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CLOSURE PLAN
CÔTÉ GOLD PROJECT

IAMGOLD

December 2018
SLR Project No.: 209.40564.00000

Amended 28 January 2022

Version	Date	Revision Description
0	December 2018	Original Submission
1	November 2020	Off-Line Dam Designs (associated with construction of Overburden Stockpile, Plant Site Area, Tailings Management Facility)
2	December 2020	Off-Line Dam Designs (associated with the Open Pit Quarry Pond dams)
3	November 2021	Off-Line Dam Design Updates (associated with the Tailings Management Facility starter dam updates)
4	January 2022	Land Tenure and Administrative Updates

CLOSURE PLAN
CÔTÉ GOLD PROJECT
SLR Project No.: 209.40564

Prepared by
SLR Consulting (Canada) Ltd.
36 King St. East, 4th Floor
Toronto, ON M5C 3B2

for

IAMGOLD CORPORATION
401 BAY STREET #3200
TORONTO, ON M5H 2Y4

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ACRONYMS AND ABBREVIATIONS

~	Approximately
ABA	Acid Base Accounting
ARD	Acid Rock Drainage
BGM	Bituminous Geomembrane
$CaCO_3$/t	Calcium Carbonate per Tonne
CDA	Canadian Dam Association
CGC	Chester Granitoid Complex
CIP	Carbon-In-Pulp
EA	Environmental Assessment
EDF	Environmental Design Flood
ENDM	Ontario Ministry of Energy, Northern Development and Mines
NDMNRF	Ontario Ministry of Northern Development, Mines and Natural Resources (Formerly ENDM)
FS	Factor Of Safety
Ha	Hectares
HDPE	High Density Polyethylene
HPGR	High Pressure Grinding Rolls
IAMGOLD	IAMGOLD Corporation
kg	Kilogram
km^2	Square Kilometers
kV	Kilovolts
m^3/d	Cubic Meters Per Day
masl	Meters Above Sea Level
MBR	Membrane Bioreactor
ML	Potentially Acid Generating
mm	Millimeters
Mm^3	Million Meters Cubed
MMER	Metal Mining Effluent Regulation
MNRF	Ontario Ministry of Natural Resources And Forestry
MPA	Maximum Potential Acidity
MRA	Mine Rock Area
Mt	Million Tonnes
Mt	Megatonne
NE	North East
NPR	Neutralization Potential Ratio
PCB	Polychlorinated Biphenyl
PDA	Project Description Area
PWQO	Provincial Water Quality Objectives
ROM	Run Of Mine
the Project	Côté Gold Project
TLA	Transmission Line Alignment
TMF	Tailings Management Facility
tpd	Tonnes/Day

Amended 28 January 2022

1.0 LETTER OF TRANSMITTAL

January 28, 2022

Intended to: Brian McMahon
Director of Mine Rehabilitation
Ministry of Northern Development, Mines and Natural Resources
and Forestry
933 Ramsey Lake Road, 6th Floor
Sudbury, Ontario. P3E 6B5

Mr. McMahon

IAMGOLD Corporation (IAMGOLD) is pleased to submit (1) digital copy and (2) hard copies of the amended pages in support of the Closure Plan for the Côté Gold Project. These amended pages for the Closure Plan are being submitted for approval under Part VII of the Act and constitutes the Closure Plan in its entirety.

If you have any questions regarding the contents of this letter, please do not hesitate to contact the undersigned.

Sincerely,

Stephen Crozier
Vice President, Corporate Affairs
IAMGOLD Corporation

cc. Zahir Jina, SLR Consulting

Enclosure: Côté Gold Project – Closure Plan Amendment Pages

2.0 CERTIFICATIONS

2.1 Certification

I (We) hereby certify that,

- The attached Closure Plan amendment complies in all respects with the *Mining Act* and Ontario Regulation 240/00, including the Mine Rehabilitation Code of Ontario (Code);

- the proponent relied upon qualified professionals in the preparation of the closure plan, where required, under the *Mining Act* and this Regulation, including the Code and the cost estimates of the rehabilitation work described in the attached closure plan are based on the market value cost of the goods and services required by the work;

- the amount of financial assurance provided for in the attached closure plan is adequate and sufficient to cover the cost of the rehabilitation work required in order to comply with the *Mining Act* and this Regulation, including the Code;

- the proponent has complied with any written direction regarding Aboriginal consultation provided by the Director pursuant to subsection 8.1 (2); and

- the attached closure plan constitutes full, true and plain disclosure of the rehabilitation work currently required to restore the site to its former use or condition or to make the site suitable for a use the Director sees fit in accordance with the *Mining Act* and this Regulation, including the Code. O. Reg. 240/00, s. 12 (2); O. Reg. 307/12, s. 7 (1).

The undersigned are authorized, as employees of the company, to act on behalf of IAMGOLD Corporation.

I confirm, to the best of my knowledge, that the environmental and closure assumptions used to determine the closure plan and calculate the closure cost estimate are appropriate, reasonable and comply with IAMGOLD policies. I confirm that the plan is aligned with IAMGOLD guidance and assure that the roles and responsibilities have been carried out accordingly.

Chief Financial Officer: Daniella Dimitrov

Date: 2022-01-28

Vice President, Corporate Affairs: Stephen Crozier

Date: 2022-01-28

2.2 Technical Certificates

This Closure Plan was prepared by professionals of SLR Consulting (Canada) Ltd, 300 Town Centre Boulevard, Suite 200, Markham, Ontario, L3R 5Z6, Tel. (905) 415-7248), Fax (905) 415-1019. Certified member of the association of Professional Engineers of Ontario (PEO Certificate #11562081) and registered member of the Association of Professional Geoscientists of Ontario (APGO Registration #90098).

2.21 Certification of Zahir Jina

On behalf of IAMGOLD, I prepared the “Côté Gold Project” Closure Plan, with input from IAMGOLD and others, and certify that the proposed closure measures (i.e., those requiring certification as per Section 12(3) of Part VII of the Act) are in accordance with the Mining Act and the Code.

Zahir Jina, EP, C.E.T, AScT.,
Project Environmental Scientist, Environmental Permitting and Compliance
SLR Consulting (Canada) Ltd.
300 Town Centre Boulevard, Suite 200
Markham, Ontario
L3R 5Z6
Tel. 416 455 8010

Project Environmental Scientist, Environmental Permitting and Compliance, employed with SLR Consulting: over 10 years of environmental industry experience; Mr. Jina has experience in providing advisory services for a variety of mining projects, from exploration through construction, operation and closure. Mr. Jina was the lead author of the Closure Plan. Mr. Jina has been involved in the Côté Gold Project since January 2018, through the preparation of the Closure Plan. The Closure Plan was compiled based on information from others (Environmental Assessment, Environmental Effects Review and engineering information).

I do not have any direct or indirect interest, current or expected, in the Côté Gold Project or IAMGOLD Corporation, or IAMGOLD Corporation affiliates, including and direct or indirect beneficial ownership in the securities of IAMGOLD or any of its affiliates.

Signed January 28, 2022

2.2.2 Certification of Mickey Davachi

On behalf of IAMGOLD, I prepared the “Côté Gold Project” Closure Plan, with input from IAMGOLD and others, and certify that the proposed closure measures (i.e., those requiring certification as per Section 12(3) of Part VII of the Act) are in accordance with the Mining Act and the Code. Specifically, I provide certification regarding:

- Geotechnical information with regards to the stability of all impoundment structures against static and dynamic loadings.

Mickey Davachi, Ph.D., P.Eng., D. GE, FASCE
Wood Environment & Infrastructures Solutions
2020 Winston Park Drive, Oakville, Ontario, L6HZ 6X7, Canada
Tel.: 905-829-5400

I am a member of Professional Engineers Ontario (Licence No.: 10567113). I graduated from Imperial College, University of London, London, UK, with Master of Engineering and Doctor of Philosophy degrees in 1974 and 1978, respectively.

I have practiced my profession for over 40 years since graduation. I have been directly involved in field of geotechnical engineering with site investigations, scoping, prefeasibility and feasibility studies, detailed design, construction, dam safety reviews and technical advisor and senior reviewer of tailings and water management facilities, including geotechnical assessments and implementations for mining projects in the Canadian Shield.

I have been involved with the Côté Gold Project since June 2018 as a Senior Reviewer and since December 2020 as the Engineer of Record (EoR). I have made several site visits in conjunction with the design development. I have had no previous involvement with the Project.

I do not have any direct or indirect interest, current or expected, in the Côté Gold Project or IAMGOLD Corporation, or any IAMGOLD Corporation affiliates, including any direct or indirect beneficial ownership in the security of IAMGOLD Corporation or any of its affiliates.

M Davachi

Signed: November 01, 2021

2.2.3 *Certification of Stephen Walker*

On behalf of IAMGOLD, I prepared the "Côté Gold Project" Closure Plan, with input from IAMGOLD and others, and certify that the proposed closure measures (i.e., those requiring certification as per Section 12(3) of Part VII of the Act) are in accordance with the Mining Act and the Code. Specifically, I provide certification regarding:

- Geochemical characterization of overburden, mine rock and tailings including management of waste rock and tailings kinetic testing and provision to source terms for geochemical modelling completed by others.

Stephen Walker, Ph.D., P.Geo.
Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood) (formerly Amec Foster Wheeler, Environment and Infrastructure)
160 Traders Boulevard E., Suite #110, Mississauga, Ontario, Canada L4Z 3K7
Tel.: +1 905 568 2929

Dr. Stephen Walker is an Associate Geochemist, and employed with Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood) – Mississauga location (member of the Association of Professional Geoscientists of Ontario Registration #2665), residing in Kingston, Ontario. Dr. Walker has over 28 years of experience and specializes in mine waste geochemistry and contaminated site assessment and remediation. He has extensive experience in the geochemical and mineralogical characterization of mine tailings, mine rock, sediments, and soils to identify and interpret metal leaching and acid rock drainage characteristics. A site visit was conducted during May 2013 by Dr. Walker to examine drill core and direct subsequent sampling by Wood and IAMGOLD personnel for mine rock assessment. Dr. Walker oversaw the set up and operation of waste rock field cells and the geochemical / mineralogical characterization of overburden and tailings; this work relied on samples collected and handled by IAMGOLD or consultants acting on their behalf. The characterization work was also guided by the mine plan, and geological information provided by IAMGOLD.

I do not have any direct or indirect interest, current or expected, in the Côté Gold Project or IAMGOLD Corporation, or any IAMGOLD Corporation affiliates, including any direct or indirect beneficial ownership in the security of IAMGOLD Corporation or any of its affiliates.

PROFESSIONAL GEOSCIENTISTS
STEPHEN R. WALKER
PRACTISING MEMBER
2665
ONTARIO

Stephen Walker, Ph.D., P.Geo.
Associate Geochemist

Signed,
October 19, 2018

2.2.4 Certification of Karen Besemann

This certificate relates to the description of the hydrogeological conditions as discussed under Section 4.5 of the Côté Gold Project" Closure Plan. On behalf of IAMGOLD, I prepared the Groundwater Section of the "Côté Gold Project" Closure Plan, with input from IAMGOLD and others. Specifically, I provide certification regarding:

- The hydrogeological studies meet the requirements of Schedule 1, Sections 50-52 of Ontario Regulation (O. Reg.) 240/00 under Part VII of the Mining Act.

Karen Besemann, P.Geo.
Golder Associates Ltd.
33 Mackenzie St.., Suite 100, Sudbury, ON P3C 4Y1
Tel.: +1-705-524-6861

Karen Besemann, P.Geo. is employed as a hydrogeologist at Golder Associates Ltd. Karen Besemann did not personally conduct the collection of hydrogeological information; rather the undersigned provided advice to IAMGOLD and others regarding proposed drilling locations, installation of monitoring wells, completion of hydraulic testing and groundwater level collection. The data collected was subsequently reviewed and interpreted by Karen Besemann. Several site visits were conducted in 2012 and 2013 by Karen Besemann to personally examine the general site conditions and assess the locations of monitoring wells.

I do not have any direct or indirect interest, current or expected, in the Côté Gold Project or IAMGOLD Corporation, or any IAMGOLD Corporation affiliates, including any direct or indirect beneficial ownership in the security of IAMGOLD Corporation or any of its affiliates.

PROFESSIONAL GEOSCIENTIST
KAREN A. BESEMANN
PRACTISING MEMBER
1122
ONTARIO

Karen Besemann, P.Geo.
Senior Hydrogeologist, Principal

Signed,
October 18, 2018

2.2.5 *Certification of Michael Gunsinger*

This certificate relates to the surface water and groundwater monitoring plans discussed under Section 10.2 of the "Côté Gold Project" Closure Plan. On behalf of IAMGOLD, I prepared the surface water and groundwater monitoring plans for the "Côté Gold Project" Closure Plan, with input from IAMGOLD and others. Specifically, I provide certification regarding:

- The proposed surface water and groundwater monitoring plans meet the requirements of Schedule 1, Sections 47-49 (surface water chemical monitoring) and 53-55 (groundwater chemical monitoring) of Ontario Regulation (O. Reg.) 240/00, under part VII of the Mining Act.

Michael Gunsinger, M.Sc., P.Geo.
Golder Associates Ltd.
6925 Century Avenue, Suite #100, Mississauga, Ontario, Canada L5N 7K2
Tel.: +1 905 567 4444

Michael Gunsinger, M.Sc., P.Geo., is employed as a hydrogeochemist by Golder Associates Ltd. (Golder). Michael Gunsinger did not personally conduct the collection of surface water or groundwater monitoring data; rather, the undersigned provided advice to IAMGOLD regarding the design of the surface water and groundwater monitoring plans, and reviewed and interpreted data and reports provided by IAMGOLD. The data and reports provided by IAMGOLD were examined intermittently from May 2013 to September 2018. A site visit was conducted during May 2013 by Michael Gunsinger to personally examine the general site conditions and assess the locations of the monitoring stations. In preparation of the surface water and groundwater monitoring plans, information and data was collected by: i) field examination of the site by Michael Gunsinger; ii) compilation of field data collected by personnel from IAMGOLD and Golder, and iii) a review of information reported by others that was provided by IAMGOLD. The information that was reviewed included: surface water and groundwater quality data, surface water and groundwater flow directions, site and topographic plans and historical reports by consultants and other specialists. The data provided by IAMGOLD were relied upon as being accurate and correct.

I do not have any direct or indirect interest, current or expected, in the Côté Gold Project or IAMGOLD Corporation, or any IAMGOLD Corporation affiliates, including any direct or indirect beneficial ownership in the security of IAMGOLD Corporation or any of its affiliates.

PROFESSIONAL GEOSCIENTIST
MICHAEL R. GUNSINGER
PRACTISING MEMBER
1651
17 OCT 18
ONTARIO

Michael Gunsinger, M.Sc., P.Geo.
Senior Hydrogeochemist, Associate

Signed,
October 17, 2018

3.0 PROJECT INFORMATION

3.1 Proponent Name and Address

IAMGOLD Corporation (IAMGOLD) is a leading mid-tier gold producer headquartered in Toronto, Ontario. IAMGOLD is listed on the Toronto Stock Exchange main board under the symbol "IMG". IAMGOLD currently has three operating gold mines (including a joint venture) and is in the process of developing two additional projects, including the Côté Gold Project.

Closure Plan Proponent:
Stephen Crozier
Vice President, Corporate Affairs
IAMGOLD Corporation
401 Bay Street, Suite 3200
Toronto, Ontario
M5H 2Y4
Tel: 416.360.4719
Email: Stephen_Crozier@iamgold.com

Project Site Location:
Côté Gold Project
Chester Mine Road
PO Box 100
Gogama, Ontario
P0M 1W0

3.2 Boundaries of Project Site and Land Tenure

The Côté Gold Project (the Project) is located in the Chester and Yeo Townships, District of Sudbury, in north-eastern Ontario, approximately 20 kilometers (km) southwest of Gogama, 130 km southwest of Timmins, and 200 km northwest of Sudbury. The Project Location is shown on Figure 3-1.

The Project is located within a connecting block of patented claims, leases and licenses of occupation and a series of cell and boundary claims held by IAMGOLD. Land tenure is shown on Figure 3-2 with additional information provided in Appendix A. IAMGOLD holds all required mining leases for all of the cell and boundary claims that cover the Project. The Project components will be located within the project boundary, shown on Figure 3-3A. The linetype in the figures satisfies the Closure Plan Boundary Guideline. Power provided to the Project, by way of a transmission line alignment (TLA) from Shining Tree, will remain on Crown Land and IAMGOLD will hold a right of way.

IAMGOLD acquired Trelawney Mining and Exploration Inc. (Trelawney) in 2012. Trelawney had been exploring the Project property since 2009 with the objective of developing an open pit gold mine and process plant. In 2016 IAMGOLD acquired mineral rights from Sanatana Resources Inc. (Sanatana Resources) which now includes lands include in the Project site.

In 2017 IAMGOLD entered into an investment agreement with Sumitomo Metal Mining Co. (SMM), a Tokyo, Japan-based mining company. SMM is wholly-owned by Sumitomo and is a global leader in the development and mining of non-ferrous metals. The investment agreement granted SMM a 30% undivided participating interest in the Project. IAMGOLD is the majority owner and mining rights holder for the Project. Refer to Appendix B for a Joint Venture and Owner Operator Clarification letter.

Besides IAMGOLD, other individuals and small junior companies have mining claims near the proposed Project site and are described as follows:

- Liberty Mines Inc. owns the Groves exploration project, located 15 km southeast of Gogama. Drilling activities took place during 2011 but stopped temporarily, with plans of continuing the drilling in the future. The property covers 6,400 ha (Liberty Mines, 2013).
- GoldOn Resources Ltd. is an exploration company focused on sourcing and exploring mineral properties in Canada (Bloomberg Businessweek, 2013).

The Mattagami 71 Reserve is the closest First Nation reserve land, located approximately 40 km north of the Project site.

3.3 Site Plans

The Project includes an open pit mine, Mine Rock Area (MRA), ore stockpile, processing plant, Tailings Management Facility (TMF), overburden stockpile, emulsion facility, accommodations complex, internal access roads and gate houses.

Two watercourse realignment channels will be constructed to divert non-contact water around the open pit mine, while several dams will be constructed to allow for open pit mining. The realignment channels will be constructed to provide fish habitat and will realign flows from Clam Lake and Chester Lake which will report to Three Duck Lake (Upper). Additional details with regard to the Project and related infrastructure are provided in Section 5.0.

The Project facility footprint, excluding the transmission line right-of-way, will cover approximately 1,050 ha (10.5 km^2) during operations. The site plan for the Project is shown on Figure 3-3A. The process plant site layout is shown on Figure 3-3B. The site layout places the required mine related facilities in close proximity to the open pit, to the extent practicable.

The Project is designed to:

- Respect the interests of other land uses and users in the area;
- Use well-known, conventional, and environmentally sound mining and processing technologies commonly used in northern Ontario, and IAMGOLD's experience with other gold mining operations;
- Minimize the overall development footprint and associated potential effects;
- Manage water effectively and efficiently;
- Mitigate or compensate for effects on fish and fish habitat; and
- Accommodate effective planning for final closure and site abandonment, rendering the site suitable for other compatible land uses and functions.

3.4 Plans and Section of Underground Development

There are currently no plans for underground development.

Figure 3-1: Project Location

Figure 3-2: Land Tenure

Figure 3-3A: Site Plan

Figure 3-4B: Process Plant Site Layout

4.0 CURRENT PROJECT SITE CONDITIONS

IAMGOLD submitted a Project Description for the Project to the Canadian Environmental Assessment Agency on March 15, 2013. The proposed Terms of Reference was approved by the Ontario Minister of the Environment on January 14, 2014. A comprehensive environmental baseline program and consultation program was undertaken to inform the Environmental Assessment (EA). The EA was submitted to the federal and provincial government in 2015. IAMGOLD received the EA decision statement by the Federal Minister of Environment and Climate Change Canada on April 13, 2016, and a Provincial decision from the Ministry of the Environment and Climate Change (now known as the Ministry of Environment Conservation and Parks) was received December 22, 2016.

Following receipt of the EA decision, IAMGOLD acquired mineral rights, previously unavailable, that surround the original mine footprint from Sanatana Resources, a company which jointly held mineral claims within the Project area. This acquisition has enabled IAMGOLD to optimize the land use with respect to siting the TMF and minimizing the environmental footprint of the Project.

4.1 Land Use

The regional area is primarily used for resource development (mineral exploration, forestry), cottaging and outdoor, wilderness pursuits such as canoeing, trapping, hunting, and fishing.

The 4M Canoe Route is located immediately adjacent to the Project through Three Duck Lakes, Weeduck Lake and Bagsverd Creek. Current Land Use is shown on Figure 4-1.

Mining and forest related activities are the predominant types of industrial or commercial land uses in the regional area. While mineral exploration activities in the area have been ongoing for over a century, no major mine development has occurred in the regional area, although interest in mineral development is evident due to a number of mineral developers active in the area. Forestry has been and continues to be an important commercial use. The regional area has active forestry uses and transects four Forest Management Units (FMUs) including the Spanish Forest, Pineland Forest, Romeo Mallet Forest, and Timiskaming Forest FMUs. There is no active agriculture in the region.

Hunted species in the regional area include black bear, moose, and white-tailed deer. Trapping in the regional area is conducted on provincially regulated trapline areas. Various species are trapped based on quotas identified by the Ontario Ministry of Natural Resources and Forestry (MNRF, now merged with Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry, NDMNRF). No commercial fisheries occur in the area, but sport fishing is popular. Outdoor recreation users use the land within the regional area for activities such as hiking, camping, canoeing, and snowmobiling.

No National Parks, regional parks, or ecological reserves are located within the regional area. Two Provincial Parks are partially located within the regional area; the La Motte Lake Provincial Park and Biscotasi Lake / Spanish River Provincial Park. Biscotasi Lake has an associated Enhanced Management Area to the southwest. The Parks are located in the Atlantic watershed, whereas the Project is located in the Arctic watershed. A conservation reserve (Akonesi Chain of Lakes Complex) is located just north of Gogama.

4.2 Topography

The regional landscape displays relatively subdued topography ranging from approximately 350 meters above sea level (masl) to 410 masl, reflecting the effects of glaciations and the infill of low-lying areas with glacial debris. Glacial till and fluvial deposits cover the area.

The Project site is located within an area with moderately hilly boreal mixed wood forest (Birch, Pine, Poplar and Spruce). Bogs, fens and lakes are commonly less than 10 m deep. Elevations range from 375 m above sea level (masl) to 425 masl, averaging approximately 400 masl near the Project site. The area of the Project site is characterized by bedrock outcrops and glacial till and is typical of the Canadian Shield. The glaciated country has a gently rolling topography that seldom exceeds 50 m. The higher ground usually has a veneer of glacial soil over bedrock, with thicker overburden present in the low-lying areas between the hills. Existing topography is shown on Figure 4-2.

4.3 Climate

Active regional climate monitoring locations are located in the vicinity of the Project in Timmins (north of the Project site), Chapleau (northwest of the Project site), Sudbury (south of the Project site) and North Bay (southeast of the Project site). Based on information collected at these locations, the climate of the Project site is characterized by cold winters (-10˚C to -35˚C) and warm summers (10˚C to 35˚C). Mean annual precipitation for the region is approximately 800 mm to 900 mm, of which approximately 30 to 40% falls as snow (EC, 2013). Mean annual evaporation is in the range of 400 mm to 600 mm (MNR 1984).

4.4 Surface Water

4.4.1 Drainage Conditions and Flows

The Project site is located at the headwaters of the Mattagami River system, just north of the watershed divide that separates the James Bay watershed from the Great Lakes watershed. Regional and local watersheds are shown on Figure 4-3.

Groundwater recharge to streamflow in the region is estimated at an annual average of 0% to 20% (MNR 1984), indicating that surface water flow is dominant in the regional systems and groundwater recharge is low compared to evapotranspiration losses.

Downstream of the Project site, the Mattagami River flows for approximately 420 km to a confluence with Moose River, which subsequently flows to James Bay. The Mattagami River is a managed river system that includes approximately 18 dams and power generating stations that fall under the Mattagami River Water Management Plan.

A number of lakes, connected by relatively short streams, are present in the vicinity of the Project site. The Mollie River, fed by Chester and Clam Lakes to the west, flows eastward through the open pit footprint and connects Côté Lake to the Three Duck Lakes system. To the north of the open pit footprint, Bagsverd Lake drains northward through Bagsverd Creek and eventually discharges into Mesomikenda Lake to the east. Other than Mesomikenda Lake, which is greater than 50 m deep in some locations, lakes are typically shallow (<10 m average depth) with bedrock-lined shorelines.

Regional discharge and water level data obtained from available hydrological monitoring locations indicate that the Mesomikenda Lake displays three distinct peak flow periods that coincide with dam operation rules, managed by government (Table 4-1). The unregulated Mollie River has a typical single spring runoff peak flow. Flow monitoring stations are shown on Figure 4-4.

Table 4-1: Mesomikenda Lake Dam - Operating Rules

Normal Operating Range (masl)	Summer Target Operating Range (Victoria Day to Thanksgiving) (masl)	Winter Target Minimum Elevation (masl)
362.30–365.30	364.94–365.30	362.30

4.4.2 Surface Water Quality

A surface water baseline program has been carried out from 2011 to 2017 to characterize the surface water quality conditions within the study area. In total, forty-six surface water quality stations have been sampled across the study area, which has included surface water features within reference areas, the boundaries of the proposed site, and downstream. A list of the surface water quality stations is tabularized in the result table provided in Appendix C – this table includes information on the station type (outlet/watercourse or profile station), rationale as to why the station was selected, duration of when the station was sampled, and the number of times the station was sampled up until mid-2017. The locations of the surface water quality monitoring stations are shown on Figure 4-4.

Baseline surface water samples are analyzed for a broad set of parameters; the complete list of water quality parameters is provided in Table 4-2.

Table 4-2: Water Quality Parameters Analyzed

Parameters	2012 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013-2017 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013-2017 Water Column Profile Quality Program	Groundwater Quality Baseline Monitoring Program (thrice per year)
pH	X	X	X	X
Alkalinity	X	X	X	X
Acidity	2 analyses	X	X	X
Electrical Conductivity (EC)	X	X	X	X
Dissolved Oxygen (DO)	—	—	X	—
Total Dissolved Solids (TDS)	X	X	X	X
Total Suspended Solids (TSS)	X	X	X	X
Hardness	X	X	X	X
Dissolved Organic Carbon (DOC)	X	X	X	—
Total Organic Carbon (TOC)	4 analyses	X	X	—
Chemical Oxygen Demand (COD)	4 analyses	X	X	—
Calcium (Ca)	X	X	X	X
Magnesium (Mg)	X	X	X	X
Potassium (K)	X	X	X	X
Sodium (Na)	X	X	X	X
Chloride (Cl)	X	X	X	X
Fluoride (F)	X	X	X	X
Soleplate (SO_4^{2-})	X	X	X	X
Aluminum (Al)	X	X	X	X
Antimony (Sb)	X	X	X	X
Arsenic (As)	X	X	X	X
Barium (Ba)	X	X	X	X
Beryllium (Be)	X	X	X	X
Boron (Bo)	X	X	X	X
Cadmium (Cd)	X	X	X	X
Chromium (Cr)	X	X	X	X
Cobalt (Co)	X	X	X	X
Copper (Cu)	X	X	X	X
Iron (Fe)	X	X	X	X
Lead (Pb)	X	X	X	X
Manganese (Mn)	X	X	X	X
Mercury (Hg)	X	X	X	X

Parameters	2012 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013-2017 Surface Water Quality Monthly / Quarterly Baseline Monitoring Program	2013-2017 Water Column Profile Quality Program	Groundwater Quality Baseline Monitoring Program (thrice per year)
Molybdenum (Mo)	X	X	X	X
Nickel (Ni)	X	X	X	X
Selenium (Se)	X	X	X	X
Silver (Ag)	X	X	X	X
Strontium (Sr)	X	X	X	X
Thallium (Th)	X	X	X	X
Titanium (Ti)	X	X	X	X
Tungsten (W)	X	X	X	X
Uranium (U)	X	X	X	X
Vanadium (V)	X	X	X	X
Zinc (Zn)	X	X	X	X
Zirconium (Zr)	X	X	X	X
Total Cyanide (Tot. CN)	X	X	X	—
Free Cyanide (CN)	—	—	X	X
Sulphur (S)	3 analyses	—	—	X
Nitrate (NO_3^-)	4 analyses	X	X	X
Nitrite (NO_2^-)	4 analyses	X	X	X
Ammonia (Tot. NH_3)	X	X	X	X
Total Kjeldahl Nitrogen (N)	4 analyses	—	—	—
Total Phosphorus (Tot. P)	X	X	X	–
Phosphate (PO_4^{3-})	X	—	—	—
Soluble Reactive Phosphorus (P)	4 analyses	—	—	—
Oil and Grease	5 analyses	X	X	—
Phenols	—	—	X	—
Polycyclic Aromatic Hydrocarbons (PAH)	—	—	X	—
Polychlorinated Biphenyls (PCB)	—	—	X	—
Escherichia coli	—	—	X	—
Total Coliform	—	—	X	—
Radium-226	Monthly from November 2012	X	X	—

– = no analysis completed
X = analysis completed
Source: Golder (2013a).

Surface water quality baseline data is provided in Appendix C. This appendix includes: a table that presents the 75th percentile concentrations compared to water quality guidelines and tables that provide full statistics for all stations, as well as the original baseline report (Golder, 2013) that was submitted along with the Environmental Impact Statement / Environmental Assessment Report. The original baseline report presents data from 2012 to 2013, whereas the table with the 75th percentile concentrations incorporates data up until mid-2017. The 75th percentile concentrations were compared, as a reference, to the Ontario Provincial Water Quality Objectives (PWQOs and iPWQOs; MOE, 1999) and the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CWQGs) for the Protection of Aquatic Life (CCME, 2013).

The surface water quality in the study area is typical of the lakes and watercourses that are present in northern Ontario. Throughout the Canadian Shield geological region, flow is strongly controlled by bedrock outcrops. Water-rock interactions with Precambrian bedrock, and sediments derived from these rocks, influence the surface water quality. With respect to the water quality guidelines, a summary of the baseline surface water quality results for key parameters is as follows:

- pH – ranges from slightly acidic to near-neutral values. Some occurrences of slightly acidic values less than the PWQO and CWQG range (<6.5) were observed, but on average these were limited to a beaver pond (P-2), a seasonal pond (P-5), Little Clam Lake and Delaney Lake (LCM and DEL-LS, respectively - which are small lakes), and one small tributary (P-3). All other surface water features, including the major surface water receivers, are characterized as having circumneutral pH conditions.
- Aluminum – 75th percentile concentrations range from 0.013 to 0.44 mg/L. The 75th percentile concentrations of aluminum are greater than: the iPWQO of 0.075 mg/L at 25 of the 46 stations; and the CWQG of 0.1 mg/L at 12 of the 46 stations. No concentrations were observed to be greater than the original PWQO of 2.0 mg/L. It is important to note that concentrations of aluminum observed in the study area are typical of northern Ontario and widespread across much or all of the Canadian Shield geologic region.
- Copper - 75th percentile concentrations range from 0.0005 to 0.0041 mg/L. The 75th percentile concentrations of copper are greater than the CWQG of 0.002 mg/L at only one station (MP – Mill Pond outlet); all other 75th percentile concentrations, including Three Duck Lakes that receives inflow from the Mill Pond, are below the CWQG. No concentrations were observed to be greater than the iPWQO of 0.005 mg/L.
- Iron – 75th percentile concentrations range from 0.005 to 1.3 mg/L. The 75th percentile concentrations of iron are greater than the PWQO and CWQG of 0.3 mg/L at 9 of the 46 stations. As with aluminum, concentrations of iron observed in the study area are typical of northern Ontario and widespread across much or all of the Canadian Shield geologic region.
- Zinc - 75th percentile concentrations range from 0.0025 to 0.043 mg/L. The 75th percentile concentrations of zinc are greater than the PWQO and CWQG of 0.03 mg/L and iPWQO of 0.002 mg/L at only one station (P-5 – a seasonal pond). All other 75th percentile concentrations are below the PWQO, iPWQO and CWQG.

