GAHCHO KUÉ MINE
NI 43-101 TECHNICAL REPORT
NWT, CANADA

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NOTICE

JDS Energy & Mining Inc. prepared this National Instrument 43-101 Technical Report, in accordance with Form 43-101F1, for Mountain Province Inc. (MPD). The quality of information, conclusions and estimates contained herein is based on: (i) information available at the time of preparation; (ii) data supplied by outside sources, and (iii) the assumptions, conditions, and qualifications set forth in this report.

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1 Summary

1.1 Property Description & Ownership

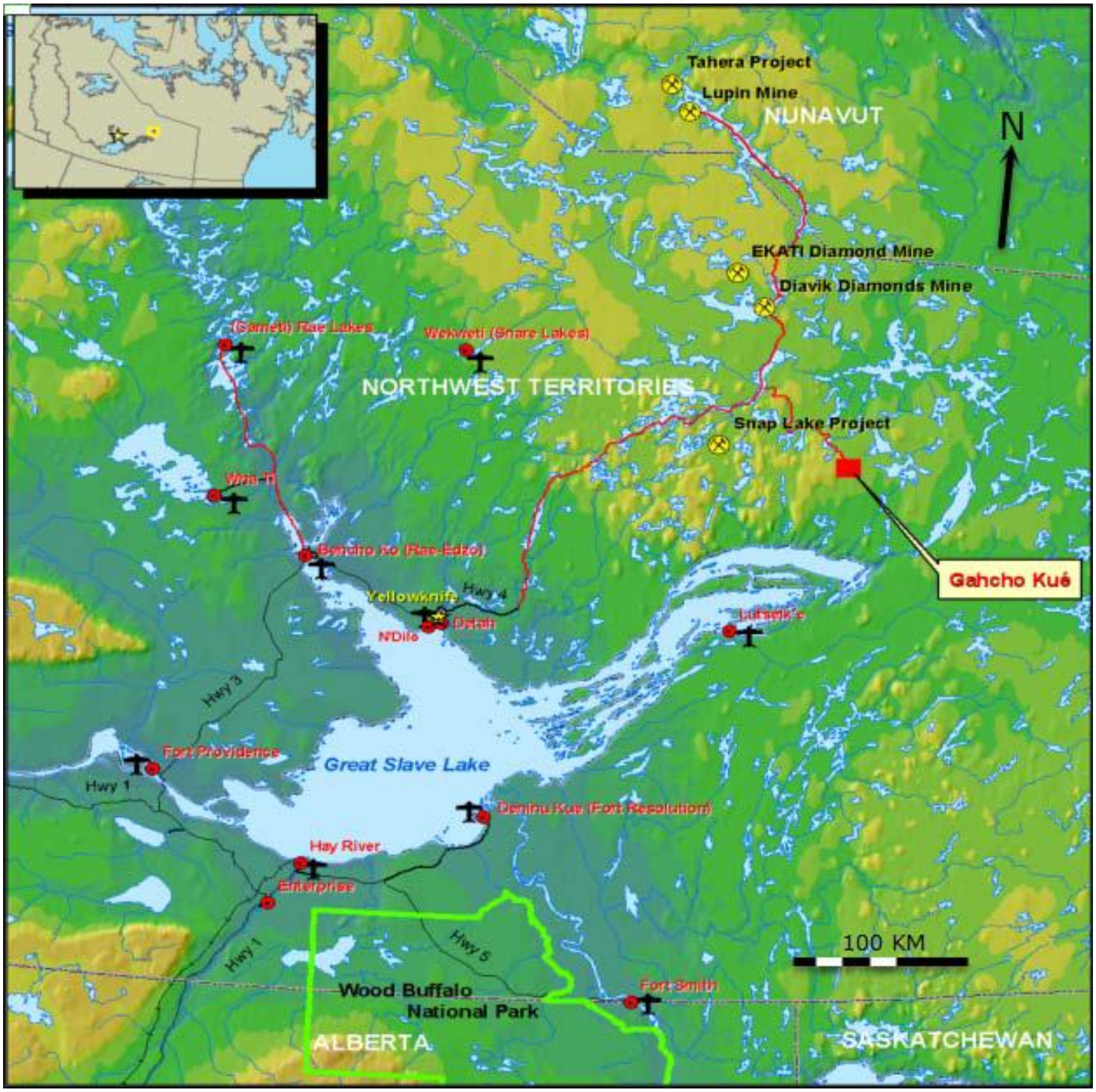
The Gahcho Kué (GK) Mine is a joint venture of De Beers Canada Inc. (De Beers) and Mountain Province Diamonds Inc. (MPD), with ownerships of 51% and 49%, respectively. The property is located in the Northwest Territories (NWT) of Canada, 300 km east-northeast of Yellowknife. The site lies on the edge of the continuous permafrost zone in an area known as the barren lands. The surface is characterised as heath / tundra, with occasional knolls, bedrock outcrops, and localised surface depressions interspersed with lakes. A thin discontinuous cover of organic and mineral soil overlies primarily bedrock, which, occurs typically within a few metres of surface. Some small stands of stunted spruce are found in the area. There are myriad lakes in the area. Kennady Lake, under which the kimberlite pipes lie, is a local headwater lake with a minimal catchment area.

Access to the site is via a 1,676m all-weather gravel airstrip which is serviced by RJ85 and 737 Jet aircraft from Calgary, as well as L-382 Hercules and smaller turbo-prop aircraft from Yellowknife.

A winter road connects Yellowknife to the Gahcho Kué, Ekati, and Diavik mines during February and March each year (Figure 1-1). The road is operated under a Licence of Occupation by the winter road JV Partners who operate the Ekati and Diavik and Gahcho Kué mines. The road passes within 70 km of the GK site, at Mackay Lake. A 120 km winter road spur was established from Mackay Lake to the Project site, and was first opened in 1999. The Gahcho Kué spur road has been open each year since 2013 to support construction and on-going mine operations.

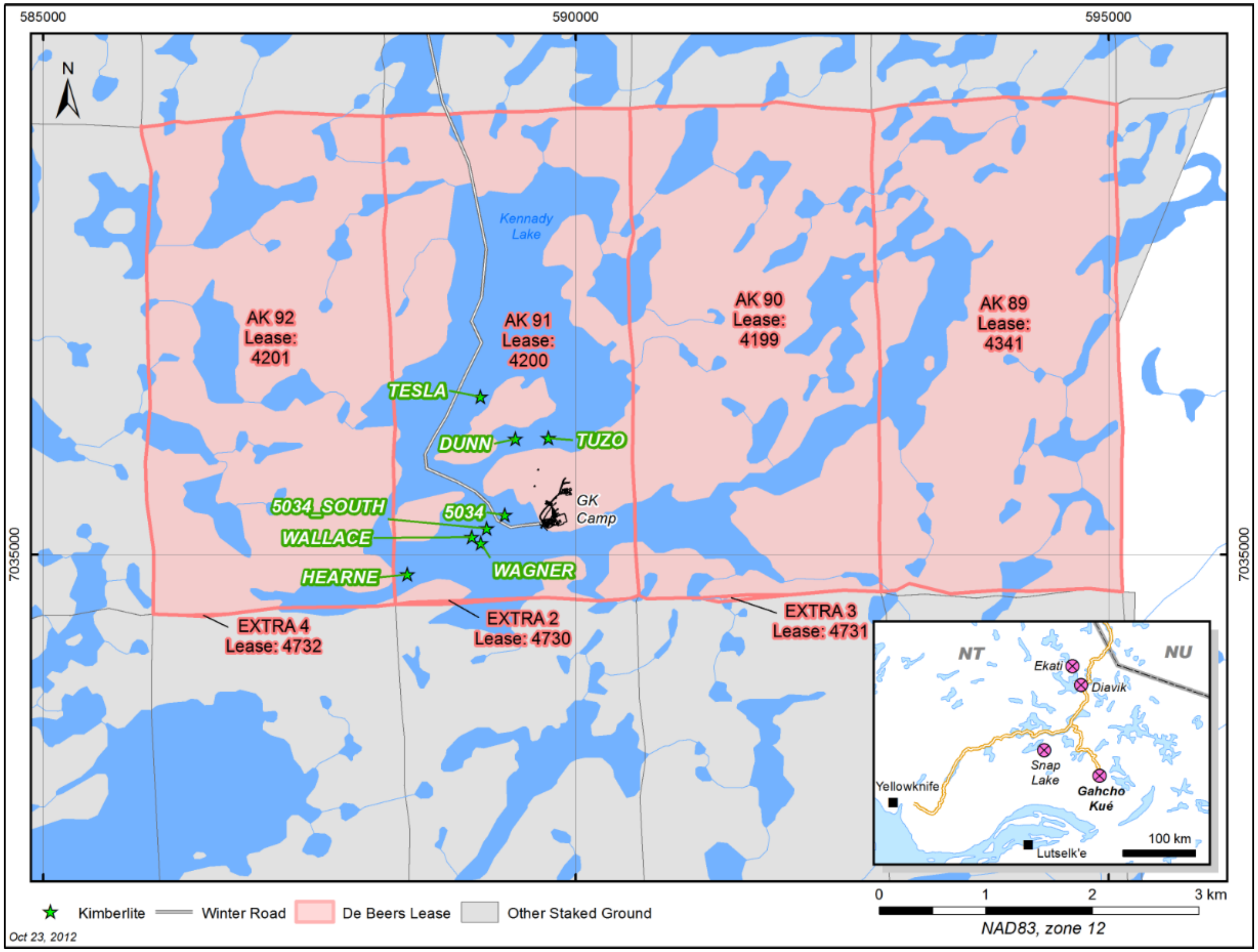
The Gahcho Kué kimberlite deposits are located within a series of mineral leases as shown in Figure 1-2. Surface rights (land leases) were issued by the Government of the Northwest Territories (GNWT) in 2015 and are presented in Figure 1-3.

Figure 1-1: Location of Gahcho Kué Mine



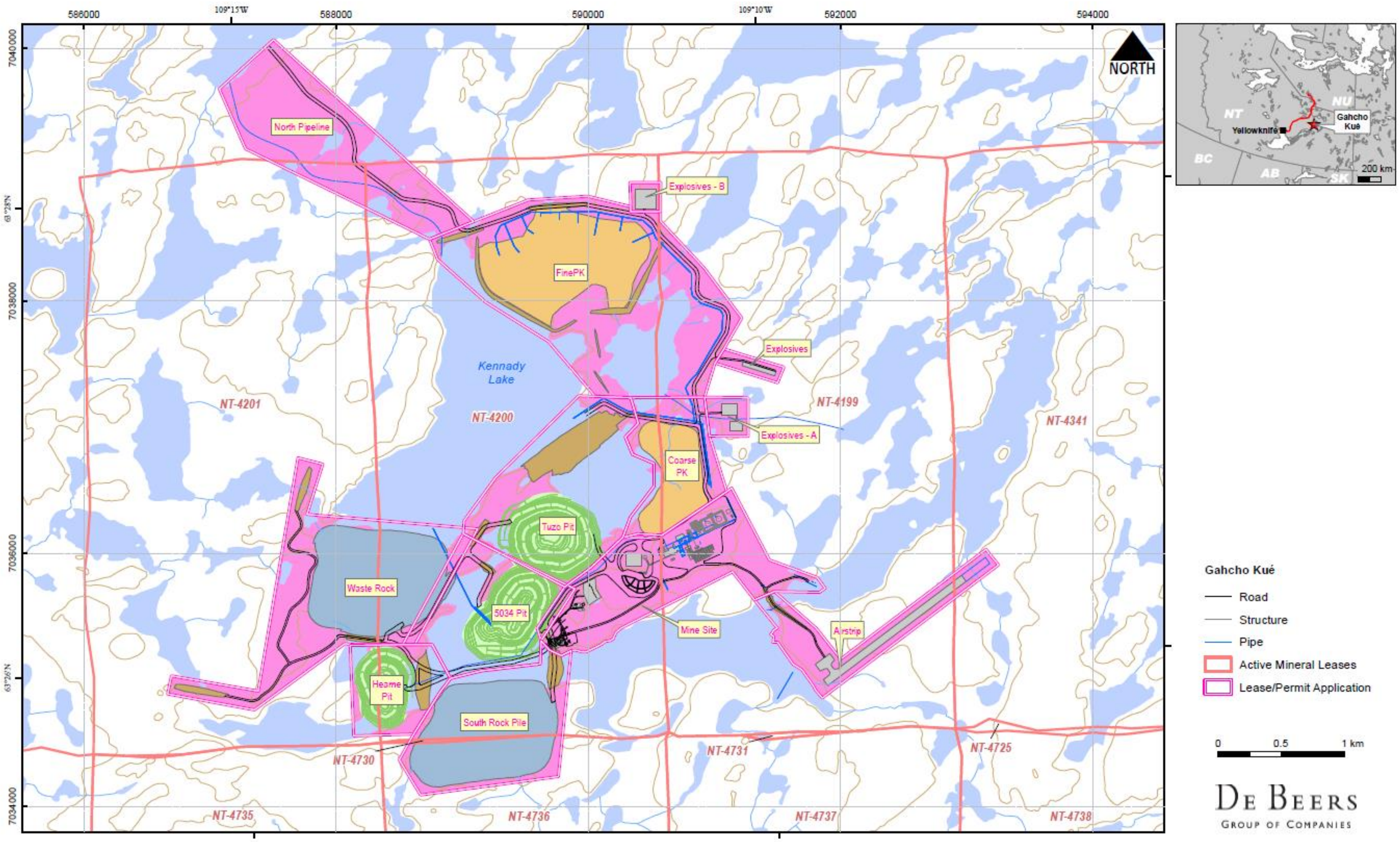
Source: DeBeers, 2013

Figure 1-2: Mineral Lease Boundary Map



Source: DeBeers, 2012

Figure 1-3: Land Lease Boundary



Source: DeBeers, 2014

1.2 Geology, Resources & Reserves

The baseline estimation and classification of the mineral resources was completed by AMEC, summarized in the “Gahcho Kué Kimberlite Project NI 43-101 Technical Report” (AMEC 2009). Additions / modifications to the AMEC mineral resource for the Tuzo Deep mineral resources deeper than 300 metres below surface (mbs) elevation are summarized in the “Update of the Mineral Resource Estimate for the Tuzo Kimberlite, Gahcho Kué Project, Northwest Territories, Canada NI 43-101 Technical Report” (Mineral Services, 2013) as a result of an additional Tuzo deep drilling program undertaken in 2012. The baseline resource (AMEC 2009) and the Tuzo Deep Resource (Mineral Services 2013) were compiled by JDS for the 2014 Gahcho Kué Technical Report and Feasibility Study (JDS, 2014).

The estimation and classification of the mineral resources has since been updated to reflect operations as of 2017. These resources are exclusive of material processed prior to this report. Resources which were mined and stockpiled at the time of this report are summed separately from the remaining in-situ resources. The resource estimate is inclusive of all potential reserves

The Gahcho Kué Mine resources are summarized in Table 1-1. JDS has reviewed the resources and compared to those stated in the 2014 Technical Report (JDS, 2014) and believes that depletion and modifying factors applied to generate the updated resource are reasonable and provide an accurate and complete basis for state of the resource (December 31, 2017). Resources are exclusive of mineral reserves.

Table 1-1: Mineral Resource Summary (December 31, 2017)

Resource	Classification	Tonnes (Mt)	Carats (Mct)	Grade (cpht)
5034	Indicated	0.9	1.5	161
	Inferred	0.8	1.3	163
Hearne	Indicated	0.2	0.3	168
	Inferred	1.2	2.1	175
Tuzo	Indicated	0.8	0.9	114
	Inferred	10.8	14.6	135
Summary (In-Situ)	**Indicated**	**1.8**	**2.6**	**142**
	Inferred	**12.8**	**18.0**	**140**
Stockpiles	Indicated	0.0	0.0	0
	Inferred	0.0	0.0	115[(3)]

Notes:
(1) Mineral Resources are reported at a bottom cut-off of 1.0 mm. Incidental diamonds are not incorporated in grade calculations.
(2) Mineral Resources are not mineral reserves and do not have demonstrated economic viability.
(3) Volume, tonnes and carats are rounded to the nearest 100,000. 12,300t of inferred resources stockpiled @ 115cpht (14,250cts total).
(4) Tuzo volume and tonnes exclude 0.6 Mt of a granite raft and CRX_BX.
(5) Resources are exclusive of indicated tonnages converted to probable reserves.
(6) Resources have been depleted of any material that was processed prior to and including Dec 31 2017. Q4 depletion is based on forecasted values and may differ slightly from actual values.

Table 1-2: Mineral Reserve Estimate

Pipe	Classification	Tonnes (Mt)	Carats (Mct)	Grade (cpt)
5034	Probable	9.7	18.4	1.91
Hearne	Probable	5.5	10.9	1.99
Tuzo	Probable	15.7	19.1	1.22
In-Situ Total	**Probable**	**30.9**	**48.4**	**1.57**
Stockpile	Probable	.6	1.0	1.61
Total	**Probable**	**31.5**	**49.4**	**1.57**

Notes:
(1) Mineral Reserves are reported at a bottom cut-off of 1.0 mm
(2) Mineral Reserves have been depleted to account for mining and processing activity prior to Dec 31 2017.
(3) Q4 2017 depletion is based on forecasted values and may differ slightly from actual depletion.
(4) Mineral Reserves are based upon the updated resource model (2017) and therefore reflect any changes to the estimation of Tonnes, Grade and Contained Carats within that resource. Details on resource changes are summarized in Section 14.
(5) Prices used to determine optimal pit shells have been escalated by factors varying by pit, which are indicative of the respective pits timing and duration.

Table 1-2 was reviewed by JDS Energy & Mining Inc. and complies with CIM definitions and standards for a National Instrument (NI) 43-101 for an operating mine. Detailed information on mining, processing, metallurgical, and other relevant factors are contained in subsequent sections of this report.

The economic viability presented in Section 22 confirms that the probable reserve estimates meet and comply with CIM definitions and (NI) 43-101 standards. At the time of this report, the mine is economically viable using current diamond prices and prevailing long-term price estimates.

1.3 Mining

The mine design and subsequent mine plan considers indicated mineral resources of the 5034, Hearne, and Tuzo kimberlite pipes. Conventional truck and shovel mining is employed utilizing 29 m^3 bucket diesel hydraulic front shovels, a 17 m^3 front-end loader and 218 t class haulage trucks to mine kimberlite and waste. This fleet is augmented by 12 m^3 bucket front-end loaders, scaling excavators and 90 t haul trucks. Production drill and blast activities is supported by a fleet of 251mm rotary drills. Pre-shear drilling is supported with a pair of 171 mm down the hole percussion drills.

Updated pit designs were completed in 2017. The design updates incorporate revised geotechnical criteria for all three pits. These pit designs were used to prepare the updated mine production plan and schedule. The plans were optimized to smooth waste stripping requirements, while ensuring adequate kimberlite availability to meet feed requirements. Optimized plans considered the waste storage, including the expansion of the West Mine Rock Pile, and in-pit waste storage at Hearne and 5034.

Pre-stripping began on land in the northern half of the 5034 pit in 2014, with the majority of the granite waste being used for road, dyke and infrastructure construction. The full extent of the 5034 pit, including the lake bottom, was opened in 2016 and mining continues to progress in the upper six benches. Mining of the 5034 pit has consisted of an internal phase, which was developed to assess and manage the geotechnical issues of 2016 / 2017, and a push back to the revised final pit design. Ore and waste mining at the 5034 pit is currently planned to continue until Q4 2023.

Pre-stripping / pioneering of Hearne pit started December 2017. Approximately 40% of kimberlite production will be sourced from Hearne from 2018 to balance additional waste mining in 5034. To accomplish this while maintaining a reasonable strip ratio, Hearne will be mined using an internal phase from 2018 to 2019 targeting the kimberlite ore body. The mining of the overall Hearne pit shell will commence in Q4 of 2018. Ore and waste mining activity at Hearne is planned to continue until Q4 of 2021.

Pre-stripping / pioneering of the Tuzo pit is expected to begin in Q4 of 2019 following the completion of Dyke B and the dewatering of Area 4. Tuzo will be mined in three relatively concurrent phases to balance the strip ratio. Phases 1 and 2 in the Tuzo pit will be mined until Q4 2022 and 2025 respectively, with ore and waste mining activity continuing in Phase 3 from Q3 2020 to Q4 2027.

1.4 Recovery Methods

The Gahcho Kué Mine extracts kimberlite resources from three different deposits over the remainder of the mine life: 5034, Hearne, and Tuzo. In the process plant, this material is treated via crushing, screening, dense media separation and x-ray sorting, to produce a diamond rich concentrate that is hand sorted on site with the resulting diamond product sent to Yellowknife for final cleaning and GNWT valuation. The processing plant is targeting the recovery of liberated diamonds in the 1 to 28 mm size range. The processing plant is designed for efficient diamond recovery over the plant's 12-year life. The Gahcho Kué Plant processes are largely automated to allow efficient production with minimal human intervention.

1.5 Site & Infrastructure

The Gahcho Kué Mine is typical of many northern Canadian mining operations that lack local and regional infrastructure such as permanent road access, navigable shipping routes and ports, and external utilities. Therefore, the mine requires site specific infrastructure to sustain operations, including power generation, sewage and water treatment, personnel accommodation, storage facilities for materials delivered on the limited annual winter ice road, and an aerodrome to provide year-round cargo, food and passenger aircraft access. The existing process complex is shown in Figure 1-4.

The majority of supplies during construction and operation are shipped to site during a 10-week winter road season. A 120 km winter access spur road is constructed each year to connect the mine site to the Tibbitt-to-Contwoyto winter road at km 271, just north of Lake of the Enemy.

The layout of the site is based on several criteria:

- All major structures are founded on bedrock;
- Compact footprint for minimal land disturbance and maximum site operations efficiency;
- Compact building sizes and layout for maximum energy efficiency;
- Efficient facility access for personnel and vehicles during operations; and
- Minimal impact of winter road truck traffic around the site.

Figure 1-4: Gahcho Kué Mine Site Q3 2017

Source: JDS, 2017

1.6 Environmental & Socioeconomic

A Class A Land Use Permit (LUP) and Type A Water License (WL) were issued by the Mackenzie Valley Land and Water Board (MVLWB) on September 30, 2014 for the Gahcho Kué Diamond Mine allowing full execution of the construction and operation of the mine. Additional details on licences, permits and authorizations that have been issued for the mine are provided in Section 20.

Baseline biophysical information has been collected within the Gahcho Kué region since 1996. Following the environmental assessment and permitting phase, data collection is focused on monitoring programs that identify potential effects, evaluate impact predictions and monitor the efficacy of mitigations.

Multiple environmental monitoring and management plans have been prepared to track and mitigate impacts that the mine may have on the environment. The Gahcho Kué water management plans are adaptations of plans used successfully at other NWT diamonds mines. At Gahcho Kué mine, potentially contaminated water is kept within a controlled management basin formed by natural drainage patterns. Excess storage capacity allowances created by initial lake dewatering activities provide for operational flexibility and contingencies. The mine incorporates, where possible, a program of progressive reclamation that minimizes costs and allows timely monitoring of performance. The mined-out 5034 and Hearne pits are used for waste storage during the later years of the mine life providing ample time for completion of the reclamation of the waste storage areas.

A Socioeconomic Agreement (SEA) for the Project was signed with the GNWT on June 28, 2013. The SEA establishes hiring priorities and employment incentives for the Project, training and employment objectives, business procurement objectives and it outlines how De Beers and the GNWT will work together to ensure the health and cultural well-being of NWT Residents. The mine expects approximately 550 permanent jobs during the 12-year operational phase.

Additional employment will be created by the multitude of service providers to the project. In addition, property and payroll taxes will add significant tax revenues to the local municipality. Impact and Benefit Agreements (IBAs) are in place with six Indigenous groups.

2 Introduction

JDS Energy & Mining Inc has prepared this technical report on Gahcho Kué Mine and associated mineral resources and mineral reserves. The report is intended to serve as an update to mineral resources and reserves at the Gahcho Kué Mine.

This technical report is prepared for Mountain Province Diamonds Inc. and is intended to be a Form 43-101F1 Technical Report for the purposes of National Instrument 43-101 to provide updated background and supporting information on the mineral resource and mineral reserve at the Gahcho Kué Mine as of December 31, 2017.

The Gahcho Kué Mine commenced commissioning of ore in September 2016 and declared commercial production in March of 2017. The mine is operated through the Gahcho Kué Joint Venture (GKJV) agreement between Mountain Province Diamonds Inc. (49%) and the De Beers Group of Companies (51%).

2.1 Qualifications & Responsibilities

Two Qualified Persons (QPs), as defined by NI 43-101, were responsible for the preparation of this Technical Report. Table 2-1 lists the qualifications for each QP, as well as the section(s) of the report for which they are responsible.

Table 2-1: Gahcho Kué NI 43-101 Qualified Person Responsibility

Qualified Person	Company	Report Section(s) of Responsibility
Daniel Johnson, P.Eng	JDS	Overall author, all sections except 15 & 16
Dino Pilotto, P.Eng	JDS	Sections 15 & 16 (Mining and Reserves)

2.2 Site Visits

- Daniel D. Johnson, P. Eng. (JDS):
  - Multiple site visits during the mine development phase between 2013 and 2016, most recently September 2016.

2.3 Currency

Costs in this report are provided in Canadian dollars (C$), unless otherwise specified.

3 Reliance on Other Experts

The QPs, authors of this report, state that they are Qualified Persons for the areas as identified in the certificates of Qualified Persons. The Authors have relied upon information provided from De Beers and Mountain Province Diamonds.

3.1 Diamond Valuations

JDS has reviewed MPD sales data from 2016 and 2017 to determine the price (US$/ct) for 5034 diamond production to date. In March 2018 MPD prepared an updated valuation of the original Hearne and Tuzo bulk sample parcels stored in Yellowknife. These updated valuations were then applied to the diamond distribution models to establish the baseline 2018 pricing (US$/ct). JDS reviewed the data, methodology and process used by MPD to update these prices and is of the opinion that the modeled estimates are a reasonable estimate for the calculation of reserves.

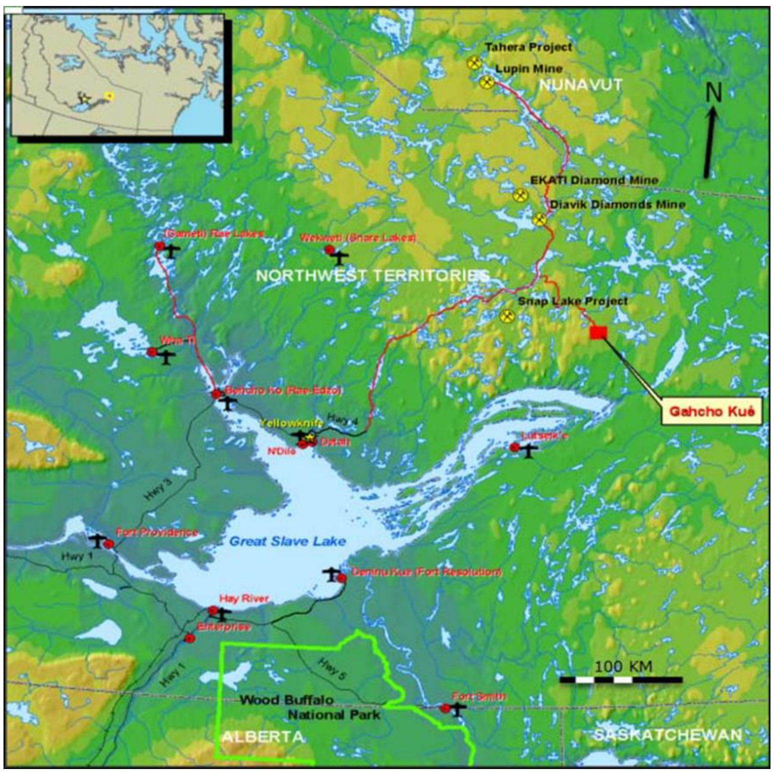
Similarly, JDS has relied on MPD for the diamond price escalation estimate. MPD has determined that a 2.0% real growth rate in USD diamond prices be used in the financial analysis which has been accepted as reasonable for the current market projections based on comparable estimates used by other Canadian diamond producers.

4 Property Description & Location

4.1 Location

The Gahcho Kué Mine is located at Kennady Lake, approximately 300 km east-northeast of Yellowknife in the District of Mackenzie, Northwest Territories, Canada, at the approximate latitude 63.26.16N and longitude 109.12.05W (NAD83 Zone 12 coordinates 7035620N, 589735E (Figure 4-1).

Figure 4-1: Location of Gahcho Kué



Source: De Beers, 2013

The Project is located 150 km south–southeast of the Diavik and Ekati diamond mines operated by Diavik Diamonds Inc. (Rio Tinto) and Dominion Diamonds respectively at Lac de Gras, and 80 km east–southeast of the De Beers Snap Lake Mine.

4.2 Tenure History

The Gahcho Kué Mine was part of a larger group of mining claims, known as the AK Property, which currently consists of four remaining mining leases (Figure 4-1). The AK Property was initially staked in 1992 by Inukshuk Capital Corp., and optioned to Mountain Province Mining, Inc. (now Mountain Province Diamonds Inc. (MPD)) later the same year.

On staking, the Project covered about 520,000 ha, and included the AK and CJ claims. The CJ claims substantially lapsed in November 2001, and the remaining CJ claims lapsed on August 17, 2002, leaving only the AK claims as current at that time.

Additional partners in the AK Property included Camphor Ventures Inc. (Camphor Ventures), and 444965 B.C. Ltd., a subsidiary company of Glenmore Highlands Inc. (Glenmore Highlands). At the time, Glenmore Highlands was a controlling shareholder of Mountain Province Mining Inc. as defined under the Securities Act of British Columbia. The Glenmore Highlands subsidiary amalgamated with MPD in 1997, and Camphor Venture's interest in the AK Property was acquired by MPD during 2007.

In 1997, Monopros (now De Beers Canada) joint ventured the property. The currently applicable agreements between the partners are summarized in Section 4.4. Surrounding claims / leases were dropped and the remaining leases comprising of the Gahcho Kué Mine are described below.

4.3 Mineral Tenure

The Gahcho Kué Mine comprises four mining leases (4199, 4341, 4200, and 4201) covering a total area of 10,353 ha (Figure 4-1 and Figure 4-2). The mining leases are 100% owned by De Beers Canada Inc. who holds them on behalf of the GKJV. The participating interest of each of the GK joint venture parties is governed by the 2002 joint venture agreement as updated in 2009, which is registered against the mineral leases (see Section 4.4).

Annual lease payments, payable to the Receiver General Canada (Northwest Territories, c/o Mining Recorders Office), comprise $1.00 per acre for the duration of the 21-year lease period (note that fees are payable on acres, not hectares, in the NWT and Nunavut). Payments increase to $2.00 per acre if a second 21-year term is granted after application to the Northwest Territories Mining Recorder for the extension.

All mining leases were legally surveyed by licensed surveyors.

JDS is of the opinion that the leases are valid and in good standing until the expiry dates in Table 4-1. Renewal of the leases is required in 2023.

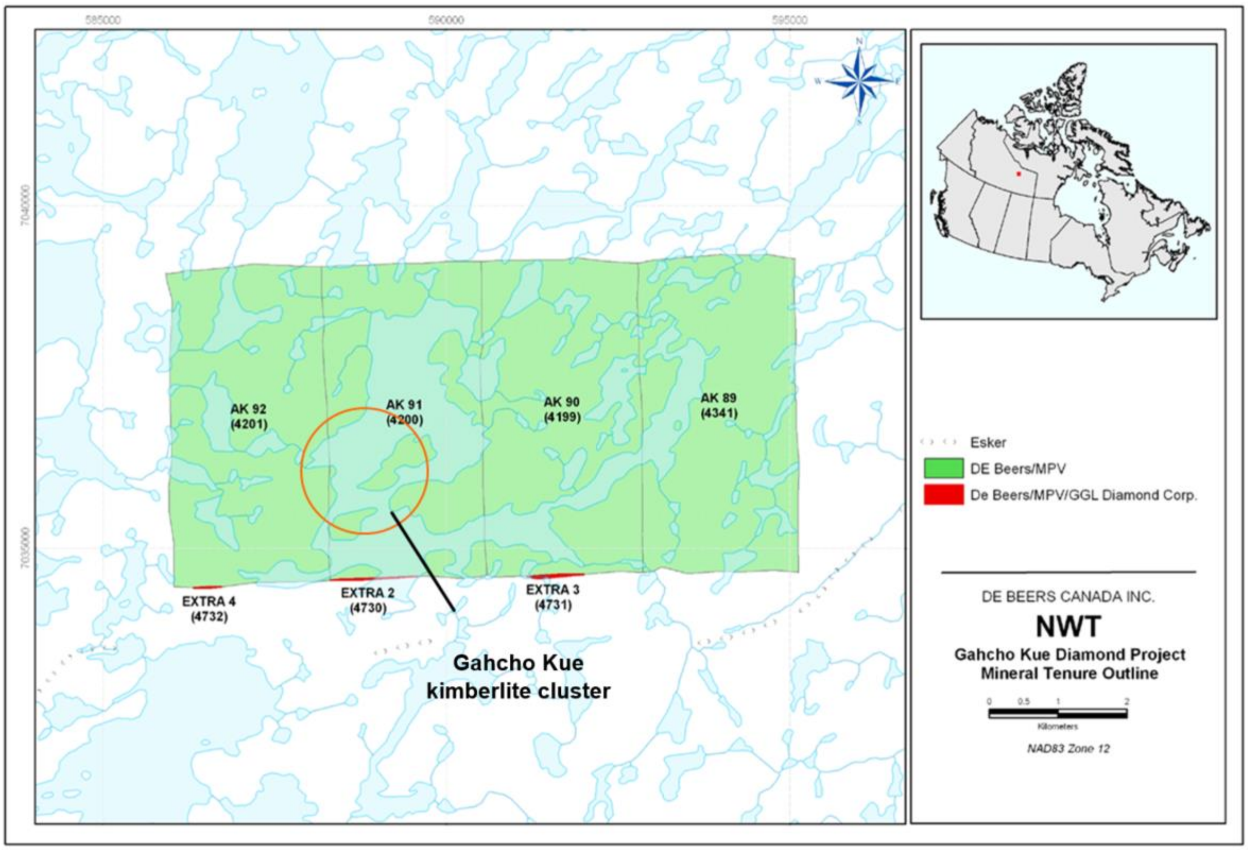
Table 4-1: Mineral Tenure Summary

Number	Tenure Type	Area (acres)	Date Granted	Expiry Date	Holder and Ownership Percentages
Gahcho Kué Mine					
4199	Lease	2,607	15-Jul-02	15-Jul-23	De Beers Canada Inc. on behalf of the GKJV. The participating interest of each of the GKJV parties is governed by the 2002 Joint Venture Agreement, which is registered against the mineral claims. Interests in the GKJV are De Beers Canada Inc (51%), Mountain Province Diamonds (49%)
4200	Lease	2,579	15-Jul-02	15-Jul-23	De Beers Canada Inc. on behalf of the GKJV. The participating interest of each of the GKJV parties is governed by the 2002 Joint Venture Agreement, which is registered against the mineral claims. Interests in the GKJV are De Beers Canada Inc (51%), Mountain Province Diamonds (49%)
4201	Lease	2,590	15-Jul-02	15-Jul-23	De Beers Canada Inc. on behalf of the GKJV. The participating interest of each of the GKJV parties is governed by the 2002 Joint Venture Agreement, which is registered against the mineral claims. Interests in the GKJV are De Beers Canada Inc (51%), Mountain Province Diamonds (49%)
4341	Lease	2,577	17-Jul-02	17-Jul-23	De Beers Canada Inc. on behalf of the GKJV. The participating interest of each of the GKJV parties is governed by the 2002 Joint Venture Agreement, which is registered against the mineral claims. Interests in the GKJV are De Beers Canada Inc (51%), Mountain Province Diamonds (49%)
Total		**10,353**			
Sliver Claims					
4730	Lease	4.92	1-Apr-05	1-Apr-26	De Beers Canada Inc (55.5%), Mountain Province Diamonds (24.5%) and GGL Diamond Corp (20%)
4731	Lease	5.76	1-Apr-05	1-Apr-26	De Beers Canada Inc (55.5%), Mountain Province Diamonds (24.5%) and GGL Diamond Corp (20%)
4732	Lease	0.84	1-Apr-05	1-Apr-26	De Beers Canada Inc (55.5%), Mountain Province Diamonds (24.5%) and GGL Diamond Corp (20%)
Total		**11.52**			

Source: JDS, 2014

Immediately to the south, and contiguous with the Project mining leases are three “sliver claims”; mining leases 4732, 4730 and 4731 (Figure 4-2). The leases have a total area of 11.52 acres, and are held in the names of De Beers Canada Inc. (55.5%), Mountain Province Diamonds Inc. (24.5%) and GGL Diamond Corp. (20%) (Figure 4-2).

Figure 4-2: Gahcho Kue Mineral Tenure



Note: Mining lease boundaries for 4732, 4730, and 4731 are approximate at this scale.
Source: De Beers, 2013

4.4 Agreements

The Monopros Ltd. Joint Venture Agreement, dated March 6, 1997, was entered into between Monopros Ltd. (Monopros; a wholly-owned Canadian subsidiary of De Beers Consolidated Mines and now known as De Beers Canada Inc.), MPD, and Camphor Ventures. The parties amended the Monopros Ltd. Joint Venture Agreement in 2000.

An updated and expanded JV Agreement between De Beers and MPD became effective on January 1, 2002, was signed October 24, 2002. This agreement provides that De Beers could earn up to a 55% interest in the Project by funding and completing a positive definitive feasibility study. The agreement also provides that De Beers could earn up to a 60% interest in the Project by funding development and construction of a commercial-scale mine.

MPD acquired Camphor Ventures’ interest in the joint venture in 2007.

A further updated and amended JV agreement between De Beers and MPD was executed effective July 3, 2009. The JV agreement superseded the previous JV agreements. The agreement maintains the Project ownership at 51% De Beers and 49% MPD. Each party responsible for funding their respective share of the project development costs from January 1, 2009 onward, and each party shall receive a proportional share of the diamond production.

The amended agreement also sets forth the amount of “allowable” expenses of exploration work between March 8, 2000, and December 31, 2008 previously funded by De Beers, and sets forth a repayment schedule by MPD to De Beers for their 49% share of the allowable expenses. The repayment schedule is triggered by milestone events with the final payment being made on the due date, which is defined as 15 months after the start of commercial production.

4.5 Surface Rights

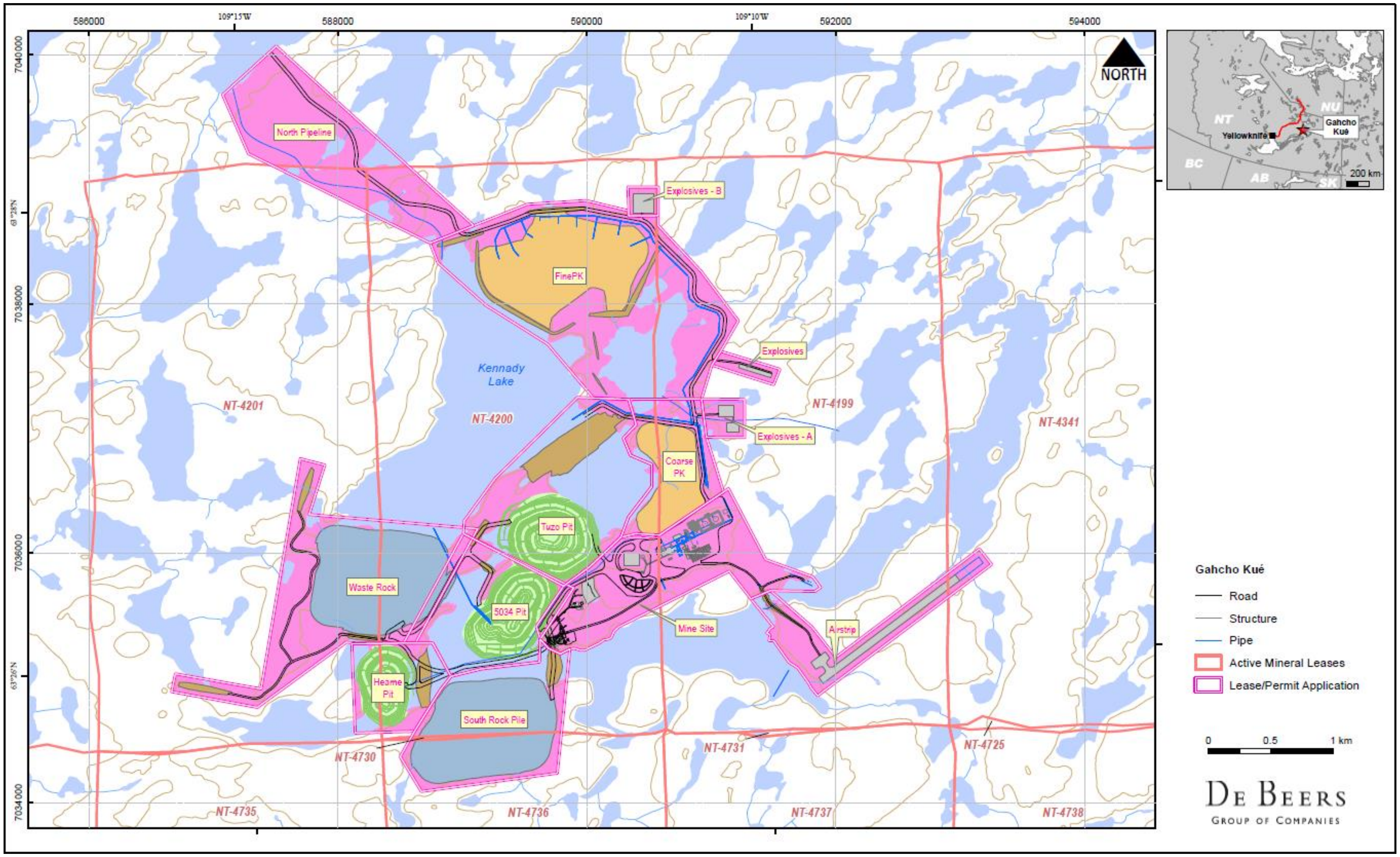
Crown lands are lands owned by the federal, territorial or provincial governments. Authority for control of these public lands rests with the Crown, hence their name. Crown land and Commissioner’s land are both types of public lands. The Federal Government manages and administers Crown land in Canada. In the Northwest Territories, Aboriginal Affairs and Northern Development Canada (AANDC) is responsible for the majority of Crown land. Effective April 1, 2014 the responsibility for public land, water and resource management in the Northwest Territories shifted from AANDC to the Government of the Northwest Territories (GNWT). Public land is managed and administered by the GNWT, and specifically, by the Department of Municipal and Community Affairs (MACA).

Administration of Crown lands, including minerals for the Northwest Territories and Nunavut, is based on the Territorial Lands Act (TLA) and its regulations. The Regulations under the TLA that deal with mineral tenure, leasing and royalties are the Northwest Territories and Nunavut Mining Regulations (NTNMRs), formerly known as the Canada Mining Regulations (CMRs). Under the current NTNMRs, a party may prospect for minerals and stake mineral claims on any Crown lands covered under the TLA, including lands in and around the area of the Mackenzie Valley.

A surface lease is required under the Territorial Lands Act if a project will require the use of Crown land anywhere in the NWT for longer than two years. A surface lease does not convey ownership to the minerals on or under the leased property. Those minerals require a mineral lease (refer to Section 4.3). The first step to acquire a surface lease is to submit an application for use of Crown land. Activities taking place on Crown land in the Mackenzie Valley require applications that are made to the Mackenzie Valley Land and Water Board. The Mackenzie Valley, as defined in the Mackenzie Valley Resource Management Act, includes all of the Northwest Territories, with the exception of the Inuvialuit Settlement Region and the Wood Buffalo National Park. JDS has confirmed that De Beers has filed applications for the surface leases, however there is no guarantee that surface leases will be issued in a timely manner or will contain terms and conditions that are acceptable to the GKJV partners. The leases applied for are depicted in Figure 4-3. Surface rights for construction of a diamond mine, including the plant, access roads, airstrip, and accommodations, have not yet been granted.

The Gahcho Kué Mine is currently operated under by authority of land use permits and water licenses. JDS has confirmed that valid licenses are currently in place for Gahcho Kué Mine. JDS has verified that a Class A Land Use Permit (permit number MV2005L2-0015, expiry date August 10, 2019) and a Type B Water License (permit number MV2005L2-0015, expiry date September 30, 2028) are current valid and in place. A detailed list of permits, licences and authorizations for the GK Mine is provided Table 4-2.

Figure 4-3: Permit Boundary Map



Land Use Boundaries
Source: De Beers, 2014

4.6 Water Rights

The water license for the Gahcho Kué Diamond Mine (Type “A” Water License (MV2005L2-0015)) sets out several conditions with respect to alteration, diversion or otherwise use water for the purpose of mining. The water licence was issued in 2014 has a term of 16 years and will require a renewal on or before September 30, 2028. The Gahcho Kué Diamond Mine is subject to the Authorization for Works or Undertakings Affecting Fish File No SC98001 (“Fisheries Authorization”) issued by Fisheries and Oceans Canada (DFO 2014). The Fisheries Authorization outlines reporting requirements and approvals, compensation requirements for the “serious harm” to fish. The finalization of options for fish habitat compensation to account for serious harm to fish associated with the Project has been developed in consultation with regulatory agencies. The current draft Offsetting Plan (formerly “No Net Loss Plan”) (Golder Associates Ltd., 2012) for Gahcho Kué includes the development of two habitat compensation options. The first is habitat enhancement through the development of a new trout spawning and nursery habitat in Kennady Lake while mining is underway so that a high quality fish habitat is in place when Kennady Lake is refilled at closure. The second option is the Redknife Bridge Culvert rehabilitation to allow for the passage of fish to the upstream reaches of the Redknife River. The rehabilitation of the culvert has the ability to provide more fish habitat than is being lost by the Mine.

4.7 Permits

The Gahcho Kué Diamond Mine is in full compliance with all existing permits, authorizations and licences. Table 4-2 provides a summary of the regulatory permits, licences and authorizations applicable to the Gahcho Kué Mine.

