PHASE 2 INITIAL BOREHOLE DRILLING AND TESTING, IGNACE AREA

WP02 Data Report – Borehole Drilling and Coring for IG_BH02

APM-REP-01332-0240 **November 2020**

Golder Associates Ltd.

nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Nuclear Waste Management Organization
22 St. Clair Avenue East, 4th Floor
Toronto, Ontario
M4T 2S3
Canada

Tel: 416-934-9814
Web: www.nwmo.ca

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GOLDER

REPORT

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WP02 Data Report - Borehole Drilling and Coring for IG_BH02

Submitted to:

Nuclear Waste Management Organization
4th Floor
22 St. Clair Avenue East
Toronto, Ontario, M4T 2S3

Submitted by:

Golder Associates Ltd.
6925 Century Avenue, Suite #100
Mississauga, Ontario, L5N 7K2 Canada

1671632 (3201)

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22 St. Clair Avenue East, Fourth Floor
Toronto, Ontario
M4T 2S3

Client Contact: Martin Sykes and Maria Sánchez-Rico Castejón

Email: msykes@nwmo.ca and msanchez@nwmo.ca

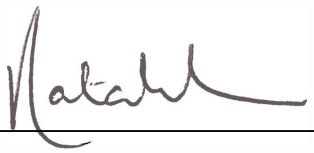
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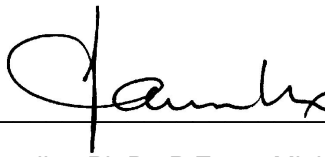
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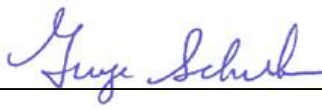
SIGNATURES

Prepared by: 

Natalie Solis, P.Eng. - Geological Engineer

Reviewed by: 

Joe Carvalho, Ph.D., P.Eng. - Mining & Rock Engineering – Principal

Approved by: 

George Schneider, M.Sc., P.Geo. – Project Director - Principal

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1.0 INTRODUCTION

The Initial Borehole Drilling and Testing project in the Wabigoon and Ignace Area, Ontario is part of Phase 2 Geoscientific Preliminary Field Investigations of the NWMO's Adaptive Phased Management (APM) Site Selection Phase.

This project involves the drilling and testing of the first of three deep boreholes within the northern portion of the Revell batholith. The second drilled borehole, IG_BH02, is located a direct distance of approximately 21 km southeast of the Wabigoon Lake Ojibway Nation and a direct distance of 44 km northwest of the Town of Ignace. Access to the IG_BH02 drill site is via Highway 17 and primary logging roads, as shown on Figure 1.

The project was carried out by a team led by Golder Associates Ltd. (Golder) on behalf of the NWMO. This report describes the methodology, activities and results for Work Package 2 (WP02): Borehole Drilling and Coring for IG_BH02, which includes: borehole drilling, coring and casing installation, borehole deviation, and drilling fluid management and use of tracers.

2.0 BACKGROUND INFORMATION

2.1 Geological Setting

The approximately 2.7 billion year old Revell batholith is located in the western part of the Wabigoon Subprovince of the Archean Superior Province. The batholith is roughly elliptical in shape trending northwest, is approximately 40 km in length, 15 km in width, and covers an area of approximately 455 km^2. Based on geophysical modelling, the batholith is approximately 2 km to 3 km thick through the center of the northern portion (SGL 2015). The batholith is surrounded by supracrustal rocks of the Raleigh Lake (to the north and east) and Bending Lake (to the southwest) greenstone belts (Figure 2).

IG_BH02 is located within an investigation area of approximately 19 km^2 in size, situated in the northern portion of the Revell batholith. Bedrock exposure in the area is generally very good due to minimal overburden, few water bodies, and relatively recent logging activities. Ground elevations generally range from 400 to 450 m above sea level. The ground surface broadly slopes towards the northwest as indicated by the flow direction of the main rivers in the area. Local water courses tend to flow to the southwest towards Mennin Lake (Figure 1).

Four main rock units are identified in the supracrustal rock group: mafic metavolcanic rocks, intermediate to felsic metavolcanic rocks, metasedimentary rocks, and mafic intrusive rocks (Figure 2). Sedimentation within the supracrustal rock assemblage was largely synvolcanic, although sediment deposition in the Bending Lake area may have continued past the volcanic period (Stone 2009; Stone 2010a; Stone 2010b). All supracrustal rocks are affected, to varying degrees, by penetrative brittle-ductile to ductile deformation under greenschist- to amphibolite-facies metamorphic conditions (Blackburn and Hinz 1996; Stone et al. 1998). In some locations, primary features, such as pillow basalt or bedding in sedimentary rocks are preserved, in other locations, primary relationships are completely masked by penetrative deformation. Uranium-lead (U-Pb) geochronological analysis of the supracrustal rocks produced ages that range between 2734.6 +/-1.1 Ma and 2725 +/-5 Ma (Stone et al. 2010).

Three main suites of plutonic rock are recognized in the Revell batholith, including, from oldest to youngest: a Biotite Tonalite to Granodiorite suite, a Hornblende Tonalite to Granodiorite suite, and a Biotite Granite to Granodiorite suite (Figure 2). Plutonic rocks of the Biotite Tonalite to Granodiorite suite occur along the southwestern and northeastern margins of the Revell batholith. The principal type of rock within this suite is a white to grey, medium-grained, variably massive to foliated or weakly gneissic, biotite tonalite to granodiorite. One sample of foliated and medium-grained biotite tonalite produced a U-Pb age of 2734.2+/-0.8 Ma (Stone et al.

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2010). The Hornblende Tonalite to Granodiorite suite occurs in two irregularly-shaped zones surrounding the central core of the Revell batholith. Rocks of the Hornblende Tonalite to Granodiorite suite range compositionally from tonalite through granodiorite to granite and also include significant proportions of quartz diorite and quartz monzodiorite. One sample of coarse-grained grey mesocratic hornblende tonalite produced a U-Pb age of 2732.3+/-0.8 Ma (Stone et al. 2010). Rocks of the Biotite Granite to Granodiorite suite underlie most of the northern, central and southern portions of the Revell batholith. Rocks of this suite are typically coarse-grained, massive to weakly foliated, and white to pink in colour. The Biotite Granite to Granodiorite suite ranges compositionally from granite through granodiorite to tonalite. A distinct potassium (K)-Feldspar Megacrystic Granite phase of the Biotite Granite to Granodiorite suite occurs as an oval-shaped body in the central portion of the Revell batholith (Figure 2). One sample of coarse-grained, pink, massive K-feldspar megacrystic biotite granite produced a U-Pb age of 2694.0+/-0.9 Ma (Stone et al. 2010).

The bedrock surrounding IG_BH02 is composed mainly of massive to weakly foliated felsic intrusive rocks that vary in composition between granodiorite and tonalite, and together form a relatively homogeneous intrusive complex. Bedrock identified as tonalite transitions gradationally into granodiorite and no distinct contact relationships between these two rock types are typically observed (SRK and Golder 2015; Golder and PGW 2017). Massive to weakly foliated granite is identified at the ground surface to the northwest of the feldspar-megacrystic granite. The granite is observed to intrude into the granodiorite-tonalite bedrock, indicating it is distinct from, and younger than, the intrusive complex (Golder and PGW 2017).

West-northwest trending mafic dykes interpreted from aeromagnetic data extend across the northern portion of the Revell batholith and into the surrounding greenstone belts. One mafic dyke occurrence, located to the northwest of IG_BH01, is approximately 15-20 m wide (Figure 2). All of these mafic dykes have a similar character and are interpreted to be part of the Wabigoon dyke swarm. One sample from the same Wabigoon swarm produced a U-Pb age of 1887+/-13 Ma (Stone et al. 2010), indicating that these mafic dykes are Proterozoic in age. It is assumed based on surface measurements that these mafic dykes are sub-vertical (Golder and PGW 2017).

Long, narrow valleys are located along the western and southern limits of the investigation area (Figure 1). These local valleys host creeks and small lakes that drain to the southwest and may represent the surface expression of structural features that extend into the bedrock. A broad valley is located along the eastern limits of the investigation area and hosts a more continuous, un-named water body that flows to the south. The linear and segmented nature of this waterbody's shorelines may also represent the surface expression of structural features that extend into the bedrock.

Regional observations from mapping have indicated that structural features are widely spaced (typical 30 to 500 cm spacing range) and dominantly comprised of sub-vertical joints with two dominant orientations, northeast and northwest trending (Golder and PGW 2017). Interpreted bedrock lineaments generally follow these same dominant orientations in the northern portion of the Revell batholith (Figure 2; DesRoches et al. 2018). Minor sub-horizontal joints have been observed with minimal alteration, suggesting they are younger and perhaps related to glacial unloading. One mapped regional-scale fault, the Washeibemaga Lake fault, trends east and is located to the west of the Revell batholith (Figure 2). Ductile lineaments, also shown on Figure 2, follow the trend of foliation mapped in the surrounding greenstone belts. Additional details of the lithological units and structures found at surface within the investigation area are reported in Golder and PGW (2017).

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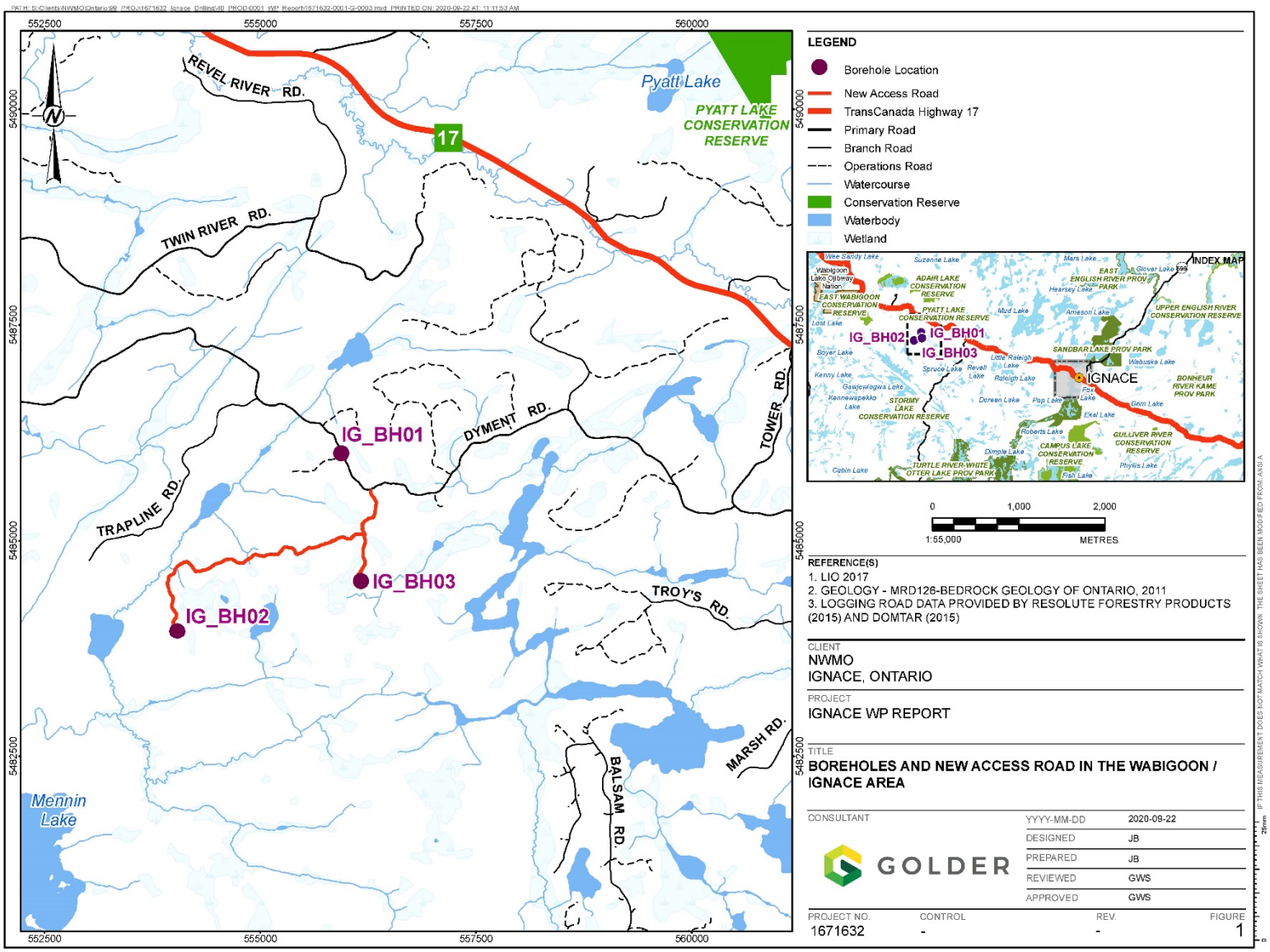


Figure 1: Location of IG_BH02 in Relation to the Wabigoon / Ignace Area

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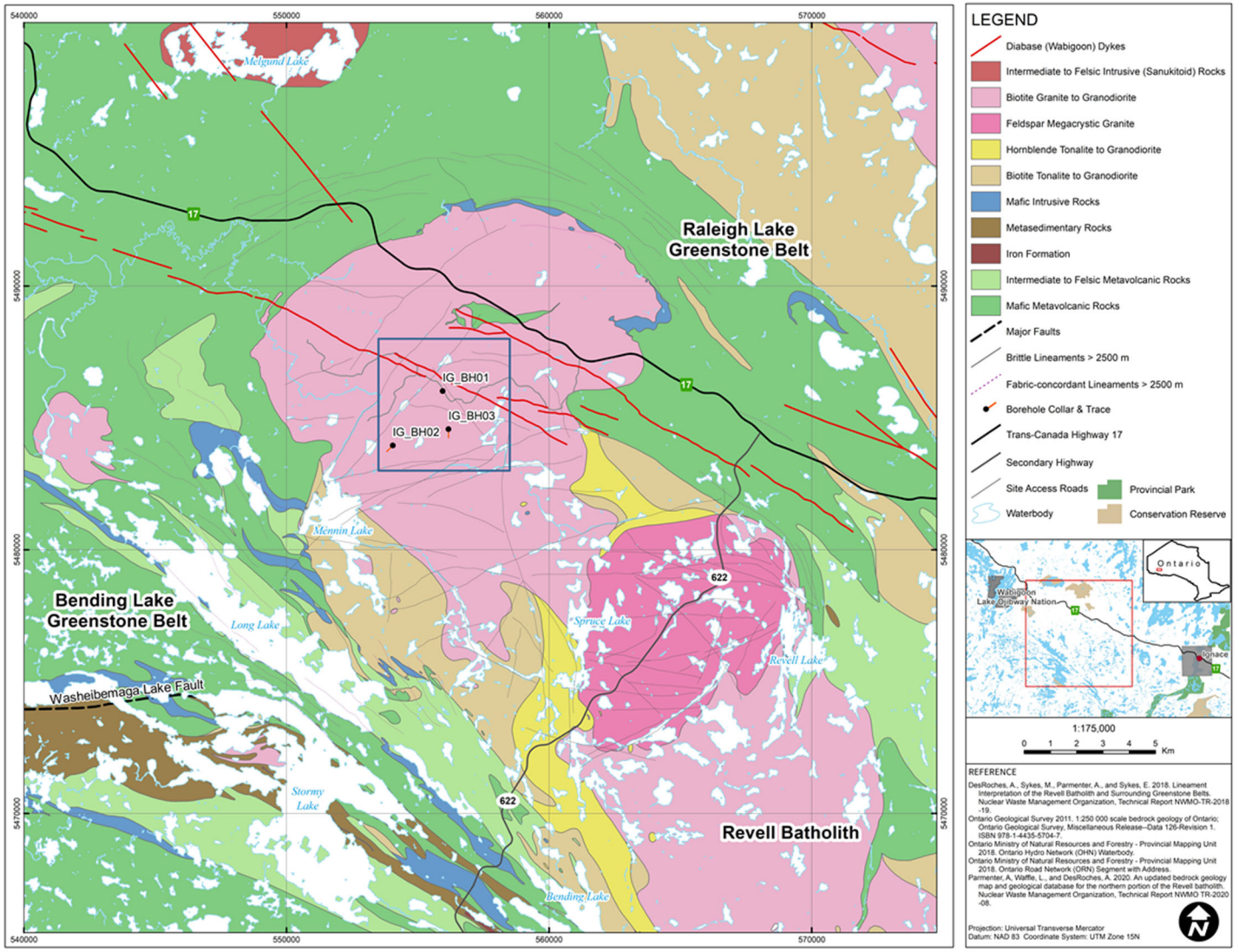


Figure 2: Geological setting and location of boreholes IG_BH01, IG_BH02 and IG_BH03 in the northern portion of the Revell batholith

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2.2 Technical Objectives

The technical objectives of the borehole drilling, coring and casing installation activities are:

- The collection of high quality bedrock core, which will allow geological and geotechnical core logging and the collection of core samples. Core samples will be used for laboratory testing programs to characterize the bedrock environment;
- To provide opportunity to complete supplementary studies such as borehole geophysical logging, hydraulic testing and opportunistic groundwater sampling while drilling; and
- To provide stable borehole walls to allow for future testing and monitoring.

The main objectives of the Drilling Fluid Management and Use of Tracers activities are:

- Optimize drilling to minimize borehole deterioration;
- Effectively remove any cuttings to maintain efficient drilling; and
- Trace the drilling fluids using a fluorescein tracer and measure fluid parameters (e.g. temperature, density and electric conductance) in order to recognize drilling fluid contamination of groundwater (to be discussed in the WP07 Report – Opportunistic Groundwater Sampling for IG_BH02, Golder 2020a) and porewater extraction samples (to be discussed in the WP04C Report – Porewater Extraction and Analysis for Petrographic Analysis for IG_BH02, Golder 2020b).

3.0 DESCRIPTION OF ACTIVITIES

Activities were overseen by Lead Contractor Golder Associates with Rodren Drilling Ltd. (Rodren), based in Winnipeg, Manitoba, contracted by Golder to carry out the drilling for IG_BH02.

Permission to drill was obtained from the Ministry of Natural Resources and Forestry (MNRF) on November 26th, 2018 with formal notification given to Golder via email from the NWMO on November 27th, 2018 with the understanding that drilling and testing would begin in the summer of 2019, following the construction of an access road and the drill site. Drilling and testing of IG_BH02 commenced immediately following completion of WP02 activities at IG_BH03.

Drilling was carried out on a 24 hour, 7 days per week basis. Day shifts ran from 7 am to 7 pm, with night shifts from 7 pm to 7 am. A driller and helper were on site for each day and night shift, and a drilling foreman was typically present during the day shifts, or as required. A Golder drilling supervisor was present on site for all drilling activities. Both the Golder drilling supervisor and the Golder core logger from WP03 followed the same shift schedule as the drillers. Shifts were shortened to manage fatigue up to twice per week where the number of site hours was reduced to 20 for a 24 hour period, that is, a 10 hour day shift and a 10 hour night shift. The Golder site supervisors (WP01) were on site during the 4 hour window, however the drillers also adhered to the fatigue management schedule. When the Golder site supervisor was not on site, the drilling supervisor took over this role. This was documented in the supervisor sign-in sheet located in the Golder trailer at the site entrance.

The Golder drilling supervisor's responsibilities were divided between two main activities: (1) Drilling, Coring and Casing (2) Drilling Fluid Management and Use of Tracers. These activities included the following actions:

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Drilling, Coring and Casing

- Verifying drill rig setup;
- Tracking and recording borehole deviation;
- Supervising installation and cementing casing(s);
- Tracking depth of the borehole;
- Monitoring drilling parameters during drilling; and
- Managing drill cutting collection and disposal.

Drilling Fluid Management and Use of Tracers

- Testing all fresh source water added to the drill fluid system;
- Monitoring drill fluid parameters and volume changes during drilling;
- Identifying any triggers for an opportunistic ground water sample;
- Collecting and archiving drill fluid samples every 50m;
- Supervising borehole flushing prior to geophysical survey (WP05); and
- Recording observed drilling parameters and measured volume changes, drill fluid parameters and borehole depth for each run.

3.1 Health and Safety

The Ignace drilling and testing program conformed to applicable health and safety standards for the duration of the program. A comprehensive “pre-drill” drill rig inspection was originally completed by Rodren prior to the start of coring IG_BH03 and was updated on September 23, 2019 prior to coring of IG_BH02. This inspection included the following checks:

- Emergency switches are in working order;
- Equipment and protective guards are in place;
- Cables, chains, pulleys, cable winches, latches / lifting devices are in proper working order;
- Drill string (coring rods) are manufacturer recommended;
- Mast is unmodified from manufacturer and regularly inspected;
- Drill controls are appropriate and free from obstructions;
- Hydraulic lines are secure and not bent or pinched;
- Pump lines (water hoses) are in good condition with whip checks, where required;
- Fire prevention supplies are present;
- Exhaust piping is directed appropriately;
- Fuel is properly stored; and

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- Other general items including maintenance logs to confirm inspections were available.

Rodren continued to complete daily rig inspections as well as monthly rig inspections to ensure that rig safety was maintained throughout the drilling program.

Once drilling commenced, a Casella Sound Level Meter was used to establish zones where hearing protection was required, that is, all areas with an equivalent sound exposure level exceeding 83 dBA (O.Reg. 851/139) due to the prolonged exposure of 12-hour shifts. The area inside of the drill rig and surrounding support shacks was established as requiring hearing protection, as well as the area adjacent to the light tower close to site entrance.

An RKI Model GX-2012, 4-Gas Monitor was installed in the drill rig and used to monitor for levels of oxygen, carbon monoxide, hydrogen sulphide and combustible gases during drilling. The gas monitor was bump checked by the Golder site supervisor daily. Two batteries were available for the unit to eliminate absences during charging. No exceedances of safe limits of these gases were encountered during drilling of IG_BH02.

Health and safety toolbox meetings were held at the beginning of each shift (day and night), where attendance of all site personnel was mandatory. The meeting reviewed all activities to be completed during that shift, and identified the hazards and mitigation efforts to reduce risk of injury. Any visitors on site, who did not participate in the toolbox meetings, were required to review and acknowledge the toolbox report before allowed to perform work on site.

3.2 Quality Confirmation

Cross-shifts between day and night shift were carried out to transfer knowledge and information about the previous shift activities. These were typically 10-15 minutes, but longer when more specific knowledge needed to be relayed. When the crews did not cross on site, during shortened fatigue management shifts, the knowledge transfer was done in Ignace or over the phone. Cross-shifts were also carried out between crews switching rotations and typically involved spending an entire shift together on site to ensure procedures were kept consistent.

Quality Confirmation was completed for each 24-hour period by the drilling supervisors and included tracking of the drilled depth at the start and end of each day and night shift, verification of the drilling parameters recorded, verification and comments for drill fluid parameter triggers and volume loss observations, as well as drill fluid samples collected, and borehole orientation surveys conducted.

Drilling supervisors ensured all tools were properly calibrated before the start of the project and performed daily calibration checks of all instruments to be used at the start of each 24-hour period. If a tool not anticipated to be used became necessary during the shift, it was calibration checked as required prior to use.

4.0 SUMMARY OF DRILLING, CORING AND CASING

Drilling of IG_BH02 commenced on September 23, 2019 and was completed on November 26, 2019. The overall drilling progress and key activities are shown on Figure 3.

The borehole was advanced to 1000.12 metres below ground surface (mbgs) drilled depth (along hole) based on the rod count and measured stickup of the drill rods on the final drill run. The final depth of IG_BH02, based on measurement of the length of retrieved core, was 1000.41 mbgs (along hole). This discrepancy in final drilled depth is not typical, and is speculated to be related to settlement of the drill rig / pad on surface after a two day period of above freezing temperatures. The measured depth from core logging was observed to gradually get

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ahead of the measured depth from drilling during coring of the final approximately 60 m of the borehole. The core run lengths, which were measured as greater than 3 m in length, were also verified by WP02 staff on site, and no instances of lost or broken core were logged during this period, with the ends and beginnings of the drill runs matching. In addition, drill fluid was observed to accumulate in the lower sump, suggesting the upper sump collecting the drill fluid return or the near surface casing became compromised during this period, potentially due to the drill rig moving with respect to the casing. The final true vertical depth of the borehole, calculated using the measured actual orientation of the borehole and the final depth based on the retrieved core, is 883.36 mgbs. Further details of the borehole orientation are discussed in Section 4.5.

Coring progress over the first 400 m of the borehole was intermittent due to frequent WP07 ground water sample events and attempts. The overall progress is shown graphically on Figure 3, and the daily progress by shift is shown on Figure 4. The maximum meterage attained for a single shift was 21.05 m on November 4, 2019 night shift, but the average rate per shift was 12.52 m (excluding WP07 sampling activities, conductor and surface casing installation and cementing, and permeable zone cementing).

Drilling of IG_BH02 was completed on the night shift of November 25, 2019. This was followed by the final borehole Reflex SPRINT-IQ™ gyro survey, borehole flushing, rod removal and preparation for geophysical logging. The core logging and sampling supplies were packed and shipped off-site. Equipment related to WP02 was not demobilized from site upon completion of drilling as most of the sampling and monitoring supplies were required for continued monitoring of drilling fluid during WP05 and WP06 activities, as well as any potential WP07 opportunistic groundwater sample attempts that may have been carried out during WP06 – Hydraulic Testing.