- 75th percentile concentrations of all other metals are below the PWQOs, iPWQOs and CWQGs.

4.4.3 Changes to Surface Water Flow and Quality

Development of the Project involves diverting the Mollie River system, which is part of the James Bay watershed, around the open pit mine via constructed water realignment channels, along with a series of dams. Drainage from both Clam Lake and Chester Lake to the Three Duck Lakes system via the Côté Lake will be interrupted when the open pit gets developed in the Côté Lake area. Bagsverd Lake to the north of the project site and the TMF are in the Mesomikenda sub-watershed, also within the James Bay watershed.

Change from existing site conditions in average annual surface water flow were evaluated through water balance modelling (Golder 2018a – see Appendix D) for average, wet and dry climate conditions, considering the planned water management concepts for on-site water management and watercourse realignments.

In general, changes to average annual surface water flow for the active closure (Stage I) phase are predicted to be similar to the Operations phase (typically less than 10% relative to baseline conditions), a result of the realignment features remaining in place and active management of the MRA collection ponds to flood the open pit. Surface water flow decreases of up to 14% are predicted through Three Duck Lakes, a result of the cessation of effluent discharge in the upper basin while the open pit is filling.

In the passive Stage II Phase (when pit lake is full), the water level will have recovered in the Côté Pit to an elevation sufficient to cause overflow (and reconnection) of the pit lake to the Three Duck Lake (Upper). With acceptable water quality, the various collection ponds will overflow to local surface water bodies and no active pumping is planned to occur on the site. The decommissioning of the realignment features will result in watersheds that more closely resemble those of pre-Project development conditions.

In general, surface water flow changes in passive closure (Stage II) were estimated to be 5% or less compared to existing site conditions, suggesting a long-term return to the natural flow regime at the Project site. Greater than 5% surface water flow changes are predicted at Moore Lake and Little Clam Lake and are a result of watershed area change due to the final configuration of the rehabilitated TMF.

Water quality effects predictions were completed (Golder, 2018b – see Appendix D) using a water quality model to estimate the water quality at key site components and potential changes to the water quality of the receiving and downstream environments during Operations and Closure; noting that Closure is referred to in Golder, 2018b as Post-closure Phase Stage I – Active and Stage II – Passive. The approach to the modelled prediction of effects along with climate scenarios is consistent with those applied in the EA. Average concentrations were calculated with the water quality model for average, 1:25-year dry and 1:25-year wet climate conditions.

Monthly average concentrations during the Operations phase, with the exception of arsenic in Three Duck Lakes (upper) and Three Duck Lakes (middle) under the 1:25-dry year climate condition only, are predicted to be below the Water Quality Guidelines (which is a single set of guidelines largely derived from the PWQOs and CWQGs). The maximum monthly average arsenic concentrations predicted to be greater than the Water Quality Guideline are: i) only slightly above the guideline value and below ecological risk thresholds, ii) limited in geographic extent, iii) limited in duration, and iv) not continuous and very limited in frequency. Therefore, the potential related effects of arsenic are immaterial. Based on the water quality modelling results, no effluent treatment will be required during the Operations phase other than sediment control.

Monthly average concentrations during the Closure phase (Post-closure Phase Stage I – Active and Stage II – Passive) are predicted to be below the Water Quality Guidelines. Based on the water quality modelling results, no effluent treatment will be required during the Closure phase.

Monitoring programs pertinent to water quality will be implemented during the Construction, Operations, and Closure phases of the Project to confirm the results of the effects predictions, and to provide a basis for future decision making regarding the environmental management of the Project.

4.5 Groundwater

4.5.1 Groundwater Well Installations

Estimates of hydraulic conductivity of the overburden and bedrock were developed from grain size analysis data (Hazen method), single well rising head and falling head response tests (slug tests) in monitoring wells, and packer testing in boreholes and drillholes. Groundwater levels were monitored at approximately 50 monitoring well locations in the spring, summer and fall of 2012 and 2013 by manual measurement of depth to groundwater. A continuous record of groundwater fluctuations was obtained at 20 locations with data loggers and pressure transducers set to record water pressures hourly. Data loggers were downloaded regularly (three times annually) and data was corrected for barometric pressure using a barologger installed at the site.

Additional baseline hydrogeological information was collected in the area of the TMF footprint in 2016. The field investigations included the drilling of 16 boreholes / piezometer installations throughout the TMF footprint. At many of the borehole locations, nested monitoring piezometers were installed in order to assess hydraulic properties of the various overburden units and bedrock at varying depths. Falling head tests were completed when possible in these piezometers. Coring into bedrock was continued until two consecutive runs of competent bedrock was achieved; where competent bedrock for geotechnical holes was defined as having a Rock Quality Designation greater than 60%. Packer testing was performed in the hydrogeological boreholes to assess bedrock hydraulic conductivity with depth. Refer to Figure 4-5 for baseline groundwater monitoring locations and Appendix F for groundwater monitoring locations.

4.5.2 Hydraulic Conductivity Values

Overburden hydraulic conductivities are from screened intervals of piezometer / monitoring wells in the TMF area. In total, seven falling head tests were carried out at screened intervals within overburden. Results are briefly summarized below:

- Gravel: 5×10^{-6} meters per second (m/s);
- silt / organics: 1×10^{-7} m/s;
- silt: 3×10^{-6} m/s;
- gravelly silt / organics: >2×10^{-6} m/s;
- organics: >1×10^{-5} m/s;
- silt and sand (TMF centre): 1×10^{-5} m/s; and
- silt and sand / bedrock interface (TMF south dam): >3 x 10-5 m/s.

Bedrock hydraulic conductivity estimates were obtained from both packer testing in open drillholes and falling head tests in installed monitoring wells. In general, hydraulic conductivity results for bedrock range from 2×10^{-5} m/s to 9×10^{-7} m/s with a general trend of decreasing hydraulic conductivity with depth.

4.5.3 Groundwater Levels and Flows

Groundwater levels were monitored manually at all groundwater monitoring wells between 2012 and 2013, and continuous (hourly) water level information was obtained from 20 groundwater monitoring wells by means of automatic water level sensor dataloggers.

The depth to groundwater observed between May and December 2012, at monitoring locations throughout the Project site, averaged 0.5 m below ground surface (bgs), and ranged from approximately 5.1 mbgs in areas of higher elevation and / or steeper topography, to 1.1 m above ground surface (ags; groundwater discharge) at lower elevations near swampy areas and surface water features. Discharge was generally observed at the base of steep slopes adjacent to low-lying swampy areas and wetlands.

The seasonal range of groundwater levels at most monitoring locations was less than 1.5 m. As a result, regional horizontal groundwater flow at the site is generally inferred to be from the south-southwest to the north-northeast.

Vertical hydraulic gradients were variable throughout the site, strongly influenced by local relief. On a more localized scale, horizontal groundwater flow is inferred to be topographically controlled and the water table generally provides a subdued reflection of the topography, with flow from recharge areas at higher elevation to discharge areas at lower elevation, commonly adjacent to surface water features. Due to this regime, low-lying areas are characterized by ponds and open water marshes with intervening short streams, which become seasonally saturated during the spring melt and storm events. As a result, the rate of recharge to the groundwater system is expected to be low, in the range of 50 mm per year or less.

Groundwater levels rise quickly in response to recharge from snow melt and larger rainfall events, as evidenced by monitoring data from late-April 2013. During the rest of the year, groundwater levels remain fairly consistent with steady decreases in response to lack of recharge between rainfall events. Levels remained consistent or decreased slightly during the winter.

4.5.4 Groundwater Quality

Groundwater quality monitoring locations were established in early 2012, designated to cover the areas of the Project site. In 2012, groundwater quality was monitored at 37 locations of paired (shallow and deep) or single monitoring wells, and was monitored three times in May-June, August and November-December 2012.

Groundwater chemistry was analyzed for major ions, metals, nutrients and physical parameters (e.g., conductivity and total dissolved solids). Groundwater quality results are compared, as a reference, to ODWS, PWQO and the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life.

Baseline results (Appendix E) indicated that several parameter concentrations occasionally exceeded regulatory criteria during one or more monitoring events in 2012. Most recorded pH values were slightly acidic to near-neutral – the lowest pH recorded was 5.5. About a quarter of the samples' aluminum, copper, iron, tungsten and zinc concentrations were consistently greater than regulatory guidelines (i.e., PWQO and CWQG). Some samples showed exceedances for concentrations of arsenic, cadmium, chromium, cobalt, molybdenum, silver, uranium and vanadium. The concentrations of other parameters analyzed were found to less than the specified criteria.

Cyanide and un-ionized ammonia concentrations were detected in some groundwater samples. Cyanide was only detected at very few monitoring well locations and only during one monitoring event – prior and follow-up sampling rounds showed cyanide concentrations below the method detection limits. Similarly, un-ionized ammonia was detectable at a single monitoring well for only one event. As such, these occurrences are interpreted to be anomalous, due to either laboratory or sampling error. The concentrations of other parameters analyzed were found to less than the specified criteria. No previous milling activities have occurred at the Site, and as such, elevated concentrations of cyanide and ammonia would not be expected. The elevated cyanide and ammonia were only observed during one monitoring event. Further groundwater monitoring will be re-instated as discussed in Section 10.0, and sampling parameters will include cyanide and ammonia

4.5.5 Groundwater Users

A search of the Ministry of the Environment, Conservation and Parks (MOECP), (formerly known as the Ministry of the Environment and Climate Change – MOECC), Water Well Record database was conducted to determine if there are any registered water wells in the vicinity of the Project site. The results of the search indicate that there are six water wells located within a radius of approximately 15 km of the Project site. The 15 km distance is considered to be well beyond the distance within which potential Project related groundwater effects would be expected to occur.

In addition, MOECP records indicate there are two active permitted water takings (PTTW) within a 15 km radius of the Project, both of which were issued to IAMGOLD. As these PTTW are issued to IAMGOLD, there are no current identified permitted water takings likely to be impacted by the Project.

4.5.6 Groundwater Model

A groundwater flow model was constructed and model simulations for the 3D model were completed for the existing conditions based on the Project layout. This model was modified to incorporate Construction phase activities, comprising the water course realignments and dams located in the vicinity of the open pit, as well as the dewatering of Côté Lake. Simulations were then completed, and predictions were developed for effects associated with the Construction phase activities. The model was further modified to incorporate Operations phase activities comprising the staged deepening of the open pit and the full footprint of the MRA and associated seepage collection ponds. Simulations were then completed, and predictions developed for effects associated with the Operations Phase.

4.5.7 Change in Groundwater Levels

Summarized predicted changes in groundwater levels are discussed for each phase below. Effects predictions were developed qualitatively for the Closure phases of the Project:

Construction Phase

- Limited to the immediate area of the watercourse realignment channels, dams and excavated channels;
- Levels will decline in the open pit as overburden is excavated; and
- Effects were incorporated in the 3D model and have been accounted for.

Operations

- The 3D model predicted seepage through dams around the open pit;
- Groundwater previous discharged to nearby lakes becomes redirected to the open pit from continued development, decreasing flow to nearby lakes;
- Leakage from lake bottoms will also contribute to pit inflows, decreasing net groundwater inflow to nearby lakes with the highest potential impacts towards the end of the mine life; and
- Open pit dewatering results in baseflow losses to nearby lakes of roughly 1% or less of the total lake flow budget.

Closure Phase

- Pumping ceases at closure, groundwater, and precipitation aid in pit flooding, along with additional flows directed to the pit from collection systems; and
- Groundwater levels return to pre-mining conditions once the pit has reconnected to the surface water system.

4.6 Terrestrial Environment

Baseline studies were conducted for the EA process (2014). Following layout optimization, additional baseline environmental studies were needed to supplement baseline studies (2017) in the TMF, overburden stockpile and transmission line footprints.

4.6.1 Wetland and Terrestrial Vegetation

The study area is located in the northeastern region of Ontario in Ecoregion 3E (Lake Abitibi Ecoregion). The vegetation in this ecoregion is boreal, with Black Spruce (*Picea mariana*), White Spruce (*Picea glauca*), Balsam Fir (*Abies balsamea*), Jack Pine (*Pinus banksiana*), Tamarack (*Larix laricina*), White Birch (*Betula papyrifera*), Trembling Aspen (*Populus tremuloides*) and Balsam Poplar (*Populus balsamifera*) constituting the main forest species. Species characteristic of the more southerly Great Lakes–St. Lawrence Forest Region, such as Eastern White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*), grow on sandy ridges and other warmer-than-normal sites and now tend to be found only in small, isolated pockets (Crins *et al.*, 2009).

There is a history of forestry and fire in the general area and this is reflected in the vegetation structure. Wetlands are characteristically bowl bogs that are treed and surrounded by peat margin swamps.

Upland deciduous / mixedwood forest, upland coniferous forest and wetland coniferous swamp communities co-dominate the regional area overall. Upland communities and ecosites consisted of deciduous, mixed wood, coniferous and cultural habitats. Wetland communities and ecosites consisted of swamp, fen and marsh-type wetlands.

Results indicate that soils throughout the Project area consist of an organic layer overlying silt and / or sand with occasional till overlying bedrock. Soils are predominantly dry and rapidly drained, though low land and wetland areas have poorly drained fibric peat or sand and silty clays. Bedrock is at, or near the surface over most of the study areas, with soil and overburden at a neutral pH range and with greater soil depth in low lying areas (ranging from 0 m to 18 m).

No provincially rare plant species listed under the Provincial ESA or federally listed species are known to inhabit the regional area (SARO, 2013; NHIC, 2013; SARA, 2013). No provincially rare plant species were detected within the local area during the field programs and no occurrences were recorded for these species within the local area by the MNRF (NHIC, 2013). No provincially tracked plant species were observed during the 2012 and 2013 field surveys. The vegetation communities in the regional area are shown on Figure 4-6.

No plant SAR or provincially rare plants have been reported in vicinity of the Project site (Amec Foster Wheeler, 2013b; Golder, 2013b; ECCC, 2017; MNRF, 2017a, b) and none were observed during the 2017 field investigations. The major vegetation classes that will be affected by the Project site are provided in Table 4-3.

Table 4-3: Number of Hectares of Vegetation Communities Affected by the Project

Vegetation Community (Golder 2014a)	Area (ha) Based on the Project Site
Bog – treed	6.1
Forest – dense coniferous	132.9
Forest – dense deciduous	49.2
Forest – dense mixed	768.7
Forest – sparse	46.7
Forest Depletion – cuts	50.8
Jack Pine Regeneration / Cut	1.1
Water – deep clear	45.5
Wetland	77.2

Source: Amec Foster Wheeler (2018a)

4.6.2 Fauna

4.6.2.1 *Upland migratory birds*

Breeding bird surveys identified a total of 79 species, and two unidentified species. Focal marsh bird species were not observed during marsh bird surveys. Waterbird surveys observed 10 species during the first round, and five during the second round. Whip-poor-wills were heard calling at one survey location within the regional area. Two owl species were heard in the local area during surveys.

In 2017 one Common Nighthawk was observed calling and flying over the coniferous forest. Two Canada Warblers were observed, and one Rusty Blackbird was observed within the TMF footprint.

4.6.2.2 *Raptors*

Five species of owls were observed in the regional area. Northern saw-whet owl (*Aegolius acadicus*) and great horned owl (*Bubo virginianus*) were the only species of owl observed in the local area. These two species, as well as longeared owl (*Asio otus*), northern hawk owl (*Surnia ulula*) and an unidentified owl species were recorded in the regional area. Bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus cyaneus*) and red-tailed hawk (*Buteo jamaicensis*) were observed as well.

In 2017 one active Bald Eagle nest was observed during aerial surveys with two adults present. The nest was located between Three Duck Lake (Upper) and Côté Lake just outside (east) of the study area. Two other raptor species, Red-tailed Hawk and Broad-winged Hawk, were observed during the 2017 spring and summer field surveys and are likely to be breeding in the vicinity of the Project site. Broad-winged Hawks were observed daily within the TMF footprint and the surrounding areas.

4.6.2.3 *Reptile and amphibians*

Reptile and amphibian surveys observed painted turtles at one location along Bagsverd Creek, Unnamed Lake #1 and Clam Lake. No Blanding's turtles were observed. Painted turtles were observed at one location along Bagsverd Creek, Unnamed Lake #1 and Clam Lake. Eight amphibian species were heard calling during surveys in the local area and four within the regional area. Amphibian species identified are all considered provincially and federally secure. The optimized location of the TMF allows for the avoidance of Bagsverd Valley and consequently avoids habitat for Painted Turtles and other herpetile species.

4.6.2.4 *Mammals*

Wildlife characteristic of the region includes white-tailed deer (*Odocoileus virginianus*), moose, black bear, lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), wolf (*Canis lupus*) and coyote (*Canis latrans*) (Environment Canada, 2010).

Evidence of moose was observed throughout the regional area including 21 individual sightings during the winter aerial survey and one sighting during the spring aerial survey. In May and June, moose were commonly observed incidentally along Highway 144 and Highway 560 and as well as at various other roadsides. Winter moose sightings and tracks were typically associated with clearcuts and regenerating forests, particularly those dominated by poplar and abundant young saplings that provide a food source to moose. Limited furbearer evidence was observed directly within the TMF footprint during winter and summer 2017 field surveys.

4.6.2.5 *Bats*

Five bat species and one unidentified bat species were recorded during acoustic surveys. Little brown myotis (*Myotis lucifugus*) was recorded at five of the six stationary acoustic stations. Northern long-eared myotis (*Myotis septentrionalis*) was not recorded. Other recorded bat species include the hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*) and red bat (*Lasiurus borealis*). Similar to the assessment completed during the EA, very limited potential bat hibernacula or potential maternity roost colonies were observed during the 2017 field investigations of the TMF and overburden stockpile area.

4.6.2.6 *Species at Risk*

According to an updated secondary source review, nine upland breeding bird species with the potential to occur in the vicinity of the Project site are currently listed under Provincial or Federal legislation. Some of these are different than those presented in the EA due to status changes or updates to known ranges since 2013. Chimney Swift and Eastern Whip-poor-will are both listed as Threatened provincially under the *Endangered Species Act* (ESA, 2007) and federally under Schedule 1 of the *Species at Risk Act* (SARA, 2012). Canada Warbler, Common Nighthawk and Wood Thrush are listed as Special Concern provincially under the ESA and as Threatened under Schedule 1 of SARA. Rusty blackbirds are listed as Special Concern under Schedule 1 of SARA but are not listed under the ESA. Bald Eagles are listed as Special Concern under the ESA but are not listed under SARA.

4.6.2.7 *Waterbirds*

Waterbirds are considered to be common and relatively abundant in the area. A total of 10 waterbird species were observed during field surveys. Bufflehead (*Bucephala albeola*) and common merganser (*Mergus merganser*) were only observed in lake habitat. Blue-winged teal (*Anas discors*) and wood duck (*Aix sponsa*) were only observed in river habitat. American black duck (*Anas rubripes*) was observed in both lake and river habitat, but mostly along river habitat. Common goldeneye (*Bucephala clangula*) was the most abundant species observed in lake habitat, while American black duck (*Anas rubripes*) was the most abundant species in river habitat.

4.7 Aquatic Environment

Baseline studies were conducted in 2013 and 2016 for the EA process and the subsequent reports are provided in Appendix G.

In 2012 and 2013, Minnow Environmental Inc. (Minnow) conducted extensive baseline studies of the aquatic environment within the study area and baseline studies were updated in 2016 (refer to Appendix G) to reflect the project changes documented in the EER. The baseline studies provided information on:

- Sediment quality (sediment cores and grab samples);
- Benthic macroinvertebrate communities.
- The fish communities and abundance;
- Fish tissue concentrations; and
- Fish habitat conditions relative to life history requirements for resident species;

There are two watersheds within the study area; the Mollie River and the Neville-Mesomikenda Lake watersheds both of which are part of the larger Mattagami River watershed, which flows north to the Abitibi River and discharges into the Moose River upstream of James Bay.

The study area is characterized by lake chain systems with typically shallow lakes (i.e., <10 m) connected through low gradient meandering streams. Water bodies within the local study are dimictic[1] and typically stratified during the summer and winter months. Water temperatures in some lakes can get very warm (23 °C) in the summer due to the shallow depth and limited flow. Most lakes with water depths greater than 5 m experience seasonal hypoxia (i.e., dissolved oxygen concentrations less than 2 mg/L). Water bodies tend to be mesotrophic and yellow-brown in colour. The yellow-brown colour is typical of northern lakes found within the local study area and is associated with the abundance of dissolved organic matter such as humus, peat or decaying plant matter from aquatic vegetation, runoff from forests or wetland areas in proximity to the water bodies. Light penetration varied depending on the water body (e.g., Secchi depth range from 1.4 to 3.7 m).

Baseline water quality within the study area was characterized by Golder (2013, Appendix C). Benchmarks were established based on the most recent water quality guidelines or 95th percentile of background concentrations, whichever was higher. Water concentrations of metals and nutrients within the study area are generally less than water quality guidelines Aluminum and iron were observed at concentrations greater than the benchmark indicating that these substances can be naturally elevated within the study area. Concentrations higher than background were also observed at some locations for chemical oxygen demand, dissolved organic carbon and total

[1] Lakes that undergo two periods of mixing, one in the spring and one in the autumn are referred to as dimictic. These lakes circulate freely twice a year and are directly stratified in the summer and inversely stratified in the winter.

organic carbon which is likely related to the habitat conditions within the lake or stream (i.e., wetlands and highly vegetated areas will have higher concentrations of organic carbon and oxygen demand).

The aquatic habitat in the lakes and ponds typically includes areas of aquatic vegetation (submergent and emergent) with some rock outcrops and sandy beaches sparsely found around the shoreline. The substrate is typically sandy and silty sand within the littoral zone with organic detritus and cobble was also observed. Littoral substrate (<2 m) is generally consistent with the shoreline substrate and transitions to more silt with increasing depth, depending on the lake. A complete description of lentic and lotic habitat conditions within the study area is provided in Aquatic Baseline Reports (Appendix G).

The fish communities within the study area were generally comprised of warm or cool water species. Both the lentic and lotic habitat were dominated by northern pike and yellow perch. Walleye, white sucker, lake whitefish and smallmouth bass are also common. The small-bodied fish community varies based on habitat conditions, but the most common species found were, blacknose shiner (Notropis heterolepis) with fewer spottail shiner (Notropis hudsonius) and Iowa darter (Etheostoma exile). A complete list of the species found in each lake is provided in Table 4.4. No endangered, threatened or special concern fish species (COSEWIC 2013) were observed within the study area in the 2012, 2013 or 2016 surveys or during field studies conducted in 2010 (AMEC 2011). Specific waterbodies that were surveyed in each year are summarized below and in Table 4-4.

Fish Habitat and Community (2014): Bagsverd Creek, Lower Bagsverd Creek, Unnamed Stream to Bagsverd Creek, Bagsverd Lake, Bagsverd Lake (East Arm), Bagsverd Lake (South Arm), Unnamed Inlet from West Beaver Pond, Unnamed Inlet from Bagsverd Pond, Bagsverd Pond, Beaver Pond, Chester Lake, Unnamed Lake, Unnamed Inlet to Chester Lake, Clam Lake, Côté Lake, Delaney Lake, East Beaver Pond, Little Clam Lake, Lower Three Duck Lake, Mesomikenda Lake, Middle Three Duck Lake, Mollie River and Clam Creek, Neville Lake, North Beaver Pond, Schist Lake, Unnamed Lake #1, Unnamed Inlet from Unnamed Lake #2, Unnamed Lake #2, Unnamed Lake #3, Unnamed Inlet to Unnamed Lake #3, Unnamed Pond, Upper Three Duck Lake, Weeduck Lake, West Beaver Pond,

Water Quality (2014): Bagsverd Creek, Bagsverd Lake, Bagsverd Lake (East Arm), Bagsverd Lake (South Arm), Bagsverd Pond, Chester Lake, Clam Lake, Côté Lake, Delaney Lake, East Beaver Pond, Errington Creek, Little Clam Lake, Lower Three Duck Lake, Mesomikenda, Middle Three Duck Lake, Mollie River, Neville Lake, North Beaver Pond, Schist Lake, Unnamed Lake #1, Unnamed Lake #2, Unnamed Pond, Upper Three Duck Lake, Weeduck Lake,

Sediment Coring (2014): Bagsverd Lake, Chester Lake, Clam Lake, Delaney Lake, Lower Three Duck Lake, Mesomikenda Lake, Middle Three Duck Lake, Neville Lake, Unnamed Lake #1, Unnamed Lake #2, Unnamed Lake #3, Upper Three Duck Lake, Weeduck Lake,

Sediment Chemistry/Benthic Invertebrates (2014): Chester Lake, Clam Lake, Weeduck Lake, Upper Three Duck Lake, Middle Three Duck Lake, Lower Three Duck Lake, Unnamed Lake #3, Delaney Lake, Schist Lake, Bagsverd Lake, Bagsverd Lake (South Arm), Unnamed Lake #2, Unnamed Lake #1, Neville Lake, Bagsverd Creek, Errington Creek,

Fish Habitat, Community (2016): Attach Lake, Chain Lake, Upper Chester Lake, Chester Pond, Dividing Lake, Upper Mollie River, Lower Three Duck Pond, Lower Mollie River, Moore Lake, Unnamed Inlet to Moore Lake, Sawpeter Lake (North Complex), Sawpeter Lake, Sawpeter Lake Outlet, Unnamed Lake #3 Outlet, Unnamed Lake #4, Unnamed Lake #5, Unnamed Lake #6, Bagsverd Creek, Unnamed Water Bodies off Bagsverd Creek, Watershed West of West Beaver Pond, Unnamed Water Body #1, Unnamed Water Body #2, Unnamed Water Body #3, Unnamed Water Body #4, Unnamed Water Body #5,

Water Quality (2016): Moore Lake, Chain Lake, Attach Lake, Upper Chester Lake, Sawpeter Lake, Lower Three Duck Pond, Dividing Lake, Lower Mollie River, Bagsverd Creek

Water Quality (in situ) (2016): Attach Lake, Chain Lake, Chester Pond, Upper Chester Lake, Dividing Lake (Inlet), Dividing Lake, Lower Three Duck Pond, Mollie River (Upstream of Dividing Lake), Mollie River (Downstream of Dividing Lake), Moore Lake, Sawpeter Lake (North Complex), Sawpeter Lake, Sawpeter Lake (South Outlet), Unnamed Lake #3 Outlet, Unnamed Lake #4, Unnamed Lake #5, Unnamed Lake #6, Unnamed Water Bodies Outlet, Bagsverd Creek, Unnamed Water Body #1, Unnamed Water Body #2, Unnamed Water Body #4.

Table 4-4: Aquatic Baseline Summary

Watershed		Mollie River Watershed																					Neville Lake Watershed											
Species		Moore Lake	Chain Lake	Attach Lake	Chester Pond	Unnamed Lake #4	Sawpeter Lake [b]	Chester Lake	East Beaver Pond	Unnamed Pond	Little Clam	Clam Lake	Clam Creek	Cote Lake	North Beaver Pond	Weeduck Lake	Three Duck Lakes			Unnamed Lake #3	Mollie River	Dividing Lake	Schist Lake	West Beaver Pond Watershed					West Beaver Pond	Bagsverd Pond	Bagsverd Lake	Bagsverd Creek	Unnamed Lake #5	Unnamed Lake #6
																	Upper	Middle	Lower					Unnamed Waterbody #1[d]	Unnamed Waterbody #2	Unnamed Waterbody #3	Unnamed Waterbody #4	Unnamed Waterbody #5[e]						
Large-bodied Fish Species	Burbot *Lota lota*											✓		✓																		✓		
	Lake whitefish *Coregonus clupeaformis*			✓				✓						✓		✓	✓	✓	✓			✓	✓								✓			
	Northern pike *Esox lucius*	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓								✓	✓		
	Smallmouth bass *Micropterus dolomieu*											✓						✓ [c]																
	Walleye *Sander vitreus*													✓ [c]			✓	✓	✓			✓	✓								✓			
	White sucker *Catostomus commersonii*		✓				✓	✓		✓				✓		✓	✓	✓	✓		✓	✓	✓						✓	✓	✓	✓		
	Yellow perch *Perca flavescens*	✓	✓	✓			✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓								✓	✓		
Small-bodied Fish Species	Blacknose shiner *Notropis heterolepis*							✓			✓	✓		✓		✓	✓	✓	✓		✓		✓								✓	✓		
	Central mudminnow *Umbra limi*																								✓				✓	✓		✓		
	Common shiner *Luxilus cornutus*																	✓																
	Fathead minnow *Pimephales promelas*								✓																✓				✓	✓	✓		✓	✓

	Finescale dace *Chrosomus neogaeus*	✔					✔		✔						✔								✔		✔	✔	✔		✔	✔			✔	✔
	Longnose dace *Rhinichthys cataractae*																																✔		
	Golden shiner *Notemigonus crysoleucas*	✔		✔			✔	✔			✔	✔		✔		✔				✔	✔		✔						✔		✔	✔		
	Iowa Darter *Etheostoma exile*	✔	✔	✔			✔	✔		✔	✔	✔				✔	✔	✔	✔	✔	✔		✔						✔	✔	✔	✔	✔	
	Johnny darter *Etheostoma nigrum*						✔					✔																						
	Northern redbelly dace *Chrosomus eos*						✔		✔						✔										✔	✔			✔	✔		✔	✔	✔
	Pearl dace *Margariscus nachtriebi*																								✔	✔			✔				✔	✔
	Sculpin sp. *Cottus bairdii* *Cottus cognatus*															✔			✔															
	Spottail shiner *Notropis hudsonius*							✔				✔				✔	✔	✔					✔								✔			
	Trout-perch *Percopsis omiscomaycus*							✔																										

[a] This table reflects fish species absence/presence in the current configurations of the Mollie River and Neville Lake watersheds.
[b] Includes North Complex, Sawpeter Lake, and South Outlet.
[c] AMEC 2011.
[d] Fish were observed in Waterbody #1 but not captured for identification.
[e] No fish were caught or observed in Waterbody #5.

4.7.1 Benthic Communities

The benthic communities within the study area were evaluated in thirteen lakes and two streams within the Mollie River and Neville Lake watersheds. Within both the deep (3.5 to 4.5 m) and shallow (1.5 to 2 m) lake stations the benthic communities were dominated by Chironomidae and Chaoboridae (midges) reflective of the habitat conditions in most of the lakes sampled (i.e., soft fine sediments with summer anoxia with depth). Benthic invertebrate density, taxon richness and Simpson's Evenness varied greatly in both the deep and shallow among and within lake stations. However, the high variability among areas resulted in few statistical differences. Generally, the benthic community structure of deep lakes differed based on the presence and abundance of the two dominant groups (Chironomidae and Chaoboridae) versus the presence of or a variety of other species (i.e., presence of Harpactoicoida in Bagsverd Lake or high abundance of *Cyclocalyx* sp. in Neville and Clam lakes). The shallow lake stations differed in their benthic community structure, but these differences were likely reflective of subtle habitat differences in sand, silt, total organic content and clay. Schist Lake was sampled as a potential reference lake for future studies. However, the benthic communities in both the shallow and deep stations proved to be quite different and it is not recommended that it be used in future studies.

4.7.2 Fisheries Resources

Large-bodied fish species (Northern Pike, Yellow Perch, White Sucker) were captured in Côté Lake, Unnamed Lake #1, Bagsverd Lake (South and East arms), Clam Lake (main basin), Unnamed Pond, Mollie River and Bagsverd Creek. In Clam Lake (East arm) and Little Clam Lake, Northern Pike and Yellow Perch, but no White Sucker, were captured. Except for the presence of White Sucker in Bagsverd Pond and West Beaver Pond, no large-bodied fish were captured in other sampled ponds (i.e., Beaver Pond, East Beaver Pond, and North Beaver Pond). Some of the water bodies also supported Lake Whitefish and Walleye, which also represent sport fish. Samplings of the water bodies did not provide evidence of any aquatic SAR (such as Lake Sturgeon) under the Committee on the Status of Endangered Wildlife in Canada.

