# Valentine Gold Project
# NI 43-101 Technical Report and Feasibility Study

Newfoundland and Labrador, Canada

**Effective Date**: **November 30, 2022**

**Submitted by:**
Marathon Gold Corporation
36 Lombard St, Suite 600
Toronto, Ontario, Canada, M5C 2X3


## List of Qualified Persons:

James Powell, P.Eng. – Marathon Gold Corporation
Roy Eccles, P.Geo. – APEX Geoscience Ltd.
Sheldon Smith, P.Geo. – Stantec Consulting Ltd.
Marc Schulte, P.Eng. – Moose Mountain Technical Services
W. Peter H. Merry, P.Eng. – Golder Associates Ltd.
Shawn Russell, P.Eng. – GEMTEC Consulting Engineers and Scientists Ltd.
Carolyn Anstey-Moore, P.Geo. – GEMTEC Consulting Engineers and Scientists Ltd.
Behzad Haghighi, P.Eng – Vieng Consulting
John R. Goode, P.Eng. – J.R Goode & Associates
Ignacy Antoni Lipiec, P.Eng. – SNC-Lavalin
Serfio Hernandez, Peng. – Progesys
Tommaso Roberto Raponi, P.Eng. – Ausenco Engineering Canada Inc.

# CERTIFICATE OF QUALIFIED PERSON

## James Powell, M.Eng., P.Eng.

1. I, James Powell, M.Eng., P.Eng., certify that I am employed as the Vice President of Regulatory and Government Affairs at Marathon Gold Corporation, 7 Queensway, Grand Falls-Windsor, NL, A2B 1K9.
2. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").
3. I graduated with a B.Sc. in Engineering (Civil) from the University of New Brunswick in Fredericton, New Brunswick in 1998 and with a M.Eng. in Mining from McGill University in Montreal, Quebec in 2005.
4. I am and have been registered as a Professional Engineer with the Newfoundland and Labrador Professional Engineers and Geoscientists ("PEGNL"; Membership Number 03986) since 1998.
5. I have worked continuously as an engineering consultant and mining professional for 24 years since graduation from my undergraduate degree except for 18 months while I was completing my Master's in Mining Engineering. I have been involved in all aspects of mineral exploration, mine development, operations and closure in Newfoundland and Labrador, Canada, and internationally. Work experience includes primarily gold, iron ore, nickel, and copper projects in Newfoundland and Labrador through all phases of mine life.
6. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101) and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purpose of NI 43-101 and those sections of the Technical Report that I am responsible for.
7. My most recent site visit at the Marathon Gold Project took place on June 13, 2021.
8. I am responsible for Sections 4.3, 4.4, 4.6, and 19 of the Technical Report.
9. I am not independent of Marathon Gold as independence is defined in Section 1.5 of NI 43-101. I am an employee of Marathon Gold.
10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, and to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all relevant scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

James Powell, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON
## Roy Eccles, P.Geo.

I, Roy Eccles, P. Geo. P. Geol., certify that I am employed as a Senior Consulting Geologist and Chief Operations Officer of APEX Geoscience Ltd., #100, 11450 – 160th Street, Edmonton, Alberta, T5M 3Y7.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").

2. I graduated with a B.Sc. in Geology from the University of Manitoba in Winnipeg, Manitoba in 1986 and with a M.Sc. in Geology from the University of Alberta in Edmonton, Alberta in 2004.

3. I am and have been registered as a Professional Geologist with the Association of Professional Engineers and Geoscientists of Alberta ("APEGA"; Membership Number 74150) since 2003, and Newfoundland and Labrador Professional Engineers and Geoscientists ("PEGNL"; Membership Number 08287) since 2015.

4. I I have worked continuously as a geologist for more than 35 years since my graduation from university. I have been involved in all aspects of mineral exploration, mineral research, and mineral resource estimations for metallic, industrial, and specialty mineral projects and deposits in Canada and other international destinations. Work experience includes Caledonian Orogeny gold mineralization projects (other multi-commodity projects) in the Dunnage Zone of Newfoundland and Scotland.

5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101) and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfill the requirements to be a Qualified Person for the purpose of NI 43-101 and those sections of the Technical Report that I am responsible for.

6. My most recent site inspection at the Marathon Gold Project took place on April 15, 2022, in which I observed the projects infrastructure, active exploration and workings, geological setting and modelling, validated the location of several drill collars, and independently verified the gold mineralization that is the subject of this Technical Report.

7. I am responsible for Sections 1.2, 1.4 to 1.9, 1.11, 1.19.2, 3, 4.1, 4.2, 4.5, 4.7, 6, 7, 8, 9, 10, 11, 12, 14, 23, 25.1 to 25.6, 26.2 and 26.3 of the Technical Report.

8. I am independent of Marathon Gold Corporation and the Valentine Lake Property applying all the tests in section 1.5 of Companion Policy 43-101 CP.

9. As an independent Qualified Person, I have been involved in the preparation of technical information for five NI 43-101 reports associated with the Valentine Gold Project:

   - Farmer, R.J., and Eccles, D.R. (2017): National Instrument 43-101 Technical Report Mineral Resource Estimate, Valentine Lake Gold Camp; report prepared for Marathon Gold Corporation, effective date November 27, 2017.

   - Lincoln, N., Peung, R., Farmer, R.J., Eccles, D.R., and Deering, P.O. (2018): National Instrument 43-101 Technical Report, Preliminary Economic Assessment of the Valentine Lake Gold Project, Newfoundland; report prepared for Marathon Gold Corporation, effective date May 28, 2018.

- Lincoln, N., Farmer, R.J., Eccles, D.R., and Deering, P.O. (2018): National Instrument 43-101 Technical Report, Preliminary Economic Assessment of the Valentine Lake Gold Project, Newfoundland; report prepared for Marathon Gold Corporation, effective date October 30, 2018.
- Staples, L.P., Schulte, M., Farmer, R.J., Eccles, R., Merry, W.P.H., Smith, S., Deering, P.O. (2020): National Instrument 43-101 Technical Report & Pre-feasibility Study on the Valentine Gold Project; report prepared for Marathon Gold Corporation, effective date April 18, 2020.
- Staples, P., Farmer, R., Eccles, D.R., Smith, S., Schulte, M., Merry, P., Russell, S., and Anstey-Moore, C (2021): Technical Report & Feasibility Study on the Valentine Gold Project, Newfoundland and Labrador, Canada; report prepared for Marathon Gold Corporation with an effective date of April 15, 2021.

10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, and to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all relevant scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Roy Eccles, MSc., P.Geol. P.Geo.

# CERTIFICATE OF QUALIFIED PERSON

## Sheldon Smith, P.Geo.

I, Sheldon Smith, P.Geo., certify that I am employed as a Senior Hydrologist with Stantec Consulting Ltd ("Stantec"), with an office address of 300W-675 Cochrane Drive, Markham, Ontario, Canada, L3R 0B8.

1. This certificate applies to the technical report titled ""Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").
2. I graduated with a B.Sc.(H) in Physical Geography from Memorial University of Newfoundland in 1994 and a Master of Environmental Studies from the University of Waterloo in 1998
3. I am a registered Professional Geoscientist with Professional Engineers and Geoscientists Newfoundland and Labrador (membership number 07606).
4. I have practiced my profession for 27 years. I have been directly involved in mine water management from over 30 similar studies or projects including Vale at more than 25 locations in Canada and South America, Glencore, Newmont, Alderon Iron Ore, Century Iron Mines, Altius Resources, Palladin/Aurora Energy, Atlantic Gold, Trevali, Thomas Resources, Marathon Gold, Premier Gold, Greenstone Gold, Wesdome, Norcliff Resources, DeBeers, Richmont, Ontario Graphite, Northern Graphite, Ferromin Inc., KGHM, Pan American Silver, Signal Gold, Generation PGM, Treasury Metals, Clean Air Metals, Matador Mining, Wallbridge and others.
5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.
6. I visited the Valentine Gold Project site between October 15 – 17, 2012 for a visit duration of 3 days.
7. I am responsible for Sections 1.15.7, 1.16, 1.19.7, 1.19.9, 18.9.1, 18.9.6, 20, 21.3.2, 26.7 and 26.9 of the Technical Report.
8. I am independent of Marathon Gold Corporation as independence is defined in Section 1.5 of NI 43-101.
9. I have been involved with the NI 43-101 Technical Report and Pre-Feasibility Study on the Valentine Gold Project dated April 18, 2020, the NI 43-101 Technical Report and Feasibility Study on the Valentine Gold Project dated April 15, 2021 and Surface Water Chapter and Appendices of the Valentine Gold Project EA/EIS submitted September 28, 2020.
10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Sheldon Smith, P.Geo.

# CERTIFICATE OF QUALIFIED PERSON

## Marc Schulte, P.Eng.

I, Marc Schulte, P.Eng., certify that I am a Mining Engineer with Moose Mountain Technical Services, with an office address of #210 1510 2nd Street North, Cranbrook, BC, Canada, V1C 3L2.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").
2. I graduated from the University of Alberta, in Edmonton, Alberta, Canada in 2022 with Bachelor of Science in Mining Engineering.
3. I am a member of the self-regulating Professional Engineers & Geoscientists of newfoundland and Labrador (PEGNL No. 09971).
4. I have practiced my profession for 20 years. Throughout my career I have worked on numerous open pit precious metals projects, within project engineering studies and within mine operations, on Mineral Reserve estimates, mine planning, and mine cost estimates.
5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.
6. I visited the Valentine Lake Property between July 14 and 15 for a visit duration of 2 days.
7. I am responsible for Sections 1.12, 1.13, 1.17.3, 1.19.3, 15, 16, 21.2.2, 21.3.1, 21.4.2 and 25.7 of the Technical Report.
8. I am independent of Marathon Gold Corporation as independence is defined in Section 1.5 of NI 43-101.
9. I have been involved with the Valentine Gold Project as co-author of the following Technical Reports:
    - Staples, L.P., Schulte, M., Farmer, R.J., Eccles, R., Merry, W.P.H., Smith, S., Deering, P.D., 2020: National Instrument 43-101 Technical Report & Pre-feasibility Study on the Valentine Gold Project, report prepared for Marathon Gold, effective date April 18, 2020.
    - Staples L.P., Farmer, R.J., Eccles, R., Smith, S., Schulte, M., Merry, W.P.H., Russell, S., Anstey-Moore, C., 2021: NI 43-101 Technical Report & Feasibility Study on the Valentine Gold Project, report prepared for Marathon Gold, effective date April 15, 2021.
10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Marc Schulte, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON
## W. Peter H. Merry, P.Eng.

I, W. Peter H. Merry, P. Eng., certify that I am employed as Principal of Golder Associates Ltd., with an office address of 6925 Century Avenue, Mississauga, Ontario, Canada, L5N 7K2. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").

I graduated from Queen's University, Kingston, Ontario, Canada in 2002 with a Bachelor of Science in Civil Engineering. I am a Professional Engineer of Newfoundland and Labrador (PEGNL No. 04809). I am also a P. Eng., registered in the Province of Ontario (PEO No. 100101561), and the Northwest Territories and Nunavut (NAPEG No. L2912). I have practiced my profession for 20 years. My relevant experience for the purpose of the Technical Report is:

- Principal, Golder Associates Ltd. — 2017 – Present
- Associate, Golder Associates Ltd. — 2011 – 2017
- Mine Waste / Geotechnical Engineer, Golder Associates Ltd. — 2002 – 2011

I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.

I visited the Valentine Gold Project site on August 18-19, 2021. I am responsible for Sections 1.15.3, 1.15.6, 1.19.8, 18.7, 18.8, 21.2.4, 21.3.4, 21.4.4, 25.10 and 26.8 of the Technical Report.

I am independent of Marathon Gold Corporation as independence is defined in Section 1.5 of NI 43-101. I have been involved with the Valentine Gold Project as the co-author of the following technical reports:

- Staples, L.P., Schulte, M., Farmer, R.J., Eccles, R., Merry, W.P.H., Smith, S., Deering, P.D., (2020): National Instrument 43-101 Technical Report & Pre-feasibility Study on the Valentine Gold Project, report prepared for Marathon Gold, effective date April 18, 2020.
- Staples, L.P., Schulte, M., Farmer, R.J., Eccles, R., Merry, W.P.H., Smith, S., Russell, S., Anstey-Moore, C. (2021): NI 43-101 Technical Report and Feasibility Study on the Valentine Gold Project, report prepared for Marathon Gold, effective date April 15, 2021.

I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

W. Peter H. Merry, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON

## Shawn Russell, P.Eng.

I, Shawn Russell, ing., P.Eng., certify that:

1. I am employed as a Senior Geotechnical Engineer with GEMTEC Consulting Engineers and Scientists Limited with an office address of 19 Dundee Avenue, Mount Pearl, Newfoundland and Labrador (NL), Canada, A1N 4R6.
2. This certificate applies to the technical report titled, “Valentine Gold Project NI 43-101 Technical Report and Feasibility Study” that has an effective date of November 30, 2022.
3. I graduated from Université Laval in Sainte-Foy, Quebec, Canada with a Bachelor of Applied Sciences degree in civil engineering in 1998.
4. I am a licensed and entitled to practice as Professional Engineer in he provinces of Newfoundland and Labrador (PEGNL No. 09684), in New Brunswick (APEGNB No. L5938), in Nova Scotia (APENS No. 20200032), Quebec (OIQ No. 122050) and Ontario (PEO No. 100544255).
5. I have practiced my profession for 25 years. I have been directly involved in civil/geotechnical engineering and design work for similar studies or projects including Signal Gold Inc. in Baie Verte, NL, and Maritime Gold in Springdale, NL.
6. I have read the definition of “Qualified Person” set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects (“NI 43-101”) and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a “Qualified Person” for those sections of the technical report that I am responsible for preparing.
7. I visited the Valentine Gold Project property on June 8, 2022, for a duration of 3 days.
8. I am responsible for Sections 18.6.1 and 18.6.2 of the Technical Report.
9. I am independent of Marathon Gold Corporation as independence is described by Section 1.5 of NI 43–101.
10. I have been involved with the Valentine Gold Project with the FS level update geotechnical and hydrogeological investigation (GEMTEC, 2022)[1].
11. I have read the NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.
12. As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: December 20, 2022

*“Original signed and sealed”*

Shawn Russell, P.Eng.

[1] GEMTEC Consulting Engineers and Scientists Limited (GEMTEC), 2022. FS Update Geotechnical and Hydrogeological Investigations, Valentine Gold Project, FINAL Report, Project 100042.003, Mount Pearl, NL, CANADA.

# CERTIFICATE OF QUALIFIED PERSON
## Carolyn Anstey-Moore, P.Geo.

I, Carolyn Anstey-Moore, P.Geo., certify that I am employed as a Senior Environmental Geoscientist with GEMTEC Consulting Engineers and Scientists Limited, with an office address of 19 Dundee Avenue, Mount Pearl, Newfoundland and Labrador, A1N 4R6.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").
2. I graduated from Memorial University of NL in 1987 with a B.Sc., (Hons) in Geology; from the University of Toronto in 1992 with a M.Sc. in Geology; and from Memorial University of NL in 2003 with a M.A.Sc. in Environmental Engineering.
3. I am a Professional Geoscientist of Newfoundland and Labrador (PEGNL No. 04085), and of New Brunswick (APEGNB No. L6124).
4. I have practiced my profession for 25 years. I have been directly involved in hydrogeological characterization studies for similar mine and industrial development projects, including Search Minerals REE Project, Labrador; Maritime Resources Hammerdown Gold Project, NL; Kutcho Copper Mine Project, BC; Century Iron Mine Joyce Lake Iron Ore Project, NL; Atlantic Minerals Lower Cover Expansion Project, NL; and Alderon Iron Ore Kami Project.
5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.
6. I visited the Valentine Lake Property between July 12 to 14, 2020 for a visit duration of 2 days, and again between June 19 to 22, 2022 for a visit duration of 3 days.
7. I am responsible for Section 18.6.3 of the Technical Report.
8. I am independent of Marathon Gold Corporation as independence is defined in Section 1.5 of NI 43-101.
9. I have been involved with the Valentine Gold Project since 2019 having worked on various hydrogeological studies, including hydrogeological characterization of mine site development areas, and packer testing and pumping test programs as part of pit geotechnical investigations. I worked on the hydrogeology section of the previous technical report in 2020.