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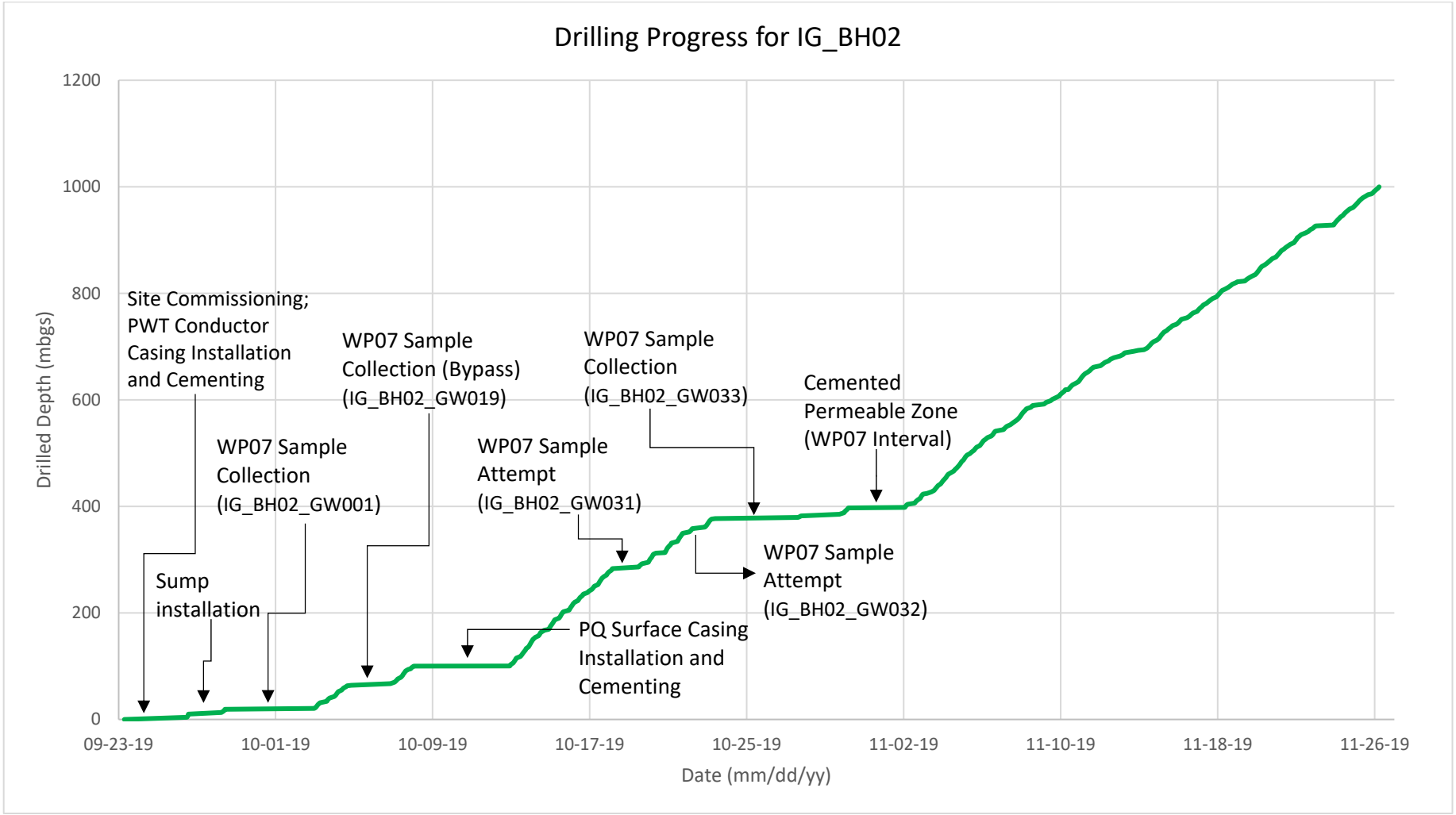


Figure 3: IG_BH02 Drilling Progress and Activities

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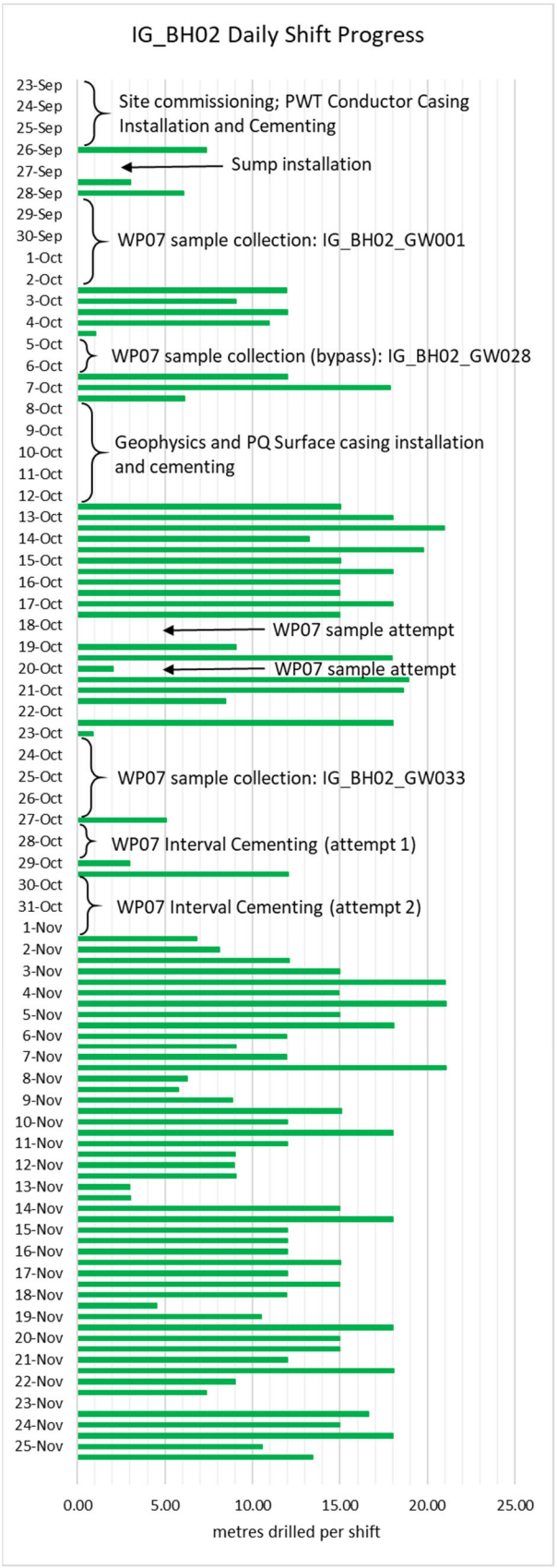


Figure 4: IG_BH02 Daily Shift Progress

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4.1 Drilling Details

4.1.1 Drill Rig Setup

A skid mounted Discovery Diamond Drill model EF-75 12 HH was used for the program, set up with containment to minimize drill fluid entering the environment. Drilling was carried out with a constant water flush, with the drill water (drill fluid) recycled initially using a Solids Removal System™ (SRU) from Australian Mud Company Pty Ltd. (AMC). This system utilized a centrifuge to remove cuttings from the return drill fluid and is shown in Figure 5.



Figure 5: Solids Removal Unit – centrifuge used to remove cuttings from drill fluid return

Set-up of the drill rig commenced once the drill pad was prepared as described in the WP01A Commissioning Report (Golder 2020c). The construction of the drill pad included lining an area of approximately 230 m^2 to provide secondary containment beneath the drill and all support equipment including the centrifuge, the core extraction shack, the wastewater and fluorescein water tanks, as well as all connecting hoses and lines. The drill pad was prepared with a gentle slope towards the borehole collar, so that all fluid contained by the liner was directed to the borehole collar (i.e. the “lower sump”), where it was pumped to a wastewater tank via a submersible sump pump. As described further in Section 4.2, an “upper sump” to contain the return drill fluid from casing and coring activities was constructed around the PWT outer conductor casing.

The planned azimuth and dip for IG_BH02 was 225˚/-70˚. Once the drill pad was constructed and the rig matting in place, the drill was moved into place using an excavator and sighted into alignment using surveyor stakes set in the ground. The stakes were positioned by surveyors using the coordinates of the borehole to set a stake to the north of the rig and two stakes to the south of the rig at 225˚ from each other. This allowed the WP02 staff to use the stakes and the drill mast to sight the azimuth (Figure 6). The dip of the borehole was set by confirming the mast dip at 70˚ using both digital and analogue angle finders, as shown in Figure 7.

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Golder WP02 and WP03 staff mobilized to site around September 23, 2019. During the initial days on site, Golder unpacked and set up the site trailers and carried out equipment calibrations, while Rodren prepared their support equipment. The overall view of the IG_BH02 site is shown in Figure 8, with images of the drill rig shown in Figure 9. Note that the images of the interior of the drill rig and support shack are from drilling of IG_BH03, however the equipment setup remained unchanged at IG_BH02.



Figure 6: Survey stakes for BH02 drill rig alignment

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Figure 7: Confirming -70˚ Inclination of Drill mast prior to drilling



Figure 8: View of IG_BH02 Drill Site facing Northeast

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Figure 9: Select Photographs of the Rodren Drill Rig. Top: Inside of Drill Rig Showing Controls and Gauges and Rig Mast; Bottom: Rodren Core Push and Support Shack

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4.1.2 Rig Maintenance

Maintenance activities of the drill rig and coring supplies during advancement of IG_BH02 were generally typical of a drilling program, with the most major repair being replacement of the rod handler when the borehole was at a depth of 926.49 mbgs (along hole).

4.1.3 Tracking Borehole Depth

The depth of the borehole was monitored on a per run basis by the drilling supervisors. This was done by measuring the stickup of the drill rods from a fixed reference point at the completion of each run plus the fixed stick up of that reference point from the ground surface, which was subtracted from the length of the drill string (core barrel plus the drill rods). The chosen reference point was the base of the drill rig mast, which was 1.86 m above ground surface (along hole). During drilling, the depth of the borehole was monitored as meters below ground surface along the hole and throughout this report depths are referred to as mbgs (along hole).

The core barrel assembly was measured as 4.22 m long and included the barrel, a reaming shell and the drill bit. All drill rods on site were confirmed as 3.0 m long (metric) HQ rods. No rod grease was used during the coring process, however thread lubricant was used on the rod threads as they were added to the drill string. As described above, the borehole depth was tracked by the number of rods added to the drill string.

A rod count was performed by WP02 supervisors during the final rod pull, where the total number of HQ coring rods used was verified as 333.

4.1.4 Drill Cuttings Management and Disposal

At the outset of the field program, the drill fluid recycling system was set up using the SRU™ (centrifuge). The drill fluid return containing cuttings from the borehole was pumped directly to the centrifuge, where the fine solids were separated from the water and directed to buckets that were emptied into steel drum holding containers to await disposal. Performance of the centrifuge was observed to be fairly consistent throughout drilling of IG_BH02.

These solid drill cuttings were sampled on October 14, 2019 and sent to Bureau Veritas Laboratories in Mississauga to be analyzed according to Ontario Regulation 558. Note that the sample was labelled “BH02-Drill-Cuttings” instead of IG_BH02_TCLP001. The results indicated that the drill cuttings were safe for disposal and were accepted by the Ignace landfill.

4.2 Casing Installation and Cementing Details

Prior to commencing coring activities, PWT conductor casing was installed and cemented to a depth of 9.75 mbgs (along hole), to prevent drill fluid from escaping through the fractured upper bedrock. While fill materials from construction of the drill pad were present at the borehole collar, no overburden was encountered or recovered during the casing installation process.

The PQ surface casing was initially advanced just beyond the PWT conductor casing to provide smaller diameter casing to stabilize the HQ sized drill rods during coring, and was initially set at 10.22 mbgs (along hole) on September 26, 2019. At this point, HQ coring to 10.08 mbgs (along hole) commenced without volume or drill fluid parameter measurements. In order to contain the return drill fluid, a metal sump box was welded to the outside of the PWT casing at the collar of the hole on September 27, 2019.

Routine coring activities then continued and were halted when the borehole was advanced to 100.10 mbgs (along hole). At this depth, the borehole was flushed and prepared for the televiewer survey. Once the parameters of the flush water were within acceptable criteria (see Section 4.6), the HQ drill rods were removed from the borehole and optical and acoustic televiewer surveys were completed.

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The PQ surface casing installation depth was determined, in coordination with NWMO, once the first 100 m of geophysical survey images were reviewed. This depth was selected so that runs with drill fluid volume measurements > 100 L were cased and cemented to seal them from the rest of the hole. Additionally, this casing installation depth covered the lowest major fracture zone between 60-65 mbgs (along hole), with 10-15 fractures per meter and secondary iron alteration observed. Collection of an opportunistic groundwater sample was attempted in this zone, however, was ultimately abandoned due to packer bypass. The installation and cementing of the surface casing served to prevent mixing of the ground water from these shallow zones with the rest of the borehole. Golder supervised Rodren throughout the installation of the PQ surface casing and cementing activities.

The surface casing installation process involved first reaming the borehole with a PQ advancer bit to the desired depth of 73.62 mbgs (along hole). The PQ casing rods were then removed from the borehole and the advancer bit was removed, with the threads of the end PQ rod ground off before they were lowered back down the borehole. A Van Ruth plug was installed below the casing using HQ rods, at a depth of 74.88 mbgs (along hole). The PQ casing was lifted slightly in order to create space for the cement mixture to flow between the PQ the end of the rods and the borehole wall.

The cement mixture was batched on surface and approximately 270 litres pumped down the inside of the PQ casing. Rodren provided Type HS High Sulphate resistant cement by LaFarge, which is a hydraulic cement that provides high sulphate resistance. The grout was pumped down the hole and chased with a wiper plug, at which point the grout mixture could be observed returning to surface through the annular space between the outside of the PQ casing and the inside of the PWT conductor casing (Figure 10). A sample of the cement mixture was collected from the mixing tank and from the annular return in order to confirm proper curing of the cement at surface.

The cement was left to cure for 30 hours, at which time a cured cored sample of the cement between the wiper plug and above the Van Ruth plug was retrieved. The Van Ruth plug was retrieved in a subsequent run. The remainder of the HQ rods required to continue regular coring activities were then added to the drill string and coring resumed for the remainder of the borehole to 1000.41 mbgs (along hole). The final IG_BH02 borehole schematic is shown in Figure 11.



Figure 10: Grout return through annulus of PWT and PQ casings

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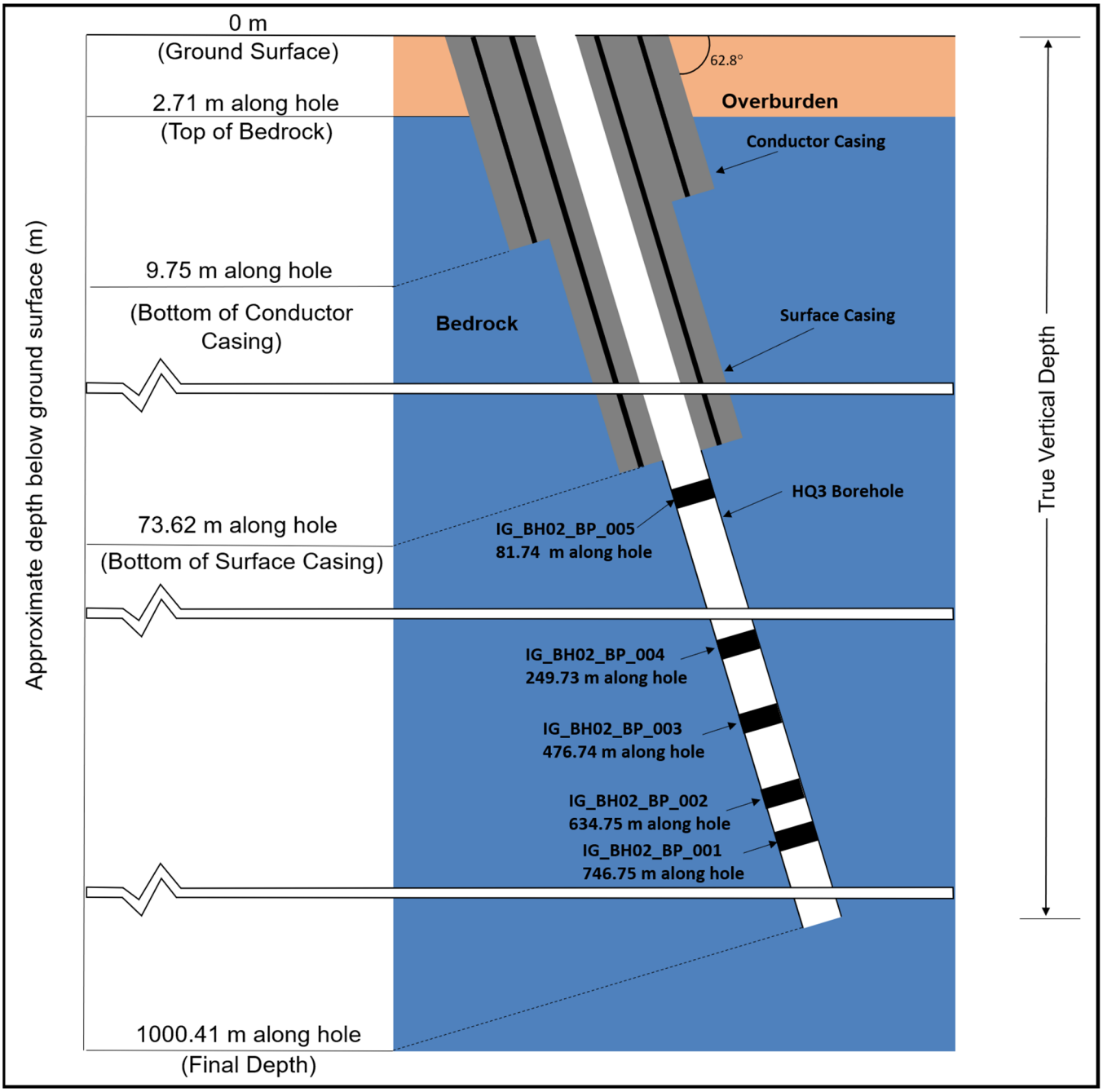


Figure 11: Final IG_BH02 Schematic

4.3 Cementing of Permeable Zones

During drilling of IG_BH02, three permeable zones were encountered that yielded successful or partially successful opportunistic groundwater sample collection as part of WP07. The final sampled zoned, encountered during run CR138 from 376.17 to 377.05 mbgs (along hole), caused a complete loss of drilling fluid circulation. Ultimately, the zone from 374.46 to 377.05 was sampled, and drilling continued to 382.14 mbgs (along hole) with no drill fluid ciruclation regained. At this stage, the decision was made to cement the zone from 374.92 to 382.14 to encompass the shear zones and open features.

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The first permeable zone cementing attempt was carried out without the use of a grout plug and with bentonite added to the grout mix. Bentonite was intended to increase the mix viscosity so that the grout would stay within the vicinity of the borehole, under the assumption that a fixed volume of a low viscosity (thinner) grout would be lost to the higher permeability zone, without sealing it. The procedure involved pulling the drill string up, pumping the grout mix through the drill rods, then chasing the grout with a wiper plug. The grout was allowed to cure for 30 hours before drilling resumed. While circulation was regained at this point, fluid losses were greater than 1000 L per run as drilling continued to 397.17 mbgs (along hole).

The cementing attempt was therefore unsuccessful, and a second attempt was made following the procedure below:

- The HQ drill rods were removed from the borehole and a Van Ruth plug was installed at the bottom of the zone, 383.92 mbgs (along hole);
- The HQ rods were again removed from the borehole, and then lowered with the grout plug to the top of the zone, 374.92 mbgs (along hole);
- Two batches of grout were pumped down the rods: a lower viscosity mix (105 L water, 7 bags of LaFarge Type HS cement, 3.5 L accelerant) followed by a higher viscosity mix (100 L water, 10 bags of LaFarge Type HS cement, 5 L accelerant). Bentonite was not used in these grout mixes as its thixoropic nature potentially contributed to the failure of the grout mix to penetrate the zone in the previous cementing attempt.
- A wiper plug was then set in the rods and pumped down with water until a pressure spike indicated the interval was pressurerized and released the grout plug from the drill rods.
- The HQ drill rods were then removed from the borehole and the curing period for the cemented zone began on October 31 at approximately 02:00.

Coring of the plugs and cemented zone was carried out on November 1, 2019. While coring through the grout plug, it became jammed in the drill bit and required a rod pull to clear the blockage. The rods were put back down hole and the cemented zone cored through. Before drilling through the Van Ruth plug, a simple falling head test in the open rods was performed to confirm that the zone was holding water. The Van Ruth plug was then drilled through and pushed down to the top of rock and recovered at the top of the next core run, CR147. Volume losses were observed to return to acceptable ranges, confirming that the zone was successfully cemented.

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Figure 12: Grout Plug prior to installation (top left) and recovered after coring through (top right), Van Ruth plug prior to installation (bottom left) and recovered Van Ruth plug (bottom right)

4.4 Coring Details

Three (3) metre long HQ sized Boart Longyear drill rods were added manually to the drill string one rod at a time as drilling progressed. As with standard deep drilling programs, two core tubes were available at all times, so that when one was removed with a drilled run, the second could be lowered and locked in place while the core was extracted from the first tube. Core tubes were lowered and retrieved using a wireline system in which an overshot tool locked on to the top of the core tube. The core tube was pumped down and locked into the core barrel using the downhole pump; the drillers monitored when it was locked into place by observing a spike in the downhole

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fluid pressure. This time required to pump and lock the core tube into place to continue coring increased with the depth of hole; having a second tube to start this process while the core was extracted from the first was valuable for efficiency.

After the conductor casing was installed, the borehole was advanced using a triple tube wireline drilling system for the entirety of the hole to minimize disturbance to the recovered drill core. Triple tube coring involves using steel, split core liners to line the inside of the core recovery tube, which is locked within the core barrel during drilling. The core tube is recovered using the wireline at the completion of each drill run, with the split liners removed from the core tube on surface. The split liners help reduce the volume of drill fluid that can circulate within the core tube, helping to prevent the drilled core from being disturbed and to retain fine grained materials encountered. Table 1 presents the details of the casing and coring rods used to complete IG_BH02, while Table 2 presents the borehole diameter details.

Table 1: Details of Casing and Coring Rods used by Rodren for IG_BH02

Casing Type	Outer Diameter (mm)	Inner Diameter (mm)	Joint Torque (Nm)	Weight (kg/m)
Conductor (PWT) Casing	139.7	127.0	N/A	21.4
Surface (PQ) Casing	114.3	101.6	N/A	17.4
PQ Advancing Bit	121.0	94.2	N/A	N/A
PQ Shoe Bit	117.5	100.5	N/A	N/A
HQ Drill Rods	88.9	77.8	2000	11.44
HQ3 Drill Bit	96.0[1]	61.1[2]	N/A	N/A

[1]Open borehole diameter. [2]HQ3 core diameter size.

Table 2: IG_BH02 Borehole Diameter Details

Depth from (mbgs along hole)	Depth to (mbgs along hole)	Casing Type	Outer Borehole Diameter (mm)	Inner Diameter Within Casing (mm)
0	9.75	Conductor (PWT) Casing and Surface (PQ) Casing	143.76	101.6
9.75	73.62	Surface (PQ) Casing	121.0	101.6
73.62	1000.41	Open Borehole (HQ size)	96.0	96.0

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4.4.1 Ground Conditions

In general, ground conditions were good and did not cause problems with the drilling process; there was a single occurrence of a core tube blockage caused by poor quality or fractured rock, which is described in the following Section 4.4.2. One instance of complete circulation loss was encountered, as described in Section 4.3.

4.4.2 Core Quality

In IG_BH02, all lost core occurrences were confirmed to be mechanical by comparison of core logging and televiewer data. Two instances (at depths less than 11 mbgs [along hole]) were logged as mechanically lost core by the core logger based on observed mechanical grinding in the recovered core and confirmed to have no loss by televiewer. The third instance was logged at 8.83 mbgs (along hole) with a lost width of 74 cm but was confirmed intact by the televiewer survey. This zone was therefore inferred to be lost mechanically from grinding of the advancing casing.

The instances of naturally broken core zones identified by the core loggers were confirmed by televiewer and can be reconciled to the individual intersecting structures over narrow widths (2 cm to 6 cm). One instance of broken core with a width of 13 cm occurred at 537.89 mbgs depth (along hole) and was confirmed by the televiewer survey to be a dense network of intersecting open structures.

Instances of mechanically broken core were also occasionally encountered. These typically occurred where the presence of sand sized ground core within the split tube resulted in the drill core becoming jammed in the core tube. When this occurred, drillers had to use mechanical force on surface to remove the inner split tube, causing damage to the rock core in the process. Ribbing (uneven or wavy core diameter) of the core tends to occur as the drill bit becomes worn down and increased torque is required to continue coring. Drillers were typically aware when this occurred due to noticeably reduced rates of penetration, and verified suspicions by inspecting the core for these signs. Bit sharpening involved momentarily increasing torque or cutting off the water supply to sharpen the drill bit by exposing fresh diamonds, but results in increased ribbing. Drillers commonly carry out bit sharpening to maintain performance during the life of the bit. Efforts were made to restrict bit sharpening to the start or end of a drill run so that uneven diameter core was not present within the central part of a core run (mainly for aesthetic purposes).

4.4.3 Drill Bit Changes

Drill bit changes were required as coring advanced and the drill bit became worn down. Bit changes involved removing the core tube from the rods, then using the rod handler on the drill rig to remove all the drill rods from the borehole, typically two at time. These stands of rods were stacked in the drill shack during the bit change so that they were easily accessed by the rod handler to go back down the borehole. When all the rods were removed, the core barrel was inspected for damage and signs of wear, and the bit replaced. Drilling in this relatively hard rock required frequent bit changes (approximately 1 every 100 m of drilling). A summary of the drill bit types used during the drilling program are shown in Table 3.

Table 3: Summary of Drill Bits used for Coring of IG_BH02

Drill Bit Name	Depth used from (mbgs)	Depth used to (mbgs)	Total drilled length used (m)
Atlas Copco AC11	0	87	87
Atlas Copco AC11	87	180	93

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Drill Bit Name	Depth used from (mbgs)	Depth used to (mbgs)	Total drilled length used (m)
Atlas Copco AC11	180	314	134
Atlas Copco AC11	314	351	37
Atlas Copco AC11	351	404	53
Atlas Copco AC11	404	423	19
Atlas Copco AC7	423	590	167
Atlas Copco AC7	590	692	102
Fordia Hero 7	692	821	129
Fordia Hero 7	821	926	105
Fordia Hero 7	926	1001	75

4.5 Borehole Location and Orientation Details

The planned drill site for IG_BH02 was surveyed Rugged Geomatics Inc. as part of the access roads survey. This original site survey involved the use of a local reference points (ORPs) derived from GPS observations using the Precise Point Positioning service from Natural Resources Canada.

The as-built borehole points were surveyed on January 31, 2020 by Rugged Geomatics Inc. Elevation data was measured for the various tops of casings, the sump weld (the point on the conductor (PWT) casing where the sump box was installed) as well as a ground surface point, with Northings and Eastings only measured for the top of the PQ and the ground surface. This ground surface point however was somewhat arbitrary as the originally measured reference point (used during drilling) was altered by the presence of additional fill material at the time of the survey.