Mollie River, Bagsverd Creek and Clam Creek are characterized by slow flows, except for shallow and rocky portions. Due to extensive macrophyte coverage observed along the banks, the surveyed watercourses provide suitable spawning grounds for Northern Pike. Ponds surrounding the Project site generally had, except for Unnamed Pond #1, emergent macrophytes and wood debris. Alders, sedges, shrubs, and grasses dominated the banks. The banks of the surveyed lakes were mostly bordered by wetlands and / or forests to the shoreline.

Black Spruce and Cedar mainly overhung the shorelines with alders, shrubs, sedges and grasses in the understory at the lakes' edges. Within the lakes, emergent macrophytes were observed in the periphery, providing spawning habitat for Yellow Perch and Northern Pike. Lake depths vary from approximately 3 m in Côté Lake, 1.6 m in Unnamed Lake #1 and up to 5.8 m in Little Clam Lake. Most lakes had a neutral to slightly acidic pH, with warm waters, shallow Secchi depths (mostly yellow-brown coloured water with moderate clarity) and DO levels typical for regional lakes.

The key sport fish within the study area include; northern pike, yellow perch, walleye, whitefish and smallmouth bass. Abundant habitat available for all life stages of northern pike and yellow perch within the study area supports the dominance of these species. There is adequate habitat to support smaller populations of walleye, smallmouth bass and lake whitefish in the study area although spawning habitat for walleye is limited. Overwintering habitat can be limited in the shallow ponds and lakes (i.e., < 2 m) due to ice cover. Overall, all large-bodied fish within the study area have similar conditions (length at weight) among lakes. Growth, measured as age at length indicated that northern pike growth was variable among lakes within the study area in 2013. All other species age at length data suggests similar growth rates among lakes.

Tissue mercury concentrations in northern pike and yellow perch often occurred at concentrations greater than consumption advisory levels (both for the general population and sensitive population). All other metals, with the exception of arsenic, did not exceed tolerable daily intake (TDI) based consumption benchmarks.

4.7.3 Sediment

Sediment physical characteristics were generally varying mixtures of sand, silt and clay for all benthic invertebrate stations. Sediment composition within the lakes closest to the proposed open pit development (Chester, Clam, Weeduck, Upper and Middle Three Duck lakes) had a naturally higher proportion of sand, likely reflective of natural differences in surficial geology.

Sediment core analysis determined that the surficial and historically deposited sediment quality was similar in all lakes. In addition, the sediment core data indicated that Mesomikenda Lake sediment was different compared to all other lakes within the study area containing higher concentrations of arsenic, barium, cobalt, iron, lead, manganese, molybdenum, titanium, vanadium and zinc. Surficial sediment chemistry taken in conjunction with the benthic invertebrate community sampling was consistent with core sediment sampling results and proved very similar among lakes (excluding Mesomikenda Lake).

Sediment metal and nutrient concentrations within the lakes were naturally enriched for some substances with concentrations above the Provincial Sediment Quality Guidelines (PSQG) Lowest Effect Level (LEL) (OMOE 1993). Specifically, mercury, arsenic, cadmium, copper, iron, lead, manganese, nickel, total phosphorus, total Kjeldahl nitrogen (TKN) and zinc concentrations were found above the LEL but lower than the Severe Effect Level (SEL)2 at one or more stations. Total organic carbon (TOC) was found at concentrations greater than the SEL in at least some stations in all lakes. Concentrations above the LEL are not surprising because the data on which the PSQG was developed was strongly weighted by data for Great Lakes basin sediments, which tend to have substantially lower natural content of many metals relative to sediments in Canadian

[2] The PSQG are numerical criteria that are designed to be protective of sediment-dwelling organisms based on long-term exposure (OMOE 1993). The PSQG include lowest effect level (LEL) and severe effect level (SEL) values. The LEL is defined as the concentration of an analyte that can be tolerated by the majority of benthic organisms (i.e., at least 90-95% of species) and reflects clean to moderately polluted sediments (MOE 1993). The SEL is the concentration at which pronounced disturbance of the benthic community (i.e., to 90-95% of benthic species) can be expected (MOE 1993) and is typically about five times higher than the LEL.

Shield lakes (Prairie and McKee 1994). As such, baseline concentrations of sediment metals, particularly at mineralized areas of the Canadian Shield, can often exceed LELs.

4.8 Site History, Potential Hazards and Current Contamination

4.8.1 Mine History

The property was first worked in 1930. Stripping operations and several trenches were excavated up to 1935. Young Shannon Gold Mines was formed in 1932. In 1936, an inclined shaft (-70 degrees) was sunk to 57m vertically below surface with a level developed at 30 meters. About 52m of lateral development was completed and 670m of diamond drilling was carried out on the 30m level. There are no records that show plans or logs of this work. In 1937, an additional 49m of lateral development on the 60 meter level was completed plus an additional 152m of diamond drilling. Again, there are no records that show plans or logs of this work. A stamp mill was installed (no record of production). Between 1944 and 1946 there was some limited surface work carried (no records). From 1946-1978 the property lay dormant. In 1978, Canadian Gold Crest Ltd leased the property, built a steel headframe (still exists) and wood frame hoist house (still exists), dewatered the shaft, and constructed a 60 tpd mill. Mill feed came from the underground workings on the “C” Zone augmented by a small pit on the “B” Zone. The mill operated successfully for seven months. This would suggest a tonnage milled of some 12,000 tonnes (no records). The gold-copper concentrate was sold to Noranda. There is no surface expression of tailings deposited, or, other stockpiles from this work. From 1979-2005, the shaft was allowed to flood, and was capped in 2013 in accordance with O. Reg. 240/00, Part VII. No other underground work was done. The Young Shannon mine cap will be assessed as part of the detailed design of proposed infrastructure.

4.8.2 Potential Hazards

The historic underground workings at Young Shannon are located North East of the pit between Côté Lake and Three Duck Lakes (Figure 3-3A). The shaft has been capped and vented at surface. The surface opening was 1.5m x 2.4m. The shaft will be overprinted by the ore stockpile. The shaft will be suitably secured through filling or additional reinforcement of the cap prior to placing ore in the stockpile.

4.8.3 Current Contamination

There is no known contamination on site.

Figure 4-1: Current Land Use

Figure 4-2: Topography

Figure 4-3: Watersheds

Figure 4-4: Baseline Surface Water Quality and Flow Monitoring Locations

Figure 4-5: Baseline Groundwater Monitoring Locations

Figure 4-6: Vegetation Communities

5.0 PROJECT DESCRIPTION

5.1 Project Summary

The Project is located in the Chester and Yeo Townships, District of Sudbury, in northeastern Ontario, approximately 20 km southwest of Gogama, 130 km southwest of Timmins, and 200 km northwest of Sudbury. The Project summary is presented in Table 5-1.

Table 5-1: Project Summary

Component	Summary
Footprint	1,050 ha (10.5 km^2)
Life of Mine	17 years
Open Pit	
Footprint	164 ha (1.64 km^2)
Depth	550 m (approx.)
Ore Processing Rate	36,000 tonnes per day (tpd)
Overburden	21 Mm^3
Ore	233 Mt
MRA	
Footprint	300 ha (3.0 km^2)
Quantity	580 Mt
Stockpile slopes	2.6H:1V
Minimum Factors of Safety (FS)	long-term static loading conditions FS = 1.5 short-term at end of construction FS = 1.3 pseudo-static FS = 1.1
Processing	
Comminution	High pressure grinding rolls (HPGR)
TMF	
Deposition Method	Thickened tailings (60-62% solids by mass)
Location	2.8 km northwest of open pit (between Moore Lake and Clam Lake)
Footprint	478 ha (4.8 km^2)
Storage Capacity	233 Mt (151.5 Mm^3)
Maximum Dam Height	82.5 m
Environmental Design Flood (EDF)	Store 1:100 year flood
Dam Design Criteria (FS)	short-term, end of construction FS = 1.3 short-term, prior to filling = 1.5 long-term, static condition FS = 1.5 pseudo-static loading FS = 1.1
Site Access	Access from Sultan (Industrial) Road to the south of the Project site
Water Intake Location	Mesomikenda Lake
Water Discharge Location	Three Duck Lake (Upper)
Emulsion Plant	Sited along the access road in accordance with Natural Resources Canada (NRCan) requirements
Overburden Stockpile	Southwest of open pit
Watercourse Realignments	2.4 km (2 realignments)
TLA	115 kV TLA from Shining Tree (44 km)
TMF Water Management Concept	Closed Loop (no direct discharge to receiving environment)

The current open pit design proposes a final pit measuring approximately 164 ha (1.64 km^2) with a depth of approximately 550 m. Ore processing rates of 36,000 tpd are planned. Extraction of the ore through open pit development will result in the production of an estimated 21 million meters cubed (Mm^3) of overburden and 580 Mt of mine rock. An ore stockpiled will be utilized to smooth the mill feed. Open pit mining and ore processing will occur over a 17-year period. The mining method will be a conventional shovel and truck type operation. The open pit mine is currently expected to operate on the basis of two 12-hour shifts, 365 days per year.

Mine rock will be located in the designated MRA covering an estimated total area of 300 ha (3.0 km^2), with an ultimate elevation of approximately 520 meters above sea level (masl), or an estimated 140 m to 150 m in height. Based on the current design, approximately 100 Mt of mine rock is expected to be used in various Project site construction activities, including major infrastructure such as the TMF, road maintenance and construction. The MRA will be developed over the life of the Project, with a final overall slope of approximately 2.6 m horizontal width to 1 m vertical height (2.6H:1V). Overburden and ore extracted from the open pit will be stockpiled on site. The MRA stability analysis is included in Appendix H.

Ore processing will involve crushing and grinding, including coarse gold recovery by gravity, cyanide leaching, carbon-in-pulp gold recovery, followed by carbon stripping and electro-winning to produce a gold sludge, which will be poured in a doré gold bar using an induction furnace.

The tailings slurry will be directed through a thickening process where the feed slurry density of 50% solids will be increased to a target of 60% to 62% solids by mass. The TMF is located adjacent to the ore processing plant and will cover an area of 478 ha (4.8 km^2). The TMF is designed as a closed loop by recirculating water to the ore processing plant for use as mill make-up water. Tailings will be discharged by pipeline from the south, west, and north sides of the TMF to maintain the TMF pond on the east side to simplify management during Operations and Closure. The TMF will be designed and constructed in accordance with CDA guidelines. The TMF will provide capacity for the storage of approximately 233 Mt (151.5 Mm^3) of tailings solids over the expected Project life.

The Project site is currently accessed from Highway 144 to the east via the Mesomikenda Lake access road, where the current IAMGOLD accommodation facilities and exploration office are located. IAMGOLD intends on using the Sultan Industrial road to the south of Côté Lake as the dedicated main access road for the Project.

Water management for the Project will be integrated to the extent practicable to:

- Maximize the rate of water reclaim / recycle for use in the ore processing plant;
- Provide for optimal effluent quality so as to not adversely affect downstream and receiving water systems.

To develop the open pit, Côté Lake will need to be dewatered. In addition, portions of Three Duck Lake (Upper), Clam Lake and the Mollie River system, and some small ponds and streams will be dammed, overprinted, or will require realignment to direct non-contact water and to allow safe operation of the open pit, TMF, and other Project components.

Power for initial construction and site preparation will be provided by the existing connection to the provincial electricity grid which is owned and operated by Hydro One. Power during the Project Operations phase will be supplied by a 115 kV TLA, 44 km in length, connected to the existing Hydro One Network from the tap near Shining Tree junction. The existing Right of Way (ROW) will be re-cleared to allow for safe operation of the TLA.

Mining operations will be supported by the development of an explosives manufacturing and storage facility. Operations will be supported by a maintenance garage, warehouse and administration complex which will be constructed adjacent to the ore processing plant.

Hazardous waste will be removed from the site and disposed of in accordance with provincial approvals and standards. A waste management plan will be generated for all phases of the Project. Agreements are in place with NDMNRF for utilizing the existing Neville Landfill. IAMGOLD and NDMNRF are currently working together on a potential expansion to accommodate the Project. Domestic sewage will be treated on-site by an appropriately-sized sewage treatment plant.

5.2 Mineralogy of Ore and Host Rock

5.2.1 Regional and Local Geology

The Project is situated in the Swayze Greenstone Belt in the southwestern extension of the Abitibi greenstone belt, and forms part of the well-defined Rideout syncline. The Swayze area went through a complex and protracted structural history of polyphaser folding, development of multiple foliations, ductile high-strain zones, and late brittle faulting.

The Project can be generally characterized by mafic metavolcanics, metasedimentary and pyroclastic bedrock overlain by a thin veneer of glacial till at higher elevations less than 1 m thick, and peak and glaciolacustrine deposits at lower elevations. Bedrock is typically encountered within 4 m depth of the ground surface, with the greatest depth to bedrock observed at 22.6 m.

The northern part of the Project site is located within the transition from felsic to intermediate metavolcanics intrusive rocks in to intermediate to felsic metavolcanics intrusive rocks. The southern portion of the Project is located within the Chester Township, overlying a narrow greenstone belt assemblage. This assemblage separates the Kenogamissi granitoid complex to the north from the Ramsey-Algoma granitoid complex to the south.

The Côté Gold deposit is hosted within the Chester Granitoid Complex (CGC), which is the northern edge of the Ramsey-Algoma granitoid complex. The Project's gold deposit is an intrusion host, disseminated gold deposit that initially has been interpreted as an Archean-aged gold porphyry deposit. Gold mineralization is associated with altered and brecciated intrusive rocks. Roughly, it can be pictured as a core breccia mass within diorite, surrounded by granodiorite. The volume of magmatically brecciated rock has been overprinted by the gold-mineralizing hydrothermal system, which has developed less definable zones of propylitic and potassic alteration. Bedrock Geology is shown on Figure 5-1 and Overburden Geology is shown on Figure 5-2.

Overburden throughout the site include organics or peat, clay, clay / silt, silt / clay, silt, silt / sand, sand / silt, sand, sand / gravel, gravel, gravel / cobbles and till. Overburden in the open pit area is generally confined to relatively narrow and steep sided bedrock valleys or troughs. The overburden in the open pit area is mostly comprised of granular materials, sand, or sand/gravel, with finer materials closer to the surface of silt with peat / organic material. Lake bottom sediments at Côté Lake range in thickness from approximately 8 m to 17 m, comprising of organic silt and fine grained materials. On average, overburden thickness over the open pit is 5 m, ranging from approximately 0.1 m and 22 m. Overburden is generally neutral to alkaline, with low concentrations of sulphur (<0.003%, mostly occurring as sulphate) and variable carbonate per tonne of overburden neutralization potential (NP, 1 to 100 kg $CaCO_3$/t).

Similar conditions are presented within the MRA, with an average overburden thickness of 5 m and ranging from 0.6 m to greater than 22 m. The central portion of TMF contains low-lying swampy terrain, with higher elevation lands along the TMF perimeter. Overburden thickness in the TMF area averages around 6 m, ranging from 1 m to greater than 17 m in low-lying areas. Conditions with the TMF also indicate neutral to alkaline conditions for overburden, with low sulphur content.

5.2.2 Mineralogy

The main lithological units within the Côté Gold deposit include:

- Diorite suite;
- hydrothermal breccia;
- diorite magmatic breccia;
- magmatic mixing breccia;
- heterolithic quartz carbonate breccia
- gneissic tonalite suite;
- mafic and ultramafic;
- course clastic metasedimentary;
- metasedimentary;
- felic to intermediate; and
- felsic to intermediate.

5.2.3 Geochemistry

Static and kinetic testing work for the open pit and mine rock including acid base accounting (ABA) and humidity cell tests determined a generally low risk of acid rock drainage (ARD) for the open pit and mine rock (Amec Foster Wheeler 2013a and Amec Foster Wheeler 2014 (See Appendix I1). Sampling and analysis identified that around 94% of the mine rock was expected to have a neutralization potential ratio (NPR) > 2 and similar percentage based on Carb NPR. In addition, mine rock was determined to have a high excess of neutralization potential, further supporting the low potential risk for ARD.

The information below provides details on data that was collected and analyzed in 2013 / 2014 which was done in support of the EA (2014). An updated analysis was conducted in 2017 in support of the Project, which had an optimized pit shell and samples outside of the optimized pit shell were not included.

5.2.3.1 *Optimized Pit Shell*

The ABA and Leco C and S databases used to support the EA (Amec Foster Wheeler, 2013) were filtered to extract any samples outside the optimized pit shell. In total, 40 samples were removed from the ABA database, which represents 17% of the total number of samples and included the following lithologies: Magma Mixing Breccia, Intrusive Feldspar Porphyry, Intermediate and Felsic Dykes, Diorite, Tonalite, Mafic Dykes and Diabase Dykes. An additional 77 samples (8%) were removed from the Leco database, including samples of Diorite Breccia, Diorite Mega Breccia, Mafic Breccia, Intrusive Feldspar Porphyry, Intermediate and Felsic Dykes, Diorite, Quartz Diorite, Tonalite, Mafic Dykes, Diabase Dykes, and Intrusive Mafic Lamprophyre.

The updated ABA (432) and Leco C and S (1949) databases were used to calculate the number and percentage of PAG and NPAG samples for each rock type within the Project pit shell. Overall, sample coverage within the Project pit shell is comparable to coverage within the EA pit shell.

5.2.3.2 *NPAG and PAG in Mine Rock*

NPAG and PAG samples were distinguished using a cut off neutralization potential ratio (NPR) <2. NPR is a method for screening of acid base accounting (ABA) results, conservatively assuming that neutralization potential ratio (NPR) values of less than 2 represented PAG waste rock or tailings. As identified in the previous investigations, assessment of carbonate NPR (Carb NPR) on the basis of total C and total S is a reasonable screening tool to assess NPR based on modified Sobek neutralization potential (NP) and acid potential (AP) based on sulphide content.

The percentage of NPAG and PAG samples (NPR < 2) in the 2014 databases (ABA and Leco) was the same as the percentage of NPAG and PAG samples within the Project optimized pit shell (94% NPAG; 6% PAG). The majority of individual rock types also reported identical percentages of NPAG and PAG samples in the ABA database with only the Intermediate and Felsic Dykes, Diorite, and Mafic Dyke lithologies reporting a slight difference (between 1% and 3%) in the proportions of NPAG and PAG samples, however, this small difference did not impact the overall proportions of NPAG and PAG in the larger dataset (Table 5-2).

In comparison, the Leco database also had identical percentages of NPAG and PAG samples (Carbonate NPR < 2), with the Diorite Breccia, Diorite Mega Breccia, Mafic Breccia, Magma Mixing Breccia, Quartz Diorite, Diabase Dykes, and Intrusive Mafic Lamprophyre lithologies reporting less than a 5% difference in NPAG and PAG samples (Table 5-3).

Table 5-2: Summary of Neutralization Potential Ratio Distribution of Mine Rock by Acid Base Accounting 2017 Project Pit Shell

Lithological Classification	NPR Distribution (ABA)			
	2014 EA ABA Database		2017 Project Pit Shell ABA Data	
	PAG (NPR < 2)	NPAG (NPR > 2)	PAG (NPR < 2)	NPAG (NPR > 2)
All	6%	94%	6%	94%
Diorite Breccia	8%	92%	8%	92%
Diorite Mega Breccia	14%	86%	14%	86%
Fault Breccia	0%	100%	0%	100%
Hydrothermal Breccia	33%	67%	33%	67%
Mafic Breccia	0%	100%	0%	100%
Magma Mixing Breccia	0%	100%	0%	100%
Quartz Carbonate Heterolithic Breccia	0%	100%	0%	100%
Fault	20%	80%	20%	80%
Intrusive Feldspar Porphyry	0%	100%	0%	100%
Intermediate and Felsic Dykes	17%	83%	20%	80%
Diorite	4%	96%	5%	95%
Quartz Diorite	0%	100%	0%	100%
Tonalite	6%	94%	6%	94%
Mafic Dykes	5%	95%	7%	93%
Diabase Dykes	0%	100%	0%	100%
Intrusive Mafic Lamprophyre	0%	100%	0%	100%
Quartz Sericite Schist	0%	100%	0%	100%

Lithological Classification	CarbNPR Distribution			
	2014 EA ABA Database		2017 Project Pit Shell	
	PAG (NPR < 2)	NPAG (NPR > 2)	PAG (NPR < 2)	NPAG (NPR > 2)
All	7%	93%	7%	93%
Diorite Breccia	15%	85%	15%	85%
Diorite Mega Breccia	14%	86%	14%	86%
Fault Breccia	0%	100%	0%	100%
Hydrothermal Breccia	33%	67%	33%	67%
Mafic Breccia	0%	100%	0%	100%
Magma Mixing Breccia	0%	100%	0%	100%
Quartz Carbonate Heterolithic Breccia	0%	100%	0%	100%
Fault	0%	100%	0%	100%
Intrusive Feldspar Porphyry	0%	100%	0%	100%
Intermediate and Felsic Dykes	17%	83%	20%	80%
Diorite	7%	93%	8%	93%
Quartz Diorite	0%	100%	0%	100%
Tonalite	6%	94%	6%	94%
Mafic Dykes	5%	95%	0%	100%
Diabase Dykes	33%	67%	25%	75%
Intrusive Mafic Lamprophyre	0%	100%	0%	100%
Quartz Sericite Schist	0%	100%	0%	100%

Amec Foster Wheeler (2018b)

Table 5-3: Summary of Neutralization Potential Ratio Distribution of Mine Rock Samples by Leco Carbon and Sulphur 2017 Environmental Effects Review Updated Pit Shell

Lithological Classification	NPR Distribution (Leco C and S)			
	2014 EA Leco Database		2017 Project Pit Shell Leco Data	
	PAG (NPR < 2)	NPAG (NPR > 2)	PAG (NPR < 2)	NPAG (NPR > 2)
All	6%	94%	6%	94%
Diorite Breccia	3%	97%	4%	96%
Diorite Mega Breccia	5%	95%	4%	96%
Fault Breccia	0%	100%	0%	100%
Hydrothermal Breccia	0%	100%	0%	100%
Mafic Breccia	33%	67%	0%	100%
Magma Mixing Breccia	4%	96%	5%	95%
Quartz Carbonate Heterolithic	0%	100%	0%	100%
Fault	0%	100%	0%	100%
Intrusive Feldspar Porphyry	4%	96%	6%	94%
Intermediate and Felsic Dykes	11%	89%	14%	86%
Diorite	4%	96%	4%	96%
Quartz Diorite	3%	97%	0%	100%
Tonalite	7%	93%	7%	93%
Mafic Dykes	7%	93%	7%	93%
Diabase Dykes	19%	81%	18%	82%
Intrusive Mafic Lamprophyre	17%	83%	22%	78%
Quartz Sericite Schist	0%	100%	0%	100%

Amec Foster Wheeler (2018b)

5.2.3.3 *Potential Increase in Diabase to Mine Rock*

In comparison to estimates presented in the EA (included as Appendix I1) of diabase in waste rock (at 0.7% of mine rock) segregation would be expected to result in a small proportion in the waste rock stockpile (e.g., <2%). Analysis has determined that due to slightly lower than average NP and slightly higher sulphide content (though average sulphide content still low at about 0.2%), diabase may have a slightly higher percentage of PAG rock than other rock types (15% to 20% based on ABA and Leco C and S data sets respectively). However, the diabase dykes occur as narrow and widely spaced sub-parallel features ranging in thickness between a few centimeters to 30 m wide (Amec Foster Wheeler 2013a – Appendix I1). Dispersal of the small fraction of diabase within the waste rock stockpile with slightly higher proportion as PAG material (<20%) is not expected to alter the original assessment of net non-acid generating character of the mine rock stockpile.

5.2.3.4 *Field Cell Data*

Field cells were originally constructed in 2013. One season of leachate was collected from these cells; however, in spring / summer 2014, the original cells were noted to leak and were reconstructed in the late summer 2014. During the reconstruction, field cells were renamed as shown in Table 5-4. At that time one cell was deemed redundant due to recategorization of lithologies (FC-3) and was retired. An additional cell for diorite was commissioned and seepage has been collected from each field cell several times per year since.

Field cell monitoring has continued since the submission of the EA and results are included below.

Table 5-4: Field Cell Summary

2013 Field Cell Name	2014 Reconstructed Field Cell Name	Rock Type
FC1	FC14-1	Tonalite
FC2	FC14-2	Tonalite
FC3*	-	Magma Mixing Breccia
-	FC14-3**	Diorite
FC4	FC14-4	Magma Mixing Breccia
FC5	FC14-5	Diorite Breccia
FC6	FC14-6	Diorite
FC7	FC-Rain	Empty field cell blank

* FC3 terminated in 2014
**FC14-3 initiated in 2014
Amec Foster Wheeler (2018b)

Appendix I2 presents the results of field cell monitoring. In general, field cells reported low concentrations of measured parameters, the majority of which decreased throughout testing. Low and decreasing sulphate concentrations indicate low rates of sulphide oxidation which corresponds to the observed low and decreasing metals concentrations. Most metals concentrations have decreased since the start of monitoring in all cells including silver, aluminum, arsenic, boron, calcium, cadmium, copper, potassium, lithium, magnesium, molybdenum, sodium, phosphorous, selenium, strontium, uranium, and vanadium. Some parameters reported detection limits in the last two years that were higher than previous: cobalt, chromium, iron, nickel, lead, antimony, titanium, thallium, vanadium and zinc. Based on the field cell data collected between 2013 and 2017 and static testing data collected for the EA (shake flask extraction), mine rock is expected to have a generally low potential for neutral metal leaching (Appendix I2). Uranium concentrations in some field cells were above the interim PWQO value applied for screening purposes; however, values decreased with time.

5.2.3.5 *Summary of Mine Rock Characterization*

An extensive characterization program of mine rock has been completed. An evaluation of the previous samples within the optimized open pit has identified that metal leaching ML / ARD results remain comparable to previous study findings. The only notable change in mine plan has been the potential exclusion of diabase from ore processing (<1% diabase to the MRA). This small change has been considered and is not expected to have an effect on the ML / ARD characteristics of the MRA. The following are the key findings of the characterization work completed:

ARD potential:

- Most mine rock sampled exhibited little potential for ML / ARD;
- Generally low concentrations of total sulphur (<0.24% at 90^{th} percentile) predominantly as sulphide are observed;
- The maximum reported sulphide content was 1.4% and the most commonly observed sulphide is pyrite;
- The materials exhibit a wide range in NP predominantly as carbonate (in the order of 1 to 450 kg $CaCO_3$/t);
- Calcite is the most commonly observed carbonate mineral with lesser amounts of dolomite and sometimes ankerite identified;
- Most samples are non-potentially acid generating (NPAG) (NPR >2), mean NPR of the mine rock was 19;
- A proxy approach using Leco C and S[3] analysis to estimate NP and maximum potential acidity (MPA) was proven to be reasonable as a stream-lined approach to guide future ARD characterization work for Project mine rock;
- Analysis of available samples within the Project pit shell identified that sufficient samples representing all lithologies continue to be represented within the Project pit shell and included 196 ABA analyses and 835 expanded data set samples;
- Approximately 6% of acid base accounting (ABA) (reference) samples were PAG based on NPR <2 and 7% of ABA samples were PAG based on NPR_{MPA} <2;
- Approximately 5% of the Leco carbon / sulphur samples (835) for the expanded proxy data set were PAG based on NPR_{MPA} <2; and
- A small sub-set of the ABA (reference) samples have been identified with low NP (<10 kg CaCO3/t) that may contain Fe carbonates that are not well characterized by the proxy approach using Leco C and S. All but one of these samples contained very low sulphide content.

The likelihood of net acid conditions occurring in the mine rock piles is considered to be very low. Analysis has concluded that rock sampled has an overall low sulphide content and is combined with a prevalence of potentially non-acid generating rock produced as waste which offsets the limited proportion of PAG samples identified. Therefore, the inclusion of any PAG materials with the bulk of the waste will be an appropriate management method, and segregation of PAG materials is neither practical nor necessary. The strategy for ensuring random distribution will be grade control and geochemical surrogate.

[3] Leco carbon (C) and sulphur (S) induction furnace method for analysing total carbon/sulphur present in samples.

A Mine Rock Management Plan which includes adaptive management considerations is appended (Appendix J). Results of additional testing and geological observation during Life of Mine will be used to update Mine Rock Management as needed. Results to date indicate an immaterial volume of analyzed material with the potential for ML / PAG rock. Mine waste will be adaptively managed and may include ARD spatial assessments, geological observation, ABA screening for verification, analysis of blast hole cuttings and covering and / or submerging identified ML / PAG rock. Provisions will be made to track any PAG rock placed in the MRA to avoid co-locating isolated occurrences of PAG rock identified and placed in the MRA.

ML Potential:

- A number of samples exceeded the 10 times crustal abundance screening criteria for arsenic, bismuth, copper and selenium;
- A few samples exceeded the 10 times crustal abundance screening criteria for cadmium and molybdenum respectively;
- Available data suggests a generally low potential for metal leaching;
- All short-term metal leach results were below O. Reg. 560/94 threshold values;
- A few elements (most frequently vanadium, silver, chromium and copper) in some samples were detected in short term leach test results above the PWQO screening criteria;
- Monitoring of field cells identified steady trends in metals that were low and generally below PWQO screening values with uranium noted to be marginally above the interim PWQO value in isolated samples in the most recent two years of testing (2016 and 2017);
- Most trace elements (including silver, beryllium, bismuth, cadmium, chromium, iron, mercury, lithium, nickel, phosphorus, lead, selenium, titanium, thallium, thorium, tungsten and zinc) were at or below detection limits in all humidity cell leachates; and
- Arsenic, antimony and molybdenum (that can tend to be mobile at neutral pH) were detected at low levels in some humidity cell leachates and copper was detected in leachate only from one PAG cell based on NPR <2.

5.2.3.6 *Overburden Work Completed*

A total of 35 selected overburden materials have been characterized from the proposed open pit area. The following are key findings of the characterization work completed:

- Open pit overburden materials generally do not have a net potential for ARD;
- Generally low concentrations of total sulphur (<0.03%) were observed with mostly similar proportions of sulphate and sulphide;
- A maximum sulphide content of 0.05% was observed;
- Some shallow (<0.9 m depth) soil samples are neutralization potential (NP) depleted (negative NP and depressed paste pH) presumably due to weathering exposure at surface;

- A wide range in NP predominantly as carbonate is present in pit overburden materials (in the order of <1 to more than 200 kg $CaCO_3$/t);
- No potentially acid generating (PAG) samples were identified on the basis of neutralization potential ratio (NPR) <2; and
- Exceedances of the Ontario Typical Range background soil standards (agricultural) were reported for copper in four of 35 samples (three samples also exceeded the residential, parkland, commercial and industrial (R/P/C/I) standard).

5.3 Mining

The mining method will be open pit mining using conventional shovel and trucks. Expected excavated rock types include: tonalite, magma mixing breccia and diorite. The overall estimated strip ratio is 2.85 kt waste to 1 kt ore (3:1).

The open pit mine is expected to operate on the basis of two 12-hour shifts, 365 days per year, with an ore production averaging 36,000 tpd. The mine life is expected to be approximately 17 years. Rock will be broken at the face using explosives and will be loaded using a hydraulic shovel onto haul trucks for transport to the primary crusher or to stockpiles (mine rock to the MRA, ore to the ore stockpile). Ramp widths will be designed to accommodate the necessary heavy equipment.

Approximately 0.33 kg of explosives is expected to be consumed for each tonne of ore and 0.25 kg for each tonne of mine rock mined. Blasting will be carried out five times per week during normal operations. A maximum blast charge per delay of approximately 536 kg has been determined for the open pit during normal operations. Dust control measures will be implemented during all phases of the Project, as required. Storage and preparation of blasting materials is further detailed in Section 5.10.

The primary mining fleet will consist of rotary blast hole drill rigs, mining hydraulic shovels, loaders and 220 t haul trucks. Dozers, graders, auxiliary excavators and other miscellaneous support equipment will support the fleet.