Table 4-2: Major Regulatory Permits, Licenses & Authorizations for Gahcho Kué

Permits, Authorizations and Agreements	Legislation	Agency	Expiry and Tenure
Archaeological Research Permit 2014-004	*NWT Archaeological Research Act*	Prince of Wales Northern Heritage Centre, Department of Education, Culture and Employment, GNWT	• Issued annually as needed for archaeological research during any phase that research is deemed necessary.
Wildlife Research Permit WL 500291	*NWT Wildlife Act*	Department of Environment and Natural Resources, GNWT	• Expiry December 31, 2018 • Permit will be needed for each phase of mine life for a wildlife monitoring plan. • Permits are issued annually.
Scientific Research Licence 15582	*NWT Research Act*	Aurora Research Institute	• Expiry December 31, 2018 • As needed for Socio-economic and Traditional Knowledge field work and investigations, and aquatic and wildlife effects monitoring plans. • Licences are issued annually.
Surface Leases: 75N/6-2- 2, 75N/6-3-2, 75N/6-5-2, 75N/6-7-2, 75N/6-8-2	*Territorial Lands Act and Regulations*	GNWT, Lands Department	• Expiry August 31, 2035 (in approval process). • Maximum 21 year lease for winter access road then renewal to cover final years.
Mineral Leases: 1. NT-4199, NT-4200, NT-4201 2. NT-4341	*Territorial Lands Act* *Northwest Territories and Nunavut Mining Regulations*	Mineral and Petroleum Resources Directorate, Aboriginal Affairs and Northern Development Canada	• Expiry: 1. July 15, 2023 2. July 17, 2023 • Initially issued from AANDC for 21 years; renewable for a further 21 years.
Type A Water Licence MV2005L2-0015	*Mackenzie Valley Resource Management Act* *Northwest Territories Waters Act* *Northwest Territories Waters Regulations*	Mackenzie Valley Land and Water Board	• Expiry September 30, 2028 • Renewable for additional years to cover remaining phases of mine life (Licence tenure in renewals may be variable as dictated by the MVLWB).
Class A Land Use Permit MV2005C0032	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	Mackenzie Valley Land and Water Board	• Expiry August 10, 2019 • Permits generally issued for five years, possibility for extension to seven years with renewal thereafter.
Class A Land Use Permit MV2018C001 (Exploration Activities)	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	• Permit submitted February 15, 2018. Approval in process.
Fisheries Authorization no. 03-HCAA-CA6- 00057.1 for the destruction of habitat associated with the following activities: 1. Dewatering of Kennady	*Fisheries Act*	Fisheries and Oceans Canada, Fish Habitat Management	• Expiry December 31, 2020 for completion of habitat destruction and compensation. • Further authorization needed at each stage of renewal of Water Licence or Land Use Permit, if

Permits, Authorizations and Agreements	Legislation	Agency	Expiry and Tenure
Lake and Lake D1 2. Construction of dykes			fish habitat is harmfully altered, disrupted, destroyed.
Licence to Fish for Scientific Purposes S-15-/16-3000-YK	*Fisheries Act* *NWT Fisheries Regulations*	Fisheries and Oceans Canada, Fish Habitat Management	• Renewed annually. • Granted for Kennady Lake fish-out (completed August 2015).
Approval for Constructing Works in Navigable Water 14-1087	*Navigable Waters Protection Act*	Transport Canada, Canadian Coast Guard	• Expiry April 1, 2019
Approval of Waste Dump, Dam, or Impoundment Plan	*Mine Health and Safety Act (Territorial)*	GNWT, Chief Inspector, Workers Compensation Board.	• Granted, no expiry indicated.
Hazardous Waste Generation, Transport and Storage Permit NTG537	*Canadian Environmental Protection Act*	Department of Environment and Natural Resources Canada	• Granted, no expiry indicated.
Hazardous Waste Storage Permit NTR138	*Canadian Environmental Protection Act*	Department of Environment and Natural Resources Canada	• Granted, no expiry indicated.
Explosive Storage, Explosives Handling, Magazine Permits 2015-0105-0106-0107 Permit to Store Detonators 2015-0104	*Mine Health and Safety Regulations (Territorial)*	GNWT, Chief Inspector, Workers Compensation Board.	• Expiry December 31, 2020 • Long-term authorization needed for all phases of mine until closure is complete.
Registration of Fuel Storage Tanks	*Canadian Environmental Protection Act*	Environment Canada with cooperation from Aboriginal Affairs and Northern Development Canada	• Granted, no expiry indicated.
Approval to Transport Dangerous Goods	*Transportation of Dangerous Goods Act*	Transport Canada	• Undergoing renewal. • Long-term authorization needed to transport dangerous goods for all phases of the mine until closure is complete.
Ni Hadi Xa Agreement		Tlicho government, the North Slave Métis Alliance, NWT Métis Nation, Lutsel K'e Dene, and Deninu Kué First Nation.	• One year past the end of active closure.

Source: JDS, 2014

4.8 Environmental Liabilities

The closure and reclamation security estimate for the Gahcho Kué Mine was completed on August 11, 2014 by the MVLWB (MVLWB, 2014). The MVLWB is authorized to set the security deposit amount by subsection 35 (1) of *the Waters Act* and the regulations promulgated under the act. The purpose of the security deposit is to ensure funds are available to complete reclamation of the site, inclusive of the closure and post-closure phases).

The financial security estimate is divided into land and water, where the land securities are held under the land use permit (MV2005C0032) and the water securities are held under the water licence (MV2005L2-0015). The payments are further divided into milestones, being:

- Prior to initiating construction activities;

- One year following the initiation of construction activities;
- Prior to Year 1 of operations;
- Prior to Year 4 of operations;
- Prior to Year 7 of operations; and
- Prior to Year 11 of operations.

These milestones were selected as they represent time periods where key operational changes occur that affect reclamation. These estimates encompass both total environmental exposure as well as any progressive reclamation work completed at that time. It should be noted that an additional exploration land use permit was applied for in February 2018 and additional securities may be applied once the permit is issued.

As of December 31 2017, the maximum reclamation lability of the Gahcho Kué Mine was C$62.5 M.

5 Accessibility, Climate, Local Resources, & Infrastructure

5.1 Site Access

Primary access to the site is via the 1,676 m all weather gravel airstrip which is routinely serviced by RJ85 and 737 Jet aircraft from the Southern provinces, including regularly scheduled twice weekly personnel flights from Calgary International Airport. Additionally, the airstrip is frequently serviced by smaller turbo-prop aircraft from Yellowknife, transporting the Northern based workforce and smaller freight shipments.

A winter road connects Yellowknife to the Snap Lake, Ekati, and Diavik mines during February and March each year (Figure 1-1). The road is operated under a Licence of Occupation by the winter road JV Partners that includes Dominion Diamonds, Rio Tinto and De Beers. The road passes within 70 km of the Gahcho Kué site, at Mackay Lake. A 120 km winter road spur has been established from Mackay Lake to the project site, and was open in 1999, 2001, 2002, and 2013 to support exploration activities. The 120 km spur road has been open continuously each year since 2013 to support construction and on-going mine operations.

5.2 Climate

The climatic data and design criteria for the project site are summarized as follows:

- January (2.5% minimum incidence of occurrence) - 46°C
- July (2.5% maximum incidence of occurrence) +25°C dry bulb / +16°C wet bulb
- Maximum recorded temperature +31°C
- Minimum recorded temperature - 54°C
- Mean temperature -9.6°C
- Barometric pressure 95.87 kPa
- Maximum wind speed 110 km/h
- Average prevailing wind speed 12 km/h
- Prevailing wind direction East
- Wind speed for infiltration 48 km/h

Temperature and precipitation characteristics at the site are expected to be close to average conditions recorded at the Yellowknife and Lac de Gras Extended AES climate stations.

5.3 Local Resources & Infrastructure

The Gahcho Kué site is typical of many northern Canadian mining operations that lack local and regional infrastructure such as permanent road access, navigable shipping routes and ports, and external utilities. Therefore, the Gahcho Kué site requires extensive infrastructure to sustain operations, including power generation, sewage and water treatment, personnel accommodation, storage facilities for materials delivered on the limited annual winter ice road, and an aerodrome to provide year-round cargo, food and passenger aircraft access.

The design approach for the Gahcho Kué site infrastructure incorporates features common to other northern mining developments:

- All weather gravel airstrip;
- Full camp accommodation and administrative complex capable of housing 300+ employees year-round;
- 50+ Million liters of diesel fuel storage capable of storing a full year's operational requirement;
- Standalone diesel fired power station;
- Water and sewage treatment facility;
- Enclosed processing plant and maintenance shop;
- Arctic corridor system connecting accommodations with plant, shop and power stations;
- Warehouses;
- Explosives manufacturing and storage facilities;
- Waste heat recycling systems;
- Heat traced and where applicable, enclosed piping and electrical infrastructure to endure harsh winter climates; and
- Microwave communications tower supplemented by satellite.

Figure 5-1: Site Aerial Photograph Q3 2017

Site Layout
Source: JDS, 2018

5.4 Physiography

The site lies on the edge of the continuous permafrost zone in an area known as the barren lands. The surface is characterised as heath / tundra, with occasional knolls, bedrock outcrops, and localised surface depressions interspersed with lakes. A thin discontinuous cover of organic and mineral soil overlies primarily bedrock, which, occurs typically within a few metres of surface. Some small stands of stunted spruce are found in the area. There are myriad lakes in the area. Kennady Lake, under which the kimberlite pipes lie, is a local headwater lake with a minimal catchment area.

6 History

In the early 1990s, Gahcho Kué, previously known as the Kennady Lake Project, was staked by Mountain Province Diamonds. Canamera Geological Ltd. was contracted to conduct the original exploration, which led to the discovery of the 5034 kimberlite pipe in January 1995. A brief history of the project is presented below.

6.1 Historical Timeline

- 1990s: Exploration by Canamera Geological on behalf of Mountain Province Mining Inc. and partners. 5034 pipe discovered.
- 1997: Letter agreement entered into with Monopros Limited (now De Beers Canada) in terms of which they could earn a 51% interest in the Project. Hearne, Tuzo and Telsa pipes discovered in mid-1997.
- 1998: Mini bulk sampling of 5034, Hearne, Tuzo and Telsa by Monopros. Preliminary scoping study by MRDI (now AMEC).
- 1999: Bulk sampling by large diameter drilling of Hearne, Tuzo and Telsa by Monopros.
- 2000: De Beers Canada conducts Desktop Study.
- 2001: Further resource drilling of 5034, Hearne and Tuzo by De Beers Canada.
- 2002: Joint Venture agreement entered into between Mountain Province (44.1%), De Beers Canada (51%) and Camphor Ventures (4.9%).
- 2003: Technical (pre-feasibility) Study commences.
- 2004 / 2005: Further hydrological, geotechnical design and resource drilling. Engineering and environmental baseline studies completed.
- 2005: Completion of the C$25 M Technical Study. Commencement of the C$38.5 M advanced Exploration Program and filing of applications for construction and operating permits.
- 2006: Mountain Province acquires controlling interest in Camphor Ventures. Independent valuation of Gahcho Kué diamonds completed. Tuzo and 5034 North Lobe delineation and geotechnical drilling completed.
- 2007: Mountain Province acquires 100% of Camphor Ventures thereby increasing interest in Gahcho Kué to 49%. Core drilling program completed at Tuzo to upgrade the Tuzo resource. Infill drilling program completed at the 5034 kimberlite. 5034 North Lobe bulk sampling program completed.
- 2008: Tuzo bulk sampling program completed. 25.14 carat gem quality diamond recovered from Tuzo drill program. Updated independent valuation completed; actual price per carat of bulk sample diamonds recovered increases 63% to $135 per carat.
- 2009: Updated mineral resource statement completed. Revised and restated joint venture agreement concluded between Mountain Province and De Beers.

- 2010: Feasibility Study completed. Updated EIS under preparation for filing in December.
- 2011: Environmental impact review commences. Updated independent diamond valuation completed ($185/carat). Feasibility study approved by GKJV. Decision to build approved by GKJV partners. Tuzo Deep resource drilling commences.
- 2012: Environmental impact review continues. GKJV approves initial C$32 M capital budget for early mobilization. Updated independent valuation completed ($186 per carat). Public hearings under environmental impact review concluded.
- 2013: Environmental impact review public record closes. Supplies to mine site commence on winter road.
- 2013: MVEIRB recommends project.
- 2013: October 22nd – Ministerial approval received for the Gahcho Kué Project.
- 2013: November 29th – Pioneer Land Use Permit Issued.
- 2014: Winter Road installed and 634 truckloads of material delivered to site.
- 2014: Revised and Updated Gahcho Kué 2014 Feasibility Study Report completed.
- 2014: Class A Land Use Permit and Type A Water Licence issued for the construction and operation of the mine.
- 2015: Structural steel erection and mechanical assembly commences for major facilities. Airstrip expansion for 737 aircraft complete.
- 2016: March 23rd – First ore exposure 5034 Pit; June 20th – First ore through processing plant.
- 2016: September 20th – Official opening of Gahcho Kué Mine.
- 2017: March 2nd – Gahcho Kué announces commercial production.

6.2 Historical Ownership

- Early 1990s – 2002: Mountain Province Mining Inc. and Partners.
- 2002 – 2007: Mountain Province Diamonds, Inc (44.1%), De Beers Group of Companies (51%) and Camphor Ventures (4.9%).
- 2007 – Present: Mountain Province Diamonds, Inc (49%), De Beers Group of Companies (51%)

6.3 Historical Mineral Resource and Reserve Estimations

The previous basis for mineral resource estimate for the property was compiled by AMEC (2009) and Mineral Services (2013). .

Re-estimation of grades in two lobes of 5034 and depletion modelling have been conducted since production commenced at the 5034 pit in 2016.

JDS has included information from these Reports in the Sections 7 through 15 below. In the opinion of JDS, the current mineral resource estimates are adequate to support a technical report on the Gahcho Kué Mine.

6.4 Historical Mining

Prior to quarrying of the 5034 pit commencing in 2013, and subsequent mining in 2015 onward, no mining activity had been conducted on the Gahcho Kué property.

7 Geological Setting & Mineralization

7.1 Geological Setting

7.1.1 Regional Geology

The Gahcho Kué kimberlite cluster occurs in the southeast Slave Craton, a small Achaean nucleus within the North American Craton (Figure 7-1), which contains rocks ranging in age from 4.05 Ga to 2.55 Ga (Bleeker et al., 1999). The oldest rocks of the Slave Craton are small remnants of felsic granites and gneisses (2.8 Ga to 3.2 Ga; Beals, 1994), and the Acasta Gneisses (3.6 to 4.0 Ga; Bowring et al., 1989) located in the western part of the craton. Several supracrustal series (metasedimentary rocks with less common metavolcanic rocks) crop out in the central and eastern parts of the Slave Craton, forming the Yellowknife Supergroup (circa 2.7 Ga). The Yellowknife Supergroup is intruded by an extensive series of pre- to post-deformational (2.69 to 2.60 Ga) felsic plutons.

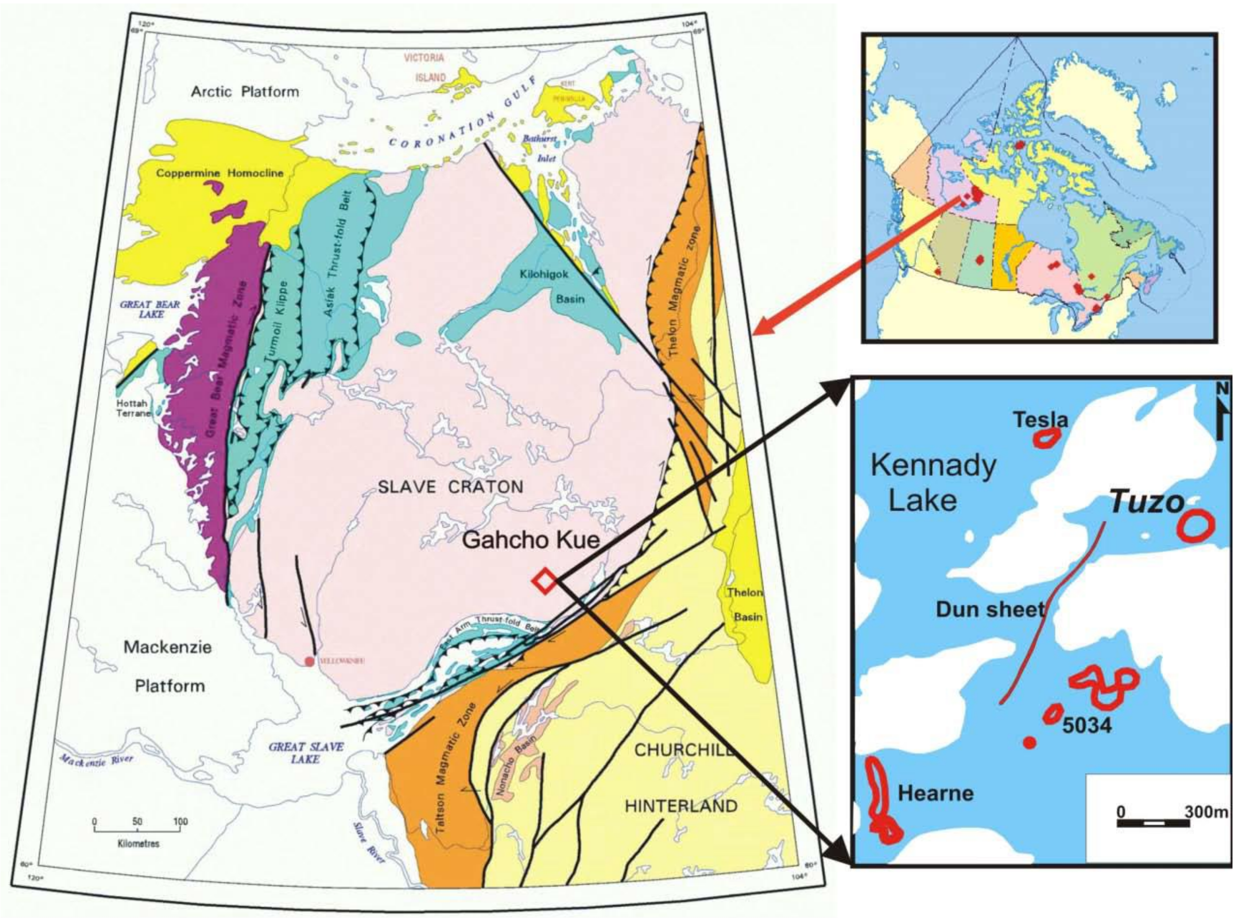
The eastern portions of the Slave Craton are Late Achaean island-arc complexes (magmatic arcs and accretionary prisms) accreted to the margin of an older continental fragment to the west (Griffin et al., 1999).

Several swarms of Early-Mid Proterozoic (2.0-2.3 Ga; see LeCheminant et al., 1995) basaltic dykes occur in the Lac de Gras area. A suggested source for the Lac de Gras dyke swarm is beneath the Kilohigok Basin.

The north–northwest trending Mackenzie dyke swarm (1.27 Ga; LeCheminant and Heaman, 1989) extends over 2,300 km from a focus, interpreted as a plume head (Fahrig, 1987), and located west of Victoria Island.

The kimberlite intrusions are of Cambrian age (approximately 540 Ma).

Figure 7-1: Regional Setting, Gahcho Kué Kimberlite Cluster



Note: Red diamonds on the plan map of Canada represent a number of other kimberlite occurrences in Canada. The inset shows the relationship between the individual kimberlites that comprise the Gahcho Kué cluster; Dun = Dunn in this Report. Source: Caro and Kopylova, 2004

7.1.2 Project Geology

7.1.2.1 Basement

Basement lithologies mapped from limited areas of outcrop in a 16 km^2 area surrounding the Gahcho Kué cluster include granite, granitic gneiss, minor granodiorite, and diorite that have undergone regional amphibolite-facies metamorphism retrograded to greenschist facies (Baker, 1998). The most common rock type, granite, varies from a medium-coarse grained, equigranular facies to highly foliated granitic gneiss.

Two distinct northwest- to north–northwest-trending, linear, magnetic highs in the eastern quadrant are interpreted to be part of the regional Mackenzie diabase dyke swarm. Two east–northeast-trending diabase dykes were identified from linear aerial photo-features occurring south of Kennady Lake and proximal to the Tesla kimberlite. These dykes can be traced in outcrop but do not have strong magnetic expression.

They are considered to belong to the Mallay dyke swarm by Baker (1998) and to predate the interpreted Mackenzie dykes.

7.1.2.2 Quaternary

The Gahcho Kué area was glaciated repeatedly during the Pleistocene Epoch, most recently by the Laurentian ice sheet. The Laurentian ice sheet began to recede 18,000 years ago, and the ice front retreated past the Gahcho Kué Project area between 9,000 and 9,500 years ago (Dyke and Prest, 1987). However, there is no stratigraphic evidence that represents deposits from previous glaciations; the Quaternary geology of the Gahcho Kué area appears to be related only to the last glacial event, the Wisconsinian glaciation (Hardy, 1997). Glacial-related sedimentation is quite thin, with only scarce patches of till blanket and large fluvioglacial outwash fans (Hardy, 1997).

Till veneer, till blanket, and outwash sediments characterize the Quaternary deposits in the Gahcho Kué area. The areas of till blanket contain abundant mud boils and no bedrock exposure. Areas of level sands and reworked till are classified as outwash sediments. Till veneer and till blanket cover most of the area except for small areas to the east of the campsite; outwash sediments occur west of Kennady Lake. Outwash sediments and a large esker that extends along a portion of the southern edge of the mapped area dominate the area south of Kennady Lake.

The stratigraphic record overlying the till is younger than the last glaciation and is composed mainly of pro-glacial sediments (glaciofluvial and glaciolacustrine deposits). As the Gahcho Kué area occurs over a relatively flat terrain, many swamps, ponds and peat deposits are present (Hardy, 1997).

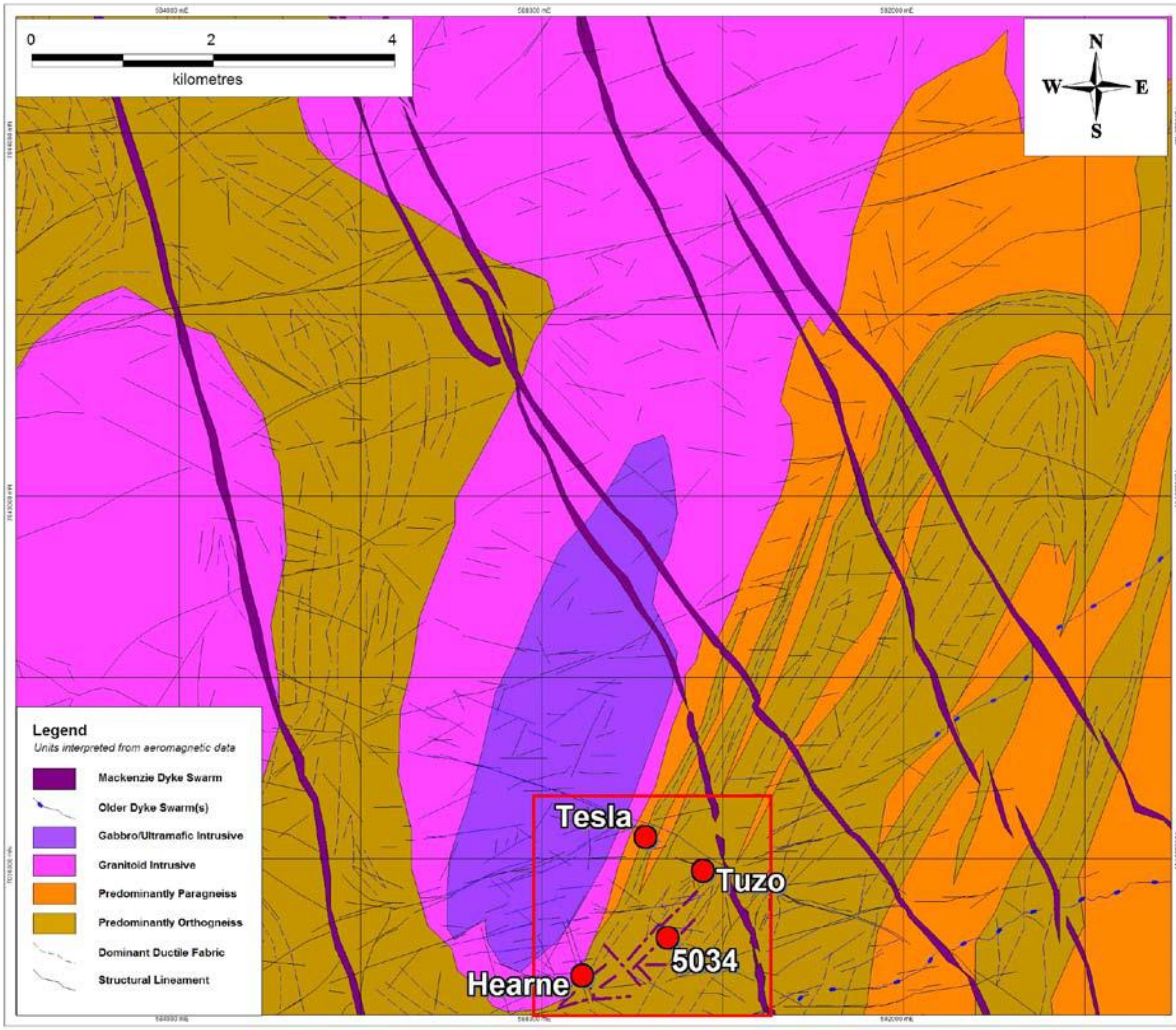
7.1.2.3 Structural Setting

Granite–gneiss terrane intruded by a series of dykes (Figure 7-2) characterizes the Gahcho Kué area. There are several granitic intrusions surrounded predominantly by gneisses; the gneisses display a clear structural pattern of being metamorphosed by the granitic intrusions. Along the eastern edge of the area, a marked geological boundary is interpreted to represent contact with meta-sediments that extend eastwards. The central portion is a structurally complex zone of folding and possible shears.

There are several groups of demagnetised lineaments with weak, negative magnetic expression; these demagnetised lineaments could be dykes or demagnetised country rock resulting from dyke intrusion or faulting. They are grouped as:

- a regular, pervasive northeast-trending set;
- a regular, pervasive northwest-trending set; or
- an east–west-trending set in the south of the area.

Figure 7-2: Litho-structural Interpretation of the Gahcho Kue Area



Note: Major first order structures trend northeast–southwest, and are parallel to the circa 2.0 Ga to 1.8 Ga Great Slave Shear Zone; second order (often younger) structures trend primarily northwest–southeast.
Source: SRK, 2004

The 5034, Hearne, Tuzo, and Tesla kimberlites all occur at the eastern edge of an interpreted south-closing fold-nose that has developed a radial fold-nose cleavage. The apparent south-closing fold is interpreted to open to the north–northeast; the dip direction is not known. The core of the fold is composed of granite and minor granodiorite. Northeast-trending axial-planar foliation associated with the fold is developed in gneiss.

7.1.3 Kimberlite Geology

7.1.3.1 Kimberlite Types

Tuffisitic Kimberlite (TK) –

Tuffisitic kimberlite (TK) is olive green to light brown in colour. These rocks are relatively soft and can swell on contact with water because of the presence of hygroscopic clay minerals. The TK drill cores are characterised by matrix-supported magmaclastic breccia textures. Common fresh, typically pink-coloured, granitoid xenoliths vary in abundance from 30% to 95% and are as large as 5 m. Xenocrysts of country rock are common and are often shard-like in shape. TK contains two generations of olivine present as macrocrysts and phenocrysts, which are completely pseudomorphed by serpentine. Pelletal lapilli are common; these typically consist of thin selvages of kimberlite, which rim most of the olivines, xenoliths and xenocrysts. Altered groundmass minerals can be identified within the selvages. The matrix between the pelletal lapilli consists of common serpentine and clays. Primary carbonate is not present. In thin sections, microlites, which include clinopyroxene, are common. Mantle xenoliths are extremely difficult to identify within the core due to alteration.

Transitional Tuffisitic Kimberlite (TKt) –

Rocks classified as transitional tuffisitic kimberlite (TKt) are broadly similar to TK but are more competent and darker in colour. The TKt rocks have a uniform olivine distribution but the breccia matrix displays inhomogeneous textures dominated by magmaclastic textures or pelletal lapilli. In thin sections, clinopyroxene microlites are present; however, they are slightly coarser grained than those within the TK rocks. These TK-like areas are closely intermixed with less common small patches that possess magmatic textures. Country rock xenoliths are less common in TKt than in TK and show greater reaction to the host kimberlite. Xenoliths often have a green colour and are more difficult to distinguish within the kimberlite matrix. Olivine macrocrysts and phenocrysts are completely altered to serpentine.

Transitional Hypabyssal Kimberlite (HKt) –

Rocks classified as transitional hypabyssal kimberlite (HKt) are broadly similar to the HK rocks but are characterised by inhomogeneous textures dominated by a magmatic groundmass with less common patches of magmaclastic kimberlite. These rocks are dark in colour and competent. The granitoid xenoliths show a degree of reaction with the host kimberlite that is intermediate between HK and TKt and are typically dark green to black in colour. Olivine macrocrysts and phenocrysts are completely pseudomorphed by serpentine. Groundmass minerals include phlogopite, spinel, carbonate, serpentine and perovskite. In thin section, clinopyroxene is common within the groundmass and is much coarser grained than the microlites present within TK and TKt rocks. Such clinopyroxene is absent within HK.

Hypabyssal Kimberlite (HK) –

Hypabyssal kimberlite (HK) is mainly fresh, competent, black to dark green, and characterised by uniform macrocrystic textures. The rocks are composed of two generations of olivine consisting of anhedral, medium-grained, often fresh, olivine macrocrysts, and smaller subhedral to euhedral olivine phenocrysts. The well-crystallised groundmass consists of monticellite, phlogopite, spinel, primary carbonate, serpentine, and perovskite. Mantle xenocrysts, in addition to olivine macrocrysts, include rare garnet and clinopyroxene. Ilmenite is not present. Rare mantle xenoliths consist of garnet lherzolites and eclogites. Country rock xenoliths are predominantly granitoids exhibiting extensive reaction to the host kimberlite, and these xenoliths range in colour from black to white. In areas where significant digestion of granitic country rock xenoliths has occurred, the groundmass is characterised by common phlogopite and/or clinopyroxene reflected in a patchy colouration of the rocks.

7.1.3.2 Country Rocks

The country rock contacts along the margins of the pipes are generally variable and broadly correlate with the textural variety of kimberlite present within the pipes. The country rock contacts can be grouped broadly into five main types based on geology:

- sharp contact zones;
- brecciated contact zones;
- chemically-altered contact zones;
- chemically-altered and disaggregated contact zones; and
- thermally metamorphosed contact zones.

Sharp Contact Zones

Present between kimberlite and country rock, these are characterised by minimal broken cores or altered country rock surrounding the pipe. Sharp contacts are associated with all textural varieties of kimberlite present within the pipes.

Brecciated Contact Zones

Brecciated contact zones are characterised by fractured country rocks that do not contain any kimberlitic component. The variable fragment sizes and shapes range between 0.5 mm to 15 cm. In general, the brecciated zones can be subdivided into two main groups: massive brecciated zones (MBZ) and pulverised brecciated zones (PBZ).

MBZ consists of coarser fragments typically greater than 2 cm in diameter. These zones are often associated with pre-existing joints. The fragments within these zones are typically loose and have not been cemented. The distribution and extent of these broken zones is highly variable and generally increases in intensity as the pipe contact is approached. However, at a distance from the pipe contact, there are contacts without brecciated zones directly adjacent to contacts with brecciated zones. This apparent haphazard distribution of the brecciated zones may be related to the interconnectedness of the country rock joints. The broken country rock fragments can often be fitted back together, with no evidence of particle movement. PBZ consists of a mixture of larger particles 2 cm to 15 cm in diameter with a matrix composed of finely pulverised country rock < 2 mm in diameter. These breccias are typically cemented. The PBZ can be either clast or matrix supported, and there is often evidence of particle movement. The proportion of fine pulverised material present within these zones is highly variable. Often the larger fragments contain smooth edges and show slight alteration or bleaching along the margins. The PBZ zones are not as common as the MBZ. These breccia zones are interpreted by GKJV to be related to pre-conditioning processes in the early emplacement of the kimberlite. Once the kimberlite has breached the surface, it is thought that the subsequent explosion and violent degassing of the magma column likely incorporated the weak brecciated zones into the pipe. Large xenoliths of this material are present within the Tuzo Pipe.

Chemically-altered Contact Zones

These are characterised by typically minor (< 5 cm) zones of alteration along joint surfaces without significant disaggregation. The intensity of this alteration is variable; however, this decreases in intensity with increasing distance from the pipe contact. Chemically altered contact zones are most often developed in areas around HK. These zones can also contain brecciated country rock. The altered zones typically are pale yellow in contrast to the pink granitoids. These areas can be porous due to the removal of quartz.

Chemically-altered & Disaggregated Contact Zones

These zones are considerably weaker and more extensive than the chemically altered contact zones where present. These areas are characterised by typically extensive chemical alteration that, in extreme cases, can result in extensive disaggregation of the country rock. These zones are also characterised by minor brecciation, but without evidence of transport or cementation. This type of contact zone is most extensively developed in areas around HK and, in particular, within the granite cap over the 5034 North lobe. The most extensive zones are present over the thicker intersections of kimberlite. The altered zones consist of a brittle core that appears bleached (particularly along joints). Feldspars are typically orange in appearance and in thin section appear sericitised. Chlorite and dolomite can be present along joint surfaces.

Thermally Metamorphosed Contact Zones

These zones are only associated with hot contacts related to HK, and are typically less than 50 cm wide. Weakest adjacent to the kimberlite, the country rock displays less reaction to the intruding kimberlite with increasing distance from the contact. The country rock within these zones is often grey or white in colour in contrast to the typically pink granitoids, and can contain significant green serpentine as well as carbonate veins.

7.1.3.3 Country Rock Xenoliths

Country rock xenoliths within the Gahcho Kué kimberlite pipes are dominated by granitoid xenoliths with lesser diabase, gneiss, and rare volcanic rocks. No sedimentary-rock xenoliths are present. Xenolith contents of the kimberlites are variable, particularly in the TK units. For logging purposes, the following terms are used to describe the kimberlite texture.

- K = kimberlite:
  - B = breccia; and
  - m = micro- breccia.

The following terms are used in indicated xenolith abundance:

- K: < 15% (not a breccia);
- KB: 15% to 50% (breccia);
- KBB: 50% to 75% (breccia);
- KBBB: >75% (breccia); and
- KmB: >15% xenoliths 5 mm to 10 mm (microbreccia).

7.1.3.4 Gahcho Kué Kimberlites

The main Gahcho Kué kimberlite cluster comprises four pipes: Hearne, 5034, Tuzo, and Tesla. The Hearne Pipe, most of the 5034 Pipe, and the Tuzo and Tesla pipes occur under Kennady Lake (refer to Figure 7-2), which has an average depth of 8 m. The kimberlites may represent the oldest known occurrences of kimberlite on the Slave Craton. The 5034 kimberlite was Rb–Sr isotopically dated (phlogopite) as Middle Cambrian (542.2±2.6 Ma: Heaman et al., 2003). Hetman et al. (2004) suggest similar ages for the Tuzo, Tesla and Hearne kimberlites based on Ar40–Ar39 dates on phlogopite that are 542 ±6, 531 ±6 and 534 ±11 Ma, respectively.

Gahcho Kué kimberlites are overlain by varying thickness of glacial boulder outwash and lake sediments (averaging 10 m thick), and have a combined water and sediment cover as much as 25 m thick.

The pipes are steep-sided and were formed by the intrusion of several distinct phases of kimberlite in which the textures vary from HK to diatreme-facies TK. TK displays many diagnostic features including abundant unaltered country rock xenoliths, pelletal lapilli, serpentinised olivines and a matrix composed of microlitic phlogopite and serpentine without carbonate. HK contains common fresh olivine set in a groundmass composed of monticellite, phlogopite, perovskite, serpentine and carbonate. A number of separate phases of kimberlite display a magmatic textural gradation from TK to HK, which are characterised by a decrease in the proportion of pelletal lapilli and country rock xenoliths, and an increase in groundmass crystallinity, proportion of fresh olivine, and the degree of xenolith digestion (Hetman et al., 2004). Characteristics of each pipe are summarised in Table 7-1.

Table 7-1: Characteristics of Gahcho Kué Kimberlites

Pipe	Characteristics
Hearne	Transitional diatreme and hypabyssal root zone
5034	Irregular hypabyssal root zone
Tesla	Transitional diatreme and hypabyssal root zone
Tuzo	Deeper part of less complex diatreme zone

Source: JDS, 2014

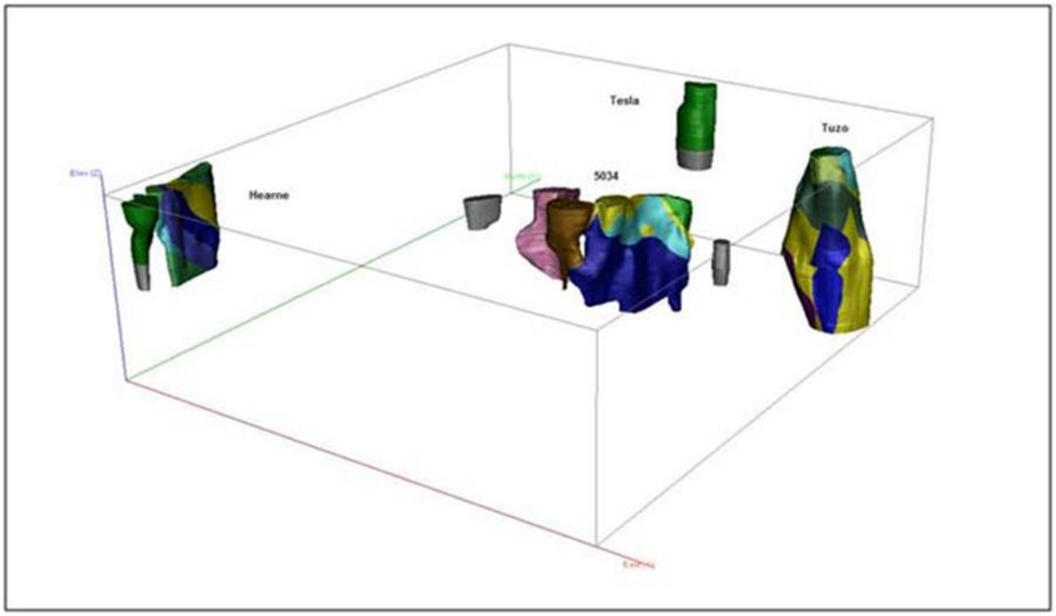
7.1.3.5 Hearne Kimberlite

Two bodies comprise the Hearne kimberlite, Hearne South and Hearne North (Figure 7-4). The bodies have smooth, steep-sided walls, and cover an area of about 1.5 ha. Hearne South is a roughly circular pipe, whereas Hearne North is a narrow, elongate pipe trending north–south. The pipes may join at depth. The width of country rock between the two bodies varies from a minimum of approximately 20 m at the sub-crop to approximately 70 m at depth. Hearne North measures a maximum of 250 m x 50 m north–south. Hearne South has a dimension of about 80 m x 90 m at surface. Hearne South is dominantly infilled with TK, and Hearne North is infilled with approximately equal amounts of HK and TK.

The present pipe geological model for Hearne South extends to 121 masl; however, there is no drill information below 225 masl. This area of the Hearne kimberlite is referred to as Hearne South undefined. At Hearne North, the pipe narrows to less than 10 m wide in the centre of the body at approximately 130 m below lake-surface. There is also evidence at the north and south ends of the body that the pipe extends below 115 masl.

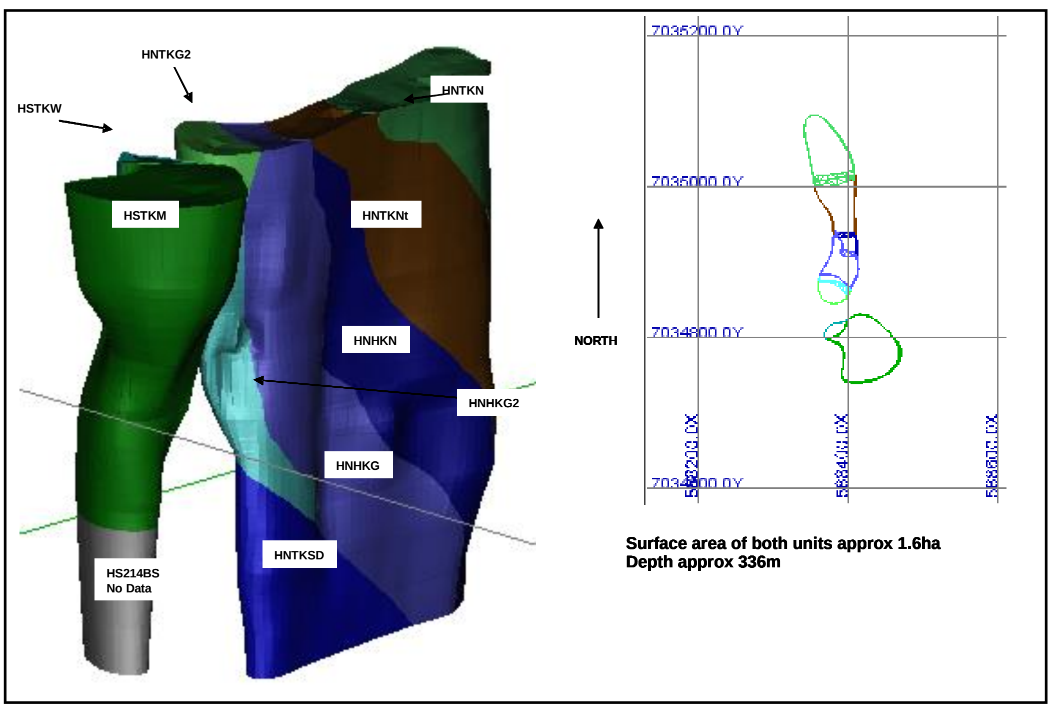
The distance from the south end of Hearne to Tuzo is about 2 km in Figure 7-3. In Figure 7-4, Hearne South is the pipe-like body on left of image, Hearne North on right.

Figure 7-3: 3D View of Gahcho Kué Kimberlite Bodies Looking Northwest



Gahcho Kue Kimberlites in GEMS
Source: De Beers, 2013

Figure 7-4: Section View of Hearne Looking



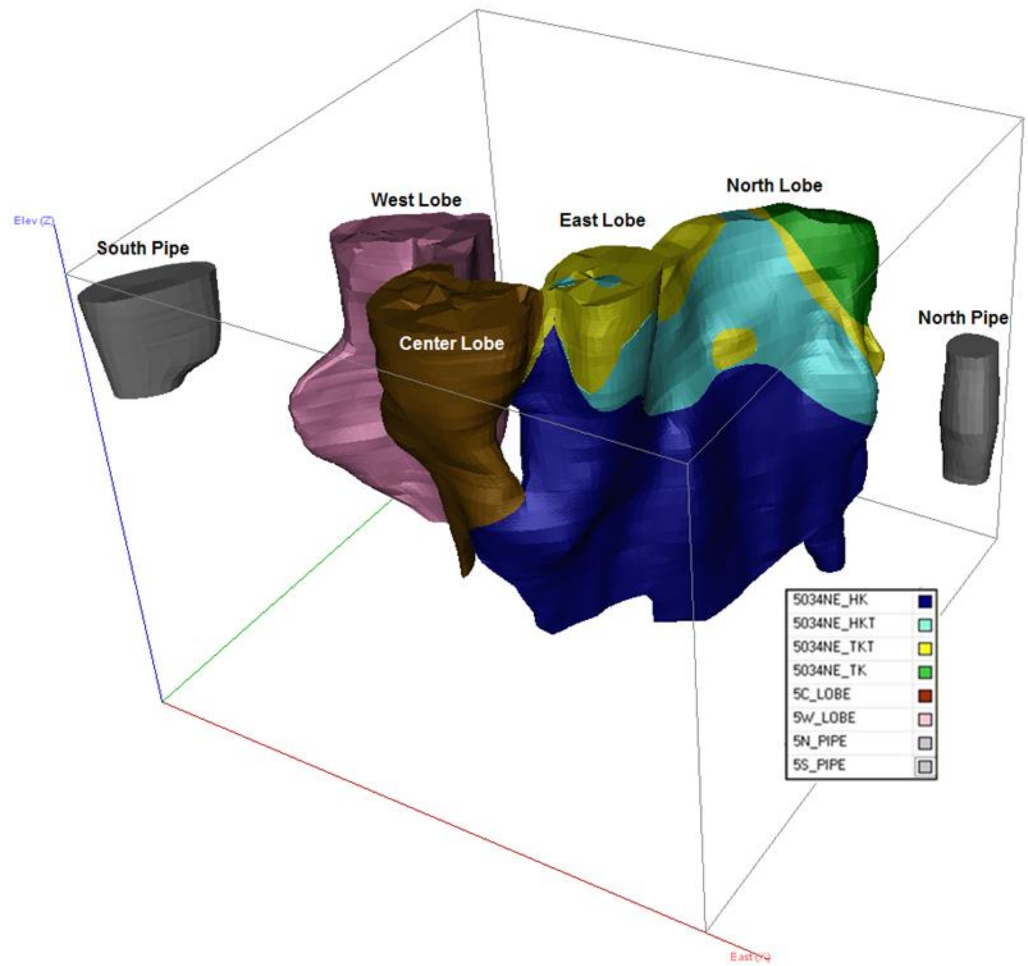
Hearne Kimberlite Geologic Shape
Source: De Beers, 2013

7.1.3.6 5034 Kimberlite

The 5034 kimberlite is a highly irregularly-shaped pipe and dyke complex, which is comparable to kimberlite root zones elsewhere and has a surface area of approximately 2.1 ha (West, Centre and East Lobe; Figure 7-5).

The 5034 kimberlite is modelled as a semi-continuous occurrence composed of five discrete kimberlite bodies, three of which are modelled as joined at the sub-crop to form one main continuous body, with two small outlying satellite pipes (Figure 7-5).

Figure 7-5: 3D View of 5034 Looking Northwest



5034 Kimberlite Models in GEMS
Source: De Beers, 2013

The five modelled kimberlite bodies are referred to as follows:

- 5034 South Pipe;

- 5034 “Main” West Lobe;
- 5034 “Main” Centre Lobe;
- 5034 “Main” North-East Lobe (i.e., East Lobe and North Lobe); and
- 5034 North Pipe.

The main part of the 5034 occurrence that reaches the surface occurs under Kennady Lake and can be divided into three lobes: West, Centre and East. These three lobes are joined at the surface, but separate at depth. The Centre and East lobes are modelled separately at shallow depth, but rejoin at greater depth producing what appears to be a window of granite within the kimberlite. The East and North lobes are joined at depth, geologically continuous, and are collectively referred to as the North-East Lobe. The surface measurements of the three lobes of the 5034 Main Pipe are approximately as follows:

- West Lobe – 125 m x 45 m;
- Centre Lobe – 125 m x 80 m; and
- East Lobe – 85 m x 65 m.

The northern portion of the 5034 North-East lobe, the North Lobe, is blind, and occurs under 60 m to 90 m of country rock cap. Approximately half of this northern lobe lies below the lakebed and half beneath the main peninsula. The blind northern portion of the 5034 North-East Lobe measures 240 m long and varies from approximately 20 to 50 m wide, averaging 30 m wide. A combined internal geology model is developed for the 5034 North-East Lobes. There are four major kimberlite types, three of which occur across both lobes (refer to Figure 7-5).

The modelled 5034 kimberlite occurrence includes two small satellite intrusions, the 5034 South Pipe and the 5034 North Pipe, which are modelled separately from the main 5034 body due to very limited information on these bodies.

Some areas of the 5034 Pipe contacts remain poorly defined. 5034 South Pipe extends as deep as 305 masl, the maximum depth of the available information. The 5034 South Pipe and the 5034 West Lobe appear to be connected by a complex tuffisitic kimberlite breccia (“TKBBB”). Interpretation of drilling data suggests.

Based on petrographic observations and whole-rock geochemical data, a systematic arrangement of litho-facies types was recognised. HK textured kimberlites are located in deeper levels of the pipe, followed by transitional textured kimberlites (HKt and TKt) until fragmental textured kimberlites (TK) dominate in the uppermost portions of the pipe. TK and TKt textured kimberlite are present in the West and North-East lobes. The Centre Lobe is dominated by HK.

Four main textural kimberlite units are identified in the 5034 North Lobe: TK, TKt, HKt, and HK (Kryvoshlyk, 2006). The spatial distribution of those rock varieties creates an antiformal structure located approximately in the geographical centre of the lobe. The most important rock types in the North Lobe are HK and HKt, which are present in the deeper levels of the lobe and comprise the saddle of the antiform. TK and TKt rock types are mainly present in the shallow levels of the flanks in the North and South of the antiform and are overlying the HK units. A specific unit, the so-called “Orange Marker,” is identified in thin sections throughout the North Lobe. A selected suite of kimberlite rocks from the East and North Lobe were examined and the samples were concluded to show well-developed petrological similarities suggesting a close genetic relationship of the two lobes (Kryvoshlyk, 2007).