I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Carolyn Anstey-Moore, P.Geo.

# CERTIFICATE OF QUALIFIED PERSON
## Behzad Haghighi, P.Eng.

I, Behzad Haghighi, P.Eng., certify that I am employed as a Director with Vieng Consulting Inc., with an office address of 115 Frini Crt. Woodbridge Ontario, Canada.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").

2. I graduated from Civil Engineering, Tehran University, Tehran, in 1992 with a BSc. In Civil-Hydraulics Engineering, and from KNT University, Tehran, in 1997 with an M.Sc.

3. I am a Professional Engineer (PEGNL: 10539; PEO: 100115770; EGBC: 53803).

4. I have practiced my profession for 30 years. I have been directly involved in the design of roads, earthworks and mining infrastructures.

5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.

6. I visited the Valentine Gold property between August 31 and September 1, 2021 for two days.

7. I am responsible for Sections 1.15.1, 1.15.2, 1.15.4, 1.15.5, 1.19.6, 18.1 to 18.5, 18.9.2 to 18.9.5, 18.10, 21.2.5, 21.3.3, 21.3.5, 25.9 and 26.6 of the Technical Report.

8. I am independent of Marathon as independence is defined in Section 1.5 of NI 43-101.

9. I have been involved with the design of roads, earthworks, freshwater intake, and effluent pipeline design for the Valentine Gold Project in 2021-2022.

10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Behzad Haghighi, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON

## John R. Goode, P.Eng.

I, John R. Goode, P.Eng., certify that I am employed as a Consulting Metallurgist with J.R. Goode and Associates, with an office address of Suite 1010, 65 Spring Garden Avenue, Toronto, Ontario, Canada, M2N 6H9.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").
2. I graduated from the Royal School of Mines, London University, U.K. in 1963 with a BSc (Chemical Engineering in Metallurgy).
3. I am a Professional Engineer registered with Professional Engineers Ontario (16561011) and Professional Engineers and Geoscientists Newfoundland & Labrador (08227).
4. I have practiced my profession for 59 years since graduation. I have been directly involved in numerous gold recovery projects having worked for Kilborn Engineering from 1976 to 1993 as a metallurgist on the Dome expansion, Detour Lake, Hemlo, and Goldstrike projects and several others. From 1994 to 1997 I worked for Barrick Gold Corporation. I have operated my own consultancy since 1997 and completed numerous gold projects since that time including work on Pascua Lama, Young-Davidson and several others.
5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.
6. I have not visited the site of the Valentine Gold Project.
7. I am responsible for Sections 1.10, 1.19.4, 13, 25.8 and 26.4 of the Technical Report.
8. I am independent of Marathon Gold Corporation as independence is defined in Section 1.5 of NI 43-101.
9. I have been involved with the Valentine Gold Project having managed and/or interpreted testwork and provided input to studies in 2014, from 2016 to 2022.
10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

John R. Goode, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON

## Ignacy Antoni Lipiec, P.Eng.

I, Ignacy Antoni Lipiec, P. Eng., certify that I am employed as a Vice President, Minerals & Metallurgical Processing with SNC-Lavalin, with an office address of 745 Thurlow Street, Vancouver, BC, Canada, V6E 0C5.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").

2. I graduated from University of British Columbia, Vancouver in 1985 with a Bachelor of Applied Science in Mining & Mineral Process Engineering.

3. I am a Professional Engineer, registered with the Professional Engineers of Ontario, 100076251.

4. I have practiced my profession for 37 years. I have been directly involved in the design, operation and construction of process plants processing gold ores on a variety of projects in Africa, Asia, North and South America since 1986.

5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.

6. I have not visited the Valentine Lake Project site.

7. I am responsible for Sections 1.14, 1.19.5, 17 and 26.5 of the Technical Report.

8. I am independent of Marathon Gold Corporation as independence is defined in Section 1.5 of NI 43-101.

9. I have had no previous involvement with Valentine Lake.

10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Ignacy Antoni Lipiec, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON
## Serfio Hernandez, P.Eng.

I, Serfio Hernandez, P.Eng., certify that I am employed as a Project Control Manager with Progesys, with an office address of 4440 Rue Garand, Laval QC, H7L5Z6.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").

2. I graduated from The University of Zulia, located in Maracaibo, Venezuela with a B.Sc. of Industrial Engineer.

3. I am an Engineer of the Order of Engineers of Quebec (No. 5055611).

4. I have practiced my profession for 20 years. I have been directly involved in large-scale construction projects in various industries such as mining, oil and gas and refineries in Canada and overseas.

5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.

6. I visited the Valentine Project site on September 28, 2022 for a visit duration of one day.

7. I am responsible for Sections 24 and 25.13 of the Technical Report.

8. I am independent of Marathon Gold as independence is defined in Section 1.5 of NI 43-101.

9. I have had no previous involvement with the Valentine Gold Project.

10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Serfio Hernandez, P.Eng.

# CERTIFICATE OF QUALIFIED PERSON
## Tommaso Roberto Raponi, P.Eng.

I, Tommaso Roberto Raponi, P. Eng., certify that I am employed as a Principal Metallurgist with Ausenco Engineering Canada Inc., with an office address of 11 King Street West, Suite 1550, Toronto, ON, M5H 4C7.

1. This certificate applies to the technical report titled "Valentine Gold Project NI 43-101 Technical Report and Feasibility Study" that has an effective date of November 30, 2022 (the "Technical Report").
2. I graduated from University of Toronto in 1984 with a bachelor's degree in Geological Engineering.
3. I am registered as a Professional Engineer in Ontario (Licence No. 902270) and Newfoundland and Labrador (Licence No. 10968).
4. I have practiced my profession continuously for over 38 years since graduation. I have been directly involved in in the development, design, commissioning and operation of mineral processing plants in Canada, United States, Mexico, Brazil, Venezuela, Surinam, Chile, Kyrgyzstan, Mongolia, Turkey, and Saudi Arabia. I have worked as an independent consultant since 2016.
5. I have read the definition of "Qualified Person" set out in the National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101") and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for those sections of the Technical Report that I am responsible for preparing.
6. I have not visited the Valentine Project Site.
7. I am responsible for Sections 1.1, 1.3, 1.17.1, 1.17.2, 1.18, 1.19.1, 1.20, 2, 5, 21.1, 21.2.1, 21.2.3, 21.2.6 to 21.2.11, 21.3.6 to 21.3.9, 21.4.1, 21.4.3, 21.4.5, 21.4.6, 22, 25.11, 25.12, 26.1 and 27 of the Technical Report.
8. I am independent of Marathon Gold Corp. as independence is defined in Section 1.5 of NI 43-101.
9. I have had no previous involvement with the Valentine Gold Project.
10. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that Instrument. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the Technical Report not misleading.

Dated: December 20, 2022

*"Original signed and sealed"*

Tommaso Robert Raponi, P.Eng.

## Important Notice

This report was prepared as National Instrument 43-101 Technical Report for Marathon Gold Corporation (Marathon Gold) by John T. Boyd Company (BOYD), Terrane Geoscience Inc. (Terrane), APEX Geoscience Ltd. (APEX) , Stantec Consulting Ltd. (Stantec), Moose Mountain Technical Services (MMTS), Golder Associates Ltd. (Golder), GEMTEC Consulting Engineers and Scientists Ltd. (GEMTEC), Vieng Consulting, J.R. Goode and Associates, SNC-Lavalin, and Ausenco Engineering Canada Inc. (Ausenco). The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in the Report Authors' services, based on (i) information available at the time of preparation, (ii) data supplied by outside sources, and (iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by client abbreviation subject to terms and conditions of its contracts with each of the report authors. Except for the purposed legislated under Canadian provincial and territorial securities law, any other uses of this report by any third party are at that party's sole risk.

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# 1 SUMMARY

## 1.1 Overview

This report was prepared by various consultants (listed below) representing all the companies that took part in the Valentine FS Update for Marathon Gold Corporation (Marathon Gold) to update and summarize the results of the Valentine Gold Project NI 43-101 Technical Report and Feasibility Study. The Valentine Gold Project, located in Newfoundland, was updated by converting the Berry zone resource into the reserve and the mine plan. The report was prepared in accordance with the Canadian disclosure requirements of National Instrument 43-101 (NI 43-101) and in accordance with the requirements of Form 43-101 F1.

The NI 43-101 responsibilities of the geological and engineering consultants are as follows:

- Ausenco peer-reviewed capital and operating cost estimates that Marathon Gold compiled with inputs from all parties. Ausenco then compiled the financial model with support from Marathon Gold.
- John T. Boyd Company (BOYD) was commissioned to complete the mineral resource estimates.
- APEX Geoscience Ltd. (APEX) was commissioned to review the geological information including verification of drilling and the sample preparation and analyses for use in the mineral resource estimate, and to review and take responsibility of the resource estimates.
- Stantec Consulting Ltd. (Stantec) was commissioned to support environmental planning, assessment, licensing, and permitting, as well as to provide a feasibility-level design update and bulk material estimates of the water management structures.
- Moose Mountain Technical Services (MMTS) was commissioned to design the open pit mine plan, mine production schedule, and mine capital and operating costs.
- Golder Associates Ltd. (Golder) was commissioned to complete the feasibility-level design update and bulk material estimates of the tailings management facility (TMF) and polishing pond.
- GEMTEC Consulting Engineers and Scientists Ltd. (GEMTEC) was commissioned to perform site-wide geotechnical and hydrogeological investigations. (GEMTEC, 2021, 2022b and 2022d).
- Vieng Consulting (Behzad Haghighi) was commissioned to review the infrastructure and road designs.
- J.R. Goode and Associates provided input to the design of the metallurgical testwork program and its interpretation.

## 1.2 Property Description

The Valentine Lake property is in the west-central region of the island of Newfoundland, Canada and consists of 14 contiguous mineral licenses for a landholding of 240 km$^2$ or 24,000 hectares (Figure 1-1). The property is 100% owned by Marathon Gold and hosts five gold deposits, namely Leprechaun, Sprite, Berry, Marathon and Victory, and several other early-stage gold prospects. The collective deposits and occurrences occur within a 32 km long northeast-trending zone known as the Valentine Gold Project.

**Figure 1-1: Island of Newfoundland & Location of the Valentine Gold Project**


Source: Marathon Gold, 2022.

## 1.3 Accessibility, Climate, Local Resources, Infrastructure and Physiography

Access to the property is by existing roads, nominally the 63 km gravel road from the Town of Millertown. Using the Trans-Canada Highway and the Buchans Highway, Millertown can be accessed by paved road. The project is situated between two major waterbodies, Valentine Lake and Victoria Reservoir. Local climate is “temperate maritime”, which means it has typically mild summers and cold winters. The weather station at Buchans shows an annual average precipitation of 1,100 mm, of which slightly more than one-fourth falls as snow with up to 1 m or more of accumulation.

Regarding temperatures, the historical average summer temperature is 14°C, and average winter temperature is -6°C. At times, short-term extreme temperatures can be observed at the project site, which have been accounted for in the project design, for a winter minimum of -26°C and the summer maximum temperature of 30°C.

## 1.4 History

The property has historically been explored by several companies since the 1960s (Table 1-1). The region was originally investigated for base metals by ASARCO Inc., and Hudson's Bay Oil and Gas Company; this exploration was consistent with historically significant base metal discoveries in the Dunnage Zone (e.g., Buchan's and Duck Pond-Boundary Cu-Zn±Au past-producing deposits).

Table 1.1: Summary of Ownership History

| Date | Operator |
|---|---|
| 1960s | ASARCO Inc. |
| 1970s to 1983 | Hudson's Bay Oil and Gas Company |
| 1983-1985 | Abitibi Price Inc. |
| 1985-1992 | BP Canada Inc. |
| 1992-1998 | Noranda Inc. |
| 1998-2003 | Mountain Lake Resources Inc. |
| 2003-2007 | Richmont Mines Inc. |
| 2007-2009 | Mountain Lake Resources Inc. |
| 2009-2010 | Marathon PGM Corporation |
| 2010-Present | Marathon Gold Corporation |

The Valentine Lake property was first recognized as a gold prospect by Abitibi Price Inc. (Abitibi) in 1983 and was acquired by BP Canada Inc. (BP) in 1985. While working for BP, Tim Froude and Gerald Harris identified gold prospects at Leprechaun and Victory deposits (Victory was formerly known as Valentine East) in 1986. Noranda Inc. (Noranda) acquired the property from BP in 1992, prior to entering into a joint venture agreement with Mountain Lake Resources Inc. (MOA) in 1998. Between 1998 and 2007, MOA and Richmont Mines Inc. (Richmont) conducted exploration programs focused on the Leprechaun and Valentine East zones and drilled exploratory holes elsewhere along the 32 km long mineralized trend including the Sprite (formerly called Osprey) prospect. In 2009, MOA entered into an option and joint venture agreement with Marathon PGM Corporation. In 2010, the gold properties held by Marathon PGM Corporation, including the Valentine Lake property, were spun out into a new company, Marathon Gold Corp. (Marathon Gold), which commenced trading in December 2010. Marathon Gold acquired a 100% interest in the Valentine Lake property in July 2012.

Between 2010 and present, Marathon Gold conducted systematic exploration programs to explore historic prospects within the property and discovered numerous additional zones of mineralization along the project trend. Marathon Gold subsequently discovered the Marathon, Sprite, and Berry deposits and has significantly expanded the known extents of mineralization at the Leprechaun and Victory deposits. Additional early-stage exploration targets were identified by Marathon Gold along the 32 km mineralized trend—this includes the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW, Victory NE, Eastern Arm, and Western Peninsula.

## 1.5 Geology and Mineralization

The Valentine Lake property is located within the Exploits Subzone of the Dunnage tectonostratigraphic zone of Central Newfoundland, part of the Newfoundland Appalachian system. Gold mineralization within the Dunnage Zone is correlated with late syn- to post-Salinic orogenic events and is typically spatially related to major structural features and proximal to, or hosted within, intrusive bodies.

The gold deposits at the Valentine Lake property are hosted primarily by the Neoproterozoic Valentine Lake Intrusive Complex, which occurs proximal to the contact between the Victoria Lake Supergroup to the northwest and the Silurian (or younger) Rogerson Lake Conglomerate to the southeast. This contact correlates with a NE-SW lithotectonic boundary, the Valentine Lake Shear Zone, which is characterized by localized shearing and faulting and was previously described as exhibiting sinistral reverse transpressive deformation corelated with the Salinic (450-423 Ma) Appalachian Orogenic event.

The Valentine Lake Intrusive Complex comprises an elongate northeast-trending body of igneous rocks consisting of dominantly fine- to medium-grained trondhjemite and quartz-eye porphyry units with lesser aphanitic quartz porphyry, gabbro, and minor pyroxenite units. The Rogerson Lake Conglomerate occurs as a narrow linear unit that extends for approximately 160 km and lies unconformably (overturned) on the southeast margin of the Valentine Lake Intrusive Complex. The conglomerate is interpreted to have infilled a fault-bounded paleo-topographic depression. The entire project area is overlain by glacial till between 1 and 5 m thick, as well as boggy areas and ponds, with bedrock exposure along a ridge trending northeast-southwest through the property and in stream beds.

Regional metamorphism in the Valentine Lake area ranges from lower to upper greenschist facies with the higher grades in the southern portion of the property. Deformation of the Valentine Lake Intrusive Complex is ductile transitioning to late-stage brittle deformation. The Rogerson Lake Conglomerate exhibits a strongly developed pervasive foliation, isoclinal folding and flattened primary clasts indicative of a pure shear crustal shortening regime.

Recent project scale structural investigations by Terrane Geosciences Inc. for Marathon, and more regionally by the Geological Survey of Canada, has established a geotectonic chronology for the deformation within the project area. Five phases of deformation are recognized. A penetrative ductile fabric associated with initiation of the Valentine Lake Shear Zone during an initial $D_1$ crustal shortening phase is characterized by a strong $S_1$ foliation and $L_1$ stretching lineation. These fabrics are observed in both the Rogerson Lake Conglomerate and in the Valentine Lake Intrusive Complex, with a SW strike and steep dip to the NW, paralleling the larger structure. Gold mineralization occurs in Quartz-Tourmaline-Pyrite (QTP) vein sets developed within the Valentine Lake Intrusive Complex correlated with a $D_3$ phase of renewed crustal shortening following a period of regional $D_2$ relaxation. Overprinting fabrics include a late $D_4$ crenulation fabric and a $D_5$ brittle fault set.