In total, an estimated 203 Mt of ore will be mined from the open pit and processed on site over the Project life. The ore will be stockpiled northeast of the open pit and will be used to balance the mill feed during operations but will be depleted prior to closure. The mine plan is summarized in Table 5-5.

Table 5-5: Summary of the Mine and Processing Production Schedules

	Ore				To	Waste			Total
Year	Direct Feed kt	Stockpiles kt	Total Feed kt	Au Grade g/t	Stockpiles kt	Overburden kt	Rock kt	Total kt	Material kt
-3	-	-	-	-	-	-	-	-	-
-2	-	-	-	-	375	687	1,627	2,315	2,689

	Ore				To	Waste			Total
	Direct Feed	Stockpiles	Total Feed	Au Grade	Stockpiles	Overburden	Rock	Total	Material
Year	kt	kt	kt	g/t	kt	kt	kt	kt	kt
-1	-	-	-	-	4,381	6,083	26,794	32,877	37,257
1	7,243	2,560	9,803	1.29	6,846	629	45,719	46,348	60,437
2	9,276	2,404	11,680	1.13	6,931	0	44,033	44,033	60,240
3	11,459	221	11,680	1.17	7,131	1,952	39,406	41,358	59,948
4	10,889	791	11,680	1.27	4,293	289	44,547	44,836	60,019
5	10,744	936	11,680	1.16	2,621	-	46,647	46,647	60,012
6	6,907	4,773	11,680	0.81	2,137	-	49,067	49,067	58,111
7	8,676	3,004	11,680	0.90	3,667	-	40,363	40,363	52,706
8	9,640	2,040	11,680	0.82	403	1,793	37,697	39,490	49,533
9	10,228	1,452	11,680	0.89	333	-	38,751	38,751	49,312
10	7,991	3,689	11,680	0.72	82	-	37,912	37,912	45,985
11	10,088	1,592	11,680	0.73	-	-	36,338	36,338	46,425
12	10,768	912	11,680	0.88	2,177	-	35,145	35,145	48,090
13	9,769	1,911	11,680	0.96	346	-	12,800	12,800	22,915
14	9,425	2,255	11,680	0.95	281	-	5,380	5,380	15,086
15	10,829	851	11,680	0.99	-	-	3,433	3,433	14,262
16	10,143	1,537	11,680	0.90	-	-	2,063	2,063	12,206
17	-	11,075	11,075	0.41	-	-	-	-	-
Total	**154,075**	**42,003**	**196,079**	**0.94**	**42,003**	**11,433**	**547,722**	**559,156**	**755,234**

Note: Material estimates from the open pit are subject to change during ongoing open pit design and development

5.4 Processing

Based on the metallurgical test work to date, the ore processing plant will utilize gravity separation and cyanidation for gold recovery. It is currently foreseen that the ore processing plant and crusher circuit will be located in a relatively flat area close to the open pit and the TMF in order to minimize transportation distances for ore and tailings and water piping.

Ore processing will involve crushing and grinding, including coarse gold recovery by gravity, cyanide leaching, carbon-in-pulp gold recovery, followed by carbon stripping and electrowinning to produce a gold sludge, which will be poured in a doré gold bar using an induction furnace.

Results from ongoing exploration activities indicate that the ore may contain copper levels such that extraction of copper could be viable in the long term. It is therefore foreseen that, in the future, the ore processing plant may be expanded to include a copper recovery circuit. However, this copper recovery circuit is not included in the scope of the Project as it is not considered feasible at this time. The primary chemicals to be used and stored at the Project site are typical of those used in gold mines in Ontario and elsewhere: fuels (diesel, propane gas and gasoline), and process-related chemicals and reagents. A list of anticipated reagents to be used is detailed in Table 5-8. The primary crusher will be located on bedrock outside and adjacent to the ore processing plant, near the open pit exit ramp. Ore is reduced in size by the crusher circuit and processed in the ore processing plant. The ore processing plant and supporting crusher have estimated throughputs of approximately 36,000 tpd. The crusher circuit includes the primary crusher, screen, secondary crusher and ROM stockpile with its associated conveying system.

The ore will be sequentially reduced in size through a series of steps, anticipated to proceed as follows:

- Hydraulic rock breaker as needed to reduce oversized ore to enable feed into the primary crusher;
- Primary crushing (gyratory crusher) to reduce the ore feed to 80% passing 164 mm;
- Secondary crushing (cone crusher) to reduce the ore feed to 80% passing 38 mm;
- HPGR to reduce the ore feed to 80% passing 2.4 mm; and
- Ball mills to reduce the ore feed to 80% passing 0.1 mm.

Make-up water will be supplied to the ore processing plant from the mine water pond, located adjacent to the ore processing plant as well as from the TMF pond, the polishing pond and Mesomikenda Lake. Approximately 90% of the process water may be derived from the open pit, runoff and seepage collection and supernatant water stored in both the mine water pond and the TMF pond. Freshwater amounting to 360 m^3/d will be taken from Mesomikenda Lake.

An adequate volume of water will be stored in both the mine water pond and the TMF pond to supply the ore processing plant with water during the winter months or during potential prolonged summer / fall drought conditions.

In the gravity separation circuit, gravity concentration takes advantage of the high specific gravity of gold to separate the heavier gold particles from the less dense rock particles, to produce a concentrate with low mass and a high gold content. The gravity concentrate will then be leached in an intense cyanidation reactor, to produce a pregnant solution laden with gold. The tailings from the gravity separation circuit will be returned to the ball mill circuit. Discharge slurry (tailings) from the carbon-in-pulp circuit is pumped to the cyanide destruction circuit and then to the tailings thickener. The thickener underflow is pumped to the TMF, and the overflow is returned for use in the process plant.

The tailing thickeners, leach tanks, lime slaking and cyanide destruction areas are anticipated to be located outside and adjacent to the ore processing plant. Adequate equipment and handling procedures will ensure that cyanide and other reagents are stored and used safely, as is standard for Ontario gold mines.

The cyclone overflow from the grinding circuit will report to a high rate thickener and then to two leach trains in parallel for leaching, each equipped with five leach tanks. The tanks will be contained in a bunded concrete slab to provide secondary containment.

While being processed inside the plant, the ore slurry is thickened to approximately 50% solids and then passes through the following stages:

- Leaching of the feed slurry in a series of leach tanks to which process air and sodium cyanide are added, within an alkaline environment (approximately pH 10.5) to keep the cyanide in solution; at lower pH values cyanide will start to volatilize to the atmosphere (and could produce unsafe conditions);
- Adsorption of the gold that is dissolved in cyanide solution onto activated carbon in the carbon-in-pulp (CIP) circuit; the CIP circuit is comprised of seven tanks containing activated carbon;
- Transfer of the loaded (gold bearing) carbon from the CIP tanks to the gold recovery circuit; and
- Discharge slurry (tailings) from the CIP tanks will be pumped to the cyanide destruction circuit. The detoxified tailings then flow to the tailings thickener. The thickener underflow is pumped to the TMF, and the overflow is returned for use in the process plant.

Most of the activated carbon used in the process will be reactivated for use in the CIP circuit. A small fraction of finer activated carbon will form an inert waste, which will be appropriately stored for subsequent disposal.

The gold recovery circuit will be a secure area with limited access. A conventional or equivalent carbon stripping and electrowinning circuit will be used to recover gold from the loaded activated carbon. The principal recovery steps include:

- Desorption of the washed loaded carbon with a higher strength, pressurized hot caustic cyanide solution, to produce a high strength pregnant (gold bearing) solution;
- Electro-winning gold from the pregnant solutions (CIP and gravity circuits), via electrowinning cells operating in series using steel wool cathodes to produce a gold sludge; and
- Drying and smelting the electro-winning cathode sludge in an induction furnace to produce doré bars.

The electrowinning circuit has been assumed to recover 99% of gold in solution.

Tailings are the primary by-product from the ore processing plant. The resulting tailings, containing some residual cyanide and dissolved metals, will be directed to an in-plant cyanide destruction/precipitation circuit.

The tailings will contain all the ore materials (minus gold) as well as residual process chemicals such as cyanide and lime. Based on geochemical characterization of tailings materials produced in metallurgical testing to date, the following are key findings:

- Almost all tailings materials (97%) indicate a low potential for ARD;
- Generally low concentrations of total sulphur (<0.3%) predominantly as sulphide are observed;
- The maximum reported sulphide content was 1.9%; and
- The materials exhibit a wide range in NP predominantly as carbonate (in the order of <1 to 450 kg $CaCO_3$/t).

The selected cyanide destruction system is the SO_2/Air process. The SO_2/Air process is an industry standard process that destroys the cyanide, and significantly lowers concentrations of dissolved metals to below effluent criteria as a result of cyanide destruction. These metals then precipitate in the TMF. The tailings will be directed to the TMF via a slurry pipeline.

The cyanide leaching process which will be used in the Project will be designed as per industry best practices to meet all conditions for the responsible management and use of cyanide. This includes sodium cyanide transportation and storage, the mixing and use of the reagent in the ore processing plant and the final destruction of cyanide tailings prior to pumping it to the TMF.

Cyanide (sodium cyanide) is dissolved and added to the leach circuit. During the leaching and CIP process, cyanide will occur as both free cyanide and complexed with heavy metals present in the ore. The cyanide will thus be partially consumed as it reacts with sulphur, oxygen and other metals in the ore. A pre-detoxification thickener will be installed to recycle some of the residual cyanide to the ore processing plant water system.

The tailings slurry will be subjected to in-plant SO_2/Air treatment for cyanide destruction. In-plant SO_2/Air treatment of cyanide and metallo-cyanide complexes involves the following (or equivalent) reactions:

$$CN^- + SO_2(g) + H_2O + O_2(g) \rightarrow CNO^- + H_2SO_4(aq)$$

Where copper is used as a catalyst to oxidize the cyanide ion (CN-) to the cyanate ion (CNO-), also producing aqueous sulphuric acid (H_2SO_4). Cyanate then reacts with water (hydrolyzes) to form ammonia (NH_3) and carbon dioxide (CO_2) in accordance with the following reaction:

$$CNO^- + 2H_2O \rightarrow OH^- + NH_3 + CO_2$$

Cyanate hydrolyzation is a long-term reaction that takes place mainly in the TMF. Often, sodium metabisulphite ($Na_2S_2O_5$) is used in the process instead of sulphur dioxide (SO_2), but the overall reaction produces a similar result, as per the following:

$$2CN^- + Na_2S_2O_5 + 2O_2(g) + H_2O \rightarrow 2CNO^- + Na_2SO_4 + H_2SO_4$$

Metallo-cyanide complexes are oxidized according to the following general reaction:

$$Metal\ (CN)_{xy}^{-x} + xSO_2(g) + xH_2O + xO_2(g) \rightarrow xCNO^{-} + xH_2SO_4(aq) + Metal^{y+}$$

The free metal ions are then precipitated by adding lime to form insoluble metal hydroxides, which subsequently become adsorbed onto tailings particle solids, forming less reactive and more environmentally friendly compounds, and will be settled out of the slurry in the TMF. The cyanide destruction will occur in destruction tanks located in a concrete containment area outside the ore processing plant building.

The concentration of cyanide from the SO_2/Air treatment for cyanide destruction is expected to be approximately 2 ppm total cyanide.

5.5 Buildings, Infrastructure and Access

5.5.1 Existing Facilities and Infrastructure

As the Project site is an active exploration area, there are a number of exploration-related facilities, such as drill pads and associated equipment, used to define the current mineral resource as well as to investigate soil and groundwater conditions.

Mineral exploration of the Project site has been carried out since about 1900 by various companies and government agencies and has continued sporadically to the present time. More concerted mineral exploration efforts were conducted in the early 1940's and from the early 1970's to about 1990. Since its discovery in 2010, extensive exploration drilling activities have been undertaken to delineate the Côté Gold deposit. As of December 31, 2015, the Côté Gold drill hole database contains results of 536 diamond drill holes for a total of 273,475 m.

5.5.2 Proposed Buildings, Equipment and Infrastructure

The following buildings and yard areas are currently planned for the Project as shown on Figures 3-3A and 3-3B. A detailed list of all buildings is provided in Appendix K:

- Primary crusher, screen, secondary crusher and ROM stockpile, with associated conveying system;
- Ore processing plant;
- Maintenance garage, warehouse and administration complex;
- Accommodations complex including potable water and wastewater treatment systems, to be used for both Construction and Operations phases;
- Fuel and lube bay;
- General laydown areas and temporary storage facilities during construction; and
- Explosives manufacturing (emulsion plant).

These facilities will be supported by related transport, piping and power infrastructure as needed. Engineering designs are ongoing, and the final location of buildings and related infrastructure may be modified to meet the needs of the Project, within the Project property boundaries, unless otherwise planned and / or negotiated.

The location of the ore processing, maintenance and administrative complexes are proposed in one centralized area northwest of the open pit, positioned far enough away from the open pit perimeter to protect workers and facilities from any potential blast (fly) rock. The overall layout has been developed to accommodate efficient operating conditions with the least travel distances between the facilities, particularly with respect to ore and mine rock haulage and tailings pumping. Special attention will be given to the separation of large haul truck traffic and other site (or local) vehicular traffic during the Construction and Operations phases.

The maintenance garage, warehouse and administration complex will be positioned near to the ore processing plant. It is expected that some temporary general laydown areas will be required during the Construction phase, particularly near the ore processing plant site. Materials and equipment will be kept in the general laydown areas near the ore processing plant site to minimize transport distances to expedite construction efforts. It is possible that some material for tailings dam construction will need to be stockpiled for short periods of time. It is planned to place these small and temporary stockpiles within the future TMF footprint, so as to avoid additional vegetation clearing.

Working bays will allow indoor maintenance on heavy equipment and smaller vehicles. Wash bay(s) will be present for trucks and other equipment to be washed and to allow for effective maintenance and to extend equipment life. Truck wash water will be treated, if required, prior to discharge to the environment to meet regulatory requirements. The chemicals being stored and details on their storage, handling and transportation are presented in Table 5-8.

It is expected that approximately 1,400 construction workers may be accommodated during the Construction phase. Construction accommodation for this workforce will be developed on site, and will include sleeping quarters, as well as a dining room, kitchen, recreation facilities and utility rooms. It is currently foreseen that the accommodation complex will be located about 1 km east of the ore processing plant to allow for easy transfer of staff from the accommodation complex to the construction areas. For the Operations phase, the accommodation complex will be converted to hold a workforce of approximately 500 full-time personnel. The location may vary slightly as engineering progresses on the Project, and it is currently envisioned that it will be located to the north of the polishing pond.

5.5.3 Security and Fencing

A security team will work on site to protect the assets of the company as well as to manage site access. This group will be provided with an inspection checklist for routine inspection rounds in order to maintain safeguards and security measures for public protection and mine site staff and infrastructure.

IAMGOLD does not intend to fence the entire lands converted to mining claims for which IAMGOLD and Sumitomo will hold surface rights. Fencing and signage will be placed strategically to address known or potential safety and security risks. Access to the site will be managed through secure points of entry and all other roads that access the mine site will be gated and appropriately monitored. Access to the site via waterways will principally be controlled through signage and some areas will no longer be accessible. Navigation through the property will be controlled and monitored to ensure safe passage.

5.5.4 Power Supply

Power for initial construction and site preparation will be provided by the existing connection to the provincial electricity grid. In the event the existing electrical connection to the grid cannot satisfy power demand during the Construction phase, isolated site loads would have to be supplied by a separate diesel power generation system which could be up to 5 MW. This system would then be utilized as an emergency source in the event of an electrical grid outage once the Project enters the Operations phase.

Power during the Project Operations phase will be supplied by a 115 kV transmission line connected to the existing Hydro One Network at the Timmins Transformer Station (TS). The Project requires the non-energized T2R 115 kV circuit between Timmins TS and Shining Tree Distribution Station (DS) to be refurbished and a new 115 kV transmission line from the tap just outside of Shining Tree DS to the mine. The alignment from Shining Tree to the Project site already exists, although additional clearing in the ROW may be required. The refurbishment of the Hydro One T2R circuit between Timmins and Shining Tree will be composed of single wood portal frame structures, along with steel powers for line and river crossings.

5.5.5 Access

The Project site is currently accessed from Highway 144 to the east via the Mesomikenda Lake access road, where the current IAMGOLD accommodation facilities and exploration office are located. Access to Côté Lake area and the existing Chester 1 mine infrastructure is through the recently installed 80 t capacity bridge over the lake via a network of light vehicle roads.

IAMGOLD intends on using the Sultan Industrial road to the south of Côté Lake as the dedicated main access point to the Project. Currently, IAMGOLD shares the use of the “Chester Access Road”, a logging road, with EACOM Timber Corporation under a Memorandum of Understanding. EACOM owns the rights to the “Chester Access Road”, which is classified as a Primary Road under the Forest Management Plan. The road at the point of entering the mine site will be managed by IAMGOLD and re-routed as need to accommodate mine infrastructure. EACOM will be provided access through the mine as required to maintain their current forestry operations in the areas adjacent to the mine. Public access will no longer be possible through this road due to the potential interaction with heavy haul trucks and the proximity to the explosives storage/manufacturing facility.

Internal haul and service roads, under the management of IAMGOLD, will link the main Project components and will be linked to the existing local road network. Large haul truck roads and dedicated light vehicle access roads will be kept separate to facilitate mining operations and increase internal road safety.

On-site roads will have nominal travel widths of a minimum of 8 m for light vehicle roads and 38 m for haul roads. Internal ramp widths in the open pit will measure approximately 20 m to 38 m in width, sufficient to accommodate one or two-way traffic of heavy equipment haul trucks and vehicles. The ramp gradient will be maximum 10% on straight sections.

Access to the TMF will be by a haul road at the north side of Little Clam Lake.

5.6 Tailings Management

The TMF has been designed to make use of a closed loop system which pumps water from the TMF pond directly to the ore processing plant for reuse. Tailings are discharged from pipelines on the dam crests at the south, west, and east sides of the TMF to maintain the TMF pond in a fixed location at the northern side (except in the first year when it will be positioned at the east) to simplify management during Operations and Closure.

Tailings were evaluated by Amec Foster Wheeler/Wood to assess the potential for metal leaching and acid rock drainage (ML / ARD). It was determined that the tailings are NAG, with a substantial excess of neutralization potential expected (Amec Foster Wheeler 2013a and 2014 (Appendix I1). There is little evidence of concern for neutral metal leaching in mine rock or tailings.

The TMF provides capacity for the storage of approximately 233 Mt (151.5 Mm^3) of tailings over the expected mine life, with potential for expansion should additional mineral resources be identified through ongoing exploration activities. The TMF dam designs are supported by information on sub-surface conditions gathered from the geotechnical investigations carried out by Golder Associates in 2014 and 2015 and by Amec Foster Wheeler in 2016, 2017/2018 and by Wood in 2019.

The TMF dams are also being designed to contain the Environmental Design Flood (EDF) with no discharge. The EDF is a 1:100-year hydrologic event (24-hour storm run-off or spring runoff event). The TMF spillway is designed to pass the Probable Maximum Flood (PMF). The TMF ultimate footprint is shown on Figure 5-3.

TMF dam designs are subject to ongoing engineering design and optimization. A smaller off-line temporary dyke, related to Construction phase water management (South Pond), within the TMF footprint has been submitted to NDMNRF for approval. IAMGOLD has also applied and received approval by MNRF with respect to *Lakes and Rivers Improvement Act* (LRIA) approvals in support of TMF starter dams.

Prior to development of the TMF dams, topsoil and other organic or unsuitable soils, will be stripped from the dam footprint and stockpiled for construction or rehabilitation activities.

5.6.1 Tailings Management Facility - Dams

The TMF dams are classified using the Canadian Dam Association (CDA) Dam Safety Guidelines (2007; 2013 Revision), the (former) MNRF Classification and Inflow Design Flood Criteria (MNR, 2011a) and the Global Tailings Standard on Tailings Management (GISTM). The following criteria will be used in the geotechnical design of the dam slopes:

- The TMF dams have been classified as ‘Very High’ hazard potential according to the MNRF classification and ‘Extreme’ based on CDA and GISTM. These classifications have been assigned based on the risk of loss of life, potential environmental, cultural-built heritage losses and infrastructure and economic losses;
- The Project site has a low to moderate seismic risk, with a 0.124 g horizontal peak ground acceleration for a 10,000 year return earthquake ($V_{s,30}$ = 760 m/s);
- The required minimum Factor of Safety values for the design slopes are:
  - Short-term, end of construction prior to tailings deposition; Factor of Safety = 1.3,
  - Long-term, static condition; Factor of Safety = 1.5,
  - Pseudo-static condition; Factor of Safety > 1.0; and
  - Post-Earthquake and static liquefaction = 1.2.

The starter dams will be constructed using mine rock with a crest width of 38 m to facilitate 220 t mine truck haulage of rockfill. The upstream and downstream slopes of the TMF dams are constructed at 2.5H:1V and 2.0H:1V, respectively. Parts of the upstream slopes (i.e., east starter dam and north dam) will be provided with a bituminous geomembrane (BGM) liner laid over filter and transition layers and placed over coarse mine rock.

The TMF perimeter dams are raised in stages with mine rock to the required elevations for tailings storage, generally using centreline construction methods, with the upstream shell founded on deposited tailings. The first raise of the east dam and the entire north dam will be constructed using the downstream construction method. The design includes filters at the upstream side of the dams to facilitate drainage of porewater but prevent the migration of tailings particles into the rockfill.

Starter dams will be constructed up to approximately 409.0 masl along the east side (maximum 28 m above the ground surface), and 411.5 masl along the west sides (maximum 20 m above the ground surface). Tentatively, the starter dam will start storage of water starting late 2022 and tailings in April of 2023. The construction of the next dam raise will start immediately following completion of the starter dam in 2023.

Figure 5-4 shows the typical cross section of the TMF and Table 5-6 provides a summary of TMF dam and pond characteristics. Refer to Appendix N for detailed designs of the off-line temporary TMF South Pond Dyke.

Table 5-6: Summary of TMF Dam and Pond Characteristics

Facility	Dam				Pond			
	Crest elevation (masl)	Maximum height (m)	Emergency spillway invert (masl)	Hazard Potential Classification	Maximum normal pond (masl)	Normal freeboard (m)	Method of decant	Environmental Design Flood
TMF Starter dams	409.0 (east) 411.5 (west)	28.0	406.4	Very High (MNRF) Extreme (CDA and GISTM)	404.7	~4.3	Pump to process plant (reclaim)	100-yr freshet
Ultimate – east side	463.5	82.5	458.2 (North Dam)		454.8	~5.7		
Ultimate – west side	460.0	88.0	N/A		Not applicable (tailings containment only)			
Polishing Pond Dams Côté Lake Dam	385.0	5.0	383.7	Low (MNRF)	382.4	2.6	Pumped to effluent discharge (Three-Duck Lake via WRC2)	100-yr 24 hour Storm
Polishing Pond East Dam	385.0	7.0		Moderate (MNRF)				
Watercourse Diversion Dams Clam Lake dams (3)	389.3	~5.5	N/A	High (MNRF)	386.8	2.5	Passive drainage into creek re-alignment channel	Not applicable
New Lake Dam	387.8	~9.0	N/A		385.0	2.8		

Notes:
1. The TMF containment dam crest elevations vary between the (higher) west and (lower) east sides.
2. Maximum dam heights are relative to original ground/bottom of waterbody.

3. The TMF containment dams are rockfill embankments with 2.0H:1V downstream slopes meeting stability requirements in all loading conditions, including the design earthquake.
4. Normal freeboard is the vertical distance from the pond to the dam crest.
5. Seepage and runoff collection dams associated with the mine waste stockpiles are not shown and are subject to detailed design.
6. Little Clam Lake is contained by a haul road and does not require a dam.
7. All dams shown are considered "on-line" and are therefore subject to approval under the Lake and Rivers Improvement Act (administered by the Ontario MNRF, now NDMNRF).

5.6.2 Tailings Deposition and Dam Raising

Tailings will be thickened to a slurry density of 60% to 62% solids by mass and will be conveyed from the mill to the TMF through an approx. 1.4 km long, double-walled, HDPE tailings delivery pipeline. Tailings will be spigotted from the crest of the embankment and sub-aerially deposited to form a tailings beach slope of 0.5 to 1%. Use of this technique minimizes segregation of particle sizes and enhances the clarity of the supernatant pond which can be maintained at a reduced nominal volume. The deposition plan promotes runoff and supernatant drainage towards TMF pond at the north side of the facility.

The perimeter dams will be raised using the pervious dam concept that involves the placement of filter and transition layers to let water permeate towards the seepage collection system while retaining tailings solids within the TMF basin. The ultimate TMF dam crest elevation will be 460.5 to 463.5 m, with a maximum height of about 82.5 m.

5.6.3 Seepage and Runoff Collection

Seepage collection pond locations are located at natural low spots around the TMF. Ditches will intercept seepage and runoff and convey flows by gravity, or pumping as required, to the collection ponds or back into the TMF basin. Groundwater monitoring wells will be installed around the full TMF prior to commencement of tailings deposition in that area.

Comprehensive 3-dimensional seepage modelling and water quality modelling has been conducted for the ultimate TMF configuration as part of the detailed design study and the following mitigations are required:

- Perimeter seepage collection ditches and ponds;
- East dam BGM liner up to the first raise;
- North dam BGM liner on upstream face;
- An approximately 30 hectare (ha) bituminous geomembrane blanket within the north part of the TMF basin connected to the North Dam liner; and
- 10 interception wells at Little Clam Lake.

5.7 Overburden, Mine Rock and Ore Management

5.7.1 Overburden

Overburden will be stripped progressively from the pit surface from the start of the Construction phase until the start of Operations. It will be excavated using diesel and electric shovels, excavators, dozers and / or comparable equipment, and will be transported by haul truck to the overburden stockpile; alternatively, it will be trucked directly to the applicable construction site (e.g., to the water realignment channels) if intended for re-use.

Project development is expected to generate approximately 21.0 Mm^3 of overburden, which will be stockpiled and used for site rehabilitation activities. It is generally anticipated that 65% of the topsoil / overburden is excavated in the pre-production period, with a total of 65% excavated by the end of the first year of production. A push-back of the open pit slopes in Years 3 and 4 yields a further 19%, and in Year 8 the remaining 16% is excavated.

Overburden slopes are expected to have an overall angle range of 3 m horizontal width to 1 m vertical height (3H:1V), with benches that are 10 m high and 15.0 m wide. The slopes may be progressively revegetated to promote long-term stability and protect them from erosion; this is expected to meet or exceed the same safety factors as for the mine rock stockpiles. The slopes may be further protected from erosion by placing NPAG mine rock armouring, as necessary. Ditches will be placed around the overburden stockpile to capture runoff for water management and monitoring of runoff quality. Runoff will be directed to the north or south sedimentation ponds as part of overburden stockpile water management. Water will be directed to the ore processing plant or discharged to the environment if water meets discharge criteria. Refer to Appendix O for detailed designs of the overburden stockpile sedimentation ponds.

5.7.2 Mine Rock

Project development is expected to generate approximately 580 Mt of mine rock. A single mine rock stockpile will be located in the designated MRA covering an estimated total area of 300 ha (3.0 km^2), with an ultimate elevation of approximately 520 masl. The maximum height of the MRA will be 150 m. Based on the current design, approximately 100 Mt of mine rock is expected to be used in various Project site construction activities, mainly for the TMF dam and road maintenance and construction.

The MRA will be developed over the life of the Project, with a final overall slope of approximately 2.6 horizontal to 1 vertical (2.6H:1V). The stockpile layout will include benches every 20 m. Overburden present in the proposed MRA area has an average thickness of 9.3 m, with the greatest thickness of 22.6 m observed on the western shore of Three Duck Lake (Middle), similar to overburden conditions of the open pit area.

The stability of the MRA stockpiles will meet or exceed the following minimum safety factors:

- Long-term static loading conditions Factor of Safety (FS) = 1.5;
- Short-term at end of construction FS = 1.3;
- Pseudo-static FS > 1.0; and
- Post-earthquake and static liquefaction = 1.2.

To meet the required safety factors, excavation of peat and unsuitable soils behind the toe perimeter slopes for a distance of 10 to 40 m depending on the area is planned.

Seepage and runoff management for the MRA will be provided by ditches and seepage collection ponds around the MRA to collect runoff and seepage for water management and monitoring of runoff quality. The collected water will be pumped from the run-off collection ponds to the polishing pond during operations.

In general, the rock analyzed to date is considered predominantly NAG, as discussed in Section 5.2.3. Additional testing is currently being completed to further characterize the rock acid-generating potential. Overall, the blending of the mine rock will neutralize any potential acid generation.

5.7.3 Ore

Medium and low-grade ore will be stockpiled for use in future ore processing late in the mine life. The ore stockpile area has been designed to accommodate a maximum quantity of 30 Mt. To enhance stability and ore rehabilitation the stockpile area will be stripped to bedrock. The historic Young-Shannon shaft cap will be inspected and reinforced prior to placement of ore.

Runoff and seepage will be collected and managed similarly to the MRA water management described in Section 5.9.

5.8 Waste Management

5.8.1 Domestic and Industrial Waste Management

Domestic wastes produced at the Project site are likely to include: food scraps, refuse, clothing, metal tins, scrap metal, glass, plastic, wood and paper. IAMGOLD has started a recycling program and will expand and accommodate waste management for the Project.

An estimated total of 41,680 m^3 of waste is expected to be produced throughout the life of the Project – approximately 31,680 m^3 during Construction and Operations, and 10,000 m^3 during closure. Non-hazardous demolition wastes related to closure of the Project are expected to be stored in a dedicated demolition waste landfill upon closure and volumes have been estimated to be less than 40,000 m^3.

The waste projection estimates assume that no recycling efforts are undertaken, however IAMGOLD has initiated recycling efforts, which will result in waste diversion and reduce estimated waste disposal.

IAMGOLD is in discussions with the NDMNRF to utilize and possibly expand their Neville landfill, negating the potential need for an on-site landfill. The development of a waste management plan will focus on recycling and waste diversion efforts. The landfill will continue to be owned by NDMNRF and its use to dispose of wastes produced at the Project will be managed through contractual agreements. Closure of the landfill would be under the care and maintenance of NDMNRF. NDMNRF has conducted a capacity study on the existing landfill to see if it will meet Project requirements and the future requirements of the existing local residences. IAMGOLD plans to support NDMNRF on an expansion study. If it is determined that the landfill will not be suitable for the Project, then an on-site landfill will be developed.

Waste oil and lubricants will be stored in double-walled or equivalent tanks or sealed containers in bermed areas, and periodically removed for off-site disposal at licensed facilities using licensed haulers. Spent solvents, cleaners and antifreeze will also be stored with appropriate secondary containment and periodically removed for off-site disposal at a licensed facility using licensed haulers.

If required, a bioremediation area could be developed for bioremediation of hydrocarbon contaminated soils rather than transporting these materials off-site. This need will be assessed during future engineering investigations. A waste management plan has been developed to support the construction phase and will be updated for the operations phase.

5.8.1.1 *Domestic Sewage*

Domestic sewage during the Construction and Operations phase will be treated by membrane bioreactor (MBR) sewage treatment plant. The MBR will be capable of high quality treatment to meet effluent regulatory limits. The MBR system will service peak camp populations during the Construction phase and typical on-site workforce during the Operations phase. Sewage will be transferred from various site domestic sources to the inlet of the sewage treatment plant by way of network piping and pumps (where appropriate) or by truck. The BMR system is designed to be mobile such that it can be demobilized and relocated as required without the need for concrete foundations or any other permanent infrastructure for installation. Sludge waste resulting from the treatment process will be temporary stored in holding tanks for either off-site disposal or potentially be disposed of in the TMF.

5.8.1.2 *Solid Wastes*

Solid mineral wastes expected to be produced by the Project include overburden, mine rock and tailings. Overburden and mine rock will be re-used where practical and reasonable for construction purposes or otherwise stored in stockpiles. Overburden is expected to be utilized for progressive rehabilitation and closure.