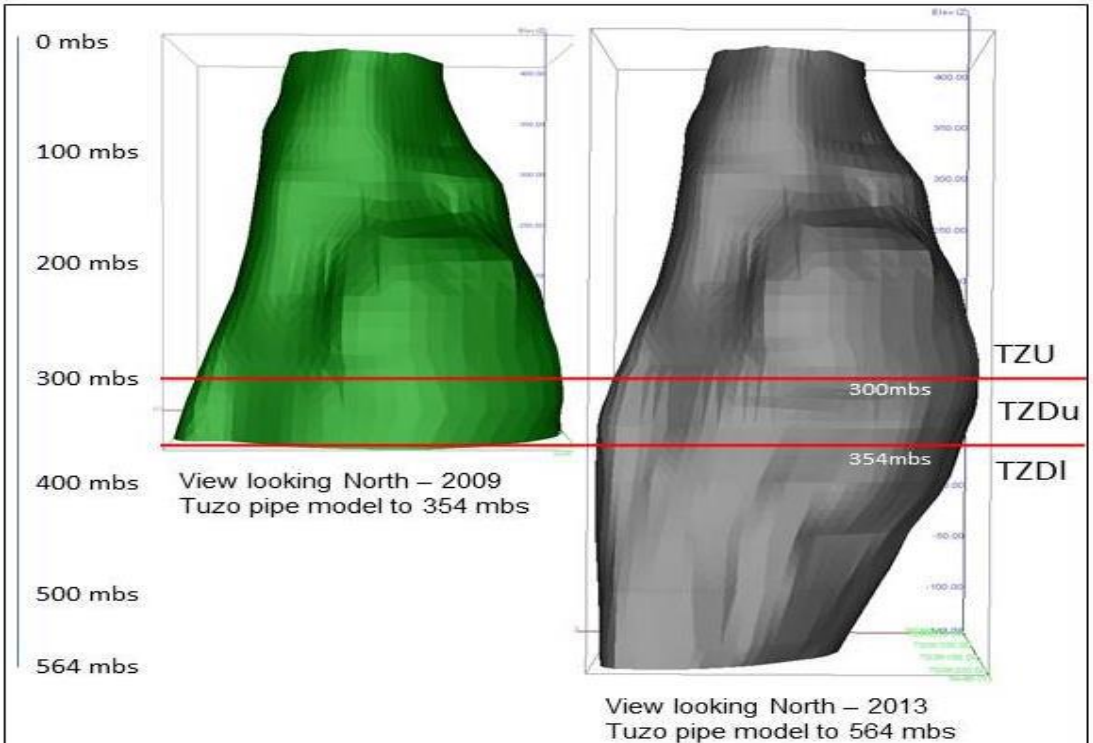
Kryvoshlyk (2008) showed that the North-East and West lobes have an overall layered internal structure, comprising gradual kimberlite textural changes from coherent HK at depth to fragmental TK at shallower levels. Transitional rocks in between these end member coherent or fragmental rocks are either called HKt or TKt, depending on their textural association. In contrast to the layered structure of most lobes, the Centre Lobe is composed exclusively of HK, which could not be subdivided with available petrological or geochemical data despite the variable diamond counts in this lobe. The HK found in all four lobes is geochemically and petrologically similar, suggesting a close genetic relationship between all four lobes.

Kryvoshlyk (2008) concluded that the quality of the geological model is strongly dependent on the data density (drill core and reference samples) and on sample collection protocols. The highest data density is present in North-East Lobe, which results in a relatively high-confidence model. The West and Centre lobes have a lower data density (both with respect to drill density and number of reference samples) and rather poor sample control (difficulties connecting micro-diamond and heavy mineral samples with geology). It is therefore not possible to produce a high-confidence geological model for West Lobe or to explain the diamond data variability in Centre Lobe without additional data. The Centre Lobe is composed almost entirely of HK, and minor HKt. With the dataset available in 2008, the HK rock types are petrographically and geochemically indistinguishable; thus, Kryvoshlyk (2008) recommended that they be modelled as one unit. The West Lobe is to some extent similar to the North-East Lobe in that the sequence HK–HKt–TKt is present, and these rocks are petrologically similar. The West Lobe is divided into three petrological units, a Main Lower HK unit, a Main Upper HKt unit, and a Secondary Upper TKt unit; however, significant uncertainty is associated with the contacts between those units, and the resource model considers the pipe to be undifferentiated kimberlite.

7.1.3.7 Tuzo Kimberlite

In the section below, the key findings from two studies (Seghedi and Maicher, 2007; Mann, 2013) conducted on the geology of Tuzo by the DBC Kimberlite Petrology Unit (KPU) on behalf of the GKJV are summarised. More detailed descriptions and presentations of data on the geology of Tuzo are available in these reports. Seghedi and Maicher (2007) presented new petrographical, geochemical and micro-diamond data for Tuzo Pipe with the purpose of developing a 3D internal geological model. The 2007 study refined the previous internal geology model (Hetman et al., 2003; and Hetman et al. 2004) and reassessed the diamond distribution model. The overall surface area of the Tuzo Pipe is about 1.2 ha, which is covered by as much as 25 m of water of and glacial overburden. The kimberlite body comprises various fragmental and coherent kimberlites, and it contains abundant inclusions of the surrounding granitic country rock. The 2007 drill program improved the definition of the shape of the pipe, which is unusual as it widens towards depth from 125 m in diameter near the surface to about 225 m at 300 m depth. Tuzo geology model commences about 25 m below lake level (lake level 420.9 masl). Information obtained from the 2011/2012 Tuzo Deep program enabled extension of the Tuzo pipe model from 360 mbs to 564 mbs, establishing that below ~330 mbs, the pipe maintains an ellipsoidal outline oriented northeast to southwest, but that the pipe dimensions gradually narrow with depth. The surface area of the pipe at the base of the model is approximately 1.3 ha (~175 m by 115 m). The 2013 update to the 2009 Tuzo pipe model is illustrated in Figure 7-6.

Figure 7-6: Profile of 3D Geological Pipe Shell Models from 2009 (left) & 2013 (right)



MINERAL SERVICES CANADA INC.	
Date:	14 July 2013
Geology By:	De Beers Canada - KPU
Model By:	De Beers Canada – KPU
Figure By:	Stephen Moss - MSC

Note: The Tuzo Deep portion of the Tuzo kimberlite begins at 360 mbs; not at 354 mbs as indicated on the in Figure 7-6; 354 mbs is mid-bench, 360 mbs is the lowest extent of the bench.

Tuzo Kimberlite Model in GEMS

Source: De Beers, 2013

Five (5) major textural sub-types of kimberlite (rock types) have been observed and logged in drill core from Tuzo. These types form a broad sequence with depth in the pipe as follows (from top to bottom): TK (tuffisitic kimberlite); TK-TKt (TK transitional to TKt); TKt (TK transitional to HK); HKt (HK transitional to TK) and HK (hypabyssal kimberlite). Additional rock types defined and logged in Tuzo include country-rock breccia with kimberlite (CRX bx w/K); country-rock xenoliths (CRX) and an Epiclastic Unit (EU). The latter comprises short intersections too widely distributed for it to have a significant impact on the Resource Classification and, as part of the Tuzo Deep geology model update, has been incorporated into the modelled country-rock breccia unit (Mann, 2013). The models for Tuzo Upper are unchanged from those used for the 2010 Feasibility Study (Johnson, et al., 2010). As part of the Tuzo Deep study, the model for upper portion of Tuzo Deep (Tuzo Deep Upper; 300 to 360 mbs) was updated and a new model generated for lower portion of Tuzo Deep (Tuzo Deep Lower; 360 to 564 mbs) (Chuchra, 2013). The updated Tuzo Deep geological model includes two kimberlite domains (TKt and HK), country-rock breccia with minor kimberlite (CRXBX), the extension of the granite raft into Tuzo Deep Upper (RAFT_TZDu), and two large isolated blocks of granite (CRX1 and CRX2). The TKt and HK domains in Tuzo Deep correspond with the TKt2 and HK in the upper reaches of the kimberlite.

Seghedi and Maicher (2007) reported that the internal geology of Tuzo is very complex. Abundant country rock xenoliths, ranging from a few millimetres in diameter up to blocks several tens of metres in size, are hosted within the pipe. The highest degree of dilution is concentrated along a belt-like zone at about 120 to 200 m depth and under the roof of the widening pipe. The distribution of lithologies follows, very generally, a trend from top to bottom: TK, TK-TKt, and TKt as well as HKt+TKt, HKt, and HK. On a more detailed scale, however, the different lithologies occur as several metres to tens of metre thick intercalated sections. Contacts in between the kimberlite rock types are mostly gradual.

The lithological units show limited horizontal extent. Instead, they appear steeply to sub-vertically oriented, which gives the Gemcom® internal geology model a rugged shape. Volcanological evidence for mixing and mingling processes combined with the general facies architecture strongly suggest the occurrence of multiple eruptive events that modified the pipe infill extensively.

Seghedi and Maicher (2007) stated that the geochemical signature of the lithologies is strongly influenced by the variable but generally high degree of country rock contamination. Fragmental kimberlite units are geochemically and petrologically very similar, suggesting a close genetic relationship. However, the coherent kimberlite types HK and HKt are slightly discordant to the geochemical trend defined by the fragmental kimberlites.

In its shallow levels the pipe contains a zone that is characterised by a higher diamond grade and lower dilution compared to the surrounding fragmental rock units. This High Grade zone (TZ-TKTh) was originally identified in 1998 from large diameter drilling (LDD) data due to a zone of higher macro-diamond grade (Williamson and Hetman, 1998).

In the geological model developed by Seghedi and Maicher (2007) the TKt_1 and TK-TKt_1 model codes form a low dilution zone that includes the pre-2007 high-grade unit. The High Grade zone shows considerable internal inhomogeneities and a high similarity to neighbouring fragmental units (TK and TK-TKt_2) with respect to many petrographical parameters as well as its mineralogy, whole rock chemistry and micro-diamond (stone counts and size frequency distribution) data. Differences are the generally lower degree of dilution and a higher-grade.

Groundmass spinel chemistry demonstrates that the majority of the TKt, HKt and HK units are of the same magma batch suggesting a voluminous, rapid emplacement. The Tuzo pipe formation begins with the emplacement of a fragmental kimberlite (initially a TK) which is soon after intruded by a coherent magma, the HK. These texturally different kimberlites are still of the same magma batch, only the fragmentation behaviour of the magma changed during emplacement likely due to external factors, such as the interaction of the first intruding kimberlite with ground water leading to magma fragmentation. The depletion of ground water supply leads to non-fragmental emplacement of kimberlite into earlier fragmented tephra. The intrusive kimberlite forms a massive pillar along the eastern margin of Tuzo Deep and has a complex interface with the hosting fragmental kimberlite tephra. Close to the kimberlite intrusion, the interface is defined by an abundance of irregular dykes and veinlets, as well as spalling and agglutination of magma droplets, which intrude and inject the hosting tephra to form a complex peperite network of coherent and fragmental textured rocks. In addition, the intrusion of low viscosity kimberlite melt into the porous tephra framework in wide areas enhances the generation of coherent-looking rocks at this interface. The resulting rock type is a transitional hypabyssal kimberlite that has a mostly coherent appearance with local patches of the original fragmental nature of the host rock. Further from the intrusive coherent kimberlite, the influence of the intruding HK becomes less apparent and the original fragmental texture of the host tephra prevails – a TKt is generated. The granite country rock breccia with kimberlite matrix is interpreted as a contact breccia eroded from the weakened pipe wall during the eruption (Mann, 2013).

The investigation proves compelling evidence:

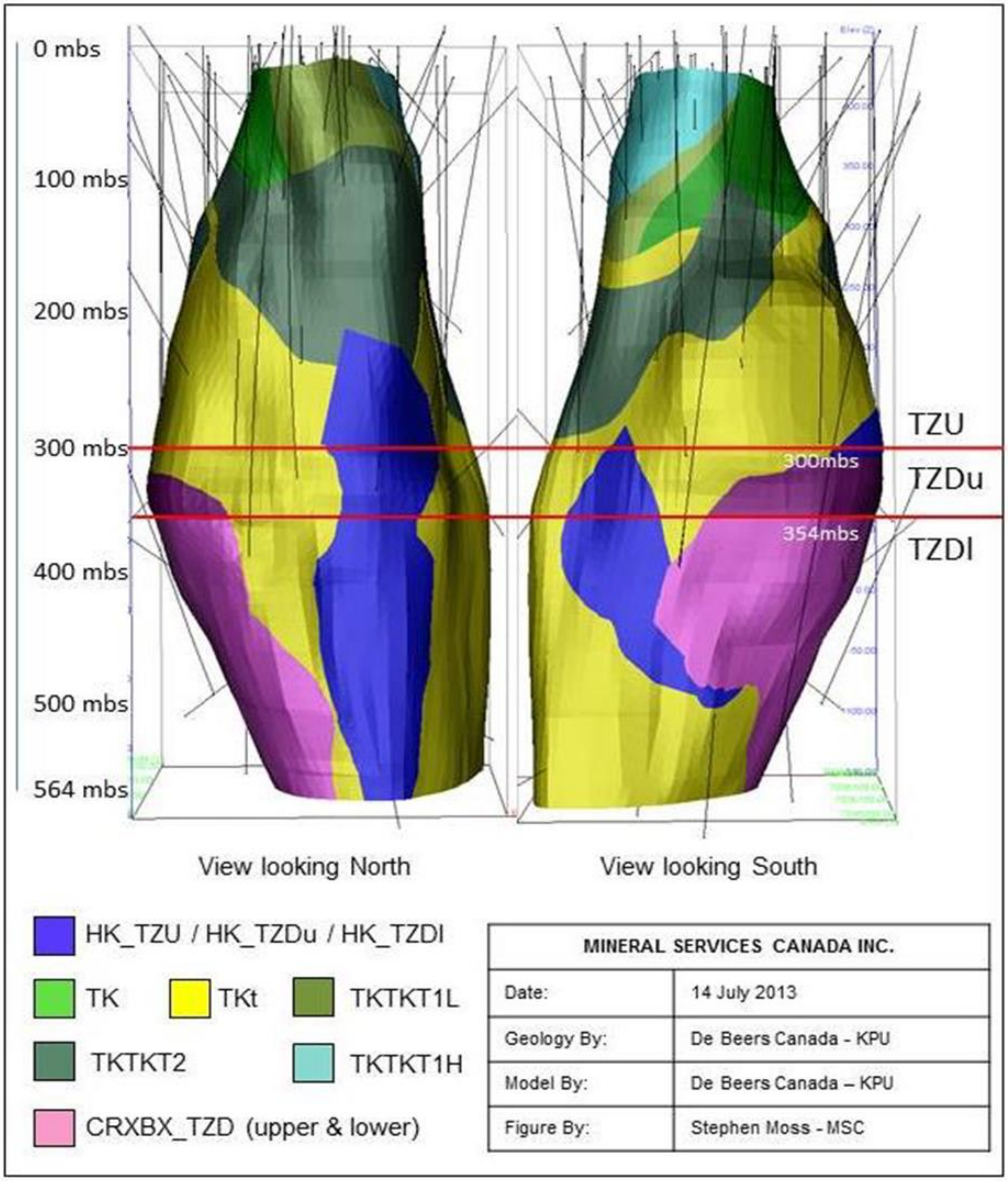
1) that the TKt unit identified in Tuzo Indicated is the same TKt unit identified in Tuzo Deep; and

2) the HKt and HK units observed in Tuzo Deep are from the same magma batch as the TKt.

The geology is complex and integration of core logging, petrology, whole rock chemistry and groundmass spinel chemistry was important in developing a 3D model (Mann, 2013).

The geological domains have been modelled in 3D and are illustrated in Figure 7-7. Modelling was undertaken by DBC using GEMCOM GEMSTM software to generate triangulated “solids” built based on the logged drill core model codes and in such a way as to reflect a reasonable interpretation of the overall geology and emplacement history of the Tuzo kimberlite (Mann, 2013; Chuchra, 2013).

Figure 7-7: 3D Geological Domain Models



Note: The Tuzo Deep portion of the Tuzo kimberlite begins at 360 mbs; not at 354 mbs as indicated on the Figure 7-6; 354 mbs is mid –bench, 360 mbs is the lowest extent of the bench.
Source: De Beers, 2013

7.1.3.8 Other Kimberlites within the GK Property

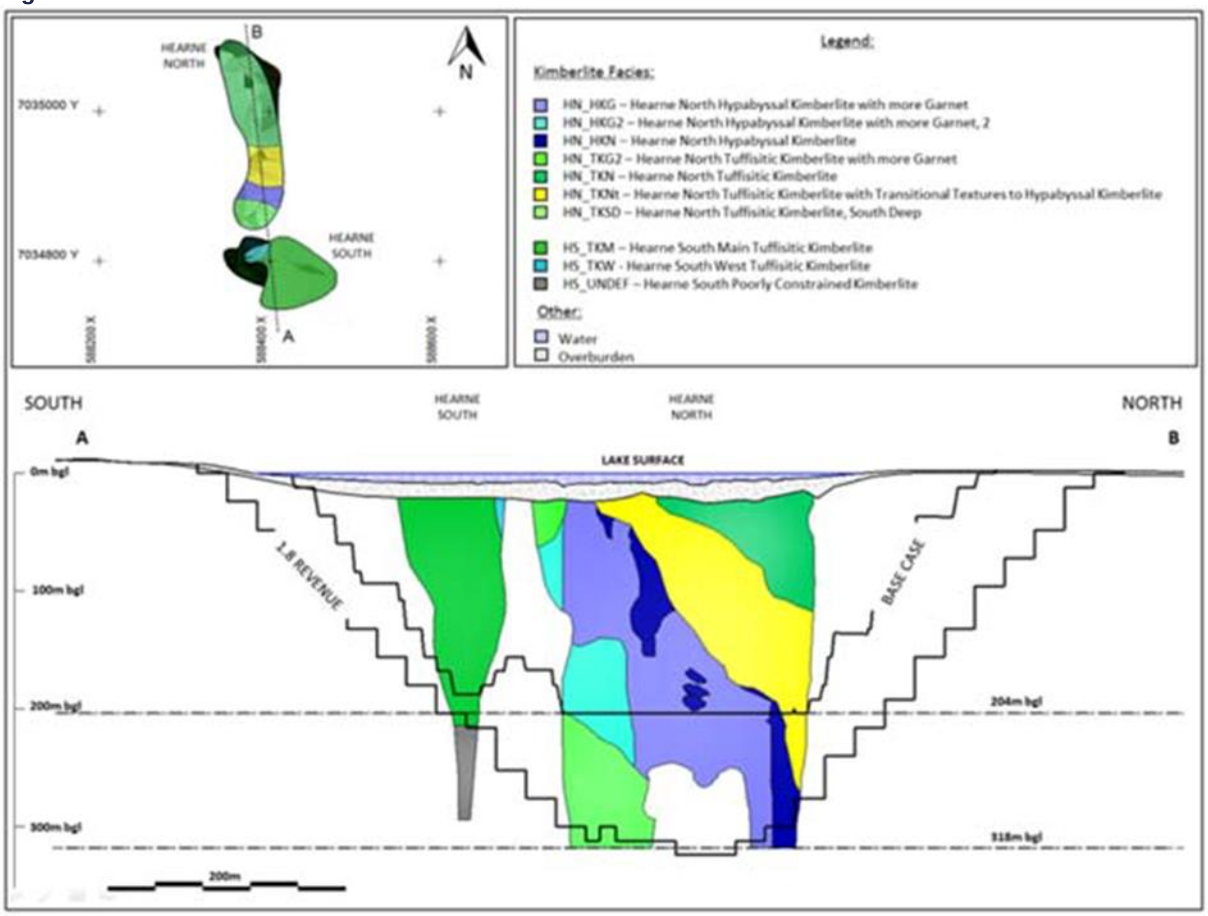
Several small kimberlite occurrences were intersected during exploration drilling programs following up geophysical and diamond indicator anomalies. These comprise dykes and what may be small pipes. None of these kimberlite occurrences are currently considered sufficiently diamondiferous to warrant additional work, and no additional exploration on the bodies is planned at this time.

7.2 Mineralization

7.2.1 Hearne Kimberlite

Five different phases of TK were recognised within the Hearne kimberlite (Figure 7-8).

Figure 7-8: Hearne Kimberlite



Hearne Kimberlite
Source: De Beers, 2013

Each TK phase can be geologically distinguished using features such as varying proportions of garnets, magmaclasts, autolith-like bodies, xenoliths, and clay minerals. The names of the different TK units are based primarily on their location within the two pipes. The green–brown, partly altered TK units are easily distinguished from the fresh black HK in both core and reverse circulation drill cuttings. Different phases of kimberlite within the black HK units are very difficult to distinguish from one another. The total HK was sub-divided into three units based primarily on macro-diamond grade with some support from geological differences and spatial positions in the pipe.

7.2.1.1 Hearne North

A major TK unit in Hearne North is the HNTKN that occupies the upper northern part of the main pipe. This TK contains <15% of granite xenoliths, but does contain autolith-like bodies and magmaclasts. The TK grades with depth into transitional textures grading towards HK. The transition zone was termed HNTKNt. This unit was geologically modelled using the upper limit of HK and the lower limit of TK textures logged in both core and reverse circulation holes. Below the transition zone is HK, some of which appears to be of the same phase of kimberlite as the overlying TK and TKt. The internal contact separating the TKN and TKNt is sub-parallel to the contact with the underlying HK. Both internal contacts dip at approximately 50° to the north. The HK immediately underlying the HNTKNt is thought to be part of the same phase and was termed HNHKN. This interpretation is supported by the similarity in macro-diamond grade between the textural varieties of kimberlite. These three textural units (HNTKN, HNTKNt, and HNHKN) represent the transition from the diatreme to the root zone within a single phase of kimberlite.

Two smaller TK units, which are unrelated to those discussed above, are present in Hearne North. HNTKG2 is located near the surface at the southern end of the pipe. This unit also seems to grade into an underlying HK, termed HNHKG2. One of the main features that distinguish the two smaller TK units from the main HNTKN is the presence of fresh garnets in the former. The HNTKSD is interpreted to be a completely different, and probably earlier, phase of kimberlite partly because the HNTKN and HNTKG2 exhibit gradational changes to HK at shallower levels in the pipe than the HNTKSD.

Although the HNHKN, discussed above, is interpreted as being related to the HNTKN, other HK units appear to be unrelated. Geologically, the latter HK units seem to contain more garnets than the HNHKN. There also appears to be sharper contacts rather than gradational changes between these and the overlying TK units. The volumetrically largest of these HK units, HNHKG, is correlated with the low- grade areas within the HK found in many of the large diameter holes. The HNHKG2 is nearly indistinguishable from the HNHKG in core.

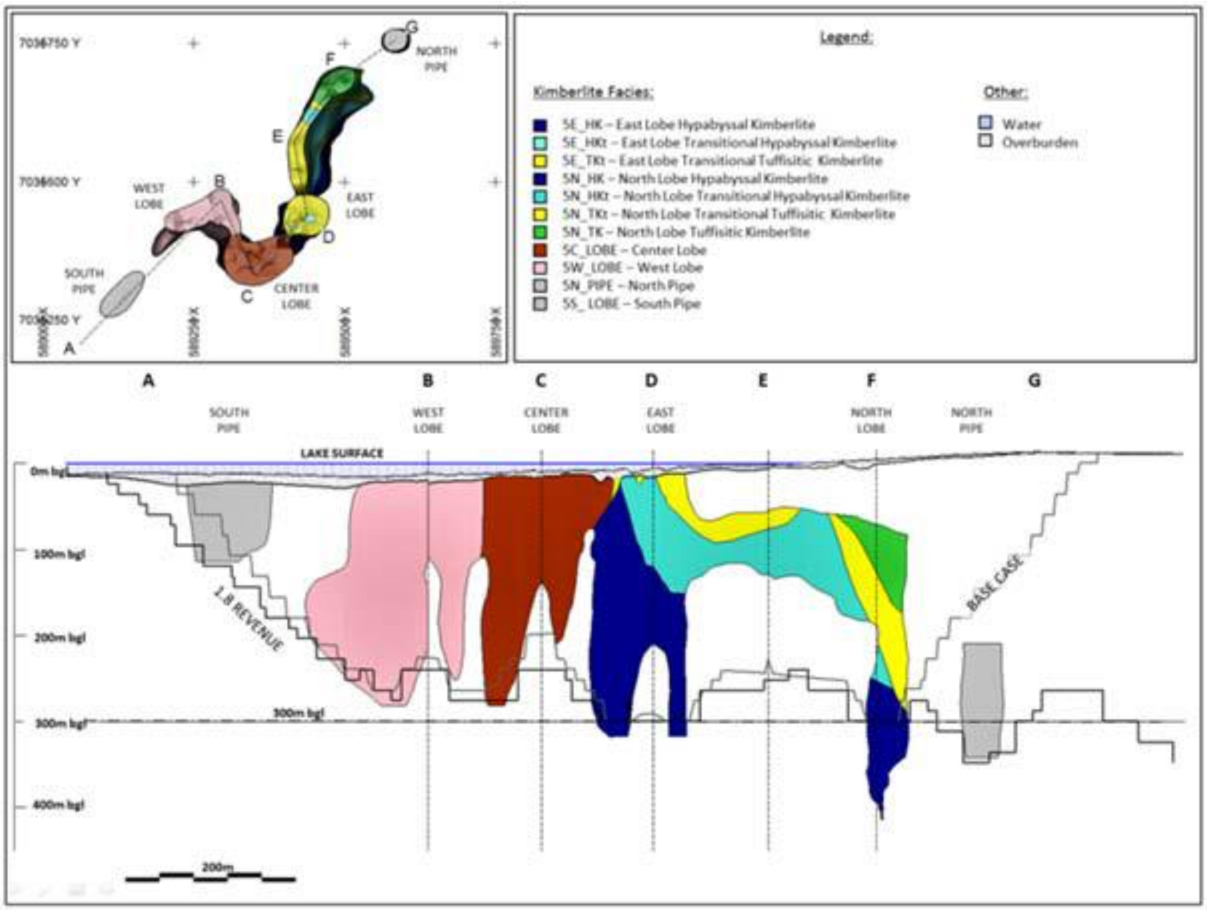
7.2.1.2 Hearne South

Based on geological interpretations from limited core drilling, this body appears to be composed mainly of uniform diatreme-facies TK, containing as much as 50% granite xenoliths. The TK unit was named HSTKM. A separate transitional HK/TK was proposed and named HSTKW. The macro-diamond grades in both of the above units are similar.

7.2.2 5034 Kimberlite

Kryvoshlyk (2008) reported that the diamond distribution in the 5034 North Lobe appears to follow the layered character of the kimberlite overall (refer to Figure 7-9). Maximum concentrations of diamonds appear often located close to the “Orange Marker” — a specific petrological layer generally found between the two units comprising the majority of the pipe infill: the upper HKt and the lower HK units. Diamond count maxima in the East Lobe appear to create a lens-like body at a depth of 85 to 131 m towards its flanks and 107 to 211 m in its centre.

Figure 7-9: 5034 Kimberlite



5034 Kimberlite Cross Section
Source: De Beers, 2013

Limited diamond and geological data for the Centre and West lobes did not allow Kryvoshlyk (2008) to produce high-confidence 3D models. The Centre Lobe macro-diamond distribution is highly variable and poorly supported by petrology, even between relatively closely spaced drill holes. The Centre Lobe micro-diamond distribution showed the presence of high-grade zones, which did not correlate with petrological changes. The resource model considers the West Lobe to be undifferentiated kimberlite and the Centre Lobe to be composed entirely of undifferentiated HK.

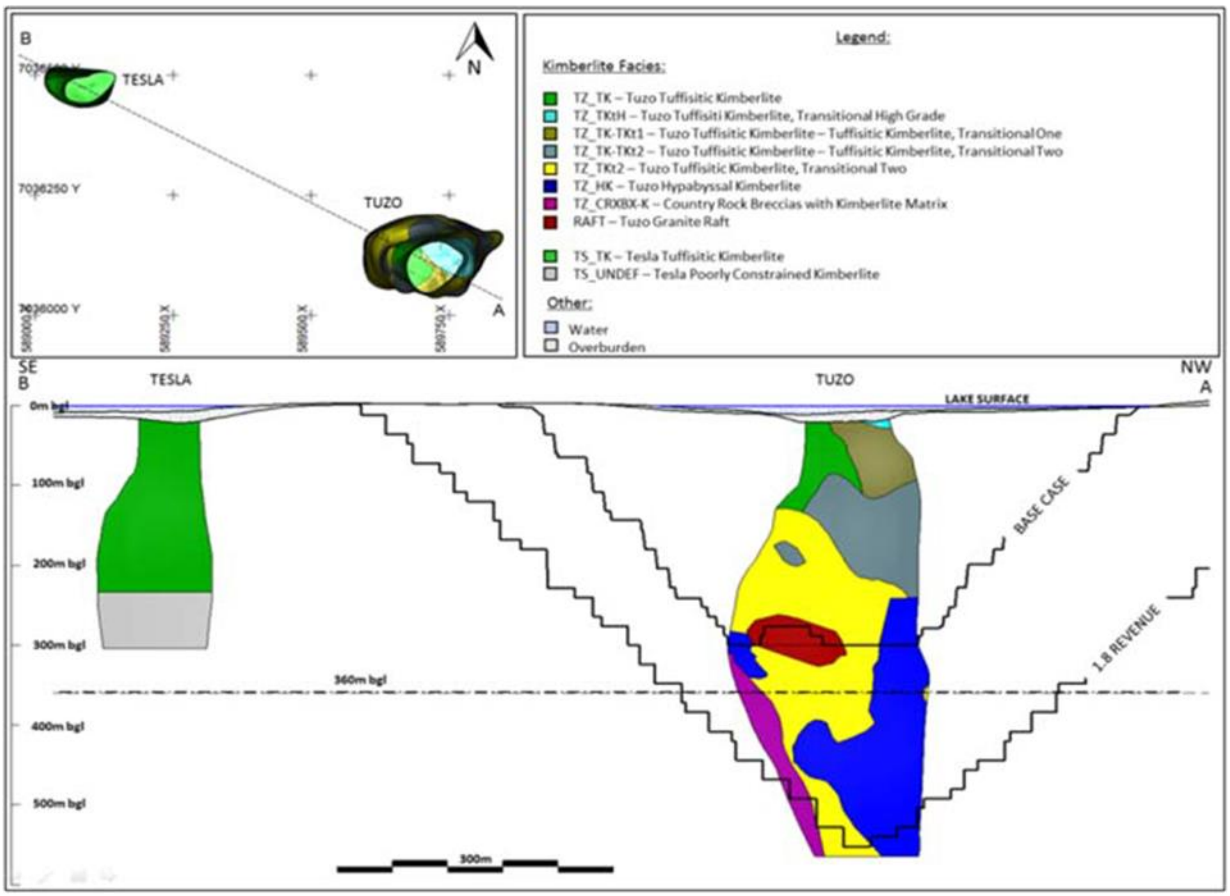
Kryvoshlyk (2008) concluded that the generation of the transitional kimberlite rock textures at 5034 is still poorly understood. If the transitional rock types are in-situ differentiates of HK magma, Kryvoshlyk (2008) maintains that they should play only a minor role in understanding the diamond distribution.

7.2.3 Tuzo Kimberlite

Seghedi and Maicher (2007) reported that the kimberlite units of the Tuzo kimberlite pipe are characterised by a large variation of diamond counts in both micro as well as macro grain size classes, likely due to varying levels of dilution within the kimberlite (Figure 7-10). One of the aims of the 2007 drill program was to better delineate the pre-2007 established high-grade and low-grade units.

Volumetrically significant lithologies with elevated diamond counts are found in the coherent HK and HKt units at depth. The fragmental lithologies in contrast have the lower stone counts, which seem to correlate negatively with country rock dilution. Seghedi and Maicher (2007) maintained that overall, the diamond distribution appears to be unrelated to spatial or depth levels, but more correlated with the abundance of dilution in an area. This in turn confirms the geological observations and geochemical data.

Figure 7-10: Tuzo Kimberlite



Tuzo Cross Section
Source: De Beers, 2013

A previous interpretation of the emplacement mechanism of the Tuzo Pipe by Hetman et al (2004) proposed that the pipe is a transition zone representing a "frozen" degassing front of a single phase of intrusive kimberlite. Seghedi and Maicher (2007) concluded that the emplacement of the Tuzo pipe was a process extended over a period with repeated eruptions of variable magnitude and nature, with resedimentation and recycling of volcaniclastic material being evident.

Micro-diamond stone counts per sample were found by Seghedi and Maicher (2007) to be highly variable, both within and in between geological units. The abundance of xenoliths within a sample correlated negatively with total stone counts, and thus the highly variable degree of country rock dilution is thought to contribute to the large range of counts. According to Seghedi and Maicher (2007), the pre-2007 high-grade unit could not be confirmed with micro-diamond data obtained from the 2007 core program. The pre-2007 high-grade unit was found to have, on average, a lower degree of dilution than the surrounding lower grade unit. For the high-grade unit, no criterion was found by Seghedi and Maicher (2007) to consistently discriminate the unit.

It was concluded by Seghedi and Maicher (2007) that:

- The kimberlite units of the Tuzo kimberlite pipe are characterized by a large variation of diamond counts in both micro and macro grain size classes.
- There are distinctive differences in the absolute value of diamond stone counts of fragmental vs. coherent units, which appears partly related to their degree of dilution, but also to possibly different batches of magma.
- The stone counts are strongly affected by the degree of dilution. However, no distinctive separation of or internal homogeneity within a unit is found by eliminating the dilution. Outliers occur in country rock xenolith rich breccia zones.
- A distinct correlation of stone ratios is not found for any of the lithologies. (Ratios of diamond grain size classes are expected to be constant within a unit, irrespective of various effects that alter the absolute numbers of stones, including the degree of dilution. Thus, individual batches of magma that have sampled different areas of the mantle for diamonds are expected to have different stone size ratios).
- Geochemically, some of the element versus micro-diamond data plots indicates a subtle correlation of the major model codes distinguished in Tuzo kimberlites, although extensive scatter prevents the definition of a distinct criterion.
- For the pre-2007 high-grade unit, there was no criterion to consistently discriminate this unit or even confirm its existence as a separate unit.

Stiefenhofer (2008b) reported an investigation to attempt to clarify the apparent existence of a high-grade unit in the Tuzo Pipe, and commented on the validity of retaining this unit in the geological model. The investigation focused on a review of observations by past workers, reappraisal of new geochemical data generated in 2007, the methods used to calculate crustal dilution, distribution of granite dilution within the pipe, distribution of diamond grade within the pipe, and lastly, consideration of the potential role that volcanic processes may have played in the generation of the high-grade feature. Stiefenhofer (2008b) concluded that geological evidence for the existence of a high-grade zone was circumstantial at best. Stiefenhofer (2008b) stated that ultimately, however, it appears that the High Grade zone was derived from magma with similar rare earth element (REE) chemistry compared to the remaining fragmental units. It should be noted that the 2008 RC drilling mini-bulk sampling program did confirm the high macro-diamond grade zone delineated by the 1999 RC drilling mini-bulk sampling program.

The possibility of a temporary obstruction during the course of the eruption and emplacement of the Tuzo Pipe was considered by Stiefenhofer (2008b) to be the most likely explanation for the High Grade zone. He speculated that the introduction of the granite raft, combined with the additional smaller blocks and fragments of granite, proved to be too voluminous for the volcano to eject at once. The feeder was forced to deviate around this obstruction, and the eruption continued. The 3D orientation of this zone of granite debris (defined largely by unit TKTKt_2) suggested to Stiefenhofer (2008b) that the new vent position was located along the eastern wall of the pipe. It is possible the proximal position to the vent will have locally influenced the diamond stone size and grade, thereby defining the High Grade zone.

Tappe (2009) reported on a preliminary groundmass spinel chemistry study to support the evaluation of a reconciliation of a high-grade unit with the 2007 Tuzo geological model. Tappe stated the data suggested that the High Grade zone of unit TK-TKt_1 and the low-grade unit TK-TKt_2 are derived from a common magma batch and that the difference in diamond grade is primarily a function of country rock dilution. The analyzed low-grade units contain multiple spinel populations, some of which are not observed in the High Grade zone. This suggests that mixing of different magma batches occurred.

According to Tappe, there appears to be an affinity of the TKt_1 model code, which is part of the high-grade material close to the surface, to HKt material at greater depths. Further groundmass spinel studies completed by Mann (2013) support the continuity between the geological units in Tuzo Deep with the upper regions of the kimberlite. There is compelling evidence that the TKT units in Tuzo Upper are the same as the TKT at depth, similarly the HK at depth is the same as the HK in mid-levels of the kimberlite.

7.2.4 Other Kimberlites

Several small kimberlite occurrences were intersected during exploration drilling programs following up geophysical and diamond indicator anomalies. These bodies include the Tesla Pipe, Dunn Sheet and Wallace occurrences that comprise part of the Gahcho Kué kimberlite cluster; the Faraday and Kelvin kimberlites are located about 8 km northeast of the Gahcho Kué kimberlite cluster and are outside the mining lease.

8 Deposit Types

The composite geological model of the Gahcho Kué kimberlite pipes (from Hetman et al., 2003) is shown in Figure 8-1. The shape and infill of the individual kimberlite pipes is similar to that of the kimberlites located in the Kimberley area of South Africa. They are, however, different from many other Canadian kimberlites, such as those found at Fort à la Corne, Attawapiskat, and Lac de Gras (Field and Scott Smith, 1999). In general, the other Canadian deposits comprise the upper levels of the pipes. The Fort à la Corne pipes are preserved as craters with kimberlite pyroclastic aprons around the craters. The Lac de Gras pipes are preserved as diatremes below the surficial craters and above the root zones. Gahcho Kué pipes preserve minor pyroclastic kimberlite attributed to the diatreme, but largely contain root-zone materials.

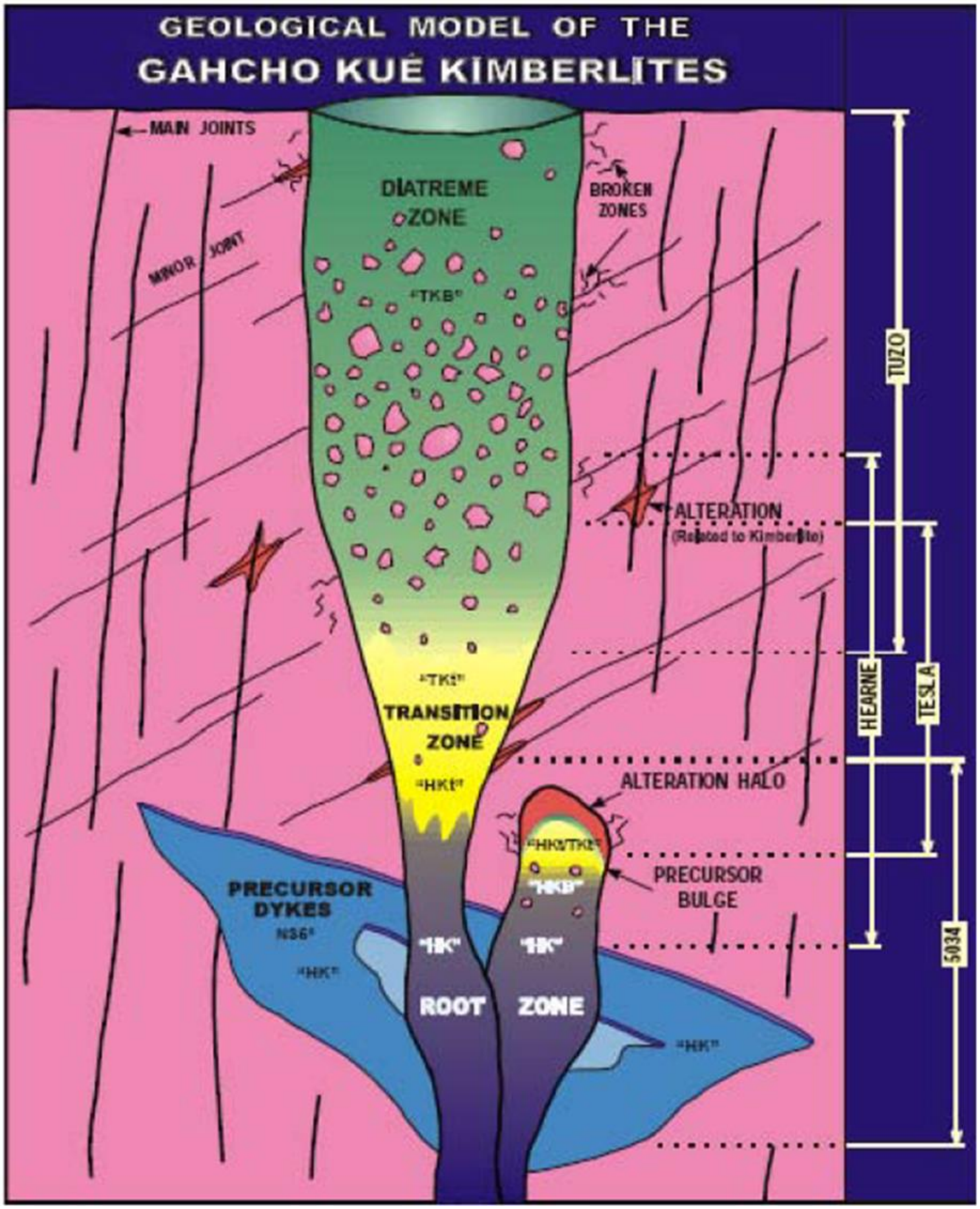
Hetman et al (2003) interpreted the Gahcho Kué pipes to be similar root-to-diatreme transition zones to those described by Clement (1982) and Clement and Reid (1989). According to Hetman et al (2003), the variations in pipe morphologies and infill displayed by the Gahcho Kué kimberlites reflect varying depths of diatreme development and are not a function of different depths of erosion for each of the pipes according to Hetman et al (2003).

With respect to emplacement, Hetman et al (2003) stated that the observed gradational TK to HK textures at Gahcho Kué are consistent with the interpretation by Clement (1982) and Clement and Reid (1989) in which the degassing of an intrusive magma column produces the diatreme zone, with the underlying transition diatreme root zone representing a “frozen” degassing front, as discussed by Field and Scott Smith (1999).

Kryvoshlyk (2008) considered that the diamond distribution in the 5034 North–East Lobe appears to follow the layered character of the kimberlite overall. Maximum concentrations of diamonds are often located close to the “Orange Marker” — a specific petrological layer generally found between the two units comprising the majority of the pipe infill: the Upper HKt and the Lower HK units. Kryvoshlyk (2008) further maintained that the diamond count maxima specifically in the East Lobe appear to create a lens-like body at a depth of 85 to 131 m towards its flanks and 107 to 211 m in its centre.

Seghedi and Maicher (2007) reported that, overall, the diamond distribution at Tuzo appears to be unrelated to spatial or depth levels, but is more related to the abundance of dilution in an area. This in turn confirms the geological observations and geochemical data. The pre-2007 established Tuzo high-grade unit could not be confirmed as separate using the micro-diamond data obtained from the 2007 drill program. However, the 2008 LDD program confirmed that higher macro-diamond grades occur in this zone, and the High Grade zone was re-incorporated into the 2007 resource model. The Seghedi and Maicher (2007) investigation demonstrated that the Tuzo Pipe is geology is complex.

Figure 8-1: Composite Geological Model of Eroded Gahcho Kué Kimberlites



Composite geological model of eroded Gahcho Kué kimberlites
Source: Hetman et al, 2003

9 Exploration

The information contained in this section is based on the "Gahcho Kué Kimberlite Project NI 43-101 Technical Report" (JDS 2014) and has been updated to include descriptions of ongoing exploration work during operations. While historical information in nature, the information has been incorporated in the Exploration section for continuity and completeness. Exploration at Gahcho Kué has included drilling, surveying, geological mapping, geophysical surveying, geochemical sampling and hydrological / geotechnical work.

All recent exploration was implemented directly by De Beers or was subcontracted out under direct supervision of De Beers as the Project operator. Exploration / delineation drilling, as well as all related sampling and processing of drill material, is described in Section 10.

9.1 Survey Control

The Gahcho Kué site was surveyed by GKJV in 1998 using the North American Datum (NAD) 27 coordinate system, with elevations recorded in height above ellipsoid (HAE).[1]

All pre-2004 drill hole collars at Gahcho Kué were surveyed using UTM NAD 27 Zone 12. Pre-existing survey control for the Base Station at the site references a First Order Geodetic Monument located near the Hoarfrost River. This coordinate was established by global positioning system (GPS) survey between 1996 and 1998 by GKJV. A surface grid tied to the UTM system was established during 1997– 1998 over each of the kimberlites. Several permanent reference points within each grid were established on land using a Trimble 4800 series GPS. These reference points were re-occupied by GKJV in 1998 with a Trimble 4800 series GPS, which confirmed the accuracy of the original locations (Hodgkinson, 1998).

From November 2003 to January 2004, GPS determination of Canadian Active Control Network (CACS) NAD 83 coordinate values with elevations in masl for the GPS Base Station at Gahcho Kué was performed using two independent methods (Hewlko, 2004). The first method involved the processing of CACS data and satellite data collected at the base station in November 2003 and January 2004. The resulting six positions agreed within 3 cm in the northing direction, 3 cm in the easting direction, and 9 cm in elevation. The second method of determining the position of the base station was to process the data observed at the base station by single point positioning. The six positions agreed within 0.6 m in the Northing, 1.1 m in the Easting and 1.7 m in Elevation. All drill hole collars surveyed for the 2004 – 2008 drilling programs utilised real time GPS CACS NAD 83 coordinates.

Unless otherwise noted, drawings and coordinates are based on the NAD83 coordinate system, with elevations in masl, and are referenced to the CACS benchmark located in Yellowknife.

The following shifts were used to convert the NAD27 HAE system to CACS NAD83 masl:

- Northing Shift: +221.619 m
- Easting Shift: - 64.211 m
- Elevation Shift: +16.917 m

[1] The term above mean sea level (amsl) refers to the elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level datum. As sea level can vary depending on air pressure, an alternative can be used, where base height measurements are referenced to an ellipsoid of the entire earth. HAE is the base reference for all GPS instruments.

The shifts noted above differ from the theoretical shift between NAD27 HAE and NAD83 masl because of the enhanced survey accuracy achieved by tying into a CACS benchmark.

9.2 Geological Mapping

A 16 km^2 area near Kennady Lake was selected in 1998 for geological mapping at 1:2000 scale) using air photo bases. The purpose of the mapping project was to document the bedrock geology, structural geology, surficial geology (overburden type), and drainage patterns within the area.

9.3 Exploration Programs

No work was conducted by the original claim staking company, Inukshuk. Exploration between 1992 and 1996 was conducted by Canamera Geological Ltd. (Canamera) as the operator for MPD and its predecessor company Mountain Province Mining. From 1997 forward, the GKJV was responsible for all exploration, with De Beers as "project operator" performing the work as directed.

9.3.1 Canamera Geological Ltd.

Canamera Geological Ltd. acted as the operator for Mountain Province Mining Inc. prior to the joint venture with Monopros Ltd. (De Beers). Exploration work carried out by Canamera between 1992 and 1994 comprised 993 reconnaissance and follow-up glacial-till samples and an airborne electromagnetic survey. From 1995 to 1996, additional exploration included bedrock and surficial mapping, airborne and ground geophysical surveys, and collection of 1,842 sediment samples.