Given the as-built coordinates of the top of the surface (PQ) casing, the along hole distance between the top of the PQ and PWT and between the top of the PWT and ground surface reference point (from WP02 field notes) as well as the casing orientation of 225˚ / -70˚, the following relationships were used to translate the Northing, Easting and elevation of the PQ casing to the PWT, sump weld and ground surface reference point:

Northing: COS(70˚)*COS(225˚)
Easting: COS(70˚)*SIN(225˚)
Elevation: -SIN(70˚)

The calculated and provided as-built coordinates of IG_BH02 are presented in Table 4.

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Table 4: IG_BH02 Final Surveyed Collar and Casing Coordinates

Point	Northing (m)	Easting (m)	Elevation (m)	Comment
Borehole Collar - Ground Surface (RP for drilling)	5483950.29	554033.97	435.16	Calculated E, N & Elev
Sump weld	5483950.48	554034.16	435.89	Calculated E, N & Elev
Top of conductor (PWT) casing	5483950.51	554034.19	436.02	Calculated E & N
Top of surface (PQ) casing	5483950.42	554034.24	436.23	Provided E, N & Elev

Note: Elevations are Geodetic and referred to the CGVD28 Datum and coordinates are referred to UTM Zone 15, NAD 83 (CSRS).

4.5.1 Borehole Orientation

The borehole was planned to be drilled with an azimuth and inclination of 225˚ / 70˚ with no correction made for deviation as the drilling progressed.

The borehole was surveyed every 50 m during drilling with a Boart Longyear TruShot™, a magnetic survey tool. Generally, the borehole was advanced two runs (about 6 m) past the 50 m mark and the core tube locked into place. This allowed the TruShot tool to sit at approximately the 50 m mark (50, 150, 200 m etc.) accounting for the length of the core barrel and actual measurement point of the tool. The TruShot was then calibration checked on surface following the manufacturer's recommendations and the tool lowered into the borehole to perform the survey. Rodren then presented the survey results to Golder and they were entered into the acQuire database. The tool's accuracy from the manufacturer is listed as ±1° for azimuth and ±0.3° for dip. The downhole TruShot measurements collected during drilling were corrected for the final Data Delivery to the NWMO using the average magnetic declination recorded over the time period that the tool was used; this average magnetic declination was 1°25.64' West.

A final borehole survey with a REFLEX SPRINT-IQ™ was carried out upon completion of drilling, with a measurement point taken every 10 m. The tool was set to collect a reading every 10 m, with a starting measurement at 990 mbgs (along hole). The control unit of the tool allows the user to control when the measurement is taken after using the wireline equipped with a depth counter to move the tool along the borehole. At the end of the survey, a measurement point was taken inside the casing at the borehole collar, estimating the original drill rig mast alignment at 224.96˚ / -70.36˚

The interim survey data collected during drilling at 50 m increments and the final survey collected every 10 m upon completion of drilling are consistent, and the final survey is presented in Table B-1 (Appendix B). Figure 13 presents the borehole deviation graphically, calculated using the minimum curvature method. Inspection of Figure 13 shows the borehole deviating 104.5 m to the West and 39.8 m to the South from the planned end location.

As part of WP05, five additional deviation runs were completed using the OBI40-2G and ABI40-2G probes, as described in WP05 Report (Golder 2020d).

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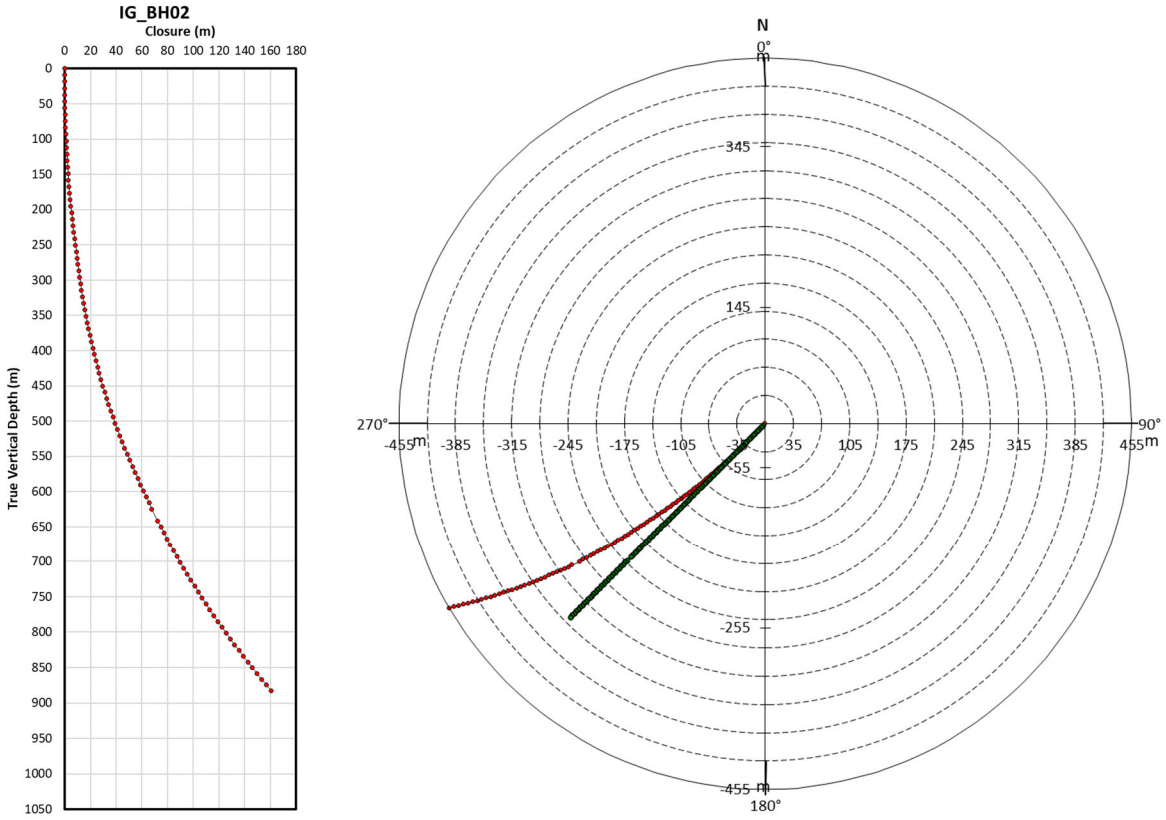


Figure 13: Borehole Deviation (left) and Bullseye Plot (right) from Final SPRINT-IQ™ Survey: red plot lines show the actual borehole trajectory and the black plot line (Bullseye Plot) indicates the planned borehole trajectory

4.6 Monitoring Drilling Parameters

Drilling supervisors were stationed at the rig during coring, to record the start and end times of each drill run and observe the drilling parameters during coring as well as any occurrences of drill fluid spills or maintenance related activities. The drill parameters included torque, thrust / holdback or down pressure, fluid injection pressure and downhole fluid flow. These parameters were observed from the gauges at the drill controls. In general, these parameters were steady over the duration of a 3 m run, with overall patterns observed for IG_BH02.

Results of the drilling parameters collected are shown graphically on Figure D-1 (Appendix D) and presented in Table B-2 (Appendix B). General observations are listed below.

- Rate of Penetration was observed to be relatively consistent, with a slight overall increasing trend with depth. Anomalous high rates were occasionally observed, but these generally correspond to runs where the bit wore out and had to be changed.
- Bit Rotation Speed was not observed as the corresponding gauge on the drill rig control panel was not functioning.
- Torque and down pressure generally increased to a depth of about 400 mbgs (along hole), where they were somewhat steady for the remainder of the borehole. From approximately 400 to 600 mbgs (along hole), a higher torque and lower down pressure can be observed, likely corresponding a particular set of drillers' preferences.

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- The down pressure was adjusted from thrust to holdback pressure at approximately 550 m as the down pressure was shown on a single gauge, therefore the adjustment from thrust to holdback had to be communicated by the drillers.
- Pump pressure increased with depth as a higher pump rate was required to adequately flush the hole.
- Fluid injection rate was consistent throughout the program.

It should be noted for all parameters that day shift and night shift drillers, as well as those on various rotations, had different approaches to their drilling technique and fluctuations in all observed parameters reflect this.

4.7 Borehole Flushing

Borehole flushing was carried out on IG_BH02 with 100 ppb fluorescein traced fresh water prior to geophysical televiewer surveys on two occasions: prior to installation and cementing of the surface casing, and at the completion of drilling.

Fresh water was circulated with a fluorescein tracer (target concentration of 100 ppb, the same used during coring) into the borehole through the drill rods until the return fluid was clear and had water quality indicator parameters that were targeted to be within 10% of the source water for turbidity, dissolved oxygen and electrical conductivity, within 20% of the source water fluorescein concentration and within 0.5 of pH of that of the fresh water used. Once reached, fresh water was to be circulated, targeting an additional 2 borehole volumes of water. After this point, drill rods were withdrawn from the borehole, and the flushed water in the borehole allowed to “settle”, targeting 12 hours before geophysical logging took place.

Prior to surface casing installation, flushing was carried out on October 8, 2019, with the borehole at a depth of 100.10 mbgs (along hole) and an approximate volume of 770 litres. Approximately 11,800 litres of fresh water (over 15 borehole volumes with HQ rods in place) was flushed through the borehole, with the fluid parameters consistently monitored to determine when they were within specified indicator parameters of the fresh water. The final fluid parameters were within 10% of the source water for turbidity, within 20% of the source water fluorescein concentration and within 0.5 of pH. Electrical conductivity and dissolved oxygen were slightly over the specified tolerance of 10%, however as these parameters would not affect the quality of the televiewer image, flushing was stopped at this point.

The final IG_BH02 flushing event was carried out over a two day period, from November 26 to 27, 2019. Approximately, 40,400 litres representing over 4 borehole volumes (borehole volume without HQ rods) were flushed through the borehole. Appendix C presents the water quality parameters for the final borehole flushing.

5.0 SUMMARY OF DRILL FLUID MANAGEMENT AND USE OF TRACERS

Monitoring of the drill fluid volume losses and gains during coring was planned and initially carried out through use of totalizing flowmeters, however the margin of error encountered through use of these was found to be too large to adequately and consistently identify actual drill fluid volume changes. The totalizers employed during the program were found to produce variable readings, and manual measurements of the volume of the drill fluid system components were observed to the most the reliable means of monitoring the drill fluid volume changes. The drill fluid recycling system and volume monitoring methods, as well as the results of the drill fluid parameter and volume monitoring are described in the subsequent sections.

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5.1 Drill Fluid Closed System

The drill fluid system consisted of three components: a centrifuge (SRU™) tank, a plastic mixing tank in the rig and the borehole itself. The centrifuge tank (approximate capacity of 2.60 m^3) pumped water to the tank in the drill rig (approximate capacity of 0.65 m^3) using a submersible pump, from which water was pumped downhole using the rig's pump. The drill water returning to surface was pumped via a submersible pump, located in the steel sump box sealed at the collar of the hole to the centrifuge where the cuttings were removed, and the cleaned water fell back into the centrifuge tank. This provided a closed system where fresh water was only introduced after confirmation from the Golder drilling supervisor. A schematic representing this closed drill fluid system is shown in Figure 14.

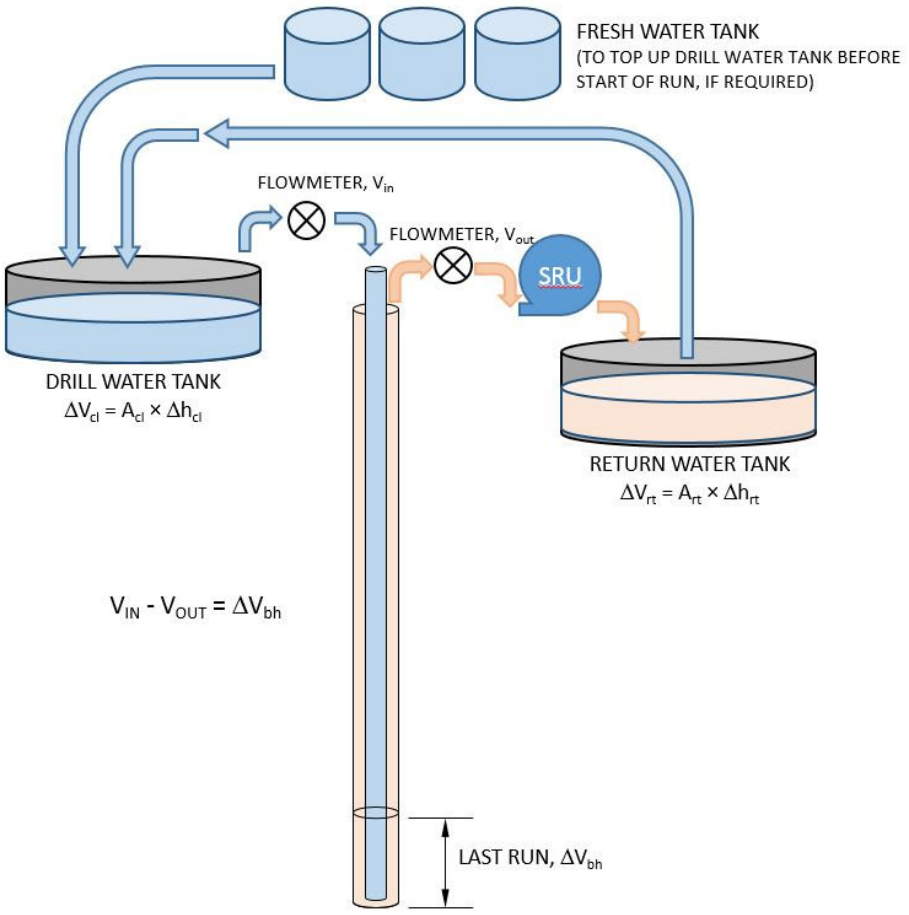


Figure 14: IG_BH02 Drill Fluid System considering manual tank measurements

5.1.1 Drill Fluid Volume Monitoring Methods

The volume of water used during drilling was initially tracked using electronic totalizing flowmeters. These displayed total volume, with one installed inline with inflow to the drill tank, from which the drill pump drew drill fluid downhole ("IN" totalizer), and one installed inline with the sump pump that pumps the return drill fluid to the settling tanks ("OUT" totalizer). Prior to commencing coring of a run, the system was paused (i.e. the pumps will be stopped temporarily) and the volume displayed on each totalizer read. The pumps were then restarted and the

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run cored. Upon completion of coring, the pumps were again temporarily stopped, and the volume displayed on each totalizer was read.

The difference in recorded volumes for the “IN” totalizer and the “OUT” totalizer indicated the total volume used during coring and the total volume returned to surface, and was intended to give a reliable indication of the volume of drill fluid lost to or gained from the formation during coring of a given run. Two Krohne electromagnetic totalizers were used for the duration of the IG_BH02 drill program. All totalizers were calibration checked in the field prior to commissioning them for use.

Due to some uncertainty in the reliability of the totalizers based on previous borehole drilling, manual tank readings were also collected throughout the drilling of IG_BH02. The volume of the system was monitored by measuring the depth of water in the borehole, the drill tank and the centrifuge tank, once all bypasses and pumps were temporarily off so that all water levels were steady. System volumes were measured at the end of each run, as well as at the start of every run when there was a significant delay in drilling, and when fresh water was added into the system. Fresh water was added to the drill system as water was lost to the formation and as the volume of the system increased relative to the volume of drill water in the system (that is, as the hole was deepened, the available volume of the system increased). A baseline reading of the new drill fluid volume in the system was recorded when this was done, so that subsequent fluid losses to the rock could be identified as potential groundwater sampling triggers. More details of the volume monitoring can be found in Section 5.5.

In general, the difficulties experienced with use of the totalizers is attributed to their sensitivity to their installed configuration, and more significantly, the highly variable flow rates and pressures they were subjected to, creating too dynamic an environment for them to provide consistent performance. In addition, with the below freezing temperatures experienced from October onwards, the recirculation between the drill tank and centrifuge tank was consistently left on to prevent freezing of the hose lines, causing artificially high readings from the IN totalizer and giving the appearance of very large, artificial volume losses.

5.2 Fresh Water Management and Sampling

Fresh water was stored in two 28,350 litre Baker tanks located on the east side of the site. Fresh water was collected from a municipal source in Ignace and transported to site via a local water truck service. Ignace has a water treatment plant, and municipal water is treated to adhere to Ontario drinking water standards. The municipal water is sourced from Lake Michel, which is located approximately 1 km north of Ignace, and undergoes filtration and chlorination at the water treatment plant. Where possible, two individual tanks of fresh water were circulated together using a submersible pump, in order to mix them into a single batch of fresh water for sampling. Each batch of fresh water was individually sampled before being introduced to the drill water system and entering the borehole. All fresh water batches were termed “water source” and designated for sample collection as IG_BH02_WSXXX.

5.2.1 Water Source Samples and Testing

Water source samples were collected from all batches of fresh water delivered to site, prior to fluorescein addition and prior to introducing the water to the drill system. Water was collected from the storage tanks into a clean, triple rinsed 19 litre (5 gallon) bucket, and then transferred into labelled bottles using new syringes, or new tubing with a peristaltic pump. Samples were collected for submission to Bureau Veritas (BV) and Isotope Tracer Technologies (IT2) as per Table 5, and in-field geochemistry analyses were carried out on the samples.

In-field geochemistry analyses methodologies are described in the WP07 Report – Opportunistic Groundwater Sampling for IG_BH02 (Golder 2020a) and include alkalinity, sulphide, ferrous iron and dissolved oxygen analyses.

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Table 5: Sample Bottle Requirements for Bureau Veritas and Isotope Tracer Technologies

Parameter Group	Parameter List	Bottle Type Requirement	Sample Volume Requirement	Head Space Requirement	Field Filtering Requirement	Preservative Requirement
Major Elements & Metals (BV)	Na, K, Ca, Mg, Sr, Li, Si, S_{Total}, Fe_{Total}	HDPE plastic bottles	120 mL	Fill line	Yes, 0.45 µm filter	Trace grade nitric acid
	SiO_2	HDPE plastic bottles	250 mL	None	Yes, 0.45 µm filter	None
	S^{2-}_{Total}	HDPE plastic bottles	125 mL	Fill line	Yes, 0.45 µm filter	Zinc acetate and sodium hydroxide solution
Anions & Nutrients (BV)	Br, F, Cl, I, SO_4, PO_4, NO_3, NO_2	HDPE plastic bottles	500 mL	None	Yes, 0.45 µm filter	None
	NH_4+NH_3, N_{Total}	HDPE plastic bottles	250 mL	Fill line	Yes, 0.45 µm filter	Trace grade sulphuric acid
	P_{Total}					
Stable Isotopes (IT2)	$\delta^{18}O$, $\delta 2H$	HDPE plastic bottles	30 mL	No headspace	Yes, 0.45 µm filter	None
	$^{87}Sr/^{86}Sr$	HDPE plastic bottle	1000 mL	No headspace	Yes, 0.45 µm filter	None
	$\delta^{13}C$ DIC	Amber glass vials, Teflon cap	2 x 40 mL glass vials with septa caps	No headspace	Yes, 0.45 µm filter	None
Radio-isotopes (IT2)	^{14}C-DIC	HDPE plastic bottle	500 mL	No headspace	Yes, 0.45 µm filter	None
	^{3}H	HDPE plastic bottle	500 mL	No headspace	Yes, 0.45 µm filter	None

A total of 8 water source samples were collected during the drilling program as follows:

- IG_BH02_WS001 to IG_BH02_WS008 were collected and used during regular coring and flushing activities.

All water source data (including in-field parameters, in-field analyses and laboratory results) are included in the Opportunistic Groundwater Sampling WP07 report for IG_BH02 (Golder 2020a).

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5.2.2 Fluorescein Addition

After a sample was collected from the fresh water tank or tanks, fluorescein was measured using an analytical scale (due to the small mass of powdered fluorescein required for each tank) and added to the tank or tanks. Each tank was circulated to mix in the fluorescein using a submersible pump with an attached hose placed inside the tank. Due to their large capacity, the tanks were generally left to circulate and mix for the majority of a 12-hour shift, or until consistent concentration readings were collected. The water was tested for fluorescein concentration using the AquaFluor fluorometer until the desired concentration was achieved. Once the fluorescein concentration was close to the specified target (100 ppb for all activities), the water was transferred to the drill system as required. Figure 15 below shows the tracer being added to the source water in one of the fresh water tanks used during the program.



Figure 15: Fluorescein Tracer being added to the Source Water

5.3 Drill Fluid Field Parameters

At the end of the core run, drilling supervisors communicated with the drillers to time the collection of drill fluid with the completion of the run, to pause to allow a rod stick-up measurement, followed by the temporary shutting off of pumps to record the values on the totalizers as well as measure the fluid volumes in the tanks. Drillers and drill supervisors developed a workflow to communicate when the drillers could proceed to the next activity, that is, when measurements and sample collection were complete, and the drillers could lower the overshot to retrieve the core barrel.

Drill fluid field parameters were measured using a Horiba U52-2 multiparameter water quality meter. A baseline reading was taken prior to the start of drilling, and all subsequent occasions when fresh water was added to the system. New baseline readings were typically collected from the drill tank when the settling tanks were in use, or from the centrifuge tank when the system was switched. At the end of each drill run, a sample of water for field parameters was collected from the return drill fluid from the outlet of the centrifuge that drained into the tank. This system allowed a sample of water directly from the borehole to be collected and tested, providing the most representative parameters possible for that run.

Fluorescein concentration was also measured from this sample. The presence of cuttings in the drill water was observed to mask the fluorescein concentration readings measured with the AquaFluor, and drill fluid samples were therefore filtered using an inline high volume 0.45 µm filter prior to collecting readings.

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The field parameters of the drill fluid measured each run and the corresponding triggers to initiate a WP07 opportunistic groundwater sample collection attempt are presented in Table 6. These parameters were monitored each run, and if a trigger was considered valid, Golder and the NWMO would coordinate to initiate an opportunistic groundwater sample (WP07).

Table 6: Drill Fluid Monitoring Parameters and WP07 Triggers

Field Parameter	Instrument	Trigger to Initiate WP07 / Target ranges for borehole flushing
Fluorescein dye (tracer)	Aquafluor Handheld Fluorometer/Turbidimeter	20% change in concentration from previous drill fluid source Note: Minimum detection limit of the fluorometer (0.4 ppb)
Turbidity	Horiba U52-2 multiparameter water quality meter	10% change from the previous drill fluid source
Dissolved Oxygen		10% change from the previous drill fluid source
Electrical conductivity		10% change from the previous drill fluid source
pH		change of at least 0.5 from previous drill fluid source
Temperature		N/A
Density	Hydrometer	N/A

5.3.1 Drill Fluid Parameter Data

The drill fluid parameter data is shown graphically on Figures B-2 and B-3 (Appendix B) and presented in Table A-2 (Appendix A).The change from settlings tanks to the centrifuge is identified on the graphs. General observations and comments are listed below.

- Fluorescein concentration required frequent adjustment in the drill fluid system, with fluorescein added about every 10-15 runs. As the borehole depth and drill fluid system volume increased, the time for the fluorescein readings to equalize in the system when extra fluorescein was added increased, and concentration readings occasionally varied over 20% from run to run. In general, the fluorescein concentration of the drill fluid remained between 80 and 100 ppb to a depth of approximately 700 mbgs (along hole). The concentration fell in the system at this depth and remained in the range of 70 ppb for the duration of the borehole drilling.
- The frequent fluorescein adjustments were necessary as the concentration in the drill fluid decreased as the fluid was processed through the centrifuge and cuttings were removed.
- Density of the drill fluid increased as the saturation with cuttings increased. When the density is observed to drop back closer to 1 g/cm^3, this generally corresponds with the addition of fresh water to the system. After the loss of return and pause in drilling to collect an opportunistic groundwater sample at 377.05 mbgs (along hole), drilling resumed with very substantial water losses until cementing of the permeable zone was successful, therefore large volumes of fresh water were added to the drill system, bringing the density close to 1 g/cm^3.
- Turbidity remained above the Horiba's measurement range (1000 NTU) for the majority of the program as the drill fluid became saturated with drill cuttings.

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- There are a few notable changes in the drill fluid electrical conductivity and pH. The spikes occurring at the very top of the borehole, around 100 mbgs (along hole) and just above 400 mbgs (along hole) are related to the initial casing installation, the surface casing installation and the cementing of the permeable zone. After each spike, electrical conductivity returned to levels below 1 mS/cm, but was observed to gradually rise, peak and start to reduce at a depth of 700 mbgs (along hole) The gradual reduction from about 900 mbgs (along hole) to the end of the borehole is likely related to the frequent addition of fresh, traced water to the drill fluid system between these depths.
- Dissolved oxygen (DO) fluctuated continuously in the sensor's range. Through these fluctuations, DO appears increase over time when the centrifuge was use.
- The temperature of the drill fluid system was generally between 15-20 ˚C until the permeable zone was encountered and cemented just before 400 mbgs (along hole). The temperature of the drill fluid then remained fairly consistently between 10-15 ˚C.

5.4 Drill Fluid Additives

Throughout the drilling of IG_BH02, a bio-degradable polymer-based drilling additive, AMC Pure-Vis, was added to the drill fluid via the drill tank in the rig. This additive generally improves the ability of the fluid to lift cuttings from the drill bit and out of the borehole, helping to manage the drill bit binding with cuttings and causing spikes in the torque. This additive was in use at the start of drilling, and the first drill fluid sample, IG_BH02_DW001, was collected to correspond to the first opportunistic groundwater sample between 14.36 – 19.16 mbgs (along hole). This drill fluid sample underwent the full suite of analytical laboratory testing as part of WP07, and therefore no specific drill fluid additive sample was collected for IG_BH02. No other drill fluid additives were used besides AMC Pure-Vis.

5.5 Drill Fluid Return Volume Monitoring Data

Drill fluid volumes were monitored continuously during coring activities through use of the totalizers and were verified by checking the water levels in the centrifuge, drill tank and borehole. When losses or gains greater than 100 litres were observed, the Golder WP07 lead was contacted following the opportunistic groundwater sampling protocol as described in WP07. If a volume change was observed, the drillers were instructed not to proceed with setting up for the next core run until the core was extracted and could be observed for indications of water bearing features. The system volume gradually increased as the hole was deepened, and water was occasionally lost on surface due to human error, as well as bound in the cuttings. Gradual system losses required occasional topping up of the system with fresh, fluorescein water. Table A-2 includes volume changes for each drill run and these can be observed graphically in Figure B-2. Comments in Table A-2 are included to document specific instances of water losses observed.