Solid wastes requiring special management at the site are expected to include: waste petroleum products and packaging, waste glycol, petroleum contaminated soil, waste explosives and possibly biomedical waste. All special management wastes will be stored in sealed containers in lined, bermed areas (or by other means of secondary containment as appropriate).

Off-specification petroleum products (and potentially waste oil) may be used as fuel for the diesel generator(s), heat generation, or transported off site. The quantities of used lubricating oils and other lubricants created on site will be minimized to the extent practical. Used glycol, lubricants and associated materials will be stored in tanks with secondary containment and shipped off site by a licensed disposal company. Opportunities to recycle some of the hazardous waste, such as used oil, will be investigated.

Small quantities of other used fluids, such as cleaning solvents and degreasing agents, will be classified by type and either treated on site, if appropriate, or stored and transported off site to licensed processing facilities in accordance with applicable regulations and best management practices.

Although every reasonable effort will be made to reduce the potential for spills to the environment, it is recognized that minor spills associated with heavy equipment usage (predominantly petroleum hydrocarbons and glycol) may occur occasionally. Contaminated overburden and other materials, associated with any such spills, will be excavated and treated in an on-site remediation area, or transported off site to a licensed facility for disposal, as appropriate.

Explosive wastes will be destroyed according to an approved methodology by the explosives contractor or licensed personnel.

Only very small quantities of biomedical waste, associated with first aid, are likely to be created on-site. Biomedical waste and other medical items, such as sharps and used needles, will be transported off site to a licensed facility for proper disposal.

5.9 Water Management and Treatment

The water management system has been designed to maximize the re-circulation process water and minimize freshwater use with mine water providing the balance of the ore processing plant make-up water. Runoff from the processing plant site will be directed to the mine water pond or polishing pond. Ditching systems will capture runoff and direct the contact water to the closest pond or sump for containment and to aid in settling sediment. Ponds and sumps will be used for wash water for vehicles. Potable water will be monitored and treated to meet water quality criteria. Water around the open pit and MRA will be collected in a series of ponds, sumps and / or ditches and pumped to the mine water pond or polishing pond for treatment (i.e., sediment control) prior to discharge in to Three Duck Lake (Upper).

Domestic sewage will be piped to a package treatment plant on site near the Accommodations Complex. Sewage will be treated and discharged when monitoring indicates it meets appropriate criteria.

5.9.1 Watercourse Realignments

The Côté Gold deposit is situated under Côté Lake, requiring that it be dewatered before pre-stripping activities advance in the open pit footprint. Dewatering of Côté Lake will require the construction of multiple dams and watercourse realignments to isolate it from connected water bodies. Portions of Three Duck Lake (Upper), Clam Lake and the Mollie River system will be dammed or will require water realignment channels to allow for development of the open pit.

The watercourse re-alignment system was designed to facilitate restoration of similar flow conditions upon closure of the mine.

Characteristics of the dams associated with the watercourse realignments are provided in Table 5-6. The two watercourse realignments are shown on Figure 3-3A and are described below.

5.9.1.1 *Clam Lake and Chester Lake*

Outflows from Clam Lake, and Little Clam Lake will require realignment, as they currently flow into the proposed open pit. They will be routed south into Chester Lake. This will be achieved by constructing three dams along the east side of Clam Lake, and potentially a dam north of Little Clam Lake. This will effectively drain Clam Creek, and the portion of the Mollie River located within the extents of the proposed open pit.

A realignment channel approximately 900 m in length with inlet invert elevation of approximately 387 m will be established between Clam Lake and Chester Lake. The realignment will pass through similar terrain to that of the existing watercourses and will provide like-for-like fish habitat replacement. It will be constructed and stabilized to provide continual safe passage of fish and suitable flow capacity.

5.9.1.2 *New Lake to Three Duck Lakes*

Chester Lake flows into New Lake which will be established between the open pit and the MRA. New Lake in turn flows passively into a 1.5 km long realignment channel with inlet invert elevation of 248 m that discharges to Three Duck Lake (Upper). The realignment will provide like-for-like fish habitat replacement. It will be constructed and stabilized to provide continual safe passage of fish and suitable flow capacity. Refer to Table 5-7 for lake elevations during operation and closure.

Table 5-7: Lake Elevations (Existing, Operations, Closure)

Waterbody		Existing	Operations	Closure
Côté Lake / Pit Lake	nominal level (m)	varies 379.9 to 381.7	-	381.5 (Note 1)
	outlet	Three Duck Lake	None (dewatered to facilitate mining)	Three Duck Lake
Little Clam Lake	nominal level (m)	varies 387.2 to 388.2	388.0	388.0
	outlet	Côté Lake	Clam Lake	Pit Lake
Clam Lake	nominal level (m)	varies 385.6 to 386.8	386.8	-
	outlet	Côté Lake	Chester Lake via re-alignment channel	Pit Lake
Chester Lake	nominal level (m)	varies 383.8 to 386.0	386.0	386.0
	outlet	Côté Lake	New Lake	New Lake
New Lake (in Chester Creek)	nominal level (m)	creek level is 382 (approx.)	385.0	382-383.6 (Note 2)
	outlet	Côté Lake	Three Duck Lake via re-alignment channel	Pit Lake OR Pit Lake / Three-Duck Lake
Three Duck Lake	nominal level (m)	varies 379.6 to 381.4		
	outlet	Mollie River		

Notes:
1 The Closure pit lake level will be controlled passively by an outlet control structure (weir) in the former polishing pond west dam
2 The New Lake dam will be removed or lowered for Closure for Post-closure habitat management
3 Hydrologic modelling will be required to set the level of the grade control structure to maintain flows into the realignment channel

5.9.2 Mine Dewatering

Mine water will accumulate during open pit mining operations; and its removal from the open pit will be required continuously for the life of the Project to maintain a dry working environment. Open pit dewatering will start during the Construction phase and will continue throughout the Operations phase. During the Construction phase, water will be directed via drains and / or sumps to three temporary ponds situated at the base of the proposed open pit, which will be progressively relocated as the open pit and respective quarrying activities develop over time. Refer to Appendix Q for detailed off-line dam designs which form the temporary quarry pit ponds for the Construction phase.

Where practicable, water runoff will be diverted from entering the open pit by ditching or other means to reduce the quantity of water flowing over the overburden slopes and the quantity of water interacting with mining operations. Runoff and seepage will be pumped to temporary ponds #1 and #2 at the plant site during the Construction phase, or the mine water pond during the Operations phase. Refer to Appendix P for detailed off-line dam designs which form the temporary plant site treatment ponds for the Construction phase.

Mine water from direct precipitation, overburden seepage and groundwater inflow will be collected in a series of drains and / or sumps at the base of the open pit, which will be progressively relocated as the pit develops over time. During the Operations phase, mine water will be pumped from the pit base to the surface for transfer to the mine water pond. During the Construction phase, water will be collected in temporary sedimentation / quarry ponds within the open pit and either transferred to the temporary plant site ponds or pumped to the TMF to provide water for the ore processing start-up.

During the Operations phase, water from the mine water pond will be pumped to the ore processing plant as needed to help satisfy water requirements, and the remainder of the flow will be sent directly to the polishing pond. No special handling or treatment of snow is considered as accumulated snow in the pit will be removed with the excavated mined materials (overburden, mine rock or ore), or will melt and drain towards the installed sumps.

Mine water is expected to contain suspended solids from general mining and earth moving activities, as well as ammonia and hydrocarbon residuals from ammonium-nitrate based explosives (e.g., ANFO explosives) and heavy equipment operation, respectively. Typical ANFO explosives generate ammonia residuals of about 5% to 10% of the ammonia originally present in the explosive material. Emulsion and emulsion blend explosives typically produce a lower ratio of ammonia residuals and are better suited for blasting in wet conditions. Hydrocarbon residuals are usually due to hydraulic hose breaks, fuel leaks and similar mishaps. Measures will be taken to prevent and clean up any hydrocarbon spills at source to prevent such materials from entering the mine water as practical.

Leaching of the exposed rock within the open pit is not expected to be present to appreciable levels of dissolved metals to the mine water due to the slow kinetics of mineral oxidation.

Ammonia-based residuals will be managed at source through best management practices for explosives handling and use, and through extended effluent aging in the polishing pond. Pumping mine water from below the sump surface will help keep any hydrocarbon residuals from being pumped to the mine water pond. Hydrocarbon collected in the sumps will be periodically removed as required using oil skimmers and / or similar absorbent materials. The absorbent materials will be appropriately handled and disposed of.

5.9.3 Mine Rock Area Runoff Management

Ditches and seepage collections ponds will be placed around the MRA to capture runoff and seepage for water management and monitoring of runoff quality. The collected water will be directed to seepage collection ponds and then pumped to the polishing pond. The system will be designed to collect the average annual precipitation seepage and runoff, with storage capacity to allow for pumping water to the polishing pond.

5.9.4 Water Supply for Ore Processing Plant Operations

The primary water reservoir to support the ore processing plant start-up will be the TMF which will be supplemented by water from the mine water pond basin. For the initial start-up, in addition to natural inflows, water may be taken from Mesomikenda Lake and stored within the TMF for future use.

The mine water pond basin will be supplied by water from runoff (drainage) and seepage collection from the open pit, stockpiles, and from general site runoff and seepage collection systems. Mesomikenda Lake is also expected to provide a potential source of make-up water as needed.

At this time the freshwater removal rate is not expected to be greater than 10% of the process water demand at the ore processing plant, however the maximum freshwater removal rate will be determined during the Permit to Take Water application phase. Freshwater will be taken in accordance with conditions associated with the Permit to Take Water, when approved. The water removal is intended to supplement recycled site water.

The water recycled from the TMF pond is proposed to minimize freshwater uptake needs. Additional water may be reclaimed from the polishing pond.

The mine water pond basin will be designed to have a storage capacity of approximately 80,000 m^3.

5.9.5 Fresh Water and Other Water Requirements

A small amount of fresh water will be used for specialized ore processing plant functions, supplied by the water takings from Mesomikenda Lake, which will supplement recycled site water and also provide for truck washing and fire reserve requirements.

Potable water for domestic consumption (i.e., drinking water and domestic use such as in kitchen and showers) will be provided by groundwater wells in the vicinity of the Project site and / or water from Mesomikenda Lake. It is estimated that an extra 245 m^3/d of freshwater will be required to meet potable water needs for the ore processing plant and accommodations complex. Outlying areas will be provided with a bottled potable water supply.

Approximately 552 m^3/d of freshwater will also be required for the truck wash facility, which will be located next to the ore processing plant, and other similar uses. Ditching around the truck wash will capture flowing water and runoff, which will be directed to the mine water pond.

Other water needs are expected to include:

- Water supply for Construction phase activities, including concrete manufacture;
- Dust control on site roads and stockpiles from various site sources; and
- Sanitary purposes (sewage).

5.9.6 Tailings Management Facility - Water Management

Tailings runoff water will discharge by gravity or seep through the dams and report to the seepage collection system. Seepage collection ditches, ponds and pumps will be installed along the TMF perimeter. Water will be reclaimed to the mill via reclaim barge pumps in the TMF pond.

5.9.7 Water Management Details

The primary water management structures for the Project include:

- The freshwater pipeline from Mesomikenda Lake to the ore processing plant;
- Reclaim water pipelines from the TMF pond, seepage collection pond east (SCP East) and polishing pond to the ore processing plant;
- The tailings slurry pipeline from the ore processing plant to the TMF;
- The seepage collection ponds and ditches for the medium and low-grade ore stockpile, MRA, overburden stockpile and TMF; and
- The polishing pond and associated discharge pipeline to the discharge location within the WRC2 realignment channel upstream of Three Duck Lake (Upper).

Freshwater will be taken from Mesomikenda Lake via a single-walled HDPE freshwater pipeline to the ore processing plant. This freshwater pipeline intake will be designed to meet applicable federal guidelines to prevent the impingement and entrainment of fish. Collection ponds and structures will be designed and constructed in accordance with CDA guidelines.

Water management ponds are described in the following sections. Other water management structures for the Project include the diversion dams and watercourse realignments that will be necessary to accommodate Project components, including the open pit and TMF.

5.9.7.1 *Mine Water Pond Basin*

The mine water pond basin will drain seepage and run-off water dewatered through pumping from the Open Pit and Plant Site run-off water passively to the polishing pond through a collection ditch around the northern perimeter of the ore stockpile. During storm events, the basin will flood and temporarily retain water until it passively drains out of the area to the Polishing Pond. Flooding of this area will not flow to any existing natural water bodies.

5.9.7.2 *TMF Pond*

The TMF pond will form from the deposition of tailings slurry within the TMF, as supernatant water which will accumulate within the topographical low towards the north end of the TMF basin, except during the first year of operations when the TMF pond will develop against the TMF East Starter Dam. The minimum capacity of the TMF pond at each stage of deposition over the Project life will be maintained at approximately 1,500,000 m^3 and will allow for settling of tailings solids and the natural degradation of residual compounds such as ammonia and cyanide.

5.9.7.3 *Polishing Pond*

The polishing pond, between the low-grade ore stockpile and Three Duck Lake (Upper), will allow for improved effluent water quality through the process of natural degradation, whereby any remaining residual chemicals in the water column are passively precipitated, oxidized, taken up through biological processes, and / or volatilized to the atmosphere.

The polishing pond will receive inflows from the mine water pond basin, oil / water separator at the Plant Site area, as well as runoff from the surrounding area. The polishing pond dams will be constructed as low-permeability water retaining structures. The polishing pond will be generally operated lower than Three Duck Lake (Upper), such that that the pressure gradient will be from Three Duck Lake (Upper) towards the polishing pond, thus avoiding the potential for seepage into Three Duck Lake (Upper). The polishing pond will be designed with enough capacity to retain the EDF. If required, water from the polishing pond will be pumped to the processing plant for reuse.

Excess water will be discharged to the environment via the polishing pond to the Three Duck Lake (Upper) via the watercourse realignment channel (WRC) 2 channel (see Site Plan, Figure 3-3A), in compliance with applicable effluent quality criteria. The polishing pond will provide sufficient retention and holding capacity to allow for water quality levels suitable for discharge in accordance with applicable regulations (MMER SOR/2002 222 and O.Reg. 560/94), and the final effluent concentrations set by the MOECP to protect the receiving water(s).

If required, water may be treated prior to release to Three Duck Lake (Upper) by means of an effluent treatment plant, although this is not expected to be needed based on water quality modelling. The polishing pond will have an emergency overflow spillway that will discharge volumes exceeding its design capacity to Three Duck Lake (Upper).

5.9.7.4 *Seepage Collection Ponds*

Where possible, the seepage collection ponds will be placed along or contained by natural topography. Dams/berms will be aligned in low-lying areas. Where the natural topography is not suitable, dams/berms will be designed in accordance with applicable guidelines.

Seepage collection ponds will be designed to collect runoff and seepage from the ore stockpile, MRA, overburden stockpile, and the TMF. They will be designed with enough storage capacity to allow for storage and pumping water to the mine water pond year-round during periods of high or low flow while also maintaining freeboard requirements. The overburden stockpile north and south sedimentation ponds discharges to the environment if water quality meets discharge criteria.

5.10 Fuels, Chemicals, Explosives, Hazardous Substances, and Toxic Substances

The chemicals to be used and stored at the Project site are: process-related chemicals and reagents, fuels (diesel, propane gas and gasoline), and equipment maintenance materials (oil, grease, lubricants and coolants). Table 5-8 provides an overview of the expected storage requirements for the reagents at the Project site. All chemicals will be transported, stored and handled in accordance with applicable regulations and good management practice. Tanks will be installed with appropriate secondary containment and protected against potential vehicular collisions if appropriate. Incompatible materials will be stored separately and not in close proximity to the warehouse or other areas.

Most of the fuel required at the Project site will be diesel which is needed to operate the heavy equipment fleet. Two refueling pads will be established adjacent to the Plant Site area and will include an oil / water separator which will be managed through approved water management facilities. Fuel stations will include a diesel fuel pump station for mining vehicles and a containerized lube top-off system for oil, grease, windshield washing fluid and coolants. Fuel will be stored in 15 diesel tanks of 50,000 L each, for a total storage of 750,000 L of diesel at the Project site. Fuel tanks will be double-walled and secondary catchment will be provided. Other vehicle maintenance liquids will be stored in double-walled tanks or equivalent.

A small quantity of gasoline will also be stored in a double-walled Enviro tank at the Project site for use by light vehicles, all-terrain vehicles, snowmobiles, boats and gas-powered tools. Propane, which would also be stored in a double-walled Enviro tank, may be required at the Project site for use in equipment and potentially for heating. Any storage of pressurized gases will be in accordance with applicable regulations. Alternatively, for gasoline storage, a dual compartment diesel and gasoline tank could be used, rather than a dedicated gasoline tank.

All liquid fuel transfer areas, where there is a reasonable potential for spills, will be constructed to contain fuel that might inadvertently be spilled. Automatic shut-off valves and other such equipment as dictated by best practice will be installed to further reduce the risk of spills during fuel transfer operations. Oil / water separators will be installed in such locations to manage runoff.

Equipment maintenance materials, such as engine oil, hydraulic oil, transmission fluid, gear oils and greases, will be stored in secured containers within the maintenance shop or warehouse. Lubricants will also be securely stored for use at the ore processing plant.

Various solvents, other cleaners and antifreeze will be required for equipment and vehicle maintenance. These materials will be stored in secured containers within the maintenance garage and protected area of the warehouses. Solvents and cleaners will also be securely stored for use at the ore processing plant.

Table 5-8: Anticipated Reagent Use and Handling

Reagent	Use	Delivery (anticipated)	Storage/Handling
Lime (CaO)	pH adjustment; mix into a hydrated lime slurry in the ore processing plant	Fine powder in contained trucks	Stored in a silo; handled in accordance with industry standards for the protection of worker safety and the environment.
Oxygen (O_2)	Required in leach circuit	Bulk liquid in tanker trucks; expected to be replaced by onsite oxygen plant	Stored in a pressurized holding vessel; handled in accordance with industry standards for the protection of worker safety and the environment.
Sulphur dioxide (SO_2)	Cyanide destruction circuit	Liquid in 26 t tanker trucks; or solid (sodium metabisulphite)	Stored in a pressurized holding vessel and handled in accordance with industry standards for the protection of worker safety and the environment; or bulk bags stored with secondary containment and handled in accordance with industry standards for the protection of worker safety and the environment.
Sodium cyanide ($NaCN$)	Dissolution of gold; mixed with water and caustic soda to form a leach solution ($NaCN$)	Solid (briquettes) in containers carried by licensed carriers (preferred); or liquid in tanker trucks, if solid briquettes are not available.	Stored in containers inside a warehouse and handled in accordance with industry standards for the protection of worker safety and the environment; or diluted in a tank, stored in holding tank(s) and handled in accordance with industry standards for the protection of worker safety and the environment.
Caustic soda ($NaOH$)	For cyanide mixing, carbon neutralization/stripping and electrowinning; diluted prior to use	Liquid in tanker trucks	Diluted in a tank and stored in holding tank(s); handled in accordance with industry standards for the protection of worker safety and the environment.
Flocculant(s)	Slurry thickening (various); mixed into solution as appropriate	Solid, bulk super bags	Bulk bags stored with secondary containment outdoors; handled in accordance with industry standards for the protection of worker safety and the environment.
Copper sulphate ($CuSO_4$)	Catalyst to aid in the cyanide destruction process; mixed with fresh water into solution	Solid, bulk super bags	Bulk bags stored with secondary containment; handled in accordance with industry standards for the protection of worker safety and the environment.

Reagent	Use	Delivery (anticipated)	Storage/Handling
Nitric acid (HNO_3) (or similar)	Acid washing of loaded carbon; diluted prior to use	Liquid in tanker trucks	Stored in a holding tank; handled in accordance with industry standards for the protection of worker safety and the environment.
Activated carbon	Adsorption of gold in solution	Solid, bulk super bags	Bulk bags stored outdoors; inert material handled for dust control.

Other minor reagents may include antiscalants, Leachaid and standard industry fluxes, typically consisting of borax, silica and nitre for use in the induction furnace.
Source: IAMGOLD (2013).

5.10.1 Explosives Storage

Explosives needed for the Project will be prepared in a dedicated manufacturing facility or emulsion plant. It is currently foreseen that this facility will be located towards the west of the MRA, at a safe distance from the open pit and mine infrastructure (as shown on the Site Plan, Figure 3-3A). The distances between the various buildings that make up the facility (emulsion plant, explosives magazines) and other facilities and roads will be established in accordance with the Quantity Distance Principles User's Manual (Natural Resources Canada, 1995). It is not expected that explosives can be reasonably transported to the Project site from an off-site facility; however, that alternative may be considered should such a commercial operation be developed locally.

5.11 Proposed Schedule

The proponent is making every effort to streamline the Project economic feasibility and engineering studies, and obtain the necessary environmental approvals, to commence some components of Project construction in the second half of 2020. Meeting this schedule would allow for gold production at the Project to start in the first quarter of 2023. IAMGOLD understands, however, that several studies are still underway and there is uncertainty in timing of receipt of environmental approvals. Consequently, the timing of some scheduled activities may be constrained.

Ownership, control or access to lands and any infrastructure required to develop the Project will be timed to support construction efforts. Unless stated otherwise above, IAMGOLD will have ownership and control of all Project components and infrastructure and will be responsible for monitoring and maintaining their integrity.

The approximate durations of the key Project phases are as follows:

- Construction: 2.5 years;
- Operations: 17 years; and
- Closure: Active (Stage I) - infrastructure removal (excluding pumping) 2 years, pit filling approximately 30 years. Passive (Stage II) breach of water retention dams to establish pre-mining conditions, ongoing monitoring.

5.11.1 Construction Phase

Construction activities will be coordinated according to manpower and equipment availability, scheduling constraints and site conditions. Some activities, particularly those involving work in wet or poorly accessible terrains, are best carried out under frozen ground conditions. The development of activities will also consider environmental aspects, such as fish spawning and bird nesting seasons.

The primary Construction phase activities will include:

- Procurement of material and equipment;
- Movement of construction materials to identified laydown areas within the site. IAMGOLD are also considering using some areas of the Chester site as staging areas to support construction. If required, amendments to the *Advanced Exploration Closure Plan for the Chester Project (G3 2010)* will be made;
- Expansion of existing environmental protection and monitoring plan(s) for construction activities;
- Construction of additional site access roads;
- Construction of dams and water realignment channels / ditches for the development of the open pit, as well as the construction of the TMF;
- Construction / placement of "compensatory" fish habitat within channel realignment works authorized to offset the loss of lake habitat;
- Fish relocation and dewatering of Côté Lake to allow for the pre-stripping of the open pit;
- Stripping of overburden and initiation of open pit mine development;
- Development of aggregate source(s) anticipated to be principally for concrete manufacture, foundation work and TMF dam filter zones;
- Establishment of site area drainage works, including pipelines from freshwater / recycled water sources;
- Development and installation of construction facilities including laydown, accommodations complex, augmenting electrical substation capacity and other related construction infrastructure;
- Construction of associated buildings and facilities, fuel bay, sewage plant and landfill (if developed);

- Preparation of on-site mineral waste handling facilities, including the TMF dams; and
- Construction and energizing of a transmission line including on-site electrical substation.

The accommodation complex, with a capacity to host 1,000 workers, will be constructed at the start of construction to be used during the construction and downsized to 500 for the Operations phases.

5.11.2 Operations Phase

During the Project Operations phase, overburden, mine rock and ore will be extracted from the pit for stockpiling or, for ore, transported directly to the ore processing plant primary crusher for sizing. Sized ore will be processed in the ore processing plant, where the gold will be recovered and doré bars produced. These products will be transported off-site by secure means by road. Typically, for a project of comparable size, the final product is shipped by truck once per week.

As Project operations continue, the open pit will become progressively deeper, and the associated overburden and mine rock stockpiles, and the TMF, will become larger and higher.

Solid and liquid wastes / effluent will be managed to comply with regulations. Environment-related activities that will be carried out during the Operations phase are anticipated to include:

- Ongoing management of chemicals and wastes;
- Water management / treatment;
- Air quality and noise management;
- Environmental monitoring and reporting;
- Follow up environmental studies; and
- Progressive site rehabilitation, where practical. Areas that are no longer required for Project use may be rehabilitated during the Operations phase. Progressive rehabilitation comprises the activities that contribute to the overall rehabilitation efforts that would otherwise be carried out at closure, and efforts carried out in support of the closure activities (e.g., field trials). Investigations may be carried out to determine if any enhancement to facilitate revegetation (e.g., fertilization) is required, and to evaluate the possibility of establishing specific wildlife habitats following closure. Progressive rehabilitation works will include:
  - Removal of construction-related buildings and rehabilitation of laydown areas and access roads used during construction;
  - Stabilization and revegetation of MRA after deposition is completed; and
  - Stabilization and revegetation of the TMF beaches after deposition is completed.

5.11.3 Closure Phase

Rehabilitation of the Project site is expected to take approximately two years to substantially complete infrastructure removal and will commence once operations have ceased. The active

Closure phase will continue while the open pit floods, which is anticipated to take approximately 30 years (Stage I). Monitoring activities will be carried out during this period. The passive Closure phase (Stage II) commences once the open pit is flooded and passively discharges to Three Duck Lake (Upper). The main objective is to reincorporate the open pit lake into the existing watershed.

Water quality is expected to meet background conditions or PWQO guidelines during the passive Closure phase. Refer to Appendix D for water balance and water quality effect predictions.

5.11.4 Approvals

A list of approvals identified during the EA process is provided in Table 5-9.

Table 5-9: Approvals Identified During the EA Process

Approval	Act / Responsible Agency	Relevant Project Component
Federal		
Section 35 (2)b. Authorization for serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery	*Fisheries Act* *Fisheries and Oceans Canada*	Construction of the tailings facility, mine rock stockpiles, access road creek crossings, water works for water intake structures, and / or groundwater dewatering effects, that would cause disruption to creeks and / or ponds supporting fish populations.
Schedule 2 Listing	*Federal Metal Mining Effluent Regulations (MMER)* *Fisheries Act* *Environment Canada*	Overprinting of waters frequented by fish, by a deleterious mineral waste (tailings management facility).
Approval of Works in Navigable Waters	*Navigation Protection Act* *Transport Canada*	Potential interference of navigability to non-scheduled waterbodies.
License for an Explosives Facility	*Explosives Act*	Operation of an on-site facility to supply explosives for use in the open pit operations.
Transportation of Dangerous Goods	*Transportation of Dangerous Goods Act* *Transport Canada*	Transporters of hazardous materials will be trained and registered according to the Federal *Transportation of Dangerous Goods Act*.
Provincial		
Closure Plan	*Mining Act* *Ministry of Energy Northern Development and Mines*	Mine Construction, Operations and Closure. Including financial assurance.
Environmental Compliance Approval – Industrial Sewage	*Ontario Water Resource Act* *MOECP*	Mine / mill water treatment system(s) discharging to the environment, such as for tailings, pit water, site stormwater and mine rock pile runoff
Environmental Compliance Approval – Waste Disposal	*Environmental Protection Act* *MOECP*	For operation of a landfill and / or waste transfer site.

Approval	Act / Responsible Agency	Relevant Project Component
Environmental Compliance Approval – Air and Noise	*Environmental Protection Act* *MOECP*	Discharge air emissions and noise, such as from mill processes, on-site laboratory and haul trucks (road dust).
Environmental Compliance Approval – Potable Water	*Ontario Water Resource Act* *MOECP*	Taking of water of greater than 50,000 litres per day.
Permit to Take Water	*Ontario Water Resource Act* *MOECP*	For taking of ground or surface water (in excess of 50 m^3/day).
Work Permits / Land Use Permits (various)	*Lakes and Rivers Improvement Act / Public Lands Act* *MNRF*	For work / construction on Crown land.
Lakes and Rivers Improvement Act	*Lakes and River Improvement Act* *MNRF*	Construction of a dam in any lake or river in circumstances set out in the regulations.
Forest Resource License	*Crown Forest Sustainability Act* *MNRF*	For clearing of Crown merchantable timber.
Aggregate Permit	*Aggregate Resource Act* *MNRF*	Extraction of aggregate (e.g., sand / gravel / rock for tailings dam or other site construction).
Endangered Species Permit	*Endangered Species Act* *MNRF*	Any activity that could adversely affect species or their habitat identified as ‘endangered’ or ‘threatened’ in the various schedules of the Act.

The Province of Ontario does not require assessment of mining projects in their entirety. Several individual aspects of the Project were however, anticipated to require completion of Provincial EA process(es).

Figure 5-1: Bedrock Geology

Figure 5-2: Overburden Geology

Figure 5-3: Tailings Management Facility Ultimate Footprint

Figure 5-4: Typical Dam Cross Sections (TMF)

6.0 PROGRESSIVE REHABILITATION

6.1 Proposed Measures and Schedule

Progressive rehabilitation will be incorporated into the mine plan throughout the Operations phase with the objectives of:

- Informing design and planning for final rehabilitation and closure;
- Testing rehabilitation methods (where possible);
- Stabilizing Project components as they reach completion to meet end land use objectives; and
- Reducing the long-term liabilities associated with the site and thereby reducing the required value of financial assurance.

Progressive rehabilitation comprises the activities that contribute to the overall rehabilitation efforts that would otherwise be carried out at closure, and efforts carried out in support of the closure activities (e.g., field trials). Investigations may be carried out to determine if any enhancement to facilitate revegetation (e.g., fertilization) is required, and to evaluate the possibility of establishing specific wildlife habitats following closure.

The following sections provide a summary of the anticipated progressive rehabilitation efforts that will be completed during operations.

6.1.1 Buildings, Laydown Areas and Access Roads

Buildings, laydown areas and access roads established during construction, and not required for operations, will be removed. Roads will be scarified, edges sloped as appropriate and revegetated. Foundations (if applicable) will be demolished to grade. Efforts will be made to promote the reuse of building materials, where possible, and building materials that cannot be reused will be recycled or disposed of. Appropriate testing will be completed to confirm soil conditions are appropriate for the intended land use and required remediation of affected soils will be completed, if required.

6.1.2 Tailings Management Facility

The tailings beach will be progressively revegetated with native species where practicable. Test plots will be carried out prior to closure to determine optimum seed mixture and fertilizers required to promote sustainable plant growth. Pending results of the test plots alternative measures may be taken into consideration to establish successful sustainable vegetation. Perimeter ditches will be left in place and protected from erosion, as needed.

Progressive rehabilitation efforts will focus on revegetation of the west / north west area of the TMF, adjacent to Moore Lake with the intent of reducing infiltration into the tailings and therefore seepage to the collection pond. This will require completion of tailings discharge in a sector or stepping-in of the tailings discharge pipeline. It is expected that up to approximately 25% of the tailings surface could be revegetated during the Operations phase. Progressive rehabilitation is generally anticipated to start in the latter part of operations.

6.1.3 Mine Rock Area

The EA anticipated revegetation of approximately 25% of the total MRA surface area (i.e. the flat areas) of the MRA at closure. The intent of this criterion was that planting “islands” would encourage infilling between islands, or natural revegetation, to return the area to a more natural state over time. Areas outside of the targeted areas for vegetation will become naturally vegetated over the course of several decades Post-closure.

Progressive rehabilitation efforts will focus on revegetation on the area of the northeast side of the MRA where the seepage collection ponds are close to Three Duck Lake (Middle and Lower). These do not flow by gravity to the pit and require pumping separately to the polishing pond during operations and closure, until such time as the effluent can be discharged to the natural environment.

More extensive progressive revegetation of the mid-lower benches on the east side of the mine rock will also be considered to improve aesthetics (from the perspective of users of the 4M Canoe route on Three Ducks Lake). Higher berms will be revegetated sporadically with island planting to meet the balance of the revegetation target per the EA commitment.

Selective growth medium will be placed in the flatter and gently sloping areas to promote vegetative growth. Selective seeding / planting will be undertaken to initiate natural revegetation and rehabilitation. Progressive rehabilitation is anticipated to start early in operations (Years 1 or 2).