The QTP-Au veining has been identified in prospecting samples, outcrop, trenching and drilling at numerous locations along the 32 km strike extent of the Valentine Lake Intrusive Complex and Valentine Lake Shear Zone within the Valentine Lake property. Significant QTP-Au veining occurs dominantly within the trondhjemite, quartz-eye porphyry and lesser mafic dyke units along and proximal to the sheared contact with the Rogerson Lake conglomerate. Minor amounts of gold-bearing QTP veining extends across the Valentine Lake Shear Zone contact and into the Rogerson Lake Conglomerate.

The gold mineralization at the Valentine Lake property occurs as structurally controlled, orogenic gold deposits consisting dominantly of en-echelon stacked SW dipping extensional vein sets (Set 1) and lesser shear parallel vein sets (Set 2) proximal to the Valentine Lake Shear Zone. This style of mineralization occurs intermittently along the defined strike length of the main gold zone in which a series of deposits and occurrences have been, and continue to be, discovered. Discoveries to date include the Leprechaun, Sprite, Berry, Marathon and Victory gold deposits, and the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW, and Victory NE occurrences.

At the deposit scale, a pervasively altered, intensely QTP-veined core complex, which is referred to by Marathon Gold as the "Main Zone", has been delineated at the Leprechaun, Berry and Marathon deposits. The Main Zones of the Marathon, Leprechaun and Berry deposits are well-defined by thorough outcrop investigation and densely spaced subsurface drillhole information. Main Zone mineralization at Leprechaun and Berry is constrained by the Valentine Lake Shear Zone to the southeast and several large mafic dykes which parallel the Valentine Lake Shear Zone to the NW, whereas the Marathon mineralization is much more diffuse. Further exploration work is required at the other deposits and occurrences to determine if the Main Zone model is present at these locales.

Individual QTP-Au veins range in thickness from a few millimeters and centimeters to meters but are typically 2 to 30 cm thick. The Set 1 extensional and Set 2 shear-parallel QTP-Au veins are up to 1.5 m thick and have been traced in trenched outcrop exposures for over 280 m of continuous strike length; however, the observed strike length of individual veins is typically in the range of meters to tens of centimeters. Up to three separate vein sets have been identified at the Leprechaun and Marathon deposits, and up to four vein sets at the Berry deposit. Set 1 QTP-Au veins developed within brittle extensional fractures dipping at a low angle to the southwest are the dominant mineralization style at the property. The QTP-Au veins represent the principal structural control on gold mineralization in the mineral resource models for the Leprechaun, Sprite, Berry, Marathon and Victory deposits.

Visible gold in the QTP veins occurs as grains, ranging in size from <0.1 mm and up to 2 to 3 mm, hosted by quartz, tourmaline masses, within and along the margins of coarse cubic pyrite, or associated with minor tellurides, as well as in altered host rock along vein margins. Highest gold grades are commonly associated with large (1 to 3 cm) cubic pyrite within the QTP veining.

The relationship between high-grade gold mineralization and the location of the dykes supports the theory that the mafic dykes provide a rheologic contrast that (1) promotes brittle fracturing of the granitoid unit and therefore, acts as a controlling factor of mineralized fluid flow, and (2) incites the eventual emplacement of zones of gold enrichment.

The detailed geological work completed by Marathon Gold adds confidence to the continuity of the high-grade mineralized zones at Marathon, Leprechaun, and Berry, and to the overall mineralization model in which the Set 1 QTP-Au veins represent the principal structural control on gold mineralization at the Valentine Lake property.

## 1.6 Deposit Type

In central Newfoundland, numerous examples of mesozonal to epizonal orogenic gold mineralizing systems are spatially related to vein-hosted gold in association with crustal-scale fault zones and faults, late orogenic timing and possible wall rock alteration as manifested by extensive carbonate alteration.

The Valentine Lake property hosts a structurally controlled, mesothermal gold deposit associated with Salinic aged crustal shortening and deformation. Gold mineralization is developed within QTP vein sets associated with brittle-ductile deformation of granitoid rocks of the Neoproterozoic Valentine Lake Intrusive Complex in contact with the Silurian Rogerson Lake Conglomerate. This contact is formed by the Valentine Lake Shear Zone, a major crustal-scale, NE-SW lithotectonic boundary.

Set 1 QTP-Au veins developed within brittle extensional fractures dipping at a low angle to the SW represent the dominant mineralization style at the property. These represent the principal structural control on gold mineralization in the mineral resource models for the Leprechaun, Sprite, Berry, Marathon and Victory deposits.

## 1.7 Exploration

Between 2010 and present, Marathon Gold has conducted a systematic exploration program to follow up on historic prospects within the Valentine Gold Property at what are now referred to as the Leprechaun and Victory deposits, and to discover additional zones of mineralization along the project's mineralized trend. This work includes geological mapping; litho-geochemical grab and channel sampling; ground geophysical surveying (induced polarization, magnetic, and seismic); and drilling and metallurgical processing. Marathon Gold subsequently discovered the Marathon, Sprite and Berry deposits. Subsequent work has significantly expanded the known extents of mineralization at all five gold deposits. Additional early-stage exploration targets were identified by Marathon Gold along the 32 km mineralized trend including the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW, Victory NE, Eastern Arm, and Western Peninsula.

The results of the detailed mapping, litho-geochemistry, and petrographic studies were used to prepare detailed geological maps for each deposit area. Detailed prospecting, grab rock samples and channel sampling, in conjunction with geological mapping, have assisted Marathon Gold with prioritizing drill targets for follow-up exploration. Geophysical data supports a complex structural geological association at the deposit areas. Distinct structural splays associated with the Valentine Lake Shear Zone and late-stage brittle fault offsets of the regional structural fabric are evident in the magnetic data and provide structural context for the exploration. Mineralization at these deposits also appears spatially associated with areas of low magnetic intensity, interpreted to result from the potential magnetite destructive sericite alteration associated with the QTP vein arrays.

## 1.8 Drilling

Between 2010 and 2021, Marathon Gold drilled 1,786 diamond drillholes totalling 413,221.4 m. The majority of the subsurface drillhole information has been concentrated at the Leprechaun, Berry, and Marathon deposits followed by Sprite and Victory deposits, and the Frank, Rainbow, Triangle, Narrows, Victory SW and Victory NE occurrences, and the Scott and Steve zones.

During 2022, Marathon Gold conducted condemnation, geotechnical, and infill drilling at the Berry deposit which included 76 drillholes totalling 14,895 m. The infill program was designed to define additional mineralization and reduce the strip ratio in the current mine plan. The 2022 infill drilling of the Berry deposit is ongoing, and most assays were outstanding; therefore, the results are not included in the mineral resource update presented in this report.

Drilling was conducted using wireline double tube barrels that produced NQ size core. Drilling includes sub-vertical and inclined holes to accommodate the dip of the mineralized shallow-dipping stacked extensional vein and steeply dipping fault-filled shear vein domains. Exploration drilling has been conducted on nominal 100 m spaced lines with 30 m spaced holes, closing to 25 m x 25 m and up to 10 to 15 m drill centers at the Marathon and Leprechaun deposits. All drillholes undergo downhole surveys to obtain drillhole deviation data. Consequently, the relationship between the sample length and the true thickness of the mineralization is well documented, and all assay sample intervals are given as core length unless noted as true thickness.

Geotechnical logging by Marathon Gold geologists included a description of the fractures, including number of fractures, fracture index, type and roughness, alteration, and core recovery. Drill core recovery is excellent, averaging 95%, and there is no evidence of bias between core recovery and assayed gold grade. Drill core samples were taken from half cut core, except in rare zones of intense fracturing where the core was split manually. Sample intervals were nominally taken at 1 m intervals in mineralized zones and 2 m intervals in barren zones.

Geological logging included an initial summary log of the principal rock types and mineralized intervals, followed by a detailed geological log that described a pre-determined index of rock type, detailed lithology, alteration type and degree, mineralization type and percentage, and structural observations in both written and graphical form. The geological log also contains the sample intervals and numbers.

Diamond drilling during the 2020 and 2021 exploration programs were focused on the discovery and expansion of the Berry deposit, as well as grassroots exploration in the Narrows and Marathon South, and drilling in the Victory deposit. The drill program in 2021 was the largest program completed to date, with a total of 299 drillholes totalling 76,628.99 m of NQ core. The bulk of this was completed in the Berry deposit as both infill and step out holes targeting expansion of mineralization at depth and along strike. The initial resource estimate of the Berry deposit, released in April of 2021 was targeted throughout the 2021 drill program to convert inferred material into the measured and/or indicated categories.

Drilling in the Victory deposit attempted to use the new exploration thesis of Main Zone mineralization focused proximal to the Valentine Lake Shear Zone to extend the current model further to the southeast. Additional mineralized zones were discovered in this area, along with the discovery that the Valentine Lake Shear Zone in this area is not overturned, and dips steeply to the southeast.

An additional 302 reverse circulation (RC) drillholes totalling 12,141 m were drilled in the 2021 season in the Leprechaun and Marathon deposits. This drilling was focused on validating the mineral resource models, testing mineralization along the edges of the Main Zone corridor, and overall grade control.

## 1.9 Sample Preparation and Data Verification

The QP has reviewed the sample preparation, analyses, and security procedures and found no significant issues or inconsistencies that would cause one to question the validity of the data. The QP is satisfied with the adequacy of the procedures implemented by Marathon Gold.

The QP has reviewed the adequacy of the exploration information and the visual, physical, and geological characteristics of the property and has found no significant issues or inconsistencies that would cause one to question the validity of the data. The samples collected by an independent QP, and the results of analytical work conducted at an independent laboratory, confirm the gold mineralization at Marathon Gold's Valentine Lake property. The QP is satisfied to include the exploration data—including the drilling, drill litho-logs and sample assays—for the purpose of resource modelling, evaluation, and the estimations presented in this report.

## 1.10 Mineral Processing and Metallurgical Testing

Marathon Gold completed several programs of metallurgical testwork on mineralized samples from the Leprechaun and Marathon deposits between 2006 and 2021, as referenced in Section 13. Samples from the Berry deposit were first metallurgically tested in 2022 with results summarized in this updated NI 43-101 report. Metallurgical testwork described in the 2021 Feasibility Study and in the recent tests have examined two flowsheets for the recovery of gold: (1) a relatively low capital cost flowsheet comprising gravity concentration and leaching of the gravity concentration tailings ("Phase 1"); and (2) a flowsheet comprising gravity concentration followed by gold and sulphide flotation, intensive treatment of the concentrate and leaching of the flotation tailings ("Phase 2").

The recent metallurgical work described in this technical report has focused on mineralized material from the Berry deposit. The testing has been intended to determine if Berry mineralized material is similar to that of the Marathon and Leprechaun deposits and therefore can be processed using the same metallurgical processes developed for these feeds and as described in the 2021 Technical Report. As such, given that the deposit lithology and other characteristics are identical to those at Marathon and Leprechaun, testwork has been largely limited to comminution, beneficiation, and leaching tests. Some testwork was also undertaken on lower grade material from the Marathon and Leprechaun deposits to better define the relationship between feed grade and gold recovery.

Twenty-three Berry variability samples consisting of half NQ core and 11 comminution samples consisting of half HQ core were retrieved from storage in Newfoundland and delivered to BaseMet in May 2022. The NQ material came from drilling campaigns in 2015, 2019, 2020, and 2022 and the HQ core from the 2020 and 2021 drilling campaigns. The samples were selected to represent the Berry deposit geographically along the strike of the deposit. Selection criteria included the need to approximate the planned mine grade, a minimum 10 m long interval, and for samples to be within the indicated pit shell.

Comminution data for Berry material showed that the abrasion index for the Berry samples is slightly higher than the average values for the Marathon and Leprechaun deposits, the rod mill work index was very similar to that of Marathon and Leprechaun material, and that the ball mill work index was slightly lower than that of Marathon and Leprechaun material. Material competency, as indicated by the average Axb values, are similar for all three deposits with Berry having a slightly higher value. All of these findings mean that Berry material is easier to grind than the other materials and that a grinding circuit designed for a mixture of Marathon and Leprechaun, as described in the 2021 Feasibility Study, will be able to handle a mixture of all three materials.

Recent and earlier small-scale gravity concentration procedures indicate a general trend in which Marathon gives low gravity recovery (~23% at 2 g/t head), Leprechaun has slightly higher gravity recovery (28% at 2 g/t) and Berry markedly higher recovery (40% at 2 g/t). However, an extended gravity recoverable gold (E-GRG) test on a composite of Berry material showed that gravity recovery was very similar to that of the other two deposits.

Intensive cyanidation testing of Berry gravity concentrate gave 98% gold extraction which is similar to that observed for concentrates from Marathon and Leprechaun. Processing of the gravity concentrate leach tailings was investigated on a mixture of Marathon and Leprechaun concentrates and it was indicated that sending the Phase 1 tailings to the primary grinding circuit will increase overall recovery from gravity concentrate to more than 99%. Testwork conducted in 2019 showed that Phase 2 gravity concentrate extraction will be 99.8% since gravity concentrate leach tailings are sent to the flotation regrind and intensive cyanidation circuit.

The grade versus gold extraction data for the Phase 1 flowsheet (gravity-leach) was determined on the 23 Berry variability samples and the eleven comminution samples. In addition, lower-grade samples from Leprechaun and Marathon (18 samples each) were processed. Combined with data from the 2021 program a total of 99 grade-recovery data points were obtained. In similar fashion, a total of 88 grade-recovery points were developed for the Phase 2 flowsheet (gravity-float-leach). The results are plotted in Figures 1-2 and 1-3.

In addition to the regression lines indicated in the figures above, overall grade-recovery relationship for both project phases and covering a mixture of feeds from all three deposits was generated. The equations are as follows:

*Phase 1: Gold extraction (%) = 0.2114 x Gold grade (g/t) + 93.59 (Capped at 96%)*

*Phase 2: Gold extraction (%) = 0.455 x Gold grade (g/t) + 95.86 (Capped at 97%)*

Note that in the above graphs and equations, soluble and other losses of gold are not included. As in the 2021 Feasibility Study, 1% soluble loss should be deducted from the recovery numbers in the figures or from recovery calculated from the equations.