Following cementing of the surface casing after a depth of 100 mbgs (along hole), typically, losses greater than 100 litres could be attributed to uncertainty in the totalizer readings, with the exception of opportunistic groundwater sample zones, specifically, the zone at 376.17 mbgs (along hole) that caused a complete loss of drill fluid circulation for numerous runs.

5.6 Drill Fluid Archive Samples and Testing

Drill fluid samples were collected and archived in 1 litre amber bottles every 50 m during drilling. These samples were generally collected from the return drill fluid prior to entering the first settling tank, or from the centrifuge outlet into a clean, triple rinsed 19 litre (5 gallon) bucket, which was taken to the sampling area and transferred into the labelled bottles using new syringes, or new tubing with a peristaltic pump.

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Drill fluid samples were also collected during opportunistic groundwater sample collection. In this instance, since coring was not actively occurring at the time of WP07 initiation, the drill fluid sample was collected from the drill tank.

Drill fluid samples were also collected at three specified depths where microbiology core samples were collected. These samples were collected from the return drill fluid prior to entering the first settling tank or from the centrifuge outlet during drilling of the core and are covered under research and development activities.

A complete list of drill water sample field parameters collected under WP02 are provided in Table A-3.

6.0 OPPORTUNISTIC GROUNDWATER SAMPLE LOCATIONS

Three opportunistic groundwater samples were successfully collected during drilling of IG_BH02: samples IG_BH02_GW001, IG_BH02_GW028 and IG_BH02_GW033. Bypass from the sample zone was observed during purging for IG_BH02_GW028, so this sample was of lower confidence. A brief summary of the zones is as follows:

- IG_BH02_GW001: This sample was collected from 14.36 – 19.16 mbgs (along hole), after a 251 L (manual tank reading) volume loss in CR6 with two broken dykes over 2 runs with alteration staining on the core and joint surfaces.
- IG_BH02_GW028: This sample was collected from 59.30 – 64.11 mbgs (along hole), after a 383 L (manual tank reading) volume loss in CR27 with hematization and broken dykes.
- IG_BH02_GW033: This sample was collected from 374.46 – 377.05 mbgs (along hole), after a complete loss of drill fluid return during drilling of CR138, where two zones of gouge infilling and hematization were observed.

Complete details of the sample collection and results are presented in the WP07 Opportunistic Groundwater Sampling Report (Golder 2020a).

7.0 REFERENCES

Blackburn, C.E. and Hinz, P., 1996. Gold and base metal potential of the northwest part of the Raleigh Lake greenstone belt, northwestern Ontario-Kenora Resident Geologist's District; in Summary of Field Work and Other Activities 1996, Ontario Geological Survey, Miscellaneous Paper 166, p.113-115.

DesRoches, A., Sykes, M., Parmenter, A. and Sykes, E., 2018. Lineament Interpretation of the Revell Batholith and Surrounding Greenstone Belts (Nuclear Waste Management Organization. No. NWMO-TR-2018-19.

Golder (Golder Associates Ltd.), 2019. Phase 2 Initial Borehole Drilling and Testing, Ignace Area - Initial Borehole Characterization Plan for IG_BH02.

Golder, 2020a. Phase 2 Initial Borehole Drilling and Testing, Ignace Area – WP07 Data Report – Opportunistic Groundwater Sampling for IG_BH02. NWMO Report Number: APM-REP-01332-0254.

Golder, 2020b. Phase 2 Initial Borehole Drilling and Testing, Ignace Area – WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for IG_BH02. NWMO Report Number: APM-REP-01332-0245 R000.

DocuSign Envelope ID: CEF4ACF3-0495-4B56-88F8-F7C689607C64

Golder, 2020c. Phase 2 Initial Borehole Drilling and Testing, Ignace Area – WP01A Report – Site Commissioning Report for IG_BH02. NWMO Report Number: APM-REP-0263.

Golder, 2020d. Phase 2 Initial Borehole Drilling and Testing, Ignace Area – WP05 Data Report – Geophysical Borehole Logging and Interpretation for IG_BH02. NWMO Report Number: APM-REP-01332-0247.

Golder and PGW (Paterson Grant and Watson Ltd.), 2017. Phase 2 Geoscientific Preliminary Assessment, Geological Mapping, Township of Ignace and Area, Ontario. NWMO Report Number: APM-REP-01332-0225.

OGS (Ontario Geological Survey), 2011. 1:250 000 scale bedrock geology of Ontario, Ontario Geological Survey, Miscellaneous Release Data 126 - Revision 1.

Parmenter, A., Waffle, L. and DesRoches, A., 2020. An updated bedrock geology map and geological database for the northern portion of the Revell batholith (No. NWMO-TR-2020-08). Nuclear Waste Management Organization.

SGL (Sander Geophysics Limited), 2015. Phase 2 Geoscientific Preliminary Assessment, Acquisition, Processing and Interpretation of High-Resolution Airborne Geophysical Data, Township of Ignace, Ontario. Prepared for Nuclear Waste Management Organization (NWMO). NWMO Report Number: APM-REP-06145-0002.

SRK (SRK Consulting, Inc.) and Golder, 2015. Phase 2 Geoscientific Preliminary Assessment, Observation of General Geological Features, Township of Ignace, Ontario. Prepared for Nuclear Waste Management Organization. NWMO Report Number: APM-REP-06145-0004.

Stone, D., 2009. Geology of the Bending Lake Area, Northwestern Ontario; *in* Summary of Field Work and Other Activities 2009. Ontario Geological Survey. Open File Report 6240.

Stone, D., 2010a. Geology of the Stormy Lake Area, Northwestern Ontario; *in* Summary of Field Work and Other Activities 2010. Ontario Geological Survey, Open File Report 6260.

Stone, D., 2010b. Precambrian geology of the central Wabigoon Subprovince area, northwestern Ontario. Ontario Geological Survey, Open File Report 5422.

Stone, D., Halle, J. and Chaloux, E., 1998. Geology of the Ignace and Pekagoning Lake Areas, Central Wabigoon Subprovince; *in* Summary of Field Work and Other Activities 1998, Ontario Geological Survey, Misc. Paper 169.

Stone, D., Davis, D.W., Hamilton, M.A. and Falcon, A., 2010. Interpretation of 2009 Geochronology in the Central Wabigoon Subprovince and Bending Lake Areas, Northwestern Ontario, *in* Summary of Field Work and Other Activities 2010, Ontario Geological Survey, Open File Report 6260.

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APPENDIX A

Table A-1: IG_BH02 Final and Interim Borehole Orientation Measurements

Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Table A-3: Field Parameters of Archived Drill Water Samples

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Depth	[1]Survey Type	Azimuth (°)	Dip (°)
0	Planned	225	-70
50.1	TruShotD	225.5	-69.5
101.16	TruShotD	221.5	-69.1
149.14	TruShotD	225.8	-68.1
200.16	TruShotD	224.5	-67.8
250.11	TruShotD	227.3	-67
299.13	TruShotD	231.3	-66.7
350.15	TruShotD	233.1	-66.1
401.16	TruShotD	234.4	-65
449.15	TruShotD	235.6	-63.9
500.1	TruShotD	236.7	-62.6
551.12	TruShotD	234.3	-61.7
602.03	TruShotD	239.5	-60.2
650.1	TruShotD	241.3	-59.6
701.1	TruShotD	241	-59.4
749.1	TruShotD	243.3	-58.4
803.12	TruShotD	247.8	-57
851.11	TruShotD	249.4	-56.1
902.12	TruShotD	252.1	-54.9
953.07	TruShotD	251.9	-54.3
0	AtCollar	224.96	-70.36
10	GyroSp-IQP	225.68	-69.91
20	GyroSp-IQP	225.42	-69.88
30	GyroSp-IQP	224.59	-69.67
40	GyroSp-IQP	224.82	-69.54
50	GyroSp-IQP	224.85	-69.4
60	GyroSp-IQP	225.61	-69.19
70	GyroSp-IQP	224.7	-68.99
80	GyroSp-IQP	224.07	-68.84
90	GyroSp-IQP	224.51	-68.69
100	GyroSp-IQP	224.92	-68.55
110	GyroSp-IQP	225.35	-68.61
120	GyroSp-IQP	225.17	-68.54
130	GyroSp-IQP	224.48	-68.43
140	GyroSp-IQP	226.12	-68.31
150	GyroSp-IQP	225.73	-68.12
160	GyroSp-IQP	225.46	-68
170	GyroSp-IQP	226.66	-67.79
180	GyroSp-IQP	226.74	-67.69
190	GyroSp-IQP	226.89	-67.3
200	GyroSp-IQP	228	-67.48
210	GyroSp-IQP	228.28	-67.17
220	GyroSp-IQP	228.76	-66.87
230	GyroSp-IQP	229.57	-66.84
240	GyroSp-IQP	228.4	-66.77
250	GyroSp-IQP	229.79	-66.63
260	GyroSp-IQP	229.21	-66.73
270	GyroSp-IQP	229.84	-66.79
280	GyroSp-IQP	229.75	-66.65

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Depth	[1]Survey Type	Azimuth (°)	Dip (°)
290	GyroSp-IQP	230.74	-66.81
300	GyroSp-IQP	230.34	-66.63
310	GyroSp-IQP	231.77	-66.8
320	GyroSp-IQP	232.04	-66.59
330	GyroSp-IQP	232.31	-66.58
340	GyroSp-IQP	233.26	-66.31
350	GyroSp-IQP	232.96	-65.98
360	GyroSp-IQP	234.34	-65.96
370	GyroSp-IQP	233.93	-65.63
380	GyroSp-IQP	233.8	-65.53
390	GyroSp-IQP	234.52	-65.33
400	GyroSp-IQP	233.9	-65.03
410	GyroSp-IQP	234.97	-64.92
420	GyroSp-IQP	235.69	-64.63
430	GyroSp-IQP	235.03	-64.59
440	GyroSp-IQP	235.95	-64.17
450	GyroSp-IQP	235.33	-64.11
460	GyroSp-IQP	233.78	-63.72
470	GyroSp-IQP	234.77	-63.46
480	GyroSp-IQP	236.58	-63.31
490	GyroSp-IQP	236.13	-62.89
500	GyroSp-IQP	237.04	-62.64
510	GyroSp-IQP	236.78	-62.49
520	GyroSp-IQP	237.26	-62.24
530	GyroSp-IQP	236.42	-61.89
540	GyroSp-IQP	236.83	-61.56
550	GyroSp-IQP	237.74	-61.37
560	GyroSp-IQP	238.86	-61.14
570	GyroSp-IQP	239.01	-60.89
580	GyroSp-IQP	239.68	-60.69
590	GyroSp-IQP	238.61	-60.41
600	GyroSp-IQP	239.48	-60.28
610	GyroSp-IQP	240.51	-60.15
620	GyroSp-IQP	241.55	-60.04
630	GyroSp-IQP	241.02	-59.9
640	GyroSp-IQP	241.13	-59.79
650	GyroSp-IQP	241.53	-59.7
660	GyroSp-IQP	242.85	-59.58
670	GyroSp-IQP	242.63	-59.47
680	GyroSp-IQP	241.55	-59.44
690	GyroSp-IQP	243.68	-59.35
710	GyroSp-IQP	243.62	-59.08
720	GyroSp-IQP	244.47	-58.86
730	GyroSp-IQP	244.99	-58.68
740	GyroSp-IQP	244.48	-58.48
750	GyroSp-IQP	247.19	-58.3
760	GyroSp-IQP	247.41	-58.09
770	GyroSp-IQP	246.11	-57.89
780	GyroSp-IQP	247.2	-57.73

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Depth	[1]Survey Type	Azimuth (°)	Dip (°)
790	GyroSp-IQP	247.59	-57.51
800	GyroSp-IQP	248.9	-57.32
810	GyroSp-IQP	248.66	-57.1
820	GyroSp-IQP	249.12	-56.87
830	GyroSp-IQP	250.19	-56.69
840	GyroSp-IQP	249.93	-56.44
850	GyroSp-IQP	250.24	-56.21
860	GyroSp-IQP	250.85	-56.01
870	GyroSp-IQP	251.62	-55.77
880	GyroSp-IQP	250.91	-55.59
890	GyroSp-IQP	252.08	-55.45
900	GyroSp-IQP	252.31	-55.21
910	GyroSp-IQP	252.64	-55.02
920	GyroSp-IQP	253.45	-54.79
930	GyroSp-IQP	254.11	-54.64
940	GyroSp-IQP	253.72	-54.42
950	GyroSp-IQP	254.11	-54.25
960	GyroSp-IQP	255.36	-54.06
970	GyroSp-IQP	255.42	-53.88
980	GyroSp-IQP	255.82	-53.69
990	GyroSp-IQP	255.64	-53.48

Notes:

[1]TruShotD measurements were collected during drilling of IG_BH02, GyroSp-IQP measurements were collected post drilling of IG_BH02

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Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
26-Sep-19	11:30	1	2.71	4.11	-	-	No volumes measured; sump containment not yet in place	-	-		-	-	-	-	-	-	-	-	-	-		-	6.43	-	-	-	-	First run after initial PQ casing.
26-Sep-19	11:57	2	4.11	4.45	-	-	No volumes measured; sump containment not yet in place	-	-	-	-	-	-	-	-	-	-	8.63	-	-	-	-	11.76	-	-	-	-	-
26-Sep-19	12:43	3	4.45	7.16	-	-	No volumes measured; sump containment not yet in place	-	-	-	22.91	10	1.00	5.710	-	12.00	-	9.84	14%	1000	-	-16	8.49	-	-	-	-	-
26-Sep-19	13:18	4	7.16	10.08	-	-	No volumes measured; sump containment not yet in place	-	-	-	25.15	20	0.93	5.810	2%	11.99	-0.01	8.00	-19%	1000	0%	-23	7.53	-	-	-	-	-
28-Sep-19	05:45	5	10.08	13.12	-1248.29	-	Manual readings of tanks = +4L	-	96.64	-	12.60	9.9	1.00	0.280	0%	10.95	0.00	6.90	-14%	323	0%	74	12.17	1350	10	45	1400	Initial run using traced drill fluid.
28-Sep-19	08:55	6	13.12	16.16	-1536	-1536	Manual readings of tanks = -251L	-	97.7	1%	15.76	10	1.00	0.266	-5%	10.73	-0.22	6.65	-4%	958	197%	89	12.17	2000	75	55	1500	-
28-Sep-19	10:08	7	16.16	19.16	-1747	211	Manual readings of tanks = -192L --> Initiate WP07	-	98.62	1%	19.56	9.9	1.00	0.267	0%	10.48	-0.25	6.42	-3%	1000	4%	90	15.00	2000	75	55	1500	-
02-Oct-19	23:15	8	19.16	20.65	-1748	1	Manual readings of tanks = -129L -> Run stopped short to add barrier between PQ & PWT casing to prevent cuttings from entering.	-	92.57	-6%	12.58	9.9	1.00	0.209	-22%	9.84	-0.64	6.37	-1%	1000	0%	342	30.20	1400	50	45	900	Intact Core
03-Oct-19	00:55	9	20.65	22.11	-92	-1655	Manual readings of tanks = -144L	-	94.33	2%	13.78	9.7	1.00	0.208	0%	10.33	0.49	5.61	-12%	1000	0%	173	23.97	1500	50	45	1000	-
03-Oct-19	02:28	10	22.11	25.10	-93	0	Manual readings of tanks = -110L	-	94.41	0%	16.44	9.5	1.00	0.221	6%	10.19	-0.14	6.79	21%	1000	0%	179	21.74	1500	50	42	1000	-
03-Oct-19	03:58	11	25.10	28.11	-232	140	Manual readings of tanks = -195L	-	91.81	-3%	17.65	9.5	1.00	0.232	5%	10.06	-0.13	4.12	-39%	1000	0%	184	19.27	1500	50	42	750	-
03-Oct-19	04:55	12	28.11	29.41	-61	-171	Manual readings of tanks = -112L	-	90.37	-2%	18.76	9.6	1.00	0.242	4%	10.07	0.01	4.18	1%	1000	0%	182	25.38	1500	50	42	750	Felsic dyke with fractures; run blocked.
03-Oct-19	06:05	13	29.41	31.12	-34	-27	Manual readings of tanks = -63L	-	90.66	0%	17.76	9.4	1.00	0.247	2%	10.02	-0.05	3.97	-5%	1000	0%	185	17.54	1500	50	42	1000	-
03-Oct-19	14:39	14	31.12	34.14	-2873	2839	Approx. 3000L added to centrifuge tank while drilling; no manual readings	-	90	-1%	13.85	9.4	1.00	0.155	-37%	9.64	-0.38	4.12	4%	1000	0%	209	20.86	2000	50	45	1250	-
03-Oct-19	15:43	15	34.14	37.17	-2112	-761	Manual readings of tanks = -100L	-	95.11	6%	13.99	9.5	1.00	0.178	15%	9.74	0.10	4.32	5%	645	-36%	224	14.19	2000	50	45	1500	-
03-Oct-19	17:17	16	37.17	39.35	-63	-2049	Manual readings of tanks = -169L	-	94.87	0%	14.57	9.6	1.00	0.176	-1%	9.71	-0.03	4.64	7%	1000	55%	220	17.89	2250	50	45	1500	-
03-Oct-19	18:15	17	39.35	40.16	-32	-30	Manual readings of tanks = -37L	-	92.99	-2%	14.46	9.4	1.00	0.177	1%	9.71	0.00	6.11	32%	1000	0%	206	13.58	2500	50	45	1500	-
03-Oct-19	23:49	18	40.16	43.10	-166	134	Manual readings of tanks = -243L	-	89.63	-4%	15.74	9.5	1.00	0.172	-3%	9.65	-0.06	6.39	5%	1000	0%	201	22.45	1600	75	42	1150	Single open fracture with quartz; vuggs present
04-Oct-19	01:43	19	43.10	46.10	-112	-54	Manual readings of tanks = -132L	-	85.54	-5%	16.71	9.5	1.00	0.179	4%	9.62	-0.03	5.78	-10%	1000	0%	201	19.00	1400	75	42	1400	2-3 open fractures
04-Oct-19	03:07	20	46.10	49.13	-125	13	Manual readings of tanks = -189L	-	83.99	-2%	19.07	9.4	1.00	0.212	18%	9.66	0.04	4.55	-21%	1000	0%	193	18.15	1900	75	42	750	Hematize alternation, open features
04-Oct-19	04:39	21	49.13	52.13	-104	-21	Manual readings of tanks = -110L	-	80.11	-5%	19.02	9.4	1.00	0.213	0%	9.67	0.01	3.58	-21%	1000	0%	210	16.00	1900	75	42	1000	Hematize alternation, open features
04-Oct-19	08:41	22	52.13	55.16	-103	-1	Manual readings of tanks = +99L	-	91.96	15%	17.15	9.4	1.00	0.248	16%	9.68	0.01	4.91	37%	1000	0%	332	15.18	2250	75	53	1500	Hematize alternation, open features
04-Oct-19	10:30	23	55.16	58.15	-101	-3	Manual readings of tanks = -125L	-	80.13	-13%	17.31	9.2	1.01	0.277	12%	9.70	0.02	4.42	-10%	1000	0%	343	15.05	2000	75	51	1500	Hematize alternation, open features
04-Oct-19	11:52	24	58.15	59.48	-78	-22	Manual readings of tanks = -109L	-	75.16	-6%	18.35	9.4	1.00	0.277	0%	9.61	-0.09	4.28	-3%	1000	0%	265	20.30	2250	75	53	1500	Hematize alternation, open features
04-Oct-19	14:00	25	59.48	61.15	-37	-41	Manual readings of tanks = -180L	-	72.45	-4%	17.42	9.1	1.01	0.285	3%	9.55	-0.06	6.30	47%	1000	0%	308	13.77	2000	50	51	1750	Hematize alternation, open features
04-Oct-19	15:20	26	61.15	63.06	-384	347	Manual readings of tanks = -400L	-	82.79	14%	16.69	8.9	1.01	0.286	0%	9.45	-0.10	5.06	-20%	1000	0%	262	10.99	2000	75	51	1500	Hematized zones present
04-Oct-19	20:31	27	63.06	64.11	-454	70	Manual readings of tanks = -454L --> Initiate WP07; zone bypassed to surface.	-	86.73	5%	12.68	8.8	1.01	0.226	-21%	9.60	0.15	3.43	-32%	1000	0%	230	8.57	2000	75	42	1500	Hematized zones present
06-Oct-19	20:35	28	64.11	67.13	-626	172	Manual readings of tanks = -435L	-	95.80	10%	12.24	9	1.01	0.184	-19%	9.51	-0.09	2.70	-21%	1000	0%	247	9.27	2000	100	45	1250	4 open fractures; 2 at top of run with oxidation and bleaching
07-Oct-19	01:35	29	67.13	70.13	-890	264	Manual readings of tanks = -830L	-	94.69	-1%	11.70	9.3	1.00	0.160	-13%	9.43	-0.08	3.72	38%	1000	0%	255	20.47	2000	100	49	1100	-
07-Oct-19	03:44	30	70.13	73.12	-955	65	Manual readings of tanks = -947L	-	102.80	9%	13.80	9.3	1.00	0.163	2%	9.47	0.04	3.59	-3%	1000	0%	223	22.41	2000	100	45	1100	-
07-Oct-19	05:20	31	73.12	76.12	-773	-183	Manual readings of tanks = -743L	-	101.10	-2%	13.31	9.4	1.00	0.149	-9%	9.41	-0.06	3.44	-4%	1000	0%	251	17.33	2000	100	45	1000	-
07-Oct-19	09:18	32	76.12	79.17	-614	-159	Manual readings of tanks = -617L	-	101.80	1%	17.45	9.4	1.00	0.172	15%	9.37	-0.04	3.91	14%	1000	0%	223	17.05	2500	50	53	1500	-
07-Oct-19	11:04	33	79.17	82.16	-609	-5	Manual readings of tanks = -630L	-	100.40	-1%	16.86	9.5	1.00	0.168	-2%	9.40	0.03	4.19	7%	1000	0%	222	13.71	2500	75	53	1500	-
07-Oct-19	12:16	34	82.16	85.17	-490	-119	Manual readings of tanks = -534L	-	96.10	-4%	17.71	9.5	1.00	0.187	11%	9.41	0.01	4.76	14%	1000	0%	216	15.28	2500	50	53	1250	-
07-Oct-19	13:49	35	85.17	88.16	-570	80	Manual readings of tanks = -582L	-	97.99	2%	16.68	9.5	1.00	0.176	-6%	9.39	-0.02	5.25	10%	1000	0%	223	15.38	2500	75	53	1500	-
07-Oct-19	15:03	36	88.16	90.98	-533	-36	Manual readings of tanks = -532L	-	93.56	-5%	17.54	9.7	1.00	0.185	5%	9.32	-0.07	4.52	-14%	1000	0%	234	15.60	2500	75	53	1250	-
07-Oct-19	18:14	37	90.98	93.98	-912	379	Manual readings of tanks = -930L	-	86.78	-7%	16.20	9.8	1.00	0.161	-13%	9.29	-0.03	6.83	51%	1000	0%	221	18.33	2500	75	55	1000	-
07-Oct-19	21:15	38	93.98	95.00	-692	-221	Manual readings of tanks = -780L	-	84.82	-2%	14.22	9.8	1.00	0.167	4%	9.13	-0.16	6.31	-8%	1000	0%	246	40.20	2500	100	57	750	-
07-Oct-19	22:04	39	95.00	97.10	-658	-34	Manual readings of tanks = -642L	-	87.70	3%	14.38	9.6	1.00	0.150	-10%	9.21	0.08	5.42	-14%	1000	0%	203	18.10	1900	75	45	1000	-
08-Oct-19	00:52	40	97.10	100.10	-752	94	Manual readings of tanks = -958L; commence flushing for 100m geophysics	-	93.16	6%	11.64	9.4	1.00	0.149	-1%	9.33	0.12	5.37	-1%	1000	0%	224	22.67	2250	75	45	1250	-
12-Oct-19	22:25	41	100.10	100.22	-105	-647	Manual readings of tanks = -61L, first run after surface casing grouting	-	76.43	-18%	14.81	9.8	1.00	7.530	4954%	12.26	2.93	4.29	-20%	1000	0%	-49	33.33	-	-	-	-	Continue drilling after PQ casing grouting; run blocked after drilling through Van Ruth plug. High pH and electrical conductivity due to coring through grout.
12-Oct-19	23:39	42	100.22	103.16	7	-112	Manual readings of tanks = -5L	-	83.04	9%	14.34	9.8	1.00	7.290	-3%	12.26	0.00	4.49	5%	1000	0%	-43	13.19	1900	75	57	1700	High pH and electrical conductivity due to coring through grout.
13-Oct-19	02:37	43	103.16	106.15	-143	150	Manual readings of tanks = -20L	-	85.04	2%	15.26	9.8	1.00	6.570	-10%	12.19	-0.07	6.61	47%	1000	0%	-45	25.33	2200	75	45	1500	-
13-Oct-19	03:59	44	106.15	109.13	-57	-86	Manual readings of tanks = -14L	-	84.83	0%	16.57	9.9	1.00	6.140	-7%	12.12	-0.07	5.34	-19%	1000	0%	-43	17.67	2600	25	45	1800	-
13-Oct-19	05:13	45	109.13	112.13	-43	-14	Manual readings of tanks = +1L	-	85.18	0%	17.06	9.8	1.00	5.950	-3%	12.10	-0.02	5.12	-4%	1000	0%	-43	16.00	2250	40	45	1600	-
13-Oct-19	06:15	46	112.13	115.13	-86	43	Manual readings of tanks = -23L	-	85.24	0%	17.17	9.9	1.00	5.520	-7%	12.06	-0.04	6.88	34%	1000	0%	-38	12.33	2500	75	57	1500	-
13-Oct-19	11:29	47	115.13	118.17	-7	-79	Manual readings of tanks = -9L	-	83.64	-2%	19.08	10	1.00	4.720	-14%	11.38	-0.68	6.03	-12%	77.2	-92%	-33	24.34	2500	40	49	1500	-
13-Oct-19	13:02	48	118.17	121.17	-54	48	Manual readings of tanks = -96L	-	85.48	2%	19.33	9.9	1.00	4.410	-7%	11.34	-0.04	7.28	21%	1000	1195%	-34	15.33	2500	75	49	1800	-
13-Oct-19	14:19	49	121.17	124.18	3	-57	Manual readings of tanks = -38L	-	86.11	1%	18.59	10	1.00	4.190	-5%	11.83	0.49	6.83	-6%	1000	0%	-36	15.28	2200	75	49	1700	-
13-Oct-19	15:58	50	124.18	127.17	7	-4	Manual readings of tanks = -97L	-	87.66	2%	18.36	9.9	1.00	4.130	-1%	11.80	-0.03	5.74	-16%	1000	0%	-28	15.05	2300	100	49	1800	-
13-Oct-19	17:27	51	127.17	130.17	-82	89	Manual readings of tanks = +8L	-	86.16	-2%	18.87	10	1.00	3.590	-13%	11.80	0.00	7.07	23%	1000	0%	-32	19.00	2350	100	53	1700	-
13-Oct-19	18:24	52	130.17	133.16	-50	-32	Manual readings of tanks = +85L	-	88.22	2%	18.94	9.9	1.00	3.360	-6%	11.72	-0.08	5.86	-17%	1000	0%	-28	14.05	2500	100	53	1700	-

Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
13-Oct-19	21:12	53	133.16	136.15	-98	48	Manual readings of tanks = -76L	-	88.55	0%	17.45	9.8	1.00	3.420	2%	11.81	0.09	4.33	-26%	1000	0%	-25	15.00	1800	125	57	1800	-
13-Oct-19	22:24	54	136.15	139.15	-57	-41	Manual readings of tanks = +15L	-	88.76	0%	17.70	9.9	1.00	3.130	-8%	11.74	-0.07	3.71	-14%	1000	0%	-26	14.67	2000	125	57	1600	-
13-Oct-19	23:35	55	139.15	142.15	-4	-53	Manual readings of tanks = +59L	-	89.97	1%	17.64	9.9	1.00	2.880	-8%	11.68	-0.06	3.77	2%	1000	0%	-21	15.00	2200	125	53	1500	-
14-Oct-19	00:39	56	142.15	145.12	-40	36	Manual readings of tanks = +4L	-	88.01	-2%	17.59	9.9	1.00	2.660	-8%	11.62	-0.06	5.24	39%	1000	0%	-18	13.00	2200	125	57	1800	-
14-Oct-19	01:48	57	145.12	148.13	-15	-25	Manual readings of tanks = +15L	-	89.47	2%	17.37	9.9	1.00	2.360	-11%	11.51	-0.11	4.00	-24%	1000	0%	-19	13.00	2100	125	57	1900	-
14-Oct-19	02:50	58	148.13	150.73	13	-28	Manual readings of tanks = +21L	-	90.68	1%	17.11	9.3	1.00	2.280	-3%	11.49	-0.02	4.64	16%	1000	0%	-24	12.31	2200	125	53	1500	-
14-Oct-19	03:27	59	150.73	151.14	3	10	Manual readings of tanks = +26L	-	88.99	-2%	16.13	9.7	1.00	2.430	7%	11.59	0.10	4.67	1%	1000	0%	-19	9.76	2200	125	57	1500	-
14-Oct-19	05:40	60	151.14	154.14	-36	39	Manual readings of tanks = +17L	-	89.98	1%	15.93	9.7	1.00	2.130	-12%	11.45	-0.14	4.49	-4%	1000	0%	-6	14.00	2300	125	53	1500	-
14-Oct-19	09:40	61	154.14	157.14	-6	-31	Manual readings of tanks = -62L	-	87.76	-2%	17.80	9.7	1.00	0.408	-81%	10.37	-1.08	4.72	5%	1000	0%	63	21.33	2500	100	53	1600	Drill fluid replaced with clean, traced water
14-Oct-19	11:00	62	157.14	160.15	24	-29	Manual readings of tanks = +4L	-	90.49	3%	17.56	9	1.01	0.650	59%	10.52	0.15	4.65	-1%	1000	0%	28	16.94	2500	100	49	1750	-
14-Oct-19	12:04	63	160.15	163.17	76	-52	Manual readings of tanks = -56L	-	92.30	2%	17.30	9.2	1.01	0.650	0%	10.44	-0.08	3.83	-18%	1000	0%	49	13.58	2400	125	49	1600	-
14-Oct-19	15:20	64	163.17	166.17	17	59	Manual readings of tanks = -75L	-	97.35	5%	16.02	8.5	1.01	0.628	-3%	10.38	-0.06	3.33	-13%	1000	0%	53	12.00	2300	150	49	2000	-
14-Oct-19	16:17	65	166.17	167.38	1	15	Manual readings of tanks = +41L	-	96.05	-1%	15.90	8.8	1.01	0.632	1%	10.32	-0.06	3.32	0%	1000	0%	51	13.22	2500	125	45	2000	-
14-Oct-19	22:07	66	167.38	169.13	-14	16	Manual readings of tanks = +18L	-	93.87	-2%	14.41	8.3	1.01	0.635	0%	10.38	0.06	2.00	-40%	1000	0%	62	9.71	2100	150	49	1600	-
14-Oct-19	23:08	67	169.13	172.12	38	-52	Manual readings of tanks = +2L	-	91.20	-3%	15.00	8.5	1.01	0.652	3%	10.35	-0.03	4.13	107%	1000	0%	61	10.67	2100	150	49	1400	-
15-Oct-19	00:18	68	172.12	175.15	41	-3	Manual readings of tanks = +34L	-	91.10	0%	15.18	8.2	1.01	0.648	-1%	10.25	-0.10	4.20	2%	1000	0%	65	13.67	2200	150	53	1500	-
15-Oct-19	01:41	69	175.15	178.14	39	1	Manual readings of tanks = +34L	-	90.46	-1%	15.68	8.3	1.01	0.663	2%	10.19	-0.06	1.42	-66%	1000	0%	73	18.00	2200	150	49	1400	-
15-Oct-19	03:01	70	178.14	181.14	-59	99	Manual readings of tanks = -36L	-	90.15	0%	16.10	8.4	1.01	0.703	6%	10.11	-0.08	1.48	4%	1000	0%	75	17.00	2300	150	53	1400	-
15-Oct-19	04:15	71	181.14	184.13	18	-77	Manual readings of tanks = +43L	-	90.05	0%	15.85	7.7	1.02	0.691	-2%	10.08	-0.03	0.73	-51%	1000	0%	75	14.33	2000	175	53	1400	-
15-Oct-19	05:25	72	184.13	187.13	63	-45	Manual readings of tanks = +18L	-	91.31	1%	15.65	7.3	1.02	0.700	1%	10.05	-0.03	3.30	352%	1000	0%	58	13.67	2400	175	57	2000	-
15-Oct-19	10:41	73	187.13	190.16	-29	92	Manual readings of tanks = +83L	-	87.90	-4%	18.42	7.5	1.02	0.681	-3%	9.96	-0.09	11.19	239%	1000	0%	53	13.53	2000	150	53	1600	-
15-Oct-19	12:01	74	190.16	193.17	22	-51	Manual readings of tanks = -46L	-	88.87	1%	18.18	7.5	1.02	0.666	-2%	9.89	-0.07	1.79	-84%	1000	0%	69	17.61	2500	150	53	1500	-
15-Oct-19	13:10	75	193.17	196.16	-17	40	Manual readings of tanks = -28L	-	91.14	3%	17.70	7.5	1.02	0.679	2%	9.85	-0.04	1.67	-7%	1000	0%	76	15.05	2500	125	53	1500	-
15-Oct-19	14:18	76	196.16	199.16	-91	74	Manual readings of tanks = -124L	-	92.35	1%	17.19	7	1.02	0.717	6%	9.83	-0.02	5.30	217%	1000	0%	70	15.00	2300	150	53	1900	-
15-Oct-19	15:48	77	199.16	202.16	-13	-78	Manual readings of tanks = +80L	-	91.09	-1%	17.07	6.7	1.02	0.720	0%	9.75	-0.08	6.20	17%	1000	0%	71	14.00	2500	200	53	2000	-
15-Oct-19	22:53	78	202.16	205.13	-130	117	Manual readings of tanks = -56L	-	80.49	-12%	15.64	7.1	1.02	0.596	-17%	9.82	0.07	3.43	-45%	1000	0%	95	15.00	2000	200	53	1500	Single fracture; extended break between day and night shift.
16-Oct-19	00:00	79	205.13	208.16	-86	-44	Manual readings of tanks = -50L	-	88.21	10%	15.53	7.1	1.02	0.608	2%	9.77	-0.05	3.80	11%	1000	0%	90	15.00	2000	200	53	1500	-
16-Oct-19	01:17	80	208.16	211.16	-89	3	Manual readings of tanks = -53L	-	86.62	-2%	15.61	7.4	1.02	0.604	-1%	9.72	-0.05	3.91	3%	1000	0%	96	17.33	2200	200	49	1500	-
16-Oct-19	02:40	81	211.16	214.12	-143	55	Manual readings of tanks = -107L	-	85.64	-1%	15.67	7.1	1.02	0.611	1%	9.65	-0.07	4.12	5%	1000	0%	89	18.67	2200	150	53	1400	Single feature with no aperture
16-Oct-19	03:51	82	214.12	217.14	-125	-19	Manual readings of tanks = -62L	-	85.16	-1%	15.70	6.9	1.02	0.646	6%	9.65	0.00	4.83	17%	1000	0%	93	16.00	2200	150	53	1500	Single feature with no aperture
16-Oct-19	05:50	83	217.14	220.16	-149	25	Manual readings of tanks = -29L	-	82.59	-3%	16.15	7.1	1.02	0.666	3%	9.53	-0.12	7.80	61%	1000	0%	80	30.00	2300	150	57	1500	-
16-Oct-19	09:46	84	220.16	223.17	-	-	Manual readings of tanks = -118L; totalizers unpluged during run	-	78.47	-5%	17.99	7.5	1.02	0.599	-10%	9.42	-0.11	3.85	-51%	1000	0%	68	16.28	2500	175	49	1700	Stick core
16-Oct-19	11:03	85	223.17	226.16	-24	-	Manual readings of tanks = -+79L	-	84.23	7%	18.23	7	1.02	0.608	2%	9.44	0.02	3.92	2%	1000	0%	80	16.39	2600	200	49	1600	-
16-Oct-19	12:24	86	226.16	229.16	-23	-1	Manual readings of tanks = +11L	-	89.09	6%	17.08	7.3	1.02	0.625	3%	9.44	0.00	4.78	22%	1000	0%	75	12.67	2700	200	49	1600	-
16-Oct-19	14:52	87	229.16	232.17	-33	10	Manual readings of tanks = -L	-	86.00	-3%	16.21	7.2	1.02	0.492	-21%	9.76	0.32	5.02	5%	1000	0%	107	10.63	2500	200	49	1500	-
16-Oct-19	04:04	88	232.17	235.14	-45	12	Manual readings of tanks = -4L	-	85.50	-1%	16.19	7.2	1.02	0.489	-1%	9.67	-0.09	8.87	77%	1000	0%	106	12.79	2300	200	53	2000	-
16-Oct-19	21:30	89	235.14	238.12	-64	19	Manual readings of tanks = -11L	-	84.58	-1%	14.77	6.4	1.03	0.517	6%	9.70	0.03	8.97	1%	1000	0%	94	11.67	2600	200	49	1500	-
16-Oct-19	23:20	90	238.12	241.09	-100	36	Manual readings of tanks = -23L	-	80.64	-5%	14.49	6.7	1.02	0.519	0%	9.70	0.00	4.62	-48%	1000	0%	86	12.33	3000	200	53	1500	-
17-Oct-19	02:42	91	241.09	244.11	-6	-94	Manual readings of tanks = -6L	-	78.82	-2%	13.86	6.3	1.03	0.554	7%	9.67	-0.03	3.80	-18%	1000	0%	80	12.67	2500	200	38	1500	-
17-Oct-19	04:22	92	244.11	247.12	-156	150	Manual readings of tanks = +43L	-	78.90	0%	13.78	6.7	1.02	0.548	-1%	9.60	-0.07	2.36	-38%	1000	0%	95	15.00	2600	200	49	1700	-
17-Oct-19	05:40	93	247.12	250.11	-161	6	Manual readings of tanks = -59L	-	80.02	1%	13.99	6.5	1.03	0.559	2%	9.57	-0.03	3.44	46%	1000	0%	83	17.33	2600	200	49	1500	-
17-Oct-19	10:16	94	250.11	253.14	-148	-14	Manual readings of tanks = +1L	-	84.39	5%	18.09	6.6	1.02	0.596	7%	9.43	-0.14	2.80	-19%	1000	0%	64	14.19	1900	200	49	2000	-
17-Oct-19	11:23	95	253.14	256.14	-67	-81	Manual readings of tanks = -21L	-	102.10	21%	16.94	6.7	1.02	0.574	-4%	9.53	0.10	2.54	-9%	1000	0%	111	12.00	2400	200	53	1800	-
17-Oct-19	12:30	96	256.14	259.16	-86	19	Manual readings of tanks = +22L	-	98.97	-3%	16.31	6.3	1.03	0.613	7%	9.58	0.05	8.55	237%	1000	0%	93	12.25	2200	200	53	1750	-
17-Oct-19	13:54	97	259.16	262.16	-70	-16	Manual readings of tanks = +44L	-	96.89	-2%	15.95	6.1	1.03	0.610	0%	9.45	-0.13	8.30	-3%	1000	0%	117	12.33	2500	200	53	1600	-
17-Oct-19	15:09	98	262.16	265.13	-50	-20	Manual readings of tanks = -8L	-	94.18	-3%	16.08	5.6	1.03	0.628	3%	9.43	-0.02	3.01	-64%	1000	0%	110	12.79	2500	200	53	1500	-
17-Oct-19	17:26	99	265.13	268.15	-117	67	Manual readings of tanks = +15L	-	91.45	-3%	15.61	5.8	1.03	0.646	3%	9.44	0.01	4.39	46%	1000	0%	121	16.89	2300	200	49	1900	-
17-Oct-19	20:49	100	268.15	271.13	-59	-58	Manual readings of tanks = 0L	-	83.79	-8%	15.20	6.2	1.03	0.651	1%	9.31	-0.13	2.26	-49%	1000	0%	122	15.33	2900	175	38	1500	-
17-Oct-19	21:52	101	271.13	274.14	-69	10	Manual readings of tanks = +8L	-	84.11	0%	21.58	6	1.03	0.603	-7%	9.32	0.01	1.20	-47%	1000	0%	98	10.00	2800	150	38	2800	-
17-Oct-19	23:54	102	274.14	277.13	-123	54	Manual readings of tanks = -49L	-	83.54	-1%	18.23	6	1.03	0.642	6%	9.37	0.05	1.85	54%	1000	0%	109	9.00	2700	200	42	2000	-
18-Oct-19	02:36	103	277.13	280.14	-53	-69	Manual readings of tanks = +63L	-	83.47	0%	16.18	5.8	1.03	0.655	2%	9.37	0.00	1.65	-11%	1000	0%	104	12.00	2600	250	53	2000	Totalizers were unplugged at start of run
18-Oct-19	03:50	104	280.14	283.12	-149	96	Manual readings of tanks = -41L	-	90.02	8%	15.87	5.5	1.03	0.689	5%	9.38	0.01	1.46	-12%	1000	0%	109	13.33	2500	250	49	1800	Purge rate assessment carried out
19-Oct-19	12:02	105	283.12	286.15	-103	-46	Manual readings of tanks = +25L	-	83.22	-8%	13.08	6	1.03	0.699	1%	8.97	-0.41	2.97	103%	1000	0%	124	11.88	2400	300	53	1900	-
19-Oct-19	13:37	106	286.15	289.15	-64	-39	Manual readings of tanks = -9L	-	99.52	20%	13.93	6.3	1.03	0.601	-14%	9.45	0.48	2.31	-22%	1000	0%	126	8.67	2300	300	53	2000	-
19-Oct-19	15:52	107	289.15	292.15	-67	3	Manual readings of tanks = -61L	-	102.70	3%	15.02	6	1.03	0.637	6%	9.39	-0.06	2.32	0%	1000	0%	113	11.00	2600	250	53	1650	-
19-Oct-19	23:51	108	292.15	295.16	-129	63	Manual readings of tanks = +22L	-	88.42	-14%	14.88	5.9	1.03	0.675	6%	9.35	-0.04	1.84	-21%	1000	0%	81	12.33	2500	300	49	1600	Stick core
20-Oct-19	00:56	109	295.16	298.16	-36	-93	Manual readings of tanks = +24L	-	91.31	3%	14.92	5.9	1.03	0.656	-3%	9.39	0.04	1.74	-5%	1000	0%	85	11.33	2500	175	38	2000	Stick core
20-Oct-19	01:57	110	298.16	301.13	-120	84	Manual readings of tanks = -24L	-	91.68	0%	14.81	5.9	1.03	0.684	4%	9.51	0.12	0.88	-49%	1000	0%	108	10.33	2200	250	42	2000	Stick core

Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
20-Oct-19	03:47	111	301.13	304.11	-89	-32	Manual readings of tanks = +17L	-	91.35	0%	14.84	5.9	1.03	0.677	-1%	9.47	-0.04	1.27	44%	1000	0%	93	9.67	2600	250	53	1700	Stick core
20-Oct-19	04:53	112	304.11	307.10	-122	33	Manual readings of tanks = -46L	-	91.22	0%	14.63	5.8	1.03	0.693	2%	9.46	-0.01	4.62	264%	1000	0%	58	9.00	2500	300	53	1500	Stick core
20-Oct-19	05:56	113	307.10	310.12	-133	11	Manual readings of tanks = -27L	-	92.78	2%	14.31	5.8	1.03	0.703	1%	9.67	0.21	3.11	-33%	1000	0%	106	12.00	2500	300	49	1100	Stick core
20-Oct-19	09:12	114	310.12	312.16	-82	-51	Manual readings of tanks = +24L	-	83.74	-10%	18.17	6.8	1.02	0.634	-10%	9.34	-0.33	4.16	34%	1000	0%	39	14.71	2300	400	53	2100	-
20-Oct-19	20:11	115	312.16	313.12	-5	-77	Manual readings of tanks = +47L	-	61.44	-27%	16.20	6.5	1.03	0.746	18%	9.39	0.05	6.81	64%	1000	0%	103	8.00	2600	250	53	1900	Fresh traced water added to centrifuge
20-Oct-19	21:19	116	313.12	316.11	-91	86	Manual readings of tanks = -8L	-	68.72	12%	16.29	6.5	1.03	0.737	-1%	9.42	0.03	8.63	27%	1000	0%	105	12.33	2500	200	45	1500	-
20-Oct-19	22:16	117	316.11	319.13	-56	-35	Manual readings of tanks = -7L	-	78.55	14%	16.89	7.1	1.02	0.669	-9%	9.40	-0.02	0.00	-100%	1000	0%	92	9.00	2500	200	45	1700	-
20-Oct-19	23:22	118	319.13	322.11	-24	-32	Manual readings of tanks = +24L	-	83.24	6%	16.51	6.6	1.02	0.720	8%	9.29	-0.11	2.84	283900%	1000	0%	77	11.67	3000	100	34	1700	-
21-Oct-19	00:57	119	322.11	325.14	-16	-8	Manual readings of tanks = +45L	-	83.98	1%	16.13	5.4	1.03	0.719	0%	9.35	0.06	8.51	200%	1000	0%	51	10.67	2800	150	38	2000	-
21-Oct-19	02:58	120	325.14	328.10	-64	48	Manual readings of tanks = +9L	-	82.63	-2%	16.75	6.4	1.03	0.713	-1%	9.39	0.04	1.20	-86%	1000	0%	92	10.00	2900	250	49	1900	-
21-Oct-19	04:02	121	328.10	331.09	-47	-17	Manual readings of tanks = +32L	-	86.02	4%	17.05	6	1.03	0.737	3%	9.29	-0.10	8.34	595%	1000	0%	98	11.33	2900	150	42	2000	-
21-Oct-19	11:28	122	331.09	334.17	-77	29	Manual readings of tanks = +56L	-	80.60	-6%	15.70	6	1.03	0.742	1%	9.44	0.15	8.10	-3%	1000	0%	147	9.74	2400	250	53	2200	-
21-Oct-19	12:30	123	334.17	337.15	-98	21	Manual readings of tanks = -33L	-	93.23	16%	16.11	6.1	1.03	0.691	-7%	9.28	-0.16	7.36	-9%	1000	0%	190	11.41	2700	250	51	2000	-
21-Oct-19	13:32	124	337.15	340.16	-119	21	Manual readings of tanks = +32L	-	97.62	5%	16.59	6	1.03	0.711	3%	9.42	0.14	8.20	11%	1000	0%	132	11.96	3000	250	53	1500	No evidence of water bearing features
21-Oct-19	14:58	125	340.16	343.15	-109	-10	Manual readings of tanks = +19L	-	103.10	6%	16.39	6	1.03	0.734	3%	9.25	-0.17	4.96	-40%	1000	0%	32	9.70	2300	300	53	2400	No evidence of water bearing features
21-Oct-19	16:20	126	343.15	346.15	-85	-24	Manual readings of tanks = +19L	-	103.80	1%	16.52	6.3	1.03	0.722	-2%	9.42	0.17	0.38	-92%	1000	0%	157	11.00	2500	400	53	2000	-
21-Oct-19	17:29	127	346.15	349.16	-127	42	Manual readings of tanks = -6L	-	103.70	0%	16.72	6.4	1.03	0.748	4%	9.30	-0.12	6.33	1566%	1000	0%	135	13.62	2500	500	51	2000	4 hematite and chlorite coated features in moderately altered rock, appear to have no apperture
21-Oct-19	18:13	128	349.16	349.71	-31	-96	Manual readings of tanks = -34L	-	104.70	1%	17.09	7.5	1.02	0.743	-1%	9.34	0.04	5.91	-7%	1000	0%	156	21.82	2800	550	53	2100	-
22-Oct-19	02:05	129	349.71	352.15	-89	57	Manual readings of tanks = +7L	-	86.21	-18%	14.77	5.8	1.03	0.761	2%	9.27	-0.07	2.79	-53%	1000	0%	75	11.48	2900	300	57	1600	-
22-Oct-19	04:04	130	352.15	355.14	-79	-10	Manual readings of tanks = +36L	-	94.79	10%	15.48	6.3	1.03	0.773	2%	9.23	-0.04	3.85	38%	1000	0%	85	15.72	3000	200	45	1500	-
22-Oct-19	05:33	131	355.14	358.16	-114	35	Manual readings of tanks = -8L	-	92.18	-3%	16.03	6.3	1.03	0.787	2%	9.24	0.01	4.41	15%	1000	0%	78	18.54	3000	200	42	1500	No evidence of water bearing features; purge rate assessment carried out
22-Oct-19	21:06	132	358.16	361.12	-190	76	Manual readings of tanks = +25L	-	89.16	-3%	14.09	5.6	1.03	0.781	-1%	9.23	-0.01	1.84	-58%	1000	0%	81	16.55	2700	200	34	1500	Stick core
22-Oct-19	23:02	133	361.12	364.15	-149	-41	Manual readings of tanks = -85L	-	87.50	-2%	14.53	6.1	1.03	0.790	1%	9.37	0.14	7.82	325%	1000	0%	92	23.10	3000	150	34	1600	Stick core
23-Oct-19	00:17	134	364.15	367.12	-23	-125	Manual readings of tanks = +56L	-	82.75	-5%	14.08	5.2	1.04	0.812	3%	9.29	-0.08	4.23	-46%	1000	0%	86	11.45	2800	200	38	1600	Stick core
23-Oct-19	01:35	135	367.12	370.14	-130	107	Manual readings of tanks = +37L	-	82.51	0%	14.14	5.4	1.03	0.831	2%	9.28	-0.01	5.87	39%	1000	0%	74	12.91	2800	200	34	1700	-
23-Oct-19	02:56	136	370.14	373.14	-139	9	Manual readings of tanks = +22L	-	80.18	-3%	14.00	4.9	1.04	0.831	0%	9.34	0.06	3.29	-44%	1000	0%	68	14.67	2900	150	34	1700	Some small dyke zones, hematite alteration present, fractures appear to have no apperture
23-Oct-19	05:04	137	373.14	376.17	-17	-122	Manual readings of tanks = +8L	-	81.28	1%	13.77	4.8	1.04	0.854	3%	9.34	0.00	1.78	-46%	1000	0%	66	13.20	3000	200	38	1800	Hematization present
23-Oct-19	09:35	138	376.17	377.05	-591	574	Manual readings of tanks = -496L. Circulation lost during run, initiate WP07.	-	-	-	-	-	-	-	-	-	-	9.38	427%	-	-	-	17.05	3100	75	47	2000	Circulation lost, no drill fluid sample collected
27-Oct-19	14:40	139	377.05	379.14	-1230	639	Manual readings of tanks = -1310L	-	-	-	-	-	-	-	-	-	-	1.43	-85%	-	-	-	9.57	3000	100	45	2100	Continued circulation loss, no drill fluid sample collected
27-Oct-19	16:22	140	379.14	380.12	-608	-622	Manual readings of tanks = -677L	-	-	-	-	-	-	-	-	-	-	7.32	412%	-	-	-	11.22	3000	75	45	2100	Continued circulation loss, no drill fluid sample collected
27-Oct-19	18:30	141	380.12	382.14	-1444	836	Manual readings of tanks = -1467L	-	-	-	-	-	-	-	-	-	-	2.56	-65%	-	-	-	17.33	2750	100	45	2400	Continued circulation loss, no drill fluid sample collected
29-Oct-19	17:25	142	382.14	385.14	-4237	2793	Manual readings of tanks = -1396L	-	90.79	12%	14.27	9.8	1.00	4.960	481%	12.42	3.08	1.66	-35%	1000	0%	16	23.33	3100	50	45	1500	No evidence of water bearing features
29-Oct-19	23:14	143	385.14	388.16	-1901	-2336	Manual readings of tanks = -805L, recirculation left on in totalizer circuit during drilling, recirculated volume counted.	-	100.00	10%	9.51	9.8	1.00	5.530	11%	12.55	0.13	6.79	309%	1000	0%	5	16.23	3000	175	49	2000	No evidence of water bearing features
30-Oct-19	00:34	144	388.16	391.15	-952	-949	Manual readings of tanks = -997L	-	122.10	22%	11.38	9.9	1.00	1.990	-64%	12.08	-0.47	1.17	-83%	1000	0%	29	13.38	2600	175	53	2000	No evidence of water bearing features
30-Oct-19	02:52	145	391.15	394.18	-1832	880	Manual readings of tanks = -1482L	-	117.80	-4%	10.78	10	1.00	2.200	11%	12.12	0.04	1.22	4%	1000	0%	19	24.42	2700	150	53	2200	No evidence of water bearing features
30-Oct-19	04:30	146	394.18	397.17	-1271	-561	Manual readings of tanks = -1154L	-	121.90	3%	10.43	9.8	1.00	0.565	-74%	11.50	-0.62	7.39	506%	1000	0%	58	14.72	2800	200	53	2400	No evidence of water bearing features
02-Nov-19	01:24	147	397.17	398.11	-154	-1117	Manual readings of tanks = -32L. First run after cementing permeable zone in CR138	-	68.71	-44%	13.55	9.8	1.00	3.530	525%	12.17	0.67	5.42	-27%	1000	0%	-1	20.21	3000	450	53	2000	-
02-Nov-19	02:32	148	398.11	400.17	-196	42	Manual readings of tanks = +8L	-	76.67	12%	13.76	9.9	1.00	5.100	44%	12.36	0.19	7.90	46%	1000	0%	-3	14.08	2500	250	53	2500	-
02-Nov-19	03:58	149	400.17	403.16	-618	422	Manual readings of tanks = +27L. Recirculation left on in totalizer circuit during drilling, recirculated volume counted for remainder of drilling. Manual measurements considered indicative of volume changes.	-	80.83	5%	13.11	9.9	1.00	3.700	-27%	12.25	-0.11	6.57	-17%	1000	0%	2	15.38	2800	325	57	2500	-
02-Nov-19	05:24	150	403.16	403.96	-417	-201	Manual readings of tanks = -16L	-	80.66	0%	14.22	9.9	1.00	4.010	8%	12.22	-0.03	1.17	-82%	1000	0%	2	28.75	3000	300	53	2500	Run blocked, bit changed carried out
02-Nov-19	13:34	151	403.96	406.10	-123	-294	Manual readings of tanks = -23L	-	82.92	3%	10.97	9.8	1.00	3.090	-23%	12.27	0.05	2.39	104%	1000	0%	-35	12.15	2500	300	57	2300	-
02-Nov-19	15:09	152	406.10	409.15	-302	180	Manual readings of tanks = -22L	-	82.04	-1%	11.62	9.9	1.00	2.330	-25%	12.11	-0.16	1.20	-50%	1000	0%	-26	19.67	3000	300	61	2000	-
02-Nov-19	17:17	153	409.15	412.07	-478	175	Manual readings of tanks = -20L	-	85.91	5%	12.98	9.9	1.00	2.320	0%	12.14	0.03	2.21	84%	1000	0%	-21	34.25	3000	300	57	1000	-
02-Nov-19	20:25	154	412.07	415.14	-65	-413	Manual readings of tanks = -11L	-	84.35	-2%	12.00	9.9	1.00	2.190	-6%	12.14	0.00	2.65	20%	1000	0%	-33	8.14	2800	250	53	2200	-
02-Nov-19	21:25	155	415.14	418.16	-444	379	Manual readings of tanks = -8L	-	83.74	-1%	12.56	9.9	1.00	2.130	-3%	12.12	-0.02	4.85	83%	1000	0%	-32	9.27	2800	300	57	2400	-
02-Nov-19	22:39	156	418.16	421.16	-274	-170	Manual readings of tanks = +33L	-	84.87	1%	12.50	9.8	1.00	2.190	3%	12.13	0.01	0.62	-87%	1000	0%	-40	10.67	3000	350	55	2100	-
02-Nov-19	23:44	157	421.16	423.02	-426	152	Manual readings of tanks = +14L	-	83.73	-1%	13.48	9.9	1.00	1.830	-16%	12.01	-0.12	4.59	640%	1000	0%	-38	15.59	3000	400	57	2400	Several high angle intact joints; run blocked
03-Nov-09	04:25	158	423.02	424.16	-252	-174	Manual readings of tanks = -8L	-	83.74	0%	12.29	9.9	1.00	2.300	26%	12.11	0.10	6.39	39%	1000	0%	-26	9.65	2800	300	53	2000	-

Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
03-Nov-09	09:53	159	424.16	427.10	-385	133	Manual readings of tanks = -38L	-	83.29	-1%	10.64	9.8	1.00	2.140	-7%	12.01	-0.10	7.35	15%	1000	0%	-9	33.33	2100	350	57	1500	-
03-Nov-09	13:16	160	427.10	430.10	-324	-61	Manual readings of tanks = -97L	-	82.37	-1%	12.58	9.8	1.00	1.840	-14%	11.85	-0.16	7.44	1%	1000	0%	-7	17.00	2100	350	57	1500	-
03-Nov-09	14:49	161	430.10	433.11	-289	-35	Manual readings of tanks = -24L	-	84.07	2%	11.76	9.7	1.00	1.810	-2%	11.76	-0.09	7.48	1%	1000	0%	-6	16.28	2100	350	57	1500	-
03-Nov-09	16:37	162	433.11	436.11	-329	40	Manual readings of tanks = -55L	-	85.52	2%	12.30	9.5	1.00	1.650	-9%	11.82	0.06	6.90	-8%	1000	0%	-6	19.33	2100	350	57	1500	-
03-Nov-09	18:08	163	436.11	439.13	-323	-6	Manual readings of tanks = -32L	-	81.56	-5%	12.85	9.7	1.00	1.480	-10%	11.77	-0.05	7.80	13%	1000	0%	-4	20.20	2100	350	57	1500	-
03-Nov-19	21:17	164	439.13	442.15	-1286	963	Manual readings of tanks = -61L	-	84.04	3%	16.90	9.6	1.00	1.020	-31%	11.53	-0.24	8.25	6%	1000	0%	3	18.21	2600	325	55	1500	-
03-Nov-19	22:47	165	442.15	445.15	-233	-1053	Manual readings of tanks = +9L	-	84.15	0%	16.20	9.5	1.00	1.170	15%	11.58	0.05	7.41	-10%	1000	0%	-1	19.00	2800	300	53	1300	-
04-Nov-19	00:14	166	445.15	448.15	-650	417	Manual readings of tanks = +27L	-	82.57	-2%	16.29	9.3	1.00	1.000	-15%	11.47	-0.11	7.83	6%	1000	0%	10	18.67	3000	300	55	1200	-
04-Nov-19	02:04	167	448.15	451.15	-306	-344	Manual readings of tanks = -47L	-	80.89	-2%	16.01	9.3	1.00	1.040	4%	11.45	-0.02	7.97	2%	1000	0%	7	16.00	2800	350	53	1400	-
04-Nov-19	03:47	168	451.15	454.17	-188	-118	Manual readings of tanks = 0L	-	78.10	-3%	15.48	9.1	1.01	1.020	-2%	11.47	0.02	4.84	-39%	1000	0%	6	16.89	2300	325	55	1500	-
04-Nov-19	05:02	169	454.17	457.16	-497	309	Manual readings of tanks = +3L	-	81.50	4%	15.12	8.7	1.01	0.986	-3%	11.37	-0.10	5.14	6%	1000	0%	18	12.37	2800	350	55	1200	-
04-Nov-19	06:39	170	457.16	460.16	-1059	562	Manual readings of tanks = -27L	-	74.94	-8%	14.68	8.7	1.01	0.961	-3%	11.32	-0.05	5.60	9%	1000	0%	15	16.67	2400	400	57	1400	-
04-Nov-19	09:54	171	460.16	463.11	-212	-847	Manual readings of tanks = -9L	-	85.50	14%	13.41	8.4	1.01	0.966	1%	11.19	-0.13	4.63	-17%	1000	0%	39	18.98	2400	400	57	1300	-
04-Nov-19	13:15	172	463.11	466.13	-363	151	Manual readings of tanks = -82L	-	97.71	14%	12.74	8.4	1.01	0.768	-20%	11.06	-0.13	7.88	70%	1000	0%	44	23.51	2400	350	57	1200	-
04-Nov-19	14:47	173	466.13	469.11	-290	-73	Manual readings of tanks = -34L	-	95.20	-3%	12.97	8.2	1.01	0.874	14%	10.98	-0.08	7.56	-4%	1000	0%	51	18.12	2200	400	53	1500	-
04-Nov-19	16:55	174	469.11	472.10	-215	-75	Manual readings of tanks = -27L	-	94.36	-1%	12.25	8.1	1.01	0.795	-9%	10.95	-0.03	5.68	-25%	1000	0%	50	18.39	2400	375	53	1350	-
04-Nov-19	18:38	175	472.10	475.11	-307	92	Manual readings of tanks = -41L	-	93.70	-1%	12.56	8.2	1.01	0.793	0%	10.96	0.01	7.92	39%	1000	0%	46	22.26	2400	350	53	1300	-
04-Nov-19	20:25	176	475.11	478.15	-207	-100	Manual readings of tanks = -16L	-	81.79	-13%	14.90	7.7	1.02	0.813	3%	10.85	-0.11	7.31	-8%	1000	0%	54	12.50	2800	350	53	1200	-
04-Nov-19	21:44	177	478.15	481.16	-548	341	Manual readings of tanks = -16L	-	89.36	9%	14.67	7.7	1.02	0.819	1%	10.83	-0.02	7.60	4%	1000	0%	53	15.28	2800	400	53	1200	-
04-Nov-19	23:02	178	481.16	484.16	-967	419	Manual readings of tanks = +59L	-	85.70	-4%	14.26	7.9	1.02	0.796	-3%	10.79	-0.04	7.91	4%	1000	0%	51	15.00	2800	350	55	1300	-
05-Nov-19	01:13	179	484.16	487.15	-2384	1417	Manual readings of tanks = -39L	-	80.19	-6%	14.25	7.8	1.02	0.811	2%	10.75	-0.04	7.04	-11%	1000	0%	56	17.06	2600	350	55	1300	-
05-Nov-19	02:27	180	487.15	490.15	-1386	-997	Manual readings of tanks = -27L	-	81.52	2%	13.86	7.7	1.02	0.800	-1%	10.72	-0.03	7.10	1%	1000	0%	60	14.33	2800	375	55	1200	-
05-Nov-19	03:38	181	490.15	493.15	-1926	540	Manual readings of tanks = +20L	-	88.21	8%	13.37	7.1	1.02	0.817	2%	10.68	-0.04	8.91	25%	1000	0%	64	13.00	2800	325	55	1200	-
05-Nov-19	05:36	182	493.15	496.16	-2634	708	Manual readings of tanks = -7L	-	83.83	-5%	13.01	7.2	1.02	0.810	-1%	10.66	-0.02	8.66	-3%	1000	0%	66	17.28	2800	375	53	1300	-
05-Nov-19	09:10	183	496.16	499.13	-234	-2400	Manual readings of tanks = +27L	-	88.88	6%	12.37	6.8	1.02	0.815	1%	10.63	-0.03	9.00	4%	1000	0%	66	29.29	2400	375	57	1200	-
05-Nov-19	11:06	184	499.13	502.10	-312	78	Manual readings of tanks = -47L	-	103.80	17%	14.06	6.9	1.02	0.844	4%	10.50	-0.13	8.30	-8%	1000	0%	70	21.21	2300	375	57	1200	-
05-Nov-19	13:53	185	502.10	505.10	-403	91	Manual readings of tanks = +51L	-	111.00	7%	13.58	7.4	1.02	0.698	-17%	10.37	-0.13	7.66	-8%	1000	0%	79	23.00	2400	375	57	1200	-
05-Nov-19	15:33	186	505.10	508.12	-258	-145	Manual readings of tanks = -27L	-	108.80	-2%	13.17	8	1.01	0.736	5%	10.46	0.09	7.79	2%	1000	0%	83	19.21	2400	375	57	1400	-
05-Nov-19	17:14	187	508.12	511.12	-358	100	Manual readings of tanks = -36L	-	103.60	-5%	12.76	7	1.02	0.798	8%	10.42	-0.04	8.81	13%	1000	0%	83	20.67	2500	400	61	1100	-
05-Nov-19	21:17	188	511.12	514.15	-3002	2644	Manual readings of tanks = -59L	-	90.32	-13%	12.53	7.1	1.02	0.781	-2%	10.35	-0.07	9.05	3%	1000	0%	82	19.80	2900	375	53	1500	-
05-Nov-19	22:48	189	514.15	517.15	-2520	-482	Manual readings of tanks = -40L	-	103.70	15%	12.32	7.2	1.02	0.752	-4%	10.29	-0.06	8.78	-3%	1000	0%	84	19.00	3000	375	53	1500	-
06-Nov-19	00:15	190	517.15	520.14	-2653	133	Manual readings of tanks = -87L	-	103.50	0%	12.05	6.8	1.02	0.807	7%	10.27	-0.02	7.60	-13%	1000	0%	87	18.06	2850	350	49	1550	-
06-Nov-19	01:37	191	520.14	523.16	-2132	-521	Manual readings of tanks = +48L	-	103.50	0%	11.97	6.7	1.02	0.843	4%	10.03	-0.24	7.69	1%	1000	0%	187	15.23	3000	400	49	1400	-
06-Nov-19	04:13	192	523.16	526.15	-1865	-267	Manual readings of tanks = -4L	-	99.27	-4%	13.87	6.7	1.02	0.869	3%	10.28	0.25	6.99	-9%	1000	0%	139	13.71	3000	400	49	1400	-
06-Nov-19	06:37	193	526.15	529.17	-2278	413	Manual readings of tanks = -4L	-	96.79	-2%	12.99	7.4	1.02	0.709	-18%	10.18	-0.10	7.36	5%	1000	0%	147	16.89	3000	400	53	1500	-
06-Nov-19	11:15	194	529.17	532.09	-481	-1796	Manual readings of tanks = -79L	-	94.51	-2%	11.60	7.1	1.02	0.601	-15%	10.14	-0.04	6.88	-7%	1000	0%	161	24.66	2400	400	61	1400	-
06-Nov-19	13:15	195	532.09	535.11	-431	-50	Manual readings of tanks = -97L	-	87.48	-7%	11.94	7.3	1.02	0.624	4%	10.11	-0.03	7.26	6%	1000	0%	177	23.51	2600	400	57	1400	-
06-Nov-19	14:31	196	535.11	538.10	-236	-196	Manual readings of tanks = -39L	-	95.38	9%	12.11	6.2	1.03	0.676	8%	9.44	-0.67	-	-	1000	0%	107	12.04	2600	375	57	1400	-
06-Nov-19	16:00	197	538.10	541.11	-321	86	Manual readings of tanks = -83L	-	87.61	-8%	12.00	6.8	1.02	0.630	-7%	10.03	0.59	6.85	-6%	1000	0%	151	15.95	2500	400	53	1500	-
07-Nov-19	02:15	198	541.11	544.14	-1979	1658	Manual readings of tanks = -51L	-	91.95	5%	12.67	6.9	1.02	0.620	-2%	9.89	-0.14	6.24	-9%	1000	0%	164	15.18	2900	450	53	1500	-
07-Nov-19	03:47	199	544.14	547.15	-2441	462	Manual readings of tanks = -73L	-	101.10	10%	12.45	6.7	1.02	0.606	-2%	9.84	-0.05	6.78	9%	1000	0%	152	18.60	3000	500	49	1400	-
07-Nov-19	06:00	200	547.15	550.17	-2447	6	Manual readings of tanks = -71L	-	98.46	-3%	12.27	7	1.02	0.563	-7%	9.75	-0.09	6.39	-6%	1000	0%	137	18.21	2900	400	49	1500	-
07-Nov-19	10:34	201	550.17	553.12	-330	-2117	Manual readings of tanks = -129L	-	99.45	1%	11.14	6.9	1.02	0.606	8%	9.71	-0.04	6.64	4%	1000	0%	155	19.32	2400	500	57	1400	Stick core
07-Nov-19	12:57	202	553.12	556.12	-480	150	Manual readings of tanks = -171L	-	96.86	-3%	11.58	6.4	1.03	0.619	2%	9.79	0.08	3.11	-53%	1000	0%	188	21.33	2400	500	57	1500	No evidence of water bearing features
07-Nov-19	15:50	203	556.12	559.10	358	-838	Manual readings of tanks = -169L	-	98.53	2%	11.38	6.9	1.02	0.636	3%	9.69	-0.10	5.54	78%	1000	0%	162	26.85	2400	450	57	1400	No evidence of water bearing features
07-Nov-19	18:27	204	559.10	562.11	-735	1092	Manual readings of tanks = -120L	-	97.00	-2%	13.03	7.2	1.02	0.542	-15%	9.57	-0.12	3.15	-43%	1000	0%	156	28.90	2700	400	57	1100	No evidence of water bearing features
07-Nov-19	20:42	205	562.11	565.15	-2376	1642	Manual readings of tanks = -70L	-	97.63	1%	13.32	7.3	1.02	0.504	-7%	9.59	0.02	6.31	100%	1000	0%	159	15.79	3000	350	49	1500	-
07-Nov-19	22:17	206	565.15	568.16	-2466	90	Manual readings of tanks = -81L	-	102.70	5%	12.63	6.3	1.03	0.593	18%	9.44	-0.15	4.60	-27%	1000	0%	115	17.28	2750	450	53	1500	-
07-Nov-19	23:38	207	568.16	571.14	-1792	-674	Manual readings of tanks = +23L	-	102.20	0%	12.58	6.4	1.03	0.554	-7%	9.46	0.02	2.65	-42%	1000	0%	141	13.76	2800	400	53	1500	-
08-Nov-19	01:01	208	571.14	574.14	-2117	325	Manual readings of tanks = -49L	-	101.30	-1%	12.20	6.6	1.02	0.606	9%	9.32	-0.14	2.30	-13%	1000	0%	128	15.33	2800	500	57	1600	-
08-Nov-19	02:36	209	574.14	577.14	-2382	266	Manual readings of tanks = -46L	-	97.47	-4%	13.26	6.8	1.02	0.586	-3%	9.36	0.04	4.72	105%	1000	0%	149	17.67	2500	500	57	1600	-
08-Nov-19	04:34	210	577.14	580.14	-2439	56	Manual readings of tanks = +26L	-	94.23	-3%	14.09	7	1.02	0.498	-15%	9.34	-0.02	3.47	-26%	1000	0%	154	18.00	3000	500	53	1500	-
08-Nov-19	06:19	211	580.14	583.15	-1878	-560	Manual readings of tanks = +15L	-	97.42	3%	13.70	6.5	1.03	0.560	12%	9.28	-0.06	3.54	2%	1000	0%	161	13.95	3000	500	57	1500	-
08-Nov-19	11:54	212	583.15	586.14	-396	-1483	Manual readings of tanks = -58L	-	94.17	-3%	12.90	7	1.02	0.554	-1%	9.24	-0.04	3.76	6%	1000	0%	170	18.06	2600	450	57	1350	-
08-Nov-19	13:35	213	586.14	589.11	-438	42	Manual readings of tanks = -106L	-	92.02	-2%	13.36	6.4	1.03	0.588	6%	9.20	-0.04	7.04	87%	1000	0%	166	20.20	2500	500	57	1500	No evidence of water bearing features
08-Nov-19	14:25	214	589.11	589.39	-5	-433	Manual readings of tanks = -30L	-	93.18	1%	13.00	7.7	1.02	0.581	-1%	9.09	-0.11	6.95	-1%	1000	0%	198	35.71	2500	450	57	1400	-
09-Nov-19	03:52	215	589.39	592.17	-3558	3553	Manual readings of tanks = -93L	-	86.53	-7%	12.96	8.4	1.01	0.926	59%	9.10	0.01	7.52	8%	1000	0%	166	15.11	2900	400	53	1600	-
09-Nov-19	06:07	216	592.17	595.16	-4168	610	Manual readings of tanks = -42L	-	91.11	5%	15.15	6.9	1.02	1.170	26%	8.63	-0.47	6.50	-14%	1000	0%	175	27.76	3000	400	53	1600	-
09-Nov-19	11:27	217	595.16	598.02	-568	-3600	Manual readings of tanks = +8L	-	90.79	0%	13.69	7.2	1.02	0.838	-28%	8.83	0.20	8.38	29%	1000	0%	178	22.73	2500	500	57	700	-
09-Nov-19	14:04	218	598.02	601.10	-531	-37	Manual readings of tanks = -60L	-	89.25	-2%	14.76	7.3	1.02	0.839	0%	8.81	-0.02	7.10	-15%	1000	0%	173	34.09	2500	450	57	1000	-
09-Nov-19	18:00	219	601.10	604.03	-1153	623	Manual readings of tanks = -134L	-	92.35	3%	15.08	7.8	1.02	0.885	5%	8.37	-0.44	4.02	-43%	1000	0%	189	52.90	2500	450	57	600	No evidence of water bearing features
09-Nov-19	22:15	220	604.03	607.13	-2420	1267	Manual readings of tanks = +5L	-	95.49	3%	14.09	7.2	1.02	0.850	-4%	8.49	0.12	4.68	16%	1000	0%	150	15.48	3000	600	53	1700	-
09-Nov-19	23:42	221	607.13	610.14	-2318	-102	Manual readings of tanks = -30L	-	98.20	3%	14.00	6.9	1.02	0.874	3%	8.50	0.01	5.05	8%	1000	0%	155	14.29	3000	450	49	1900	-
10-Nov-19	01:58	222	610.14	613.14	-1931	-387	Manual readings of tanks = -50L	-	98.10	0%	12.46	6.6	1.02	0.916	5%	8.57	0.07	4.67	-8%	1000	0%	155	13.33	2900	400	49	1800	-

Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
10-Nov-19	04:26	223	613.14	616.14	-2527	596	Manual readings of tanks = -58L	-	97.67	0%	12.11	6.9	1.02	0.889	-3%	8.52	-0.05	4.14	-11%	1000	0%	178	14.00	2300	400	49	1900	-
10-Nov-19	05:48	224	616.14	619.13	-1736	-791	Manual readings of tanks = +27L	-	97.95	0%	11.82	6.3	1.03	0.914	3%	8.49	-0.03	6.50	57%	1009	1%	173	12.71	2400	450	53	1900	-
10-Nov-19	09:20	225	619.13	619.31	11	-1746	Manual readings of tanks = +37L	-	90.83	-7%	11.12	7	1.02	0.964	5%	8.44	-0.05	5.74	-12%	1000	-1%	239	55.56	-	-	-	-	-
10-Nov-19	10:55	226	619.31	622.10	-209	220	Manual readings of tanks = +14L	-	91.19	0%	11.32	7.4	1.02	0.793	-18%	8.57	0.13	6.59	15%	1000	0%	193	14.34	2000	500	57	1600	-
10-Nov-19	12:36	227	622.10	625.13	-285	75	Manual readings of tanks = -42L	-	92.84	2%	11.18	7	1.02	0.930	17%	8.46	-0.11	5.70	-14%	1000	0%	176	19.47	2200	450	57	1400	-
10-Nov-19	14:43	228	625.13	628.15	-358	73	Manual readings of tanks = +10L	-	91.24	-2%	12.10	7.7	1.02	0.916	-2%	8.49	0.03	5.93	4%	1000	0%	194	28.15	2400	450	57	1100	-
10-Nov-19	18:28	229	628.15	631.13	-439	81	Manual readings of tanks = +24L	-	92.20	1%	11.96	7	1.02	0.913	0%	8.51	0.02	9.43	59%	1000	0%	185	16.11	2100	500	57	1400	-
10-Nov-19	21:45	230	631.13	634.13	-2242	1803	Manual readings of tanks = +11L	-	98.00	6%	13.73	6.9	1.02	0.915	0%	8.67	0.16	7.80	-17%	1000	0%	166	15.67	2400	550	53	1600	-
10-Nov-19	11:23	231	634.13	637.12	-2405	163	Manual readings of tanks = +17L	-	96.38	-2%	13.20	7	1.02	0.907	-1%	8.38	-0.29	9.04	16%	1000	0%	151	16.39	2900	550	53	1700	-
11-Nov-19	00:48	232	637.12	640.13	-2241	-163	Manual readings of tanks = -59L	-	95.23	-1%	12.80	6.8	1.02	0.929	2%	8.56	0.18	10.37	15%	1000	0%	146	16.28	2700	500	53	2000	-
11-Nov-19	02:09	233	640.13	643.12	-2076	-166	Manual readings of tanks = -56L	-	95.05	0%	12.53	6.8	1.02	0.936	1%	8.14	-0.42	10.33	0%	1000	0%	176	13.71	2100	500	53	2000	-
11-Nov-19	03:53	234	643.12	646.14	-2164	89	Manual readings of tanks = -54L	-	90.83	-4%	12.38	6.8	1.02	0.947	1%	8.55	0.41	9.81	-5%	1000	0%	161	15.23	2300	550	53	1900	-
11-Nov-19	05:54	235	646.14	649.13	-2069	-95	Manual readings of tanks = -13L	-	95.32	5%	12.49	7.4	1.02	0.967	2%	8.52	-0.03	9.48	-3%	1000	0%	162	14.72	2000	500	53	1700	-
11-Nov-19	09:13	236	649.13	652.10	-355	-1714	Manual readings of tanks = +65L	-	94.44	-1%	11.22	6.7	1.02	1.000	3%	8.66	0.14	7.76	-18%	1000	0%	220	18.86	1900	550	57	1600	-
11-Nov-19	11:48	237	652.10	655.12	-328	-27	Manual readings of tanks = +57L	-	91.50	-3%	10.67	6.3	1.03	1.030	3%	8.48	-0.18	7.73	0%	1000	0%	192	17.55	1800	550	57	1600	-
11-Nov-19	13:39	238	655.12	658.11	-750	422	Manual readings of tanks = +11L	-	91.29	0%	10.62	6	1.03	1.030	0%	8.62	0.14	8.84	14%	1000	0%	193	17.73	1700	600	57	1600	-
11-Nov-19	16:06	239	658.11	661.11	-521	-229	Manual readings of tanks = +10L	-	90.80	-1%	11.51	6	1.03	1.060	3%	8.80	0.18	10.51	19%	1000	0%	207	25.67	1700	550	57	1200	-
12-Nov-19	00:54	240	661.11	664.13	-1832	1311	Manual readings of tanks = +14L	-	84.74	-7%	11.44	6.6	1.02	0.955	-10%	8.73	-0.07	7.86	-25%	1000	0%	160	12.91	2600	500	49	1600	-
12-Nov-19	03:28	241	664.13	667.12	-2172	340	Manual readings of tanks = +93L	-	89.94	6%	11.99	7.1	1.02	0.999	5%	8.52	-0.21	6.44	-18%	1000	0%	164	15.05	2250	550	53	2000	-
12-Nov-19	05:54	242	667.12	670.13	-2258	86	Manual readings of tanks = +41L	-	94.37	5%	11.76	6.8	1.02	1.000	0%	8.57	0.05	6.57	2%	1000	0%	171	17.94	2000	550	53	2000	-
12-Nov-19	10:40	243	670.13	673.13	-328	-1930	Manual readings of tanks = -24L	-	90.09	-5%	11.48	6.9	1.02	1.030	3%	8.70	0.13	15.68	139%	1000	0%	219	18.33	1700	550	57	1900	-
12-Nov-19	13:05	244	673.13	676.13	-458	131	Manual readings of tanks = -14L	-	88.83	-1%	12.01	7.6	1.02	0.925	-10%	8.90	0.20	14.21	-9%	1000	0%	217	14.33	1900	550	57	1700	-
12-Nov-19	17:08	245	676.13	679.09	-485	27	Manual readings of tanks = -13L	-	92.24	4%	12.98	7.2	1.02	0.935	1%	8.94	0.04	13.03	-8%	1000	0%	217	21.28	1700	550	57	1700	-
13-Nov-19	00:32	246	679.09	682.15	-1889	1403	Manual readings of tanks = +125L	-	88.73	-4%	14.43	6.9	1.02	0.972	4%	8.61	-0.33	13.70	5%	1000	0%	207	14.38	2000	500	53	2000	-
13-Nov-19	04:16	247	682.15	685.14	-2023	135	Manual readings of tanks = +64L	-	99.00	12%	12.55	6.9	1.02	1.030	6%	8.44	-0.17	12.82	-6%	1000	0%	196	15.38	2000	550	53	2000	-
13-Nov-19	06:07	248	685.14	688.14	-2053	30	Manual readings of tanks = +120L	-	96.20	-3%	12.13	7.8	1.02	1.110	8%	8.33	-0.11	11.94	-7%	1000	0%	172	16.67	2000	550	53	1750	Torque spikes to 3000 psi at end of run
13-Nov-19	17:01	249	688.14	691.11	-495	-1559	Manual readings of tanks = +104L	-	88.71	-8%	16.43	7.9	1.02	1.420	28%	8.18	-0.15	9.94	-17%	1000	0%	262	45.45	2000	550	57	1700	Run paused to replace drill fluid with clean, traced water due to high drilling mud content
13-Nov-19	22:59	250	691.11	692.84	-2525	2031	Manual readings of tanks = -24L	-	91.09	3%	13.38	7.6	1.02	1.080	-24%	8.21	0.03	9.82	-1%	1000	0%	231	28.90	3000	500	53	1600	-
14-Nov-19	06:00	251	692.84	694.13	-1212	-1313	Manual readings of tanks = -41L	-	86.22	-5%	12.73	7.7	1.02	1.530	42%	8.08	-0.13	10.24	4%	1000	0%	202	20.93	2700	450	57	1800	-
14-Nov-19	09:50	252	694.13	697.13	-600	-612	Manual readings of tanks = +165L	-	83.61	-3%	11.74	9	1.01	2.610	71%	7.49	-0.59	8.84	-14%	1000	0%	203	31.67	2400	450	57	1800	No evidence of water bearing features
14-Nov-19	11:43	253	697.13	700.12	-406	-194	Manual readings of tanks = -236L	-	74.57	-11%	12.40	9	1.01	2.410	-8%	7.74	0.25	7.49	-15%	1000	0%	194	17.73	2100	450	57	1500	No evidence of water bearing features
14-Nov-19	13:30	254	700.12	703.13	-295	-111	Manual readings of tanks = +132L	-	74.12	-1%	12.86	8.1	1.01	2.130	-12%	7.71	-0.03	5.17	-31%	1000	0%	192	19.27	2300	450	57	1400	No evidence of water bearing features
14-Nov-19	15:10	255	703.13	706.10	-181	-114	Manual readings of tanks = +29L	-	74.78	1%	13.07	8.4	1.01	2.470	16%	7.59	-0.12	7.89	53%	1000	0%	189	16.84	2300	500	57	1400	-
14-Nov-19	17:36	256	706.10	709.11	-509	328	Manual readings of tanks = +36L	-	67.96	-9%	12.79	7.8	1.02	2.170	-12%	7.70	0.11	7.72	-2%	1000	0%	191	23.92	2200	450	57	1600	-
14-Nov-19	21:48	257	709.11	712.14	-2598	2088	Manual readings of tanks = -47L	-	67.53	-1%	11.96	7.9	1.02	2.150	-1%	7.72	0.02	7.42	-4%	1000	0%	173	16.50	3000	450	49	1500	-
15-Nov-19	00:07	258	712.14	715.11	-4501	1903	Manual readings of tanks = -43L	-	68.45	1%	11.98	8	1.01	2.410	12%	7.46	-0.26	5.54	-25%	1000	0%	211	29.63	3000	400	49	1500	-
15-Nov-19	01:41	259	715.11	718.12	-2761	-1740	Manual readings of tanks = -41L	-	66.57	-3%	11.95	8	1.01	2.590	7%	7.59	0.13	8.21	48%	1000	0%	163	18.60	2900	450	49	1500	-
15-Nov-19	02:56	260	718.12	721.14	-1958	-802	Manual readings of tanks = -62L	-	65.05	-2%	11.92	8.3	1.01	2.570	-1%	7.48	-0.11	7.90	-4%	1000	0%	218	11.26	2900	400	49	1700	-
15-Nov-19	04:36	261	721.14	724.12	-1700	-258	Manual readings of tanks = -90L	-	63.55	-2%	11.62	8.1	1.01	2.680	4%	7.56	0.08	7.72	-2%	1000	0%	166	11.07	2400	500	49	1800	-
15-Nov-19	06:16	262	724.12	727.11	-2838	1138	Manual readings of tanks = -39L	-	63.43	0%	11.66	7.7	1.02	2.700	1%	7.58	0.02	9.33	21%	1000	0%	191	18.06	2000	500	49	2000	-
15-Nov-19	09:50	263	727.11	730.11	-529	-2309	Manual readings of tanks = +326L	-	64.60	2%	12.88	8.5	1.01	2.870	6%	7.58	0.00	8.70	-7%	1000	0%	209	26.67	2100	550	57	1700	No evidence of water bearing features
15-Nov-19	11:54	264	730.11	733.13	-370	-159	Manual readings of tanks = -214L	-	64.35	0%	12.80	8.2	1.01	2.840	-1%	7.53	-0.05	8.12	-7%	1000	0%	192	20.86	2000	500	57	1600	No evidence of water bearing features
15-Nov-19	14:34	265	733.13	736.12	-476	106	Manual readings of tanks = +320L	-	65.34	2%	12.18	8.6	1.01	3.130	10%	7.52	-0.01	5.12	-37%	1000	0%	204	25.75	2100	550	57	1500	No evidence of water bearing features
15-Nov-19	16:49	266	736.12	739.11	-370	-106	Manual readings of tanks = +189L	-	65.46	0%	12.75	8.8	1.01	3.160	1%	7.67	0.15	6.80	33%	1000	0%	217	26.09	2300	500	57	1500	No evidence of water bearing features
15-Nov-19	21:56	267	739.11	742.13	-3068	2698	Manual readings of tanks = -177L	-	64.36	-2%	11.76	8.9	1.01	3.470	10%	7.44	-0.23	8.65	27%	1000	0%	181	18.21	2500	500	49	1600	No evidence of water bearing features
16-Nov-19	00:14	268	742.13	745.13	-3638	570	Manual readings of tanks = +78L	-	66.09	3%	14.33	8.7	1.01	3.570	3%	7.37	-0.07	6.00	-31%	1000	0%	187	19.00	2000	500	53	2000	-
16-Nov-19	01:53	269	745.13	748.09	-2484	-1154	Manual readings of tanks = -16L	-	64.75	-2%	12.96	8.4	1.01	2.980	-17%	7.46	0.09	8.20	37%	1000	0%	190	21.48	2400	500	53	2000	-
16-Nov-19	03:41	270	748.09	751.12	-2838	354	Manual readings of tanks = +68L	-	64.84	0%	12.49	8.4	1.01	3.280	10%	7.44	-0.02	8.08	-1%	1000	0%	172	22.11	2400	550	53	1900	-
16-Nov-19	10:41	271	751.12	754.10	-427	-2411	Manual readings of tanks = +239L	-	63.69	-2%	13.24	9.1	1.01	2.970	-9%	7.50	0.06	8.70	8%	1000	0%	183	21.48	2200	550	57	1700	No evidence of water bearing features
16-Nov-19	13:33	272	754.10	757.13	-456	30	Manual readings of tanks = -22L	-	63.60	0%	13.25	8.9	1.01	3.090	4%	7.53	0.03	6.39	-27%	1000	0%	187	23.10	2000	550	57	1900	-
16-Nov-19	15:35	273	757.13	760.12	-315	-142	Manual readings of tanks = +91L	-	64.05	1%	13.15	8.5	1.01	2.900	-6%	7.56	0.03	7.63	19%	1000	0%	206	25.08	2100	550	57	1600	-
16-Nov-19	17:59	274	760.12	763.10	-349	35	Manual readings of tanks = +38L	-	64.86	1%	13.27	8.9	1.01	3.150	9%	7.52	-0.04	5.80	-24%	1000	0%	192	26.51	2100	500	57	1500	-
16-Nov-19	22:59	275	763.10	766.10	-3287	2937	Manual readings of tanks = +384L	-	57.57	-11%	14.87	9.5	1.00	3.240	3%	7.55	0.03	5.95	3%	1000	0%	188	25.00	2700	450	49	1800	No evidence of water bearing features
17-Nov-19	00:39	276	766.10	769.12	-2269	-1017	Manual readings of tanks = -121L	-	57.03	-1%	14.98	9.6	1.00	3.300	2%	7.52	-0.03	6.66	12%	1000	0%	176	17.88	2900	500	49	1600	No evidence of water bearing features
17-Nov-19	02:24	277	769.12	772.12	-2757	487	Manual readings of tanks = -273L	-	57.17	0%	14.71	8.2	1.01	3.260	-1%	7.50	-0.02	6.20	-7%	1000	0%	157	21.67	2300	500	49	2000	No evidence of water bearing features
17-Nov-19	04:43	278	772.12	775.12	-2472	-285	Manual readings of tanks = +149L	-	63.65	11%	14.49	8.9	1.01	3.460	6%	7.50	0.00	6.73	9%	1000	0%	180	19.00	2500	500	53	1800	No evidence of water bearing features
17-Nov-19	06:30	279	775.12	778.12	-2171	-301	Manual readings of tanks = +53L	-	64.67	2%	15.17	7.5	1.02	3.420	-1%	7.44	-0.06	10.50	56%	1000	0%	163	17.67	2300	500	53	1600	-
17-Nov-19	10:14	280	778.12	781.13	-518	-1653	Manual readings of tanks = -33L	-	65.64	1%	14.33	8.3	1.01	2.350	-31%	7.43	-0.01	11.21	7%	1000	0%	205	22.59	2000	550	57	1900	-
17-Nov-19	12:42	281	781.13	784.13	-479	-39	Manual readings of tanks = +144L	-	67.41	3%	13.40	8.7	1.01	3.280	40%	7.53	0.10	10.64	-5%	1000	0%	221	26.33	2200	550	57	1700	-
17-Nov-19	15:02	282	784.13	787.10	-555	75	Manual readings of tanks = -69L	-	68.68	2%	13.61	9.3	1.00	3.500	7%	7.45	-0.08	9.08	-15%	1000	0%	190	31.31	2000	550	57	1700	-
17-Nov-19	17:48	283	787.10	790.13	-409	-145	Manual readings of tanks = +268L	-	68.82	0%	13.60	9.4	1.00	3.610	3%	7.43	-0.02	8.86	-2%	1000	0%	198	35.64	2100	550	57	1600	-
17-Nov-19	22:26	284	790.13	793.15	-4345	3936	Manual readings of tanks = +118L	-	68.34	-1%	14.16	8.6	1.01	3.400	-6%	7.38	-0.05	8.85	0%	1000	0%	182	20.53	2400	500	53	1900	-
18-Nov-19	00:13	285	793.15	796.13	-2723	-1622	Manual readings of tanks = +29L	-	68.09	0%	13.97	8.9	1.01	3.550	4%	7.38	0.00	7.16	-19%	1000	0%	165	21.48	2400	500	49	2000	-

Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
18-Nov-19	02:00	286	796.13	799.13	-2399	-324	Manual readings of tanks = -1L	-	66.44	-2%	13.96	8.9	1.01	3.620	2%	7.36	-0.02	7.06	-1%	1000	0%	147	19.33	2600	550	53	1900	-
18-Nov-19	03:37	287	799.13	802.13	-2211	-189	Manual readings of tanks = -78L	-	67.74	2%	14.18	8.5	1.01	3.560	-2%	7.39	0.03	6.39	-9%	1000	0%	172	17.67	2600	450	53	1900	-
18-Nov-19	05:23	288	802.13	805.12	-2486	275	Manual readings of tanks = +74L	-	68.62	1%	14.04	8.9	1.01	3.660	3%	7.39	0.00	9.33	46%	1000	0%	161	20.40	2400	500	53	2000	-
18-Nov-19	09:23	289	805.12	808.13	-513	-1973	Manual readings of tanks = +181L	-	71.26	4%	15.14	8.7	1.01	3.670	0%	7.36	-0.03	9.15	-2%	1000	0%	196	33.55	2400	550	57	1600	-
18-Nov-19	12:58	290	808.13	811.08	-284	-230	Manual readings of tanks = +350L	-	69.18	-3%	14.39	9.1	1.01	3.960	8%	7.39	0.03	6.12	-33%	1000	0%	192	35.25	2100	550	57	1700	-
18-Nov-19	15:37	291	811.08	814.09	-386	103	Manual readings of tanks = +101L	-	66.54	-4%	14.61	8.7	1.01	3.930	-1%	7.38	-0.01	5.29	-14%	1000	0%	188	29.24	2100	550	57	1900	-
18-Nov-19	18:03	292	814.09	817.08	-431	44	Manual readings of tanks = -56L	-	57.28	-14%	14.72	9.5	1.00	3.820	-3%	7.45	0.07	4.84	-9%	1000	0%	199	30.43	2100	550	57	1800	-
18-Nov-19	22:41	293	817.08	820.14	-2719	2288	Manual readings of tanks = +59L	-	70.66	23%	14.07	9.8	1.00	3.930	3%	7.43	-0.02	6.11	26%	1000	0%	177	22.55	2400	550	57	1800	-
19-Nov-19	00:03	294	820.14	821.60	-1558	-1161	Manual readings of tanks = -18L	-	69.37	-2%	13.84	7.7	1.02	3.640	-7%	7.35	-0.08	14.48	137%	1000	0%	156	23.97	2400	610	57	1700	Run blocked, bit changed carried out
19-Nov-19	09:18	295	821.60	823.15	-355	-1203	Manual readings of tanks = +20L	-	70.28	1%	13.15	9.3	1.00	4.360	20%	7.33	-0.02	6.60	-54%	1000	0%	157	22.58	2100	550	57	2000	-
19-Nov-19	11:39	296	823.15	826.10	-292	-63	Manual readings of tanks = +34L	-	71.63	2%	13.70	9.1	1.01	4.780	10%	7.23	-0.10	3.07	-53%	1000	0%	172	23.39	2200	550	57	1500	-
19-Nov-19	14:23	297	826.10	829.10	-509	217	Manual readings of tanks = +12L	-	70.83	-1%	14.27	8.2	1.01	4.220	-12%	7.37	0.14	1.22	-60%	1000	0%	228	35.67	2400	550	57	1200	-
19-Nov-19	17:55	298	829.10	832.10	-667	158	Manual readings of tanks = +52L	-	70.73	0%	14.76	9.3	1.00	4.760	13%	7.26	-0.11	8.26	577%	1000	0%	209	54.00	2400	550	57	1300	-
19-Nov-19	22:10	299	832.10	835.13	-3541	2874	Manual readings of tanks = +143L	-	70.74	0%	15.65	10.8	0.99	4.730	-1%	7.23	-0.03	7.30	-12%	1000	0%	189	25.74	300	450	45	1500	-
19-Nov-19	23:53	300	835.13	838.14	-1929	-1612	Manual readings of tanks = -96L	-	68.91	-3%	15.56	9.7	1.00	4.530	-4%	7.32	0.09	9.33	28%	1000	0%	211	16.28	2750	300	57	1700	-
20-Nov-19	01:23	301	838.14	841.12	-1592	-337	Manual readings of tanks = -91L	-	67.77	-2%	15.10	7.5	1.02	4.690	4%	7.23	-0.09	9.38	1%	1000	0%	110	12.75	3000	600	53	1600	-
20-Nov-19	02:51	302	841.12	844.13	-1612	20	Manual readings of tanks = -13L	-	68.26	1%	14.10	8.6	1.01	4.940	5%	7.35	0.12	9.11	-3%	1000	0%	132	15.28	2800	550	53	1600	-
20-Nov-19	04:17	303	844.13	847.13	-2396	784	Manual readings of tanks = 0L	-	69.28	1%	14.06	8.5	1.01	4.940	0%	7.35	0.00	8.88	-3%	1000	0%	123	15.00	2750	575	57	1600	-
20-Nov-19	05:54	304	847.13	850.12	-1932	-464	Manual readings of tanks = -7L	-	69.49	0%	13.46	8.1	1.01	4.950	0%	7.30	-0.05	6.82	-23%	1000	0%	135	17.06	2500	600	57	1700	-
20-Nov-19	09:23	305	850.12	853.11	-276	-1657	Manual readings of tanks = +224L	-	69.88	1%	13.25	9.4	1.00	5.100	3%	7.33	0.03	8.89	30%	1000	0%	115	22.74	2200	650	57	1500	-
20-Nov-19	12:09	306	853.11	856.13	-404	128	Manual readings of tanks = -146L	-	70.17	0%	13.44	9.3	1.00	4.190	-18%	7.34	0.01	7.43	-16%	1000	0%	123	27.15	2200	600	57	1600	-
20-Nov-19	14:21	307	856.13	859.11	-472	68	Manual readings of tanks = -70L	-	71.39	2%	13.41	9.8	1.00	4.610	10%	7.34	0.00	8.01	8%	1000	0%	128	24.83	2400	600	53	1650	-
20-Nov-19	16:44	308	859.11	862.08	-424	-48	Manual readings of tanks = +181L	-	70.50	-1%	13.50	11.2	0.99	5.130	11%	7.34	0.00	7.31	-9%	1000	0%	131	31.31	2200	600	57	1500	-
20-Nov-19	18:53	309	862.08	865.11	-519	94	Manual readings of tanks = -212L	-	70.39	0%	14.28	9.9	1.00	4.650	-9%	7.31	-0.03	7.00	-4%	1000	0%	122	25.74	2400	550	57	1500	-
20-Nov-19	23:18	310	865.11	868.12	-42	-477	Manual readings of tanks = 46L	-	70.60	0%	13.40	8.5	1.01	4.860	5%	7.29	-0.02	7.12	2%	1000	0%	144	16.94	2700	575	45	1700	-
21-Nov-19	01:04	311	868.12	871.12	-93	51	Manual readings of tanks = 5L	-	70.20	-1%	13.42	7.4	1.02	4.520	-7%	7.20	-0.09	7.57	6%	1000	0%	138	19.33	2400	650	45	1700	-
21-Nov-19	02:46	312	871.12	874.12	-140	47	Manual readings of tanks = -144L	-	70.99	1%	13.13	9.8	1.00	4.940	9%	7.32	0.12	8.94	18%	1000	0%	131	18.00	2700	575	49	1700	-
21-Nov-19	04:27	313	874.12	877.12	-138	-2	Manual readings of tanks = -9L	-	71.84	1%	12.79	8	1.01	4.700	-5%	7.25	-0.07	9.19	3%	1000	0%	138	18.33	2400	650	49	1700	-
21-Nov-19	06:03	314	877.12	880.10	-2177	2039	Manual readings of tanks = 35L	-	67.04	-7%	12.79	8.9	1.01	4.780	2%	7.32	0.07	9.88	8%	1000	0%	134	17.45	2300	600	49	1700	-
21-Nov-19	09:10	315	880.10	883.13	-475	-1702	Manual readings of tanks = +92L	-	67.56	1%	14.21	9.2	1.01	4.960	4%	7.25	-0.07	10.22	3%	1000	0%	96	22.11	2300	650	57	1700	-
21-Nov-19	11:20	316	883.13	886.09	-415	-60	Manual readings of tanks = -67L	-	71.71	6%	13.04	9.5	1.00	5.120	3%	7.18	-0.07	9.67	-5%	1000	0%	168	23.65	1900	650	57	1650	-
21-Nov-19	14:15	317	886.09	889.12	-282	-132	Manual readings of tanks = +237L	-	74.38	4%	12.98	10	1.00	5.200	2%	7.98	0.80	11.11	15%	1000	0%	169	33.00	2100	650	57	1600	Fresh traced water added to centrifuge prior to starting run; parameters fluctuating
21-Nov-19	16:50	318	889.12	892.07	-479	197	Manual readings of tanks = -26L	-	74.91	1%	12.73	10.1	1.00	5.230	1%	7.19	-0.79	9.93	-11%	1000	0%	222	33.90	2100	650	53	1400	-
21-Nov-19	21:23	319	892.07	895.13	-2034	1555	Manual readings of tanks = 86L	-	72.52	-3%	11.14	8.7	1.01	4.270	-18%	7.29	0.10	9.62	-3%	1000	0%	110	16.83	2400	575	49	1700	-
21-Nov-19	22:52	320	895.13	898.12	-1919	-115	Manual readings of tanks = 37L	-	71.90	-1%	11.65	9.4	1.00	4.910	15%	7.28	-0.01	10.65	11%	1000	0%	88	15.38	2300	650	45	1700	-
22-Nov-19	00:31	321	898.12	901.13	-1033	-886	Manual readings of tanks = -38L	-	68.90	-4%	11.58	8.3	1.01	4.920	0%	7.17	-0.11	10.88	2%	1000	0%	105	17.94	2600	600	49	1800	-
22-Nov-19	01:14	322	901.13	904.12	-2059	1026	Manual readings of tanks = 76L	-	68.42	-1%	11.92	7.9	1.02	5.060	3%	7.15	-0.02	9.33	-14%	1000	0%	183	18.73	2600	600	53	1700	-
22-Nov-19	04:09	323	904.12	907.13	-1922	-137	Manual readings of tanks = -4L	-	68.73	0%	11.77	9.3	1.00	5.150	2%	7.09	-0.06	10.98	18%	1000	0%	71	16.61	2600	575	49	1800	-
22-Nov-19	06:05	324	907.13	910.15	-2573	651	Manual readings of tanks = -4L	-	66.10	-4%	12.09	8.4	1.01	4.850	-6%	7.12	0.03	11.70	7%	1000	0%	201	23.18	2300	600	49	1800	-
22-Nov-19	11:10	325	910.15	913.10	-1784	-789	Manual readings of tanks = +32L	-	67.68	2%	13.23	10	1.00	5.150	6%	7.40	0.28	12.29	5%	1000	0%	91	17.01	2600	500	45	2800	-
22-Nov-19	15:00	326	913.10	916.14	-2463	679	Manual readings of tanks = +131L	-	12.44	-82%	13.36	9.1	1.01	5.040	-2%	7.37	-0.03	12.19	-1%	1000	0%	175	19.87	2600	600	45	2500	-
22-Nov-19	16:55	327	916.14	919.13	-2175	-288	Manual readings of tanks = -99L	-	45.13	263%	13.72	9.5	1.00	5.260	4%	7.33	-0.04	12.73	4%	1000	0%	156	20.07	2700	600	45	2000	Fluorescein added to centrifuge tank at end of run
22-Nov-19	20:39	328	919.13	922.15	-6694	4519	Manual readings of tanks = 334L	-	68.28	51%	12.82	8.5	1.01	5.600	6%	7.46	0.13	9.97	-22%	1000	0%	148	19.21	2400	650	53	1900	-
22-Nov-19	22:37	329	922.15	925.13	-2279	-4415	Manual readings of tanks = 247L	-	58.72	-14%	13.30	9.6	1.00	5.470	-2%	7.54	0.08	11.10	11%	1000	0%	151	21.14	2600	625	49	1900	-
22-Nov-19	23:58	330	925.13	926.49	-1541	-738	Manual readings of tanks = -12L	-	60.83	4%	11.00	11.2	0.99	5.490	0%	7.53	-0.01	12.11	9%	1000	0%	227	25.74	2500	900	49	1900	Run blocked, bit changed carried out
23-Nov-19	21:49	331	926.49	928.15	-1143	-398	Manual readings of tanks = 29L	-	73.84	21%	13.60	13.6	0.98	4.260	-22%	6.99	-0.54	11.92	-2%	1000	0%	102	19.28	2700	650	49	1600	-
23-Nov-19	23:11	332	928.15	931.13	-1472	329	Manual readings of tanks = 0L	-	73.17	-1%	14.03	9.4	1.00	4.460	5%	7.08	0.09	11.15	-6%	1000	0%	8	8.39	2800	525	45	1500	-
24-Nov-19	00:41	333	931.13	934.13	-5933	4461	Manual readings of tanks = 69L	-	68.14	-7%	13.52	9.3	1.00	4.360	-2%	7.52	0.44	8.86	-21%	1000	0%	83	13.67	2700	575	49	1700	-
24-Nov-19	02:24	334	934.13	937.12	-2309	-3623	Manual readings of tanks = -145L; fluid accumulating in sump	-	68.78	1%	13.51	9.1	1.01	4.480	3%	7.14	-0.38	7.53	-15%	1000	0%	108	18.06	2500	575	45	1800	-
24-Nov-19	04:23	335	937.12	940.14	-2667	358	Manual readings of tanks = -145L; fluid accumulating in sump	-	65.45	-5%	14.03	8.4	1.01	4.640	4%	7.13	-0.01	6.32	-16%	1000	0%	127	21.81	2400	550	45	1900	-
24-Nov-19	06:12	336	940.14	943.13	-2503	-163	Manual readings of tanks = 95L	-	67.90	4%	13.82	9.3	1.00	4.420	-5%	7.29	0.16	8.22	30%	1000	0%	118	18.39	2400	600	45	1900	-
24-Nov-19	09:05	337	943.13	946.13	-3035	532	Manual readings of tanks = -110L	-	67.50	-1%	14.62	9	1.01	4.800	9%	7.13	-0.16	5.04	-39%	1000	0%	161	20.00	2400	600	45	1600	-
24-Nov-19	10:50	338	946.13	949.13	-2050	-985	Manual readings of tanks = -31L	-	23.40	-65%	14.50	9.5	1.00	4.590	-4%	7.21	0.08	7.23	43%	1000	0%	102	16.67	2500	600	45	1500	-
24-Nov-19	12:40	339	949.13	952.11	-2094	44	Manual readings of tanks = -118L	-	45.18	93%	14.14	9.3	1.00	4.570	0%	7.23	0.02	4.97	-31%	1000	0%	172	18.46	2500	550	42	1500	-
24-Nov-19	14:55	340	952.11	955.07	-3943	1849	Manual readings of tanks = -25L	-	52.86	17%	14.75	8.1	1.01	5.020	10%	7.25	0.02	10.41	109%	1000	0%	205	21.96	2700	600	45	1500	-
24-Nov-19	17:25	341	955.07	958.10	-2686	-1257	Manual readings of tanks = -4L	-	57.75	9%	14.21	7.7	1.02	4.250	-15%	7.30	0.05	9.48	-9%	1000	0%	197	23.10	2900	600	45	1500	-
24-Nov-19	21:39	342	958.10	961.15	-2030	-655	Manual readings of tanks = 328L	-	62.13	8%	13.70	9.6	1.00	4.980	17%	7.27	-0.03	9.45	0%	1000	0%	105	16.07	2700	675	53	1800	Fresh traced water added to centrifuge in previous run; parameters fluctuating
24-Nov-19	23:36	343	961.15	964.12	-2682	652	Manual readings of tanks = -14L	-	63.37	2%	13.84	8.8	1.01	4.040	-19%	7.32	0.05	14.80	57%	1000	0%	130	23.91	2600	600	49	1900	Fresh traced water added to centrifuge in previous run; parameters fluctuating
25-Nov-19	01:27	344	964.12	967.12	-2646	-36	Manual readings of tanks = -117L	-	65.30	3%	14.18	8	1.01	3.790	-6%	7.35	0.03	15.97	8%	1000	0%	148	21.00	2400	650	53	1400	Fresh traced water added to centrifuge in previous run; parameters fluctuating
25-Nov-19	03:24	345	967.12	970.12	-2759	113	Manual readings of tanks = -44L	-	68.53	5%	14.38	8.8	1.01	4.280	13%	7.33	-0.02	15.26	-4%	1000	0%	143	22.33	2400	625	49	1700	Fresh traced water added to centrifuge in previous run; parameters fluctuating