6.1.4 Aggregates

Permitted Aggregate sites will be closed out under agreements with NDMNRF prepared under the Aggregate Resource Act for a Category 9 Aggregate Permit. Current practice is progressive rehabilitation that will limit all slopes to be 3(horizontal): 1(vertical). Appropriate material will be applied to cover the slopes and floor of the pit. Seed will be applied to prevent erosion. Areas are currently being investigated for potential fish habitat compensation if required.

7.0 REHABILITATION MEASURES – TEMPORARY SUSPENSION

The *Mining Act* defines “Temporary Suspension” as “planned or unplanned suspension of a project in accordance with a filed Closure Plan where protective measures are in place and the site is being monitored continuously by the proponent.”

The general objectives of rehabilitation during Temporary Suspension are to:

- Prevent personal injury or property damage that is reasonably foreseeable as a result of putting a project under Temporary Suspension; and

- Maintain the effluent treatment measures that are required to keep the effluent quality within acceptable levels during Temporary Suspension.

In accordance with Schedule 2 of O.Reg. 240/00, the following issues need to be addressed during Temporary Suspension:

- Access to buildings and other structures and site security;
- Security of mine openings to the surface;
- Management of mechanical, hydraulic and electrical systems;
- Control of all types of effluent discharges and secure waste management systems / sites;
- Management of stockpiles; and
- Management of the tailings, water and other impoundment structures.

These are discussed further below.

7.1 Restriction of Access and Site Security

During Temporary Suspension continued site security would be maintained. This would include a number of operational and maintenance staff and other support staff being on site at all times. Site security personnel will carry out routine inspections of the security, safety and environmental measures and maintain records of these inspections.

As with operations, access to the project site, all buildings and other structures (such as open pit, MRA and TMF) would be restricted to authorized personnel only. Non-essential mechanical, hydraulic and electrical systems will be left in a no-load condition. Live electrical systems will be fenced and locked. Fixed and mobile equipment will be stored in appropriate locations within the Project site or removed. Hazard warning signs will be posted where necessary.

There would be removal of any explosives and ancillary materials and locking of storage areas, with safe storage of chemicals and fuels in locked facilities. Secured areas would be monitored for leakage / damage on a regular basis.

Inspections of the primary crushing facility and crushed ore stockpile will take place. These features would be rendered safe by locking movable parts, removing loose objects, and providing barriers to entry of dangerous areas.

Waste management facilities on site would continue normal operations on an as-required basis.

The access, perimeter and mine haul roads and transmission lines would be maintained, as necessary.

Fuel would need to be maintained on site at all times to support the maintenance activities. Should Temporary Suspension be prolonged (i.e. greater than six months), materials on site that have a limited shelf life or pose a potential hazard, would be transported off site and either returned to suppliers or removed by licensed contractors for appropriate disposal.

7.2 Security of Mine Openings

The security system established for the Construction and Operations phases will be maintained to prevent inadvertent access to the mine openings. The entrance ramp to the open pit would be fenced using boulders or other means, to prevent inadvertent access. A boulder fence and signage will be placed around the perimeter of the open pit.

The historic Young Shannon shaft has already been capped and vented at surface. Inspection of the cap will continue during Temporary Suspension if not overprinted by the ore stockpile.

7.3 Maintenance of Mechanical and Hydraulic Systems and Safety and Security of Electrical Systems

All equipment required for site security and safety, including environmental aspects and safety will be maintained in working condition.

The dewatering pumps will continue to operate to keep the open pit dry, as required. Water treatment and disposal will continue as during normal day-to-day operations as these systems will be used by site maintenance personnel.

All buildings will be locked or otherwise secured to prevent inadvertent access.

All mechanical and hydraulic systems will be left in a no-load condition, excepting those required by the onsite staff for site maintenance and security.

Live electrical systems will be fenced, locked or otherwise secured to prevent inadvertent entry or contact and appropriate signage will be placed to warn of potential hazards. Non-essential electrical systems will be placed in de-energized condition.

All mechanical, hydraulic and electrical systems will be maintained and serviced as required and made safe by qualified personnel.

7.4 Control of Effluents and Secure Waste Management Systems/Sites

Site water management will be required, including:

- Continuation of treatment (i.e., sediment control) and discharge of open pit dewatering as during normal operation to ensure the stability of the workings;
- Continuation of domestic sewage treatment;
- Surface runoff to drainage ditches would continue to be directed and monitored as during normal operation; and
- Monitoring and reporting of discharges and associated receiving waters would continue, as per the permitting requirements.

An inventory of all hydrocarbon products, chemicals, and hazardous wastes (e.g., used oils and greases, and degreasing agents) would be updated during or prior to Temporary Suspension and the storage facilities containing these materials would be monitored for leakage / damage on a regular basis.

Explosives would be removed from site by the supplier.

7.5 Stabilization of Stockpiles

Mine rock, low-grade ore, topsoil and overburden stockpiles will be visually assessed for stability at the start of Temporary Suspension and stabilized as required. Periodic inspections of these areas would be conducted thereafter. Pumping to the polishing pond would continue during Temporary Suspension.

7.6 Stabilization of Tailings, Water and Impoundment Structures

These structures will continue to be managed during Temporary suspension and inspections will be conducted by site personnel on a regular basis to ensure integrity. The pond water levels will also be monitored, and the pumping systems will be operated and maintained as required to ensure that the dams do not overflow.

The berms, swales, decants and culverts associated with the mine water pond, seepage collection ponds, TMF pond and polishing pond will be inspected on a daily basis, cleared of debris and maintained as necessary. Areas with evidence of erosion, sedimentation or slope failure will be repaired by grading, soil placement and reseeding, as necessary.

The TMF dams will be visually inspected by a qualified professional engineer once a year in accordance with all relevant codes and regulations. Other water impoundment structures will be monitored in accordance with provincial permit requirements.

The TMF pond and the polishing pond will have emergency overflow spillways for discharge volumes exceeding design capacity. The TMF pond would discharge to Bagsverd Lake and the polishing pond would discharge to Three Duck Lake (Upper).

7.7 Schedule of Rehabilitation Measures – Temporary Suspension

In summary, the following activities will be carried out within one month of a decision being made to place the site in a state of Temporary Suspension:

- Submission of the Notice of Project Status to the Director of Mine Rehabilitation, indicating that the site is being put under Temporary Suspension;
- Locking the access gates to the site and maintaining site security;
- Continuation of dewatering of the mine workings;
- Putting non-necessary mechanical and hydraulic equipment under no-load condition and non-essential electrical systems in de-energized condition;
- Removal of explosives from site and safe storage of chemicals and fuels in locked facilities;
- Continuation of necessary effluent treatment as required; and
- Monitoring of chemical and physical stability.

8.0 REHABILITATION MEASURES – STATE OF INACTIVITY

The *Mining Act* defines the "State of inactivity" as "indefinite suspension of a project in accordance with a filed Closure Plan where protective measures are in place, but the site is not being continuously monitored by the proponent".

As required by O.Reg. 240/00, Section 23(1), the rehabilitation measures for a State of Inactivity will include all reasonable measures to prevent personal injury or property damage that is reasonably foreseeable as a result of placing the Project in a State of Inactivity.

The general objectives of rehabilitation during a State of Inactivity are the same as those of Temporary Suspension.

In accordance with Schedule 2 of O.Reg. 240/00, the following issues need to be addressed during State of Inactivity:

- Access to buildings and other structures and site security;
- Security of mine openings to the surface;
- Security of mechanical, hydraulic and electrical systems;
- Management of the tailings, water and other impoundment structures
- Management of landfills and other waste management sites;
- Security of fuels, chemicals, explosives, hazardous and toxic substances; and
- Management of stockpiles.

These are discussed further below.

8.1 Restriction of Access and Site Security

Access roads to the site would be secured through locked gates and locks will be placed on all doors to specific site structures. Monthly site inspection visits will be undertaken by security personnel to protect any company assets, restrict entry and ensure that all the safeguards and security measures for protection of the public remain in place.

8.2 Security of Mine Openings – Shafts, Raises and Stopes

The historic Young Shannon shaft has already been capped and vented at surface. Inspection of the cap will continue during State of Inactivity, if not overprinted by the ore stockpile.

There will not be any raises or open stopes as part of the Project.

8.3 Security of Mine Openings – Portals, Adits and Declines

There will not be any portals, adits or declines as part of the Project.

8.4 Security of Mine Openings – Other Mine Openings

During the State of Inactivity, the pit will be allowed to fill. Flooding will be achieved passively through receipt of groundwater and precipitation. It is estimated that it will take approximately 75 years for the pit to fill naturally. Pit Overflow will be via a constructed channel between the ore stockpiles to the polishing pond. A stability assessment will be conducted on all surface mine working as determined by a qualified professional engineer. The entrance ramp to the open pit would be fenced using boulders or other means, to prevent inadvertent access. A boulder fence and signage will be placed around the perimeter of the open pit.

8.5 Security of Mechanical, Hydraulic and Electrical Systems

All salvageable mechanical and electrical equipment will be removed from the pit area and non-necessary mechanical and hydraulic equipment would be placed under a no-load condition. The electrical systems would be placed in a de-energized condition and generators removed from site. Power equipment and materials, including oil-filled transformers, will be taken off site for sale or reuse.

8.6 Monitoring, Maintenance and Rehabilitation of Tailings Impoundment Areas

The water management features of the TMF, including spillway and seepage controls, will continue to be operated as required by the ECA. Discharge will be treated, as necessary. The spillway flow capacity is sufficient to ensure the required freeboard behind the embankment.

The TMF spillway will be maintained during a state of inactivity (see Figure 5-3). If the water is deemed to be dischargeable per the ECA guidelines, it will be allowed to overflow to Bagsverd Lake. If the water is not dischargeable to the environment, it will be diverted to the open pit (by gravity, given the elevation drop). Dam inspections by a qualified engineer will continue. It is expected that the tailings pond will provide adequate retention to prevent sediment (tailings) transport.

8.7 Monitoring, Maintenance and Rehabilitation of all Landfill and other Waste Management Sites

There are no landfills at the proposed Project, therefore no action is required. Should the demolition landfill site be constructed before entering into a State of Inactivity, inspection of the landfill will be conducted monthly.

Salvageable machinery, equipment and other materials will be dismantled and taken off site for sale. There will be no equipment containing polychlorinated biphenyl (PCB) used at the site. Gearboxes or other equipment, containing hydrocarbons that cannot be cleaned out, will be removed from equipment and machinery and transported off site for disposal at a licensed facility. Above-grade concrete structures will be broken and reduced to near grade, as required.

8.8 Security of Fuels, Chemicals, Explosives, Hazardous Substances, and Toxic Substances

All petroleum products and chemicals will be removed from the site. Empty tanks will be sold as scrap, re-used off-site, or cleaned to remove any residual fuel or chemicals and disposed of at an appropriately licensed facility.

Any remaining explosives would be removed from site by the supplier.

8.9 Stabilization of Stockpiles

If closure and rehabilitation has not been completed, the remaining stockpile areas will be inspected and graded if necessary to promote surface drainage and to prevent excessive erosion and assure stable, safe slopes. Runoff and seepage, if any, will be collected in their respective seepage collection ponds. Water quality will be monitored in the seepage collection ponds. Seepage collection ponds may discharge to the environment, if water quality meets discharge criteria.

8.10 Stabilization of Tailings, Water and Impoundment Structures

Dams will all be designed for closure; therefore, no additional stabilization will be required. Monthly inspections would be completed to ensure hydraulic structures and drainage channels are free of debris and sediments. An annual inspection of the physical stability of dams, dykes, channels and ditches would be undertaken by a qualified professional engineer.

The TMF pond and the polishing pond will have emergency overflow spillways for discharge volumes exceeding design capacity. The TMF pond would discharge to Bagsverd Lake and the polishing pond would discharge to Three Duck Lake (Upper). If the water quality of the seepage collection ponds is not deemed suitable for direct discharge to the environment, pumping of this water into the mine water pond (and then pit) would continue. Water would be pumped to the pit directly, if required, once the mine water pond has been decommissioned.

8.11 Site Inspection Program

The site inspection program during a State of Inactivity is discussed in Section 10. In summary, this would include physical stability monitoring and water quality monitoring.

The results of all physical and chemical stability monitoring will be reported to the MOECP and NDMNRF on a bi-annual basis.

8.12 Schedule of Measures for State of Inactivity

The following activities would be carried out during a State of Inactivity:

- Submission of the Notice of Project Status to the Director of Mine Rehabilitation, indicating that the site is being put under State of Inactivity;
- Retention of site security, though inspections would be monthly;
- Removal of mechanical and electrical equipment from the open pit
- Cessation and removal of pit pumping infrastructure to allow the open pit to flood;
- Putting non-necessary mechanical and hydraulic equipment under no-load condition and non-essential electrical systems in de-energized condition;
- Removal of explosives from site and safe storage of chemicals and fuels in locked facilities;
- Continuation of necessary effluent treatment as required; and
- Monitoring of chemical and physical stability.

9.0 REHABILITATION MEASURES – CLOSING OUT

“Closing Out” as defined in the Mining Act is “that the final stage of closure has been reached and that all requirements of a Closure Plan have been complied with”. A notice will be provided to the Director of the Ministry of Energy Northern Development and Mines, as per Subsection 144 (1) of the Mining Act, immediately following a decision to proceed to closing out of the project. For the purposes s. 145 of the Mining Act, the ‘rehabilitation measures’ that may be carried out by the Crown or an agent thereof are not limited to the rehabilitation measures explicitly set out in this closure plan – rather, in those circumstances, the term ‘rehabilitation measures’ includes any rehabilitation measure that the Director, acting reasonably, believes is necessary in the circumstances.

The primary objective of the Closure phase is to rehabilitate the Project site area to promote endemic flora and fauna, and aquatic habitat that supports healthy fish populations. Once the open pit is flooded the open pit lake will be incorporated into the exiting watershed. Access will be maintained or re-established for traditional and non-traditional land users. All infrastructure will be removed (unless otherwise stipulated, based on agreements with the respective authorities and local communities), ground disturbance areas will be rehabilitated, and surface drainage will be re-established. A second objective is to prevent personal injury or property damage that is reasonably foreseeable as a result of closing out the project.

The sections below outline the measures that would be taken for final closure of the project site in order to accomplish the above mentioned objectives.

9.1 Security of Shafts, Raises and Open Stopes

There will not be any shafts, raises or open stopes as part of the Project.

9.2 Security of Portals of Adits and Declines

There will not be any portals, adits or declines as part of the Project.

9.3 Stabilization and Security of Other Mine Openings

The open pit is the only mine opening and is discussed in Section 9.4. As stated previously, the historical Young Shannon shaft will be overprinted by the ore stockpile during operations. Inspection of the cap will occur upon removal of the ore stockpile.

9.4 Stabilization of Surface and Subsurface Mine Workings

9.4.1 Open Pit

It is planned that the open pit will begin filling once dewatering activities cease. The closure pit lake level is expected to be approximately 381.5 masl, or about 0.5 m above the nominal Three-Duck Lake level. The outlet elevation at Closure will be close to existing conditions, so as to keep the flows through there similar to Pre-mining conditions. Pit inflows are summarized in Appendix D.

Flooding is predicted to take 25 - 30 years. Flooding will occur through natural groundwater infiltration and precipitation, as well as by potential active filling from the following sources:

- TMF pond;
- Polishing pond;
- Water collected in some or all of the MRA seepage collection ponds;
- Site runoff from areas naturally draining towards the open pit; and
- A portion of the spring freshet from New Lake.

Other measures to be taken to rehabilitate the open pit are likely to include:

- Construction of a boulder fence around the perimeter of the open pit and a barricade at the pit access ramp(s) during or following active mining operations to maintain safety while the pit is flooding;
- Removal of infrastructure and equipment within the open pit and clean-up of any fuels and lubricants such as petroleum hydrocarbons from vehicles and / or mechanical equipment, if necessary; and
- Revegetation of the non-flooded overburden slopes within the open pit to help stabilize the slopes and facilitate establishment of riparian habitat along the pit lake margins. Stockpiled topsoil or overburden will be used as a medium for revegetation.

Engineering designs for the proposed open pit have incorporated stable side slopes. At the time of closure, the final condition of the pit walls in the open pit will be reviewed by a professional engineer in compliance with the Code. Refer to Appendix D for water balance and water quality effects predictions.

Once the open pit is flooded and starts discharging to the surface water receiver, it is expected that the outflow will meet water quality guidelines (PWQOs and CWQGs). As a contingency measure, IAMGOLD is committed to treating surface water outflow from the open pit, if required. Water quality monitoring will be ongoing during operations and closure, and contingency water treatment options would be evaluated based on an adaptive management approach; that is, treatment needs would be based on water quality data collected during the Operations phase and during the 30 years (approx.) when the pit is flooding.

Issues with regards to the chemistry of the flooded open pit water are not anticipated. However, a contingency for treatment will be provided if pit lake water quality is not as predicted. The watercourse re-alignment channels will be left in place for as long as required, which will ensure flows could bypass the open pit and continue to Three Duck Lake (Upper) and avoid the potential need to discharge pit lake water which would not meet water quality guidelines. This contingency would also be applied in the event that vertical transport of contaminants cause shallow pit water chemistry to not meet water quality guidelines and regulatory requirements for direct discharge to environment. These options allow for flexibility in terms of how the Mollie River system can be managed to ensure continued ecological integrity.

9.4.2 Aggregate Pits

Aggregate pits are not included in this Closure Plan as they are separately permitted. If a quarry or additional pits are required and developed during the construction and / or Operations phases, these, as well as the already existing aggregate sources, will be progressively rehabilitated and reclaimed according to Provincial approvals and standards.

9.5 Removal of Buildings and Infrastructure

9.5.1 Pipelines and Power Lines

There will be a number of pipelines at the site, including the tailings slurry pipeline and the reclaim water pipeline between the ore processing plant and the TMF. Buried pipelines will be purged, dismantled and disposed of in the on-site demolition waste landfill.

The transmission line from Shining Tree to the site will continue to operate to provide power to the pump houses and potential water treatment system as required. Once the water quality is suitable for discharge to the environment without potential treatment, there will no longer be a necessity to keep maintaining the transmission line and this one will be dismantled. Rehabilitation will involve removal and recycling / reuse of electrical equipment. Poles will be removed or cut at grade, and either reused or appropriately disposed of, either in the demolition landfill or in an appropriate off-site location, unless another use is negotiated with local communities and / or Indigenous groups. The transmission line component from Timmins to Shining Tree will remain under Hydro One Networks' control and management

The on-site transmission lines, poles and associated equipment that have no salvage value will be dismantled and deposited in the on-site demolition landfill. Other power equipment and materials, including oil-filled transformers, will be taken off site for sale or reuse. Any contamination, should it occur, will be appropriately cleaned up.

It is assumed that IAMGOLD will remove the transmission line at the end of the Project unless otherwise transferred to another operator as needed to service regional needs. It is anticipated that this will be determined in consultation with stakeholders during the Operations phase.

9.5.2 Dewatering Infrastructure

Pumps, pipelines, sumps and associated equipment used for open pit dewatering during the Operations phase will be removed from the pit and sold for re-use / recycle or disposed of either at the on-site demolition landfill or at external licensed facilities.

The pumps and pipelines used to direct water from the MRA seepage collection ponds to the mine water pond during the Operations phase will be used to direct water from the MRA water seepage collection ponds to the open pit.

9.6 Removal of Machinery, Equipment and Storage Tanks

Salvageable machinery, equipment and other materials will be dismantled and taken offsite for sale or recycling, where economically feasible.

Empty fuel tanks will be removed from site and sold as scrap or reused, where economically feasible. Otherwise they will be taken to an appropriately licensed landfill facility offsite.

Any remaining materials will be disposed of in a licensed landfill in accordance with all applicable governmental regulations.

Precautions will be taken to avoid spills and soils would be tested for hydrocarbon contamination at closure.

9.7 Closing of Transportation Corridors

Unless otherwise previously negotiated with the respective authorities, Indigenous groups and local communities, site roads will be scarified, edges sloped as appropriate, and vegetated when no longer required to support final rehabilitation, long-term site management and / or environmental monitoring program objectives. Safety berms, if any, along the perimeter of haul roads will be levelled. Culverts will be removed in accordance with Provincial guidelines and roads will be breached to allow natural drainage.

The Chester EACOM road as well as the public access road (as shown on the Site Plan, Figure 3-3A) is expected to remain in place following closure to provide continued access to forest harvest areas or camps in the region.

9.8 Removal or Covering of Concrete Structures, Foundations and Slabs

Concrete foundations will be levelled to near grade and large slabs will be broken up to facilitate drainage. Remaining concrete foundations for buildings and equipment will be covered with approximately 0.2 m of overburden and revegetated.

9.9 Removal of Fuels, Chemicals, Explosives and Wastes

All petroleum products and chemicals will ultimately be removed from the site. Empty tanks will be sold as scrap, re-used off-site, or cleaned to remove any residual fuel or chemicals and deposited within the demolition landfill.

Any remaining explosives will be either detonated on site or hauled off site by an authorized transportation company.

9.10 Removal of PCB or PCB Contaminated Material

Not applicable. There will be no equipment containing polychlorinated biphenyl (PCB) used at the site.

9.11 Rehabilitation of Waste Management Sites

9.11.1 Solid Wastes

Development of a dedicated on-site demolition waste landfill is proposed for the disposal of non-hazardous demolition wastes (such as concrete, steel, wall board and other inert materials) generated during closure. It is expected that this demolition landfill will be developed within a portion of the MRA or within an approved landfill site. Anticipated waste volumes for the demolition landfill are less than 40,000 m^3.

At the end of rehabilitation activities, the on-site landfill will be capped and revegetated in a manner consistent with the remainder of the Project site and environmental approval requirements.

9.11.2 Domestic Sewage

The sewage treatment plant installed at the Project site will be removed and disposed of. Non-hazardous wastes will be sent to the on-site demolition waste landfill, while hazardous wastes will be removed from the site and disposed of in accordance with Provincial approvals and standards.

9.12 Soils Testing

An environmental site assessment will be conducted at the end of Operations or early in the Closure phase to delineate areas of potential soil contamination. Specific areas that may require an assessment are generally anticipated to be around the Processing Plant, administration complex, fuel and lube areas, emulsion plant and mine camp, however additional areas may be determined at the end of Operations. Soil found to exceed acceptable criteria will be remediated on site or transported off site to an approved disposal facility.

9.13 Stabilization of Tailings Areas

Approximately 2 years prior to implementing final closure of the tailings management area IAMGOLD will undertake a review of climate change scenarios to confirm or modify anticipated future hydrological conditions and inform the closure approach. The emergency spillway will also be in place and suitable for closure. The magnitude of the design flood will be reviewed through ongoing dam safety reviews. The Closure Plan will be updated with data obtained during operational monitoring if appropriate.

The TMF has been developed with the closure concept to promote long-term chemical and physical stability, minimize erosion, provide long-term environmental protection, and minimize long-term maintenance requirements. Assessments predict that the tailings will be NPAG. Additional tailings geochemical test work will be undertaken concurrent with ongoing engineering studies.

At the end of the Operations phase the TMF will be fully drained of supernatant water, excluding a small sedimentation pond in front of the spillway. Excess water during this period is expected to be directed to the open pit to enhance flooding by siphoning or gravity drainage and monitoring would continue in accordance with ECA requirements.

Tailings beach revegetation will comprise placement and tilling of approximately 0.2 m of growth medium and seeding with native species. Test plots will be carried out prior to closure to determine optimum seed mixture and fertilizers required to promote sustainable plant growth. Pending results of the test plots alternative measures may be taken into consideration to establish successful sustainable vegetation. Perimeter ditches will be left in place and protected from erosion, as needed. It is expected that the majority of the tailings surface will be revegetated ultimately. Of this, approximately 25% is expected to be completed during the operating period.

Monitoring of the TMF pond will be ongoing during open pit filling. Based on results of current studies of the tailings geochemistry, issues with water quality are not anticipated. If the water quality is deemed suitable for discharge to the environment, pumping from the TMF pond to the pit would cease. The TMF Pond would be drained. Any settled solids or sediments would be sampled to identify suitability to remain in place. Pumping infrastructure would be removed and appropriately disposed of and / or recycled / reused where possible, either in the demolition landfill or in an appropriate off-site location.

If the water quality from the TMF pond is not deemed suitable for direct discharge to the environment, pumping or gravity drainage of the TMF pond water into the pit would continue; and closing of the transmission line would only be carried out at the end of this stage.

9.14 Stabilization of Stockpiles

9.14.1 Mine Rock Area

Overburden stockpiled during the site Construction phase, primarily from initial open pit stripping operations, will be used during this phase to provide the medium for revegetation of the rehabilitated site components and areas. It is expected that only a small quantity of overburden will be stripped and stockpiled from the Project site for rehabilitation in the MRA during closure activities, due to the limited amount of overburden occurring over the Project site. Overburden stockpiled during operations will be strategically placed during closure activities to achieve closure goals.

Geochemical analyses indicate that mine rock is NPAG. The MRA slopes will be designed and constructed to meet closure requirements. The exterior slopes of the MRA will be graded and stabilized, if / where required, to promote long-term stability and drainage, once the maximum height is reached. Approximately 25% of the total MRA surface area (i.e. the flat areas) of the MRA will be covered with 0.2 m of growth medium and revegetated to expedite the revegetation of indigenous plants and trees. The intent of the 25% revegetation criterion is that planting "islands" will encourage infilling between islands, or natural revegetation, to return the area to a more natural state over time Areas which receive a layer of overburden will be designed to prevent pooling of water. It is expected that progressive rehabilitation of the MRA will be carried out during operations, with the final configuration reached to minimize the amount of rehabilitation effort required at the time of Closure.

Once the open pit is fully flooded or pumping from the MRA seepage ponds has ceased, the water quality of the MRA seepage ponds will be monitored. If the water quality of the MRA seepage ponds is not deemed suitable for direction discharge to the environment, pumping of this water into the mine water pond would continue. Alternatively, the water could be pumped to the pit to accelerate flooding (Table 9-1). Based on current studies of the mine rock geochemistry, issues with water quality are currently not anticipated. Progressive re-habilitation of the MRA will also be undertaken. Should water quality not be as predicted a contingency for treatment will be provided if required.

The MRA seepage ponds would be drained. Any settled solids or sediments would be sampled to identify suitability to remain in place. The pond dams would then be breached, and the breached dam slopes stabilized. The area around the seepage water collection ponds would be revegetated and the water would naturally drain to the environment. The infrastructure that facilitated the pumping would be removed and appropriately disposed of and / or recycled / reused where possible, either in the demolition landfill or in an appropriate off-site location.

If the water quality of the MRA seepage collection ponds is not deemed suitable for direct discharge to the environment, pumping of this water into the pit would continue, if required, once the mine water pond has been decommissioned.

9.14.2 Medium and Low-Grade Ore Stockpiles
All stockpiled medium and low-grade ROM ore will be processed during the Operations phase. Thus, rehabilitation of these stockpiles is not expected.

9.14.3 Overburden Stockpile
During closure, material from the overburden stockpile, including topsoil, will be used during rehabilitation of other facilities. Should any topsoil / overburden remain at closure, this material will be graded to promote drainage and vegetated. Once vegetation is established, the dams creating the runoff collection ponds would be breached and runoff either directed to the open pit to assist with flooding or discharged to the environment.

9.15 Stabilization of Tailings, Water and Other Impoundment Structures
Tailings are discussed in Section 9.13. The Engineer of Records will be Mickey Davachi of Wood Group plc.

9.15.1 Mine Water Pond Basin
Water will be pumped from the mine water pond to the pit and the liner will be removed and disposed. The area will be graded as part of the plant site rehabilitation.

9.15.2 Polishing Pond
Upon closure, water from the polishing pond will be pumped and drained to the open pit to assist with pit flooding. The west dam will be breached to approximately 383.0 masl with a grade control structure (i.e., broad-crested weir) with invert elevation approximately 381.5 m. Sediments in the polishing pond will be tested in accordance with O. Reg. 347/90 (General – Waste Management, under the *Environmental Protection Act*) and removed if needed to an appropriately licensed waste management facility. The polishing pond area will be regraded and vegetated to prevent erosion and promote the re-establishment of baseline habitat in the area. Re-grading will include promoting natural flooding of the area, reconnecting the flooded open pit to flow in to Three Duck Lake (Upper). This aligns with the natural drainage of the area.

9.15.3 Site Drainage and Water Structures
The general site drainage patterns will remain in place at closure, except for drainage from culverts and related ditches during site road rehabilitation activities.

Water intake structures constructed at the Mesomikenda Lake (or other water bodies, if any) will be removed and any mechanical components will be disposed of in the on-site demolition waste landfill or sent for offsite recycling.

9.16 Removal of Decant Structures
Not applicable. There will not be any decant structures as part of the Project.

9.17 Stability and Integration of Watercourses and Drainage Channels

Watercourse realignments and associated dams will be left in place during active closure. Once the open pit is full the remaining dams will be removed / breached to restore natural flow through the Mollie River subwatershed.

The dam between the flooded open pit and the former polishing pond area will be removed / breached and flows from the open pit will drain towards Three Duck Lake (Upper). Side slopes of reclaimed water retention dams will be stabilized.

The dams located between Clam Lake and the open pit lake will be removed / breached. The re-alignment channel between Clam Lake and Chester Lake will remain in place and will be contoured and revegetated to promote establishment of connected wetland habitat.

The dam between New Lake and the open pit lake will be removed or lowered to restore the Mollie River system and will be directed to the open pit with low flows maintained to the re-alignment channel to support fisheries. This will fully integrate the pit lake it into the Mollie River subwatershed.

The details regarding maintenance of a portion of the New Lake as a grade control structure or weir to divert a portion of the flows to the re-alignment channel to maintain fish habitat will be re-evaluated prior to closure. This control structure could also enhance flexibility to maintain flows through the Three-Duck Lake system if the pit lake water quality is not as predicted.

9.18 Revegetation

The primary aim of the site revegetation / rehabilitation program is to control erosion and ensure physical stability, improve the aesthetics of the site, promote vegetation communities that support habitat for local species diversity.

Some revegetation details of specific areas (e.g., the open pit, landfill, TMF, and MRA), have been discussed within the respective sections above.

Revegetation of disturbed areas will be accomplished through seeding and planting of seedlings including indigenous plant species, as appropriate, to initiate revegetation of those plant species and natural regeneration. The species mix / mixes for the site revegetation will be determined through onsite test work programs during the Operations phase and will be refined during progressive rehabilitation. The programs will assist with revegetation success at closure.

9.19 Rehabilitative Schedule for Final Closure

Active closure (Stage I) includes site rehabilitation and infrastructure removal that would be undertaken within approximately 2 years of shutdown of operations as well as the period during which the open pit is flooding (approximately 30 years). Active Closure (Stage I) is shown on Figure 9-1. Table 9-1 shows the water balance for the base case pit flooding as well as contingency scenarios that introduce flexibility if the water quality departs from the expected values. Watercourse realignments and associated dams will be left in place during active closure

(Stage I). The transmission line will continue to operate during this stage to provide power to the pump houses. Should water quality in the TMF pond and seepage collection ponds around the MRA be determined suitable for release to the environment, IAMGOLD may consider ceasing pumping from the MRA seepage ponds to the open pit during this closure stage.