**Figure 1-2: Gold Grade Versus Gold Extraction – Phase 1**

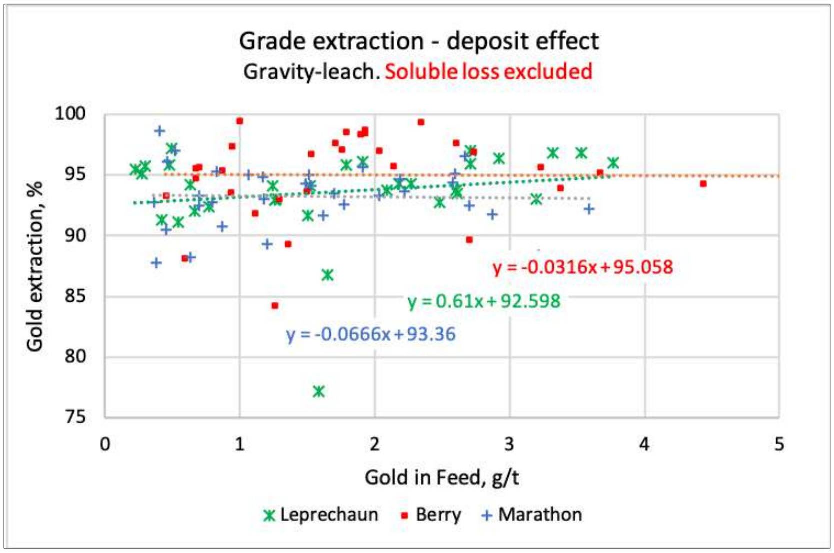
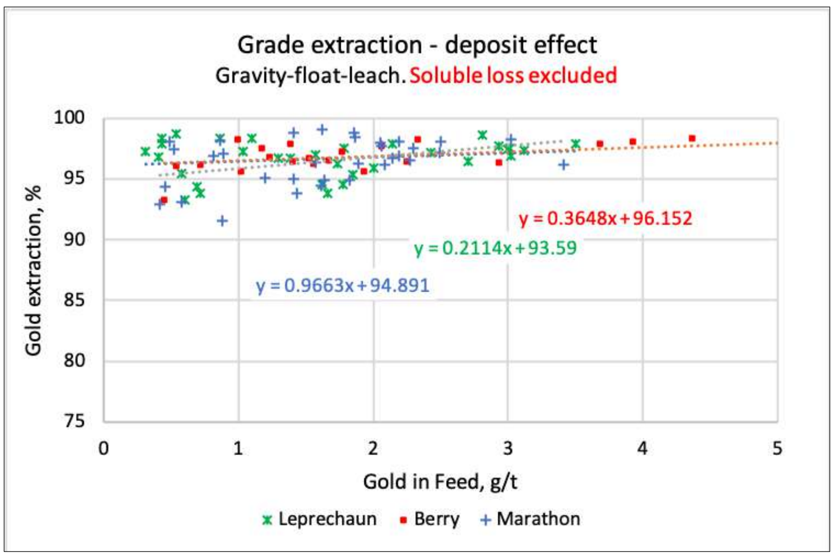



**Figure 1-3: Gold Grade Versus Gold Extraction – Phase 2**




## 1.11 Mineral Resource

The mineral resource estimates were completed by BOYD under the supervision of Mr. Eccles, who reviewed and accepts responsibility of the mineral resources. The mineral resources, reported below in Table 1-2, include five identified gold deposits—Leprechaun, Sprite, Berry, Marathon, and Victory—that comprise the Valentine Gold Project.

Mineral resources are not mineral reserves and do not have demonstrated economic viability. The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 1.2: Consolidated Valentine Gold Project Mineral Resources**

| Material/ Category | Open Pit | | | Underground | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tonnes (t) | Grade (g/t) | Gold (oz) | Tonnes (t) | Grade (g/t) | Gold (oz) | Tonnes (t) | Grade (g/t) | Gold (oz) |
| **Leprechaun Deposit** | | | | | | | | | |
| Measured | 7,315,000 | 2.56 | 601,400 | 57,000 | 3.38 | 6,200 | 7,372,000 | 2.56 | 607,600 |
| Indicated | 8,023,000 | 1.75 | 451,000 | 194,000 | 3.18 | 19,800 | 8,217,000 | 1.78 | 470,800 |
| **M+I** | **15,338,000** | **2.13** | **1,052,400** | **251,000** | **3.22** | **26,000** | **15,589,000** | **2.15** | **1,078,400** |
| Inferred | 4,131,000 | 1.28 | 169,500 | 725,000 | 3.28 | 76,500 | 4,856,000 | 1.58 | 246,000 |
| **Sprite Deposit** | | | | | | | | | |
| Measured | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 |
| Indicated | 695,000 | 1.74 | 38,800 | 6,000 | 2.20 | 400 | 701,000 | 1.74 | 39,200 |
| **M+I** | **695,000** | **1.74** | **38,800** | **6,000** | **2.20** | **400** | **701,000** | **1.74** | **39,200** |
| Inferred | 1,189,000 | 1.20 | 45,900 | 61,000 | 2.47 | 4,800 | 1,250,000 | 1.26 | 50,700 |
| **Berry Deposit** | | | | | | | | | |
| Measured | 6,678,000 | 2.41 | 517,600 | 73,000 | 3.72 | 8,700 | 6,751,000 | 2.43 | 526,300 |
| Indicated | 10,178,000 | 1.66 | 542,700 | 230,000 | 2.32 | 17,100 | 10,408,000 | 1.67 | 559,800 |
| **M+I** | **16,856,000** | **1.96** | **1,060,300** | **303,000** | **2.66** | **25,800** | **17,159,000** | **1.97** | **1,086,100** |
| Inferred | 4,740,000 | 1.31 | 200,300 | 592,000 | 2.87 | 54,600 | 5,332,000 | 1.49 | 254,900 |
| **Marathon Deposit** | | | | | | | | | |
| Measured | 14,851,000 | 1.86 | 889,600 | 252,000 | 4.32 | 35,000 | 15,103,000 | 1.90 | 924,600 |
| Indicated | 14,092,000 | 1.49 | 673,700 | 895,000 | 3.55 | 102,200 | 14,987,000 | 1.61 | 775,900 |
| **M+I** | **28,943,000** | **1.680** | **1,563,300** | **1,147,000** | **3.72** | **137,200** | **30,090,000** | **1.76** | **1,700,500** |
| Inferred | 5,285,000 | 1.50 | 254,300 | 1,699,000 | 3.66 | 200,000 | 6,984,000 | 2.02 | 454,300 |
| **Victory Deposit** | | | | | | | | | |
| Measured | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 |
| Indicated | 1,084,000 | 1.46 | 50,800 | 1,000 | 1.80 | 100 | 1,085,000 | 1.46 | 50,900 |
| **M+I** | **1,084,000** | **1.46** | **50,800** | **1,000** | **1.80** | **100** | **1,085,000** | **1.46** | **50,900** |
| Inferred | 2,200,000 | 1.16 | 81,800 | 130,000 | 3.05 | 12,700 | 2,330,000 | 1.26 | 94,500 |
| **All Deposits** | | | | | | | | | |
| Measured | 28,844,000 | 2.17 | 2,008,600 | 382,000 | 4.06 | 49,900 | 29,226,000 | 2.19 | 2,058,500 |
| Indicated | 34,072,000 | 1.60 | 1,757,000 | 1,326,000 | 3.28 | 139,600 | 35,398,000 | 1.67 | 1,896,600 |
| **M+I** | **62,916,000** | **1.86** | **3,765,600** | **1,708,000** | **3.45** | **189,500** | **64,624,000** | **1.90** | **3,955,100** |
| Inferred | 17,545,000 | 1.33 | 751,800 | 3,207,000 | 3.38 | 348,600 | 20,752,000 | 1.65 | 1,100,400 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Leprechaun, Berry, and Marathon MREs is June 15, 2022. The effective date for the Sprite and Victory MREs is November 20, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR**. 6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available.**7.** Numbers may not add or multiply correctly due to rounding.

## 1.12 Mineral Reserve

Proven and probable mineral reserves have been modified from measured and indicated mineral resources at Marathon, Leprechaun and Berry and are summarized in Table 1-3. Inferred mineral resources are set to waste. Mineral reserves are supported by feasibility study engineering. Mineral resources from the Berry, Victory and Sprite deposits, and any underground mineral resources, are not included in the feasibility study mine plan or mineral reserves.

**Table 1.3: Proven & Probable Mineral Reserves**

| Mine Area | Reserve Class | Mill Feed (Mt) | Diluted Gold Grade (g/t Au) | Contained Metal (Moz) |
|---|---|---|---|---|
| Marathon | Proven | 11.5 | 1.70 | 0.6 |
| | Probable | 9.9 | 1.40 | 0.4 |
| | **Marathon Total** | 21.3 | 1.56 | 1.1 |
| Leprechaun | Proven | 6.6 | 2.11 | 0.4 |
| | Probable | 8.6 | 1.44 | 0.4 |
| | **Leprechaun Total** | 15.1 | 1.73 | 0.8 |
| Berry | Proven | 5.3 | 2.03 | 0.3 |
| | Probable | 9.8 | 1.36 | 0.4 |
| | **Berry Total** | 15.1 | 1.60 | 0.8 |
| Subtotal | Proven | 23.4 | 1.89 | 1.4 |
| | Probable | 28.2 | 1.40 | 1.3 |
| Grand Total | **Total Proven & Probable** | 51.6 | 1.62 | 2.7 |

Notes: **1.** The mineral reserve estimates were prepared by Marc Schulte, P.Eng. (who is also an independent Qualified Person), reported using the 2014 CIM Definition Standards, and have an effective date of November 30, 2022. **2.** Mineral reserves are mined tonnes and grade; the reference point is the mill feed at the primary crusher. **3.** Mineral reserves are reported at a cut-off grade of 0.38 g/t Au. **4.** Cut-off grade assumes US$1,650/oz Au at a currency exchange rate of US$0.78 per C$1.00; 99.8% payable gold; US$5.00/oz off-site costs (refining and transport); and uses an 87% metallurgical recovery. The cut off-grade covers processing costs of $15.20/t, administrative (G&A) costs of $5.30/t, and a stockpile rehandle cost of $1.85/t. **5.** Mined tonnes and grade are based on an SMU of 6 m x 6 m x 6 m, including additional mining losses estimated for the removal of isolated blocks (surrounded by waste) and low-grade (<0.5 g/t Au) blocks bounded by waste on three sides. **6.** Numbers have been rounded as required by reporting guidelines.

Open pits are based on the results of ultimate pit limit sensitivity analysis, with limits chosen for pit shells generated from gold price inputs of US$950/oz at Leprechaun to US$1,200/oz at Marathon and US$1,350/oz at Berry. These shell targets are then designed into detailed pit phases to develop ore and waste contents for mine production scheduling. Mill feed tonnes and gold grades are based on re-blocking the original resource model blocks to a selective mining unit (SMU) block size of 6 m x 6 m x 6 m. Further mining recovery parameters have been introduced, treating the following SMU blocks as waste:

- all isolated, mineralized blocks (blocks bounded by waste on all sides)
- all blocks below 0.50 g/t gold grade that are bounded by waste on all but one side.

Factors that may affect the mineral reserve estimates include metal prices, changes in interpretations of mineralization geometry and continuity of mineralization zones, geotechnical and hydrogeological assumptions, ability of the mining operation to meet the annual production rate, planned mining dilution, and mining recovery, process plant recoveries, the ability to meet and maintain permitting and environmental license conditions, and the ability to maintain the social license to operate.

## 1.13 Mining

Mining is based on conventional open pit methods suited for the project location and local site requirements. The mining fleet will include diesel-powered rotary drills with 200 mm bit size for bulk production drilling and down-the-hole (DTH) drills with 144 mm bit size for selective drilling; diesel-powered RC drills for bench-scale grade control drilling; 15.5 $m^3$ bucket-sized hydraulic excavators and 13 $m^3$ bucket-sized wheel loaders for bulk production loading and 12.0 $m^3$ bucket-sized diesel hydraulic excavators for selective production loading; 140- and 90-tonne payload rigid-frame haul trucks and 40-tonne articulated trucks for production hauling; plus ancillary and service equipment to support the mining operations. In-pit dewatering systems will be established for each pit. All surface water and precipitation encountered in the pits will be directed out of the pits and into ex-pit settling ponds by ditching, in pit sumps, and diesel-driven pumps.

Ore will be hauled to a crusher 3.5 km southwest of the Marathon pit, 3.0 km northeast of the Leprechaun pit and 1.0 km south of the Berry pit. Ore will be crushed to feed the process plant, while waste rock will be deposited into waste rock storage facilities (WRSF) directly adjacent to the pits or used as rockfill to construct a tailing's dam 2 km southwest of the Marathon pit, 4.5 km northeast of the Leprechaun pit and 1.5 km southeast of the Berry pit. Ultimate pit limits are split into phases or pushbacks to target higher economic margin material earlier in the mine life. The Marathon, Leprechaun and Berry pits are all split into three phases, or an initial phase followed by two pushbacks, with the initial phases containing higher gold grade mineralization and a lower strip ratio.

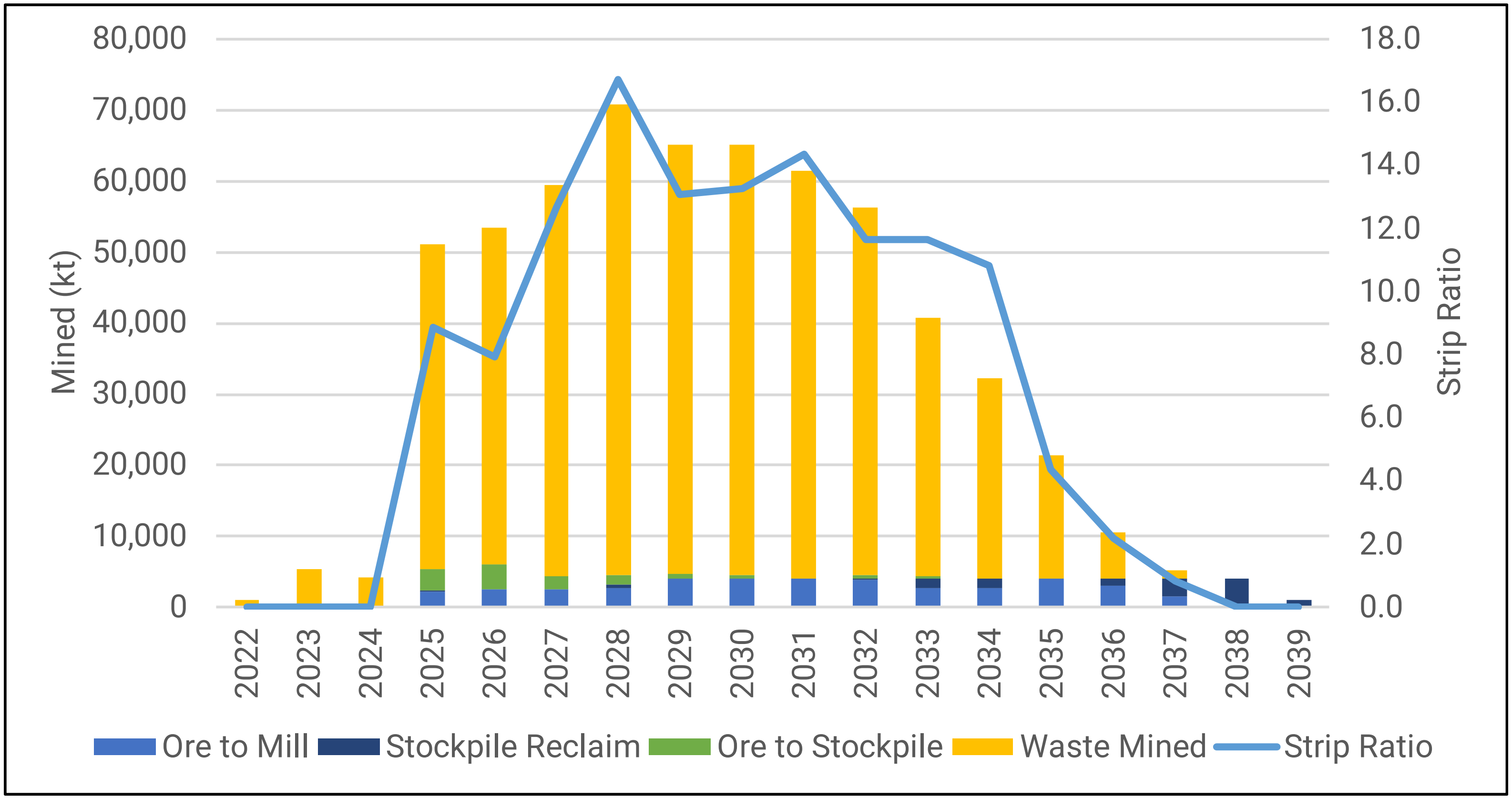
Cut-off grade optimization has been carried out on the mine production schedule. The bottom cut off gold grade for the mill feed is dynamically altered in each scheduled period, based on the mill throughput target and the availability of ore in the open pit. With the intent to capture this dynamic approach, ore above a bottom cut-off of 0.70 g/t Au is characterized as "high grade mill feed" in the definition of mineral reserves by processing grade bin in Chapter 15. Quantities of mined lower grade ore, exceeding the annual mill feed target, are stockpiled for processing later in the mine life, preferentially treating higher grade ores earlier in the mine life. During the construction phase, prior to mill start-up, all ore mined in the pit will be stockpiled. Throughout the life of mill operations, mined ore grading between 0.38 and up to 0.80 g/t Au that exceeds the mill throughput target will be stored in two low-grade stockpiles, each 1.5 km from the pit limits. The low-grade stockpiled ore is planned to be re-handled and fed to the crusher once the open pits are exhausted. Mined ore above 0.80 g/t Au, exceeding the mill throughput target, is sent to a high-grade ore stockpile located directly north of the primary crusher. The mine plan rehandles this high-grade ore to the crusher during operations as a supplement to direct mill feed from the open pits; the high-grade ore stockpile is planned to be exhausted before the open pits are completed.