In January 1995, the AK5034 (5034) kimberlite was discovered, and from 1995 to 1996 it was tested by 68 exploration and delineation NQ core holes. In addition to the core drilling, geotechnical investigations of the kimberlite were completed by Canamera and Bruce Geotechnical Consultants Inc. Data collected included core recovery, rock quality designation, lithological information and alteration, point load tests, preliminary determinations of rock mass types, strength ratings, and preliminary determinations of slope requirements for rock mass types.

In 1996, a 105.2 tonne mini-bulk sample of the 5034 kimberlite was obtained by PQ core drilling of 43 holes for macro-diamond recovery. Material from NQ delineation holes completed in 1996 contributed an additional 10.2 tonnes to the mini-bulk sample.

9.3.2 GKJV Pre-Production

Initial exploration by the joint venture in 1997 comprised a low-level airborne magnetic and five-frequency electromagnetic (EM) survey over the AK property. Geophysical anomalies generated from the surveys were followed by 2,211 sediment samples, 652 m of NQ core in five holes, and 85.35 m of reverse circulation drilling in four holes. Eight targets were identified in the AK property from this work, and included the discovery of three additional kimberlites: Tesla in May 1997; and Tuzo and Hearne in August 1997. Delineation drilling on the four kimberlites (including 5034) comprised nine NQ diamond holes for 2,658.89 m.

During 1998, exploration stage sediment sampling (945 samples) and diamond drilling programs (664 m in four holes) were performed. Thirteen drill holes (2,673 m) were completed in 1999 on geophysical targets from airborne and ground geophysical surveys. A total of 708 sediment samples were collected primarily in the southern portion of the AK property. The sediment samples included material for geochemical analysis collected from a detailed grid up- and down-ice of the Gahcho Kué kimberlites.

The 2000 exploration program included airborne and ground geophysical surveys, and collection of 670 20-litre indicator mineral samples and 385 geochemical samples. Sample collection was primarily from the southern portion of the AK property.

Detailed electromagnetic surveys at 40 m line spacing and 20 m station spacing were conducted at Kennady Lake near 5034, Hearne, Tuzo, and Tesla, and 12 km to the northeast over the Kelvin kimberlite intrusion. The electromagnetic data collected during this survey completed full coverage of Kennady Lake south of Tesla, and mapped the full extent of the Dunn dyke.

A total of 23 geophysical targets were drill-tested, one NQ core hole was drilled at the Hearne kimberlite, and three holes tested the Dunn anomaly, located about 250 m west of the 5034 and Tuzo kimberlites, for a total 543 m drilled.

Six ground gravity surveys and four extensions to grids were completed in the AK Claims in 2003. In addition, glacial sediment sampling was undertaken (21 samples).

A total of 1,198 line kilometres of airborne gravity survey was completed in October of 2011, covering the extent of the project area.

Delineation drill programs were undertaken from 1997 to 2008. Drilling and sampling of the deeper portions of Tuzo was undertaken from 2010 to 2013.

In conjunction with the Tuzo deep drilling programs, additional drilling was conducted to delineate geophysical anomalies identified during geophysical surveys conducted during 2012. These programs consisted of a flown 1037 line-km survey followed by 3230 ground gravity surveys. 12 holes, totalling 1064.8 m of drilling, were drilled to delineate the anomalies identified during geophysics surveys; however, no new kimberlites were identified.

9.3.3 GKJV Production

Additional drilling and geophysical exploration work has been conducted in 2017 to extend and delineate a known target connecting to the South end of the 5034 ore body.

9.4 Petrography, Mineralogy & Other Studies

Detailed petrography and mineralogy is an integral part of GKJV's exploration process. Reports include Caro and Kopylova (2004), Hetman et al. (2004), Kryvoshlyk (2007), Seller (2008), Kryvoshlyk (2008), and Mann (2013).

Details of methodologies are discussed in Webb et al. (2006), Field and Ferreira (2006), Seghedi and Maicher (2007), Stiefenhofer (2007), Kryvoshlyk (2008) and Mann (2013). Methods include abundant use of thin sections and polished slabs, detailed mineral counts, and whole-rock geochemistry.

9.5 Hydrology & Geotechnical

Golder Associates (Eichenberg, 1999) trained GKJV personnel in the geotechnical aspects of core logging, and in 1999 a geotechnical study was performed by Golder Associates (Eichenberg, 1999). The Laubscher rock mass classification system was used to assess the geotechnical data. Geotechnical units identified were based on fracture frequency, rock strength, and joint conditions, in country rock and in kimberlite. The following work was performed:

- core orientation, fracture frequency, rock strength and joint conditions were measured; and

- rock mass rating and rock mass strength for each unit was calculated.

Point load testing of kimberlite and country rock xenoliths from the Tuzo 2002 HQ core specimens was performed (Charlebois, 2003). The aim of this exercise was to obtain fresh point-load strength index data for comparison against possible future rock-strength classification by ore dressing studies (ODS).

Geotechnical and geohydrology consultants were employed on site during the 2004 drilling program for detailed logging. A standard geotechnical logging template developed by SRK was used to record field drill hole data, including geotechnical logs, field geological log, density sample results and down-hole survey measurements. A site-specific geotechnical discontinuity atlas was produced. SRK supervised a geotechnical drilling program in the area of proposed open-pit mining, comprising geotechnical logging and an assessment of geological structures, rock strength, and hydrogeology for pit design and slope optimization.

Hydrology and geothermal drilling programs were also completed in 2004, supervised by HCI Hydrologic Consultants, Colorado, USA. Work comprised hydro-structural drilling of faults and potential lake dewatering dykes. Hydrological data for hydrological modelling were tied into environmental baseline studies. Packer testing was undertaken at 3 m and 9 to 12 m, for a total of 141 test intervals. Sub-permafrost sampling was undertaken, as was water sampling of the 5034 proposed pit, where 12 airlift tests at 30 m intervals were completed. To collect geothermal data for modelling to tie into environmental baseline studies, thermistors were installed at a depth of 250 m.

An assessment of uniaxial compressive strength and elasticity of 66 kimberlite and country-rock samples collected from the 2011/2012 core drilling campaign was carried out by Mirarco (Suorineni, 2012). Instrumented unconfined compressive strength testing was carried out on all intact core specimens.

Additional geotechnical drilling was commissioned in 2016/2017 to further assess the impact and continuity of the J5 joint set after the magnitude of the joint set was confirmed during the mining of 5034. These drill programs were supervised by Piteau Associates and conducted during mine operations. The field investigation was conducted by Aurora Geosciences and consisted of twelve boreholes which were used to obtain rock mass characteristics through oriented core logging.

10 Drilling

The property was the subject of several drilling campaigns since the initial work by Canamera Geological Ltd. in January 1995. In 1995, small diameter core drilling (47.6 mm NQ core) by Canamera Geological Ltd. discovered the 5034 kimberlite during drilling of geophysical anomalies at the head of a kimberlitic indicator mineral dispersion train.

Since then, small-diameter NQ core drilling was used extensively to test geophysical and kimberlite indicator mineral dispersion-train targets peripheral to the 5034 cluster (Tuzo and Hearne were discovered in 1997), as well as to delineate the shape of the kimberlite bodies and to provide data (including micro-diamonds) for geological and mineral resource modelling.

Large diameter core (LDC) drilling was used to collect small mini-bulk samples from 5034. In 1996, Canamera Geological Ltd. obtained PQ-sized core samples (85 mm diameter), and in 2007 GKJV obtained 149 mm diameter LDC samples. The LDC samples provide additional information (macro-diamonds) regarding the diamond content of the pipes.

Large diameter reverse-circulation (RC) drilling (LDD) was used to collect kimberlite mini-bulk samples by GKJV. LDD programs have included smaller scale 140 mm (5.5 inch) diameter drill holes in 1998 and 1999; 311 mm (12.25 inch) drill holes in 1999; to the largest employed, the 610 mm (24 inch) diameter drill holes in the 2001, 2002, and 2008 mini-bulk sampling programs. The LDD mini-bulk sample programs obtained macro-diamonds for grade and revenue estimation.

In 2011, 2012 and 2014 small diameter (HQ) drilling was conducted on the Tuzo pipe to collect kimberlite samples at depth.

Additional resource drilling was conducted during 2017 to further define inferred resources which form the Southwest Corridor.

10.1 5034

Canamera Geological Ltd's 1995 and 1996 drilling of the 5034 kimberlite comprised 69 NQ core holes to obtain geological and pipe volume data and 43 PQ core holes to obtain macro-diamonds for a preliminary estimate of diamond grade. An additional 11 NQ core holes and 17 RC holes of various sizes were drilled by GKJV between 1998 and 2002. Mini-bulk sampling conducted between 1998 and 2002 to determine diamond grade and revenue has included 140 mm (5.5 inch) diameter drill holes in 1998, 311 mm (12.25 inch) diameter drill holes in 1999, and 610 mm (24 inch) diameter holes that were drilled in 2001 and 2002. The 1998 and 1999 drilling focused on the 5034 West, Centre and East lobes. In 2001, the East Lobe and the west neck of the Centre Lobe were drilled. In 2002, work focused on the narrow corridor drilled previously in 1999 through the West and Centre lobes. There was one delineation NQ core hole drilled by GKJV at 5034 in 2003.

In 2004, 13 core holes drilled into the 5034 kimberlite as part of pit geotechnical, hydrogeology, and ore dressing studies (ODS). In 2005, a single core hole for hydrogeology studies was drilled through the East Lobe of 5034, and two core holes were drilled at the North Lobe of 5034 to provide additional geological data. A substantial core program followed this in 2006 that comprised 11 HQ core holes for pit geotechnical, pipe volume delineation, and geological investigations. A campaign of core drilling was conducted in 2007 with five HQ core holes being drilled to provide geological data from the 5034 East Lobe and five LDC holes (149 mm, 5.875 inch) drilled into the 5034 North Lobe to obtain a small parcel of macro-diamonds for comparative purposes.

During 2017 additional resource drilling was conducted to further define and extend a target known as the Southwest corridor. Six drill holes were completed by December 31, 2017 with an additional 10 holes in early 2018.

10.2 Hearne

A total of 25 core holes were drilled in and around the Hearne kimberlite by GKJV during 1997 – 2003:

- 17 in Hearne North.
- 6 in Hearne South (1 that intersected both pipes).
- 2 of which did not intersect kimberlite.

In 1998, 19 LDD holes (140 mm diameter) were drilled into the Hearne kimberlite to test the diamond grade:

- 16 were located at Hearne North.
- 1 in Hearne South.
- 2 holes intersected only granite.

In 1999, eight LDD (311 mm diameter) holes were drilled into Hearne North and two were drilled into Hearne South to obtain macro-diamonds for initial revenue estimation. In 2001, three LDD (610 mm diameter) holes were drilled into the northern half of Hearne North, and five more LDD (610 mm diameter) holes tested Hearne North in 2002 to increase the parcel of macro-diamonds available for revenue estimation.

In 2004, 14 NQ core holes were drilled into the Hearne kimberlite as part of pit geotechnical and ODS programs. In 2005, a single core hole was drilled for hydrogeological studies; and in 2006, a single core hole was drilled to support pit geotechnical studies.

10.3 Tuzo

Between 1997 and 1999, eight NQ core holes were drilled into Tuzo. All of these were angle holes collared outside the kimberlite body and drilled into, and sometimes through, the kimberlite. In 2002, seven vertical HQ core holes were drilled into the pipe. LDD mini-bulk sample drilling took place in 1998 and 1999. Drilling to a maximum depth of 166 m, 17 LDD holes (140 mm diameter) were completed in 1998, and an additional 11 LDD holes (311 mm diameter) were completed in 1999 to a maximum depth of 300 m.

In 2004, two HQ core holes were drilled at Tuzo as part of a pit geotechnical study. This was followed by an 11-hole HQ core program in 2006 to provide pipe delineation and geological data. In 2007, a grid of 27 HQ core holes was completed to provide additional geological and pipe volume delineation data. The final resource drilling at Tuzo was an LDD mini-bulk sample program conducted in 2008 with nine holes (610 mm) completed to provide additional macro-diamonds for diamond revenue estimation.

An additional six HQ diameter core drill holes (4,127 m) were drilled in 2011/2012 with the purpose of further delineating the deep (300 – 564 mbs) portion of the Tuzo kimberlite and obtaining material for microdiamond sampling.

A three-hole drill program was completed in 2014 to test the Tuzo kimberlite to a depth of 750 mbs level.

11 Sample Preparation, Analyses and Security

Information contained in this section has been taken from AMEC's 2009 Technical Report (AMEC, 2009) and the Mineral Services' 2013 Report. JDS has reviewed the information contained in the previous Technical Reports and are of the opinion that sample preparation, analyses and security measures used meet industry standards and are adequate. Sections from these reports are included below.

11.1.1 Core Sample Preparation

11.1.1.1 Canamera (1994 – 1996)

The kimberlite intersections recovered by Canamera Geological Ltd. In Vancouver BC, where the core was split after detailed petrologic logging. Portions of the split samples were processed for micro-diamonds by caustic fusion at both the Canamera Geological Ltd. laboratory in Vancouver and at the Saskatchewan Research Council facility in Saskatoon (Clement et al., 1996).

11.1.1.2 GKJV (1996 – 2007)

Core samples recovered by GKJV over 1997-2007 core drilling programs were utilised for the following studies:

- Geology studies – slab and thin section analyses, petrology investigations, whole rock chemistry, heavy mineral analysis, and internal dilution estimation;
- Mineral Resource estimation – density determinations, micro-diamond estimation geotechnical studies – slope stability analysis, rock strength point load and uniaxial compressive strength tests, concrete aggregate suitability, weathering and slake testing;
- Process plant design – ODS;
- Environmental baseline – ARD; and
- Micro-diamond analysis.

Kimberlite core with corresponding country rock contact zones were shipped to Yellowknife, Vancouver, Toronto, or Sudbury for detailed logging by project petrologists. Core was kept intact during collection at the drill sites, and packed into labelled core boxes with depth markers placed between each drilled core run. Geotechnical logging was conducted at the drill sites. After detailed petrological logging was completed off-site, Project petrologists selected samples for geology studies including slab and thin section analyses, petrological investigations, whole-rock chemistry, heavy-mineral analysis, and internal-dilution estimation.

Samples removed for slab and thin section, micro-diamond, whole rock chemistry, heavy mineral analysis, uniaxial compressive strength, ore dressing studies, acid rock drainage and slake weathering tests were removed from the core boxes, processed, and are considered destroyed. Density and rock-strength point-load samples were returned to their respective core boxes after completion of processing. Kimberlite core sampled for geology studies from the 2007 program is the only core that was split.

All unprocessed kimberlite core, along with 30 m, more or less, of the country-rock contact zones, is currently stored at a De Beers warehouse in Sudbury, Ontario. Country-rock core is stored at the Gahcho Kué site.

11.1.2 Mini Bulk Sample Preparation

11.1.2.1 Canamera (1996 – 1998)

In 1996 a 105.2 ton mini-bulk sample of the 5034 kimberlite was obtained by PQ core drilling of 43 holes with an additional 10.2 tons from 30 NQ delineation holes contributing to the total of 115.4 tons. Reportedly, 103.7 tons were processed at the Canamera Geological Ltd. diamond recovery plant (Clement et al., 1996).

11.1.2.2 1998 GKJV – 150 mm (5.5-inch) RC Mini-Bulk Sampling Program

From the 1998 mini-bulk RC drilling program, a total of 73 x 150 mm diameter RC drill holes provided 222 tonnes of kimberlite (callipered mass) from the 5034, Hearne, Tuzo, and Tesla kimberlites for a total of 7,170.32 m of drilling. The screen aperture used was nominally 1.0 mm. Samples were collected on average every 36 m, but the actual interval ranged from 6 to 60 m. The 1998 mini-bulk samples were processed at the De Beers Grande Prairie treatment facility at a bottom cut-off of 1.0 mm (Williamson and Hetman, 1998).

11.1.2.3 GKJV (1999 – 2008)

The 1999 LDD bulk sampling program produced 1,820.3 t of kimberlite, measured by caliper, from the 5034, Hearne, Tuzo, and Tesla bodies in 43 boreholes for a total of 10,451.2 m of drilling (Grenon et al., 1999). A nominal 1.4 mm screen aperture size with tolerances between 1.35 to 1.52 mm was employed at the drill site (Grenon et al., 1999). Drill holes were processed by individual bulk samples collected between 18 m and 24 m intervals. The process plant lower cut-off used was 1.6 mm square aperture (Williamson et al., 1999).

During the 2001 bulk sampling program, a total of 968.5 t of kimberlite were measured by caliper from seven LDD holes drilled in the 5034 and Hearne North kimberlites. The total interval of kimberlite sampled was about 1,240 m. The bottom screen cut-off at the drill rig was 1.58 mm. A nominal 1.5 mm bottom screen cut-off was employed during sample processing that was conducted at the De Beers Grande Prairie plant (Skinner et al., 2001). Drill holes were processed by individual bulk samples collected at 12 m bench intervals.

A total of 1,919 m of kimberlite was RC drilled and sampled at the 5034 and Hearne kimberlites in 2002. The bottom screen cut-off at the drill rig was 1.58 mm. Based on caliper measurements, a total sample mass of 1,502 t was extracted. A nominal 1.5 mm bottom screen cut-off was employed during sample processing that was conducted at the De Beers Grande Prairie plant. Drill holes were processed by individual bulk samples collected at 12 m bench intervals. The 2002 LDD mini-bulk sample processing is reported in Skinner et al. (2002).

The LDC kimberlite intersection in 2007 of the 5034 North Lobe totalled 638 m, and an additional hammered kimberlite intersection of 45.4 m of kimberlite was processed. Geological logging of 5034 North Lobe LDD core determined geology units that were utilised for sample processing intervals. Sample processing was conducted at the De Beers plant in Grande Prairie, Alberta at 1.0 mm bottom cut-off, with a primary crush at -12.0 mm, and secondary crush of the -12 +6.0 mm fraction at -6.0 +1.0 mm (Skinner, 2007).

During 2008, the drilled Tuzo kimberlite intersection totalled 1,234.1 m in RC samples, and produced about 956.2 t as measured by caliper. A nominal 1.5 mm bottom screen cut-off was employed during sample processing that was conducted at the De Beers Grande Prairie plant (Thomson, 2008). Drill holes were processed by individual bulk samples collected at 12 m bench intervals.

Mini-bulk sample preparation procedures are typical of the industry and are adequate to support Mineral Resource estimation.

11.1.3 Analyses

11.1.3.1 Micro-diamond Samples

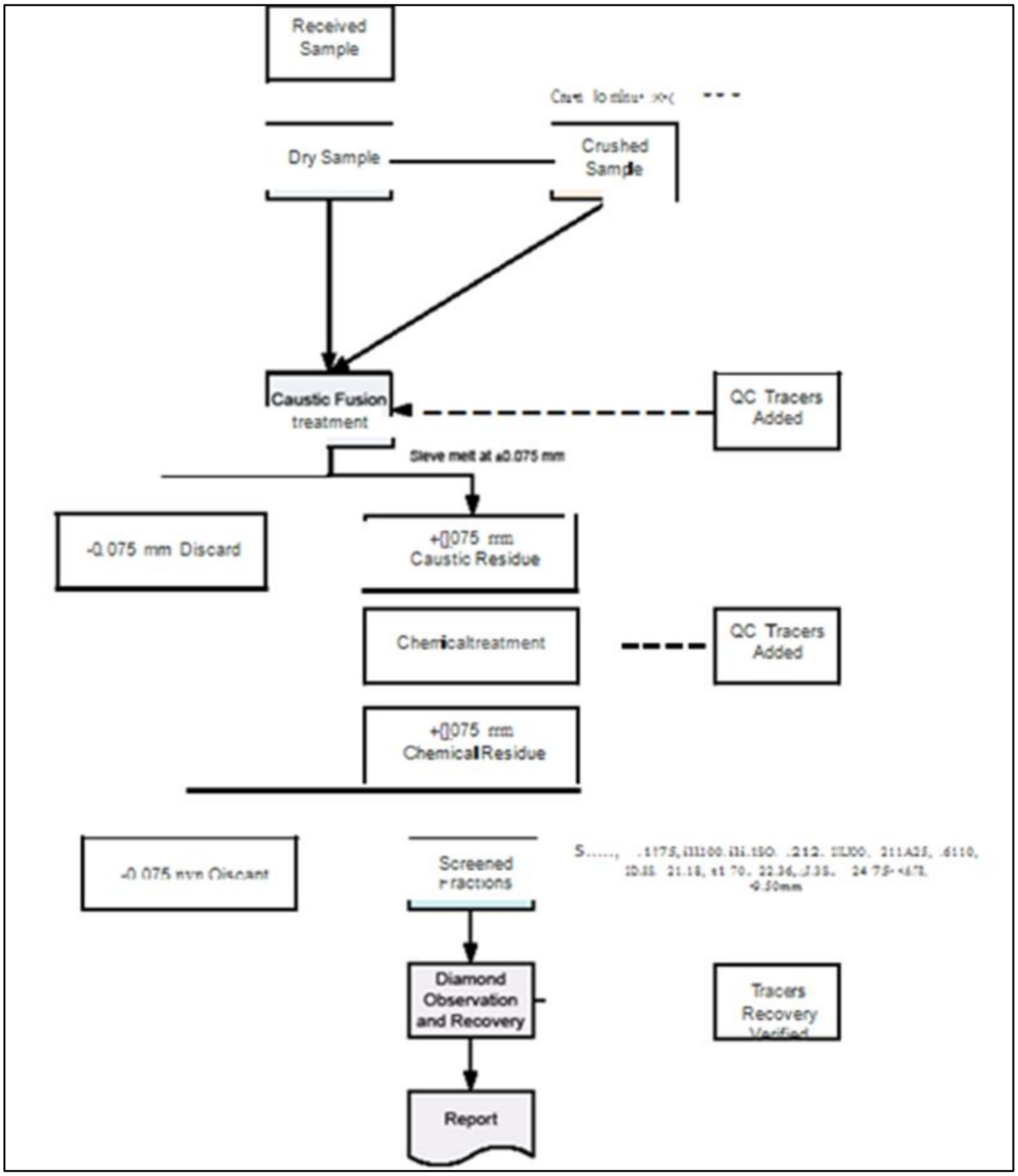
Micro-diamond samples were processed at De Beers Kimberley South Africa micro-diamond laboratory (De Beers Kimberley), SGS Lakefield Research Laboratories (SGS) and at the Saskatchewan Research Council (SRC) Geoanalytical Laboratories. Selected micro-diamond and residue samples recovered at SGS and SRC have undergone audits at the De Beers Kimberley Micro-diamond Laboratory as part of routine quality assurance and quality control (QA/QC) measures.

The following discussion of micro-diamond processing is based on a visit by AMEC to the Saskatchewan Research Council micro-Diamond recovery facility in Saskatoon, Saskatchewan. Figure 11-1 is a generic micro-diamond recovery flowsheet.

11.1.3.2 Sample Receiving & Preparation

Kimberlite samples are received by the laboratory, sorted, and assigned laboratory sample numbers. The samples are logged into the laboratory information system (LIMS) and are dried for 12 to 16 hours at 60°C. The samples are crushed, if necessary, to about -½ inch and split into 8 kg aliquots. The samples are removed from the oven and allowed to cool.

Figure 11-1: Generic Micro-Diamond Recovery Flow Sheet



Source: Hatch, 2013

11.1.3.3 Caustic Fusion Processing

The caustic fusion process begins with placing 75 kg of virgin caustic (NaOH) in an approximately 40 L furnace pot. The 8 kg sample is then loaded on top of the caustic. Bright yellow synthetic diamonds, 150 to 212 µm in diameter are loaded on top of the kimberlite sample as a spike.

The temperature is then ramped up to 550° C, and the sample is held at that temperature for 40 hours. After 40 hours, the pots are removed from the kilns and allowed to cool. The molten sample is then poured through a 75 µm screen. These screens are single-use screens that are discarded after use. Micro diamonds and insoluble minerals remain on top of the screen. Insoluble minerals are typically ilmenite and chromite. The pot is then thoroughly soaked with water to remove any remaining caustic and trapped diamonds and the water is again poured through the screen.

Because not all of the material dissolves, additional steps are required to clean ilmenite, chromite, and other materials from the concentrate. Samples are sent to the "wet" lab where acid is added to neutralize the solution. The residue is then rinsed and treated with acid to dissolve readily soluble materials from the residue.

The sample is transferred to a zirconium crucible along with an additional bright yellow synthetic tracer diamonds and fused with sodium peroxide to remove any remaining minerals other than diamond from the sample. The sample is allowed to completely cool, and the liquid is decanted from the beaker. The remaining residue is then wet screened to divide the recovered diamonds into micro-diamond size classes. Stones are stored in plastic vials containing methanol.

11.1.3.4 Sample Picking, Weighing & Data Recording

Samples are then sent to the observation room where they are handpicked by trained observers. Spikes are recovered first. After spike recovery is deemed complete, diamonds are picked from the residue and individually weighed. The weight of each stone in each size class is recorded. In GKJV's case, stones smaller than 300 µm are not individually weighed, but the total parcel in each size class is weighed.

Stones are weighed on ultra-micro balances capable of accurately weighing 75 µg. Data are recorded on paper that is then manually entered into a spreadsheet by trained clerical personnel.

11.1.4 Mini-Bulk Samples

GKJV mini-bulk samples underwent dense media separation (DMS) concentration at the De Beers DMS facility in Grande Prairie. Sealed bulk sample concentrates were shipped under "Kimberley Process" chain-of-custody procedures to the De Beers Johannesburg, SA facility for final diamond recovery by x-ray fluorescence. The recovered microdiamonds were shipped under the same chain-of-custody procedure to the De Beers Diamond Trading Company (DTC) in London UK for appraisal and revenue analysis.

11.1.4.1 1999 GKJV Mini-bulk Sample Processing

Sample processing during 1999 was by gravity feed from the sample bag through a scrubber fitted with 12.5 mm square aperture a trommel screen, all +12.5 mm material was crushed to 10 mm and fed back into the scrubber. All -12.5 mm to 1.6 mm material was fed via a dropout box onto a 1.6 mm square aperture poly-panel pre-preparation screen, where this DMS feed was washed.

Following preparation, the sample was gravity fed into the mixing box from where the FeSi sample mix was pumped through a 200 mm diameter cyclone with a 46 mm spigot.

11.1.4.2 2001 – 2008 Grande Prairie Dense Media Separation (DMS) Circuit

A purpose-built 5 t/h (200 mm cyclone) DMS plant, with an integral scrubber, trommel screen, crusher, preparation screen and concentrate recovery system was installed at De Beers' processing facility in Grande Prairie, Alberta and used in 2001.

The sample material was gravity fed from the 2-ton sample bag into a 2-ton feed bin; from the feed bin the sample was fed onto a 9 m long feed-belt; feed speed was controlled by a gate in the front of the conveyor feed tray. From the conveyor, the material was gravity-fed into the scrubber, with the assistance of the crusher pump water. After scrubbing, the sample was discharged through a 14 mm trommel screen into a

4/3 Warman pump. This material was fed via the 4/3 Warman pump through a drop-out box onto the prep screen on the DMS unit. Material over 14 mm in size fell from the trommel screen lip into a 6 x 4 Masco jaw crusher, set to a 10 mm closed-gap setting. This crushed product was gravity fed into a 3/2 Warman pump and returned to the scrubber. In this way, the circulating +14 mm oversize material remained in closed circuit until reduced to below 14 mm in size. Due to the minimal amount of +14 mm material present in the samples, the jaw crusher could not be choke-fed during production; however, most of the oversize material preferentially, remained inside the scrubber during feeding. This material was choke-fed through the crusher when the scrubber was reversed during clean- out at the end of treatment of each sample.

During processing, fines (-1.5 mm material) are removed on the preparation screen, while the sample material is split into high- and low-density components in the cyclone. Sample concentrate reports to pails within a concentrate cage, and tails are collected in a per-numbered sample bag and stored on a per-sample basis. The single deck prep screen is fitted with 1.6 mm square aperture poly-panel screen panels and a set of spray bars. After washing on the prep screen, the sample material is gravity fed into the DMS mixing box, where the sample material is mixed with the dense medium (270D grade ferrosilicon (FeSi) and water mix). This mixture is pump-fed at a pressure of ~98 Kpa into a 200 mm DMS cyclone with a 46 mm spigot. Lights (sample tailings) from the cyclone are drained and washed across the lower deck of a double deck product screen to recover FeSi and discharged to a bulk-sample bag for weighing and storage. Spigot product from the cyclone (DMS concentrate) is similarly washed across the upper deck of the double deck product screen (1 mm square poly-panel) and gravity fed to a 20 litre concentrate pail, located within a secure cage.

DMS concentrates are collected into a pail within a cage that is secured by two padlocks and two single-use security seals. The pail is sealed while inside the glove-box equipped concentrate cage, before being removed from the cage and weighed. These concentrate drums were all sealed with uniquely numbered security seals and were then stored in a locked transport container prior to shipment.

A video camera was installed inside the transport container (which was also alarmed), and two cameras overlooked the treatment plant concentrate cage. Two seals, as well as two padlocks, seal both the cage and transport container. The plant supervisor and the operator each held a key to one of these padlocks; consequently, neither the cage nor the concentrate container could be opened without both the plant supervisor and the operator being in attendance.

Prior to export, concentrate pails were drained of water, weighed, and boxed within a palletised wooden crate, which was firmly screwed together and then strapped using metal bands. Uniquely numbered, tamper-evident seals were strategically placed on these straps to detect unauthorised opening the crates. Sample shipments were made on a regular basis. Shipments would be collected from the Grande Prairie premises by a Brinks Inc. armoured vehicle and driven with an armed escort, to the Edmonton airport, where they were air-freighted to Johannesburg via London.

Following DMS concentration, an overall concentrate percentage yield (concentrate mass divided by sample mass calculated from caliper measurements of hole diameter) was recorded. An overall sample recovery was calculated by dividing the headfeed sample mass by the sample mass calculated from caliper measurements of the hole diameter. All samples were subjected to similar processing, except for clay-rich samples, where small clay balls could still be found in the tailings following treatment. Such samples were re-processed.

Other measurements recorded during processing include moisture content and representative screening analysis of the tailings material. The treatment plant's operational parameters were recorded. This included measurement of operational time-and-motion information with discrimination of operational activities and downtime. Medium density was recorded regularly, as was the operating-medium pressure at the cyclone. Testing with density tracers was routinely undertaken, and the density cut-point and probable error (Ep) were determined.

Various measures were implemented to prevent sample contamination. The plant was cleaned after every sample. This involved a thorough cleaning of the scrubber, feed bin, pumps, screens, etc. A more thorough clean-out and a clean-up procedure was followed between processing material from the different kimberlite pipes.

In an attempt to avoid contamination, the scrubber was reversed and pressure-washed. Spillage was collected from beneath the plant and re-introduced into the process stream. All screens were hosed and un-blinded between samples. The cyclone-feed pump would be stopped and restarted, to dislodge any trapped grains. The plant was operated without load for 15 minutes between samples in order to flush out any entrained material, in an attempt to prevent contamination between samples.

Macro-diamond sample preparation and recovery was performed using industry-standard procedures. The resultant diamond populations are adequate for Mineral Resource estimation and mine planning.

11.2 Program Quality Assurance / Quality Control

11.2.1 Canamera Geological Ltd. 1992 – 1996 QA/QC

Monopros Ltd. undertook a due diligence study of the 5034 kimberlite and the AK and CJ claims in 1996 (Clement et al., 1996). The study encompassed:

- assessment of the information supplied by Mountain Province Mining Inc.;
- discovery history;
- local geological and topographic setting;
- Kimberlite discoveries;
- pipe location and general geology of the occurrence;
- petrological and mineralogical results and reports;
- borehole information;
- drill sampling information;
- geophysical surveys;
- details of micro-diamond samples;
- geochemical analysis of indicator minerals;
- macro-diamond sampling and diamond valuation;
- treatment procedures for macro-diamond samples; and
- access to diamonds for examination and valuation.

Kimberlite drill core received from Canamera Geological was transported from Vancouver, BC and initially stored in the De Beers' warehouse in Grande Prairie, AB, moved to the De Beers' warehouse in Yellowknife, NWT and subsequently to De Beers' Sudbury warehouse facility where it is currently stored. The country-rock drill core remains on the Gahcho Kué site.

11.2.2 GKJV 1997 – 2003 Core Programs QA/QC

A surface grid tied to the Universal Transverse Mercator (UTM) system was established in the winters of 1997 and 1998 over each of the kimberlites. Several permanent reference points in each grid were established on land using the Trimble 4800 series global positioning system (GPS). These reference points were re-occupied later that year, again with a Trimble 4800 series GPS, which confirmed the accuracy of the original locations (Hodgkinson, 1998).

SRK Consulting conducted three quality assurance exercises during the 1998-1999 GKJV geotechnical program (Eichenburg, 1999), covering:

- hole collar locations and drill rig setup;
- core orientation (Pajari® tool and acid-test surveys); and
- Geotechnical measurements.

11.2.3 GKJV 1998 – 2002 Bulk and Mini-Bulk Sampling Programs QA/QC

In all cases, marked or synthetic diamond tracers were added to the samples to monitor recovery efficiency. Additional QA/QC measures are discussed below.

The coordinate grid established in 1997 to 1998 was re-established from previously laid-out permanent markers using a Trimble 4800 Series GPS system. The LDD hole collar locations were all established by measuring from the grid (Williams, 1999). A contractor independently surveyed about 50% of the collar positions (Valeriote, 1999).

An external audit of the procedures for the 1999 evaluation program at Kennady Lake was performed by a geologist and geostatistician from MRDI (now AMEC), during a site-visit lasting six days from 10 to 16 February 1999.

Conclusions and recommendations from that audit included but were not limited to:

- data entry and verification procedures should be reviewed to reduce data entry errors;
- manual sample logging prior to treatment at the Geological Sample Processing Services (GSPS);
- facility results in occasional errors such as duplicate sample numbering and incorrect seal numbers on sample manifests;
- more frequent field granulometry samples should be taken;
- an estimate of slimes lost during dewatering of the kimberlite should be made for each hole;
- security during all phases of the sample drilling and treatment is adequate and meets or exceeds industry standard;
- data collected during sample treatment in Grande Prairie should be consolidated into one central entry point, with formal back-up procedures in place;
- the sample treatment plant is adequate. However, the double-deck screen arrangement requires frequent monitoring during operation to ensure efficient diamond recovery;

- control of security seals at the Grande Prairie facility requires attention;
- DMS concentrate transportation should be reviewed to eliminate the road transport from Edmonton to Vancouver, en route to Johannesburg;
- a data acquisition program be initiated to provide engineering data for a future feasibility study;
- alternative containers for transporting DMS concentrate from Grande Prairie to Johannesburg should be investigated;
- process equipment at the GSPS facility should be reviewed to eliminate double screening and manual de-dusting steps;
- additional computer terminals should be considered at the GSPS facility to reduce waiting time and potential data entry errors; and
- random checks of samples revealed several discrepancies on the Geotrack sample tracking system in use at the GSPS facility.

Recommendations for improvements were implemented (Williams, 1999). Similar audits were undertaken at the Monopros Ltd. Grande Prairie, Alberta mini-bulk sample processing plant and the Geological Sample Processing Services (GSPS) diamond recovery plant in Johannesburg, SA.

Procedures during the 2001 to 2002 program included:

- 2001 program LDD hole collars were located using Real Time Kinematics GPS with the Leica system 500 tied in to a local GPS reference stations; collars were re-surveyed after hole completion.
- 2002 program LDD hole locations were determined using a Trimble 5700 series system GPS in Real Time Kinematics mode tied in to a local base station receiver (Rikhotso, Williamson and Podolsky 2002). Hole collars were re-surveyed after completion.
- Kimberley Process Chain-of-Custody documentation is used for all concentrate transfers.

11.2.4 GKJV 2004 – 2008 QA/QC

- Density samples were subjected to a procedure based on ASTM Designation – C 97-96; variations in electronic scale output were monitored with standard weights. Density samples underwent a 1% external and 1.5% internal lab testing of duplicate density samples for verification of field density results.
- Kimberley Process Chain-of-Custody documentation.

11.3 Database

Drilling data collected from the 1999 to 2003 exploration and evaluation programs were captured for GKJV using Access®. During 2001, a major database validation was completed, and the earlier files were consolidated into one database. Drilling data collected from the 2004 to 2005 Advanced Exploration programs continued to be captured using Access®.

In 2005 to 2006, a Datamine® geological data management system was implemented and utilized for capturing drill program data. The Datamine® data management system configures a central geological database through a series of configurable tables, columns and pick up lists with a query builder function.

Hole collar survey, drilling (core and large diameter), geological and geotechnical logging, sample collection and consignment information were captured. The system has an open structure in that remotely-entered field data were copied onto a Microsoft SQL server central database in Johannesburg, South Africa.

The Mineral Resource Sampling Database (MinSAMP) model is a generic, advanced diamond sampling workflow-based repository capable of storing all sample-related data. The current Gahcho Kué Project MinSAMP model stores 2007 to 2008 collar survey, drilling (core and large diameter drilling), geological and geotechnical logging, sample collection and consignment, sample processing and plant configuration, diamond sorting and consignment data. The model consists of several groups of tables and views named according to the workflow process or type of data they contain. The MinSAMP database is currently running on a Microsoft SQL® server located in the De Beers Toronto office. Databases from pre-2007 drilling programs are being migrated into MinSAMP.

All DBC–KPU petrological data, such as geology logs, line scan, photographs, whole-rock chemistry, micro-diamonds, maps, cross sections, consignment, tables and scorecards, and general communications, are currently saved on a central server at De Beers Toronto office. These data are being migrated into MinSAMP for GKJV.

The Gahcho Kué kimberlites are modelled in three dimensions (3D) using Gemcom® software. Waldegger (2005b) reported that the first 3D model was completed in 1998 and that subsequent iterations were completed in 1999 and 2002. The current Gemcom® model iteration of the Hearne kimberlite was completed in 2005. The 5034 and Tuzo kimberlite Gemcom® models were completed in 2007 to 2008. All the final interpreted data from drilling and mapping used in both the country rock and kimberlite modelling are stored in an Access® database.

The database was internally audited during April to July 2004. Line verification was undertaken on collar location, downhole survey data, geological logs and macro-diamond data. Drill hole folders were compiled for the Gahcho Kué data room in conjunction with the audit. A major restructuring of the Gemcom® project and associated database was completed by the project resource geologist (Waldegger, 2005b).

Hard copy exploration and advanced evaluation geology, Mineral Resource estimate data including drilling program reports and individual drill hole files were compiled. The hard copy drill hole reports correspond to the drill holes in the Gemcom® database. The hard copy reports are filed and indexed in the geology and resource data room at the Gahcho Kué Project office in Yellowknife. The geology and resource data room files are also digitally copied and stored in a project "Electronic Data Management System" on a central server at De Beers Toronto office.

AMEC and its precursor MRDI audited the database in 1999, 2003, 2005, 2007 and 2008 and found no significant errors or omissions.

AMEC is of the opinion that the database is adequate to support Mineral Resource estimation. Routine backups, integrity checks and audits minimize the likelihood of significant numbers of errors finding their way into the database.

11.4 Sample Security

Security procedures were in place during bulk and mini-bulk sampling drilling programs at the Gahcho Kué site during sample processing at the De Beers DMS facility in Grande Prairie; during diamond recovery at the De Beers Group Exploration Macro-Diamond Laboratory (GEMDL) in Johannesburg, RSA; and at the Saskatchewan Research Council Geoanalytical Laboratories.

The purpose of security procedures at the Gahcho Kué site was to set out the security duties, transportation and chain-of-custody processes around the handling, storage, documentation and overall security for the bulk sampling programs. Independent security contractors were employed at the Gahcho Kué site for the 2001, 2002, and 2008 large-diameter drill hole RC bulk sampling programs.

Mini-bulk samples collected during LDD RC programs were secured in closed bags with uniquely numbered single-use security seals at the Gahcho Kué site. The chain-of-custody was maintained through a series of consignment document sign-offs and tracking of the sample and security seal numbers from the initial collection of the sample, during transportation and to the final processing stages. Field consignment records of the bag and seal number, bag weight and condition were documented.

The mini-bulk samples were transported directly from Gahcho Kué to Grande Prairie in vans that were padlocked and affixed with uniquely numbered security tags via winter ice roads when possible, or flown by commercial aircraft to Yellowknife and then transferred to closed vans for shipment to Grande Prairie.

The De Beers Grande Prairie bulk sample DMS processing warehouse is a locked facility, monitored by multi-camera video surveillance by contracted security personnel. DMS concentrate is fed into a pail within a locked cage. Once a sample is completed the pail is sealed using a glove-box arrangement. Concentrate cages and storage areas are double sealed and locked, requiring the presence of one senior GKJV person and one contracted security personnel for access. Records are kept of visitors to the facility. DMS concentrates are locked into sealed 20-L containers, each of which has a uniquely numbered, single-use seal affixed. These containers are stored inside a class-three demountable vault until periodic shipments are made to Johannesburg using a security contractor.

At the Saskatchewan Research Council Geoanalytical Laboratory macro-diamond recovery facility, GKJV security staff reviewed the security procedures and systems and made recommendations for improved camera surveillance and hands-off microdiamond sorting by glove box. The recommendations were implemented.

The De Beers GEMDL facility in Johannesburg conforms to all the De Beers' Diamond Control Teams requirements for the secure processing of diamondiferous material. This involves access control, surveillance, hands-off processing and diamond control in accordance with the South African Diamond Act No. 56/86. JDS is of the opinion that the security procedures and measures undertaken during the Gahcho Kué sampling programs are adequate.

12 Data Verification

JDS has reviewed Data Verification processes undertaken in the previous Technical Reports. JDS is of the opinion that the Data Verification is adequate for use in the Report. A summary of data verification from these reports is provided below. Independent data verifications were undertaken on a number of occasions between 1999 and 2017:

- 1999, 2004, 2007 – independent consultants made site visits to review quality assurance / quality control (QA/QC).
- 1999 – external consultant audit of the 1999 evaluation program.
- 2000 – geology (petrological) peer review.
- 2004 – geotechnical and hydrogeology consultants QA/QC site visit, internal and external mineral resource evaluation data base audits, geology (petrological) peer review, Gemcom® three-dimensional (3D) model peer review.
- 2007 – internal and external petrological peer reviews; external verification of macro-diamond resource evaluation data set.
- 2008 – external review of 2003 Technical Report resource estimation and density (rock density) models.
- 2012 – peer review of updated geological models and Mineral Resource estimates; external consultant reviews of geological solid models and zonal estimate for Tuzo Deep Lower.
- 2017 – peer review of updated geological models and Mineral Resource estimates.

Resource evaluation database verification included the following:

- audits of drill collar locations and lengths;
- down-hole survey data;
- geological logs;
- bulk density data; and
- macro-diamond data.

Data storage and verification procedures are adequate to support the geological interpretations and mineral resource estimation. Data are stored digitally using appropriate database management software (Microsoft Access®), are being migrated into a diamond sampling workflow-based repository running on a SQL server located in Toronto, and are backed up periodically to ensure against loss of data due to failure of a single computer or hard drive. Original data are properly stored as paper and / or digital files with appropriate backups. Most paper files were scanned and stored digitally. The project database undergoes periodic internal verification as well as periodic audits by external reviewers.

13 Mineral Processing and Metallurgical Testing

13.1 Metallurgical Testing

Mineral processing and metallurgical testing supports the mineral recovery and process plant design and was undertaken by ADP, Polysius and De Beers. Mineral processing and metallurgical test work undertaken on from the Gahcho Kué Kimberlites is summarized below. JDS is of the opinion that the metallurgical testwork was adequate for use on the design of the process plant.

13.1.1 2002

Sample and mineralization characteristics were evaluated from a combination of the 2002 ODS results, and suitable information from the treatment of the LDD chips at the De Beers Grand Prairie facility during the 2000 (5034, Hearne, Tuzo and Tesla) and 2001 (5034 and Hearne) Gahcho Kué evaluation programs. This included dense media separation (DMS) and granulometry data.

Examination of the DMS operating parameters indicates that data derived from the sample treatment plant are reliable. The information is summarized in Table 13-1 and Table 13-2.

Preliminary data from both the ore dressing studies (ODS) and the LDD chip processing indicated that the kimberlite has a low DMS yield that should result in easy DMS operations and a relatively small recovery plant. The fines content presented in Table 13-2 is the total amount of fines produced during both drilling and scrubbing operations. As such, this is not considered representative of the fines that would be generated in a production plant.

Table 13-1: Mineralization Characteristics 2000 (Summary)

Pipe	Density (g/cm^3)	Total % (-1.0 mm)	DMS Concentrate (% of DMS Feed)	X-ray Yield (%)
5034	2.59	49.8	0.40	3.10
Hearne	2.59	49.8	0.38	2.61
Tuzo	2.40	65.7	0.31	4.05
Tesla	2.39	58.0	0.20	2.23
Average	**2.39**	**55.2**	**0.36**	**3.00**

Source: JDS, 2014

Table 13-2: Mineralization Characteristics 2001 & 2002 (Summary)

Pipe	Total % (-0.1 mm)	DMS Concentrate (% of DMS Feed)	
		2001 Grande Prairie	2002 ODS (Theoretical Yield Ep = 0.08)
5034	42.5	0.42	0.03
Hearne	54.7	0.28	0.09
Average	**46.7**	**0.37**	**Not Applicable**

Source: JDS, 2014

A significant amount of internal granite dilution can be expected at times. This could have an impact on liberation (granulometry) and result in accelerated wear.

The kimberlite content of the expected run-of-mine (ROM) feed based on these data is widely variable but on average is higher than 90%.

Information relating to the x-ray properties of diamonds was available from the evaluation programs and from the 2002 ODS. The ODS included magnetic susceptibility testing of the diamonds and gangue and the development of a luminescent profile of the gangue material. The recoverability of diamonds by x-ray sorting based on stones recovered during the evaluation programs, is summarized in Table 13-3. The number of stones larger than diamond sieve #12 was small, and the results were therefore biased toward the luminescence intensity (LI) values of the small stones. Generally, the large stones (>#12) showed good luminescence, while the smaller ones were more problematic. Recovery of small sizes would require very sensitive diamond sorting equipment, that is, the x-ray sorting equipment will need to be set at a lower than normal threshold setting, which could have an impact on diamond recovery.

Luminescence data obtained for the gangue material show that high yields can be expected when X-ray recovery technology is used to process DMS concentrate. Yields for the finer size fractions are estimated to be in the order of 0.3%. Excessively high yields can be expected for the coarser size fractions (+8 mm material). The data also showed that a yield in excess of 44% could be expected when processing material from certain areas of the kimberlite pipes. The actual diamond recovery may vary compared to the test work.

Table 13-3: Diamond Recovery Characteristics (Evaluation Process)

Pipe	% Recovery Characteristics of 0.25 Volts
5034	90.8
Hearne	94.3
Tuzo	90.3
Tesla	Not Applicable

Note: The 0.25 V is a threshold setting on an X-ray machine. When a diamond luminesces, the light is converted to an electrical signal, and if the signal is above 0.25 V the machine will eject the diamond and surrounding particles to the concentrate chute.

Source: JDS, 2014

All the diamonds samples have a magnetic susceptibility less than 20 x 10-6 cm^3 and thus could be recovered using high intensity magnetic separation. Magnetic susceptibility results showed that of the diamonds tested, 13% were diamagnetic and would not be recovered in using high intensity magnetic separation; thus, other methods are required to recover those stones. With the use of an NdFeB magnet, gangue mass reductions of up to 81.95% were measured.

13.1.2 2005

Testwork, as shown in Table 13-4, was completed from 2002 to 2005.