Table 9-1: Water Balance – Base Case Pit Flooding and Contingency Scenario

Input Data	Unit	Base Case	Alternative 1 (no TMF flows)	Alternative 2 (TMF seepage only)	Alternative 3 (no WRA flows)	Alternative 4 (draw 10% of Chester discharge)	Alternative 5 (draw 20% of Chester discharge)
Total pit volume (approx.)	m^3	300,000,000	-	-	-	-	-
Average annual precipitation:	mm/yr	856.3	-	-	-	-	-
Total open pit footprint:	ha	132	-	-	-	-	-
Total MRA footprint:	ha	279	-	-	-	-	-
Total TMF footprint:	ha	460	-	-	-	-	-
Inflows (m^3/year)							
Pit wall seepage		876,000	876,000	876,000	876,000	876,000	876,000
Direct precip. and runoff to pit lake		2,557,000	2,557,000	2,557,000	2,557,000	2,557,000	2,557,000
Flow from TMF to pit:		-	-		-	-	-
TMF seepage only		-	-	1,382,285	-	-	-
TMF seepage and runoff		3,348,133	-		3,348,133	3,348,133	3,348,133
Re-alignment dam seepage:		63,900	63,900	63,900	63,900	63,900	63,900
MRA runoff to pit:		1,550,952	1,550,952	1,550,952		1,550,952	1,550,952
Portion of Chester Lake outflow		-	-	-	-	1,146,465	2,292,930
TOTAL INFLOW	**m^3/year**	**8,395,985**	**5,047,852**	**6,430,137**	**6,845,033**	**9,542,450**	**10,688,915**
Time to fill:	**years**	**35.7**	**59.4**	**46.7**	**43.8**	**31.4**	**28.1**

Passive Closure (Stage II) is the final stage of rehabilitation of the site and commences once the open pit is completely flooded. This will be completed as shown in Figure 9-2. The main objective is to reincorporate the open pit lake into the existing watershed. The transmission line from Shining Tree to the site will continue to operate to provide power to the pump houses and potential water treatment system as required. Once the water quality is suitable for discharge to the environment without potential treatment, there will no longer be a necessity to keep maintaining the transmission line and this one will be dismantled.

Figure 9-1: Active Closure (Stage I)

Figure 9-2: Passive Closure (Stage II)

10.0 MONITORING

A Post-closure monitoring program will be implemented to ensure that the rehabilitation measures remain effective and continue to provide a high level of public and environmental protection. The monitoring programs will be implemented to meet the requirements of Schedule 1 of O.Reg. 240/00.

The principle of adaptive management will be applied to the Project's management plan. For the Project, this means that should monitoring results indicate that realized effects are different than predicted, mitigation strategies may be modified and monitoring requirements with regards to parameters, locations and frequency will be adapted appropriately.

A written report detailing the result of physical, chemical and biological monitoring will be submitted to the director of NDMNRF on an annual basis according to the procedures described in O.Reg. 560/94. As requested by NDMNRF, chemical stability monitoring reports will comprise data summaries, interpretation of the data and analysis of tends in water quality, supported by historical data and time-series graphs.

10.1 Physical Stability

The key objective of physical stability monitoring is to demonstrate the safety of the site by ensuring that all lands, water management structures and other Project-related structures are left in a long-term stable condition. Another objective is to identify any indications of physical instability and take appropriate corrective measures.

Physical stability monitoring will be carried out in accordance with the Code (Part 8).

10.1.1 Temporary Suspension

Daily inspections would be completed to ensure that the hydraulic structures and drainage channels are maintained free of debris and sediments. Security personnel would also complete daily inspections to protect company assets and restrict entry.

An annual inspection would be completed by a qualified engineer for all dams, dykes, hydraulic structures and drainage channels to ensure compliance with designs. Any remedial measures that are deemed necessary as a result of the inspection findings would be undertaken immediately.

10.1.2 State of Inactivity

Monthly inspections would be completed to ensure that the hydraulic structures and drainage channels are maintained free of debris and sediments. Security personnel would also complete monthly inspections to protect company assets and to ensure that safeguards and security measures for public protection remain in place.

An annual inspection would be completed by a qualified engineer for all dams, dykes, hydraulic structures and drainage channels to ensure compliance with designs. Any remedial measures that are deemed necessary as a result of the inspection findings would be undertaken immediately.

10.1.3 Permanent Closure

During Closure, monitoring at the Project facility will include: visual inspection, photography and field notes on the conditions of the rehabilitated surface areas.

Monitoring during Closure will continue on an annual basis for 5 years and be carried out by a qualified professional engineer who will issue a report presenting the findings of the inspection. Any remedial measures that are deemed necessary as a result of the inspection findings would be undertaken immediately.

Following any extreme events, such as significant flood events or a major earthquake, a thorough inspection will be carried out immediately. This inspection will include the items normally monitored, as well as a detailed inspection of all structures, embankments, roads, etc., that may have been impacted. Any detected damage to these structures will be assessed and necessary remedial measures will be undertaken immediately to restore the structures to their original design conditions.

10.2 Chemical Stability

Once mining operations have ceded the surface and groundwater monitoring programs in this Closure Plan will be implemented to monitor the effectiveness of rehabilitation activities. Effluent and air quality during operations will be strictly regulated by Provincial standards as well as approval-specific requirements.

Chemical stability monitoring will be conducted in accordance with the Code (Part 5 – surface water monitoring and Part 6 – groundwater monitoring).

All sampling will be conducted in accordance with standard sampling protocols. Quality assurance / quality control samples such as blind duplicates, trip blanks, field blanks and filter blanks will be collected during each sampling event to represent a minimum of 10% of the samples. The program will be adapted based on actual site condition observed through the Operations phase. Sites will be monitored quarterly during the first year following completion of final closure activities at the Project site and then quarterly for two years for the parameters listed in the code.

Table 10-1 lists proposed surface water quality monitoring locations for the Closure phase, Table 10-2 lists proposed groundwater monitoring locations from the baseline and in to the Operations phase and Table 10-3 lists proposed groundwater monitoring locations for the Closure phase. Tables 10-1 to 10-3 apply to all stages of closure.

Table 10-1: Proposed Surface Water Quality Monitoring Locations (Closure)

Location*	Station ID	Rationale
Background/Reference Monitoring Stations		
Somme River	SR	Regional background monitoring station
Schist Lake	SL-LS1	Local reference monitoring station
Weeduck Lake	WD	Local reference monitoring station
Sawpeter Lake	SP	Local reference monitoring station
Effluent Monitoring Stations		
Open Pit	TBD	Open pit receives water from the TMF Pond, TMF/MRA Seepage Collection Ponds during stage I; flooded open pit will eventually discharge to Three Duck Lakes
Surface Water Monitoring Stations		
Moore Lake	ML	Moore Lake is located downgradient (west) of the TMF
Unnamed Lake 5 & 6	SL2	Unnamed Lakes 5 & 6 are located downgradient (north) of the TMF
Little Clam Lake	LCM	Little Clam Lake is located downgradient (east) of the TMF
Clam Lake	CM & CLRC	Clam Lake is located downgradient (east) of the TMF
Bagsverd Lake	REPO	Bagsverd Lake (south basin) is located downgradient (east) of the TMF Pond
Chester Lake	CHLK	Chester Lake is located downgradient (west) of the MRA
Three Duck Lakes	3D-A & 3D-C	Three Duck Lakes are located downstream of the pit lake, the lower basin is located downgradient (east) of the MRA
Delaney Lake	DEL	Delaney Lake is located downgradient (south) of the MRA
Dividing Lake	DIV	Dividing Lake is located downstream of all site facilities

*Locations are shown on Figure 10-1.

Table 10-2: Proposed Groundwater Monitoring Locations (Baseline and Operations)

Location*	Screened Interval	Rational
Tailings Management Facility		
BH-TMF-06	Bedrock	Assess water quality and flow between TMF and Moore Lake
HGBH17-01A/B	Overburden & Bedrock	
BH16-TMF-16A/B	Overburden & Bedrock	Assess water quality and flow between TMF and Chain / Attach Lakes
BH16-TMF-15	Bedrock	
BH16-TMF-12A/B	Organics & Bedrock	Assess water quality and flow between TMF and Schist Lake
BH16-TMF-05	Bedrock	
DH12-WD-19	Bedrock	Assess water quality and flow between TMF and Clam / Little Clam Lakes
BH16-TMF-04	Bedrock	
4 locations TBD	Overburden & Bedrock	Downgradient of seepage collection ponds once constructed
Mine Rock Area		
DH12-WD-17A/B	Overburden & Bedrock	North of MRA - Assess water quality and flow between MRA and Three Duck Lake (Middle)
DH12-WD-23	Overburden	East of MRA - Assess water quality and flow between MRA and Three Duck Lake (Middle and Lower)
DH13-WD-04	Overburden & Bedrock	
MRA14-12	Overburden	
MRA14-11	Overburden	
DH13-WD-03	Overburden & Bedrock	West of MRA - Assess water quality and flow between MRA and Chester Lake
MRA14-2	Overburden	
MRA14-7	Overburden & Bedrock	East of MRA - Assess water quality and flow between MRA and un-named Lake

Location*	Screened Interval	Rational
Ore Stockpile		
DH12-WD-01	Bedrock	East of Ore Stockpile - Assess water quality and flow between the Ore Stockpile and Three Duck Lake (Upper)
DH12-PO-01	Bedrock	West of Ore Stockpile - Assess water quality and flow between the Ore Stockpile and Open Pit
Open Pit – Water Level only		
DH13-PO-08	Bedrock	Assess groundwater level changes due to pit dewatering
DH12-PO-16A/B	Overburden	
DH12-PO-21A/B	Overburden	
DH12-PO-20A/B	Overburden	
DH13-PO-18	Bedrock	
DH13-PO-20	Bedrock	

*Locations are shown in Appendix F

Table 10-3: Proposed Groundwater Monitoring Locations (Closure)

Location*	Screened Interval	Rational
Tailings Management Facility		
HGBH17-01A/B	Overburden & Bedrock	Assess water quality and flow between TMF and Moore Lake
BH16-TMF-16A/B	Overburden & Bedrock	Assess water quality and flow between TMF and Chain / Attach Lakes
BH16-TMF-12A/B	Organics & Bedrock	Assess water quality and flow between TMF and Schist Lake
BH16-TMF-04	Bedrock	Assess water quality and flow between TMF and Clam / Little Clam Lakes
4 locations TBD	Overburden & Bedrock	Downgradient of seepage collection ponds once constructed
Mine Rock Area		
DH12-WD-17A/B	Overburden & Bedrock	North of MRA - Assess water quality and flow between MRA and Three Duck Lake (Middle)
DH12-WD-23	Overburden	East of MRA - Assess water quality and flow between MRA and Three Duck Lake (Middle and Lower)
DH13-WD-04	Overburden & Bedrock	
DH13-WD-03	Overburden & Bedrock	West of MRA - Assess water quality and flow between MRA and Chester Lake
MRA14-7	Overburden & Bedrock	East of MRA - Assess water quality and flow between MRA and un-named Lake
Ore Stockpile		
DH12-WD-01	Bedrock	East of Ore Stockpile - Assess water quality and flow between the Ore Stockpile and Three Duck Lake (Upper)
DH12-PO-01	Bedrock	West of Ore Stockpile - Assess water quality and flow between the Ore Stockpile and Open Pit
Open Pit – Water Level only		
DH13-PO-08	Bedrock	Assess groundwater level changes while pit is flooding – to be completed until pit is fully flooded.
DH12-PO-16A/B	Overburden	

Location*	Screened Interval	Rational
DH12-PO-21A/B	Overburden	
DH12-PO-20A/B	Overburden	
DH13-PO-18	Bedrock	
DH13-PO-20	Bedrock	

*Locations are shown on Figure 10-2

10.2.1 Temporary Suspension

During Temporary Suspension the mine facilities will continue to operate in accordance with ECA requirements, including continuing to carry out the monitoring commitments. Contact water will continue to be collected and pumped to the polishing pond. Water quality of the discharge to Three Duck Lake (Upper) will be monitored in accordance with the ECA and other applicable regulations. Monthly sampling for the following parameters will occur as per the Code (Part 5): pH, conductivity, total suspended solids, total dissolved solids, alkalinity, acidity, hardness, cyanide, ammonium, sulphate, aluminum, arsenic, cadmium, calcium, copper, iron, lead, mercury, molybdenum, nickel and zinc.

Groundwater samples will also be obtained on a monthly basis for the following parameters, as per the Code (Part 6): pH, conductivity, total suspended solids, alkalinity, acidity, hardness, cyanide, ammonium, sulphate, aluminum, arsenic, cadmium, calcium, copper, iron, lead, mercury, molybdenum, nickel and zinc.

Surface water and groundwater monitoring would continue as specified in the ECA.

Following one year of monitoring the program will be evaluated, and if water quality warrants, an application will be made to the MOECP and NDMNRF to reduce sampling frequencies. In addition, if monitoring data indicates that the list of monitoring parameters can be reduced, an application will be made to the MOECP and NDMNRF for such a reduction.

10.2.2 State of Inactivity

Sampling for the following parameters will occur as per the Code (Part 5): pH, conductivity, total suspended solids, total dissolved solids, alkalinity, acidity, hardness, cyanide, ammonium, sulphate, aluminum, arsenic, cadmium, calcium, copper, iron, lead, mercury, molybdenum, nickel and zinc.

Groundwater samples will also be obtained on a monthly basis for the following parameters, as per the Code (Part 6): pH, conductivity, total suspended solids, alkalinity, acidity, hardness, cyanide, ammonium, sulphate, aluminum, arsenic, cadmium, calcium, copper, iron, lead, mercury, molybdenum, nickel and zinc.

Surface water and groundwater monitoring would continue as specified in the ECA. Monitoring locations will be modified to account for cessation of pumping during a state of inactivity.

10.2.3 Permanent Closure

Post-closure monitoring of the TMF overflow will be completed on a weekly basis for the first year of discharge through the spillway (when flow is present) and quarterly thereafter until two years after revegetation is complete. Discharge through the spillway to Bagsverd will not occur until rehabilitation of the TMF is complete and water quality has been demonstrated to be acceptable for discharge. Sampling for the following parameters will occur as per the Code (Part 5): pH, conductivity, total suspended solids, total dissolved solids, alkalinity, acidity, hardness, cyanide, ammonium, sulphate, aluminum, arsenic, cadmium, calcium, copper, iron, lead, mercury, molybdenum, nickel and zinc.

Groundwater samples will also be obtained on a monthly basis for the following parameters, as per the Code (Part 6): pH, conductivity, total suspended solids, alkalinity, acidity, hardness, cyanide, ammonium, sulphate, aluminum, arsenic, cadmium, calcium, copper, iron, lead, mercury, molybdenum, nickel and zinc.

Surface water and groundwater monitoring would continue as specified in the ECA and the Code.

Post-closure surface water monitoring locations are shown on Figure 10-1. The program will be adapted based on actual site conditions observed through operation. Sites will be monitored quarterly during the first year following completion of final closure activities at the Project site and then quarterly for two years for the parameters listed in the Code. At the completion of the monitoring period the results will be reviewed to determine future monitoring requirements.

Post-closure groundwater monitoring will occur downgradient of the seepage collection system / ponds around the perimeter of the TMF and MRA. Wells will also be located downgradient of the ore stockpile and plant site. Approximate groundwater quality monitoring locations are shown on Figure 10-2. The program will be adapted based on actual site conditions observed through operation in accordance with the ECA.

10.3 Biological Monitoring

10.3.1 Aquatic Environment

A monitoring program was developed for the Aquatic Biology component of the EA based to the mine plan through construction, operations and the two phases of post-closure. The monitoring plan addressed the potential impacts to the aquatic environment identified within the Environmental Assessment. While the footprint of the optimized mine plan and the associated effects are less than those associated with the EA, monitoring of the aquatic environment will continue to be required to demonstrate that conditions within the aquatic habitats are consistent with predictions. Monitoring will be required by DFO and Environment and Climate Change Canada (ECCC) as a condition of the approved offsetting plan under Sections 35 and 36 (Schedule 2 amendment) of the *Fisheries Act*. However, this monitoring is not included in the recommended monitoring described herein.

During operations the mine will be required to undertake monitoring for a number of permits and approvals as well as monitoring required under the Metal and Diamond Mining Effluent Regulations (MDMER). These monitoring requirements should be addressed through a single comprehensive monitoring program undertaken during operations. This program will be reviewed at regular intervals and will be modified to reflect conditions in the aquatic environment and/or changes in mine operations (i.e., a change in ore characteristics can cause changes in effluent chemistry).

The operational monitoring program will include:

- A receiving water quality monitoring program will be implemented. The scope of this program will be reviewed to ensure:
    - Sampling locations are representative of potential mine related sources.
    - Reference locations are included that are representative of similar habitat conditions to mine-exposed locations (i.e., flow, depth, watershed area) but are upstream of potential mine influence.
    - Monitoring frequencies are adequate to detect change.
    - The analytes monitored represent expected mine related substances as well as total and methyl mercury and measures to support the interpretation (i.e., hardness, DOC, alkalinity, pH).
    - Method detection limits should be well below applicable guidelines for fish and aquatic life and method detection limits for total phosphorus and zinc should be reviewed.
- A sediment monitoring program should be implemented every three years, consistent with the national Environmental Effects Monitoring (EEM) program requirements under MMER. Sediment should be collected in all lakes and streams downstream of mine source loadings (including drainage, direct discharge and groundwater seepage). Sediment samples should be collected concurrent with benthic invertebrate samples to allow for assessment of the benthic community relative to sediment conditions. Sediment core samples (top 1 cm) should be collected in the deepest location in key lakes downstream of mine discharges (Chester Lake, Upper Three Duck Lake, Middle Three Duck Lake Lower Three Duck Lake and Bagsverd Lake). Sediment samples should be analyzed for TOC, grain size[4], nutrients (TKN, total phosphorus), mercury (total and methyl) and metals (full ICP-MS scan).
- A benthic invertebrate monitoring program should be implemented every three years, consistent with EEM. The program should focus on lakes and streams receiving mine discharges and should incorporate reference lakes and streams as well. Five stations

[4] Grain sized should not be analyzed in the sediment core.

should be located in each mine-exposed area and multiple reference locations should be sampled if comparable habitats can be found. Sampling stations should be located in depositional areas with care taken to locate stations above the thermocline and in areas of comparable habitat conditions (i.e., depth, substrate, flow, stream gradient).

- Fish monitoring should focus on the functioning of created fish habitat and on fish health downstream of mine sources (e.g., effluent discharge).
  - The constructed habitat and habitat compensation/offsetting areas should be assessed annually for the first three years and then every three years until conditions can be demonstrated to be stable.
  - Fish tissue monitoring for mercury should also be conducted on all lakes where water levels are going to increase as a result of watercourse realignments.
- Fish health monitoring should be conducted every three years in accordance with the EEM, following standard EEM guidance (EC 2011).
- Routine inspection of fish screens on water intake structures.

Table 10-4 provides the monitoring measures applicable to the EER and indicates if the scope of the monitoring requirements that have changed or stayed the same from the EA. Instances where monitoring is no longer applicable have been identified and similarly where additional monitoring is required has also been identified.

Table 10-4: Aquatic Biology Monitoring Measures – EA and EER Comparison

Discipline	Parameter	Monitoring Method	Standard	Frequency / Timeframe	Location	Comparison between EA and EER measures
Aquatic Biology	Water- TSS and turbidity	Standard Methods and water quality multi-meter	1 mg/L TSS and 1 Nephelometric Turbidity Unit (NTU) as Method Detection Limits (MDLs)	Daily during construction.	Downstream of active construction areas.	The monitoring requirement has not changed from the EA.
Aquatic Biology	Water - metals, pH, nutrients, hardness, dissolved organic carbon, alkalinity. The parameters suite may be reduced if it can be demonstrated that any of the tests are not applicable. Additional parameters may be considered depending on site-specific characteristics.	Surface water grab sample collection using in-field filtering and preservation, as required. Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Quality assurance /quality control samples such as blind duplicates, trip blanks, field blanks and filter blanks will be collected during each sampling event to represent a minimum of 10% of the samples.	(MDL< PWQO/CWQG standards). Concentrations in mine-exposed areas will also be compared to baseline and reference area values.	Sampling events will be conducted during all project phases at a frequency sufficient to detect changes in water quality; the frequency will therefore depend on the station location and will aim to capture a range of flow conditions, as required monitoring will be conducted until conditions are stable or less than guidelines for the protection of aquatic life.	Downstream of Project discharge and in all areas potentially affected by mine related discharges as well as in appropriate reference areas.	Monitoring Measure updated. Total and free cyanide should be added to the monitoring parameter list.

Discipline	Parameter	Monitoring Method	Standard	Frequency / Timeframe	Location	Comparison between EA and EER measures
Aquatic Biology	Sediment-metals, total organic carbon, grain size, mercury and methyl mercury. The parameters suite may be reduced if it can be demonstrated that any of the tests are not applicable. Additional parameters may be considered depending on site-specific characteristics.	Surficial sediment collected from grab or core sample (top depositional layer). Method detection limits will be less than federal and provincial water quality guidelines.	Ontario's Provincial Sediment Quality Objectives and the Canadian Sediment Quality Guidelines. Concentrations in mine-exposed areas will also be compared to baseline and reference area values.	Every 3 years during Operations and twice following Closure.	Locations downstream of Project discharge and reference areas.	The monitoring requirement has not changed from the EA.
Aquatic Biology	Benthic invertebrate community	Depositional sampling using petite Ponar, reduced to 500 microns and identified to lowest practical level.	EEM under Federal Metal Mining Effluent Regulations (MMER) and Canadian-Ontario Agreement (COA) requirements under OWRA.	Every 3 years during Operations and twice following Closure.	Locations downstream of the Project discharge and reference areas.	The monitoring requirement has not changed from the EA.

Discipline	Parameter	Monitoring Method	Standard	Frequency / Timeframe	Location	Comparison between EA and EER measures
Aquatic Biology	Fish community	Collect fish (small-bodied and large bodied) using standardized collection methods. Identify and enumerate and determine relative abundance.	EEM under MMER and COA requirements under OWRA.	Every 3 years during Operations and twice following Closure.	Locations downstream of the Project discharge and habitats affected by watercourse realignments.	The monitoring requirement has not changed from the EA.
Aquatic Biology	Fish health	Two sentinel species – either a non-destructive study design (i.e. 100 individuals for length, weight and age) or a lethal survey (40 males and 40 females for length, weight, age, liver weight, gonad weight, egg size and fecundity). Measures of abnormalities on all fish collected.	EEM under MMER and COA requirements under OWRA.	Every 3 years during Operations and twice following Closure.	Locations downstream of the Project discharge and reference areas.	The monitoring requirement has not changed from the EA.

Discipline	Parameter	Monitoring Method	Standard	Frequency / Timeframe	Location	Comparison between EA and EER measures
Aquatic Biology	Fish tissue	Non-lethal biopsy tissue sampling methods will be used to collect skinless, boneless muscle samples (5 g filet) from live individuals. Samples will be analyzed for total mercury. Samples will be weighed, and acid digested prior to analysis using a variant of "Environmental Protection Agency Method 1631- mercury in water by oxidation, purge and trap, and cold vapour atomic fluorescence spectrometry". Using this technique, low method detection limits of approximately 1 ng Hg/g wet tissue weight can be achieved.	Health Canada and Ministry of the Environment and Climate Change consumption benchmarks.	Every 3 years during Operations and twice following Closure or until mercury concentrations in fish are stable or equal to reference areas.	In areas affected by stream realignments and reference areas.	Monitoring Measure updated. This monitoring should be conducted in New Lake and in reference lakes as no other terrestrial habitats are proposed for flooding.

The active Closure phase will continue while the open pit floods, which is anticipated to take approximately 30 years (Stage I). Monitoring activities will be carried out during this period. The passive Closure phase (Stage II) commences once the open pit is flooded and passively discharges to Three Duck Lake (Upper). Water quality is predicted to improve during stage one of closure and to be less than water quality benchmarks for most substances by stage two. Monitoring during these stages of closure should focus on demonstrating improvements in water quality consistent with predictions and relative to water quality benchmarks. Corresponding changes to the scope of the monitoring program will occur (i.e., monitoring should be conducted closer to mine sources and stations further downstream may be eliminated as improvements in conditions are demonstrated).

The following approach to monitoring during closure should be implemented:

- Continue the operational water quality monitoring program, removing stations and substances when conditions achieve acceptability criteria5. The frequency of monitoring should be reduced when stable conditions can be verified. When source areas are stable, and receiving environment conditions are acceptable, receiving environment monitoring should be discontinued.
- Continue a data quality management plan as long as water quality monitoring continues.
- Sediment quality, benthic invertebrate monitoring and fish health should be conducted for two cycles following the cessation of operations (i.e., 3 and 6 years following the end of mine operations) consistent with MDMER (Table 10-5).
- New habitat will be constructed to connect the open pit to Upper Three Duck Lake once the pit is full. Clam Creek will be rehabilitated to connect Clam Lake back to the pit lake. The constructed habitat and habitat compensation/offsetting areas should be assessed annually for the first three years and then every three years until conditions can be demonstrated to be stable (Table 10-5)

[5] Acceptability criteria can be set at water quality guidelines, background or modeled predicted levels if safe for aquatic life.

Table 10-5: Aquatic Effects Monitoring for Closure

Component	Locations	Scope	Measures	Frequency
Sediment	Clam Lake, New Lake, Upper Three Duck Lake, Middle Three Duck Lake, Lower Three Duck Lake, Moore Lake, South Bagsverd Lake, Bagsverd Lake, 2 Reference Lakes	Five surficial grab samples per lake synoptic with benthic invertebrate sampling locations, one sediment core at the deepest location in each lake (1, 5 and 10 cm)	TOC and grain size[1], metals, nutrients and methyl mercury	3 and 6 years following closure.
Benthic Invertebrates	Clam Lake, New Lake, Upper Three Duck Lake, Middle Three Duck Lake, Lower Three Duck Lake, Moore Lake, South Bagsverd Lake, Bagsverd Lake, 2 Reference Lakes	Five surficial grab samples per lake.	Reduce with 500 micron sieve. Identification to lowest practical level. Metric to be calculated to include, total density, richness, Simpsons evenness.	
Fish Health	Clam Lake, Bagsverd Lake, New Lake, Upper Three Duck Lake and two reference lakes	two species preferably small-bodied non-lethal survey (100 adults)	length and weight with 10% for age confirmation. Assessment endpoints to include, growth, energy storage and survival	
Fish Tissue	New Lake, Upper Three Duck Lake, South Bagsverd Lake, Bagsverd Lake and 2 Reference Lakes	15 adult northern pike, yellow perch, walleye, or whitefish	dorsal muscle mercury concentrations	
Fish Habitat	New habitat required to accommodate closure plan development	habitat stability, establishment and utilization	fish and benthic community establishment and presence absence, document habitat stability through photo log.	every year for first 3 years then every 3 years until conditions are stable (expected to be 9 years).

10.3.2 Terrestrial Environment

Revegetation monitoring will be conducted as per O.Reg. 240/00 to ensure that the cover and erosion control measures provided by the vegetation are maintained.

Two objectives for site revegetation are long-term physical stability of the site (e.g., erosion control) and improvement of the site aesthetics. Inspection will be done to determine the success of the program and the need for any remedial work. Revegetated areas will be inspected near the start and end of each growing season during the active rehabilitation phases (2 years) and annually for a period up to ten years, or until a self-sustaining vegetative cover is established. Should revegetation be demonstrated to be successful in a shorter period of time IAMGOLD may contact NDMNRF for a relaxation of this monitoring period.

Revegetation monitoring will include the following activities:

- Undertaking inspections semi-annual following initial planting until vegetation is successfully established;
- Analyzing soil for nutrients and pH annually in the spring until vegetation is successfully established;
- Restoring areas showing evidence of erosion, sedimentation, or slope failure; and
- Reassessing the revegetation program in the event of evidence of excessive vegetation stress or poorly established areas being observed; additional measures will be implemented to ensure successful revegetation.

Figure 10-1: Surface Water Monitoring Stations at Closure

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Figure 10-2: Groundwater Monitoring Stations at Closure

11.0 EXPECTED SITE CONDITIONS FOLLOWING CLOSURE

Figures 9-1 and 9-2 show conceptual site conditions following closure.

11.1 Land Use

The primary objective of the Closure Plan is to rehabilitate the Project site area to promote endemic flora and fauna, and aquatic habitat that supports healthy fish populations. Once the open pit is flooded the open pit lake will be incorporated into the exiting watershed. Access will be maintained or re-established for traditional and non-traditional land users.

11.2 Site Topography

The main topographic changes within the project site relative to predevelopment conditions include the following:

- A pit lake (which overprints Côté Lake) with a boulder fence installed around the perimeter. The pit lake will be approximately 164 ha, with a depth of 550 m. The simulated Closure pit lake elevations are between ~380 masl and ~381 masl.
- The TMF will cover an area of approximately 478 ha. Starter dams will be constructed up to approximately 409 masl along the east side (maximum 28 m above the ground surface), and 411.5 masl along the west sides (maximum 19 m above the ground surface). The ultimate TMF dam crest elevation will be 460 to 463.5 m, with a maximum height ranging from 82.5 to 88 m.
- The MRA will cover an area of approximately 300 ha with an ultimate elevation of approximately 520 masl.
- The re-alignment channel between New Lake and Three Duck Lake (Upper) will remain in place and will be new wetland habitat.
- The re-alignment channel between Clam Lake and Chester Lake will remain in place and will be wetland habitat.
- Remnants of other infrastructure at the site, including the access roads and plant site, which will be scarified and revegetated at closure, will be flattened and raised slightly above the surrounding terrain.

11.3 Local Surface Water and Receiving Waters

The dam between New Lake and the open pit lake will be removed / breached and the Mollie River system will be directed to the open pit. It is estimated that it will take approximately 30 years for the pit to fill. The dam between the flooded open pit and the former polishing pond area will be removed / breached and flows from the open pit will drain towards Three Duck Lake (Upper). Side slopes of reclaimed water retention dams will be stabilized. The open pit lake will be integrated into the Mollie River subwatershed.

For simulated climate conditions, surface water flow changes in closure (Stage I) are estimated to be 10% or less compared to Existing Conditions, suggesting a long-term return to the natural flow regime at the Project site. Greater than 10% surface water flow changes are predicted at Clam Lake and Little Clam Lake and are a result of watershed area change and seepage at the rehabilitated TMF and rehabilitation and resulting runoff from the rehabilitated Overburden Stockpile area.

For closure (Stage II), the water quality modelling predictions for the watersheds suggest that the monthly average concentrations of all parameters are expected to be less than the Water Quality Guidelines at all locations in the surface water receiving environment (Golder, 2018b).

For the purposes of the EA and EER, a single set of "Water Quality Guidelines" were developed for the purposes of the water quality effects assessment. The Water Quality Guidelines are a compilation of the most recent of the PWQOs and CWQC for each parameter, and for parameters where a guideline value does not exist, the British Columbia Water Quality Guidelines (BCWQGs) were considered. Water Balance and Water Quality Predictions are provided in Appendix D.

11.4 Local Groundwater

At Closure, pumping activities in the open pit will be terminated and the water level in the open pit will begin to rise in response to pumping from collection facilities, direct precipitation inputs and groundwater inflow. Groundwater levels will rise over the area affected by the Project. During passive closure, when the open pit is filled and re-connected to the surface water flow system, groundwater levels will continue to rise and over time will approximate pre-mining conditions.

11.5 Terrestrial Plant and Animal Life Community

Following closure of the Project, it is anticipated that many of the terrestrial plants will be revegetated through active or passive revegetation. All disturbed sites will begin a process of natural revegetation resulting in various terrain types that can be utilized by a diversity of wildlife species. This will continue to progress throughout the Closure phase. Forest regeneration can take upwards of 60 years to regenerate

Vegetation loss is shown in Table 4-3. In general loss includes:

- Bog (treed) – 6 ha;
- Forest (coniferous, deciduous, mixed, spars and cuts) – 1,048 ha; and
- Wetland - 77 ha.

Revegetation is anticipated to result in the following habitat types (Closure Stage II, Figure 9-2):

- Successional grassland = 325 ha;
- Successional forest = 280 ha;
- Wetland = 20 ha;
- Mixed exposed rock slope and successional forest = 200 ha; and
- The remainder will comprise of exposed rock slopes.

Areas that are no longer required for Project use may be rehabilitated during the Operations phase. Progressive rehabilitation comprises the activities that contribute to the overall rehabilitation efforts that would otherwise be carried out at closure, and efforts carried out in support of the closure activities (e.g., field trials). During operations, IAMGOLD will carry out studies to evaluate the most effective revegetation approach for project components, such as the TMF. The results of these studies will be used to update and inform the revegetation approach related to topsoil / overburden / nutrient mixture, seed mixture, planting species, irrigation, mulching and fertilization requirements. The selected seed mixture will be comprised of non-invasive species to promote the development of natural revegetation.