Mining operations will be based on 365 operating days per year with two 12-hour shifts per day. An annual allowance of 15 days of no mine production has been built into the mine schedule to allow for adverse weather conditions. Maintenance on mine equipment will be performed in the field with major repairs to mobile equipment completed in the shops located near the plant facilities. Pre-production mine construction is planned to take place from 2022 to 2024, with mill start-up planned in 2025. Pit operations are expected to run from 2022 to 2037, with mill feed continuing from low grade ore stockpiles until 2039.

Annual mine operating costs per tonne mined range from $2.62 to $5.75/t with a LOM average of $3.03/t mined. Owner-operated mine operations will include grade control and production drilling, blasting, loading, hauling, and pit, haul road, and stockpile maintenance functions. Mobile equipment maintenance operations will also be managed by the Owner and are included in the mine planning and costs. The initial primary mine equipment fleet, planned from 2022 to 2025, is purchased via a lease financing arrangement. Ancillary gear, and all expansion and replacements to the primary fleet, are planned as traditional capital purchases in the period they are required.

Figure 1-4 summarizes the proposed ore and waste schedule for the 2022 Feasibility Study Mine Plan. The summarized mine schedule is shown in Table 1-4.

**Figure 1-4: Mine Production Schedule, Material Mined & Strip Ratio (All Deposits)**




Source: Stantec & MMTS, 2022.

**Table 1.4: Mine Production Schedule**

| Total Mine Production | Year | LOM | Pre-Prod | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mill Feed Tonnes | kt | **51,580** | 0 | 2,295 | 2,500 | 2,500 | 3,250 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,002 | 4,000 | 4,000 | 4,000 | 4,000 | 1,031 |
| Mill Feed Grade, Au | g/t | **1.62** | 0.00 | 2.83 | 2.69 | 2.73 | 1.78 | 1.69 | 1.86 | 1.39 | 1.78 | 1.46 | 1.37 | 1.77 | 1.35 | 1.11 | 0.53 | 0.53 |
| Mill Feed Contained Metal | koz | **2,689** | 0 | 209 | 216 | 220 | 186 | 217 | 239 | 179 | 229 | 188 | 176 | 227 | 174 | 143 | 69 | 18 |
| Ore Tonnes from Pit | kt | **51,580** | 298 | 5,164 | 5,993 | 4,345 | 3,968 | 4,627 | 4,564 | 4,000 | 4,435 | 3,117 | 2,613 | 4,000 | 3,000 | 1,455 | 0 | 0 |
| Ore Grade from Pit, Au | g/t | **1.62** | 1.20 | 1.61 | 1.53 | 1.83 | 1.50 | 1.52 | 1.68 | 1.39 | 1.64 | 1.54 | 1.74 | 1.77 | 1.63 | 2.12 | 0.00 | 0.00 |
| Stockpile Tonnes to Mill | kt | **12,006** | 0 | 140 | 0 | 0 | 485 | 0 | 0 | 0 | 100 | 1,316 | 1,389 | 0 | 1,000 | 2,545 | 4,000 | 1,031 |
| Stockpile Grade to Mill, Au | g/t | **0.63** | 0.00 | 1.77 | 0.00 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 | 0.96 | 0.96 | 0.67 | 0.00 | 0.53 | 0.53 | 0.53 | 0.53 |
| Waste Tonnes from Pit | kt | **545,424** | 10,347 | 45,858 | 47,518 | 55,120 | 66,403 | 60,539 | 60,555 | 57,427 | 51,772 | 36,339 | 28,284 | 17,479 | 6,550 | 1,234 | 0 | 0 |
| Total Mined from Pits | kt | **597,003** | 10,645 | 51,022 | 53,511 | 59,465 | 70,371 | 65,166 | 65,119 | 61,427 | 56,207 | 39,456 | 30,897 | 21,479 | 9,550 | 2,689 | 0 | 0 |
| Total Moved | kt | **609,010** | 10,645 | 51,162 | 53,511 | 59,465 | 70,856 | 65,166 | 65,119 | 61,427 | 56,307 | 40,772 | 32,287 | 21,479 | 10,550 | 5,234 | 4,000 | 1,031 |

## 1.14 Recovery Methods

The testwork provided was thoroughly analysed and several process options were addressed in the initial stages of the feasibility study. Based on the analysis, a process route was chosen as the best suited for the testwork results and subsequent detailed engineering. The unit operations selected are typical for this industry.

Per the mining production schedule, as the high-grade ore is fed to the mill in the first three years, the project will utilize a more capital cost-effective mill design, including a grind size with 80% passing a screen size of 75 µm, gravity recovery of gold, and gravity tails cyanidation.

As the mill feed grade decreases, and plant capacity is required to increase to maintain gold production, the project will use the existing grinding mills and coarsen the primary grind to 150 µm. Flotation equipment will then be employed to recover most of the gold to a low mass concentrate stream, at 5% mass pull (of mill feed), and ultra-fine grinding and cyanidation will be applied. Using this approach, initial capital costs will be reduced where possible, and when the mill is required to expand to maintain a steady gold production profile, the flowsheet will be modified to again reduce the expansion capital costs and operating costs.

In essence, the project will be constructed in two distinct phases, as follows:

- Phase 1 (2.5 Mt/a) – Comprises a semi-autogenous grinding (SAG) mill, ball mill, gravity concentration, and gravity tails leaching, carbon elution, and gold recovery. Leach-adsorption tails will be treated for cyanide destruction, thickened, and deposited in the TMF.

- Phase 2 (expansion to 4.0 Mt/a) – Includes Phase 1 equipment with the addition of pebble crushing, gravity tails flotation, flotation concentrate regrinding, flotation concentrate leaching, and thickening of both the flotation concentrate and flotation tailings streams.

Key process design criteria are listed below:

- Phase 1 nominal throughput of 6,850 t/d or 2.5 Mt/a

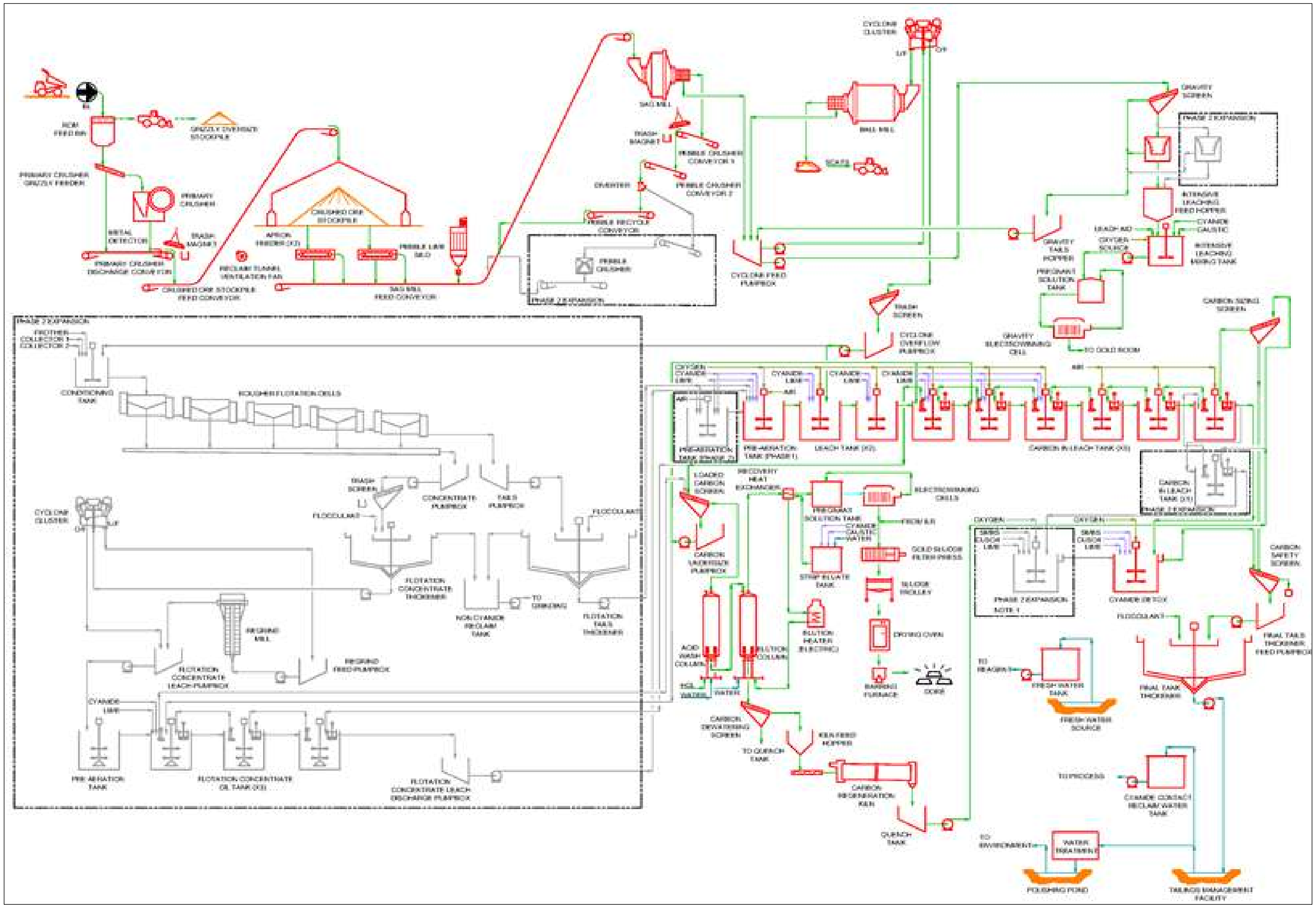
- Phase 2 nominal throughput of 10,960 t/d or 4.0 Mt/a

- crushing plant availability of 75%

- plant availability of 92% for grinding, gravity concentration, flotation, and leach plant and gold recovery operations.

An overall process flow diagram showing the unit operations in the selected process flowsheet is presented in Figure 1-5.

**Figure 1-5: Overall Process Flow Diagram**



Source: SNC-Lavalin 2022.

## 1.15 Infrastructure

The overall site plan in Figure 1-6 shows the major project facilities, including the open pit mines, tailings management facility (TMF), waste rock facilities, polishing pond, mine services, access road, accommodations camp, and effluent treatment plant. Access to the facility is from the northeast side of the property from the existing public access road. Access to the process plant will be via the security gate at the public road intersection.

### 1.15.1 Access

The site public access road will be refurbished and upgraded. Upgrades will include replacing timber bridges and repairing existing steel bridges on the public access road. The plant access road from the public road and in-plant roads will be 6 m wide gravel roads with surface drainage. New access roads will be built for the infrastructure areas, camp, and explosives plant.

### 1.15.2 Power

Newfoundland and Labrador Hydro (NL Hydro) will supply power to the Valentine Gold Project as per conditions outlined in a Power Supply Agreement with Marathon Gold. The system supply point will be the Star Lake Terminal Station located approximately 20 km (in a straight line) to the northwest of the Valentine Gold Project.

Site power will be provided by tie-ins performed to NL Hydro's equipment at Star Lake Terminal Station. A 40 km long overhead line is proposed to be installed between NL Hydro's Star Lake Terminal Station and Marathon Gold's Valentine Lake Terminal Station. To facilitate the connection, the following infrastructure will be required:

- Upgrade of the existing Star Lake Terminal Station to support the addition of electrical, protection and control, and communications equipment required to provide power to the Valentine Terminal Station; communications equipment will also be installed at NL Hydro's Buchans Terminal Station and at Valentine Terminal Station for remote monitoring and protection.
- Construction of a 40 km 66 kV wood pole transmission line (TL 271) from the Star Lake Terminal Station to the Valentine Terminal Station.

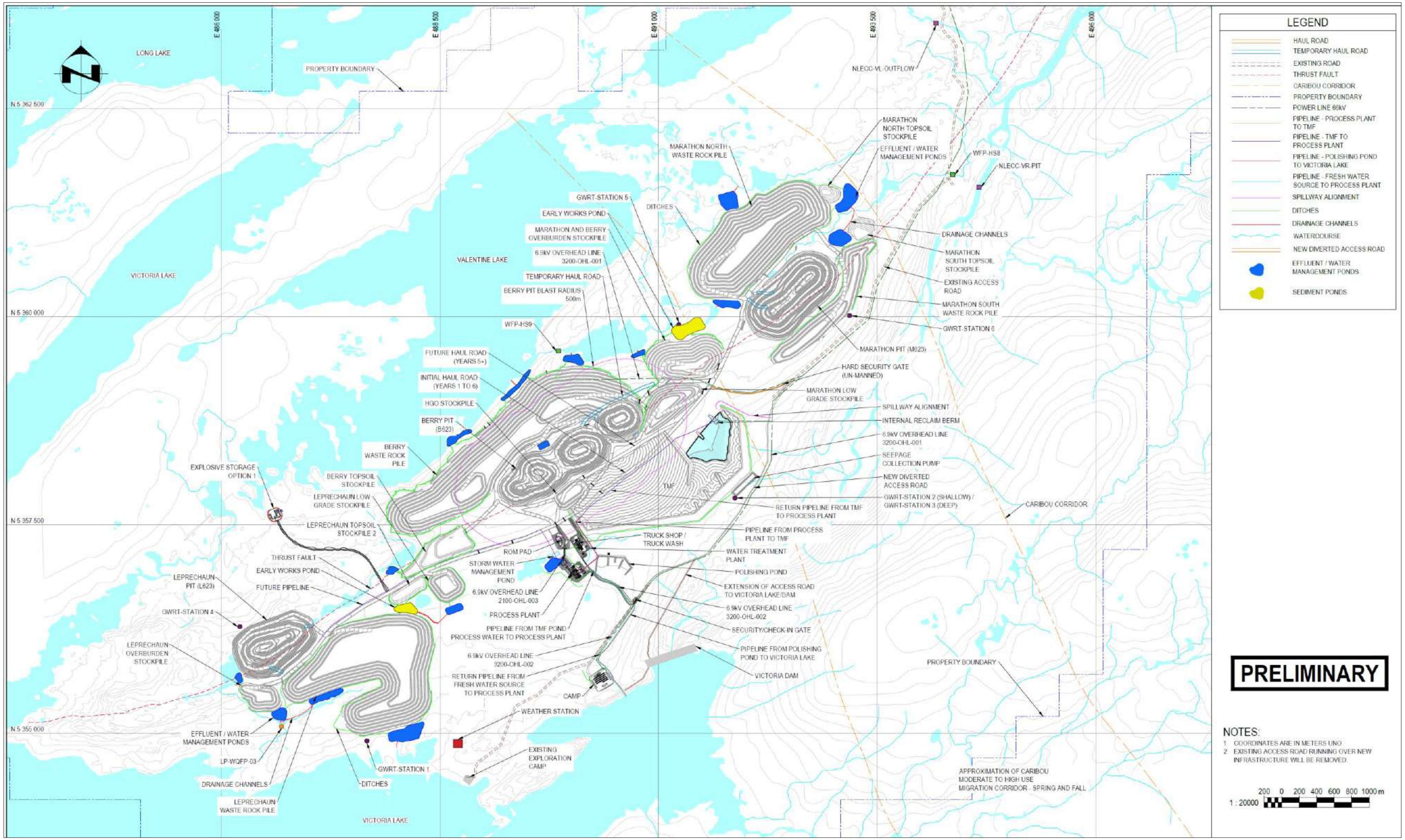
The Valentine Gold Project has the following load requirements:

- Phase 1: 17 MW for initial start-up requirement between 2024 and 2028
- Phase 2: 20 MW full-load requirement in 2028 to end of life.

The plant electrical system is based on 6.6 kV, 2,000 A, 60 Hz distribution. The 66 kV feed from local power authority will be stepped down to 6.6 kV at the plant main substation and will supply the plant main 6.6 kV switchgear housed in the main process plant electrical room.

