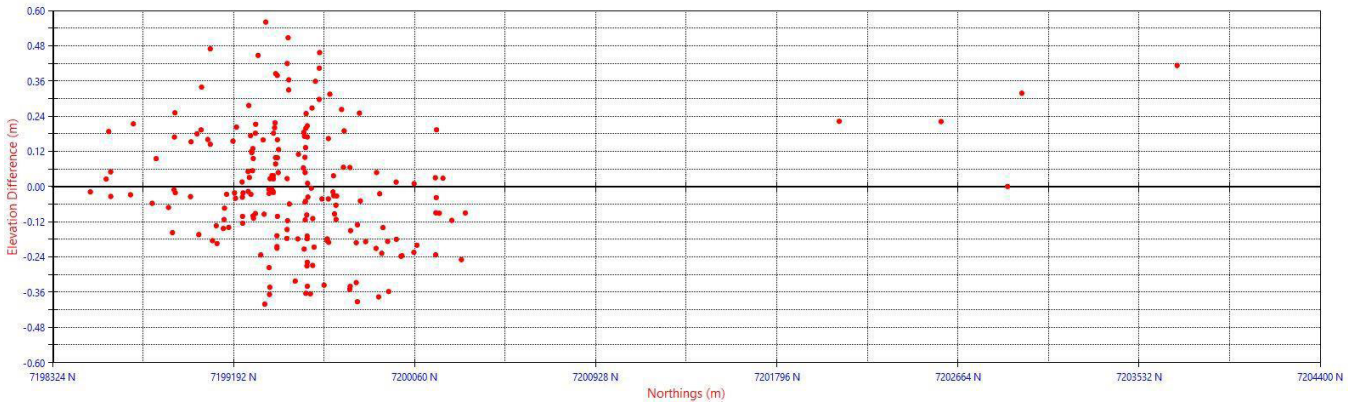


Figure 8: Vertical match between the 2006 drill collars and PhotoSat survey

Source: North-south scatterplot, produced by PhotoSat

Identification of Diablillos Drill Holes with Probable Survey Errors

After the 2006 drill hole collars and the PhotoSat survey elevations were adjusted to match the 2017 drill hole collar elevations, PhotoSat reviewed the survey coordinates of all of the drill holes.

All of the 2017 drill holes appear to have correct horizontal and vertical survey coordinates.

Eleven of the 206, 2006 drill holes had probable survey errors. These are detailed below:

Point ID	Difference from PhotoSat elevation survey (cm)	Remarks
DDH-97-001	-108	probable vertical drill hole collar survey error
DAR-021	-65	probable vertical drill hole collar survey error
DAR-040	-69	possible drill hole collar survey error, possible road building
RC-96-006	-169	probable horizontal drill hole collar survey error
RC-96-007	-76	probable horizontal drill hole collar survey error
RC-96-021	-69	probable vertical / horizontal drill hole collar survey error
RC-96-027	88	probable vertical / horizontal drill hole collar survey error
RC-96-030	-110	probable horizontal drill hole collar survey error
RC-97-054	63	probable vertical drill hole collar survey error
RC-97-063	-98	probable vertical / horizontal drill hole collar survey error
RC-97-090	86	probable vertical drill hole collar survey error

Table 1: List of 2006 drill hole collars with probable survey errors

DDH-97-001

This drill hole collar has a probable vertical survey error.

Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 9: Location of drill hole collar DDH-97-001

DAR-021

This drill hole collar has a probable vertical survey error.

Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 10: Location of drill hole collar DAR-021