Table 13-4: Testwork Summary

Testwork Location	Tests Undertaken / Data Generated
Gahcho Kue LLD (Grande Prairie processing facility) Diamonds sorted at the GEMDL (South Africa)	Particle size distribution DMS concentrate yield Diamond recovery Diamond size distributions Granulometry
DebTech (South Africa)	Diamond and gangue luminescence Diamond and gangue magnetic susceptibility Recovery plant yield Drop weight data Slimes characterization Whole ore desimetric analysis Rock mechanics Preliminary scrubbing tests
Patterson and Cooke Consulting Engineers (South Africa)	Slime slurry rheology and pumping
Krupp Polysius (Germany)	High-pressure rolls crushing
Kawasaki (EarthTechnica, Japan)	Cone crushing

Source: JDS, 2014

Testwork findings were as follows:

- Gahcho Kué kimberlites exhibit similar impact breakage to their associated granite rock. The impact breakage characteristic of these samples can be classified as medium to hard; therefore, crushers utilising higher input energies such as 1 kWh/t or higher may be required.
- Gahcho Kué material is resistant to comminution by abrasion as indicated by ta values of 0.27 to 0.52, where ta is the measure (index) of resistance to abrasion breakage. This indicates that a scrubber or a mill could be utilised as a 'washer' rather than a comminution unit.
- Laboratory scrubbing results indicated that comminution attributed to scrubbing would generate very low fines, less than 10%.
- Polysius testwork generated design data for application of a high pressure rolls crushing (HPRC) unit either in a secondary or tertiary crushing mode. The required product size for treating approximately 350 t/h of a mixture of plant feed (-50+30 mm) and DMS rejects (-30+6 mm) will be achieved by a truncated feed size at higher press force, 3.4 N/mm^2 and with specific energy of 3.0 kWh/t.
- EarthTechnica crusher testwork generated design and scale-up data for secondary crushing application using a Kawasaki type crusher. These data were generated for a blend of Hearne and 5034 samples. However, it was established that if these kimberlite bodies are treated separately it would result in similar trends within certain limits. This conclusion was based on the individual drop-weight tests (DWT) and rock mechanics results provided to their technical team by GTS Metallurgy.
- Three Kawasaki crusher options, such as KM3015Z, KM3682Z and KG4015Z, were investigated for scale-up.

- DMS yields should be relatively low, potentially less than 1%, for both 5034 and Hearne kimberlite bodies. The optimum split size based purely on the lowest calculated yield was found to be 8 mm. A split DMS was recommended for the conceptual Gahcho Kué process flowsheet.
- Co-thickening has benefit in terms of reagent consumption, water savings and generation of high-density slurry. A high density thickening unit with picket rakes would be necessary to assist with the compaction of the mud-bed to achieve higher-density slurry.
- The results from the ore dressing study showed that the Gahcho Kué material is similar to other kimberlites processed in Southern Africa with respect to comminution and densimetric profiling.
- Normal wear rates are expected for the processing of the Gahcho Kué material through standard diamond processing comminution devices such as cone and high pressure roll crushers. DMS yields can be classed as “medium to low” with less than 1% yield being obtained for both the 5034 and Hearne kimberlites.
- One problematic area that was identified by the ore dressing study was the large amount of luminescent material that reported to the DMS sinks fraction. This material was subsequently tested on a dual-wavelength X-ray machine to determine the probable yields that could be obtained from a production unit. Initial indications were that up to 90% of the luminescent gangue material could be rejected.
- High flocculant consumption rates were obtained for treatment of slimes where the grit fraction had been removed. Flocculant consumption for co-thickened slurries were approximately half that of the slimes only fraction.

13.1.3 2006

Conceptual use of grease recovery technology was explored during 2006. Grease technology was considered to have advantages over the earlier use of x-ray technology at Gahcho Kué because grease technology typically has:

- high efficiency, typically greater than 95% diamond recovery for -3 +1.5 mm material and 97% recovery for -6 +3 mm material;
- low capital and operating costs;
- low yields of 0.05% for -3 +1.5 mm material and 0.01% for -6+3 mm material;
- high throughputs, typically 500 kg/h for -3 +1.5 mm material and 1,000 kg/h for -6 +3 mm material;
- small footprint; and
- fully enclosed for security of product.

The conceptual recovery plant designed in 2006 was based on grease recovery for -6 mm material and X-ray recovery for +6 mm material. To remove non-diamond material, degreased -6 mm concentrate was proposed to be chemically treated using hot molten caustic, and +6 mm X-ray concentrate to be hand-sorted.

13.1.4 2007

Samples of Gahcho Kué Tuzo gangue were characterised at DebTech for amenability to x-ray sorting and magnetic separation technologies. The samples were composed of material fractions, -8 +3 mm and -3 +1.18 mm. The respective size fractions were separately subjected to x-ray excited luminescence intensity, as well as mass magnetic susceptibility measurements.

Tuzo gangue was found to be amenable to X-ray sorting. Magnetic susceptibility data for the Tuzo drill core samples and diamonds indicate that magnetic sorting to reduce the feed to recovery can be applied.

13.1.5 2011 – 2013

A review of all testwork completed was undertaken by De Beers Technical Services to establish the final design criteria for the process plant design.

13.2 Mineral Processing

As a producing mine the Gahcho Kué Diamond Mine operates a full scale and a permanent process facility which treats run-of-mine kimberlite material to produce a rough diamond concentrate. The Gahcho Kué process plant has been operating continuously since commissioning in September 2016. To date the plant has treated a mix of various lobes from the 5034 deposit. Section 17 further describes the process plant design methodology.

Two production scale bulk samples known as “revenue samples” were treated independently during 2017 to provide insights into the size, quantity and quality of stones recovered from specific lobes in 5034. The samples are discussed in further detail in Section 14.

14 Mineral Resource Estimates

14.1 Introduction

The baseline estimation and classification of the mineral resources was completed by AMEC, summarized in the "Gahcho Kué Kimberlite Project NI 43-101 Technical Report" (AMEC 2009). Additions / modifications to the AMEC mineral resource for the Tuzo Deep mineral resources deeper than 300 metres below surface (mbs) elevation are summarized in the "Update of the Mineral Resource Estimate for the Tuzo Kimberlite, Gahcho Kué Project, Northwest Territories, Canada NI 43-101 Technical Report" (Mineral Services 2013) as a result of an additional 'Tuzo deep' drilling program undertaken in 2012.

JDS reviewed both the (AMEC, 2009) and (Mineral Services, 2013) resource statements and compiled the information into a single resource estimate for the 2014 (NI) 43-101 Technical Study (JDS 2014).

The databases were constructed and maintained in the Gemcom® modelling system. Geological models were constructed using Gemcom® modelling tools. Mineral resource estimations were carried out in both Gemcom® software and Isatis®. Open-pit shells for use in resource declaration were developed in Whittle® using the Lerchs-Grossman open-pit optimization algorithm.

LDD was used to collect samples of kimberlite for grade and diamond value modelling. Macrodiamonds[2] from the LDD were used to estimate local grades on 5034 West and Centre lobes and Hearne Pipe. Grade estimations for these pipes were completed using variography and kriging methods. Diamonds from this drilling were also used to confirm diamond size and value data for all lobes and pipes. Microdiamonds[3] from drill core were used to create local estimates of grade for the 5034 North-East Lobe and Tuzo Pipe. Micro-diamonds are stones (less than 0.5 mm) recovered from the dissolution of drill core using a caustic fusion process. These results were used for local estimation (kriging) into blocks (25 m x 25 m x 12 m) and then converted to carats per hundred tonnes above a commercial bottom cut-off using a micro−macro model of grade as a function of size. Micro-diamonds were used in these cases primarily due to the difficulty of obtaining adequate macro-diamond samples for the purposes of local resource block estimation. In these cases, the available macro-diamonds were used for valuation purposes and for calibration of micro-diamonds models.

Micro-diamonds from drill core were used to create global estimates of grade for the 5034 North and South pipes. Zonal estimates of grade (grade / rocktype) were completed in 2013 for Tuzo Deep.

Density modelling was completed using dry bulk densities. Density was estimated per lobe for 5034 West and Centre, locally into mining blocks for the 5034 NE Lobe, by rock type for Hearne Pipe, and locally into mining blocks for Tuzo Pipe.

[2] Macro-diamonds for the purposes of this report are those stones recovered from LDD samples by a treatment process that involves crushing and screening.

[3] Traditionally, stones retained on a 0.5 mm square-mesh screen after sieving are referred to as macro-diamonds, while stones that pass through the sieve are referred to as micro-diamonds. For the purposes of this report, micro-diamond results refer to stones recovered from diamond drill core subjected to acid digestion or caustic fusion. Strictly speaking, these results may contain both micro- and macro-diamonds. The micro-diamond treatment process involves dissolving the kimberlite in an acidic or caustic solution and recovering any diamonds released above a specified bottom cut-off (usually 75 µm or 106 µm). The micro-diamond results can be used to estimate the grade in carats per hundred tonnes (cpht) of a kimberlite above a given cut-off. Estimates of grade using micro-diamonds must be adjusted to reflect a realistic bottom cut-off (e.g., 1.0 mm), and may need adjustment to reflect differences in liberation and recovery in a commercial treatment plant and the micro-diamond treatment process.

Appropriate techniques were used to ensure calculation and reporting of the diamond mineral resource at a +1 mm lower cut-off. The mineral resource was adjusted appropriately for expectation of main treatment plant recoveries.

To establish a reasonable cut-off grade and assess reasonable prospects for economic extraction to support declaration of the mineral resources, average diamond pricing was applied to the resource, and Whittle® software was used to establish a series of pit shells.

14.2 Mineral Resource Estimation

14.2.1 Geologic Models & Estimation Domains

The following sections briefly discuss the geologic models as they relate to the estimation of the resource grades.

14.2.1.1 5034

The 5034 Pipe is composed of four joined kimberlite bodies, referred to as “lobes” and two small satellite pipes (North and South pipes; see Figure 7-5). In plan view the West, Centre and East lobes have irregular, but roughly circular shapes of approximately 80 m diameter. The North Lobe is comprised of a 35 m wide dyke-like protrusion, which extends from the East Lobe 300 m to the north–northeast. The North Lobe lies under a cap of 70 m to 80 m of granite, which is likely to be in-situ. In this report, the North and East lobes were treated as one lobe, the North-East Lobe, for the purposes of mineral resource estimation.

The North-East and West Lobes exhibit a layered internal structure with kimberlite gradually changing texture from coherent hypabyssal kimberlite (HK) at depth to a fragmental tuffisitic kimberlite (TK) at shallower levels. In contrast to the layered structure of most lobes, the Centre Lobe is composed exclusively of HK, which cannot be subdivided using petrological or geochemical means. The hypabyssal kimberlite found in all four lobes is geochemically and petrologically very similar, suggesting a close genetic relationship of all four lobes.

14.2.1.2 Hearne

The Hearne kimberlite consists of two pipes, North and South, and comprises a mix of HK and TK. The North Pipe is elongate with an approximate near-surface 55 m width and 215 m length. The South Pipe is roughly circular with a near-surface diameter of 90 m. Each TK kimberlite can be distinguished geologically based on garnet content, magma clasts, autolith-like bodies, xenoliths and clay minerals. The names of the different TK units are based primarily on their location within the two pipes. The HK kimberlites represent the transition from diatreme to root zone and are differentiated largely based on garnet content and grade.

14.2.1.3 Tuzo

Tuzo Pipe covers 1.27 ha at surface, measures approximately 115 m x 110 m in plan, and is overlain by lake-bottom sediments, glacial overburden, and the waters of Kennady Lake. The pipe is circular at surface, but widens at depth, resulting in an unusual inverted conical shape.

For the purposes of mineral resource estimation, one of the fragmental units (TKTKT1) was subdivided into a high-grade and a lower grade portion using macro grade information from LDD samples taken in 1999 and 2008.

The High-Grade zone was originally identified in 1998 from LDD data due to a zone of higher macro-diamond grade. Subsequent logging and re-logging of existing core suggested overall slight petrographic differences between the “High-Grade” zone and the adjacent “Low-Grade” area, but also considerable textural inhomogeneities within the High-Grade zone itself. A possible scenario to explain these features is that the High-Grade zone is a feeder conduit that has collapsed and mixed on a grain-by-grain basis with the surrounding tephra of the TK unit.

Although not an ideal approach, it is relatively common industry practice to isolate a high-grade zone in this manner where it is recognized that to not do so would cause undue spreading of the anomalous (high into low, low into high or both) grade during an interpolation. In this case, the approach is preferable, particularly where the data available are insufficient in number to risk potential over-projection of high-grade samples.

The Tuzo Deep program resulted in the extension of the geological model to a depth of 564 mbs. Of the main kimberlite types identified in the Tuzo upper, only two main types (HK and TKt) extend below 300 mbs. The TKt unit is volumetrically dominant representing 59% of the Tuzo deep model and represents transitional kimberlite that has been demonstrated to be geologically continuous with the TKT2 domain modelled in Tuzo Upper (Mann, 2013). HK makes up approximately 24% of the Tuzo Deep geological model. It has been demonstrated to be continuous with and, for the most part, geochemically and mineralogically similar to the HK occurring in Tuzo Upper (Mann, 2013). In addition to the main kimberlite types, the granite breccia / xenolith zone (granite “Raft”) modelled in the lower portion of Tuzo Upper extends into the upper portion of Tuzo Deep. This, together with a marginal zone of country rock breccia (with minor kimberlite; referred to here as CRXBX) and large blocks of granite modelled as separate solids (CRX), are included in the geological model, but for the purpose of Mineral Resource estimation are classified as internal waste. Waste units comprise approximately 17% of the Tuzo Deep geological model. The solids for the TKt, HK and CRXBX domains have been subdivided at 360 mbs for the purpose of Mineral Resource estimation.

14.2.2 Grade Estimation – 5034 West & Centre Lobes

14.2.2.1 Estimation Approach

For the West and Centre Lobes of 5034, local block estimates were created within a 3D block model using the macro-diamonds recovered from LDD. Grade was first estimated locally in carats per cubic metre (ct/m^3) and then converted to cpht by applying a global density for each lobe (grade in cpht is obtained by dividing grade in ct/m^3 by density and multiplying by 100).

Note, modifying factors have been applied to the center lobe as of Dec 31 2017 based on a discrete production bulk sample, which are described in detail in Section 14.2.6.

14.2.2.2 Large Diameter Drilling Data (Macro-diamond Data)

The 1999 LDD holes were drilled using a drill bit diameter of 12.25" over 18 m lifts; the 2001 and 2002 drilling used a 24" drill bit diameter over 6 or 12 m lifts. Table 14-1 summarizes the holes located in the West and Centre Lobes, and Source: JDS, 2014

Table 14-2 summarizes the sample statistics by lobe. Both tables have a bottom cut-off at 1.5 mm including incidentals.

Table 14-1: 5034 West & Centre Raw LLD Data

Hole ID	Location X	Location Y	Location Z	Depth (m)	Volume (m^3)	Carats	Stones (No.)
MPD-99-01L	589231.79	7035426.62	394.47	75.00	4.198	19.050	171
MPD-99-02L	589249.29	7035423.62	386.82	219.70	15.944	81.665	1,089
MPD-99-03L	589274.79	7035431.62	395.87	263.10	19.921	92.195	1,277
MPD-99-04L	589297.79	7035430.62	396.02	281.10	20.864	100.895	1,210
MPD-99-05L	589324.79	7035386.62	399.37	237.10	17.341	60.160	630
MPD-99-06L	589321.79	7035371.62	395.37	203.50	14.802	38.455	567
MPD-99-07L	589341.79	7035369.62	399.57	209.10	15.289	31.365	403
MPD-99-08L	589359.79	7035362.62	399.92	208.50	15.485	52.530	644
MPD-02-081L	589318.91	7035387.49	399.27	190.20	51.668	137.215	1,462
MPD-02-086L	589317.99	7035376.18	398.60	192.27	52.128	109.575	1,191
MPD-02-088L	589281.77	7035429.16	395.40	259.50	75.514	414.020	3,961
MPD-02-089L	589282.58	7035422.64	386.25	206.76	58.303	243.430	2,578
MPD-02-090L	589313.67	7035384.07	399.94	167.40	44.476	123.370	1,462
MPD-02-102L	589276.67	7035425.08	386.32	151.59	41.428	179.735	1,879

Source: JDS, 2014

Table 14-2: Raw Sample Data Statistics

		1999		2001 & 2002		All	
Rock Type	Code	No.	Avg. ct/m^3	No.	Avg. ct/m^3	No.	Avg. ct/m^3
5034 W Lobe	101	44	4.8	42	5.3	86	5.0
5034 C Lobe	107	57	3.3	48	2.6	105	3.1

Source: JDS, 2014

14.2.2.3 Other Considerations Impacting Grade Determination

A number of other issues were considered prior to the grade estimation of 5034 West and Centre lobes:

- The effect of different sample-support sizes of the two LDD programs. Different sample support sizes (in this case, 311 mm and 610 mm diameter LDD drill holes) tend to result in similar grade means, but different grade variances: the larger support size has a smaller variance. A technique to adjust the sample variance of the smaller diameter holes was considered in 2003, but was not applied due to inconsistent results. In this report, as in 2003, no adjustment was made for different hole diameters.
- The effect of different sample lifts, namely 6 m, 12 m and 18 m. The issue of different sample lifts was resolved by regularization, a process that calculates the grade per mining bench height by combining or sub-dividing samples into common lengths and weight averaging the diamond content over the new interval. For Gacho Kué, a bench height of 12 m was planned, and grade values were drill hole length weighted according to the drill hole intersection per bench to accommodate sample lengths that varied from less than 12 m to greater than 18 m.

- The impact of clustering of the 2002 drill holes. To test the effect of the clustered LDD samples on the mineral resource estimates, a de-clustering method was tested but not applied for two reasons. Only small differences were found between global grades using de-clustered data and clustered data, and the semi-variograms indicated that the correlation between sample points was preferentially orientated in a vertical rather than horizontal direction.

- Assess the diamond recovery differences between campaigns. Results from different campaigns exhibited differences in recovery characteristics, which were related to reasonably well understood drilling conditions.

14.2.2.4 Composite Preparation (CP)

The adjusted sample macro data were imported into Gemcom® where they were bench composited to 12 m lengths while honouring geology. The cut-off for the minimum length of composites to be used in the estimation was investigated by comparing the average cp/m^{3}* value of composites at several cut-offs to ensure there was no bias in the selection of composite length. The difference in the average cp/m^{3} value between all composites, and those where bottom cut-offs were applied, is negligible. To maximize the use of available grade information, a minimum length of 6 m was imposed.

14.2.2.5 Histograms & Univariate Statistics

Histograms and probability plots of the 12 m bench composites were generated for each rock type containing macro data. Summary statistics are shown in Table 14-3 at a bottom cut-off at 1.5 mm including incidentals.

Table 14-3: 5034 Composite Statistics by Rock Type

Rock Type	Rock Code	No.	Avg. cp/m^{3}*	CV
5034 W Lobe	101	102	4.843	0.324
5034 C Lobe	107	130	2.805	0.559

* Bottom cut-off at 1.5 mm includes 9% incidentals in 5034
Source: JDS, 2014

14.2.2.6 Variography

Grade variography was conducted on the 12 m bench composites for each lobe in 5034. Experimental correlograms were calculated and modelled using Sage2001®. Directional correlograms were generated using a 20 m lag; the vertical correlogram is based on a lag spacing of 12 m. Greatest continuity is in the down-dip direction for all rock units. For the 5034 Pipe, this equates to the vertical orientation of the holes.

14.2.2.7 Local Grade Estimation

A 25 m x 25 m x 12 m block model project was defined in Gemcom®. Ordinary block kriging was performed for each by a kriging estimator using two passes. Search ellipses were orientated in the direction of continuity as defined by the correlograms. In Pass 1 for 5034, the search radii were 75 m x 75 m x 50 m in the X, Y and Z directions, respectively. In Pass 2, search radii were increased to allow all blocks within the model to be assigned a grade. Validation of the mineral resource estimate included a visual inspection, comparison of statistics, and analyses to detect spatial bias and excessive smoothing. Table 14-4, at a bottom cut-off at 1.5 mm including incidentals, shows the percent difference between the kriged and nearest-neighbour (NN) block estimates are typically less than 5% for any given rock type.

Table 14-4: Comparing Kriged & NN Estimates by Rock Type

Rock Type	Code	Composites			Kriged Estimates			NN Estimates			% Diff. = (KRG-NN)/NN
		No.	Avg. cp/m³	CV	No.	Avg. cp/m³	CV	No.	Avg. cp/m³	CV	
5034 W Lobe	101	102	4.8	0.324	357	4.8	0.102	357	4.9	0.345	-3.0
5034 C Lobe	107	130	2.8	0.559	295	2.8	0.310	295	2.9	0.513	-3.6

[4] Bottom cut-off at 1.5 mm includes 9% incidentals in 5034

Source: JDS, 2014

14.2.2.8 Density Model

The 2003 Mineral Resource estimate applied an in-situ (wet) density, rather than a standard dry density, due to the limited number of dry density measurements available. In this update, dry density was used where available. Where too few dry measurements were taken, available in-situ density measurements were converted to a dry density. The average dry densities by lobe were calculated for the Centre and West Lobes and applied to the mineral resource model (Table 14-5).

Table 14-5: Calculated Dry Density by Rock Type

Rock Type	Dry Density (g/cm³)
W Lobe	2.34
C Lobe	2.66
5034 South	2.40
5034 North	2.58
HNTKN	2.22
HNTKNT	2.34
HNHKN	2.63
HNTKG2	2.37
HNHKG2	2.68
HNTKSD	2.22
HNHKG	2.65
HSTKM	2.21
HSTKW	2.22
HS_UNDEF	2.21

Source: JDS, 2014

14.2.3 Grade Estimation – 5034 North-East Lobe

14.2.3.1 Estimation Approach

De Beers and other companies have used micro-diamond sampling to estimate diamond grade in kimberlites for some time. In almost all cases, the approach was to estimate grade globally or per lithofacies. For the North-East Lobe, the estimation of global grade using micro-diamonds was extended to allow the estimation of local block grades. This was achieved by combining models of stone density and diamond size distribution data and by estimating stone density rather than carat grade locally. Calibration and consistency of the models was achieved using macro-diamonds.

This method was considered particularly apt for the North Lobe, which lies below 60 m of granite that has proved difficult to penetrate using large diameter drilling (the conventional approach to kimberlite grade estimation). In addition, the inclined nature of the North Lobe limited the amount of sampling that could be achieved from vertical holes. The use of micro-diamond sampling provided a practical method of estimating grade.

The estimation approach is summarized as follows:

- The North-East Lobe was evaluated by means of micro-diamond sampling with confirmation of macro-diamond size distributions from LDD on the East and North lobes, respectively.
- The lobes were first evaluated individually in terms of their litho-facies.
- The two lobes were then combined, and a global diamond content was estimated for each litho-facies where the North and East lobes were treated as one unit (the North-East Lobe).
- Diamond content was estimated on the basis of micro-diamond and macro-diamond sampling. Micro-diamond samples comprised 8 kg samples from fixed lengths of core at regular intervals down-the-hole with diamond recovery above 0.074 mm. Macro-diamonds were recovered from LDD and LDC samples with recovery above a 1.5 mm (LDD) and 1 mm (LDC) bottom cut-off.
- A spatial model for density was constructed for the calculation of block tonnages.
- The global diamond content was proportioned into the local resource blocks (25 m x 25 m x 12 m) on the basis of the spatial distribution of micro-diamond sample stone counts (stone densities).

Note, modifying factors have been applied to the North-East lobe as of Dec 31 2017 based on a discrete production bulk sample, which are described in detail in Section 14.2.6.

14.2.3.2 Sample Data

A total of 200 micro-diamond samples, each weighing approximately 8 kg, were collected from 11 core drill holes drilled into the North Lobe, amounting to some 1,615 kg of sampling material. From the East Lobe, 107 samples were collected from five core holes with samples comprising an average of 8.1 kg from an average core length of 3.1 m. This program yielded a total sample weight of 866 kg.

Table 14-6 is a summary of the core drill holes treated for micro-diamonds used in this analysis, showing summary depths with recovered stones and carats from 5034 East and North lobes.

In order to eliminate irregular recoveries in the very small size classes and to facilitate better comparison, it was decided to work with stone counts and stone density above the De Beers micro-diamond size class md6, which represents diamonds larger than 0.00003 cts. Diamond density was expressed in terms of stones per 10 kg. A further breakdown of micro-diamond sampling results by lobe and litho-facies is shown in Source: JDS, 2014

Table 14-7. One drill hole intersected the North Pipe, and with the results for these samples similar to HK from North and East lobes, it was decided to include its samples in the analysis.

Table 14-6: Core Holes for Macro-diamonds from 5034 North & East

Hole ID	From (m)	To (m)	Sample weight (kg)	Consignment	Lobe	Stones total	Stones +md6	Stones / 10 kg	Stones 10 kg +md6	Carats total
MPD-07-296C	29.4	310.3	177	CAN070177	East	1,694	755	95	43	0.9397
MPD-07-294C	26.2	225.2	137	CAN070180	East	866	371	63	27	0.3361
MPD-07-298C	17.6	295.7	179	CAN070199	East	1,590	616	89	34	1.0202
MPD-07-303C	18.1	276.0	171	CAN070210	East	1,745	777	102	46	1.1861
MPD-07-305C	18.1	307.2	203	CAN070233	East	2,176	922	107	45	1.5364
			866			8,071	3441	93	40	5.0185
MPD-05-242	66.9	296.8	193	CAN060012	North	1,769	756	92	39	1.1375
MPD-05-239	180.7	322.8	121	CAN060015	North	1,134	451	94	37	0.6572
MPD-05-241	84	404.8	193	CAN060018	North	961	588	50	30	2.1683
MPD-05-244	55.9	305.8	201	CAN060022	North	1,150	683	57	34	0.8002
MPD-05-243	69.8	345.3	226	CAN060026	North	1,000	609	44	27	1.3368
MPD-05-245	70.6	344.5	193	CAN060030	North	1,241	759	64	39	0.9514
MPD-05-234	122.0	222.2	89	CAN060034	North	780	468	88	53	0.5023
MPD-05-260	305.7	341.9	40	CAN060083	North	232	145	57	36	0.1231
MPD-05-261	300.8	358.3	57	CAN060087	North	295	184	52	32	0.1149
MPD-05-258	60.4	358.4	253	CAN060122	North	1,445	899	57	36	1.2024
MPD-05-275	152.7	200.5	49	CAN060125	North	276	158	56	32	0.2504
			1,615			10,283	5700	64	35	9.2446

Source: JDS, 2014

Table 14-7: 5034 North & East Lobe Micro-diamond Sampling Results per Litho-facies

Lobe Litho-facies	East				North					
	HK	HKT	TKT	Total	HK HKT					
Sample wt (kg)	583.1	186.2	97.1	866.4	928.6	395.3	88.6	145.6	56.8	1614.8
Dilution %	-	-	-	-	13	15	32	20	13	15
Undiluted kg	583.1	186.2	97.1	866.4	809.5	336.8	60.3	116.7	49.2	1372.6
Stones	4802	2396	873	8071	5515	3241	409	823	295	10283
Carats	3.2012	1.4106	0.4067	5.0185	5.5683	2.2146	0.4551	0.8917	0.1149	9.2446
Stones (+md6)	2040	1057	344	3441	2941	1820	254	500	184	5700
Stones / 10 kg (+md6)	35	56.8	35.4	39.7	31.7	46	28.7	34.4	32.4	35.3

Source: JDS, 2014

14.2.3.3 Diamond Size Distribution Modelling

Individual size distributions for micro-diamond samples were plotted and compared with other samples from the same litho-facies to observe sample variability and to eliminate possible outliers. No samples were identified as outliers. In addition, samples were plotted and combined by hole and litho-facies to compare drill hole results.

Sample diamond-size distributions were compared by lobe and litho-facies (North and East Lobe data were kept separate), and by litho-facies for the North and East lobes together. The plots showed that the smaller TKT sample totals from the East and North lobes were more variable and the North Lobe TKT indicated a coarser diamond size distribution than the other litho-facies, while TKT from East lobe indicated exactly the opposite. Combining the two sets of TKT samples resulted in a size distribution similar to the other litho-facies.

This final comparison by litho-facies between the North Lobe and East Lobe suggests that the litho-facies all have a similar diamond size distribution. The observation of a similar diamond size distribution for all the litho-facies in North and East lobes supports the idea of geological continuity from the East to the North Lobe.

Macro-diamond results were subsequently plotted for the different litho-facies to ascertain if the suggestion of a similar overall diamond size distribution was also evident on the basis of macro-diamond sampling results. In this comparison the North Lobe LDC sampling results were plotted, along with the LDD results for East Lobe.

These plots exhibit a similarity of macro-diamond size distributions and further confirm the observed geological continuity between the East Lobe and the North Lobe.

Size distribution modelling was concluded by obtaining the (log-normal) statistical parameters from the sample diamond size distributions. Diamond size distribution modelling was done iteratively by creating a diamond "parcel" based on the modelled diamond size distribution, with an iteration comprising two million "samples," which were combined to form the diamond parcel.

The results were plotted on one graph showing the micro- and macro-diamond sampling results. The process was repeated until both micro- and macro-diamond sample results were satisfactorily replicated.

In view of the common diamond size distribution for all litho-facies, it was concluded that differences in diamond content between litho-facies and between North and East Lobes would be attributed to differences in diamond density (stone density) and that the spatial variability of diamond density would have to be established in order to estimate diamond content in resource blocks.

14.2.3.4 Diamond Density Distribution (stones per 10 kg) Modelling

Micro-diamond samples were analysed per litho-facies to obtain diamond density (concentration) models required for grade modelling.

In view of the similarity in stone counts between the TK and TKT litho-facies, it was decided to group these samples for modelling. This also increased the number of samples available for the procedure. Furthermore, GKJV concluded that North Lobe and East Lobe HK samples could be combined, as was the case for North Lobe and East Lobe HKT samples and for all the TK and TKT samples from North Lobe and East Lobe.

14.2.3.5 Estimation of Global Diamond Content per Litho-facies

Global diamond content was estimated by creating a "diamond parcel" for the litho-facies under consideration. This diamond parcel was based on the modelled diamond size and diamond density distributions (see above).

The diamond parcel was generated by simulating two million samples using the model attributes for diamond size and diamond density. A Monte Carlo simulation was then used to construct a diamond parcel as follows:

- A sample stone density is drawn at random from the modelled stone density distribution.
- The stones in this sample are assigned a weight by randomly drawing from the modelled diamond size distribution.
- The stones and weights from each draw are accumulated.
- The simulation is repeated until the required number of samples was drawn resulting in a "diamond parcel".

The parcel stones were allocated to size classes and presented in the form of log-probability and grade-size[4] curves. Diamond data for the corresponding micro- and macro-diamond sample parcels were plotted with the simulated parcel curves for comparison. Global estimates of grade were prepared for units HK, HKT and combined TK and TKT based on the simulated parcels.

The grade estimates prepared this way represent the total diamond content. This means that the estimates include stones that would not usually be recovered after treatment in a conventional production treatment plant. Such grades are therefore optimistic relative to what will be achieved in a conventional treatment plant and require adjustment. The global grades for the two lobes combined are shown in Table 14-8.

Table 14-8: Zonal Diamond Content for 5034 North-East Lobe

Items	North & East Lobe HKT		North & East Lobe HK		North & East Lobe TK & TKT	
	+5ds (cpht)	+2ds (cpht)	+5ds (cpht)	+2ds (cpht)	+5ds (cpht)	+2ds (cpht)
No incidentals	200	289	142	206	143	207

Note: Total content grades are given in carats/100 t at +5 and +2 ds, (effectively +1.5 mm and +1.0 mm). Content derived from grade-size models from sampling data for the combined lobes.
Source: JDS - 2014

14.2.3.6 Spatial Estimation of Stone Density & Proportioning of the Global Diamond Content

A spatial model for micro-diamond stone density was created to obtain a spatial model and local estimates for macro-diamond grade in carats / 100 tonnes. Local estimates for stone density were calculated by means of kriging. This process involved a spatial analysis per litho-facies to obtain spatial structure for stone density, followed by the kriging process.

Variograms were modelled for units HK and HKT combined for the two lobes and kriged using the combined micro-diamond sample stone densities. A range of 60 m and a nugget effect of around 50% of the sill were used with a kriging neighbourhood of 75 m in all directions for HK and HKT, applying ordinary kriging in all cases. For the sparser sampled TKs, a unique kriging neighbourhood was used.

By using calculated block tonnages and kriged block stone density the corresponding block stones were calculated and accumulated to total stones for each litho-facies. To obtain block carat estimates at a given

[4] One way to view micro-diamond data (and estimate a grade) is to plot the micro-diamond results for a given kimberlite facies on a grade-size graph. In such a graph, the average size of the micro-diamonds in a particular sieve size is plotted on the X-axis, and the "grade" of the sieve class in stones per tonne is plotted on the Y-axis. If the data are plotted using a log-log scale, a polynomial can be fitted to the data points and the grade of the kimberlite above a bottom cut-off calculated by measuring the area under the fitted curve. The relative position of the fitted curve on the plot is indicative of kimberlite grade, while the curvature of the fitted line reflects the diamond size distribution.

bottom cut-off, the corresponding total carat estimate for the unit (zone) was apportioned into resource blocks in the ratio of block stones to total stones for the unit.

Table 14-9 is a summary of global grades at +5 ds derived from block carat estimates per litho-facies and lobe, after localising zonal diamond content.

Table 14-9: Estimated Grades for Gahcho Kue 5034 North & East Lobes

Lobe	Rock	Sample Grade (cpht, +ds)	Zonal Estimate (cpht, +5ds)
East	HK	126	147
	HKT	155	207
	TKT	169	156
North	HK	105	140
	HKT	203	197
	TK	156	128
	TKT	146	144

Source: JDS, 2014

14.2.3.7 Bulk Density Model

Spatial analyses were performed using dry density per unit for the combined lobes. Bulk densities for blocks were estimated using a kriging estimator. Table 14-10 shows reasonable comparisons between estimated blocks and sample data.

Table 14-10: Sampled & Estimated Dry Density for Gahcho Kue 5034 North & East

Density data by lobe & rock type					Used for kriging in Isatis® (spatial selection into litho-facies by zonal polygons)			Kriged Result	
			In Situ	Dry Bulk		In Situ	Dry Bulk		Dry
Lobe	Rock Type	No. Samples	Density (g/cm^3)	Density (g/cm^3)	No. Samples	Density (g/cm^3)	Density (g/cm^3)	Number Blocks	Density (g/cm^3)
North	HK	164	2.63	2.58	151	2.65	2.60	406	2.58
	HKT	84	2.54	2.44	77	2.55	2.46	262	2.46
	TK	16	2.31	2.08	18	2.32	2.10	86	2.10
	TKT	19	2.35	2.15	21	2.36	2.16	169	2.18
East	HK	46	2.73	-	56	2.72	2.69	286	2.65
	HKT	15	2.61	-	21	2.58	2.49	103	2.47
	TKT	-	-	-	6	2.52	2.42	76	2.35
	Not Coded	18	2.63	2.55					
Not Coded	Granite	87	2.60	2.56					
North Pipe	HK	11	2.57	2.51					

Source: JDS, 2014

14.2.4 Grade Estimation – Hearne

14.2.4.1 Estimate Approach

For the Hearne Pipe, local block estimates were created within the 3D block model using the LDD results. Estimates were constructed for 12 m benches across the entire pipe.

14.2.4.2 Large Diameter Drill Data (Macro-diamond Data)

Similar to the drilling on 5034 West and Centre lobes, the 1999 LDD holes were drilled using a drill bit diameter of 12.25" over 18 m lifts; the 2001 and 2002 drilling used a 24" drill bit diameter over 6 m or 12 m lifts. Table 14-11 summarizes the holes located in the Hearne Pipe. There are no macro-diamond data for rock units HNTKG2 AND HS_UNDEF.

14.2.4.3 Other Considerations Impacting Grade Determination

Hearne macro-diamonds are impacted by the same considerations presented for the LDD data from 5034 West and Centre Lobes.

14.2.4.4 Composite Preparation

Hearne composites were prepared in the same manner as the composites for 5034 West and Centre Lobes.

Table 14-11: Hearne Raw LDDH Data

Hole-ID	Location X	Location Y	Location Z	Depth (m)	Volume (m^3)	Carats	Stones (No.)
MPD-99-37L	588381.79	7034806.62	395.815	203	19.294	93.745	1391
MPD-99-38L	588367.79	7034806.62	305.82	173	5.259	25.835	352
MPD-99-39L	588392.79	7034921.62	396.195	299	22.324	94.565	1065
MPD-99-40L	588380.79	7035041.62	395.895	299	23.076	101.320	1126
MPD-99-41L	588387.79	7034961.62	396.72	257	19.310	68.770	730
MPD-99-42L	388385.79	7035001.62	394.07	288.8	21.514	77.720	976
MPD-99-44L	588385.79	7035021.62	395.22	294	22.046	87.785	969
MPD-99-45L	588390.79	7034941.62	392.2	155.2	13.621	63.890	1262
MPD-99-46L	588365.79	7035061.62	397.32	285.2	26.012	179.135	2941
MPD-99-47L	588392.79	7034901.62	394.82	203.2	17.640	48.445	724
MPD-01-057L	588366.04	7035065.45	397.895	159.44	43.900	242.755	2657
MPD-01-058L	588389.98	7035037.37	395.07	189.3	50.190	281.880	3139
MPD-01-060L	588376.57	7035054.86	396.885	150.79	40.790	223.110	2462
MPD-01-091L	588391.33	7034881.68	396.775	267.8	73.284	172.320	1663
MPD-01-099L	588382.84	7034998.17	386.62	225.7	57.940	258.470	2560
MPD-01-101L	588380.84	7035031.80	395.165	186.6	49.656	281.855	2871
MPD-01-103L	588386.14	7034991.63	393.92	154.04	40.640	227.710	2448
MPD-01-105L	588378.17	7034992.65	394.57	159.86	42.168	221.210	2378

Note: Bottom cut-off at 1.5 mm including incidentals.
Source: JDS, 2014

14.2.4.5 Histograms & Univariate Statistics

Histograms and probability plots of the 12 m bench composites were generated for each rock type containing macro data. Table 14-12 summarizes the statistics by rock type.

Table 14-12: Hearne Composite Statistics by Rock Type

Rock Type	Rock Code	No.	Avg. cpm3	CV
HNTKN	200	47	5.9	0.178
HNTKNT	201	96	5.4	0.179
HNHKN	202	17	4.9	0.320
HNHKG2	204	19	3.9	0.417
HNTKSD	205	11	6.4	0.271
HNHKG	206	74	1.4	0.755
HSTKM	207	16	4.2	0.299
HSTKW	208	4	4.8	0.101

Note: Bottom cut-off at 1.5 mm including incidentals.
Source: JDS, 2014

There is limited data available to analyze the Hearne rock types. HNTKN and HNTKNT exhibit higher grades and illustrate normal distributions; HNHKG contains low-grade material with a positively skewed distribution. Remaining Hearne units do not have sufficient data to make an informed comment.

Units with limited data are difficult to model and are grouped with units with similar statistical behaviour, specifically grade. Four rock groups were created for Hearne Pipe based on geology, location and grade:

- high-grade tuffisitic (TK_HG) – HNTKN (200), HNTKNT (201), HNTKSD (205);
- medium-grade hypabyssal (HK_MG) – HNHKN (202), HNHKG2 (204);
- medium-grade tuffisitic (TK_MG) – HSTKM (207), HSTKW (208); and
- low-grade hypabyssal (HK_LG) – HNTKG (206).

14.2.4.6 Variography

Grade variography was conducted on the 12 m bench composites for each rock group as defined above. For the Hearne units, maximum continuity is down dip following the interpreted dip direction of the rock units. Defined correlogram models were imposed on rock units demonstrating limited structure due to insufficient data. Experimental correlograms with limited data were modelled with structures of a group with similar grade. The correlogram model for Hearne TK_HG group was imposed on the Hearne HK_MG group with a slight modification to the range in the Z direction. The model for Hearne HK_LG group was imposed on the Hearne TK_MG group.

14.2.4.7 Local Grade Estimation

A 25 m x 25 m x 12 m block model project was defined in Gemcom®. Ordinary block kriging was performed for each lobe, and the kriged estimates were validated globally and locally by a NN model generated for each lobe.

Ordinary block kriging was performed for each rock type with the exception of HS_UNDEF. The kriged estimates were validated by a nearest-neighbour (NN) model generated for each rock type. Soft boundaries between rock types within the same rock group were imposed.

Solid models exist for two Hearne rock units that have no macro data, HNTKG2 and HS_UNDEF. HNTKG2 sits just below the overburden surface in the south of Hearne North. As a result of its position in relation to Hearne South and its commonality in rock units (tuffisitic), HNTKG2 is estimated using HSTKM and HSTKW data and TK_MG estimation parameters.

Kriging was performed using two passes. The Hearne search strategy follows the strategy of mining bench-by-bench due to the slender north-south striking nature of the body. Search radii reaching the north-south and east-west extents aimed to include all allowable composites within a limited number of surrounding benches. Search radii are dependent on rock type for both passes. In the second kriging pass, search radii were increased to allow all blocks within the model to be assigned a grade.

Validation of the mineral resource estimate included a visual inspection, comparison of statistics, and analyses to detect spatial bias and excessive smoothing. Table 14-13 and Source: JDS, 2014

Table 14-14 show the percent difference between the kriged and NN block estimates for rock type and rock group.

Table 14-13: Hearne Kriged & NN Estimate Comparison by Rock Type

Rock Type	Code	Composites			Kriged Estimates			NN Estimates			% Diff = (KRG-NN)/NN
		No.	Avg. cpm³	CV	No.	Avg. cpm³	CV	No.	Avg. cpm³	CV	
HNTKN	200	47	5.865	0.178	101	5.580	0.044	101	5.883	0.175	-5.2
HNTKNT	201	96	5.383	0.179	210	5.516	0.035	210	5.484	0.191	0.6
HNHKN	202	17	4.938	0.320	157	4.393	0.073	157	4.866	0.304	-9.7
HNTKG2	103	-	-	-	40	4.739	0.028	40	4.948	0.094	4.2
HNHKG2	204	19	3.900	0.417	97	4.289	0.083	97	3.759	0.363	14.1
HNTKSD	204	11	6.363	0.271	82	6.393	0.105	82	6.632	0.271	-3.6
HNHKG	206	74	1.370	0.755	265	1.530	0.400	265	1.562	0.764	-2.0
HSTKM	207	16	4.145	0.299	219	4.391	0.126	219	4.420	0.263	-0.7
HSTKW	208	4	4.796	0.101	30	4.767	0.056	30	4.856	0.100	-1.8

Source: JDS, 2014

Table 14-14: Hearne Kriged & NN Estimate Comparison by Rock Group

Rock Type	Code	Composites			Kriged Estimates			NN Estimates			% Diff = (KRG-NN)/NN
		No.	Avg. cpm³	CV	No.	Avg. cpm³	CV	No.	Avg. cpm³	CV	
TK_HG	200, 201, 205	154	5.596	0.197	393	5.630	0.071	393	5.725	0.210	-1.7
HK_MG	202, 204	36	4.371	0.386	254	4.349	0.079	254	4.399	0.348	-1.1
TK_MG	207, 208	20	4.277	0.271	249	4.405	0.125	249	4.435	0.259	-0.7
HK_LG	206	74	1.370	0.755	265	1.530	0.400	265	1.562	0.764	-2.0

Source: JDS, 2014

Table 14-13 shows that the percentage difference between the kriged and NN block estimates are typically less than 5% for any given rock type. Rock types with percent differences around 10% are those belonging to the HK_MG group (HNHKN AND HNHKG2).

The difference in the composite means of these rock types is close to 1.000 cpm^3; hence estimating using soft boundaries is the main reason for the percentage differences observed. Source: JDS, 2014

Table 14-14 shows the comparison of statistics for the kriged and NN models by rock group. Percentage differences between the kriged and NN means are generally less than 4%, illustrating no bias exists in the estimate.

Initial estimation was completed without the capping of potential outliers. Validation results showed this not to be a problem for all units with the exception of HNHKG. Kriging estimation of HNHKG was overestimating the composite mean by 10%. The locations of three higher grade outliers were identified on the unit's boundary with rock units with higher grades, and composites were capped to 3.0 cpm^3. Both kriged and NN estimation were re-run with improved results.

14.2.4.8 Bulk Density Model

The 2003 Mineral Resource estimate applied an in-situ (wet) density rather than a standard dry density due to the limited number of dry density measurements available. In this update, dry density was used where available. Where too few dry measurements had been taken, available in-situ density measurements were converted to a dry density.

The average dry densities by lobe were calculated and applied to the mineral resource model using the values in Table 14-10.

14.2.5 Grade Estimation – Tuzo

14.2.5.1 Estimation Approach

As with 5034 North-East Lobe, the estimation of global grade using micro-diamonds was extended to allow the estimation of local block grades. This was achieved by combining models of stone density and diamond size distribution data and by estimating stone density locally. Calibration and consistency of the models was achieved using macro-diamond data collected from large diameter percussion drilling in 1999.

The close-spaced drill grid (35 m) in 2007 had the advantage of providing a high quality geological data set that included quantitative measures of dilution throughout the Tuzo body.

Estimation was carried out in three stages: estimation of global diamond content per litho-facies; estimation of block tonnage; and local estimation of grade per mining block.

A key difference at Tuzo is the need for a dilution model on a local basis. Dilution was estimated in blocks so that a more accurate tonnage calculation can be made in the model. Consequently, grade estimates must be fully diluted. This is achieved by using the 2007 micro-diamond dataset.

14.2.5.2 Estimation of Global Diamond Content per Litho-facies

Diamond size was the first component of diamond content to be modelled. Samples were combined and plotted on log-probability plots to observe the size distribution per litho-facies and to express the distribution of diamond size per litho-facies in terms of a statistical distribution. Diamond stone density or diamond concentration was the second component of diamond content to be modelled.

Stone density was used to estimate diamond concentration by zone per litho-facies and locally in resource blocks. The statistical distribution of stone density was modelled per litho-facies and expressed in terms of a statistical distribution. The combination of stone density distribution and stone size distribution was used to reproduce (simulate) a representative diamond parcel statistically for comparison with observed samples.

14.2.5.3 Estimation of Block Tonnage

A detailed set of dilution measurements of drill core was prepared for every hole. The dilution measurements were used in a spatial analysis to obtain an estimate of the percent dilution in each resource block. Estimates for undiluted kimberlite density and granite density were combined with the percentage block dilution to calculate a block tonnage. Density estimates for kimberlite and granite were estimated locally. Block volume was split into kimberlite and granite volume based on the block dilution estimate and converted into tonnages by means of the kimberlite and granite density estimates. The two tonnage components were combined into a single block tonnage and used with block volume to derive an overall block density estimate.

14.2.5.4 Local Estimation of Grade

An estimate of stone density was made per mining block. These local estimates and block tonnages were used to calculate block stones, which were accumulated to total stones per litho-facies. The individual estimates of stones per mining block and the total stones per litho-facies were used with the global carats per litho-facies to calculate the carats in each mining block. The mining block carats were divided by the block tonnes (the total of kimberlite and granite tonnes) to give a grade in carats per 100 tonnes (dry).

The estimation procedure involved the following steps:

- diamond size distribution modelling;
- diamond stone density distribution modelling;
- estimation of the global diamond content per litho-facies. This is based on micro-diamond stone;
- density distributions in combination with diamond size distribution models;
- estimation of a local relative density for kimberlite and a global estimate of density for granite;
- estimation of dilution per mining block;
- estimation of local stone density using micro-diamond sampling; and
- proportioning of global diamond content into local blocks on the basis of local stone density.

These steps are explained in more detail.

14.2.5.5 Sampling Data

A total of 367 samples of core were treated for micro-diamonds. The average sample weight was 8 kg comprising 2 m drill core sections and amounted to a total sample weight of 2,860 kg. The average dilution for the micro-diamond samples is 37%.