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Table A-2: IG_BH02 Drilling and Drill Fluid Parameters

Date (End of Run)	Time (End of Run)	Run #	Top of Run	Bottom of Run	Drill Fluid Volume Change (L)	Drill Fluid Volume Change (L)	Vol. observations and comments	Fluorescein Concentration			Temp	Density		Elec. Cond.		pH		Dissolved Oxygen		Turbidity		ORP	ROP	Torque	Thrust Pressure (Down-pressure)	Fluid Injection (pump) Pressure	Return Flow Rate	Comments
								Inlet	Outlet	Change				Reading	Change	Reading	Change	Reading	Change	Reading	Change							
dd-mmm-yy	hh:mm	-	(mbgs)	(mbgs)	>100 L	>100 L vs prev. run	-	(ppb)	(ppb)	>20% change	(°C)	API Gravity	SG	(mS/cm)	>10% change	-	>0.5 Change	(mg/L)	>10% Change	(NTU)	>10% Change	(mV)	min/m	psi	psi	psi	L/min	
25-Nov-19	05:07	346	970.12	973.12	-2270	-489	Manual readings of tanks = -63L	-	70.99	4%	14.35	9.1	1.01	4.000	-7%	7.32	-0.01	15.21	0%	1000	0%	110	17.33	2800	650	53	1700	-
25-Nov-19	07:02	347	973.12	976.14	-572	-1698	Manual readings of tanks = -39L	-	72.24	2%	14.27	9.08	1.01	4.270	7%	7.28	-0.04	7.15	-53%	1000	0%	135	19.87	2400	650	57	1600	-
25-Nov-19	09:25	348	976.14	979.16	-2514	1942	Manual readings of tanks = -49L	-	73.27	1%	14.03	7.8	1.02	4.160	-3%	7.24	-0.04	6.92	-3%	1000	0%	279	19.87	2900	550	45	1500	-
25-Nov-19	12:45	349	979.16	982.16	-3161	647	Manual readings of tanks = -61L	-	80.12	9%	14.27	8.4	1.01	4.450	7%	7.26	0.02	7.40	7%	1000	0%	251	30.00	2900	600	49	1600	-
25-Nov-19	15:55	350	982.16	985.16	-4260	1099	Manual readings of tanks = +221L; long run duration	-	82.64	3%	14.57	8.4	1.01	4.330	-3%	7.25	-0.01	7.30	-1%	1000	0%	231	35.00	3000	450	45	1500	-
25-Nov-19	19:50	351	985.16	986.68	-6754	2494	Manual readings of tanks = -441L; long run duration	-	88.57	7%	14.53	9.8	1.00	4.380	1%	7.24	-0.01	8.23	13%	1000	0%	172	82.24	2700	600	53	1400	-
25-Nov-19	21:31	352	986.68	988.13	-1265	-5490	Manual readings of tanks = -39L	-	86.14	-3%	14.04	9.5	1.00	3.900	-11%	7.14	-0.10	9.10	11%	1000	0%	141	86.21	2400	500	45	1100	-
25-Nov-19	23:19	353	988.13	991.14	-2621	1356	Manual readings of tanks = -39L	-	85.17	-1%	14.26	8.8	1.01	3.140	-19%	7.32	0.18	9.21	1%	1000	0%	112	18.27	2500	600	49	1600	-
26-Nov-19	01:32	354	991.14	994.14	-3013	392	Manual readings of tanks = 14L	-	84.16	-1%	14.04	9.5	1.00	3.810	21%	7.24	-0.08	9.27	1%	1000	0%	155	23.00	2400	650	49	1400	Fresh traced water added to centrifuge in previous run; parameters fluctuating
26-Nov-19	03:53	355	994.14	997.13	-2140	-872	Manual readings of tanks = -291L	-	83.75	0%	14.54	8.3	1.01	3.270	-14%	7.26	0.02	9.52	3%	1000	0%	156	29.77	2600	550	49	1500	Fresh traced water added to centrifuge in previous run; parameters fluctuating
26-Nov-19	05:28	356	997.13	1000.12	-176	-1965	Manual readings of tanks = -25L	-	88.05	5%	14.13	8.9	1.01	3.820	17%	7.28	0.02	8.71	-9%	1000	0%	145	15.72	1500	700	49	2800	Fresh traced water added to centrifuge in previous run; parameters fluctuating

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Table A-3: Field Parameters of Archived Drill Water Samples 1671632 (3201)

Sample ID	From	To	Date	Fluorescein	Density	Temp	EC	pH	DO	ORP	Turbidity
-	mbgs	mbgs	dd-mmm-yy	ppb	g/cm^3	°C	mS/cm	-	mg/L	mV	NTU
IG_BH02_DW003	52.13	55.16	4-Oct-19	78.2	1.00	16.41	0.232	9.59	4.28	287	1000
IG_BH02_DW006	97.10	100.10	08-Oct-19	92.4	1.00	17.23	0.127	8.97	7.62	246	1000
IG_BH02_DW007	148.13	150.73	14-Oct-19	90.7	1.00	17.11	2.280	11.49	11.21	-24	1000
IG_BH02_DW008	199.16	202.16	15-Oct-19	91.1	1.02	17.07	0.720	9.75	4.35	71	1000
IG_BH02_DW012	247.12	250.11	17-Oct-19	80.0	1.03	13.99	0.554	9.57	9.83	83	1000
IG_BH02_DW014	298.16	301.13	20-Oct-19	91.7	1.03	14.81	0.684	9.51	22.11	108	1000
IG_BH02_DW015	349.71	352.15	22-Oct-19	86.2	1.03	14.77	0.761	9.27	8.38	75	1000
IG_BH02_DW021	400.17	403.16	02-Nov-19	80.8	1.00	13.11	3.700	12.25	10.50	2	1000
IG_BH02_DW022	448.15	451.15	04-Nov-19	80.9	1.00	16.01	1.040	11.45	9.99	7	1000
IG_BH02_DW023	499.16	502.10	05-Nov-19	98.4	1.02	16.72	0.664	10.36	5.77	-37	1000
IG_BH02_DW027	547.15	550.17	06-Nov-19	98.5	1.02	12.27	0.563	9.75	9.89	137	1000
IG_BH02_DW028	598.02	601.10	09-Nov-19	89.3	1.02	14.76	0.839	8.81	8.59	173	1000
IG_BH02_DW029	649.13	652.10	11-Nov-19	94.4	1.02	11.22	1.000	8.66	9.94	220	1000
IG_BH02_DW030	697.13	700.12	14-Nov-19	74.6	1.01	12.40	2.410	7.74	7.14	194	1000
IG_BH02_DW031	748.09	751.12	16-Nov-19	64.8	1.01	12.49	3.280	7.44	8.27	172	1000
IG_BH02_DW032	799.13	802.13	18-Nov-19	67.7	1.01	14.18	3.560	7.39	7.46	172	1000
IG_BH02_DW033	847.13	850.12	20-Nov-19	69.5	1.01	13.46	4.950	7.3	8.63	135	1000
IG_BH02_DW034	898.12	901.13	22-Nov-19	68.9	1.01	11.58	4.92	7.17	10.94	105	1000
IG_BH02_DW035	949.13	952.11	24-Nov-19	45.2	1.00	14.14	4.57	7.23	11.50	172	1000
IG_BH02_DW036	997.13	1000.12	26-Nov-19	88.1	1.01	14.13	3.82	7.28	9.31	145	1000

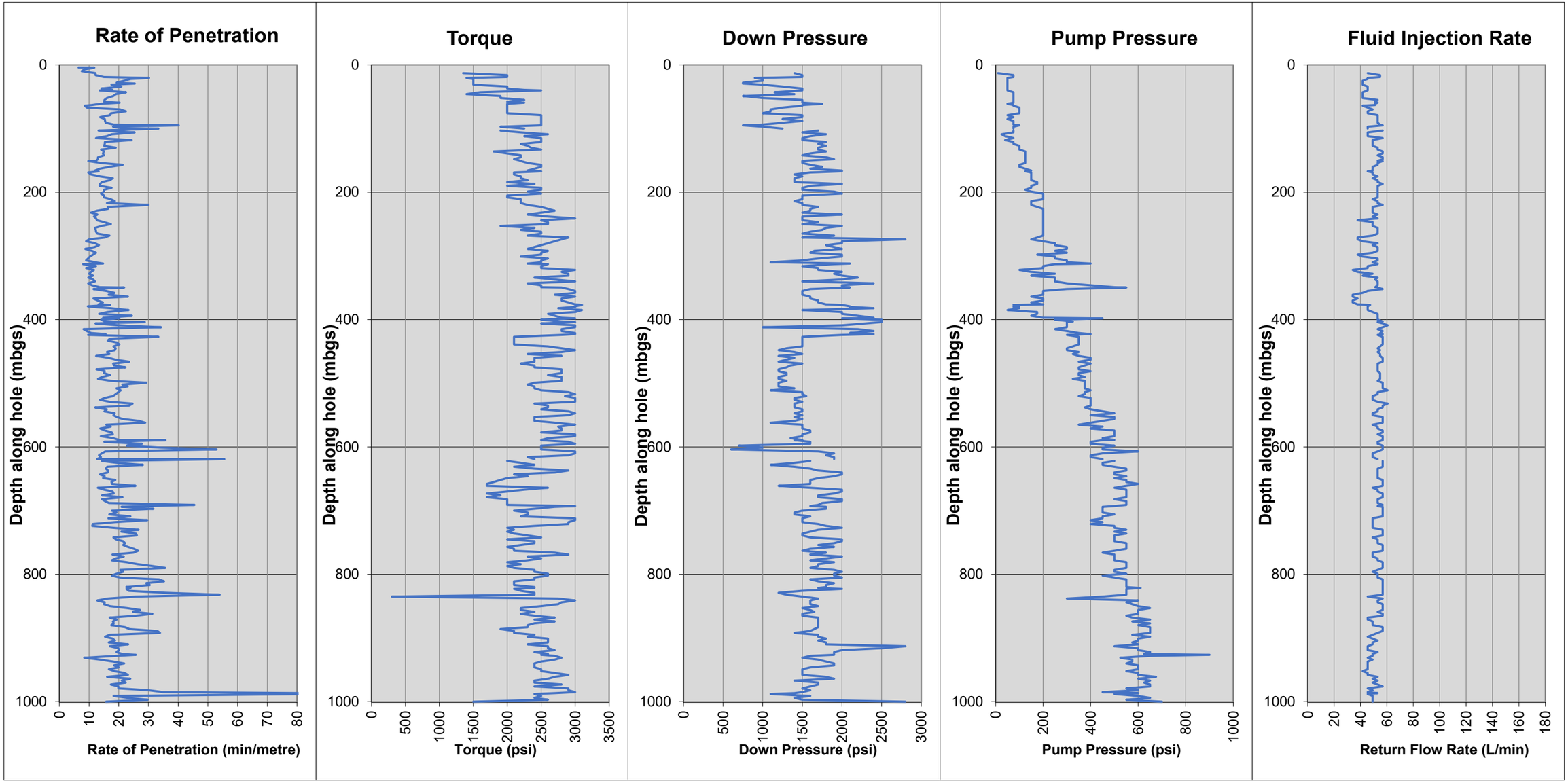
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APPENDIX B

IG_BH02 Drilling and Drill Fluid Parameter Figures

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NOTES

1. Gaps in data appear where readings were not available.

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NWMO Ignace Drilling IG_BH02

TITLE
Figure B-1: Drilling Parameters

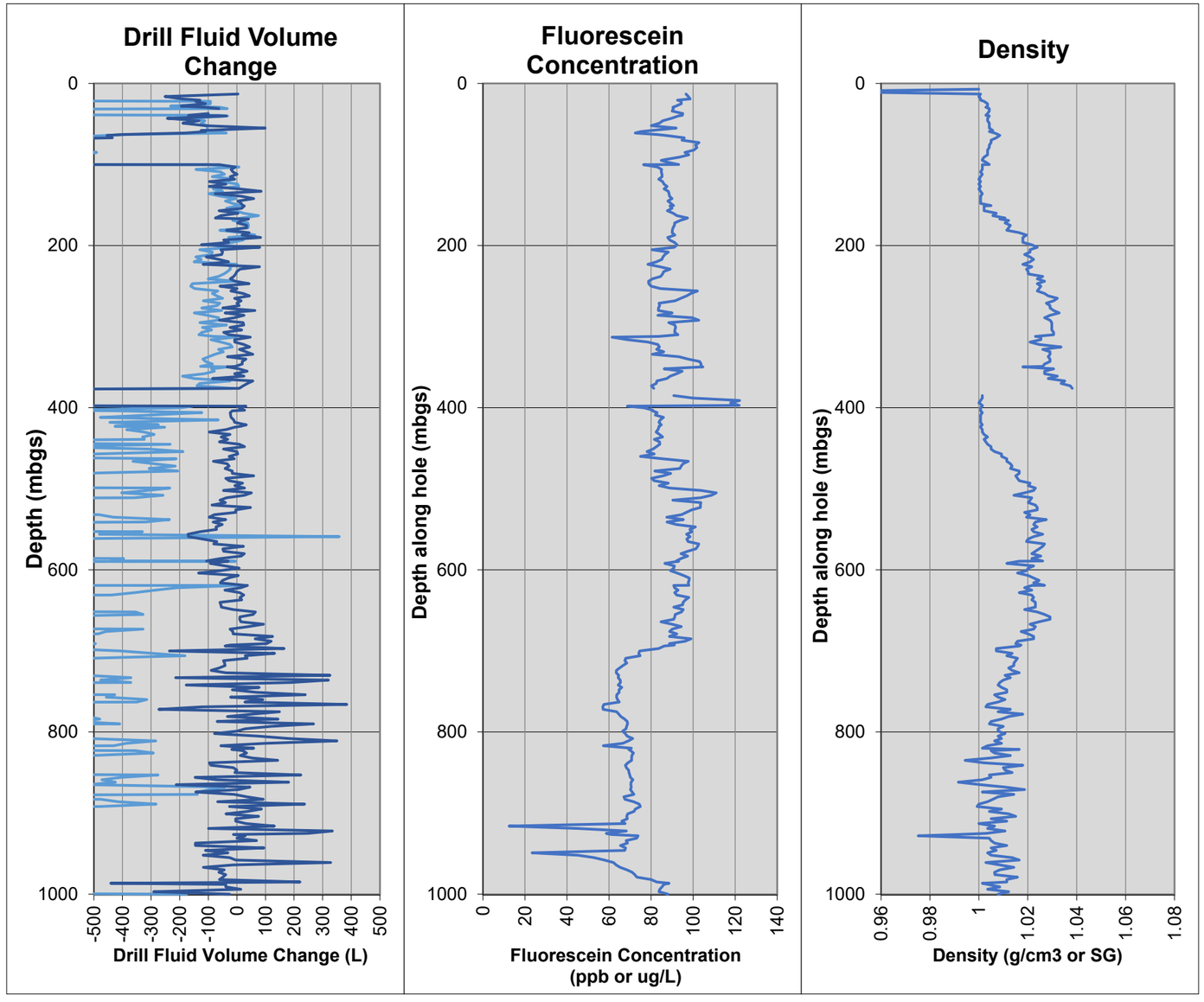
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https://golderassociates.sharepoint.com/sites/13226g/Technical Work BH02/WP02 Drilling/09 - Report/R0a/Appendix B/Drill Parameters_R0a.pptx

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NOTES

1. Gaps in data appear where readings were not available.
2. —— Indicates manual drill fluid measurements.

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TITLE
Figure B-2: Drill Fluid Parameters

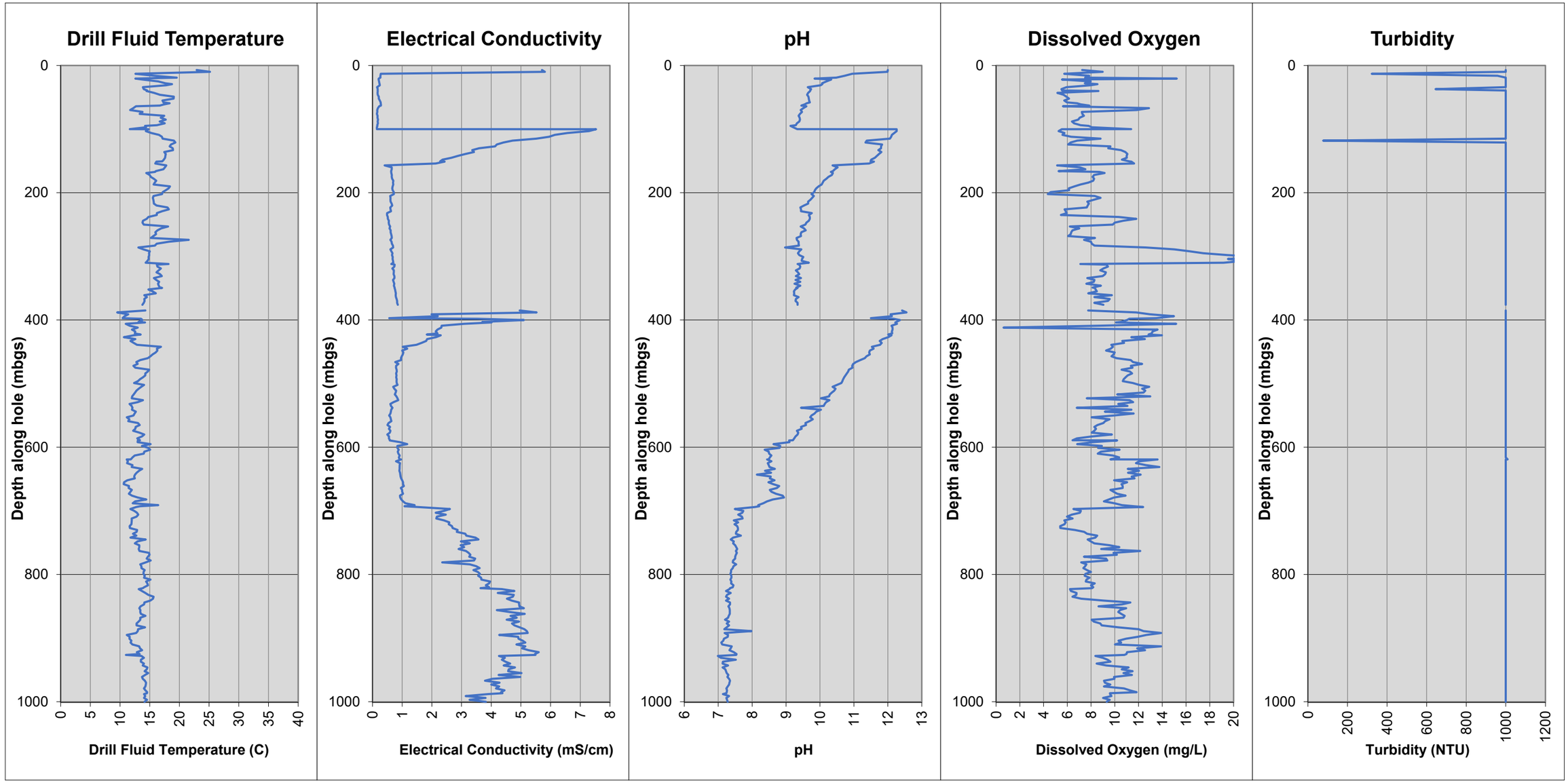
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1671632 (3201)

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NOTES

1. Gaps in data appear where readings were not available.

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TITLE
Figure B-3: Drill Fluid Parameters

DATE
2020-03-26

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https://golderassociates.sharepoint.com/sites/13226g/Technical%20Work/WP2%20Drilling%20and%20Coring/Reporting/R0/Appendix%20D/Drill%20Parameters_R0.pptx

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APPENDIX C

Final IG_BH02 Flushing Data

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Table C-1: Water Quality Parameters collected during final IG_BH02 Flushing 1671632 (3201)

Flush Sequence	Date / Time	Elapsed Time (hours)	Approx. Volume (L)	Fluorescein (ppb)	Temperature (°C)	pH	ORP (mV)	Conducivity (mS/cm)	Turbidity (NTU)	DO[1] (mg/L)
1	26-Nov-19 / 15:50	0.00	0	100.4	17.25	7.01	308	0.086	0	9.95
	26-Nov-19 / 16:50	1.00	1120		12.68	7.35	-77	3.56	1000	3.30
	26-Nov-19 / 17:50	2.00	2367	62.21	12.82	7.35	-77	3.52	1000	1.68
	26-Nov-19 / 18:50	3.00	4092	124.90	12.98	7.20	-12	3.50	1000	2.35
	26-Nov-19 / 19:50	4.00	5573	137.90	14.15	7.25	42	0.116	663	2.20
	26-Nov-19 / 20:50	5.00	7495	141.0	13.88	7.44	95	0.113	46.9	2.10
	26-Nov-19 / 21:50	6.00	8996	146.3	14.19	8.29	80	0.445	2.7	2.29
	26-Nov-19 / 22:50	7.00	10790	127.1	13.84	7.21	126	0.224	4.3	1.80
	26-Nov-19 / 23:50	8.00	12668	117.8	13.31	7.43	174	0.325	4.6	1.93
	27-Nov-19 / 00:50	9.00	13805	107.3	13.59	7.24	142	0.126	0	9.82
	27-Nov-19 / 01:50	10.00	14914	100.0	13.51	7.14	144	0.107	5.1	2.23
	27-Nov-19 / 02:50	11.00	16021	95.1	12.85	7.91	84	0.045	0	2.99
	27-Nov-19 / 03:50	12.00	16994	92.80	12.93	8.31	74	0.112	1	2.05
	27-Nov-19 / 04:50	13.00	18148	87.1	12.93	7.26	94	0.577	6.2	2.05
	27-Nov-19 / 05:50	14.00	19322	85.57	18.22	8.94	16	0.110	15.8	1.12
	27-Nov-19 / 07:50	16.00	21722	83.90	14.57	7.84	56	0.081	13.5	0.86
2	27-Nov-19 / 08:05	16.25	21722	98.5	17	7.44	289	0.064	7.9	10.35
	27-Nov-19 / 08:35	16.75	22534	96.9	14.62	8.34	-8	0.051	7.4	11.23
	27-Nov-19 / 09:10	17.33	23747	86.4	14.21	8.25	60	0.061	6.5	0.56
	27-Nov-19 / 09:48	17.97	24508	91.14	13.99	8.27	42	0.065	4.2	0.00
	27-Nov-19 / 10:45	18.92	26076	89.83	13.88	8.22	45	0.064	8.6	0.65
	27-Nov-19 / 11:40	19.83	27686	88.14	13.76	8.12	68	0.067	7.1	1.57
	27-Nov-19 / 12:15	20.42	28407	-	-	-	-	-	-	-
	27-Nov-19 / 12:58	21.13	28788	85.03	13.88	8.4	3.3	0.073	3.3	0.25
	27-Nov-19 / 14:42	22.87	29583	89.39	12.99	8.37	-18	0.073	2.4	2.21
	27-Nov-19 / 16:25	24.58	30380	86.67	12.23	8.44	-46	0.073	7.5	1.82

Note:

Indicates baseline readings for water source

Blanks appears where a reading was not collected

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