DAR-040

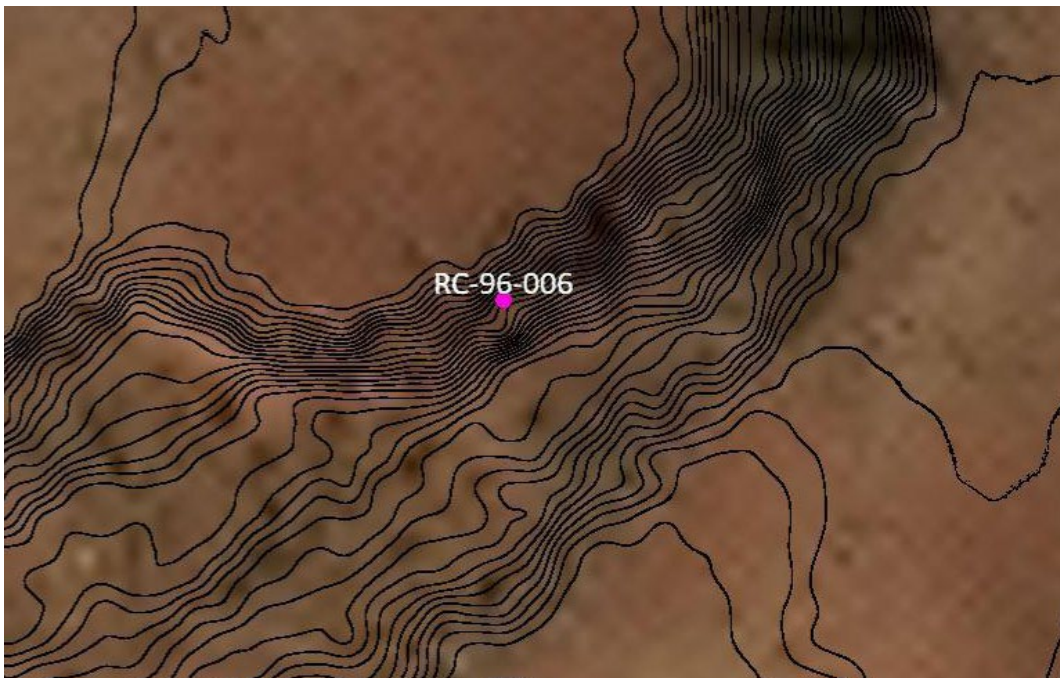
This drill hole collar has a possible survey error or possibly the surface has been changed by road works.

Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 11: Location of drill hole collar DAR-040

RC-96-006

This drill hole collar has a probable horizontal survey error as it would not have been located on a slope.



Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 12: Location of drill hole collar RC-96-006

RC-96-007

This drill hole collar has a probable horizontal survey error as it would not have been located on a slope.

Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 13: Location of drill hole collar RC-96-007

RC-96-021

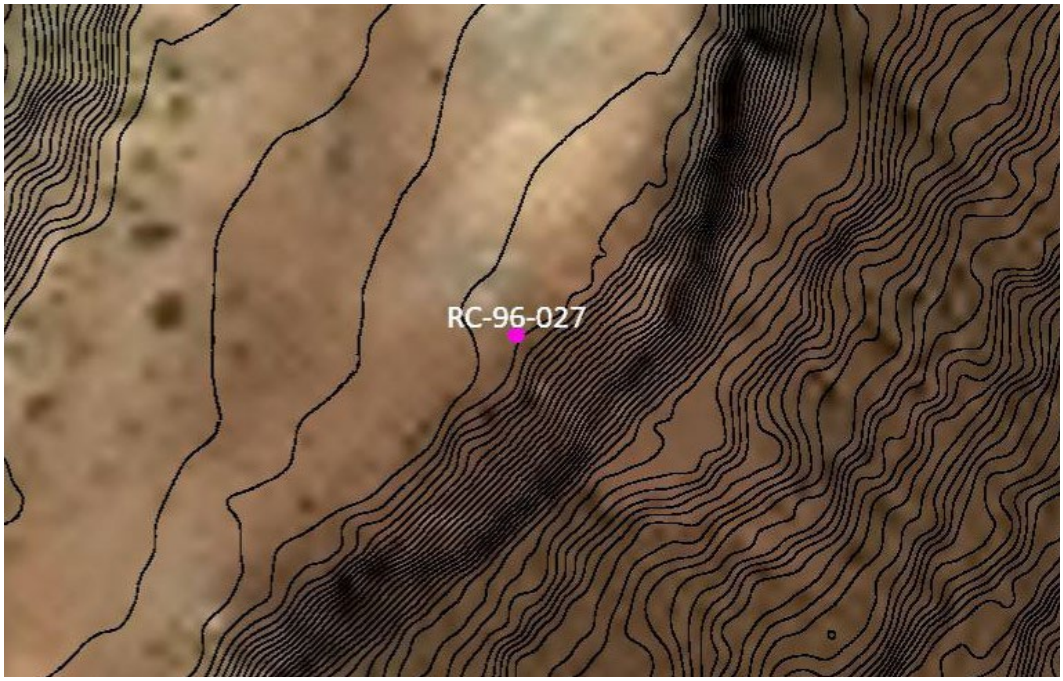
This drill hole collar has a probable vertical / horizontal survey error as it would not have been located on a slope.

Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 14: Location of drill hole collar RC-96-021

RC-96-027

This drill hole collar has a probable vertical / horizontal survey error.



Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 15: Location of drill hole collar RC-96-027

RC-96-030

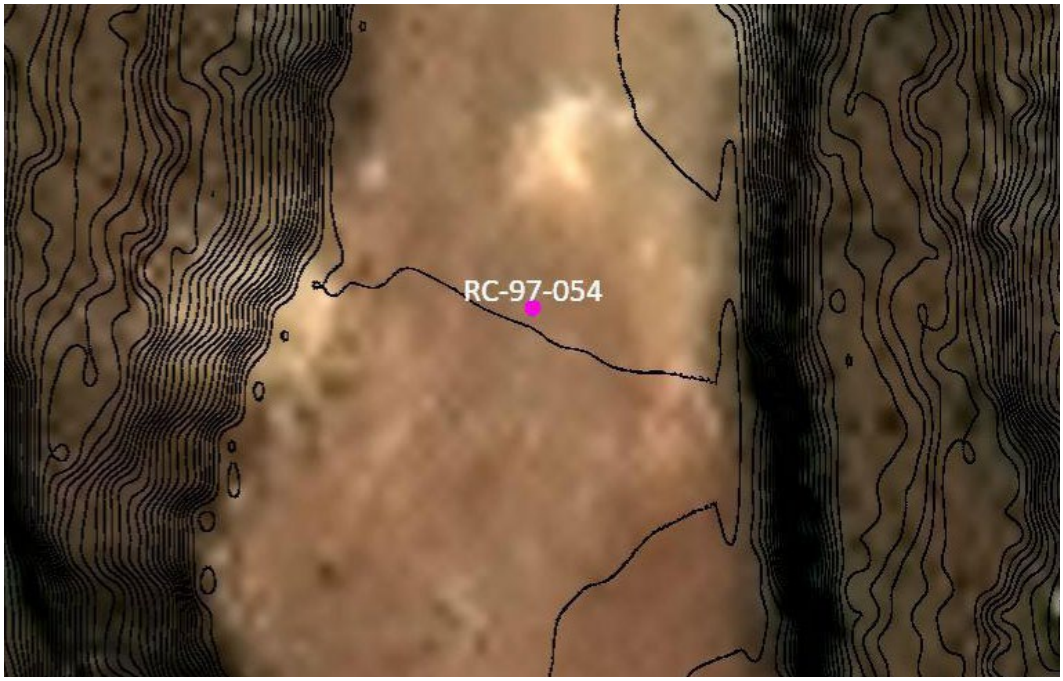
This drill hole collar has a probable horizontal survey error.

Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 16: Location of drill hole collar RC-96-030

RC-97-054

This drill hole collar has a probable vertical survey error.