Table 14-15 shows a summary of micro-diamond recoveries broken down into the nine litho-facies units identified for the body.

Small numbers of samples were collected from units TK and EU with low likelihood of being used in advanced spatial analysis for diamond content.

Table 14-15: Tuzo Micro-diamond Recoveries

Rock Type	No. of Samples	Weight (kg)	Dilution (%)	Undiluted Wt. (kg)	Stones (+md5)	Stones / 8 kg (+md5) Diluted	Stones / 8 kg (+md5) Undiluted
CR	9	65	23	50	205	25	33
EU	5	40	82	7	22	4	24
Granite	3	22	63	8	26	10	26
HK	28	215	28	155	911	34	47
TK	10	81	33	54	161	16	24
TKT2	169	1331	29	940	2832	23	33
TKTKT1H	21	155	30	109	452	23	33
TKTKT1L	16	129	36	83	221	14	21
TKTKT2	106	822	51	402	1085	11	22

Source: JDS, 2014

Results from the 1999 and 2008 LDD programs were incorporated into this study and used in combination with micro-diamonds to model diamond size distributions to ensure the diamond size distribution is coherent over the entire diamond size range.

Table 14-16 shows a summary of LDD results broken down per litho-facies. No macro-diamond results were available for unit HK. Diamond recovery took place at a bottom cut-off of 1.5 mm; all stones are reported including those recovered below the bottom cut-off. Samples were not weighed, but sample volume was derived from hole-diameter and used in combination with density estimates to calculate an equivalent sample weight, as shown.

Table 14-16: Tuzo Results from GKJV LDD Sampling Carried Out in 1999 & 2008

	TK			TKT2			TKTKT1H			TKTKT1L			TKTKT2		
	2008	1999	Total	2008	1999	Total	2008	1999	Total	2008	1999	Total	2008	1999	Total
Cts/100t	108.55	68.33	91.09	119.04	114.78	117.63	244.48	276.21	247.77	872.74	99.38	143.55	54.91	59.27	57.67
Cts/100t +5	90.02	61.01	77.42	99.37	102.66	100.46	205.67	252.18	210.49	770.79	90.19	129.06	46.90	53.81	51.27
Volume m^3	23.81	18.34	42.15	74.04	36.30	110.34	233.12	25.26	258.39	3.99	34.47	38.46	56.68	100.13	156.81
Tons	58.68	45.03	103.70	180.65	89.40	270.05	538.05	62.20	600.25	5.10	84.20	89.30	140.56	242.09	382.65
Carats	63.70	30.77	94.46	215.05	102.61	317.66	1315.43	171.82	1487.24	44.52	83.68	128.20	77.18	143.49	220.67
Carats +5	52.82	27.47	80.29	179.51	91.78	271.29	1106.59	156.87	1263.46	39.32	75.94	115.26	65.93	130.28	196.21
Stones	797	380	1,177	2,806	1,187	3,993	16,084	1,841	17,925	401	940	1,341	907	1,678	2,585
Stones +5	451	274	725	1,691	820	2,511	9,486	1,337	10,823	250	671	921	586	1,234	1,820
Stones															
+23	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
+21	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
+19	1	0	1	1	1	2	10	3	13	2	0	2	2	0	2
+17	1	0	1	2	1	3	15	2	17	3	0	3	0	0	0
+15	0	0	0	1	2	3	9	3	12	0	2	2	2	0	2
+13	4	1	5	10	7	17	70	13	83	5	7	12	6	7	13
+12	4	3	7	8	6	14	99	19	118	6	10	16	6	16	22
+11	20	9	29	50	30	80	325	44	369	8	21	29	20	39	59
+ 9	43	27	70	146	83	229	912	115	1,027	27	67	94	55	122	177
+ 7	71	36	107	255	107	362	1,380	187	1,567	37	88	125	89	172	261
+ 6	107	66	173	410	184	594	2,281	316	2,597	54	166	220	139	323	462
+ 5	200	132	332	807	399	1,206	4,384	635	5,019	108	310	418	267	555	822
+ 3	280	84	364	937	277	1,214	5,478	394	5,872	137	198	335	288	337	625
	TK			TKT			TKTKT1H			TKTKT1L			TKTKT2		

	2008	1999	Total	2008	1999		2008	1999	Total	2008	1999	Total	2008	1999	Total
+ 2	56	11	67	121	47	168	758	61	819	10	33	43	24	53	77
+ 1	10	10	20	47	32	79	277	36	313	2	30	32	8	40	48
- 1	0	1	1	10	11	21	85	13	98	2	8	10	1	14	15
Carats															
+23	0.00	0.00	0.00	0.00	0.00	0.00	25.14	0.00	25.14	0.00	0.00	0.00	0.00	0.00	0.00
+21	0.00	0.00	0.00	4.47	0.00	4.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
+19	2.53	0.00	2.53	2.58	2.14	4.71	26.94	8.74	35.68	5.58	0.00	5.58	3.15	0.00	3.15
+17	1.08	0.00	1.08	3.18	1.83	5.00	22.42	3.27	25.69	3.13	0.00	3.13	0.00	0.00	0.00
+15	0.00	0.00	0.00	0.87	2.30	3.17	12.36	4.09	16.45	0.00	2.29	2.29	2.04	0.00	2.04
+13	3.57	0.61	4.17	6.89	5.94	12.83	57.05	9.95	67.00	4.65	6.22	10.86	3.80	5.83	9.62
+12	1.93	1.29	3.22	4.07	2.71	6.78	53.31	9.59	62.90	2.57	5.26	7.82	2.45	8.00	10.45
+11	6.65	2.99	9.63	18.50	10.56	29.05	116.00	15.12	131.11	2.57	7.22	9.79	6.99	12.88	19.87
+ 9	8.43	5.69	14.12	29.66	17.18	46.83	189.22	22.98	212.20	5.84	13.65	19.49	10.81	25.34	36.14
+ 7	8.80	4.22	13.02	31.88	13.37	45.25	176.00	22.78	198.77	4.47	11.01	15.48	10.59	21.13	31.72
+ 6	8.86	5.30	14.16	34.25	14.65	48.90	191.54	26.21	217.74	4.53	13.66	18.19	11.77	26.84	38.61
+ 5	10.97	7.39	18.36	43.17	21.12	64.29	236.64	34.16	270.80	6.00	16.65	22.65	14.33	30.27	44.60
+ 3	9.50	2.94	12.44	32.19	9.45	41.64	187.84	13.15	200.99	4.86	6.69	11.55	10.54	11.69	22.23
+ 2	1.18	0.24	1.42	2.59	0.96	3.55	16.40	1.26	17.66	0.29	0.63	0.91	0.59	0.97	1.55
+ 1	0.19	0.11	0.30	0.70	0.36	1.06	4.14	0.47	4.61	0.06	0.38	0.44	0.12	0.48	0.60
- 1	0.00	0.01	0.01	0.06	0.07	0.12	0.46	0.08	0.54	0.01	0.05	0.05	0.00	0.08	0.08

Source: JDS, 2014

14.2.6 Modifying Factors for Grade & Diamond Size Distributions

Since mine operations commenced in September 2016, ongoing work has been conducted on the resource based on resource depletion and reconciliation. During 2017 data collected through two discrete production samples was used to modify diamond SFD and grade in two lobes of 5034, the Center and the Northeast.

These production bulk samples consisted of a discrete and measured volume of the specific lobe which was blasted and processed independent of any blend of other lobes within 5034. Prior to processing, attempts are made to purge the plant of any additional kimberlite to ensure the accuracy of the sample results.

14.2.6.1 Center Lobe Modifying Factors

In January 2017 a production bulk sample was conducted on the Center Lobe of 5034 to validate the SFD and grade models used for life of mine planning. This sample was prompted after a measured over performance of the resource grade for a number of months. A dedicated sample was collected from the 385 bench in 5034 totalling 55,800 tonnes. Carats collected during the sample period totalled 69,229 cts. The reconciled grade of the bulk sample was 124 cpht where the depleted model predicted 95cpht resulting in a grade performance ratio of 1.3. All remaining Center Lobe resource grades have been multiplied by a factor of 1.3 as of December 31 2017.

In addition to the increased grade, a revised SFD was constructed based on the increased sample size. Generally the SFD for Center Lobe has been coarser than predicted. Due to the increased confidence in the larger sample, the new SFD has been adopted for life of mine planning moving forward of December 31 2017. The revised SFD is shown against the original SFD in Table 14-17 below:

Table 14-17: Center Lobe Revised SFD

	Budget Center Lobe SFD	Center Lobe Revised SFD
Sieve Size	% Carats	% Carats
+23	0.61%	1.34%
+21	2.09%	2.33%
+19	3.59%	4.25%
+17	2.65%	2.84%
+15	1.72%	1.96%
+13	6.07%	7.77%
+12	5.06%	6.45%
+11	9.47%	13.34%
+9	13.04%	17.52%
+7	12.68%	13.16%
+6	12.97%	10.42%
+5	10.75%	9.26%
+3	13.40%	6.66%
+2	4.35%	1.64%
+1	1.57%	1.04%
-1		
TOTAL	100.00%	100.00%

Source: De Beers, 2017

14.2.6.2 North East Lobe Modifying Factors

In May 2017 a production bulk sample was conducted on the East Lobe of 5034 to validate the SFD and grade models used for life of mine planning. This sample was prompted after a measured over performance of the resource grade for a number of months. A dedicated sample was collected from the 361 bench in 5034 totalling 48, 9866 tonnes. Carats collected during the sample period totalled 120,825 cts. The reconciled grade of the bulk sample was 246cpht where the depleted model predicted 222cpht resulting in a grade performance ratio of 1.11. All remaining North East Lobe resource grades have been multiplied by a factor of 1.11 as of December 31, 2017.

In addition to the increased grade, a revised SFD was constructed based on the increased sample size. Generally the SFD for North East Lobe has shown a finer distribution than the original sample by a factor of approximately 0.79. Due to the increased confidence in the larger sample, the new SFD has been adopted for life of mine planning moving forward of December 31, 2017. The revised SFD is shown against the original SFD in Table 14-18 below:

Table 14-18: North East Lobe Revised SFD

	Budget Center Lobe SFD	Center Lobe Revised SFD
Sieve Size	% Carats	% Carats
+23	1.63%	0.65%
+21	2.06%	1.04%
+19	3.20%	2.45%
+17	2.10%	1.79%
+15	1.45%	1.33%
+13	5.57%	5.35%
+12	3.98%	4.57%
+11	8.36%	7.83%
+9	12.27%	13.66%
+7	11.08%	12.32%
+6	11.58%	12.98%
+5	16.26%	14.14%
+3	14.97%	14.72%
+2	4.40%	4.24%
+1	1.09%	2.95%
-1		
TOTAL	100.00%	100.00%

Source: De Beers, 2017

14.2.6.3 Removal of Incidental Diamonds

All incidental carats (-1.00mm) were removed from the resource estimates in 2016 resulting in a loss of 175,000 carats from the stated inferred resource. While these carats carried no value, they did contribute to overall contained carat weight and thus, the grade of the overall resource.

14.2.6.4 Depletion

The resource estimate for December 31 2017 has been accurately depleted. Depletion has been the result of continuous mining and processing of the resources since September 2016. Depleted tonnes and carats are considered those which have been processed. Depletion included in the mineral resource estimate (December 31 2017) includes the following:

- 5034: 5.4Mt / 5.3Mcts
- Hearne: 0.2Mt / 0.3Mcts

Note that for the purposes of resource reporting, Quarter 4 – 2017 depletion numbers were based on forecasted values for the this report. Actual depletion varied during Quarter 4, and no Hearne material was processed during 2017.

14.2.6.5 Tuzo Tonnages

In December of 2013, a reclassification of the Tuzo resource between levels 300mbs and 360mbs from the inferred to indicated category added approximately 0.4Mt of indicated ore, increasing overall tonnage from 15.8Mt to 16.2Mt. Being that the original estimate was done on a mid-bench basis, the remaining half bench was obtained during the re-estimate. Aside from the mid-bench convention, revisions to the wireframe were made at depth.

In addition to the indicated resources mentioned above, an underground RPEEE desktop study was performed in early 2014 for which 10.8 Mt passed, boosting the inferred resources to the 10.8 Mt stated in Section 14.3

14.3 Mineral Resource Summary

The Gahcho Kué Mine resources are summarized in Table 1-19. JDS has reviewed the resources and compared to those stated in the 2014 (NI) 43-101 Technical Report, (JDS 2014). During this comparison, JDS noted the following changes in resource estimates:

1) 5034: Depletion of 5.4Mt / 5.3Mcts

   Modifying grade factors of +1.30 and +1.11 for Center and North East lobes respectively

   Removal of incidental diamonds from grade calculations

2) Hearne: Depletion of 0.2Mt / 0.3Mcts

   Removal of incidental diamonds from grade calculations

3) Tuzo: Revisions to resource classification and wireframes

   Removal of incidental diamonds from grade calculations

JDS is of the opinion that the resource estimate presented in Table 1-19 provides an accurate and complete basis for state of the resource (December 31, 2017). Resources are exclusive of mineral reserves.

Table 14-19: Mineral Resource Summary (December 31, 2017)

Resource	Classification	Tonnes (Mt)	Carats (Mct)	Grade (cpht)
5034	Indicated	0.9	1.5	161
	Inferred	0.8	1.3	163
Hearne	Indicated	0.2	0.3	168
	Inferred	1.2	2.1	175
Tuzo	Indicated	0.8	0.9	114
	Inferred	10.8	14.6	135
Summary (In-Situ)	**Indicated**	**1.8**	**2.6**	**142**
	Inferred	**12.8**	**18.0**	**140**
Stockpiles	Indicated	0.0	0.0	0
	Inferred	0.0	0.0	115(3)

Notes:
(1) Mineral Resources are reported at a bottom cut-off of 1.0 mm. Incidental diamonds are not incorporated in grade calculations.
(2) Mineral Resources are not mineral reserves and do not have demonstrated economic viability.
(3) Volume, tonnes and carats are rounded to the nearest 100,000. 12,300t of inferred resources stockpiled @ 115cpht (14,250cts total).
(4) Tuzo volume and tonnes exclude 0.6 Mt of a granite raft and CRX_BX.
(5) Resources are exclusive of mineral reserves.
(6) Resources have been depleted of any material that was processed prior to and including Dec 31 2017. Q4 depletion is based on forecasted values and may differ slightly from actual values.

Source: JDS, 2018

15 Mineral Reserve Estimates

15.1 Open Pit Geotechnical

Mine geotechnical investigations at Gahcho Kué have been ongoing since 1996 primarily under the supervision of independent consultants SRK and more recently, Piteau Associates. Between 1996 and 2013 a geotechnical model for the Gahcho Kué deposits was created through eight drilling and core logging campaigns, and three field mapping programs. These programs resulted in the development of the mine geotechnical parameters and pit slope design criteria used during the 2014 PFS. The original criteria outlined in a 2004 SRK study identified six distinct structural domains used to develop the pit design sectors for 5034, Hearne and Tuzo. The pit slope design parameters outlined in the 2014 PFS and subsequent pit designs were used as the basis for operational mine planning and reserve reporting during 2014, 2015 and 2016.

During 2015 and 2016, field observations of the performance of the Eastern walls in 5034 warranted additional investigation into the geotechnical design criteria. The significance of the J5 joint set, a shallow dipping Northeast trending structure was made apparent during the excavations of the first two benches of the 5034 pit. The J5 structure's unfavourable orientation presented the possibility for significant crest loss and compromised ramp widths on the Eastern pit walls of 5034.

As a result the GKJV commissioned a new geotechnical study under the supervision of Piteau Associates in 2016 with the following primary objectives:

- Conduct a drilling and logging of twelve bore holes with a primary focus on assessing the geotechnical characteristics of 5034, Hearne and Tuzo, as well as the significance and continuity of the J5 structure.
- Perform updated kinematic analysis using new geotechnical data and re-assess the geotechnical domains for all three pits.
- Provide revised geotechnical design criteria based on updated analysis for the purpose of open pit optimization and detailed pit design to mitigate the potential concerns of J5 in 5034, Hearne and Tuzo.

Results from the Piteau field investigation were used to update rock mass data, 17 pit design sectors were developed providing recommendations and alternatives on inter-ramp angle, bench face angle and catchment width and provided to Gahcho Kué in early 2017.

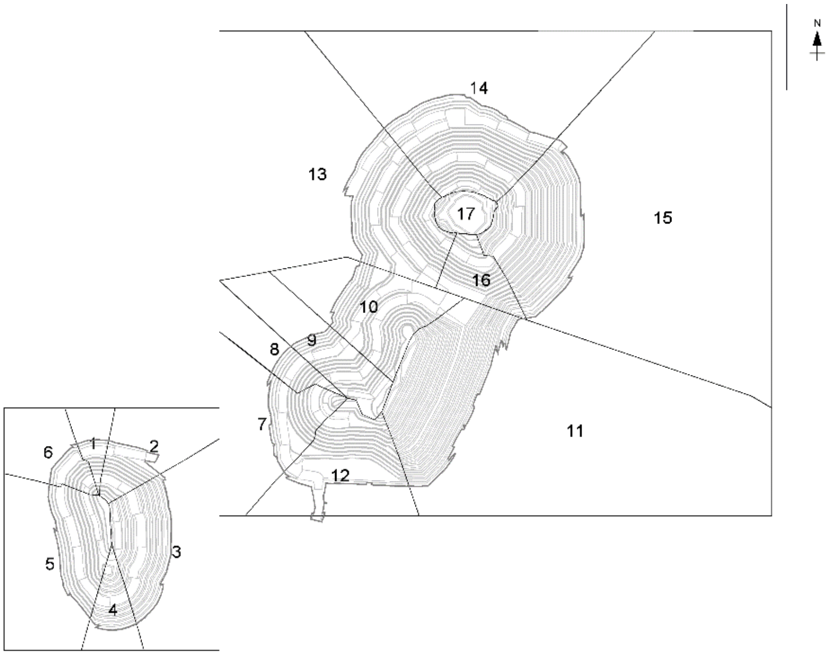
Economic and risk analysis were conducted on the impact of each alternative presented in the various design sectors. Table 15-1 outlines the pit slope criteria selected by Gahcho Kué as the basis for the updated pit optimizations, detailed designs and reserves as of December 31, 2017.

Table 15-1: Pit Slope Design Criteria

Design Sector	Pit Area	Lithology	Double Bench Permitted	Effective Bench Face Angle °	Effective Catchment Berm (m)	Inter-Ramp Angle °
1	Hearne	Granite	Yes	78.9	10	58
2			Yes	78.9	10	58
3			Yes	67.0	10	50
4			Yes	65.2	10	49
5			Yes	78.9	10	58
6			Yes	78.9	10	58
7	5034	Granite	Yes	78.9	10	58
8			Yes	78.9	10	58
9			Yes	78.9	10	58
10			Yes	78.9	10	58
11			No	63.8	8	41
12			Yes	78.9	10	58
13	Tuzo	Granite	Yes	77.8	10	58
14			Yes	78.9	10	58
15			Yes	67.0	10	50
16			Yes	78.6	10	58
17		Kimberlite	No	68.5	8	43

Source: JDS, 2018

Figure 15-1: Pit Slope Design Sectors



Piteau Pit Design Sectors
Source: JDS, 2018

15.2 Open Pit Optimization

De Beers used Whittle® software to conduct pit optimizations on the three deposits at Gahcho Kué to establish open-pit shells. The Whittle® optimization process uses a set of input parameters to develop open pit shapes. Table 15-2 shows the design input parameters used to generate the various pit shapes.

Table 15-2: Open Pit Optimization Parameters

Parameter	Unit	Value
Mining OPEX	CAD / t mined	3.00
Mining Sus. CAPEX	CAD / t mined	0.18
Rehabilitation OPEX	CAD / t mined	0.21
Processing OPEX	CAD / t processed	6.41
Processing Sus. CAPEX	CAD / t processed	0.37
G&A OPEX	CAD / t processed	46.37
G&A Sus. CAPEX	CAD / t processed	1.51
Exchange Rate	CAD : USD	1.18
Dilution		
5034	%	8.40
Hearne	%	7.80
Tuzo	%	2.80
Mining Losses	%	1.00
Prices		
5034 North	US$/ct	89.73
5034 South	US$/ct	87.82
5034 West	US$/ct	90.82
5034 Centre	US$/ct	97.16
5034 North East	US$/ct	107.45
Hearne	US$/ct	75.23
Tuzo	US$/ct	66.85
Price Escalation		
5034		1.24
Hearne		1.10
Tuzo		1.32
Pit Slope Parameters	Refer to Section 15.1.1	

Note: Mine design parameters in this table differ from final cost estimates but the QP does not consider the differences to be material.
Source: De Beers, 2017

The Whittle software varies the prices (revenue factor) and generates a 'breakeven' pit shell for each revenue factor.

Pit optimization was completed using a depleted resource model using a topographic survey updated to the end of January 2017 which was representative of mining activity in 5034 up to that date.

A large number of scenarios were evaluated to assess the impact of revised geotechnical design criteria provided by Piteau Associates in 2017 on overall ore and waste tonnages for each of the three pits. The revised geotechnical criteria provided both "recommended" and "alternative" criteria for each of the design sectors in the three pits. Each alternative presented differing criteria for bench face, inter-ramp and overall pit slopes angles as well as berm width and ramp location. The selected case, includes a 5% increase in mill production, a 30% increase in grade in the 5034 Centre Lobe and internal phasing in all three pits. The increase in throughput and grade were selected from observed mill performance results at the time, and modifying factors in the 5034 resource mentioned in section 14.2.6.

Prices used for the optimization have been escalated by factors varying by pit, indicative of the timing and duration of each pit.

15.3 Open Pit Design

All stated reserves for the Gahcho Kué Mine exist within detailed pit designs. These detailed designs are based on the selected geotechnical parameters for each geotechnical zone, as well as the selected optimal Whittle® shell. Detailed pit designs for each of the three deposits were generated with the following considerations:

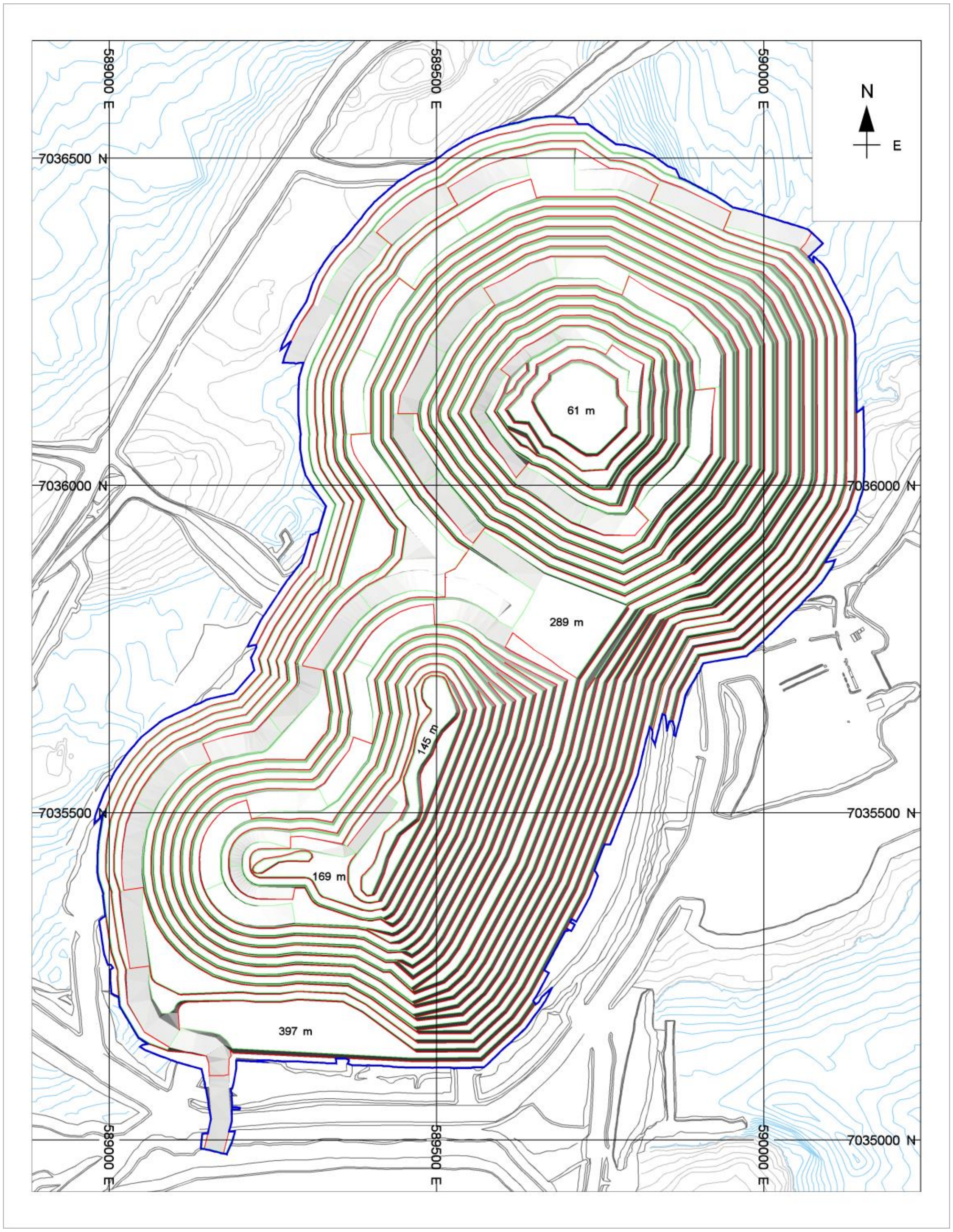
- Double and single lane haul ramps designed to meet the regulations outlined in the NWT Mines Health and Safety Regulations. (3x and 2x the width of the largest haul truck + berm);
- Catchment benches;
- Minimum mining widths;
- 12.0 m benches; and
- Double benching were applicable (At this time double benching is applied to all pits and walls below the 373 masl elevation with the exception of the East wall in 5034 and final benches of Tuzo, where single benching is maintained to final depth).

Due to the close proximity of the Tuzo and 5034 pipes, the two pits connect at a common saddle at the 289 masl elevation. Ramps from both 5034 and Tuzo are designed to meet on this platform promoting secondary egress and reduced waste haulage distances during the 5034 backfill program. The Hearne pit is a stand-alone design with no interaction to 5034 at this time.

Ramp orientations have been established to optimize exit distances relative to waste rock piles and critical infrastructure. Ramps are a mixture of concentric and switchback designs based geotechnical criteria. Tuzo and Hearne maintain a concentric ramp while 5034 includes a switchback on the West wall due to geotechnical constraints outlined in Section 15.1.

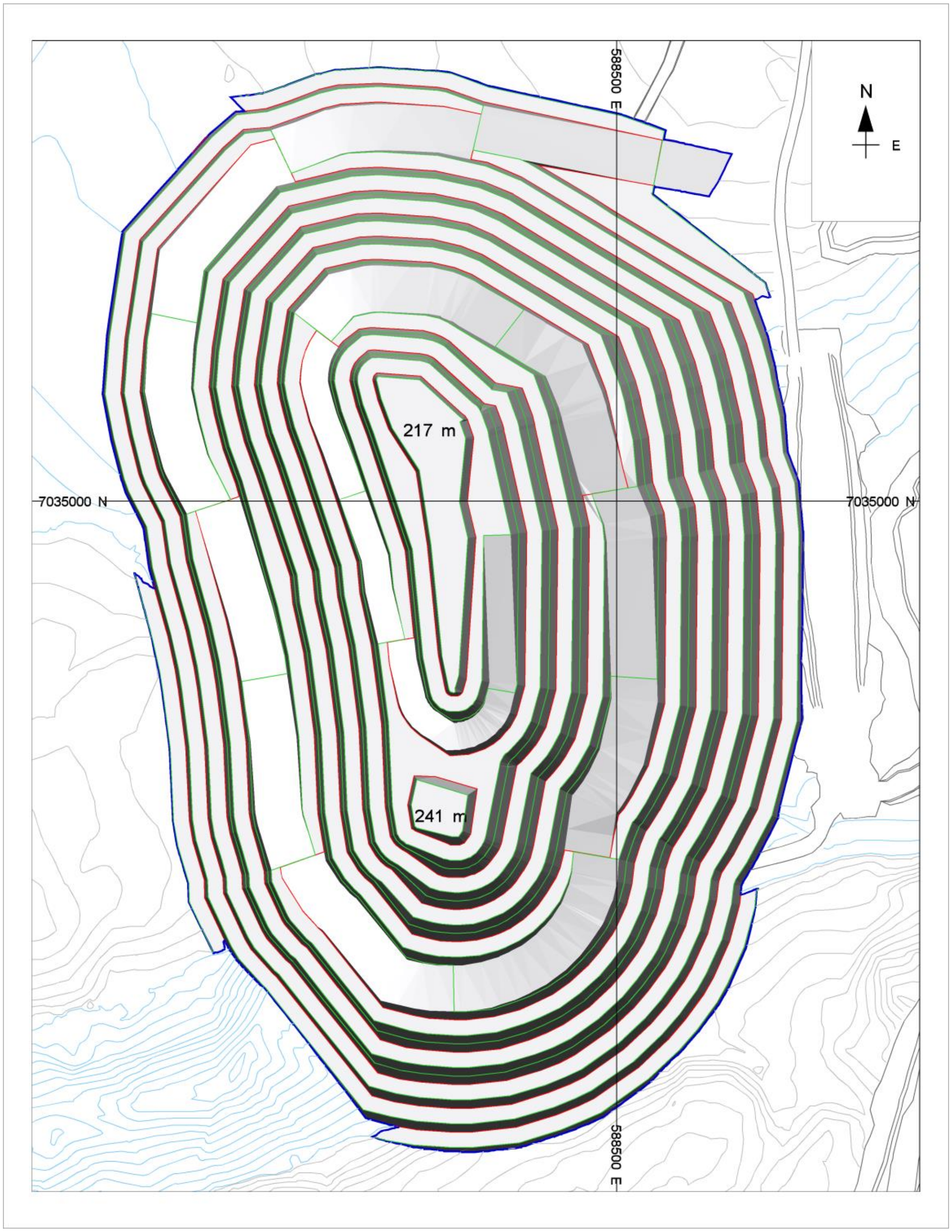
Pit designs for 5034, Hearne and Tuzo are presented in figures below:

Figure 15-2: 5034 / Tuzo LOM Pit Design



5034 / Tuzo Pit Design
Source: JDS, 2018

Figure 15-3: Hearne LOM Pit Design



Hearne Pit Design
Source: JDS, 2018

15.4 Mining Dilution and Losses

Dilution and mining losses have been incorporated in the conversion of mineral resources to mineral reserves. A global factor of 1% has been applied to all reserves to account for mining losses while dilution has been modelled separately for each pit.

Dilution has been estimated to account for both contact and internal dilution. Each pit has been modelled separately and is presented below:

- 5034: 8.4%;
- Hearne: 7.8%; and
- Tuzo: 2.8%.

15.5 Open Pit Mineral Reserves

The optimization results and subsequent pit designs have determined the economic mineral reserve estimate for each pipe as summarized in Table 15-3.

Table 15-3: Mineral Reserve Estimate

Pipe	Classification	Tonnes (Mt)	Carats (Mct)	Grade (cpt)
5034	Probable	9.7	18.4	1.91
Hearne	Probable	5.5	10.9	1.99
Tuzo	Probable	15.7	19.1	1.22
In-Situe Total	**Probable**	**30.9**	**48.4**	**1.57**
Stockpile	Probable	.6	1.0	1.61
Total	**Probable**	**31.5**	**49.4**	**1.57**

Notes:
(1) Mineral Reserves are reported at a bottom cut-off of 1.0 mm
(2) Mineral Reserves have been depleted to account for mining and processing activity prior to Dec 31 2017.
(3) Q4 2017 depletion is based on forecasted values and may differ slightly from actual depletion.
(4) Mineral Reserves are based upon the updated resource model (2017) and therefor reflect any changes to the estimation of Tonnes, Grade and Contained Carats within that resource. Details on resource changes are summarized in Section 14.
(5) Prices used to determine optimal pit shells have been escalated by factors varying by pit, which are indicative of the respective pits timing and duration.

Source: JDS, 2018

Table 15-3 was reviewed by JDS Energy & Mining Inc. and complies with CIM definitions and standards for a National Instrument (NI) 43-101 for an operating mine.

The economic viability presented in Section 22 confirms that the probable reserve estimates meet and comply with CIM definitions and (NI) 43-101 standards. At the time of this report, the mine is economically viable using current diamond prices and prevailing long-term price estimates.

15.5.1 Stockpiles

The Gahcho Kué Mine stockpiles run of mine (ROM) ore on a pad adjacent to the primary crusher. Ore is loaded into the hopper of the primary crusher using WA900 loaders at a rate of approximately 400 tph. As of December 31, 2017, the ROM stockpile at the Gahcho Kué Mine totaled 640,000 tonnes of kimberlite ore, at an estimated average grade of 161 cpht. While small portions of this material may be deemed oversize rock, requiring additional breaking prior to processing, 100% can be considered ready for process.

16 Mining Methods

16.1 Mining Methods

The Gahcho Kué Mine employs conventional open pit mining methods. Waste and ore are blasted and loaded out using a fleet of diesel powered trucks, shovels, drills and ancillary equipment. Waste rock will be stored in two surface mine rock piles as well as in two of the excavated pits at later stages of the mine life. Kimberlite ore is hauled to a run-of-mine storage pad where the ore is stockpiled and loaded into the primary crusher via a front end loader. Kimberlite processing creates two additional waste streams of coarse and fine processed kimberlite. Coarse processed kimberlite (CPK) is loaded into haul trucks and stacked in a pile North of the plant, while the fine processed kimberlite (FPK) is deposited via slurry into a settlement pond known as Area 2. Non-acid generating (NAG) and potentially-acid generating (PAG) waste rock is differentiated using an on-site sampling system of blast hole cuttings. PAG rock is encapsulated within the surface mine rock piles and below the restored final lake elevation of Kennady Lake during period of pit backfill.

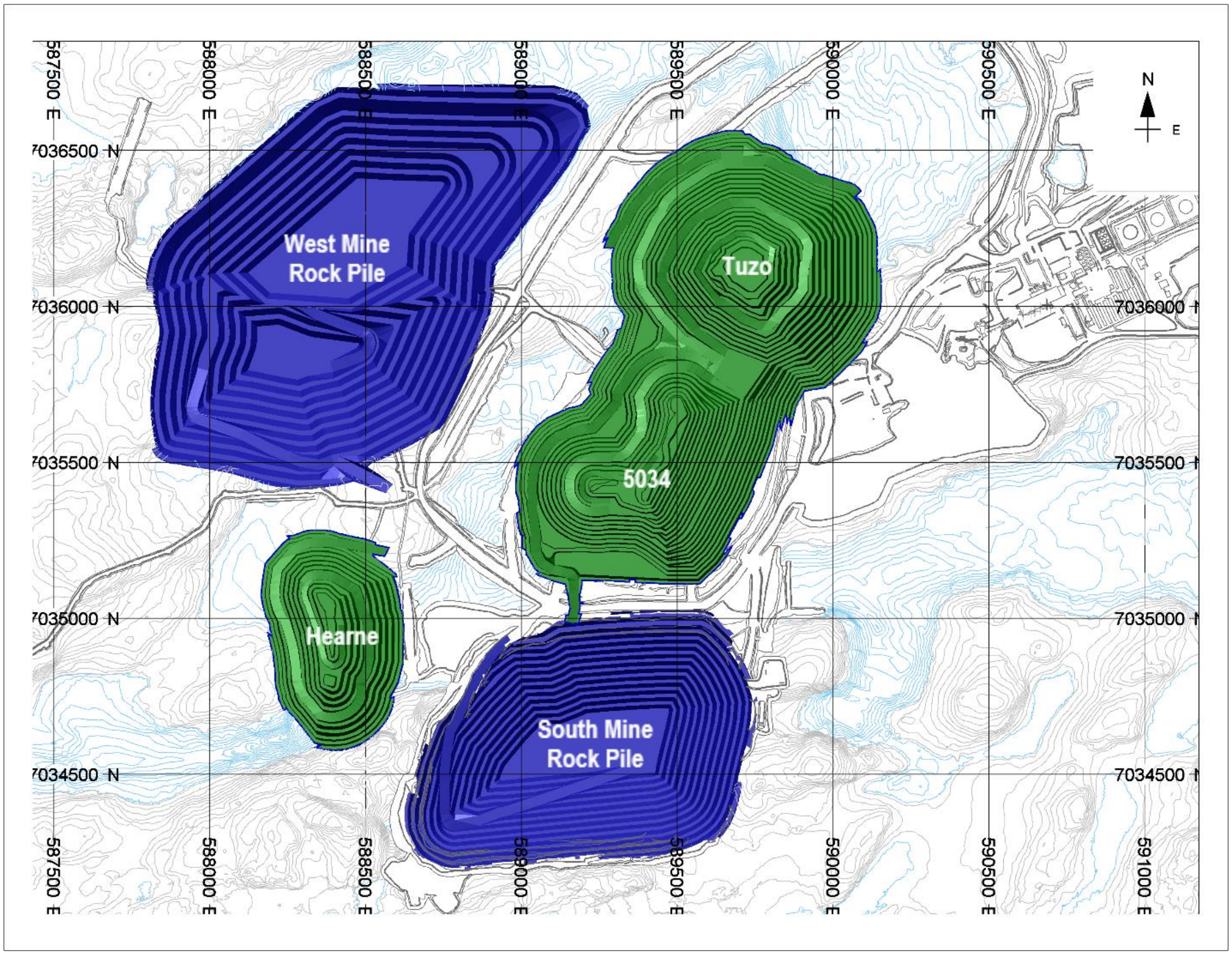
The mine design and consequent mine plan considers conventional truck / shovel mining utilizing 29 m^3 bucket diesel hydraulic front shovels, a 17 m^3 front-end loader and 218 t class haulage trucks will be employed to mine the kimberlite and waste quantities. This large fleet will be augmented by 12 m^3 bucket front-end loaders, scaling excavators and 100 t haul trucks. Production drill and blast activities will be supported by a fleet of rotary blast hole drills drilling 251mm holes. Pre-shear drilling will be supported with a pair of down the hole percussion drills drilling 171mm holes.

The three open pits are mined in a sequence which maximizes the value of the contained ore. The pre-strip sequence for the pits is 5034, Hearne and finally Tuzo, with production from all three pits overlapping at times. All three kimberlite deposits exist under Kennady Lake, and required substantial dewatering efforts prior to mining. Dewatering of the Southern portion of Kennady Lake (Area 8, 7 and 6) was completed in 2015 along with construction of the primary dewatering infrastructure exposing the 5034 and Hearne deposits. Completion of the remaining dewatering dike network and substantial dewatering of Area 4 is planned for 2018 and 2019, which will expose the Tuzo mining area.

The Hearne pit will be used as a storage facility for processed kimberlite as well as waste mine rock upon depletion in 2022, and 5034 will be used as a waste rock storage facility for Tuzo mining operations from 2024 to the end of the mine life.

A general layout of the mining area is shown in Figure 16-1.

Figure 16-1: General mine arrangement, Gahcho Kué Mine



General Mine Layout GK
Source: JDS, 2018

16.1.1 Operations

The Gahcho Kué Mine operates 365 days per year, 24 hours per day. The mine operation is run using two-12 hours shifts, with the majority of operations and operational support personnel working a 14 day on / 14 day off rotation. A portion of Yellowknife based mine management and mine administrative staff work a four day on / three day off schedule working 12 hour shifts and provide a consistent management presence at the mine site.

16.2 Mine Production Plan

The current mine production plan for Gahcho Kué is developed around maximizing the value of the 5034, Hearne and Tuzo reserves through a strategic mining sequence. This sequence considers internal phasing to balance strip ratios during pre-strip activities, concurrent mining of all three pits, ore stockpiling and blending as well as in-pit backfill of the Hearne and 5034 pits during the later years of the mine life. The three pits are mined in the following order and for the following durations:

- 5034 – commenced in 2015 and extends to 2023;
- Hearne – 2018 to 2021; and
- Tuzo – 2019 to 2027.

Annual mine production figures for 2018 to 2027 are summarized below in Table 16-1. Note production figures below include material from the Inferred category in the South Pipe of 5034 in the mining and processing plan, however the material has been included at zero grade.

Table 16-1: Mine Reserves Production Summary

Mine Reserve Production	Units	Grand Total	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Waste mined Total	**mt**	**312.0**	**43.3**	**43.1**	**39.3**	**38.9**	**42.9**	**41.0**	**31.9**	**21.4**	**9.1**	**0.9**	**-**
Waste mined 5034	mt	**89.3**	38.7	31.5	6.3	1.5	7.1	4.2	-	-	-	-	-
Waste mined Hearne	mt	**42.8**	4.6	11.1	19.4	7.7	-	-	-	-	-	-	-
Waste mined Tuzo	mt	**179.9**	-	0.6	13.6	29.7	35.8	36.8	31.9	21.4	9.1	0.9	-
Ore mined Total	**mt**	**30.7**	**3.2**	**3.1**	**2.9**	**3.2**	**3.0**	**3.3**	**2.9**	**2.9**	**3.7**	**2.5**	**-**
Ore mined 5034	mt	**9.5**	2.0	2.9	0.9	0.3	1.6	1.8	-	-	-	-	-
Ore mined Hearne	mt	**5.5**	1.2	0.2	1.8	2.2	-	-	-	-	-	-	-
Ore mined Tuzo	mt	**15.7**	-	-	0.1	0.7	1.5	1.5	2.9	2.9	3.7	2.5	-
Strip Ratio	**W:O**	**10.2**	**13.5**	**14.0**	**13.7**	**12.1**	**14.1**	**12.2**	**11.1**	**7.4**	**2.4**	**0.3**	**-**
Ore treated Total	**mt**	**31.2**	**3.1**	**3.1**	**3.2**	**3.1**	**3.1**	**3.1**	**3.2**	**3.1**	**3.1**	**3.1**	**0.2**
Ore treated 5034	mt	**10.0**	1.9	2.9	1.2	0.7	1.4	1.7	0.2	0.2	-	0.1	0.2
Ore treated Hearne	mt	**5.5**	1.2	0.2	1.8	1.9	0.3	0.0	0.0	-	-	-	-
Ore treated Tuzo	mt	**15.7**	-	-	0.1	0.6	1.4	1.5	2.9	2.9	3.1	3.1	-
Average grade Total	**cpt**	**1.59**	**2.06**	**1.90**	**2.04**	**1.83**	**1.73**	**1.27**	**0.87**	**1.21**	**1.40**	**1.48**	**1.55**
Average grade 5034	cpt	**1.84**	2.04	1.89	1.92	1.69	1.89	1.76	1.77	1.61	-	1.61	1.60
Average grade Hearne	cpt	**2.08**	2.17	2.70	2.15	1.95	1.73	-	-	-	-	-	-
Average grade Tuzo	cpt	**1.23**	-	-	2.12	1.67	1.58	0.72	0.81	1.18	1.40	1.47	-
Recovered carats Total	**m carats**	**49.7**	**6.4**	**6.0**	**6.4**	**5.8**	**5.5**	**4.0**	**2.7**	**3.8**	**4.4**	**4.6**	**0.3**
Recovered carats 5034	m carats	**19.3**	3.8	5.4	2.0	1.2	2.6	2.9	0.5	0.3	-	0.1	0.3
Recovered carats Hearne	m carats	**11.3**	2.6	0.6	3.9	3.6	0.6	-	-	-	-	-	-
Recovered carats Tuzo	m carats	**19.3**	-	-	0.2	1.0	2.2	1.0	2.4	3.5	4.4	4.6	-

Note: Figures may not add up due to rounding
Source: JDS, 2018

16.3 Mine Equipment

Mine equipment at the Gahcho Kué mine has been subdivided into three categories for costing purposes:

- Load and Haul – Primary Production Fleet (Shovels, large excavators, haul trucks loaders and large dozers);
- Drill and Blast – Drills and explosives trucks; and
- Support or Ancillary – small dozers and excavators, fuel / service trucks, tool carriers, pick-ups, buses, cranes and all other mobile equipment.

Equipment requirements, costing, maintenance and scheduling is based on Service Meter Unit (SMU) hours correlated directly to the mine plan as per the Anglo Time Model. Equipment requirements are calculated by comparing modelled productivities and SMU hour requirements for each type of equipment to the maximum effective working hours for a single unit (P200). These effective working hours account for equipment availability and all controllable and non-controllable production delays.

16.3.1 Equipment Selection

Major mining equipment size and type has been selected based on the following criteria:

- Annual mine production schedule and waste stripping requirements;
- Pit design parameters and working bench height;
- Productivity and operating costs;
- Proven original equipment manufacturers (OEM) with Canadian Arctic diamond experience;
- Established supplier maintenance, repair and supply chain systems capable of supporting the owner's team; and
- Compliance with all safety and environmental standards.

The mining fleet must deliver 3.1 Mt of kimberlite to the process plant during production and strip an average of 31 Mt of waste per year during the same period. Peak waste stripping is approximately 43 Mt per year in 2019 as stripping is conducted at both Hearne and Tuzo.

During 2017 Gahcho Kué implemented a GPS based collision avoidance program through a partnership with Hexagon Mining®. The system has been outfitted to all mobile equipment in both the production and ancillary fleets. Additionally, the mine is working towards the implementation of a GPS based high precision drill management system.

SMS-Komatsu is currently the primary equipment supplier and maintenance contractor for shovels, excavators, haul trucks, dozers and the majority of support equipment. Atlas Copco is the primary drill supplier and drill maintenance contractor, providing maintenance expertise under the direction of the Gahcho Kué maintenance program.

Life of mine equipment requirements for the Gahcho Kué mine is presented in Table 16-2.

Table 16-2: Life of Mine Equipment Requirements

Equipment Type	Model	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
29 m^3 Shovel	PC5500	3	3	3	3	3	3	3	3	1	1
17 m^3 FEL	WA1200	1	1	1	1	1	1	1	1	0	0
12 m^3 Excavator	PC2000	1	1	1	1	1	1	1	1	1	1
Scaling Excavator	PC1250	1	1	1	1	1	1	1	1	1	1
218 t Haul Truck	830E	14	15	13	13	14	17*	6	6	5	2
Rotary Drill 251mm	PV271	4	4	3	3	3	3	2	2	2	1
Percussion Drill 171mm	ACD65	2	2	2	2	2	2	2	2	2	1

*Note: at this time a maximum of 15 830E haul trucks are scheduled to be purchased, additional hours in 2023 will be supplemented by the 90t fleet.

Source: JDS, 2018

16.3.2 Equipment Availability

Equipment availability has been modelled for each piece of equipment. Updated availability models have been constructed to account for the following operational factors:

- Equipment age and cumulative hours;
- Major capital overhauls; and
- Seasonal effects of extreme cold weather.

Target availabilities vary over the life of mine. Average availabilities for the primary production fleet are summarized in Table 16-3 below:

Table 16-3: Equipment Availability Assumptions

Equipment Type	Model	Target Annual Availability (LOM Average)	Target Operating Utilization (LOM Average)
29 m^3 Shovel	PC5500	85%	72%
17 m^3 FEL	WA1200	85%	72%
12 m^3 Excavator	PC2000	85%	72%
Scaling Excavator	PC1250	85%	72%
218 t Haul Truck	830E	85%	76%
Rotary Drill 251mm	PV271	85%	76%

Source: JDS, 2018

16.3.3 Mine Equipment Maintenance

Mobile equipment maintenance at Gahcho Kué is managed and executed by a combination of De Beers and contractor personnel. Primary production equipment maintenance is managed through a Reliability, Availability and Maintenance service agreement with SMS and Atlas Copco. Additional contracts are in place for specialty services such as welding, light vehicles and tire management.