11.6 Aquatic Plant and Animal Life Communities

Fish habitat will be affected by the construction of dams and channel realignments required to accommodate the removal of Côté Lake and the development of the open pit, as well as the TMF.

A final Fisheries Offset Plan will be developed in conjunction with stakeholder consultation, including regulators, local residents, and Indigenous communities to compensate and offset for the loss of habitat.

The objective of habitat compensation / offsetting measures associated with the Project will be to create habitat which achieves the biotic and abiotic habitat requirements of the resident fish species (northern pike, yellow perch, walleye, smallmouth bass and whitefish) and minimizes the risk of adverse effects to the environment (i.e., flooding and sedimentation). The overarching goal will be to provide "like for like" habitat to maintain the fish communities within, and the functionality of, the affected watersheds. Therefore, the general approach will be to design habitat to meet the life history requirements of the resident fish. Consideration with respect to spawning, juvenile rearing, adult foraging, migration and over wintering habitat will be incorporated into the design as appropriate. The compensation / offsetting plans will consider not only the physical habitat requirements (i.e., flow, depth, fish passage, cover, substrate) but also the biological requirements (i.e., food base, vegetation).

12.0 CLOSURE PLAN COSTS ESTIMATE

12.1 Closure Cost Estimate Summary

The total cost estimate summary shown in Table 12-1 for the reclamation of the Côté Gold Project is $95,763,000. This cost is stated in 2018 Canadian dollars and includes progressive rehabilitation costs during Mine operation of $20,646,000 and closure construction cost of $46,971,000 for the major closure and rehabilitation work immediately following cessation of milling and gold recovery. Following closure construction, the estimate provides $25,873,000 for site Operations, Maintenance and Monitoring (OM&M) during pit filling and $2,273,000 for site Post-Closure Care, Maintenance and Monitoring.

Table 12-1 also shows that included in the estimate is a contingency in the amount of $11,393,000 to cover likely variations in quantities of the work or in the unit prices to accomplish the work. This amounts to almost 13.5% of the estimate costs and is considered adequate considering the scope definition at this point in the project development. The overall accuracy of the estimate is consistent with a Class 4 estimate as defined by AACE International and is considered to be -20% to +30%.

These costs are believed to be conservative given that the Project will be a modern mine and will be designed for closure. Refer to Appendix L for the detailed Life of Mine cost estimate.

12.2 Schedule

This closure cost estimate provides an estimate covering an overall duration of about 57 years from the start of ore processing until further maintenance and monitoring can be ended. This schedule includes progressive rehabilitation during the 17 years of planned mine operation and gold recovery followed by a two year period of closure construction and including facilities demolition and major site rehabilitation. This is followed site OM&M for the estimated period of 25 years required for the pit to fill and an additional 15 years of site monitoring following active closure periods. The length of the final site monitoring is indefinite and will most likely be determined by the success of revegetation efforts and water quality. The 25 years plus 15 years provides a total of 40 years for the site to come to a steady state such that additional inspection and monitoring is not necessary.

12.3 Closure Cost Estimates

IAMGOLD confirms that the cost estimate meets the requirements of O.Reg. 240/00. The cost estimates are based on the market value costs of the goods and services required by the work.

12.3.1 Progressive Rehabilitation

Progressive rehabilitation during the operation of the Mine is planned primarily for the MRA and the TMF. It is estimated that approximately 60% of the MRA and 70% of the TMF closure and rehabilitation of those facilities can be completed using the mine equipment and personnel. This will provide two primary benefits. First, early revegetation will provide proof-of-concept for the planned methods and add to the time period available to establishment of self-sustaining and stable conditions while the full contingent of staff and equipment are available on of the site. Secondly, completion will mitigate potential risks associated with the planned direct discharge of runoff and seepage collection ponds to the environment.

12.3.2 Active Closure (Stage I)

The majority of the closure and rehabilitation effort will be accomplished during the planned two year period when all above ground facilities and installations, that are not needed to support pit-filling and the OM&M of the site, will be removed. All mine mobile equipment will be removed from the site along with reusable or recyclable materials and equipment. Buildings will first be gutted to remove reusable materials and equipment and will be shipped offsite. The buildings will then be demolished or de-constructed if this would result in salvage of useful materials or recyclables. Generally concrete foundations will be demolished to grade, and the below grade portions covered with overburden and revegetated.

Development of a dedicated on-site demolition waste landfill is proposed for the disposal of non-hazardous demolition wastes (such as concrete, steel, wall board and other inert materials) generated during closure. It is expected that this demolition landfill will be developed within a portion of the NPAG, MRA or within an approved landfill site. At this time, the on-site landfill has been included in the cost estimate. At the end of reclamation activities, the on-site landfill will be capped and revegetated in a manner consistent with the remainder of the Project site and environmental approval requirements. Hazardous waste materials, special wastes and traditional garbage generated during closure construction will be removed from the site and disposed as required by law.

The estimate provides cost to perform site OM&M services during the time the pit is filling with water. It is anticipated that personnel located in either Timmins or Sudbury or both will make regular visits to the site as needed to check pump operation and maintain the pumps and pipelines.

Monitoring included in the estimate during this period consists of surface, groundwater and aquatic effects monitoring twice per year. A hydrology inspection is included twice per year, once in the Spring and another inspection once per year in response to a major storm event. A geotechnical monitoring inspection including a report is provided once per year and the meteorological station will be maintained and the data collected will be available to authorized parties.

It is expected during this 25 year period that monitoring will show that pumping of water at locations around the site can be discontinued as the site reaches a steady state. As pumps and pipelines are no longer needed, they will be removed from the site. Ponds no longer needed will be graded out or, if appropriate, may be retained as part of the rehabilitation of the site.

As soon as the pit has filled, and all pumping can be discontinued the final facilities and installations on the site will be removed. The last remaining seepage ponds will be graded out, pending suitable water quality, and water retention dams will be breeched to restore the natural drainage.

Lastly the 44 kilometre 115 kV powerline will be removed, and materials disposed off-site or recycled. Roads not required to access monitoring points and any remaining disturbed areas will be graded out and revegetated.

12.3.4 Passive Closure (Stage II)

The estimate provides for 15 years of post-closure inspections and monitoring. A crew from either Timmins or Sudbury is priced to visit the site a total of 18 times a year. Generally, once a month, plus 6 inspections in response to unusual storms or to visit areas not observed during the previous year. Monitoring of surface and groundwater and aquatic effects is provided once per year as is a hydrology inspection and geotechnical monitoring inspection including a report.

This long term post closure monitoring will continue until it is deemed no longer legally required by the appropriate authorities.

Table 12-1: Summary Life of Mine Cost Estimate

Phase	Task	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Progressive Rehabilitation ($1000's)	Closure Construction ($1000's)	Pit Filling OM&M ($1000's)	Post-Closure Care ($1000's)
Closure Construction		Closure at LOM - Remove Facilities, Equipment and Site Rehabilitation							
	1000	**Mine and Related Facilities Closure**							
	1100	Ore Stockpiles and Mine Rock Areas	$10,145	$1,255	$11,400	$3,877	$5,791	$1,732	
	1200	Open Pit Mine Filling							
	1300	Open Pit Mine Equipment	$1,482	$222	$1,704	$341	$1,363		
	1400	Open Pit Mine Infrastructure	$828	$149	$977	$157	$495	$324	
	2000	**Mine Site Infrastructure, Building and Facilities Demolition and Closure**							
	2100	Site Preparation, Site Area Preparation, Regrading and Revegetation	$6,087	$918	$7,004		$7,004		
	2200	On-Site Roads	$1,298	$161	$1,459		$1,313	$146	
	2300	Construction and Operations Camp Accommodations Area	$752	$102	$854		$854		
	2400	On-Site Bulk Storage	$86	$13	$98		$98		
	2500	On-Site Utilities	$333	$67	$400		$76	$324	
	2600	On-Site Communications	$50	$10	$60		$60		
	2700	On-Site Power Supply and Distribution	$256	$51	$307		$117	$190	
	2800	Offices and Personnel Buildings	$192	$29	$221		$221		
	2900	Laboratories, Shops and Warehousing	$1,330	$199	$1,529		$1,529		
	3000	**Processing Plant**							
	3100	Ore Handling Facilities	$1,080	$162	$1,242		$1,242		
	3200	Process Plant	$6,668	$722	$7,391		$7,391		
	4000	**Tailings and Water Management**							
	4100	Runoff, Erosion and Sediment Control	$212	$42	$255		$255		
	4200	Tailings Management Facility	$21,204	$2,901	$24,106	$16,271	$7,835		
	4300	Storm Water/Mine Water Pond	$733	$112	$845		$845		
	4400	Seepage Ponds and Restoration of Natural Drainage	$1,209	$124	$1,333			$1,333	
	4500	Polishing Pond and Water Reclaim Pond	$2,306	$346	$2,652			$2,652	
	6000	**Off-Site Facilities**							
	6100	Main Power Line	$506	$51	$557			$557	
	6200	Water Supply	$179	$29	$208		$208		
	7000	**Site Services and Project Indirects for Mine Closure Construction**	$7,942	$923	$8,865		$7,818	$1,047	
		Subtotal	$64,877	$8,589	$73,466	$20,646	$44,516	$8,305	
	9000	Site Operations, Maintenance and Monitoring							
	9100	**During Permitting, Engineering and Construction (Excluded)**							
	9200	**During Mine Operations (Excluded)**							
Closure (2 Years)	9300	**During Closure (2 Years)**	$2,179	$276	$2,456		$2,456		
Pit Filling (25 Years)	9400	**Site OM&M Pending Pit Filling Completion (Estimated at 25 Years)**	$15,350	$2,218	$17,568			$17,568	
Post Closure (15 Years)	9500	**Site OM&M for an Indefinite Period (Estimated at 15 Years)**	$1,964	$309	$2,273				$2,273
		Subtotal	$19,493	$2,804	$22,297				
		Grand Total of All Cash Flows	**$84,370**	**$11,393**	**$95,763**	**$20,646**	**$46,971**	**$25,873**	**$2,273**

13.0 FINANCIAL ASSURANCE

13.1 Form and Amount of Financial Assurance

Financial assurance for closure in will be provided by IAMGOLD to the Crown, as represented by NDMNRF in a phased approach. Table 13-1 outlines the phases and timing of Closure Plan Amendments and associated financial assurance updates.

The cost updates, (and associated financial assurance) for each phase will reflect new knowledge such as that gained through progressive rehabilitation as well as any potential Project design changes.

Table 13-1: Financial Assurance Phases

Phase	Due Date *	Period Covering	Milestone Activities	Total FA Required	Progressive Reclamation Completed	Net Added Closure Cost
1	With Closure Plan Submission	2.5 years (anticipate 2019-2022)	Pre-operations – finalize the Mine Rock Management Plan, construction of process plant, ancillary/support facilities, starter dam for TMF and pre-production stripping of overburden and development of the open pit including the MRA, Ore Stockpile and Overburden Stockpile areas. (Primary construction activities are listed in Section 5.11.1).	$47,885,000	N/A	N/A
2	Within the year preceding the milestone (anticipate 2022)	+ 3 years (anticipate 2023 – 2024)	Commercial operations - Mill commissioning and early production in year 1. Full production in year 2 and 3. Development of TMF footprint to 50% of Ultimate (approx. 200 Ha) and MRA footprint to 90% (approx. 250 Ha) and start of progressive reclamation of the east side of the MRA	$71,171,000	$618,000	$23,286,000

3	Within the year preceding the milestone (anticipate 2022)	+ 5 years (anticipate 2025-2030)	Mine and Mill operating at full production. Development of MRA footprint complete and TMF footprint 70% (approx. 280 Ha). Progressive reclamation of the east side of the MRA continues.	$88,659,000	$1,892,000	$17,488,000
4	Within the year preceding the milestone (anticipate 2028)	+ 9 years (anticipate 2031-2040)	Mine and Mill operating at full production. Build out of facility footprints complete. Progressive reclamation of the MRA continues and commences for the TMF	$93,871,000	$1,892,000	$5,212,000
					Life of Mine **	**Total $95,763**
5	Within the year preceding the milestone (anticipate 2037)	Final closure financial assurance review and update	Mine hazards have been rehabilitated to the standards of the Mining Act and Ontario Regulation 240/00 and long-term monitoring is to commence	$28,146,000	67,617,000	
					FA to remain in support of post operation/monitoring stages (Estimates subject to change; NDMNRF will assesses actual liabilities over time to update required FA)	**Total $28,146**

* The year preceding means: 9 month draft closure plan amendment review (no FA instrument provided) and a 3 month final CPA review and filing process (with FA instrument provided)

** The total presented in Table 13-1 does not equal the overall LOM estimate (as presented in Table 12-1). The difference is the amount of the progressive rehabilitation that has already been accomplished during years 1 through 8 of operations. At that time progressive rehabilitation in the amount of 1.3 million is scheduled to already be done on the MRF and 0.6 million is scheduled to be done on the Ore Stockpile Area. Closure costs already spent when a new closure cost estimate is prepared would not be included in closure costs

Additional information on the schedule basis and total estimate cost for Financial Assurance (FA) Phase 1 as well as an outline for Phase 2, (which will be updated as per the milestone noted in Table 13-1) is provided in Table 13-2.

Table 13-2: Summary of Closure Schedules and Estimated Closure Costs

Mine Phase	FA Phase 1: Close at Construction Completion	FA Phase 2: Close at End of Year 3 Operations
Mine Operations	0	3
Mine Closure Construction	2	2
Phase I – Pit Filling	3	10
Long Term Care	7	20
Total Time (Years)	12	35
Total Estimated Closure Cost	**47.9 Million Cdn$**	**Refer to Table 13-5**

An overview of the materials balance for the site related to the total mined from the pit and the disposition of that total is provided in Table 13-3.

Table 13-3: Comparison of Material Balances for Closure Scenarios
(1,000's of Metric Tonnes or Cubic Meters Unless Otherwise Noted)

Description	FA Phase 1: Close at Construction Completion	FA Phase 2: Close at End of Year 3 Operations
Total Mined	39,900	220,600
Overburden To Stockpile	6,800	9,400
Barren Rock to TMF/MRA	28,400	157,600
Tailings Deposited in TMF	0	33,200
Ore Remaining in Stockpile	4,800	20,500
Total Pit Volume at Closure	14,800 Cubic Meter	80,200 Cubic Meter
Annual Average Filling Rate	5,000 Cubic Meters	8,000 Cubic Meters
Years to Fill Pit	3 Years	10 Years

A summary for each of the Financial Assurance Phases (1 through 5) is provided in Table 13-4 through Table 13-8.

Table 13-4: Summary Financial Assurance Phase 1 (2018 Cdn$)

Phase	Task	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Progressive Rehabilitation ($1000's)	Closure Construction ($1000's)	Pit Filling OM&M ($1000's)	Post-Closure Care ($1000's)
Closure Construction		**Closure at LOM - Remove Facilities, Equipment and Site Rehabilitation**							
	1000	**Mine and Related Facilities Closure**							
	1100	Ore Stockpiles and Mine Rock Areas	$5,198	$659	$5,857		$5,362	$496	
	1200	Open Pit Mine Filling							
	1300	Open Pit Mine Equipment	$1,482	$222	$1,704		$1,704		
	1400	Open Pit Mine Infrastructure	$793	$143	$936		$612	$324	
	2000	**Mine Site Infrastructure, Building and Facilities Demolition and Closure**							
	2100	Site Preparation, Site Area Preparation, Regrading and Revegetation	$5,639	$828	$6,467		$6,467		
	2200	On-Site Roads	$973	$121	$1,094		$875	$219	
	2300	Construction and Operations Camp Accommodations Area	$752	$102	$854		$854		
	2400	On-Site Bulk Storage	$86	$13	$98		$98		
	2500	On-Site Utilities	$183	$37	$220		$184	$36	
	2600	On-Site Communications	$50	$10	$60		$60		
	2700	On-Site Power Supply and Distribution	$238	$48	$286		$191	$95	
	2800	Offices and Personnel Buildings	$192	$29	$221		$221		
	2900	Laboratories, Shops and Warehousing	$1,330	$199	$1,529		$1,529		
	3000	**Processing Plant**							
	3100	Ore Handling Facilities	$1,080	$162	$1,242		$1,242		
	3200	Process Plant	$6,668	$722	$7,391		$7,391		
	4000	**Tailings and Water Management**							
	4100	Runoff, Erosion and Sediment Control	$89	$18	$106		$106		
	4200	Tailings Management Facility	$3,694	$457	$4,151		$4,151		
	4300	Storm Water/Mine Water Pond	$390	$61	$451		$451		
	4400	Seepage Ponds and Restoration of Natural Drainage	$925	$139	$1,064		$1,064		
	4500	Polishing Pond and Water Reclaim Pond	$1,711	$257	$1,967		$1,967		
	6000	**Off-Site Facilities**							
	6100	Main Power Line	$506	$51	$557			$557	
	6200	Water Supply	$179	$29	$208		$208		
	7000	**Site Services and Project Indirects for Mine Closure Construction**	5,136	$616	$5,753		$5,564	$189	
		Subtotal	$37,293	$4,923	$42,216	$0	$40,301	$1,915	
	9000	**Site Operations, Maintenance and Monitoring**							
	9100	**During Permitting, Engineering and Construction (Excluded)**							
	9200	**During Mine Operations (Excluded)**							
Closure (2 Years)	**9300**	**During Closure (2 Years)**	$1,875	$231	$2,106		$2,106		
Pit Filling (10 Years)	**9400**	**Site OM&M Pending Pit Filling Completion (Estimated at 10 Years)**	$2,128	$295	$2,423			$2,423	
Post Closure (20 Years)	**9500**	**Site OM&M for an Indefinite Period (Estimated at 20 Years)**	$975	$165	$1,140				$1,140
		Subtotal	**$4,978**	**$692**	**$5,670**				
		Grand Total of All Cash Flows	**$42,271**	**$5,614**	**$47,885**	**$0**	**$42,407**	**$4,338**	**$1,140**

Table 13-55: Summary Financial Assurance Phase 2 (2018 Cdn$)

Phase	Task	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Progressive Rehabilitation ($1000's)	Closure Construction ($1000's)	Pit Filling OM&M ($1000's)	Post-Closure Care ($1000's)
Closure Construction		**Closure at LOM - Remove Facilities, Equipment and Site Rehabilitation**							
	1000	**Mine and Related Facilities Closure**							
	1100	Ore Stockpiles and Mine Rock Areas	$9,759	$1,237	$10,996		$9,284	$1,712	
	1200	Open Pit Mine Filling							
	1300	Open Pit Mine Equipment	$1,482	$222	$1,704		$1,704		
	1400	Open Pit Mine Infrastructure	$793	$143	$936		$612	$324	
	2000	**Mine Site Infrastructure, Building and Facilities Demolition and Closure**							
	2100	Site Preparation, Site Area Preparation, Regrading and Revegetation	$5,751	$850	$6,601		$6,601		
	2200	On-Site Roads	$1,168	$145	$1,313		$1,050	$263	
	2300	Construction and Operations Camp Accommodations Area	$752	$102	$854		$854		
	2400	On-Site Bulk Storage	$86	$13	$98		$98		
	2500	On-Site Utilities	$303	$61	$364		$72	$292	
	2600	On-Site Communications	$50	$10	$60		$60		
	2700	On-Site Power Supply and Distribution	$238	$48	$286		$115	$171	
	2800	Offices and Personnel Buildings	$192	$29	$221		$221		
	2900	Laboratories, Shops and Warehousing	$1,330	$199	$1,529		$1,529		
	3000	**Processing Plant**							
	3100	Ore Handling Facilities	$1,080	$162	$1,242		$1,242		
	3200	Process Plant	$6,668	$722	$7,391		$7,391		
	4000	**Tailings and Water Management**							
	4100	Runoff, Erosion and Sediment Control	$159	$32	$191		$191		
	4200	Tailings Management Facility	$10,159	$1,080	$11,239		$3,807	$7,432	
	4300	Storm Water/Mine Water Pond	$390	$61	$451		$451		
	4400	Seepage Ponds and Restoration of Natural Drainage	$1,209	$124	$1,333			$1,333	
	4500	Polishing Pond and Water Reclaim Pond	$1,711	$257	$1,967			$1,967	
	6000	**Off-Site Facilities**							
	6100	Main Power Line	$506	$51	$557			$557	
	6200	Water Supply	$179	$29	$208		$208		
	7000	**Site Services and Project Indirects for Mine Closure Construction**	7,477	$897	$8,374		$6,499	$1,875	
		Subtotal	$51,441	$6,474	$57,916	$0	$41,991	$15,925	
	9000	**Site Operations, Maintenance and Monitoring**							
	9100	**During Permitting, Engineering and Construction (Excluded)**							
	9200	**During Mine Operations (Excluded)**							
Closure (2 Years)	9300	**During Closure (2 Years)**	$2,073	$256	$2,328		$2,328		
Pit Filling (10 Years)	9400	**Site OM&M Pending Pit Filling Completion (Estimated at 10 Years)**	$6,506	$940	$7,446			$7,446	
Post Closure (20 Years)	9500	**Site OM&M for an Indefinite Period (Estimated at 20 Years)**	$2,977	$504	$3,481				$3,481
		Subtotal	**$11,556**	**$1,700**	**$13,256**				
		Grand Total of All Cash Flows	**$62,997**	**$8,174**	**$71,171**	**$0**	**$44,319**	**$23,371**	**$3,481**

Table 13-6: Summary Financial Assurance Phase 3 (2018 Cdn$)

Phase	Task	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Progressive Rehabilitation ($1000's)	Closure Construction ($1000's)	Pit Filling OM&M ($1000's)	Post-Closure Care ($1000's)
Closure Construction		Closure at LOM - Remove Facilities, Equipment and Site Rehabilitation							
	1000	**Mine and Related Facilities Closure**							
	1100	Ore Stockpiles and Mine Rock Areas	$8,573	$1,062	$9,635		$8,073	$1,562	
	1200	Open Pit Mine Filling							
	1300	Open Pit Mine Equipment	$1,482	$222	$1,704		$1,704		
	1400	Open Pit Mine Infrastructure	$776	$138	$914		$590	$324	
	2000	**Mine Site Infrastructure, Building and Facilities Demolition and Closure**							
	2100	Site Preparation, Site Area Preparation, Regrading and Revegetation	$6,087	$918	$7,004		$7,004		
	2200	On-Site Roads	$1,298	$161	$1,459		$1,313	$146	
	2300	Construction and Operations Camp Accommodations Area	$752	$102	$854		$854		
	2400	On-Site Bulk Storage	$86	$13	$98		$98		
	2500	On-Site Utilities	$333	$67	$400		$76	$324	
	2600	On-Site Communications	$50	$10	$60		$60		
	2700	On-Site Power Supply and Distribution	$256	$51	$307		$117	$190	
	2800	Offices and Personnel Buildings	$192	$29	$221		$221		
	2900	Laboratories, Shops and Warehousing	$1,330	$199	$1,529		$1,529		
	3000	**Processing Plant**							
	3100	Ore Handling Facilities	$1,080	$162	$1,242		$1,242		
	3200	Process Plant	$6,668	$722	$7,391		$7,391		
	4000	**Tailings and Water Management**							
	4100	Runoff, Erosion and Sediment Control	$212	$42	$255		$255		
	4200	Tailings Management Facility	$19,159	$2,622	$21,781		$12,367	$9,414	
	4300	Storm Water/Mine Water Pond	$733	$112	$845		$845		
	4400	Seepage Ponds and Restoration of Natural Drainage	$1,209	$124	$1,333			$1,333	
	4500	Polishing Pond and Water Reclaim Pond	$2,306	$346	$2,652			$2,652	
	6000	**Off-Site Facilities**							
	6100	Main Power Line	$506	$51	$557			$557	
	6200	Water Supply	$179	$29	$208		$208		
	7000	**Site Services and Project Indirects for Mine Closure Construction**	$8,518	$1,001	$9,519		$7,699	$1,820	
		Subtotal	$61,784	$8,185	$69,969	$0	$51,647	$18,322	
	9000	Site Operations, Maintenance and Monitoring							
	9100	**During Permitting, Engineering and Construction (Excluded)**							
	9200	**During Mine Operations (Excluded)**							
Closure (2 Years)	9300	**During Closure (2 Years)**	$2,179	$276	$2,456		$2,456		
Pit Filling (25 Years)	9400	**Site OM&M Pending Pit Filling Completion (Estimated at 25 Years)**	$12,199	$1,763	$13,961			$13,961	
Post Closure (15 Years)	9500	**Site OM&M for an Indefinite Period (Estimated at 15 Years)**	$1,964	$309	$2,273				$2,273
		Subtotal	**$16,342**	**$2,348**	**$18,690**				
		Grand Total of All Cash Flows	**$78,125**	**$10,534**	**$88,659**	**$0**	**$54,103**	**$32,283**	**$2,273**

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Table 13-7: Summary Financial Assurance Phase 4 (2018 Cdn$)

Phase	Task	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Progressive Rehabilitation ($1000's)	Closure Construction ($1000's)	Pit Filling OM&M ($1000's)	Post-Closure Care ($1000's)
Closure Construction		Closure at LOM - Remove Facilities, Equipment and Site Rehabilitation							
	1000	**Mine and Related Facilities Closure**							
	1100	Ore Stockpiles and Mine Rock Areas	$8,510	$1,060	$9,570	$2,047	$5,791	$1,732	
	1200	Open Pit Mine Filling							
	1300	Open Pit Mine Equipment	$1,482	$222	$1,704	$341	$1,363		
	1400	Open Pit Mine Infrastructure	$776	$138	$914	$94	$495	$324	
	2000	**Mine Site Infrastructure, Building and Facilities Demolition and Closure**							
	2100	Site Preparation, Site Area Preparation, Regrading and Revegetation	$6,087	$918	$7,004		$7,004		
	2200	On-Site Roads	$1,298	$161	$1,459		$1,313	$146	
	2300	Construction and Operations Camp Accommodations Area	$752	$102	$854		$854		
	2400	On-Site Bulk Storage	$86	$13	$98		$98		
	2500	On-Site Utilities	$333	$67	$400		$76	$324	
	2600	On-Site Communications	$50	$10	$60		$60		
	2700	On-Site Power Supply and Distribution	$256	$51	$307		$117	$190	
	2800	Offices and Personnel Buildings	$192	$29	$221		$221		
	2900	Laboratories, Shops and Warehousing	$1,330	$199	$1,529		$1,529		
	3000	**Processing Plant**							
	3100	Ore Handling Facilities	$1,080	$162	$1,242		$1,242		
	3200	Process Plant	$6,668	$722	$7,391		$7,391		
	4000	**Tailings and Water Management**							
	4100	Runoff, Erosion and Sediment Control	$212	$42	$255		$255		
	4200	Tailings Management Facility	$21,204	$2,901	$24,106	$16,271	$7,835		
	4300	Storm Water/Mine Water Pond	$733	$112	$845		$845		
	4400	Seepage Ponds and Restoration of Natural Drainage	$1,209	$124	$1,333			$1,333	
	4500	Polishing Pond and Water Reclaim Pond	$2,306	$346	$2,652			$2,652	
	6000	**Off-Site Facilities**							
	6100	Main Power Line	$506	$51	$557			$557	
	6200	Water Supply	$179	$29	$208		$208		
	7000	**Site Services and Project Indirects for Mine Closure Construction**	$7,942	$923	$8,865		$7,818	$1,047	
		Subtotal	$63,190	$8,383	$71,574	$18,753	$44,516	$8,305	
	9000	**Site Operations, Maintenance and Monitoring**							
	9100	**During Permitting, Engineering and Construction (Excluded)**							
	9200	**During Mine Operations (Excluded)**							
Closure (2 Years)	9300	**During Closure (2 Years)**	$2,179	$276	$2,456		$2,456		
Pit Filling (25 Years)	9400	**Site OM&M Pending Pit Filling Completion (Estimated at 25 Years)**	$15,350	$2,218	$17,568			$17,568	
Post Closure (15 Years)	9500	**Site OM&M for an Indefinite Period (Estimated at 15 Years)**	$1,964	$309	$2,273				$2,273
		Subtotal	**$19,493**	**$2,804**	**$22,297**				
		Grand Total of All Cash Flows	**$82,684**	**$11,187**	**$93,871**	**$18,753**	**$46,971**	**$25,873**	**$2,273**

Table 13-8: Summary Financial Assurance Phase 5 (2018 Cdn$)

Phase	Task	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Progressive Rehabilitation ($1000's)	Closure Construction ($1000's)	Pit Filling OM&M ($1000's)	Post-Closure Care ($1000's)
Closure Construction		Closure at LOM - Remove Facilities, Equipment and Site Rehabilitation							
	1000	**Mine and Related Facilities Closure**							
	1100	Ore Stockpiles and Mine Rock Areas	$1,534	$198	$1,732	$0	$0	$1,732	
	1200	Open Pit Mine Filling							
	1300	Open Pit Mine Equipment	$0	$0	$0	$0	$0		
	1400	Open Pit Mine Infrastructure	$270	$54	$324	$0	$0	$324	
	2000	**Mine Site Infrastructure, Building and Facilities Demolition and Closure**							
	2100	Site Preparation, Site Area Preparation, Regrading and Revegetation	$0	$0	$0		$0		
	2200	On-Site Roads	$130	$16	$146		$0	$146	
	2300	Construction and Operations Camp Accommodations Area	$0	$0	$0		$0		
	2400	On-Site Bulk Storage	$0	$0	$0		$0		
	2500	On-Site Utilities	$270	$54	$324		$0	$324	
	2600	On-Site Communications	$0	$0	$0		$0		
	2700	On-Site Power Supply and Distribution	$158	$32	$190		$0	$190	
	2800	Offices and Personnel Buildings	$0	$0	$0		$0		
	2900	Laboratories, Shops and Warehousing	$0	$0	$0		$0		
	3000	**Processing Plant**							
	3100	Ore Handling Facilities	$0	$0	$0		$0		
	3200	Process Plant	$0	$0	$0		$0		
	4000	**Tailings and Water Management**							
	4100	Runoff, Erosion and Sediment Control	$0	$0	$0		$0		
	4200	Tailings Management Facility	$0	$0	$0	$0	$0		
	4300	Storm Water/Mine Water Pond	$0	$0	$0		$0		
	4400	Seepage Ponds and Restoration of Natural Drainage	$1,159	$174	$1,333			$1,333	
	4500	Polishing Pond and Water Reclaim Pond	$2,306	$346	$2,652			$2,652	
	6000	**Off-Site Facilities**							
	6100	Main Power Line	$506	$51	$557			$557	
	6200	Water Supply	$0	$0	$0		$0		
	7000	**Site Services and Project Indirects for Mine Closure Construction**	$938	$109	$1,047		$0	$1,047	
		Subtotal	$7,272	$1,033	$8,305	$0	$0	$8,305	
	9000	**Site Operations, Maintenance and Monitoring**							
	9100	**During Permitting, Engineering and Construction (Excluded)**							
	9200	**During Mine Operations (Excluded)**							
Closure (2 Years)	9300	**During Closure (2 Years)**	$0	$0	$0		$0		
Pit Filling (25 Years)	9400	**Site OM&M Pending Pit Filling Completion (Estimated at 25 Years)**	$15,350	$2,218	$17,568			$17,568	
Post Closure (15 Years)	9500	**Site OM&M for an Indefinite Period (Estimated at 15 Years)**	$1,964	$309	$2,273				$2,273
		Subtotal	**$17,314**	**$2,527**	**$19,841**				
		Grand Total of All Cash Flows	**$24,586**	**$3,560**	**$28,146**	**$0**	**$0**	**$25,873**	**$2,273**

IAMGOLD recognizes that closure costs must be re-assessed to determine present-time rates within the terms of the *Mining Act* Regulations. Any addition to, or refunding of, financial assurances will be undertaken following acceptance of the assessment report and discussions with the Director of Mine Rehabilitation at NDMNRF.

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