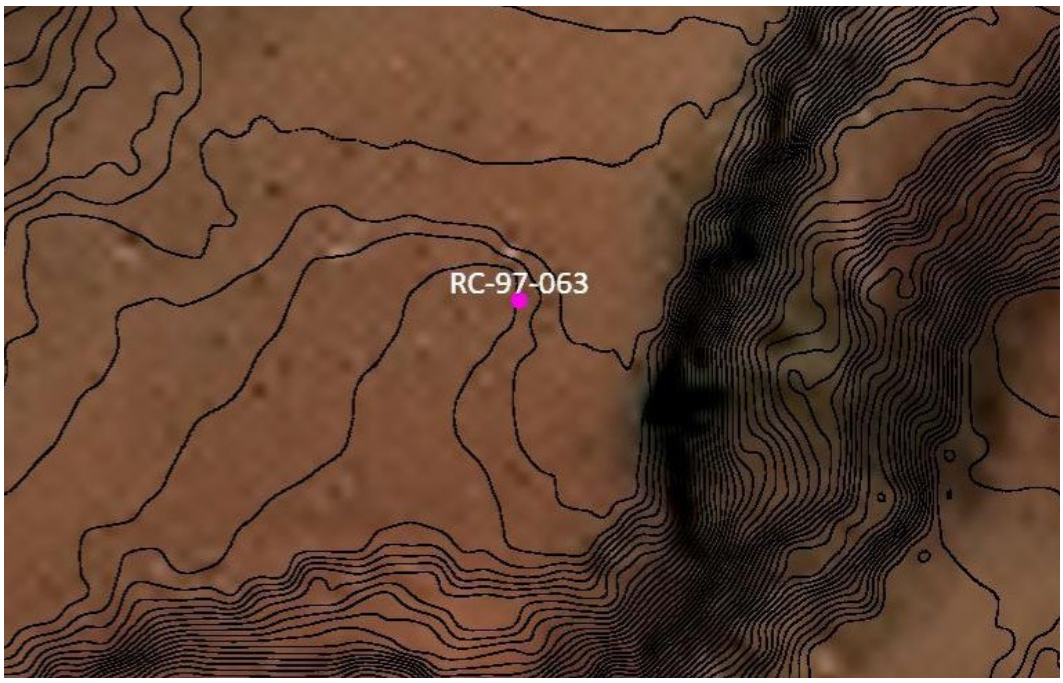


Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 17: Location of drill l hole collar RC-97-054

RC-97-063

This drill hole collar has a probable vertical / horizontal survey error.

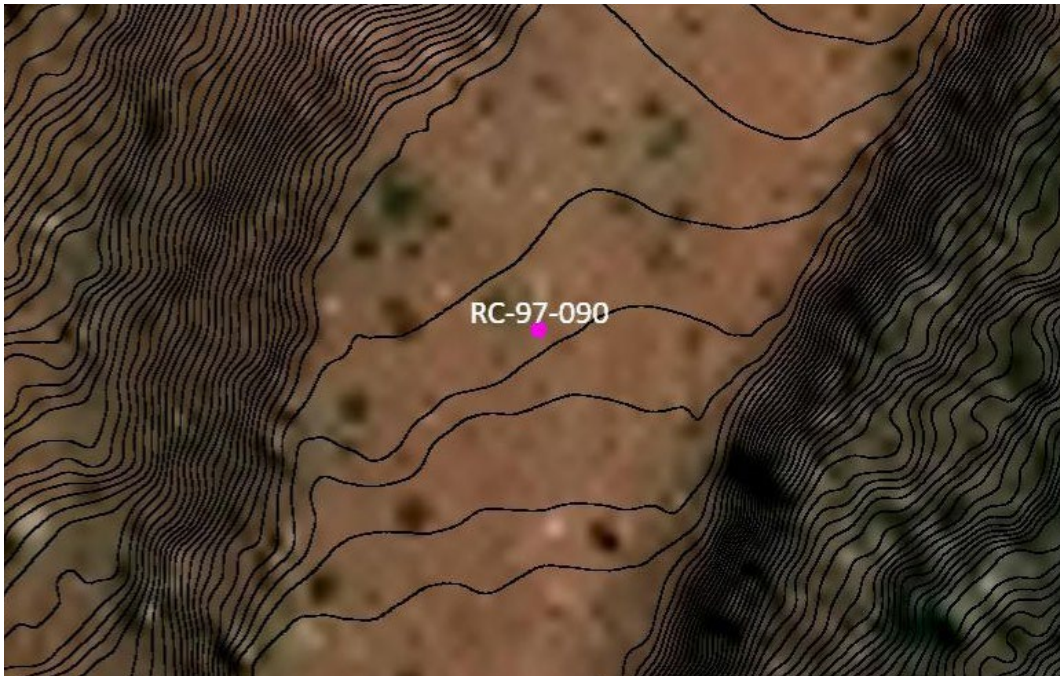


Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 18: Location of drill hole collar RC-97-063

RC-97-090

This drill hole collar has a probable vertical survey error.



Source: Orthophoto with overlaid 20 cm contours, September 12th, 2017, produced by PhotoSat from WV-2 satellite imagery

Figure 19: Location of drill hole collar RC-97-090

Conclusion

Satellite surveying offers a methodology to independently verify the location of drill collars. In many cases this involves the comparison of drill collar data sets against a survey with a chosen set of reference data. The validation of drill collar location increased confidence in the further development of exploration and development projects.

For further information about this case history, contact our technical team at:

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