The overall mine maintenance strategy has been modified since the 2014 FS to incorporate the following changes in 2017:

- De Beers maintenance management, engineering and supervision;
- De Beers / SMS split heavy equipment technician (HET) labour force;
- Specialist sub-contracted maintenance activities (Atlas Copco for drills, Tire North for tires, Aurora Ford for light vehicles); and
- Standalone surge welding support contract.

Maintenance activities are conducted in several facilities at the mine as well as in the field. The primary maintenance facilities at Gahcho Kué include:

- Primary 5 bay truck shop with wash bay (Built to accommodate the 218 t haul trucks and WA1200 Loader);
- Welding shop;
- Tire shop; and
- Light vehicle shop.

16.4 Explosives

Blasting at the Gahcho Kué Mine consists of the following activities:

- Production waste rock blasting;
- Production ore blasting; and
- Pre-shear and wall control blasting.

Each activity requires specific patterns and explosive products to achieve optimal results depending on rock type and drill-hole diameter.

Explosive supply, transportation, inventory and manufacturing at the Gahcho Kué Mine is managed by a single service contractor (ORICA) responsible for all explosives related activities up to, and including pumping down the hole. The Gahcho Kué mine uses a 70/30 bulk emulsion explosive product for production blasting which is manufactured on-site at a contractor managed facility. Bulk ammonium nitrate is stored on site in quantities sufficient for one full year of production, and transported to the manufacturing facility from the storage facility on a daily basis. Pre-packaged explosive products and explosives accessories are also stored on-site in four magazines. Packaged explosive products and accessories are shipped to site periodically by air throughout the year as supply dictates.

Once manufactured, bulk explosive product is shipped from the on-site emulsion facility to the blast pattern using two “triple threat” emulsion trucks. Bulk explosives are then pumped down-hole, primed and tied in by the mine’s blasting personnel.

16.5 Mine Personnel

This section describes the methods used to estimate the total personnel requirements for the Gahcho Kué operation. Being a remote operation, the mine utilizes a combination of two types of rotations to generate the on-site manpower roster. These rotations include two-week-on / two-week-off rosters for the majority of operations personnel, as well as four day on / three day off rosters for management and some technical services positions. For the purposes of this report, the organizational structure of the Gahcho Kué mine site has been broken down into the following categories:

- Mine Operations and Mobile Maintenance;
- Processing, Engineering and Fixed Plant Maintenance;
- Site Services and Camp Operations;
- Technical Services; and
- General and Administrative.

16.5.1 Mine Operations and Mobile Maintenance

Mine operations manpower refers to all personnel directly and indirectly related to the management and execution of mining activities such as:

- Heavy equipment operation of the mining fleet for load and haul (LHP) activities;
- Drill and blast;
- Mobile equipment maintenance;
- Earthworks construction;
- Pit dewatering;
- Mine engineering; and
- Mine management.

16.5.2 Processing Operations, Engineering and Fixed Plant Maintenance

Process operations, engineering and fixed plant maintenance manpower refers to all personnel directly and indirectly related to the operation and maintenance of the process plant and major fixed site infrastructure including:

- Process plant operations;
- Process plant maintenance;
- Metallurgy and sorting;
- Electrical and instrumentation;
- Powerhouse maintenance; and
- Communications.

16.5.3 Site Services and Camp Operations

Site services and camp operations manpower refers to all personnel directly related to the operation of the mine's ancillary equipment and accommodation facilities including:

- Crane operations;
- Carpentry;

- Boiler house maintenance and operations;
- Water and sewage treatment;
- Waste management;
- Catering; and
- Cleaning.

16.5.4 Technical Services

Technical Services manpower refers to all personnel directly related to the technical support and reporting functions of the mine operation, these include:

- Geology
- Geotechnical
- Hydrogeology
- Survey
- Strategic and long-range planning

16.5.5 General and Administrative

General and Administrative manpower refers to all personnel directly and indirectly related to the management, safety, environment, logistics and overhead functions which support the operation of the mine. These roles include:

- General management;
- Health, safety and environment;
- Logistics, materials management and procurement;
- Aboriginal affairs; and
- Human resources.

The organizational philosophy of the Gahcho Kué operation has been structured to minimize the number of on-site personnel to maintain a lean operating environment. De Beers has supported this initiative through the development of an off-site support center based in Calgary, Alberta, where many supplementary administrative roles are based.

A summary of total on-site manpower is presented in Table 16-4 below:

Table 16-4: On-Site Manpower

Areas	Average Manpower L.O.M	Max Manpower L.O.M
Mine Operations	**128**	**156**
Mining Management	3	3
Mine Engineering	4	5
LHP	60	79
Drill & Blast (Including explosives contractor)	18	22
Mobile Maintenance	42	47
Processing, Engineering and Maintenance	**71**	**76**
Plant & Engineering Management	5	5
Plant Operations	23	25
Metallurgy	4	5
Plant Maintenance	19	20
Electrical & Instrumentation	20	22
Site Services & Camp Operations	**51**	**54**
Management & Supervision	5	5
Equipment Operators	16	16
Waste & Water Management	2	2
Cleaning & Catering Contractor	28	31
Technical Services	**8**	**10**
Management & Supervision	1	1
Geology	3	3
Geotechnical & Hydrogeology	2	3
Survey	2	2
Planning	1	1
General & Administrative	**46**	**47**
Management & Business Improvement	4	5
Safety, Health, Environment	10	10
Protective Services	9	9
Logistics & Materials Management	14	14
Aboriginal Affairs	3	3
Human Resources	7	7
GRAND TOTAL SITE MANPOWER	**304**	**342**

Source: JDS, 2018

The numbers in Table 16-4 represent personnel on-site and not total number of employees hired, as such, positions rostered by a 2x2 rotation will require double the stated on-site requirement.

17 Recovery Methods

17.1 Kimberlite Processing

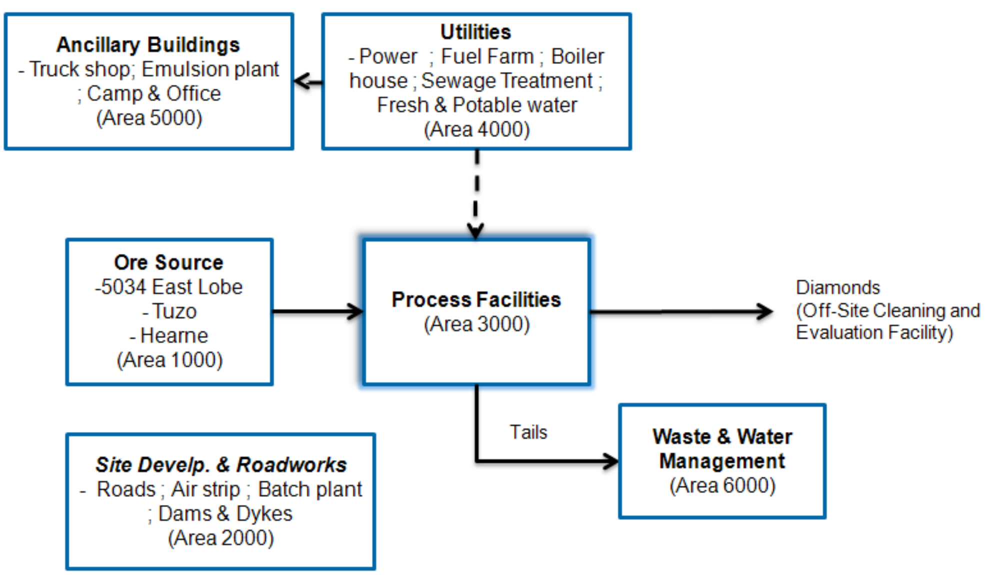
17.1.1 Process Summary

De Beers Canada and Mountain Province operate a diamond mine in Northwest Territories of Canada. The mine will extract Kimberlite ore from three different kimberlite pipes: 5034, Hearne, and Tuzo.

In the process plant, the ore is treated via crushing, screening, dense media separation and x-ray sorting, to produce a diamond rich concentrate that is sent to Yellowknife for final cleaning and Northwest Territories Government valuation. The processing plant targets the recovery of liberated diamonds in the 1 to 28 mm size range. The processing plant is designed for efficient diamond recovery over the mine's twelve-year life.

The following block flow diagram (Figure 17-1) shows the place of the Process Facilities (Area 3000) compared to the other key areas of the Gahcho Kué site.

Figure 17-1: High Level BFD of the Overall Process / Site



Source: Site BFD (Hatch, 2013)

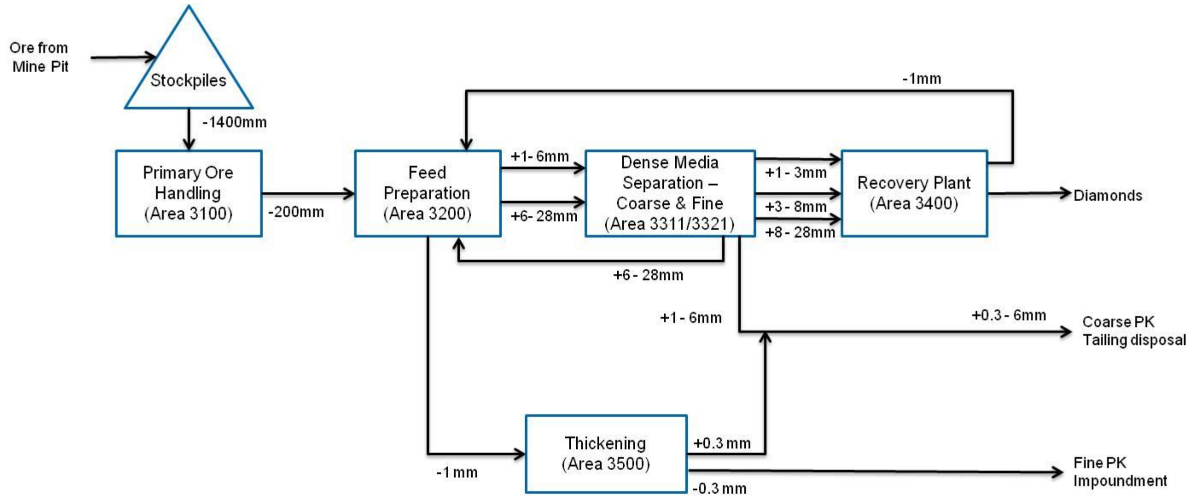
17.1.2 Process Plant Description – General Overview

The Process Facilities (Area 3000) are divided into the following areas and sub-areas:

- Primary Ore Handling (Area 3100):
- Feed Preparation (Area 3200):
- Dense Medium Separation (DMS):

- Recovery Plant (Area 3400):
- Thickening (Area 3500):
- Plant Water and Air Systems (Area 3600):

Figure 17-2: Block Flow Diagram of the Process Plant



Source: Process Plant BFD (Hatch, 2013)

17.1.3 Process Design Criteria & Quality

This section presents a summary of the main criteria used for the plant design for various areas of the plant. Values in the Table 17-1 will vary, or may have been adjusted depending of equipment selection during construction or changes during operations. They are presented as guideline.

Table 17-1: Process Design Criteria

Description	Min	Ave	Max	Units
Primary Ore Crushing – Area 3100				
Top size from mine			1400	mm
Top size to primary crushing – (grizzly cut size)			900	mm
Top size to secondary crushing – (target)		250		mm
Feed Preparation - Area 3200				
HPGR crusher feed size - target	1		75	mm
Degrit cut size - target		1		mm
Size fraction to DMS – Fine DMS	1		6	mm
Size fraction to DMS – Coarse DMS	6		28	mm
DMS area – Area 3300				
DMS modules	1 Coarse & 1 Fine			text
Medium Type	FeSi – 150D – 270 D			text
Coarse DMS – FeSi Medium to ore ratio	5:1			vol/vol
Fine DMS – FeSi Medium to ore ratio	7:1			vol/vol
Fine Process Kimberlite (PK) impoundment			0.3	mm
Coarse Process Kimberlite (PK) cut size (float screen)	1		6	mm
Coarse Process Kimberlite (PK) cut size (de-watering screen)	0.3		1	mm

Source: JDS, 2014

17.2 Recoverability and Reconciliation

Reconciliation refers to the comparison of actual production to the current estimates of production, most commonly to mine plans, or resource and reserve models. Reconciliation is carried out both monthly and annually. This comparison is used to measure the performance of the original resource and reserve estimates, mine plans and process plant.

Tonnage reconciliation at Gahcho Kué is completed monthly and compares:

- Measured tonnes treated from a weightometer on the front end of the plant to;
- Surveyed tonnages incorporating mined volumes and stockpile depletion / additions.

Grade reconciliations compares the predicted grade in the resource model for the associated depleted volumes to the real calculated grade (recovered carats / weightometer tonnage).

17.3 Processed Kimberlite Containment

Processed kimberlite from the Gahcho Kué Plant is produced in two streams:

- Coarse Processed Kimberlite (CPK); and
- Fine Processed Kimberlite (FPK).

Coarse processed kimberlite consists of the reject fraction of materials from the coarse and fine DMS. The material is a +0.3 - 6.0 mm fraction which is discharged on a conveyor belt from the North side of the plant. The material is piled under the tail end of the conveyor where the material is loaded into 100 t haul trucks by a WA900 loader. Storage capacity of the plant discharge is currently such that this loading process occurs on a continuous basis during plant operations. Once loaded, CPK material is transported directly North of the Plant and Truck Shop where the CPK is stacked in lifts on the Coarse Processed Kimberlite Pile. The CPK pile is designed to provide capacity until 2023. Once full CPK will be co-deposited in Hearne with FPK materials once again using 100 t haul trucks to transport.

Figure 17-3: Coarse Processed Kimberlite Pile Q3 2017

Source: CPK Facility (JDS, 2018)

Fine processed kimberlite consists of the final reject fraction from the thickening fraction. This would include all remaining kimberlite content less than 0.3 mm in size. The material is pumped as a slurry to be deposited in one of two final locations:

1) Sub-aqueously in the Area 2 FPK storage facility (Years 2017 to 2022); and
2) Hearne pit (Years 2022 to 2027).

The Area 2 Fine Processed Kimberlite facility consists of both impermeable retention walls to contain the FPK and associated discharge water from entering the receiving environment, as well as a large filtration dike on the South perimeter to allow water to permeate and filter back into the Area 3 water management pond for process plant recirculation or potential discharge. Once this facility is full, FPK discharge infrastructure will be re-oriented to co-deposit FPK materials into the Hearne pit along with CPK and potentially waste rock.

Figure 17-4: Area 2 Fine Processed Kimberlite Facility Q3 2017

Source: Area 2 FPK Facility (JDS, 2018)

17.4 Plant Control Philosophy

The Gahcho Kué Plant processes are automated to allow high-quality production with minimal human intervention.

The Instrumentation and control systems are capable of providing the information and control necessary to operate the plant safely, efficiently, and economically.

The design of the instrumentation and control system allow for the control and monitoring of all field instrumentation, motors and actuators from a central control room using a basic process control system (BPCS). The BPCS is based on Programmable Logical Controllers (PLCs) and Human Machine Interfaces (HMIs).

The Instrumentation and control system is designed for fail-safe operation and allow for fault diagnosis and reporting.

Control valves are pneumatically operated. Mechanical equipment complies with Z432 – Safeguarding of Machinery and include all necessary safety devices (E-Stop, Pull cords, etc.).

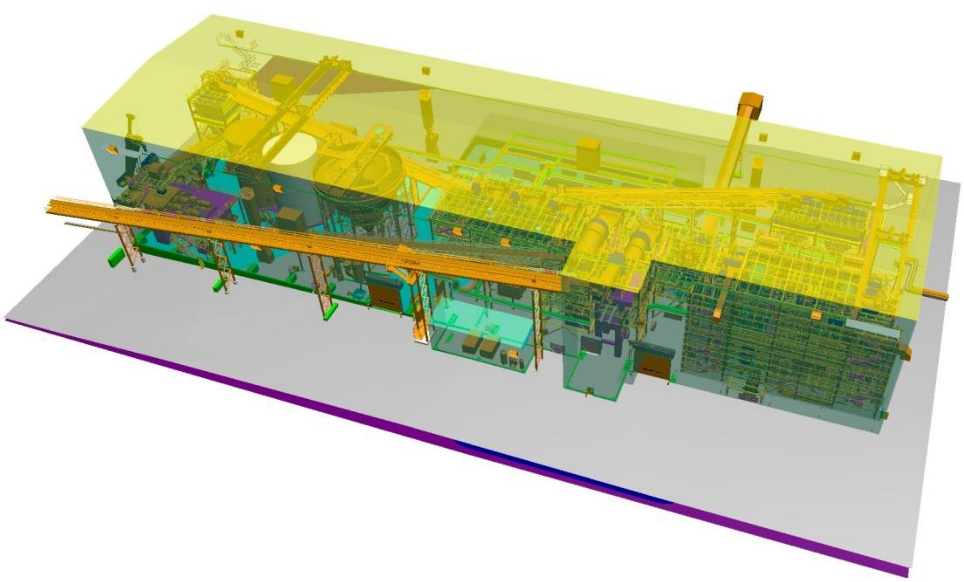
The Plant is controlled from a Central Control Room. This Control room shall be located in a strategic location to provide a clean, safe and air conditioned operating environment and will be manned 24/7.

The PLCs and control system servers and communication devices are installed in an air-conditioned Server Room adjacent to the Control Room. Access to the server room is restricted.

17.5 Process Plant Facilities Description

The process plant is oriented along an east-west axis. Plant feed is introduced near the middle of the plant length. In the middle of the plant is the secondary cone crusher, the scrubbers and primary screening. On the west side of the plant the HPGR is positioned, along with the water tanks and the thickener. On the East side of the plant the dense media separation modules are positioned and, in a separate building within the plant, the recovery. Coarse PK tails leave by conveyor from the North side of the plant.

Figure 17-5: Process Plant Oblique Isometric



Source: Process Plant Isometric (Hatch, 2013)

Two 30 t overhead cranes, with a 5 tonne auxiliary hoist, service the building.

Fire water pumps are located in a modular building on the north side of the process plant.

Compressors are located in a modular building on the south side of the process plant.

The security system divides the plant into “Red” (recovery plant / sort house; high-security) and “Blue” (remaining plant; lower-security) areas. The Red area is physically separated by steel cladding walls from the rest of the plant. All wall penetrations are sealed. Authorized entry and exit is controlled by fingerprint identification and a system of inter-locking doors. In addition, facilities are in place for the random selection of personnel exiting the Blue area for additional search. Mandatory search will be in effect for exit from the red area. Normal access to the plant (Red and Blue zone) is done through the PCC building located at the east side of the process plant.

18 Project Infrastructure

18.1 Re-Supply Logistics and Personnel Transport

18.1.1 Winter Road

The primary means of material supply for the Gahcho Kué mine is via the winter road. The winter road is typically open for a 60 day period from February 1 to March 30. The winter road consists of a 120 km spur road to Gahcho Kué which is connected to the Tibbitt-to-Contwoyto GKJV road shared between several other operating mines in the region. The winter road is used as the primary economic window for re-supply of bulk and heavy loads including:

- Fuel (50 million L during peak operations);
- Ammonium Nitrate;
- Lubricants, emulsifiers and other bulk consumable liquids;
- Mining equipment (Haul trucks, shovels, drills, etc); and
- Bulk materials for infrastructure and plant upgrade projects.

These items, due to their size or required quantities would be considered un-economic or not feasible to be transported by air.

18.1.2 Air Freight

All freight transported to Gahcho Kué outside of the winter road season must be done via air. Routine air freight consists of high volume site consumables with limited storage capacity such as:

- Food;
- Non-critical maintenance parts for mobile equipment; and
- Explosive accessories.

The majority of heavy freight transport into Gahcho Kué is planned for the winter roads to minimize cost, however the airstrip is designed to accommodate Boeing-737 and L-382 Hercules aircraft capable of transporting up to 13,600kg and 21,800kg respectively for unplanned re-supplies of certain critical spares.

18.1.3 Personnel Transport

Personnel working at the Gahcho Kué mine site arrive by air transport during all seasons. Routine personnel charter flights are organized out of two primary locations directly to the GK Aerodrome:

- Calgary International Airport (YYC) – RJ85 jet aircraft twice weekly; and
- Yellowknife Regional Airport (YZF) – Turbo prop aircraft minimum 3x weekly.

18.2 On-Site Operations Support

On-site operational support is limited to those services which are deemed necessary to ensure the continuity of the 24/7 operation. These overhead services include:

- 1 full time medic;
- 1 full time IT personnel for troubleshooting and maintenance of site communications;
- Full time trainers to administer training on site procedures, policies, equipment operation and orientations; and
- Full time safety and environmental department.

Department heads typically work a four days on / three days off schedule and are on-site with general management weekly.

18.3 Corporate and Administrative

De Beers corporate and administrative support for the Gahcho Kué mine site is located off-site at the Calgary Operational Support Center. The facility is located at the Calgary International Airport which when required, promotes ease of travel to and from the mine site on planned weekly charters.

Corporate and administrative manpower based at the Calgary Support Center include:

- Corporate leadership team;
- Strategic business planning and long range mine planning;
- Mine accounting;
- Resource management and exploration;
- Permitting;
- Public relations;
- Technical support and I.T.; and
- Human Resources Management.

18.4 Site Layout

Figure 18-1: General Site Layout Drawing

Source: General Site Layout (De Beers, 2017)

18.5 Power Generation and Distribution

Power is generated by modular on-site diesel driven power plants. Five generators have been installed rated for 2,825 kWe output at 4,160 V/3Phase each. Each generator is provided in a modular enclosure with independent cooling and an 8-hour fuel tank. The generators are connected electrically using 5 kV switchgear.

The generators have been installed in an N+1+1 arrangement using three generators to meet average demands, one generator on stand-by and one available for routine maintenance. Total design operating load for the power station is 8.05 mW.

Power distribution is generally at 4.16 kV, with lesser loads supplied at 600 V. All plant site distribution is cable run within the utilidors as much as possible. Cable required for the outlying areas is run along the ground. The cables are suitably marked for safety purposes and to prevent damage.

The 4.16 kV feeders originating at the power plant are distributed to area substations throughout the site using overland cables adjacent to service roadways. These area substations step voltage down to 600 V for distribution to MCCs and power panels as required.

18.6 Fuel Supply, Storage and Distribution

The Gahcho Kué tank farm is designed for the storage and dispensing of diesel and oils, such as:

- Diesel fuel to feed all mobile equipment and powerhouse;
- Fresh and used lube-oil, fluids and greases for the mobile maintenance group; and
- Glycol for waste heat recovery.

These liquids will be stored in:

- Three 18,000 m^3 main storage fuel tanks;
- Eight 500 m^3 fuel tanks; and
- Ten 60 m^3 multi-usage tanks.

All fuel storage facilities are constructed with lined containment designed for 110% of the stored liquid capacity.

Diesel fuel and lubricants supplied to fixed infrastructure such as the powerhouse and truck shop are delivered via a permanent piping network. Fuel and lube supply to mobile equipment and remote infrastructure is done using a series of tandem axle fuel and fuel / lube distribution trucks.

18.7 Camp & Administration Office Complex

The Gahcho Kué camp and administrative complex was constructed as a pre-fabricated modular-type construction designed for arctic weather conditions. The facility rests on-top of temporary cribbing supports and does not included any concrete foundations. The facility is connected to the process plant, truck shop and other ancillary infrastructure using a series of arctic corridors.

The facility served as both the construction camp and mine operations camp, undergoing minor additions and modification since construction in 2014. To date the facility consists of the following components:

- 11 Dormitory wings;
- Kitchen and food storage facilities;
- Dining hall;
- Arrivals / Departure area;
- Medical center;
- Heated three bay fire hall;
- Gymnasium and recreational facilities;
- Training and cultural center;
- Personnel control center (PCC) building, including the process plant change rooms (blue area);
- Dry;
- Laundry facilities;
- Water treatment plant;
- Sewage treatment plant; and
- Server Rooms.

18.8 Truck Shop & Warehouse Facilities

The remote location of Gahcho Kué requires that all routine maintenance of the mobile production and service equipment be carried out on-site. To effectively accomplish the task, a fully equipped workshop, warehouse and offices were constructed. In addition to the structures proposed in the 2014 FS, several temporary structures were adapted post-construction for maintenance and warehouse purposes. A summary of maintenance and warehouse related facilities is listed below:

- Main five bay truck shop – All primary maintenance activities and warehousing for mobile production and support equipment.
- Megadome structure – Primary heated indoor warehouse facility.
- Welding shop – Re-purposed construction facility for welding and G.E.T repairs.
- Light vehicle shop – Temporary construction maintenance shop, re-purposed specifically for light vehicle maintenance.
- Tire Shop – Dedicated structure for all tire repairs and replacements.
- East laydown – Primary winter road freight offload point for large freight complete with scales.
- West Laydown – Adjacent to the megadome and process plant this is the primary outdoor warehouse location for critical process spares.

18.9 Ancillary Facilities

Ancillary facilities constructed for the operation of Gahcho Kué are as follows:

- Mobile aggregate crushing plant;
- Fresh water treatment module;
- Sewage treatment module;
- Microwave communications antenna;
- Incinerator;
- Mine operations muster;
- Ammonium nitrate storage facility;
- Bulk emulsion plant;
- Explosives storage magazines; and
- Environmental laboratory, geo-sampling facility and dust monitoring facility.

18.10 Aerodrome

The gravel strip aerodrome has been designed to Transport Canada specifications for landing approach angle, runway lighting, lighted windsocks, standard and RNav GPS approach, non-directional beacon, AWOS and VHF radio facilities. The aerodrome will also be outfitted with an aircraft radio control of aerodrome lighting unit (ARCAL). Additionally, the strip has been equipped with basic de-icing, refueling and airport firefighting capabilities. Overall length of the strip is 1,676m and overall width is 46m, not including run-off or graded areas.

The airstrip length and width has been constructed and certified to accommodate 737-type jet aircraft and is regularly serviced by RJ85 and Boeing-737 jets for passengers and cargo respectively.

18.11 Roads

18.11.1 Winter Access Road

The winter access road links the project site with the existing Tibbitt-to-Contwoyto to winter road at MacKay Lake. A 120 km winter access road spur off the north end of MacKay Lake will be constructed each year to connect the Project site to the Tibbitt-to-Contwoyto winter road at km 271, just north of Lake of the Enemy. The winter access road will be constructed and operated in accordance with license and regulatory conditions and with appropriate updates and improvements as required.

18.11.2 Site Roads

Site haul, access and service roads are constructed using crushed and screened mine rock, as well as suitable overburden material and run of mine rock. Site roads have been classified into three types, each with specific design requirements. The three types of roads are as follows:

- Mine Haul Road: Primary haulage routes on site, excluding in-pit and waste dump roads designed to 3x the width of the 218 t haul fleet.
- Main Access Road: Access to mine site facilities from winter road and the N11 discharge (11 m minimum width).
- Service Road: Used to access site infrastructure off primary haul routes (10 m minimum width).

Road materials are a mix of till material and run-of-mine blast rock for fill and sized crush rock for surfacing. The structure of the mine haul roads includes a maintained road surface comprised of 40 mm minus gravel, this surface will be placed on top of a minimum fill embankment of 1700 mm run of mine or till.

It is expected that regular grading and levelling using crushed gravel will be required to keep the roads in an acceptable condition to reduce wear and tear on the trucks and tires.

18.12 Fire Protection and Emergency Response

18.12.1 Fire Protection

Fire protection for each facility in the plant site area consists of a combination of hydrant / hose stations, sprinkler systems, heat and smoke detection and portable chemical fire extinguishers. Fire-fighting water is provided from dedicated storage tanks and fire pumps.

The fire water reserve and pumping system for the plant site is located inside the process plant. Here, the lower 500 m^3 of the reclaim water tank is dedicated fire water storage. This capacity will allow for two hours of fire-fighting. If an extended fire-fighting time is required, the remaining capacity of the raw water tank and the capacity of the process water tank can be used.

Two 250 m^3/h pumps—one electric and one diesel (back-up)—along with a pressure maintaining jockey pump provide the line pressure and volume to sustain fire-fighting water requirements to any one of the main areas within the plant site.

18.12.2 Emergency Response

The Gahcho Kué mine site is equipped with a volunteer emergency response team. Emergency response activities are based out of a heated three bay fire hall attached directly to the medical center. The emergency response group are equipped with a conventional pumper fire truck, modern four-wheel drive ambulance and Panther 6x6 ARFF fire truck for aircraft fire and rescue. The team consists entirely of volunteers which attend mandatory practices with minimum hours outline by the NWT Mines Health and Safety Act.

19 Diamond Market and Sales Process

19.1 Diamond Market Outlook

JDS has relied on MPD marketing group to provide a current overall description of the diamond market outlook.

Q4 of each year is the defining period for consumer diamond jewellery demand, with Thanksgiving and Christmas in western markets, and Diwali in India, as major gifting occasions. Overall, Q4 2017 retail demand was strong, giving a boost to an otherwise mediocre year. Against a backdrop of moderated supply volumes, this has driven buoyant rough demand into Q1 2018.

US holiday sales exceeded expectations, achieving year-on-year growth of 5-6%. Retail landscape continues to shift, with declining mall traffic and fiercer competition and discounting amongst mall-based outlets. Bricks and mortar retailers continue to contract, but at slowing rate. Online channels growing and performing strongly; double-digit growth is anticipated for 2018.

In Asian markets, recovery of Hong Kong is particularly encouraging. Hong Kong visitor numbers from mainland China were up 8% year-on-year in November and December. Major retailers all posted double-digit growth in Q4 for Hong Kong, although this was offset by a more static picture in mainland China. However, early reports following recent Chinese New Year indicate strong sales from jewellery retailers.

In India, Diwali season closed out well and exceeded expectations, helped by the lifting of government reporting regulations on jewellery transactions.

Global high-end brands are performing well, with Tiffany, Richemont, Kering and LVMH all posting strong results for jewellery business units.

Strong Q4 demand in all the major consumer centres resulted in good polished sell-through from polished wholesale markets. This depleted stocks in cutting centres, driving demand for rough replenishment. The unusually long gap in major rough producer sales between December and January reinforced this, resulting in high demand in January.

Manufacturing margins remain relatively thin as polished prices have been slow to increase, although smaller diamonds in particular have rebounded slightly. In view of this, the major producers have kept rough diamond pricing stable, keen to avoid volatility seen in recent years. However, given strong demand, rough traded on the secondary market is sold at premium, and producers selling through auction and tender systems have achieved higher prices.

Midstream financing remains a concern in the market. Major western banks have been withdrawing from the industry in recent years, creating increased dependence on Indian banks, who appeared solid. The recent Nirav Modi banking fraud, whilst quite isolated from midstream banking practices, may result in a more cautious approach by Indian banks.

Overall, the near-term outlook remains solid and the rough market is expected to be stable. Longer term, based on the analysis contained in the Bain & Company Global Diamond Industry report of December 2017, moderate demand growth of 1% to 4% can be expected, however the report also cautions that overlaps in short term supply and demand may create uncertainty in mid-term price evolution.

19.2 MPD Marketing and Sales Process Overview

Mountain Province Diamonds sells its share of the GK mine production through its own unique distribution model. MPD's marketing team are involved at all steps of the sales process ensuring accuracy and consistency.

Production split and royalty valuation

MPD's 49% share of the Gahcho Kué production is confirmed after the JV royalty valuation/ production split is agreed between the Government of the Northwest Territories, MPD and De Beers Canada. These 49:51 production splits occur approximately every 5 weeks in Yellowknife, with a prearranged annual schedule agreed to by all parties. MPD's sale dates to customers are also set annually with individual sale dates aligned to industry buying cycles. MPD's 49% share of production is exported to India for sorting and valuation in accordance with this sales schedule.

To achieve earlier cash flows and reduce average working capital levels, MPD began expediting partial shipments of smaller-size (2 carats and smaller) diamonds half-way through the accumulation period in Yellowknife. Smaller sizes can be mechanically split to JV proportions, with valuation cut-offs remaining in Yellowknife for the royalty valuation and GNWT's checks. These goods are processed in India and are rolled with goods destined for the earlier sale.

The setting of both production split and sale dates, are driven by external factors; the former by GNWT valuation dates and De Beers, and the latter by the industry buying cycles which revolve around De Beers' sights. There is also a three-week processing time required by the contractor in Yellowknife (DDMI's Product Splitting Facility) to receive all goods from Gahcho Kué mine, size and clean the goods, and prepare the 100% production for JV splitting and royalty valuation.

Fancies and Specials (Fancies are coloured diamonds, Specials are diamonds larger than 10.8 carats) are settled through an internal tender process with De Beers. Highest bidder pays the opposing JV partner their respective share of the bid price.

The average time from production split in Yellowknife to closure of sale in Antwerp was 55 days.

MPD sorting, valuation and sale

Diamond sorting and valuation is completed in Visakhapatnam, India by the Constell Group, a highly respected diamond services contractor whose clients include other major diamond producers and jewelers.

The Gahcho Kué orebody and product profile are complex, producing a broad range of white commercial goods together with large, high value Special stones and higher than expected volumes of small, brown diamonds. The Gahcho Kué product also exhibits varying degrees of fluorescence.

Each of these product types has a market and an established customer base. All Gahcho Kué goods, with the natural exception of some industrials, are sold into market segments that cut and polish the rough, with resultant polished destined for the major diamond jewelry markets of the US, India and China. MPD's diamonds are sold independently on the open market as a discrete production and to date a 100% sell-through rate has been achieved.

Competitive tender sales are conducted in Antwerp and operated by Bonas Group ('Bonas'), the world's oldest diamond brokering and consultancy firm. Ten sales are scheduled per year with lot viewings and tender logistics managed by Bonas. Bids are submitted through an online bidding system, offering a simple, secure and convenient process for buyers. Lots are sold to the highest bidder and Bonas facilitates the collection of payment and delivery to winning bidder. Payment terms are five working days.

Market interest in the MPD tender sales has been strong from the outset, with customer participation rates increasing since the initial sale. An average of 11 bids per lot were received in 2017, with individual tenders offering approximately 125 lots per sale. There is a high level of customer competition for Gahcho Kué diamonds with over 100 companies bidding each sale. MPD is confident these high levels of competition deliver the maximum, current market price.

MPD customers include polished and jewelry manufacturers, rough traders and financiers, with operations in the major diamond markets of Belgium, India, Israel, UAE and China. This high calibre of participating companies indicates that industry leaders are investing in the product for the long term. MPD’s direct and independent control over its sales provides a highly visible chain of custody.

19.3 Diamond Pricing

MPD provided updated diamond price baseline data. Modeled diamond prices for of the three Gahcho Kue mine pits are updated based on actual sales information for 5034 and revaluation of the Hearne and Tuzo bulk sample parcels. JDS relied upon and reviewed the underlying data and pricing valuation methodologies and is of the opinion that the modelled diamond prices used reflect reasonable prices to use for baseline 2018 diamond prices for the GK current and planned production.

Based on their outlook for the market, MPD has also provided a baseline 2% real growth factor in diamonds prices, year to year, to be applied to future production. JDS compared the MPD price growth factor to those price factors utilized by other Canadian diamond producers and is of the opinion that the MPD factor is reasonable.

19.3.1 5034 Diamond Prices

The Gahcho Kue Mine has, thus far, produced a complex profile with large high value stones mixed with higher than expected volumes of small brown diamonds. All production to date has been sourced from the 5034 pit. Mountain Province Diamonds provided JDS a detail breakdown of sales to date for the diamonds recovered and sold in 2017.

MPD completed 11 sales to date, selling its share of the Gahcho Kué production mined from the onset of production up through November 2017. GK production is currently sourced from the various lobes of the 5034 pipe. The operator produces high level monthly production reports with estimates of total carats recovered by mining location, however this information does not directly translate to the goods included in each production split and, with the minor exception of two discrete lobe processing tests conducted in 2017, production is not differentiated by lobe when shipped to Yellowknife for initial processing. As the diamonds from the 5034 lobes become intermingled as part of the GK operations, only a global 5034 diamond price can be reasonably assessed.

Based on the actual 5034 production and sales data (MPD split proportion only), along with the pricing trends throughout the year, the 2018 baseline unit carat price for the average 5034 diamond was determined to be US$70/carat.

19.3.2 Hearne

In March 2018, MPD’s Marketing personnel travelled to Yellowknife and conducted a re-valuation of the Hearne bulk sample parcel of diamonds. The Hearne bulk sample parcel totals 2,905 carats recovered from the Hearne pipe. The sample parcel was valued by MPD at US$53/carat.

The new valuations were then applied to the expected size frequency distribution model for the Hearne diamonds. Where the bulk sample parcel size fractions have a representative number of stones to be statistically significant the new valuation were used and for larger stone fraction sizes pricing was adjusted to reflect the 2014 models quality. Specifically for the +11 to -3 sizes the pricing model uses the new bulk sample valuation results. For 3GR-10CT, with lower sample volumes, pricing models by size assume the average quality distribution from 2014 model, re-valued to current MPD pricing projections. This results in a modelled average carat value for the Hearne diamonds at US$75/carat to be used as the 2018 baseline price.

19.3.3 Tuzo

Similar to Hearne, MPD Marketing personnel also re-valued the Tuzo bulk sample parcel totaling 2,322 carats to current market values. The Tuzo parcel was valued at an average value of US$192/carat. Again the current valuations were applied directly for the smaller diamond fraction sizes and to the previous predicted quality models for Tuzo resulting in a modelled average carat value for the Tuzo diamonds to be US$72/ct to be used as the 2018 baseline price.

20 Environmental Studies, Permitting, & Social / Community Impact

20.1 Permits

The Gahcho Kué Diamond Mine is in full compliance with all existing permits, authorizations and licences. Table 20-1 provides a summary of the regulatory permits, licences and authorizations applicable to the Gahcho Kué Mine. The mine is currently in compliances with all legal requirements.

Table 20-1: Existing Permits, Licenses and Authorizations

Permits, Authorizations and Agreements	Legislation	Agency	Expiry and Tenure
Archaeological Research Permit 2014-004	*NWT Archaeological Research Act*	Prince of Wales Northern Heritage Centre, Department of Education, Culture and Employment, GNWT	• Issued annually as needed for archaeological research during any phase that research is deemed necessary.
Wildlife Research Permit WL 500291	*NWT Wildlife Act*	Department of Environment and Natural Resources, GNWT	• Expiry December 31, 2018 • Permit will be needed for each phase of mine life for a wildlife monitoring plan. • Permits are issued annually.
Scientific Research Licence 15582	*NWT Research Act*	Aurora Research Institute	• Expiry December 31, 2018 • As needed for Socio-economic and Traditional Knowledge field work and investigations, and aquatic and wildlife effects monitoring plans. • Licences are issued annually.
Surface Leases: 75N/6-2- 2, 75N/6-3-2, 75N/6-5-2, 75N/6-7-2, 75N/6-8-2	*Territorial Lands Act* and Regulations	GNWT, Lands Department	• Expiry August 31, 2035 (in approval process). • Maximum 21 year lease for winter access road then renewal to cover final years.
Mineral Leases: 1. NT-4199, NT-4200, NT-4201 2. NT-4341	*Territorial Lands Act Northwest Territories and Nunavut Mining Regulations*	Mineral and Petroleum Resources Directorate, Aboriginal Affairs and Northern Development Canada	• Expiry: 1. July 15, 2023 2. July 17, 2023 • Initially issued from AANDC for 21 years; renewable for a further 21 years.
Type A Water Licence MV2005L2-0015	*Mackenzie Valley Resource Management Act*	Mackenzie Valley Land and Water Board	• Expiry September 30, 2028. • Renewable for additional years to cover remaining

Permits, Authorizations and Agreements	Legislation	Agency	Expiry and Tenure
	Northwest Territories Waters Act *Northwest Territories Waters Regulations*		phases of mine life (Licence tenure in renewals may be variable as dictated by the MVLWB).
Class A Land Use Permit MV2005C0032	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	Mackenzie Valley Land and Water Board	• Expiry August 10, 2019. • Permits generally issued for five years, possibility for extension to seven years with renewal thereafter.
Class A Land Use Permit MV2018C001 (Exploration Activities)	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	• Permit submitted February 15, 2018. Approval in process.
Fisheries Authorization no. 03-HCAA-CA6- 00057.1 for the destruction of habitat associated with the following activities: 1. Dewatering of Kennady Lake and Lake D1 2. Construction of dykes	*Fisheries Act*	Fisheries and Oceans Canada, Fish Habitat Management	• Expiry December 31, 2020 for completion of habitat destruction and compensation. • Further authorization needed at each stage of renewal of Water Licence or Land Use Permit, if fish habitat is harmfully altered, disrupted, destroyed.
Licence to Fish for Scientific Purposes S-15- /16-3000-YK	*Fisheries Act* *NWT Fisheries Regulations*	Fisheries and Oceans Canada, Fish Habitat Management	• Renewed annually. • Granted for Kennady Lake fish- out (completed August 2015).
Approval for Constructing Works in Navigable Water 14-1087	*Navigable Waters Protection Act*	Transport Canada, Canadian Coast Guard	• Expiry April 1, 2019.
Approval of Waste Dump, Dam, or Impoundment Plan	*Mine Health and Safety Act (Territorial)*	GNWT, Chief Inspector, Workers Compensation Board.	• Granted, no expiry indicated.
Hazardous Waste Generation, Transport and Storage Permit NTG537	*Canadian Environmental Protection Act*	Department of Environment and Natural Resources Canada	• Granted, no expiry indicated.
Hazardous Waste Storage Permit NTR138	*Canadian Environmental Protection*	Department of Environment and Natural Resources Canada	• Granted, no expiry indicated.

Permits, Authorizations and Agreements	Legislation	Agency	Expiry and Tenure
	Act		
Explosive Storage, Explosives Handling, Magazine Permits 2015- 0105-0106-0107 Permit to Store Detonators 2015-0104	*Mine Health and Safety Regulations (Territorial)*	GNWT, Chief Inspector, Workers Compensation Board.	• Expiry December 31, 2020. • Long-term authorization needed for all phases of mine until closure is complete.
Registration of Fuel Storage Tanks	*Canadian Environmental Protection Act*	Environment Canada with cooperation from Aboriginal Affairs and Northern Development Canada	• Granted, no expiry indicated.
Approval to Transport Dangerous Goods	*Transportation of Dangerous Goods Act*	Transport Canada	• Undergoing renewal. • Long-term authorization needed to transport dangerous goods for all phases of the mine until closure is complete.
Ni Hadi Xa Agreement		Tlicho government, the North Slave Métis Alliance, NWT Métis Nation, Lutsel K'e Dene, and Deninu Kué First Nation.	• One year past the end of active closure.

Source: JDS, 2014

The water licence for the Gahcho Kué Diamond Mine (Type "A" Water Licence (MV2005L2-0015) sets out several conditions with respect to alteration, diversion or otherwise use water for the purpose of mining. The water licence was issued in 2014 has a term of 16 years and will require a renewal on or before September 2028.

The Gahcho Kué Diamond Mine is subject to the Authorization for Works or Undertakings Affecting Fish ("Fisheries Authorization") issued by Fisheries and Oceans Canada (DFO 2014). The Fisheries Authorization outlines reporting requirements and approvals, and compensation requirements for the "serious harm" to fish. The finalization of options for fish habitat compensation to account for serious harm to fish associated with the Project has been developed in consultation with regulatory agencies. The current draft Offsetting Plan (formerly "No Net Loss Plan") (Golder Associates Ltd., 2012) for Gahcho Kué includes the development of two habitat compensation options. The first is habitat enhancement through development of new trout spawning and nursery habitat in Kennady Lake while mining is underway so that a high quality fish habitat is in place when Kennady Lake is refilled at closure. The second option is the Redknife Bridge Culvert rehabilitation to allow for the passage of fish to the upstream reaches of the Redknife River. The rehabilitation of the culvert has the ability to provide more fish habitat than is being lost by the Mine.

The federal explosives permit approves and regulates the operation of the bulk explosives manufacturing facility and ensures the safety of personnel and property within specified radii surrounding the plant. This permit is issued to and holds responsible the explosives supplier as the owner and operator of the manufacturing plant on-site. Nothing in this permit precludes the requirements of the territorial mines act and regulations governing the storage, handling and use of the explosives in the mine.

The Gahcho Kué Diamond Mine's closure and reclamation liabilities are covered by financial security provisions required under the water licence.

20.2 Communities

The area around Gahcho Kué is sparsely populated. The closest community to the mine is Lutsel K'e, located 80 km southeast.

Historically, two groups of indigenous peoples have used the region surrounding Kennady Lake: the Dene and the Métis. A cultural heritage assessment and archaeological surveys were completed and approved as part of the original mine development planning.

During the mine's original approval process, De Beers committed to the priority hiring of northern residents and indigenous people born in the Northwest Territories and their descendants. De Beers has an effective communities program that has been in place for several years and will continue through post-closure.

De Beers entered into six impact benefit agreements as part of the mine development:

- Socio-Economic Monitoring Agreement with the Government of the Northwest Territories. The Agreement outlines De Beers' commitments to local employment, economic benefits, cultural and community well-being and the monitoring of these requirements by a Board of community, government and De Beers' representatives.
- Environmental Agreement with five indigenous groups. Ni Hadi Ya. The agreement provides funding for independent environmental monitoring and engagement.
- Impact Benefit Agreements (IBAs) have been developed between De Beers and six indigenous groups that assert ties to the Gahcho Kué region include the following:
  - Tli Cho Government;
  - Yellowknives Dene First Nation;
  - Lutsel K'e Dene First Nation;
  - Denenukue;
  - North Slave Métis Alliance; and
  - NWT Métis Nation.

20.2.1 Tlicho Communities

Whati — The second-largest Tli Cho community had a 2010 population of 497, the majority of whom are aboriginal. A traditional lifestyle and economy are maintained in Whati is based almost solely on trapping, fishing and hunting. Employment is primarily with the governments of the First Nation, the territory, and the hamlet. There is little in the way of private business besides a bed-and-breakfast and convenience store. There is some employment by the three diamond mines, with employees working on rotation.

Gameti — Gameti had a 2010 population of 295 people. Approximately 7% of the population is non-aboriginal. Gameti was a seasonal hunting camp used by Tli Cho people for many years and became a more permanent settlement in the 1970s. Fishing, hunting and trapping remain a large part of the local economy and way of life. Some residents work at the diamond mining operations. A local business development corporation offers business services to Gameti residents and operates a motel, gas station, and a fishing camp.

Wekweeti — According to 2009 statistics, Wekweeti had a population of 140 people. Wekweeti's location on the Snare River was originally for fishing and travel. Today, the river is the location of a series of dams and powerhouses that provide hydroelectricity to Yellowknife and Behchoko. Tourism is strong with fishing and hiking outfitting services offered in the area.

20.2.2 The Yellowknife's Dene First Nation (YKDFN):

Dettah — Dettah is a small aboriginal community of 257 people (2009 NWT Statistics). Economic activities include government, private enterprise and mining-related work. Many residents of Dettah are employed in nearby Yellowknife. The YKDFN also has a business arm called the Det'on Cho Corporation whose mandate is to create training and job opportunities for Yellowknife's Dene and bring in revenue through profitable business ventures. The corporation includes over 20 companies in the construction transportation, logistics, and training and management sectors.

N'dilo — N'dilo is an aboriginal community of 257 people (2009 NWT Statistics) located at the outskirts of Yellowknife, a short walk from Yellowknife's "Old Town". Some residents retain a traditional Dene lifestyle, fishing and hunting nearby, while others work in Yellowknife and at the diamond mines. The main occupations are related to government, private enterprise and mining-related work. There is a business arm, the Det'on Cho Corporation, as noted above for Dettah.