The larger variable frequency drives (VFDs) will have 6.6 kV input, fed by plant main 6.6 kV switchgear. Separate 6.6 kV / 600 V distribution transformers at the various electrical rooms will be fed from the plant main 6.6kV switchgear. Overhead power lines of 6.6 kV will provide power to various remote facilities. Pole-mounted or pad-mounted transformers will step down the voltage at each location and supply the low-voltage distribution system to each equipment area.

**Figure 1-6: Overall Site Plan**




Source: MMTS, 2022.

### 1.15.3 Tailings Management Facility

The TMF is located between the Leprechaun and Marathon pits to the south of the Valentine Lake Shear Zone and northeast of the process plant. Geotechnical and hydrogeological investigations were completed at the TMF site in 2020 and 2021 by GEMTEC. The results of the site investigations agree with available surficial geology mapping for the project site. The subsurface conditions encountered at the TMF comprise a surficial layer of organics up to approximately 3.3 m thick underlain by a non-cohesive glacial till deposit described as sandy silt to silty sand and gravel containing cobbles and boulders. The till extends to the bedrock surface and ranges in thickness from 0.0 m to 9.1 m. The bedrock surface was encountered at an average depth of 3.1 m below ground surface. The TMF dam will be founded on the competent, compact to very dense till deposit or bedrock. In-situ testing of the overburden till computed a geometric mean hydraulic conductivity of approximately $6.0 \times 10^{-6}$ m/s. The computed geometric mean hydraulic conductivity for the bedrock was $5.0 \times 10^{-6}$ m/s.

The TMF is designed to store 31.6 Mt of tailings to be processed over the initial ten years of the mine life. For the remaining mine life, 20.0 Mt of tailings will be deposited in the mined-out Berry open pit. The dams are stage-raised rockfill embankments with lined upstream slopes. A seepage mitigation measure in the form of an upstream extension of the liner on the foundation is incorporated in the design. The dams will be raised by the downstream method. The facility has an emergency spillway and a downstream seepage and runoff collection system. Closure will include re-grading the tailings surface, lowering of the emergency spillway to remove the supernatant pond, and providing a vegetated overburden cover for the tailings.

The operational plan for the TMF is to deposit tailings via spigots as a thickened slurry. The deposition will initially be done from the perimeter embankment to provide a protective layer of tailings over the liner, and subsequently from the natural high ground on the northwest side of the TMF. This will allow the tailings pond to be located on the east side of the TMF and a tailings beach will form that slopes from the deposition points along the high ground down to the perimeter embankment.

The accumulation of water in the TMF has been modelled for the mean and 25-year wet and dry annual precipitation conditions. Reclaim water is pumped from the TMF to the process plant. A water treatment plant and polishing pond allow for the treatment and discharge of the excess site water to Victoria Lake. Treatment and discharge are designed for 7 to 8 months each year. The TMF pond has been sized to store the excess water during non-discharge periods.

### 1.15.4 Accommodation

A permanent accommodations camp is included in the design for the pre-production and operations phases. It will be tied to the plant power grid and will accommodate 430 people.

### 1.15.5 Buildings

The process plant consists of three main process buildings located southeast of the primary crusher building and east of the coarse ore storage stockpile/reclaim: (1) the mill building (grinding/elution, gold room, gravity); (2) reagent building, and (3) flotation/regrind building (Phase 2 only). All buildings will be supported on reinforced concrete footings with concrete slabs and pedestals. All pre-engineered and fabric buildings will be fully enclosed with metal cladding and fabric covers, respectively.

Additional fabric and modular buildings will be provided for the mine truck workshop, mine truck wash bay, mining warehouse, process mill warehouse, reagent dry store, mining muster/administration block, process mill administration block, general administration block, and security-gatehouse.

### 1.15.6 Polishing Pond

The polishing pond is located east of the process plant site and has a footprint area of 8 ha. The polishing pond design has a retention time of 7 days (assumed) and will have an operational capacity of about 57,700 $m^3$ based on a maximum flow-through rate, which is sufficient to treat runoff, precipitation, and process flows for up to a 25-year wet precipitation year. To promote settling and flow distribution, the pond includes internal rockfill baffles designed to reduce short-circuiting.

### 1.15.7 Water Management

The mine site is divided into four complexes. From north to south, they are the (1) Marathon Complex, (2) Berry Complex, (3) Process Plant and TMF Complex, and (4) Leprechaun Complex. Water management in these complexes functions independently with decentralized treatment and control in each complex.

Water management components for the Marathon, Berry and Leprechaun complexes consist of water management (i.e., flood attenuation and sedimentation) ponds, dams, berms, drainage ditches, and pumps to collect and contain surface water runoff from waste rock, low-grade stockpiles, overburden stockpiles, topsoil stockpiles, and pits.

The process plant pad and truck shop area will be served by a series of collection ditches and a sedimentation pond. Water management in the TMF consists of the tailings pond, effluent treatment plant, polishing pond, seepage collection ditches, pumps, and a discharge pipeline to Victoria Lake.

## 1.16 Environmental Studies, Permitting and Social or Community Impact

The project is located in part of the island that is characterized by a boreal forest (mainly coniferous forest) and continental climate (colder winters and warmer summers than coastal areas). The project is in a relatively undisturbed wilderness area.

The Valentine Gold Project was subject to the *Newfoundland and Labrador Environmental Protection Act*, associated Environmental Assessment Regulations, and the *Canadian Environmental Assessment Act* (CEAA, 2012). As indicated in Section 20.2.1, in 2020 Marathon prepared and submitted an EIS to the Impact Assessment Agency of Canada (IAAC) and the NL Environment and Climate Change (EA Division) to meet the requirements of CEAA (2012) and the NL EPA, respectively, in accordance with the project-specific guidelines issued by the federal and provincial governments. The scope of assessment for the EIS included the mine access road, Marathon Complex, Leprechaun Complex and Processing Plant/TMF Complex, and associated infrastructure. The Valentine Gold Project was released from the provincial EA process on March 17, 2022, and the federal EA process on August 24, 2022. The Berry Complex is anticipated to be subject to further provincial EA requirements, proposed for submission in 2023, and similar documentation will be submitted federally to IAAC as a change to the Designated Project.

The assessment of environment effects in the Valentine Gold Project EIS focused on valued components (VCs), which are the elements of the environment that could be affected by the project and are of importance or interest to regulators, Indigenous groups and stakeholders. The assessment included a characterization of the existing conditions within the spatial boundaries of each VC, including a discussion of the influences of past and present physical activities on the VC, leading to the current conditions. The assessment followed standard EA methods for describing project interactions with each of the VCs and determining the potential environmental effects, including areas of federal jurisdiction, associated with the project for the construction, operation, and decommissioning, rehabilitation and closure phases.

The EA process served as a mechanism for Marathon Gold to incorporate results of engagement in early project planning to reduce and avoid environmental effects. Several important aspects of the project concept and engineering design were modified, refined, and adapted to reduce potential adverse effects for incorporation into the EIS. These changes were made as project design has advanced, in consideration of discussions with regulators, stakeholders and Indigenous groups, and in response to input received during public, Indigenous and regulatory review throughout the EA process.

The environmental assessment predicted that routine project activities associated with the Valentine Gold Project will not cause significant adverse environmental effects on any of the VCs, except for caribou. Similar results were determined for cumulative effects, where project effects are considered in combination with the effects of other projects (past, present, and reasonably foreseeable future projects). The full description of predicted residual effects of the project can be found in the EIS (Marathon Gold, 2020) (https://iaac-aeic.gc.ca/050/evaluations/document/136521).

The anticipated EA requirements for the Berry Complex and associated project changes will assess, identify and mitigate potential environmental effects during project phases, including construction, operation, decommissioning, rehabilitation and closure and post-closure. From the Provincial Environmental Assessment perspective, the inclusion of the Berry pit complex would be considered a new undertaking, whereas federally the Berry pit complex would be considered a change to the Designated Project. The federal designated project list (Physical Activities Regulations- SOR 2019-285) sets out specific triggers related to project changes such as mine expansions and refers to metal mine expansion of mining area and/or mill capacity after expansion. The proposed Berry pit complex does not meet the thresholds identified in the Regulations such that a federal EA would be triggered under the *Impact Assessment Act*. Marathon Gold will confirm EA requirements for the Berry pit complex with provincial and federal regulators.

Upon release from the provincial and federal EA processes, numerous approval, authorization, and permit applications were prepared and submitted for approval prior to initiating project construction. Permits could only be issued following release from the EA processes, however, some long-lead items, such as the *Fisheries Act* application, were initiated prior to EA release. A list of permits applicable to the Valentine Gold Project is provided in Section 20.

New and/or amended permits and authorizations will be required for the Berry Complex and associated changes to the Valentine Gold Project. A list of anticipated permits (new and/or amended) is provided in Section 20. Conditions of approval, standards contained in federal and provincial legislation and regulations, and commitments made during the EA processes (including application of mitigation measures, and monitoring and follow-up requirements), are being addressed through project planning, including implementation of an Environmental and Social Management System, and compliance requirements will continue throughout construction, operation and decommissioning.

Progressive and final rehabilitation and closure planning are requirements under the *Newfoundland and Labrador Mining Act*. As the planning and design stages of the project continue, consideration for the future closure requirements will continue to be incorporated into project design. The approach to rehabilitation and closure and post-closure and long-term monitoring is described in Section 20.8.1. The environmental effects of rehabilitation and closure have been assessed as part of the EIS. The formal plan is currently being developed to restore the site to pre-development conditions as practicable or to a suitable condition for an alternate use upon project closure. The plan will outline the methods to be used for progressive and closure rehabilitation, and post-closure monitoring.

There are substantial employment and economic benefits to flow from the project to the benefit of local communities, the central region of NL, and the province. The development of an on-site accommodations camp for all workers, on-site medical and emergency response resources will reduce potential effects on local community infrastructure and services. Local hiring and contracting policies for direct employment and contracts, and induced employment and business in the region will result in substantial benefits to the local and regional economy over a >15-year period (including construction, operation and decommissioning, rehabilitation and closure).

Marathon Gold is committed to operating the project within a sustainable development framework which reduces harm to the environment, contributes to local communities, respects human and Indigenous rights, and adheres to openness and transparency in operations. One of the key principles of sustainable development is meaningful engagement with the individuals, communities, groups, and organizations interested in or potentially affected by the project to build and maintain positive, long-term and mutually beneficial relationships. Marathon Gold has engaged with relevant government departments and agencies, Indigenous groups, and stakeholder organizations, including communities, business and industry organizations, fish and wildlife organizations, environmental non-governmental organizations and individuals. Marathon Gold will continue this engagement process throughout the life of the Valentine Gold Project. Community relations and consultation efforts are further described in Section 20.9.

## 1.17 Capital and Operating Costs

### 1.17.1 Capital Cost

The estimate conforms to Class 3 guidelines for a feasibility-level estimate with a ±15% accuracy according to the Association for the Advancement of Cost Engineering International (AACE International). Table 1-5 provides a summary of the overall initial capital cost estimate. The costs are expressed in Q3 2022 Canadian dollars and include all costs related to the Valentine Gold Project (e.g., mining, site preparation, process plant, tailings facility, power infrastructure, camp, Owners' costs, spares, first fills, buildings, roadworks, and off-site infrastructure).

The project will be constructed in two distinct phases. Phase 1 (2.5 Mt/a) is based on a gravity-leach flowsheet, and Phase 2 (expansion to 4.0 Mt/a) is based on a gravity-flotation-regrind-leach concentrate-leach tail flowsheet. The estimate is based on structure considering a contracted engineering and procurement service and a separate contract for construction management for the process/infrastructure areas, and an Owner-managed execution for the civil-earthworks, camp and power infrastructure packages, as outlined in Section 24.

The following parameters and qualifications were considered:

- No allowance has been made for exchange rate fluctuations.
- There is no escalation added to the estimate.
- A growth allowance is included.
- For equipment sourced in US dollars, an exchange rate of 1.33 Canadian dollar per 1.00 US dollar was assumed.
- Data for the estimates have been obtained from numerous sources, including:
  - mine schedules
  - feasibility-level engineering design
  - topographical information obtained from the site survey
  - geotechnical investigations
  - budgetary equipment quotes from Canadian and International suppliers
  - budgetary unit costs from numerous local NL contractors for civil, concrete, steel, electrical, piping and mechanical works
  - data from similar recently completed studies and projects.

**Table 1.5: Summary of Capital Costs**

| WBS | Description | Initial Cost (C$M) | Expansion Cost (C$M) | Sustaining Costs (C$M) |
|---|---|---|---|---|
| 1100 | Mine Infrastructure and Services | 28 | 0 | 10 |
| 1200 | Mine Fixed Equipment | 11 | 0 | 0 |
| 1300 | Mine Mobile Equipment | 28 | 0 | 253 |
| 2000 | Process Plant - Site Wide | 124 | 0 | 0 |
| 2100 | Primary Crushing | 3 | 0 | 0 |
| 2200 | Grinding | 22 | 0 | 0 |
| 2300 | Leaching | 1 | 2 | 0 |
| 2400 | Elution & Gold Room | 7 | 0 | 0 |
| 2500 | Tailings Disposal | 3 | 0 | 1 |
| 2600 | Reagents | 2 | 0 | 0 |
| 2700 | Air & Water Services | 1 | 5 | 0 |
| 2800 | Process Buildings | 0 | 0 | 0 |
| 2900 | Phase 2 - Flotation / Concentrate Leach / Pebble Crushing | 0 | 34 | 0 |
| 3100 | Bulk Earthworks | 18 | 0 | 8 |
| 3200 | High-Voltage Power Switchyard & Power Distribution | 26 | 0 | 0 |
| 3300 | Communications | 3 | 0 | 0 |
| 3400 | Fuel Storage | 0 | 0 | 0 |
| 3500 | Sewage | 1 | 0 | 0 |
| 3600 | Infrastructure Buildings | 11 | 0 | 4 |
| 3700 | Water Supply | 0 | 0 | 35 |
| 3800 | Tailings Management Facility | 33 | 0 | 55 |
| 3900 | Permanent Camp | 28 | 2 | 0 |
| 4100 | Main Access Road | 6 | 0 | 0 |
| 4200 | High-Voltage Power Supply | 16 | 0 | 0 |
| 5100 | Temporary Construction Facilities & Services | 30 | 7 | 0 |
| 5200 | Commissioning Representatives & Assistance | 2 | 0 | 0 |
| 5300 | Spares | 1 | 0 | 2 |
| 5400 | First Fills & Initial Charges | 1 | 0 | 0 |
| 6300 | Phase 1 - Engineering Subconsultants & QA/QC | 21 | 0 | 0 |
| 6500 | Phase 2 - EPCM Scope Delivery | 0 | 8 | 0 |
| 7100 | Project Staffing & Expenses | 7 | 0 | 0 |
| 7400 | Home Office Financial, Legal, Insurance | 4 | 0 | 0 |
| 7500 | Owner's Cost | 59 | 0 | 0 |
| - | Closure Costs | - | - | 72 |
| - | Salvage Value | 0 | 0 | (30) |
| | **Subtotal** | **496** | **60** | **410** |
| 8100 | Project Contingency | 39 | 6 | 17 |
| | **Total Project Costs** | **534** | **66** | **427** |

Major cost categories (permanent equipment, material purchase, installation, subcontracts, indirect costs, and Owner's costs) were identified and analysed. A percentage of contingency was allocated to each of these categories on a line-item basis based on the accuracy of the data. An overall contingency amount was derived in this fashion.

As outlined in Table 1-8, the overall capital cost of the project in Phase 1 will be approximately C$305 million, followed by the expansion in Phase 2 at C$44 million, with ongoing sustaining costs of C$332 million. Of the total Phase 1 capital costs, more than 88% of the project costs were derived from first principles bulk material take-offs and equipment sizing calculations, with supporting quotations for major equipment, and contractor supply/installation rates. Furthermore, above 70% of the project costs are projected to be spent within Newfoundland and Labrador.

### 1.17.2 Operating Cost – Processing

The operating cost estimate is presented in Q3 2022 Canadian dollars. The estimate was developed to have an accuracy of ±15%. The estimate includes mining, processing, general and administration (G&A), and accommodations costs. The operating cost estimates for the life of mine are provided in Table 1-6.

**Table 1.6: Average Annual Operating Cost Summary**

| Tonnes Milled | Phase 1 – 2.5 Mt/a | | Phase 2 – 4.0 Mt/a | |
|---|---|---|---|---|
| **Cost Center** | **C$M** | **C$/t** | **C$M** | **C$/t** |
| **Processing & Tailings** | | | | |
| Consumables | 25.7 | 10.53 | 37.3 | 9.4 |
| Plant Maintenance | 2.2 | 0.91 | 2.7 | 0.68 |
| Power | 7.0 | 2.86 | 8.8 | 2.22 |
| Laboratory | 0.17 | 0.07 | 0.21 | 0.05 |
| Labour (O&M) | 12.2 | 5.02 | 11.9 | 2.99 |
| Processing Mobile Equipment | 0.2 | 0.1 | 0.3 | 0.07 |
| **Subtotal** | **47.5** | **19.5** | **61.1** | **15.4** |
| **Effluent Treatment** | | | | |
| Plant Maintenance | 0.11 | 0.04 | 0.11 | 0.03 |
| Labour | 0.05 | 0.02 | 0.05 | 0.01 |
| Power | 0.23 | 0.09 | 0.23 | 0.06 |
| Other (including consumables) | 0.70 | 0.28 | 0.79 | 0.20 |
| **Subtotal** | **2.5** | **1.03** | **63.1** | **15.9** |
| **Subtotal Plant Operating Cost** | **36.4** | **14.6** | **48.1** | **12.0** |
| **General & Administration** | | | | |
| Labour (G&A) | 6.8 | 2.79 | 7.4 | 1.87 |
| G&A Expenses | 12.1 | 4.95 | 11.6 | 2.77 |
| Site Maintenance | 3.5 | 0.94 | 3.4 | 0.58 |
| Camp | 2.9 | 1.73 | 2.9 | 0.99 |
| **Subtotal** | **25.3** | **10.4** | **25.3** | **6.2** |
| **Total** | **75.3** | **30.9** | **88.4** | **22.1** |

The operating cost estimates are based on the following assumptions:

- No allowance has been made for inflation.
- For material sourced in US dollars, an exchange rate of 1.31 Canadian dollars per US dollar was assumed.
- Fuel costs and associated taxes were established using the forward-looking contract pricing as 2025 and onwards.
- Rates are decreased during the construction period of the project as the Newfoundland and Labrador Provincial Road Tax is assumed not to apply.
- Diesel rates applied are $1.3858 exclusive of HST but including all other charges.
- The annual power costs were calculated using a unit price of C$0.044/kWh. The numbers were based on Newfoundland Industrial Firm Rates located in the "Schedule of Rates, Rules and Regulations" – July 1, 2022.
- Labour is assumed to come mostly from Newfoundland, and locally from places such as Buchans, Millertown, Badger, Grand Falls-Windsor, and Bishop's Falls.

### 1.17.3 Operating Cost – Mining

Mine operating costs are built up from first principles. Inputs are derived from vendor quotations and historical data collected by MMTS. This includes quoted cost and consumption rates for such inputs as fuel, lubes, explosives, tires, undercarriage, ground-engaging tools (GET), drill bits/rods/strings, machine parts, machine major components, and operating and maintenance labour ratios. Labour rates for planned hourly and salaried personnel were supplied by Marathon Gold.

Annual average mine operating costs per tonne mined range from $2.62 to $5.75/t with a LOM average of $3.03/t mined. Owner-operated mine operations will include grade control and production drilling, blasting, loading, hauling, and pit, haul road and stockpile maintenance functions. Mobile equipment maintenance operations will also be managed by the Owner and are included in the mine planning and cost estimates.

## 1.18 Economic Analysis

An engineering economic model was developed to estimate annual pre-tax and post-tax cash flows and sensitivities of the project based on a 5% discount rate. It must be noted that tax calculations involve complex variables that can only be accurately determined during operations, and, as such, the actual after-tax results may differ from those estimated. A sensitivity analysis was performed to assess the impact of variations in metal prices, foreign exchange rates, operating costs, and initial capital costs.

### 1.18.1 Financial Model Parameters

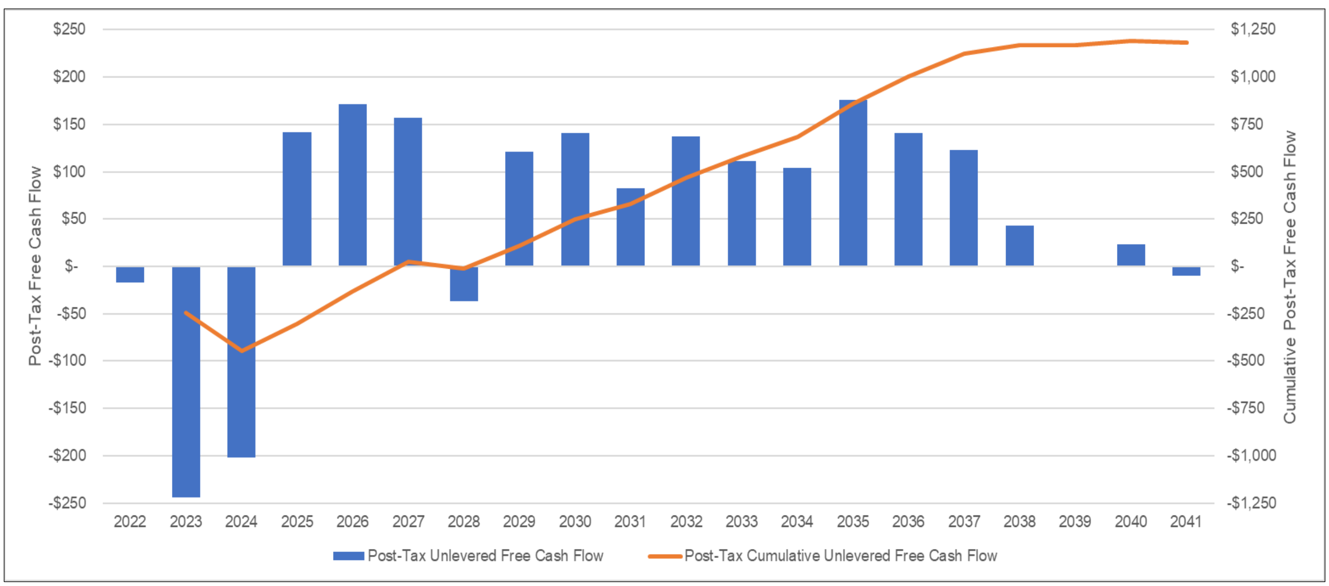
A base case gold price of US$1,700/oz is based on two- and three-year trailing averages of the LBMA Gold Bullion price and is meant to reflect the average metal price expectation over the life of the project. No price inflation or escalation factors were considered. Commodity prices can be volatile, and there is the potential for deviation from the forecast. The economic analysis was performed using the following assumptions:

- project construction starting October 5, 2022
- commercial production starting on January 1, 2025
- mine life of 14.3 years
- exchange rate of 0.75 (USD:CAD)
- cost estimates in constant 2022 Canadian dollars with no inflation or escalation
- 100% ownership with 1.5% NSR (assumes buy back of 0.5% NSR)
- capital costs funded with 100% equity (no financing costs assumed)
- all cash flows discounted to December 31, 2022 using mid period discounting convention
- working capital based on accounts payable of 30 days, accounts receivable of 15 days, and inventory of 15 days
- gold is assumed to be sold in the same year its produced
- no contractual arrangements for refining currently exist.

### 1.18.2 Economic Analysis

The economic analysis was performed assuming a 5% discount rate, with all cashflows being discounted to December 31, 2022. All cashflows in 2022 occur prior to this date and have not been included in calculations for net present value (NPV), internal rate of return (IRR), cumulative cash flow, and the payback period. The pre-tax NPV discounted at 5% is C$1,000 million; the internal rate of return IRR is 26.7%; and the payback period is 2.7 years. On an after-tax basis, the NPV discounted at 5% is C$648 million; the IRR is 22.4%; and the payback period is 2.8 years. A summary of project economics is shown graphically in Figure 1-7 and listed in Table 1-7.

**Figure 1-7: Project Economics**




Source: Ausenco, 2022.

**Table 1.7: Summary of Project Economics**

| General | | LOM Total / Avg. |
|---|---|---|
| Gold Price (US$/oz) | | $1,700 |
| Mine Life (years) | | 14.3 |
| Total Waste Tonnes Mined (kt) | | 545,424 |
| Total Mill Feed Tonnes (kt) | | 51,580 |
| Strip Ratio | | 10.57x |
| **Production** | | **LOM Total / Avg.** |
| Mill Head Grade (g/t) | | 1.62 |
| Mill Recovery Rate (%) | | 95% |
| Total Mill Ounces Recovered (koz) | | 2,553 |
| Total Average Annual Production (koz) | | 179 |
| **Operating Costs** | | **LOM Total / Avg.** |
| Mining Cost (C$/t Mined) | | $3.03 |
| Processing Cost (C$/t Milled) | | $16.62 |
| G&A Cost (C$/t Milled) | | $6.99 |
| Refining & Transport Cost (C$/oz) | | $3.93 |
| Silver Credit (C$/oz) | | ($9.61) |
| Total Operating Costs (C$/t Milled) | | $58.09 |
| Cash Costs (US$/oz AuEq) | | $902 |
| AISC (US$/oz AuEq) | | $1,046 |
| **Capital Costs** | | **LOM Total / Avg.** |
| Sunk Capital (C$M) | | $71 |
| Remaining Initial Capital (C$M) | | $463 |
| Expansion Capital (C$M) | | $66 |
| Sustaining Capital (C$M) | | $377 |
| Closure Costs (C$M) | | $79 |
| Salvage Costs (C$M) | | ($30) |
| Sustaining Capital incl. Salvage and Closure Costs (C$M) | | $426 |
| **Financials** | **Pre-Tax** | **Post-Tax** |
| NPV (5%) C($M) | $1,000 | $648 |
| IRR (%) | 26.7% | 22.4% |
| Payback (years) | 2.7 | 2.8 |

Notes: **1.** Cash costs consist of mining costs, processing costs, mine-level G&A, refining charges (including silver credit) and royalties. **2.** AISC includes cash costs plus expansion capital, sustaining capital, salvage value and closure costs. **3.** Calculations for pre-tax and post-tax financials exclude cashflows occurring in 2022. **4.** Sunk Capital includes actual expenditures from January 2021 up to and including October 2022. Remaining Initial Capital includes forecasted expenditures from November 2022 up to and including December 2024.

### 1.18.3 Sensitivity Analysis

A sensitivity analysis was conducted on the base case pre-tax and after-tax NPV and IRR of the project using the following variables: gold price, foreign exchange rate, operating costs, and initial capital costs. Table 1-8 shows the post-tax sensitivity results. The analysis revealed that the project is most sensitive to changes in foreign exchange rate and gold price, and less sensitive to operating costs and initial capital costs.

**Table 1.8: Post-Tax Sensitivity**

**Post-Tax NPV Sensitivity to Discount Rate** (Gold Price (US$/oz))

| Discount Rate | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.0% | $764 | $976 | $1,181 | $1,382 | $1,583 | $1,784 |
| 3.0% | $494 | $663 | $825 | $983 | $1,140 | $1,298 |
| 5.0% | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 8.0% | $209 | $330 | $445 | $555 | $664 | $774 |
| 10.0% | $133 | $240 | $341 | $437 | $533 | $629 |

**Post-Tax IRR Sensitivity to Discount Rate** (Gold Price (US$/oz))

| Discount Rate | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 3.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 5.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 8.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 10.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |

**Post-Tax NPV Sensitivity to Foreign Exchange** (Gold Price (US$/oz))

| FX | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.65 | $691 | $847 | $1,003 | $1,158 | $1,311 | $1,464 |
| 0.70 | $518 | $668 | $813 | $958 | $1,102 | $1,244 |
| 0.75 | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 0.80 | $217 | $360 | $498 | $630 | $757 | $884 |
| 0.85 | $81 | $225 | $360 | $489 | $614 | $734 |

**Post-Tax IRR Sensitivity to Foreign Exchange** (Gold Price (US$/oz))

| FX | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.65 | 23.4% | 27.0% | 30.5% | 33.8% | 36.9% | 40.0% |
| 0.70 | 19.1% | 22.9% | 26.2% | 29.5% | 32.7% | 35.6% |
| 0.75 | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 0.80 | 10.9% | 14.9% | 18.6% | 21.9% | 25.0% | 27.9% |
| 0.85 | 7.2% | 11.2% | 14.9% | 18.3% | 21.5% | 24.4% |

**Post-Tax NPV Sensitivity to Operating Costs** (Gold Price (US$/oz))

| Opex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | $622 | $759 | $894 | $1,029 | $1,162 | $1,294 |
| (10.0%) | $495 | $635 | $771 | $906 | $1,041 | $1,174 |
| -- | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 10.0% | $222 | $374 | $520 | $660 | $795 | $931 |
| 20.0% | $72 | $236 | $388 | $533 | $672 | $807 |

**Post-Tax IRR Sensitivity to Operating Costs** (Gold Price (US$/oz))

| Opex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | 21.8% | 25.0% | 28.1% | 31.1% | 33.9% | 36.6% |
| (10.0%) | 18.5% | 22.1% | 25.3% | 28.4% | 31.4% | 34.2% |
| -- | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 10.0% | 11.0% | 15.3% | 19.1% | 22.7% | 25.8% | 28.9% |
| 20.0% | 6.9% | 11.4% | 15.6% | 19.4% | 22.9% | 26.1% |

**Post-Tax NPV Sensitivity to Initial Capital Costs** (Gold Price (US$/oz))

| Initial Capex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | $425 | $568 | $704 | $840 | $975 | $1,109 |
| (10.0%) | $393 | $538 | $676 | $812 | $947 | $1,081 |
| -- | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 10.0% | $328 | $477 | $618 | $755 | $890 | $1,026 |
| 20.0% | $295 | $445 | $588 | $727 | $862 | $997 |

**Post-Tax IRR Sensitivity to Initial Capital Costs** (Gold Price (US$/oz))

| Initial Capex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | 18.8% | 23.3% | 27.2% | 30.9% | 34.5% | 37.9% |
| (10.0%) | 16.7% | 20.8% | 24.6% | 28.0% | 31.3% | 34.5% |
| -- | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 10.0% | 13.4% | 17.1% | 20.4% | 23.5% | 26.4% | 29.2% |
| 20.0% | 12.0% | 15.5% | 18.8% | 21.7% | 24.5% | 27.1% |

## 1.19 Recommendations

### 1.19.1 Overall

Based on the financial analysis, the Valentine Gold Project has robust economics and merits further exploration and development.

### 1.19.2 Exploration and Mineral Resources

Marathon Gold should continue with the company's infill and exploratory drill program strategies.

- Further drilling on the Valentine Gold Project should focus on decreasing strip ratios of the three main deposits (Leprechaun, Berry, Marathon) as well as greenfields exploration in previously underexplored areas proximal to the VLSZ.
- Exploratory drilling targets should be developed through prospecting and trenching of areas will little previous exploration work.
- A reverse-circulation drill program should be continued with a focus on advanced grade control in the Leprechaun and Marathon deposits.

Further prospecting should be conducted on the recently (2022) defined Eastern Arm and Western Peninsula occurrences. Prospecting, soil and till sampling should be used to define targets for potential follow-up work including trenching, and possibly drill testing. Trenching should be conducted in previously underexplored areas of the VLSZ between the currently defined deposits to define any potential zones of economic mineralization and drill targets.

Additional QA/QC strategies were put in place during the 2022 exploration program; the protocols have elevated the confidence level of the Valentine Gold Project's geology and mineralization. Marathon should continue to follow these protocols rigorously. Umpire and duplicate sampling programs should be undertaken at the end of the 2022 exploration program.

Further refine the constraining mineralized domains within the geological models. This would involve improving the mafic dike solids as well as the QTPV domain. Results will be used for drillhole targeting, short-term block models, and future mineral resource updates.

### 1.19.3 Mineral Reserve and Mine Plan

The following recommendations are made as the project advances through construction. Costs for these programs have been estimated and included in the mining area operating costs for the project.