20.2.3 Lutsel K'e First Nations (LKDFN):

Lutsel K'e — This Dene community has approximately 312 residents. Languages spoken are Chipewyan and English. The local economy is largely traditionally based with hunting and trapping remaining key occupations for most residents. Arts and crafts are important as well. In recent years, efforts have been made to develop the tourism potential of the area. A fishing lodge is located near the community and accommodation is available there. There is also some employment with the mines. The Denesoline Development Corporation, based in Lutsel K'e, manages the for-profit businesses owned by the Lutsel K'e membership and provides management services to the Limited Partnerships in which Denesoline Corporation has an interest.

20.2.4 North Slave Métis Alliance (NSMA):

Métis are a culturally distinct group of indigenous people that emerged from the relations of aboriginal women and European men. Based in Yellowknife, the North Slave Métis Alliance (NSMA) is a non- profit organization whose core mandate is to represent the interests of the direct descendants of the Métis of the North Slave region of the Northwest Territories. Its objectives include negotiation and implementation of a land and resources agreement, founded on the principles of self-government and to promote the educational, economic, social and cultural development of the Métis of the region. The economic development arm of the NSMA is MÉTCOR Inc., formed to create business and employment opportunities for Métis in the North Slave region of the Northwest Territories. MÉTCOR's joint ventures and subsidiary companies provide a range of services to the territory's mining industry, creating direct and indirect employment and contracting opportunities for members of the NSMA.

20.2.5 Deninu K'ue First Nations (DKFN):

Deninu K'ue means "moose island" and is a settlement corporation at Fort Resolution, southwest of the Slave River Delta on the south shore of Great Slave Lake. According to Aboriginal Affairs and Northern Development Canada, as of December 2012, the Deninu K'ue First Nation (DKFN) has a total registered population of 878 people. DKFN have asserted that their traditional territory extends into the region. The DKFN own, operates and are participants in joint venture agreements in the region.

20.2.6 The Northwest Territory Métis Nation (NWTMN):

The Northwest Territory Métis Nation (NWTMN) represents the indigenous Métis of the South Slave region. They are the Aboriginal descendants of the Cree, Slavey and/or Chipewyan people of the South Slave region. The home communities of the NWTMN are Hay River, Fort Resolution and Fort Smith. The Metis currently and historically undertake hunting and trapping in the region. The NWTMN owns, operates or are in joint venture in the region.

20.3 Land Use and Mineral Tenure

The Gahcho Kué Mine operates within five adjoining Land Lease parcels administered by the GNWT. The Land Lease requirements overlap with those outlined in the Water Licence (MV2005L2-0015), with an additional requirement that addresses the "deposit and maintenance of financial security deposit". Financial security estimations summarized in Section 10 of this document. The Land Use Permit (MV2005C0032) also includes conditions specific to the development of an ICRP, and execution of the approved reclamation activities within a specified timeline. These requirements are satisfied through conformance with conditions detailed in the Water Licence (MV2005L2-0015).

20.4 Environmental Management

The mine's environmental management system is ISO 14001 certified. A full-time environmental staff is responsible for monitoring, directing, reporting and communicating on environmental matters.

Key areas of environmental management and monitoring include:

- Ecological monitoring and sampling;
- Wildlife monitoring and management;
- Water flow management in open pit;
- Acid generation potential of waste rock;
- Sewage water;
- Treatment of effluent water and removal suspended solids;
- Ammonia, phosphorus and suspended solids in effluent water discharged to downstream;
- Effluent water monitoring to determine potential toxicity to fish; and
- Mine closure planning, reclamation research and site rehabilitation activities.

Water quality monitoring activity includes surveillance of water in and around the mine site, and an aquatic effects monitoring program that measures changes in the downstream aquatic environment. Results from water quality monitoring programs are reviewed to identify the need for any follow-up action.

De Beers monitoring programs are focused on assessing the potential effects of the mine on wildlife and wildlife habitat. This helps to determine if predictions made in the environmental assessment are accurate and help assess the effectiveness of mitigation strategies. The mine staff conducts caribou, raptor, wolverine, grizzly bear, and other wildlife monitoring programs. Caribou are a key indicator species because of their cultural and economic value to northern residents as well as being of ecological importance. Low-impact behavioral surveys of caribou are undertaken at varying distances from the mine. Ni Hadi Ha also undertakes independent monitoring and review of data collection and reporting.

Every three years, mine environment staff undertake studies to measure dust deposition on lichen, both on- and off-site. Lichen is very important as a food source for caribou throughout the year. De Beers undertakes engagement sessions and workshops to incorporate both scientific methods and traditional knowledge into the work.

The complete range of environmental monitoring and study programs includes:

- Dust monitoring:
  - suppression of dust generated by the mine operation dust sampling and dispersion behaviour by season use of suppressants air quality monitoring;
  - meteorology; and
  - measurement of wind speed and direction, temperature, humidity, precipitation, evaporation, solar radiation.
- Water quality:
  - sample collection and analysis;
  - water levels in ponds and dams;
  - makeup water usage; and
  - site water balance.
- Aquatic effects:
  - sampling and analysis for water quality, phytoplankton, zooplankton, benthic invertebrates, sediment chemistry, fish health; and
  - short- and long-term effects.
- Wildlife:
  - caribou, raptor and waterfowl, wolverine, grizzly bear, other wildlife; and
  - accuracy of predictions, effectiveness of mitigation strategies.
- Fisheries:
  - licence requirements; and
  - studies to determine metal concentrations in fish tissue.
- Reclamation research:
  - re-vegetation test plots; and
  - country rock test piles.

Government inspections provide assurances that Gahcho Kué remains in compliance with the legal provisions of permits and licences related to land and water use and waste management.

20.5 Mine Closure Planning

The Gahcho Kué Diamond Mine has a mine closure plan and cost estimate in place for closing the mining areas, dismantling buildings, capping / sealing the processed kimberlite containment, restoring the land, breaching the dikes and returning the lake water to original shoreline.

Financial security to cover the closure liability is in place and held by the Government of the Northwest Territories. In assessing the adequacy of the coverage, the territorial government obtained an independent review of the mine closure concept and cost estimate for the Gahcho Kué Diamond Mine from a recognized independent industry expert in 2014. The next comprehensive regulatory review of the security amount is scheduled for 2017.

The government's independent estimate of total mine closure cost for Gahcho Kué and the financial security amount levied on the mine for the liability provides substantially for the actual mine closure plans in place.

De Beers has had a mine closure plan for Gahcho Kué since project inception. The overall approach to reclamation and closure planning for Gahcho Kué conforms to both corporate and established international guidelines for mine closure. The closure plan is an ongoing work-in-progress with periodic updates based on long-term research underway in the field and a growing base of traditional knowledge gained from engagement with community members. As a requirement of the Type A water licence and land leases, a report is prepared annually to report to stakeholders on progress, research results, and ongoing changes to the interim closure plan.

The mine closure cost, being driven by the mine closure plan which is updated periodically, is likewise updated periodically and dialogues with the government are held regularly to ensure that the liability coverage remains appropriate.

The closure and reclamation security estimate for the Gahcho Kué Mine was completed on August 11, 2014 by the MVLWB (MVLWB, 2014). The MVLWB is authorized to set the security deposit amount by subsection 35 (1) of the Waters Act and the regulations promulgated under the act. The purpose of the security deposit is to ensure funds are available to complete reclamation of the site, inclusive of the closure and post-closure phases.

The financial security estimate is divided into land and water, where the land securities are held under the land use permit (MV2005C0032) and the water securities are held under the water licence (MV2005L2-0015). The payments are further divided into milestones, being:

- Prior to initiating construction activities;
- One year following the initiation of construction activities;
- Prior to Year 1 of operations;
- Prior to Year 4 of operations;
- Prior to Year 7 of operations; and,
- Prior to Year 11 of operations.

These milestones were selected as they represent time periods where key operational changes occur that affect reclamation. These operational changes are the beginning of mining and milling (Year 1), the end of mining Hearne Pit (Year 4), the end of mining 5034 Pit (Year 7) and the end of operations (Year 11). There is a clear spike in financial security in Year 4 as it marks the end of Hearne pit, as well as the beginning of pre-stripping and mining Tuzo Pit.

Table 20-2: Summary of construction and operations phase security (total) at project milestones (MVLWB, 2014)

Phased Payment Schedule	Cumulative Total	Land	Water
Construction Phase			
Prior to Initiating Construction Activities	$15.4	$11.8	$3.6
One Year following the Initiation of Construction Activities (2015)	$19.0	$11.8	$3.6
Operation Phase			
Prior to Year 1 of Operations	$37.6	$13.8	$23.8
Prior to Year 4 of Operations	$79.7	$15.2	$64.5
Prior to Year 7 of Operations	$82.1	$16.0	$66.0
Prior to Year 11 of Operations	$83.8	$16.7	$67.1
Total	**$83.8**	**$16.7**	**$67.1**

Source: JDS, 2014

20.6 Socioeconomic Agreement with GNWT

Early in the mine development, De Beers committed to northern training, employment, and business opportunities in addition to the environmental stewardship associated with sustainable development. To provide a formal mechanism for ensuring that environmental mitigation measures as well as social commitments were appropriately implemented and monitored, the environmental assessment of the Gahcho Kué Diamond Mine included a requirement for the aforementioned Socio-Economic Monitoring Agreement (SEMA).

20.7 Comment

The QPs are satisfied that the status of permitting, quality of environmental management, monitoring performance, positive community impacts and social acceptance support the economic viability of the estimated mineral reserves.

21 Capital and Operating Costs

21.1 Mine Development Capital Costs

The initial capital used to construct the Gahcho Kué Diamond Mine was spent between late 2013 and mid-2016. Capital projects incorporated into this phase of the project included:

- Pre-Development (*Exploration, Drilling, Engineering*);
- Airstrip;
- Process plant;
- Truck shop;
- Fuel farm;
- Explosive plant;
- Powerhouse;
- Camp and supporting infrastructure; and
- Bulk earthworks for infrastructure, airstrip and several water management structures critical to initial lake dewatering and pre-stripping of 5034.

The initial capital phase of the project was completed in 2016 on budget and ahead of schedule. Total capital cost of the project phase was reported as C$1,056M plus an additional C$259.5M in pre-development costs.

21.2 Sustaining Capital Costs

Since production commenced in 2016, plans for ongoing capital expenditures identified to sustain operations or further develop aspects of the mine's process and infrastructure have been developed. Sustaining capital expenditures include:

- Purchase of additional or replacement surface mining equipment;
- Replacement of light vehicles;
- Ongoing construction of water management structures and lake dewatering activities;
- Value added infrastructure development projects identified to improve the operation as a whole; and
- Purchase of critical spares.

Life of mine capital projects at the Gahcho Kué Mine are referred to as Stay in Business (SIB) Capital, and are forecasted on an annual basis with an emphasis placed on the upcoming budgeting year. Due to the seasonal nature of the ice road and optimum construction season, it is critical that these projects are scoped and budgeted in time to allow for procurement and mobilization to incorporate the winter road when required.

Capital cost assumptions in this report reflect the current life of mine SIB model for the mine as a whole.

Table 21-1: Sustaining Capital Expenditures Gahcho Kué Diamond Mine

Year	Unit	Mining	Process	Development Projects	TOTAL SIB CAPITAL
2018	C$M	41.1	4.5	9.0	54.6
2019	C$M	23.9	2.7	5.0	31.5
2020	C$M	2.5	1.5	8.7	12.7
2021	C$M	1.1	0.5	7.5	9.1
2022	C$M	0.8	3.5	3.0	7.4
2023	C$M	0.5	0.5	2.6	3.7
2024	C$M	0.5	0.8	2.6	3.9
2025	C$M	0.5	2.6	2.4	5.5
2026	C$M	0.1	0.3	2.8	3.2
2027	C$M	0.1	-	2.0	2.0
CLOSURE	C$M	-	-	-	62.5

Source: JDS, 2018

21.3 Operating Costs

Operating costs include all normal, recurring costs of production including:

- Open pit mining (labour, maintenance, fuel, explosives);
- Processing (process consumables, maintenance, engineering);
- Site & Corporate;
  - Power generation;
  - Site services, support and logistics;
  - Site labor;
  - Technical services; and
  - Corporate and administrative functions.

Operating budgets are based on first principal calculations provided by each respective department. Budgets are updated in detail annually to reflect changes in markets, consumable prices and site specific operating parameters. Annual budgets are scrutinized internally by department heads, senior management and strategic business planners to ensure costs align with business objectives and sufficient detail is present. Operating budgets are finalized to ensure adequate time for the procurement process to take place prior to the winter road season.

The Gahcho Kué Mine operating costs consist of both variable and fixed cost items. Variable costs have a linear correlation to cost drivers such as open pit production, equipment hours or process throughput, while fixed costs do not.

For the mineral reserves in this report and the schedule of mining and processing envisioned for them, Table 21-2 depicts modeled estimates of the associated operating costs by year in Canadian dollars and in real terms.

Table 21-2: Modeled Operating Costs

Year	Unit	Open Pit Mining	Processing	Site, Corporate & Closure	Total Operating Expense
2018	C$M	141.4	28.6	140.0	**310.0**
2019	C$M	151.6	32.2	135.8	**319.6**
2020	C$M	147.3	32.2	139.4	**319.0**
2021	C$M	149.1	33.4	136.9	**319.4**
2022	C$M	162.5	33.4	137.0	**332.9**
2023	C$M	160.0	32.9	135.1	**328.0**
2024	C$M	122.4	32.9	131.7	**287.0**
2025	C$M	109.4	32.3	131.2	**273.0**
2026	C$M	78.2	31.8	127.5	**237.5**
2027	C$M	54.7	31.8	122.2	**208.7**

Source: JDS, 2018

21.4 Continuous Business Planning

While strategic business plan updates happen annually, continuous business planning activities including quarterly and monthly reforecasting are practiced at Gahcho Kué. Historically production deficits are re-distributed throughout the year at the end of each production month in an attempt to keep production targets in line with the strategic business plan (SBP). Additionally, weekly, monthly and quarterly plans are generated within each business unit to identify and track against key production metrics relative to that unit. Departmental forecasting and planning is conducted at these intervals to capture and mitigate operational challenges such as equipment outages, weather delays and other potential production delays. When re-forecasting within business units, if targets or goals become unreasonable given the operations various constraints, planning challenges are elevated to upper management and the strategic planning team where decisions can be made on changes to the SBP.

22 Reserves Economic Viability Analysis

22.1 Introduction

This economic analysis is presented solely to demonstrate economic viability of the Gahcho Kué Mine mineral reserves and is presented on a 100% project basis. This analysis does not represent the actual business plans, tax positions or cash flows of either De Beers or MPD or their respective ownership of the Gahcho Kué Mine. The economic viability analysis of mineral reserves in this report represents a forward-looking view that is subject to known and unknown risks as well as other factors which may cause actual results to differ from those portrayed here.

Forward looking views in this report include but are not limited to:

- Future diamond values;
- Resource and reserve estimates;
- Mineability and recovery of the mineral reserve;
- Geotechnical assumptions;
- Production sequence, schedule and volumes;
- Processing rates and recoveries;
- Operating costs;
- Capital costs;
- Product sales;
- Exchange rates;
- Assumption that zero catastrophic events will occur;
- Assumption the mine will continue to maintain a social license to operate and all necessary permits;
- Assumption that the mine will continue to manage environmental risks in a way that does not negatively impact operations; and
- Assumption of retention of property title with no disputes.

Without limiting the generality of the above statements, certain specific risks can be highlighted. These risks have presented themselves during the 2017 operating year and have resulted in changes to reserves.

Specific risks impacting the Gahcho Kué Mine in 2017 are presented below:

- Geotechnical Assumptions: Open pit geotechnical issues and pit re-design**:** Geotechnical constraints that were different from the Feasibility Study resulted in new pit designs, higher waste rock tonnages adding additional operating costs to the LOM plan.
- Resource and Reserves estimates: The reserve grades for 5034 and average diamond quality of 5034 varied from those in the 2014 Feasibility Study. This resulted in higher carat production and lower $/ct sales prices. Grades in 5034 are higher than predicted in the 2014 Feasibility Study and

the average diamond quality of 5034 diamonds recovered to date have been a lower quality mix than originally predicted. These have been updated accordingly in this Technical Report.

- Future Diamond Values: Diamonds prices and markets have changed since the 2014 Feasibility Study. This resulted in lower unit carat sales price for the 5034 production and lower projected sales prices assumptions for the Hearne and Tuzo future production This Technical Report sets new baseline diamond prices for 2018 based on actual sales and updated valuations of diamond bulk sample parcels.

22.2 Reserve Determination

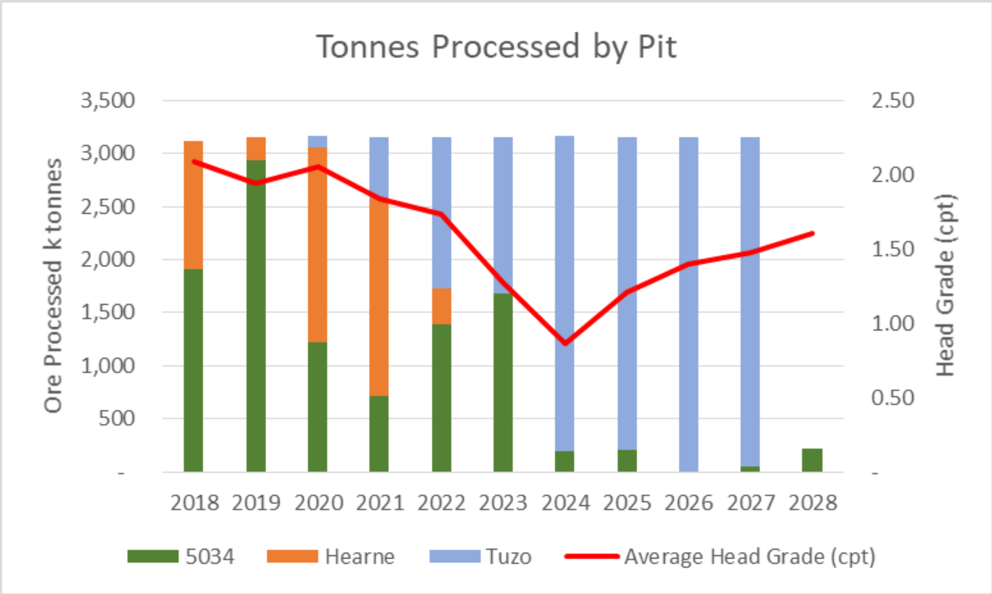
Due to the nature of mining kimberlite deposits at the Gahcho Kué Mine, cut-off grade economics are not used to convert ore into waste, or waste into ore. Kimberlite forms a discrete contact with the host granite rock clearly separating, in most cases visually, ore from waste. While the kimberlite itself may contain varying levels of granitic dilution, and varying levels of diamond grade and quality, diamonds are not found beyond the contact. Therefore, all Gahcho Kué kimberlites qualifying as reserves are mined with no selectivity, including zones of unexplained lower diamond content.

22.3 Discounted Cash Flow Analysis

An annual discounted cash flow analysis is presented in this report to demonstrate the economic viability of the mine operation to depletion of the current mineral reserves and validate the reserve determination. The cash flow is presented as that of the overall mine and does not differentiate between the portions shared by De Beers (51%) or Mountain Province Diamonds (49%). Economic reserve viability is considered to be demonstrated by the resulting overall positive cash flows.

The mine output and process throughput assumptions used for this cash flow analysis are considered to be within the capabilities of the Gahcho Kué Mine. These rates are based on known operating performance from 2017 and reflect the intentions of the mine production plan outlined in Section 16. Diamond recoveries are assumed to be 100% over a 1.00 mm screen slot size.

Figure 22-1: Ore Processing Profile



Source: Ore Processed (JDS, 2018)

Operating costs are explained in detail in Section 21.3 and are inclusive of all fixed and variable costs directly associated with the mine operation including closure. Costs summarized in Section 21.3 do not include any government royalties however they have been accounted for in the cash flow analysis. For the purpose of this analysis, territorial royalty of 13% has been directly applied to annual pre-tax cash flow. No third party royalties have been included in this cash flow analysis.

Taxation for the purposed of this report is applied to the Gahcho Kué Mine as a whole entity and on a simplified basis. In reality, De Beers and Mountain Province Diamonds are responsible for managing their own taxes in the Northwest Territories. For the purposes of this analysist, a corporate income tax 26.5% has been applied to net operating income after the territorial royalty.

Prices used for this analysis have been updated based on a combination of recent sales information from 5034 and a re-valuation of the samples from Hearne and Tuzo. Average prices are summarized below:

- 5034 US$69/carat – average sales price and parcel distribution 2017.
- Hearne US$75/carat – updated pricing for original bulk sample distributions.
- Tuzo US$72/carat – updated pricing for original bulk sample distributions.

A price escalator of 2.0% has been applied equally to all 3 pipes, and assumes year by year escalation of prices by 2.0% starting in calendar year 2017.

An exchange rate between Canadian and U.S. currencies has been assumed to be C$/US$ = 1.28.

Inflation has not been considered in this analysis as the analysis is discounted and all amounts are in present dollars.

The discounted cash flow analysis indicates positive economics for the mineral reserves over the remaining ten year mine life. Assuming a 7% discount rate, the mine presents a net present value (NPV) of C$857 Million / US$669M.

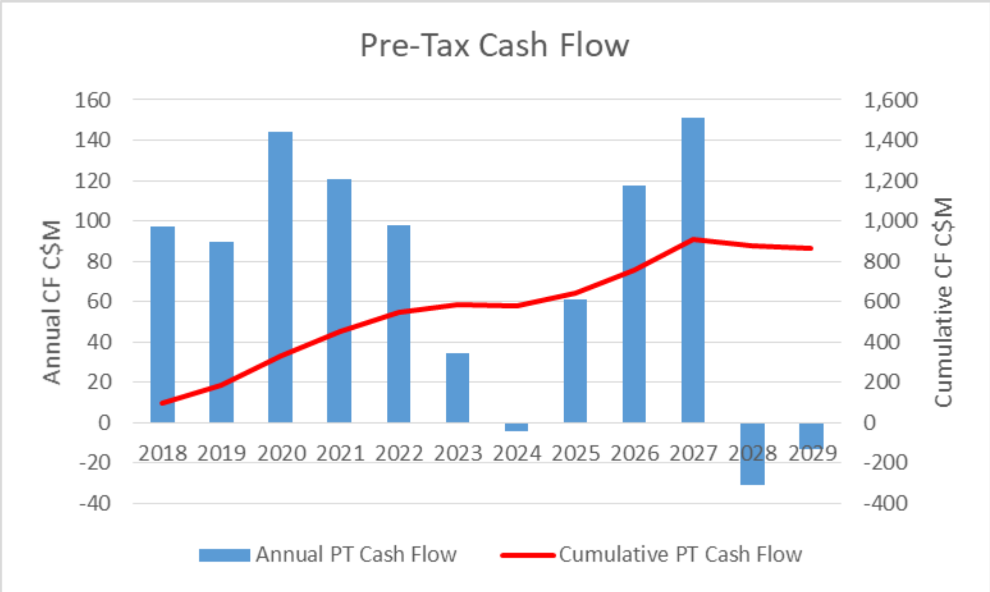
Note: The cash flow model shown in Figure 22-3 is presented solely to indicate the economic viability of the mineral reserves stated in this report. The cash flow is not a forecast of either De Beers or Mountain Province Diamond's share of the cash flow from the Gahcho Kué Mine nor does it reflect the actual business model of either De Beers or Mountain Province Diamonds in terms of depreciation, amortization, financing and interest charges, use of tax loss carryforwards, etc., all of which would impact royalty and income tax payment levels.

Figure 22-2: Gahcho Kué Discounted Cash Flow Analysis

Mountain Province Diamonds Gahcho Kue 43-101 *Economic Model*	Unit	Total	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
PRICE														
Average Carat Price	US$/Carat	**78.72**	71.73	71.34	75.84	77.83	77.24	78.14	81.09	82.70	84.56	86.20	84.79	0.00
Escalation	Annual %	**2%**	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
F/X Rate	USD:CAD	**0.78**	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
MINE PRODUCTION														
Waste Mined														
5034	k tonnes	**89,346**	38,695	31,513	6,327	1,491	7,118	4,203	0	0	0	0	0	0
Hearne	k tonnes	**42,801**	4,646	11,057	19,391	7,708	0	0	0	0	0	0	0	0
Tuzo	k tonnes	**179,862**	0	570	13,572	29,750	35,810	36,819	31,913	21,435	9,069	922	0	0
Subtotal - Waste Mined	**k tonnes**	**312,009**	**43,341**	**43,140**	**39,290**	**38,948**	**42,928**	**41,022**	**31,913**	**21,435**	**9,069**	**922**	**0**	**0**
Ore Mined														
5034	k tonnes	**9,519**	1,998	2,868	928	334	1,557	1,834	0	0	0	0	0	0
Hearne	k tonnes	**5,460**	1,206	214	1,834	2,205	0	0	0	0	0	0	0	0
Tuzo	k tonnes	**15,721**	0	0	103	668	1,473	1,506	2,857	2,866	3,706	2,543	0	0
Subtotal - Ore Mined	**k tonnes**	**30,699**	**3,204**	**3,082**	**2,865**	**3,207**	**3,030**	**3,340**	**2,857**	**2,866**	**3,706**	**2,543**	**0**	**0**
Total Material Mined														
5034	k tonnes	**98,865**	40,692	34,381	7,255	1,825	8,675	6,037	0	0	0	0	0	0
Hearne	k tonnes	**48,261**	5,852	11,271	21,225	9,913	0	0	0	0	0	0	0	0
Tuzo	k tonnes	**195,582**	0	570	13,675	30,417	37,283	38,325	34,770	24,301	12,775	3,466	0	0
Subtotal - Material Mined	**k tonnes**	**342,708**	**46,544**	**46,222**	**42,155**	**42,155**	**45,958**	**44,362**	**34,770**	**24,301**	**12,775**	**3,466**	**0**	**0**
Total Material Treated														
	k tonnes	**31,720**	**3,115**	**3,153**	**3,161**	**3,153**	**3,153**	**3,153**	**3,161**	**3,153**	**3,153**	**3,153**	**215**	**0**
Treated Material Grade														
	cpt	**1.58**	**2.06**	**1.90**	**2.04**	**1.83**	**1.73**	**1.27**	**0.87**	**1.21**	**1.40**	**1.48**	**1.55**	**0.00**
Contained Carats														
	k carats	**50,066**	**6,422**	**5,997**	**6,458**	**5,765**	**5,461**	**4,016**	**2,742**	**3,806**	**4,410**	**4,654**	**334**	**0**
Strip Ratio - OP only	w:o	**6.2**	6.7	7.2	6.1	6.8	7.9	10.2	11.6	5.6	2.1	0.2	0.0	0.0
MILL FEED														
Ore Processed	**k tonnes**	**31,720**	**3,115**	**3,153**	**3,161**	**3,153**	**3,153**	**3,153**	**3,161**	**3,153**	**3,153**	**3,153**	**215**	**0**
Ore Grade	**cpt**	**1.58**	**2.06**	**1.90**	**2.04**	**1.83**	**1.73**	**1.27**	**0.87**	**1.21**	**1.40**	**1.48**	**1.55**	**0.00**
Contained Carats	**k carats**	**50,066**	**6,422**	**5,997**	**6,458**	**5,765**	**5,461**	**4,016**	**2,742**	**3,806**	**4,410**	**4,654**	**334**	**0**
	US$M	**3,902**	**461**	**428**	**490**	**449**	**422**	**314**	**222**	**315**	**373**	**401**	**28**	**0**
Recovery	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	k carats	**50,066**	**6,422**	**5,997**	**6,458**	**5,765**	**5,461**	**4,016**	**2,742**	**3,806**	**4,410**	**4,654**	**334**	**0**
REVENUE														
Payable	%	**100%**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	k carats	**50,066**	6,422	5,997	6,458	5,765	5,461	4,016	2,742	3,806	4,410	4,654	334	0
Payable Value	US$M	**3,902**	461	428	490	449	422	314	222	315	373	401	28	0
	C$M	**5,003**	591	548	628	575	541	402	285	404	478	514	36	0
Selling Costs	US$M	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	C$M	**0**	0	0	0	0	0	0	0	0	0	0	0	0
Royalties	% of Value	**0%**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	US$M	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	C$M	**0**	0	0	0	0	0	0	0	0	0	0	0	0
Net Revenue	**US$M**	**3,902**	**461**	**428**	**490**	**449**	**422**	**314**	**222**	**315**	**373**	**401**	**28**	**0**
	C$M	**5,003**	**591**	**548**	**628**	**575**	**541**	**402**	**285**	**404**	**478**	**514**	**36**	**0**
OPERATING COSTS														
Mining - OP	C$/tonne	**4**	3	3	3	4	4	4	4	5	6	16	0	0
	C$M	**1,277**	141.4	151.6	147.3	149.1	162.5	160.0	122.4	109.4	78.2	54.7	0.0	0.0
Closure	C$/tonne	**1**	1	1	1	1	1	1	1	1	1	1	7	0
	C$M	**20**	4	2	2	2	2	2	2	2	2	2	1	0
Processing	C$/tonne	**10**	9	10	10	11	11	10	10	10	10	10	11	0
	C$M	**324**	29	32	32	33	33	33	33	32	32	32	2	0
G&A	C$/tonne	**43**	44	43	44	43	43	42	41	41	40	38	160	0
	C$M	**1,353**	136	134	138	135	135	133	130	130	126	121	35	0
Subtotal - OPEX	**C$/tonne**	**94**	**100**	**101**	**101**	**101**	**106**	**104**	**91**	**87**	**75**	**66**	**178**	**0**
	US$M	**2,319**	**242**	**249**	**249**	**249**	**260**	**256**	**224**	**213**	**185**	**163**	**30**	**0**
	C$M	**2,973**	**310**	**320**	**319**	**319**	**333**	**328**	**287**	**273**	**237**	**209**	**38**	**0**
NET OPERATING INCOME	**US$M**	**1,583**	**219**	**179**	**241**	**200**	**162**	**58**	**-2**	**102**	**188**	**238**	**-2**	**0**
	C$M	**2,030**	**281**	**229**	**309**	**256**	**208**	**74**	**-2**	**131**	**241**	**306**	**-2**	**0**
ROYALTIES														
NWT Royalty	%	**13%**	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
	US$M	**206**	28	23	31	26	21	8	0	13	24	31	0	0
	C$M	**264**	36	30	40	33	27	10	0	17	31	40	0	0
AFTER ROYALTY NET OPERATING INCOME	**US$M**	**1,377**	**190**	**155**	**210**	**174**	**141**	**50**	**-1**	**89**	**163**	**207**	**-1**	**0**
	C$M	**1,766**	**244**	**199**	**269**	**223**	**181**	**65**	**-2**	**114**	**209**	**266**	**-2**	**0**
TAXES														
NWT and Federal Taxes	%	**26.5%**	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%	26.5%
	US$M	**365**	50	41	56	46	37	13	0	23	43	55	0	0
	C$M	**468**	65	53	71	59	48	17	0	30	55	70	0	0
AFTER TAX NET OPERATING INCOME	**US$M**	**1,012**	**140**	**114**	**154**	**128**	**104**	**37**	**-1**	**65**	**120**	**152**	**-1**	**0**
	C$M	**1,298**	**179**	**146**	**198**	**164**	**133**	**48**	**-1**	**83**	**154**	**195**	**-1**	**0**
CAPEX														
Sustaining	C$M	**134**	55	31	13	9	7	4	4	6	3	2	1	0
Closure	C$M	**54**											37	17
Subtotal - CAPEX	**C$M**	**188**	**55**	**31**	**13**	**9**	**7**	**4**	**4**	**6**	**3**	**2**	**38**	**17**
Contingency	C$M	**0**												
Total CAPEX	**US$M**	**147**	**43**	**25**	**10**	**7**	**6**	**3**	**3**	**4**	**3**	**2**	**30**	**13**
	C$M	**188**	**55**	**31**	**13**	**9**	**7**	**4**	**4**	**6**	**3**	**2**	**38**	**17**
NET CASH FLOW	**US$M**	**866**	**97**	**90**	**144**	**121**	**98**	**34**	**-4**	**61**	**118**	**151**	**-31**	**-13**
	C$M	**1,110**	**125**	**115**	**185**	**155**	**126**	**44**	**-5**	**78**	**151**	**193**	**-39**	**-17**
Cumulative Cash Flow	**US$M**		**97**	**187**	**331**	**452**	**550**	**584**	**580**	**641**	**758**	**909**	**879**	**866**
	C$M		**125**	**240**	**425**	**579**	**705**	**749**	**743**	**821**	**972**	**1,165**	**1,126**	**1,110**
After-Tax NPV	7%													
	US$M	**669**												
	C$M	**857**												

NOTE: This cash flow is presented solely to demonstrate economic viability of the Gahcho Kué Mine mineral reserves and does not represent the actual business plans, tax positions or cash flows of either De Beers or MPD.

Figure 22-3: LOM Pre-Tax Cash Flow



Source: PT Cash Flow (JDS, 2018)

Note: This cash flow is presented solely to demonstrate economic viability of the Gahcho Kué Mine mineral reserves and does not represent the actual business plans, tax positions or cash flows of either De Beers or MPD.

22.4 Sensitivities

The economics of the Gahcho Kué Mine are sensitive to changes in various parameters. Using the $NPV_{7\%}$ as the basis of comparison, the impact to changes in key parameters were evaluated. Sensitivity to five key variables was assessed to +/- 30%, sensitivity to these variables is presented below in Figure 22-4.

Figure 22-4: Gahcho Kué NPV Sensitivity Analysis

Source: NPV Sensitivity (Note grade and Ct price overlap) (JDS, 2018)

The majority of factors for which the Gahcho Kué Mine are most sensitive are considered to be external. Externally, the mine is most vulnerable to the foreign exchange rate, as products are sold in US$ and costs are incurred in C$. Additionally, the carat price, which is largely a product of external market influences, as well as the in-situ resource has a notable effect on project economics.

Internally the mine is sensitive primarily to operating costs. Given the remote location, and challenging climate, swings in costs for materials, fuel and labor have a substantial effect on project economics. Diligent control over operating efficiency is required to cushion against uncontrollable fluctuations in external sensitivities.

23 Adjacent Properties

In addition to their 49% share of the GKJV, Mountain Province Diamonds has entered an agreement to acquire Kennady Diamonds Inc. Resources for the known Kennady Diamonds Inc. Kelvin and Faraday deposits were published in 2016 and 2017 respectively. Table 23-1 summarizes the publicly disclosed resources (http://www.kennadydiamonds.com) mentioned above based on a 1 mm bottom cut-off.

Table 23-1: Kennady North Mineral Resources

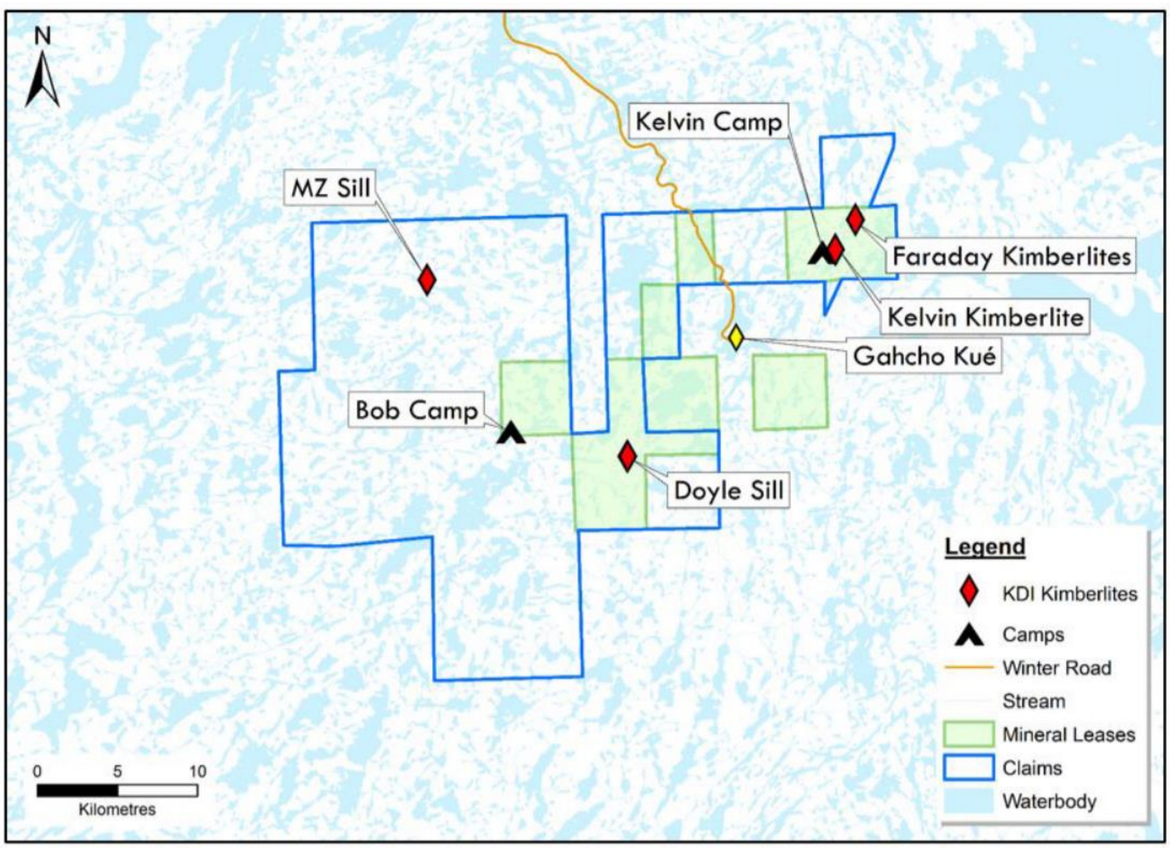
Deposit	Classification	Tonnes (Mt)	Grade (cpht)	Carats (Mcts)
Kelvin	Indicated	8.5	160	13.6
Faraday 2	Inferred	1.4	224	3.1
Faraday 3	Inferred	1.9	101	1.9

Note:

(1) Mineral Resources are reported at a bottom cut-off of 1.0 mm.
(2) Mineral Resources are not mineral reserves and do not have demonstrated economic viability.

Source: Kennady Diamonds Inc, 2018

Figure 23-1: Kennady Diamonds Kimberlite Prospects and Claim Boundaries



Source: Kennady Diamonds Inc., 2016

24 Other Relevant Data & Information

24.1 Reserve Exploitation to Date

Open pit mining and subsequent processing of kimberlite reserves has been continuously ongoing since September 2016. Total reserve exploitation as of December 31, 2017 has been reported as:

Table 24-1: Total Reserve Exploitation as of December 31, 2017

Deposit	Treated Tonnage (Mt)	Grade (cpht)	Carats (Mcts)
5034	3.29	206.08	6.78
Hearne	0.00	0.00	0.00
Tuzo	0.00	0.00	0.00
Total	**3.29**	**206.08**	**6.78**

Source: JDS, 2018

Exploited reserves above represent actual processed reserves and actual reported diamond recoveries as of December 31, 2017.

25 Interpretations & Conclusions

25.1 Interpretations & Conclusions

The QPs are satisfied with the status of the mineral tenure, regulatory permits, environmental and social stewardship and workplace quality. A strong record, both during development and operations presents a positive outlook in these areas moving forward.

The geological setting, mineralization, structures and the kimberlite bodies themselves are well understood. A high level of diligence from the mine's technical team continues to refine this knowledge as the mine evolves.

Qualified technical staff are employed at the Gahcho Kué Mine and additional diamond and mining industry experts are available from outside the mine. The geological database is conscientiously managed in-house. All modelling is performed within a framework of both peer and expert review. Audits have been performed by 3rd parties to provide assurance of the reliability and completeness of the data for resource estimation.

Classification of mineral resources into indicated and inferred categories is consistent with CIM Definition and Standards on Mineral Resources and Mineral Reserves.

The Gahcho Kué Processing plant has operated continuously since since commissioning in September 2016 and has since exceeded 'nameplate' capacity. Nevertheless the operation remains focused on improving the efficiency of the process to reduce costs and increase productivity.

The mine engineering design, operating parameters and economic assumptions provide a credible basis for the conversion of mineral resources into mineral reserves. One full year of operating history is now available. Forward looking views of pricing and exchange rates are established and approved at the corporate level and considered reasonable by the QPs.

Notwithstanding the impossibility of assaying for diamonds and the difficulty of closing reconciliation loops, efforts to reconcile the models to actual production have been diligent and rigorous. Learnings are providing valuable feedback for keeping the resource and reserve models updated and relevant as prediction tools for the mine.

The Gahcho Kué Mine is a fully functioning mine operation with the majority of infrastructure in place for LOM operations. There is a well-defined sustaining capital plan for remaining infrastructure developments required to maintain continuous production. Key remaining projects include Dyke B, Tuzo dewatering, various expansions to the Area 2 FPK facility, and expansion of the mining fleet to its final projected size. Projected operating and capital costs appear realistic and the proposed schedules appear reasonable for the methods employed and planned resources.

The global market for diamonds is considered to have sound fundamentals and a favorable outlook based on projected demands outpacing the availability and rate of new mining developments. The price forecasts are based on MPDs sales experience and are a best estimate to provide external long-term pricing trends. The forecasts are a reasonable assumption on which to base the estimated mineral reserves in this report.

With the exception of 2024, cash flows for the Gahcho Kué Mine are positive in every year of the mine life. The LOM cash flow position supports the definition of mineral reserves for all three deposits.

25.2 Risks

As with most mining Projects, there are many risks that could affect the economic viability of the Project. Many of these risks are based on lack of detailed knowledge, and given that the Gahcho Kue Mine is in operation, these risks can be managed as more sampling, testing, design, and detailed engineering are conducted.

The most significant potential risks associated with the Project are operating and capital cost escalation, unforeseen schedule delays, and changes in regulatory requirements. These risks are common to most mining Projects, many of which can be mitigated with adequate engineering, planning, and pro-active management.

External risks are, to a certain extent, beyond the control of the Project proponents and are much more difficult to anticipate and mitigate, although, in many instances, some risk reduction can be achieved. External risks are things such as the political situation in the Project region, diamond prices, exchange rates, and government legislation. These external risks are generally applicable to all mining Projects. Negative variance to these items from the assumptions made in the economic model would reduce the profitability of the mine and the mineral resource and reserve estimates.

25.3 Opportunities

Opportunities include:

- Developing and incorporating the Kennady Lake Diamonds kimberlites near the end of the current mine life. The Kennady Lake Diamonds kimberlites are a mixture of inferred and indicated resources approximately 10km North East of Gahcho Kué, additional information can be found in section 23.
- Developing and mining the Tuzo Deep resources using a bulk underground mining method similar to the neighboring Ekati and Diavik mines. These resources are inferred at this time and additional resource drilling would be required to upgrade the resource to an indicated level.
- As mining progresses in 5034, monitor and review the revised eastern pit slope and look for opportunities to increase slope angles at depth if geotechnical conditions warrant.

At the time of this report, no permitting, detailed engineering, or detailed economic analysis has been published to conclude the economic feasibility of these opportunities.

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27 Units of Measure and Abbreviations

Table 27-1: Units of Measure and Abbreviation

Abbreviation	Units of Measure	Abbreviation	Units of Measure
'	Foot	Ha	Hectare
"	Inch	hp	Horsepower
µm	Micron (micrometre)	in	Inch
A	annum	kg	Kilogram
A	Ampere	km	Kilometre
Ac	Acre	km^2	Square kilometre
Ag	Silver	kPa	Kilopascal
Au	Gold	kt	Kiloton
cfm	Cubic feet per minute	kW	Kilowatt
cm	Centimetre	kWh	Kilowatt hour
Cu	Copper	L	Liter
d/a	Days per annum	lb	Pound
Dmt	Dry metric tonne	m	Metre
ft	Foot	M	Million
ft^3	Cubic foot	m^2	Square metre
g	Gram	m^3	Cubic metre
h	Hour	min	minute
mm	Millimetre	ppm	Parts per million
MPa	Mega Pascal	psi	Pounds per square inch
mph	Miles per hour	S	Second
Mt/a	Million tonnes per annum	T	Metric tonne
Mt	Million tonnes	t/d	Tonnes per day
°C	Degree Celsius	t/h	Tonnes per hour
°F	Degree Fahrenheit	V	Volt
oz	Troy ounce	W	Watt
Pa	Pascal	wmt	Wet metric tonne
ppb	Parts per billion	Zn	Zinc

Source: JDS, 2017

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CERTIFICATE OF AUTHOR

I, Daniel Johnson, P. Eng., do hereby certify that:

1. I am a Principal of JDS Energy & Mining Inc. with an office at 3200 Richter St, Kelowna, BC V1W 3R4, Canada.

2. This certificate applies to the technical report (Report) entitled "Gahcho Kué Mine; NI 43-101 Technical Report," with effective date December 31 2017.

3. I am a Registered Professional Mining Engineer in good standing in NWT/Nunavut and in Virginia, USA (#0402038687). I am a graduate of Virginia Tech with a Bachelor of Science degree in Civil Engineering, 1977. I am a graduate of the Amos Tuck School of Business Administration at Dartmouth College with a Masters of Business Administration, 1981. I have practiced my profession continuously since 1981. Relevant experience includes advanced exploration, mine design, permitting, engineering and construction, operations management, and executive management for mineral related properties, mines and companies.

4. I have completed personal inspections of the Gahcho Kué project site, the most recent of which was September 2016.

5. I am responsible for all sections of this technical report entitled "Gahcho Kué Mine; NI 43-101 Technical Report", except sections 15 & 16, with effective date December 31 2017.

6. I am independent of the issuer, Mountain Province Diamonds Inc., as defined in Section 1.5 of NI 43-101.

7. I have prior involvement with the Gahcho Kué property since 2007 and was an author of some sections in the report entitled "Gahcho Kué Project, Feasibility Study, NI 43-101 Technical Report", with effective date May 20, 2014.

8. I have read the definition of "Qualified Person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association, and past relevant experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

9. I have read NI 43-101 and confirm that the sections of the Report for which I am responsible, have been prepared in compliance of NI 43-101.

10. As of the effective date of the Report, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Effective Date: March 16, 2018

(Original signed and sealed) "Daniel D. Johnson, P. Eng."

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CERTIFICATE OF AUTHOR

I, Dino Pilotto, P. Eng., do hereby certify that:

1. I am an Engineering Manager of JDS Energy & Mining Inc. with an office at Suite 900 - 999 West Hastings Street, Vancouver, BC, V6C 2W2, Canada.

2. This certificate applies to the technical report (Report) entitled "Gahcho Kué Mine; NI 43-101 Technical Report," with effective date December 31 2017.

3. I am a Registered Professional Mining Engineer in good standing in the Northwest Territories, Alberta and the Yukon. I am a graduate of the University of British Columbia with a B.Sc. in Mining and Mineral Process Engineering (1987). I have practiced my profession continuously since June 1987. Relevant experience includes mining operations, mine engineering and consulting covering a variety of commodities at locations in North America, South America, Africa, and Eastern Europe.

4. I have not visited the Gahcho Kué project site.

5. I am responsible for Items (Sections) 15 and 16 of this technical report entitled "Gahcho Kué Mine; NI 43-101 Technical Report," with effective date December 31 2017.

6. I am independent of the issuer, Mountain Province Diamonds Inc., as defined in Section 1.5 of NI 43-101.

7. I have had prior involvement with the Gahcho Kué property since 2008 and assisted with some sections in the report entitled "Gahcho Kué Project, Feasibility Study, NI 43-101 Technical Report", with effective date May 20, 2014.

8. I have read the definition of "Qualified Person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association, and past relevant experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

9. I have read NI 43-101 and confirm that the sections of the Report for which I am responsible, have been prepared in compliance of NI 43-101.

10. As of the effective date of the Report, to the best of my knowledge, information and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Effective Date: March 16, 2018

(Original signed and sealed) "Dino G. Pilotto, P. Eng."

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Engineering Manager, JDS Energy & Mining Inc.