- Geotechnical monitoring and field data collection of the open pit walls is recommended throughout the life of the open pits. These programs should begin at the on-set of mining to allow for confirmation of design assumption herein.
  - Geotechnical mapping and regular inspection of benches. This should include tension crack mapping along the crest of benches.
  - Geological and major structure mapping informing an up to date lithological and structural geologic model.

  - Develop a program to monitor any potential large-scale movements on the open pit slopes (surface prisms or radar).
  - Yearly to bi-annual third-party inspections and slope stability audits.
  - Implement a geomechanical testing program to confirm all pit slope design values. Comparison and adjustment of recommended slope designs based on performance monitoring of the slopes.
  - Additional piezometer installation to allow for on-going assessment of water levels relative to slope depressurization targets.[i]

- Mid-range monthly mine planning through the construction period and first year of mill operations. Develop physical cut plans for each month, as well as associated stockpile advancements and primary fleet equipment hour estimates.
- Further engagement with equipment vendors to secure build spots for long lead time items should be carried out.
- Blasting to both minimize dilution while improving mine-to-mill performance can be optimized in future studies. This will require field measurements and adjustments during operations.
- Opportunities should be explored to increase project value via alternative deposit development strategies. The inclusion of the Berry, Sprite, and Victory resource deposits into the overall project should be examined.
- Completing a desktop study on the potential impacts of ore sorting is recommended. The variable nature of the mineralization and the fact that it is a vein-gold deposit would strongly suggest that this deposit is a candidate for ore-sorting.

The following geotechnical recommendations apply to developing the Berry deposit. Costs for these programs are additional to the mine area capital and operating costs.

- Berry specific geotechnical investigations to bring the models to a construction level of confidence, to be completed in advance of Berry pit mining in 2025.
  - Drilling of three or four additional geotechnical holes to evaluate the potential effect of major structures on the Berry footwall.
  - Targeted pumping tests for Berry should be completed to provide another measure of bulk hydraulic conductivity of the rock mass at the pit-scale and to provide data on anisotropy (both horizontal and vertical) in the hydraulic response to refine predictions of pit inflows and dewatering requirements.
  - Complete an evaluation of earlier pit phases versus the geotechnical data to evaluate if interim pit phases require design adjustments.

### 1.19.4 Metallurgical Testwork

The following activities are recommended to support the detailed design of processing facility beyond the feasibility study:

- Further optimize flotation concentrate leach conditions, including confirmation and definition of the beneficial effect of adding cyanide to the ultra-fine grinding mill, confirmation of the usefulness of a pre-aeration step, and optimization of the leach/CIL residence time. Consider reducing leach/CIL time from 48 hours to 36 hours or less, prior to transfer of the residue to flotation tailings leach where it sees an additional 22 hour of leach/CIL treatment.

- Further optimize gravity-leach flowsheet cyanide detoxification reagent additions required to obtain suitable detoxification conditions.

- Confirm the suitability of recirculating detoxified barren solution and tailings solution supernate to the grinding circuit as a source of process water.

### 1.19.5 Recovery Methods

The following activities are recommended to support the design of the processing plant in detailed engineering:

- Additional geotechnical site investigations (both test pit and borehole methods) should be carried out at the preferred process plant site locations to validate the existing information that has been gathered on the foundation conditions associated with the proposed buildings.

- Finalization of all testwork reports for delivery into detailed engineering.

### 1.19.6 Site Infrastructure

The following activities are recommended to support the detailed design of the site infrastructure beyond the feasibility study:

- GEMTEC carried out the field program for the original feasibility study level from September 4 to October 30, 2020 (GEMTEC, 2021). This was followed up by a site-wide detailed design- and construction-level geotechnical and hydrogeological field investigation from August 5, 2021 to June 27, 2022 that focused on additional characterization of sub-surface conditions primarily in the areas of the TMF and plant, and borrow source studies of new areas for project development (GEMTEC, 2022b). GEMTEC’s field investigation for the current update to the original feasibility study was carried out between June 8 and June 29, 2022 and was completed to characterize geotechnical and hydrogeological conditions in the areas of the waste rock pile and other material stockpiles associated with development of the Berry deposit (GEMTEC, 2022d).

### 1.19.7 Water Management

The following activities are recommended to support the design of the water management systems beyond the feasibility study and into detailed design:

- progress the design of de-centralized water management in each complex (i.e., sedimentation ponds, berms, drainage ditches and outlet channels)

- maintain adequate component waterbody setbacks to account for regulatory buffers and water management infrastructure
- identify opportunities to enhance sedimentation pond volumes at select locations
- continue geochemical testing and assessment of ARD/ML to further refine parameters of potential concern
- refine assimilative capacity study of effluent meeting MDMER criteria in keeping with water management infrastructure updates
- further optimize cut and fill of water management components and/or use of surplus material
- conduct a geotechnical program at the locations of proposed water management features prior to detailed design to refine the assumptions associated with overburden, bedrock, and required grubbing
- continue hydrogeological testing and monitoring to refine and optimize pit and excavation dewatering and estimates of shallow seepage collection.

### 1.19.8 Tailings Management Facility

The following activities are recommended to support the design of the TMF in the next phase of study:

- carry out supplemental geotechnical and hydrogeological site investigations for further definition of the subsurface conditions and to support construction material quantity estimation for later stages of dam raising
- carry out geotechnical investigations within the property boundary to identify potential borrow sources and requirements for development of the borrow areas
- optimize deposition planning (including in-pit disposal at Berry pit) and construction staging based on the findings of the geotechnical site investigations and other project developments
- optimize the design of the water treatment plant and polishing pond
- develop construction drawings and technical specifications for the first stage of construction
- verify the geochemistry results of tailings generated from Berry pit to ensure they do not impact closure cover design
- further characterize the hydrogeological conditions of the Berry open pit and groundwater modelling following in-pit tailings disposal
- advance closure design planning in early years of operation and implement progressive closure once tailings deposition in the TMF has ceased.

### 1.19.9 Environment, Permitting and Community Relations

As indicated in Section 20.2.1, Marathon Gold prepared and submitted an EIS for the Valentine Gold Project to meet the requirements of CEAA 2012, the NL EPA and the project-specific guidelines issued by the federal government and the provincial government. Upon release from the provincial and federal EA processes, numerous approval, authorization, and permit applications were prepared and submitted for approval prior to initiating project construction. Permits could only be issued following release from the EA processes, however, some long-lead items, such as the *Fisheries Act* application, were initiated prior to EA release. A list of permits applicable to the Valentine Gold Project is provided in Section 20.

New and/or amended permits and authorizations will be required for the Berry Complex and associated changes to the Valentine Gold Project. A list of anticipated permits is provided in Section 20. Conditions of approval, standards contained in federal and provincial legislation and regulations, and commitments made during the EA processes (including application of mitigation measures, and monitoring and follow-up requirements), are being addressed through project planning, including the development and implementation of an Environmental and Social Management System, and compliance requirements will continue throughout construction, operation and decommissioning.

Engagement with stakeholders and Indigenous groups, initiated prior to and during the EA process, has continued following EA release. The public and Indigenous groups will also be consulted with regarding the Berry Complex and associated project changes, prior to and during regulatory consultation.

Since EIS/EA submission, Marathon Gold has continued baseline studies in several disciplines including aquatic and terrestrial communities, surface and groundwater resources. Marathon Gold has undertaken a gap assessment of baseline environmental studies needed to support the Berry complex EA and anticipates that continued and proposed baseline monitoring has and will fill gaps. Marathon Gold has initiated early works permitting and has permitting in hand to support the start of construction. Early works permitting as well as discussions with community stakeholders is ongoing. Recommendations for this section include:

- continue baseline and effects monitoring in support of the project
- notify IAAC of a change to the previously designated project
- undertake an environmental assessment in keeping with regulatory guidance for the Berry pit complex
- continue early works and undertake subsequent permitting for the operational phase and Berry pit project extension
- continue engagement and consultation with community, indigenous and other stakeholders.

## 1.20 Conclusion

Based on the assumptions and parameters presented in the report, the project has a mine plan that is technically feasible and economically viable. The positive financials of the project ($648 million after-tax NPV5% and 22.4% after-tax IRR) support the mineral reserve.

# 2 INTRODUCTION

## 2.1 Terms of Reference and Purpose of this Report

This report was prepared and compiled by the parties listed below for Marathon Gold to summarize the results of an update to the feasibility study for the Valentine Gold Project. The report was prepared in accordance with the Canadian disclosure requirements of National Instrument 43-101 (NI 43-101) and in accordance with the requirements of Form 43-101 F1. This feasibility study update was prepared in accordance with NI 43-101 Standards of Disclosure for Mineral Projects.

John T. Boyd Company (BOYD), APEX Geoscience Ltd. (APEX), Terrane Geoscience Inc. (Terrane), Stantec Consulting Ltd. (Stantec), Moose Mountain Technical Services (MMTS), Golder Associates Ltd. (Golder), SNC-Lavalin (SNC), J.R. Goode and Associates (Goode) and GEMTEC Consulting Engineers and Scientists Ltd. (GEMTEC) provided input to the report, and the individuals presented in Table 2-1, by virtue of their education, experience, and professional association, are considered Qualified Persons (QPs) as defined by NI 43-101.

## 2.2 Units of Measurement

Unless otherwise stated, all units of measurement in this report are metric and all currencies are expressed in Canadian dollars (“C$” as a symbol or “CAD” when referring to the currency). Contained gold metal is expressed as troy ounces (oz), where 1 oz = 31.1035 g. All material tonnes are expressed as dry tonnes (t) unless stated otherwise.

## 2.3 Site Visits

Mr. Eccles’ most recent site inspection took place on April 15, 2022. The site visit allowed the QP to observe the Valentine Gold Project’s infrastructure, active exploration and workings, geological setting and modelling, as well as validate the location of several drill collars and independently verify the gold mineralization that is the subject of this report (see Section 12).

Mr. Schulte’s most recent site inspection took place on July 14 and 15, 2021. The QP was able to assess the general topography of the project, inspecting proposed open pit, stockpile and haul road locations, and the locations of existing and proposed infrastructure.

Mr. Smith visited the site for three days in October 2012. During the visited he assessed watercourse and waterbody locations for instrumentation as hydrometric monitoring stations. He also installed the first hydrometric stations during that visit with continuous recording water level dataloggers, collected in-situ flow measurements and trained Marathon Gold staff in station monitoring.

Ms. Anstey-Moore visited the site from July 12 to 14, 2020 as part of GEMTEC’s 2020 site-wide geotechnical and hydrogeological program, and again from June 19 to 22, 2022 as part of GEMTEC’s 2022 Feasibility Study Update geotechnical and hydrogeological investigation on the Berry deposit area. For both visits, she conducted site walkovers to observe topography and ground indicators of underlying hydrogeological conditions. The June 2022 visit included the observation of borehole drilling and monitoring well installation activities, and the July 2020 visit included initial siting of 2020 hydrogeological test locations.

Mr. Shawn Russell, as part of GEMTEC's 2022 site-wide geotechnical investigation field program, visited the site from June 8 to 10, 2022. During this visit Mr. Russell walked the proposed footprints of the Berry pit area, Berry waste rock pile, Berry topsoil stockpile, Berry and Marathon overburden stockpile, both the north and south Marathon topsoil stockpiles, both the Marathon north and south waste rock piles, and the Leprechaun topsoil stockpile for the purpose of observing ongoing test pit and borehole drilling operations and of identifying visible near-surface organic, overburden and bedrock conditions in addition to identifying potential signs of localized slope instability, within the general area of the proposed development.

Mr. Merry most recently visited the project site between August 18 and 19, 2021 to visually assess the general topography of the project site. This included a site walk-over at the proposed TMF, polishing pond, access roads and ancillary structures. The QP was also able to observe the location of some test pits that were recently investigated by GEMTEC as part of the site-wide geotechnical investigation program.

Mr. Haghighi's most recent site inspection took place August 31 to September 1, 2021. The QP was able to assess the general topography of the project, inspecting the areas for the proposed process plant, permanent camp, main access road, and locations of existing and proposed infrastructure.

## 2.4 Sources of Information and Data

### 2.4.1 Source of Information

The authors of this report have assumed and relied on the fact that all the information and technical documents listed in Section 27, References, are accurate and complete in all material aspects.

Ausenco received and relied upon costs and input from other consultants for the capital and operating cost estimates in this report. The updated mine plan provided by MMTS, and tax model provided by Marathon Gold's tax consultants, along with the updated capital and operating costs, were incorporated into the financial model created by Ausenco.

Information related to legal, socio-economic, land title, or political issues has been provided directly by Marathon Gold or via Marathon Gold's news releases during the preparation of this report (September to October 2022) and include, without limitation, validity of mineral tenure, status of environmental and other liabilities, and permitting to allow completion of annual assessment work. These matters were not independently verified by the QPs but appear to be reasonable representations that are suitable for inclusion in Section 4 of this report. The authors have not attempted to verify the legal status of the property; however, the Government of Newfoundland and Labrador, Natural Resources' online mineral claims staking system, Mineral Rights Administration System (MIRIAD), was reviewed by the QP on October 31, 2022, and reports that the Marathon Gold mineral claims are active and in good standing at the effective date of this report.

**Table 2.1: Report Contributors**

| Qualified Person | Professional Designation | Position | Employer | Independent of Marathon Gold? | Date of Last Site Visit | Report Sections |
|---|---|---|---|---|---|---|
| James Powell | P.Eng. (NL) | VP Regulatory and Government Affairs | Marathon Gold Corporation | No | N/A | 4.3, 4.4, 4.6, 19 |
| Roy Eccles | P.Geo. (NL)<br>P.Geol. (AB) | Chief Operations Officer and Senior Consulting Geologist | APEX Geoscience Ltd. | Yes | April 15, 2022 | 1.2, 1.4 to 1.9, 1.11, 1.19.2, 3, 4.1, 4.2, 4.5, 4.7, 6, 7, 8, 9, 10, 11, 12, 14, 23, 25.1 to 25.6, 26.2, 26.3 |
| Sheldon Smith | P.Geo. (NL)<br>P.Geo. (ON) | Senior Principal, Senior Hydrologist | Stantec Consulting Ltd. | Yes | October 15-17, 2012 | 1.15.7, 1.16, 1.19.7, 1.19.9, 18.9.1, 18.9.6, 20, 21.3.2, 26.7, 26.9 |
| Marc Schulte | P.Eng. (NL) | Mining Engineer | Moose Mountain Technical Services | Yes | July 14-15, 2021 | 1.12, 1.13, 1.17.3, 1.19.3, 15, 16, 21.2.2, 21.3.1, 21.4.2, 25.7 |
| W. Peter H. Merry | P.Eng. (NL)<br>P.Eng. (ON)<br>P.Eng. (NT)<br>P.Eng. (NU) | Principal, Senior Mine Waste Engineer | Golder Associates Ltd. | Yes | August 18-19, 2021 | 1.15.3, 1.15.6, 1.19.8, 18.7, 18.8, 21.2.4, 21.3.4, 21.4.4, 25.10, 26.8 |
| Shawn Russell | P.Eng. (NL) | Senior Geotechnical Engineer | GEMTEC Consulting Engineers and Scientists Ltd. | Yes | June 8-10, 2022 | 18.6.1, 18.6.2 |
| Carolyn Anstey-Moore | P.Geo. (NL)<br>P.Geo. (NB) | Senior Environmental Geoscientist | GEMTEC Consulting Engineers and Scientists Ltd. | Yes | July 12-14, 2020;<br>June 19-22, 2022 | 18.6.3 |
| Behzad Haghighi | P.Eng. (ON)<br>P.Eng. (NL) | Senior Civil Engineer | Vieng Consulting | Yes | September 1, 2021 | 1.15.1, 1.15.2, 1.15.4, 1.15.5, 1.19.6, 18.1 to 18.5, 18.9.2 to 18.9.5, 18.10, 21.2.5, 21.3.3, 21.3.5, 25.9, 26.6 |
| John Goode | P.Eng. (NL)<br>P.Eng. (ON) | Principal & Consulting Metallurgist | J.R Goode & Associates | Yes | N/A | 1.10, 1.19.4, 13, 25.8, 26.4 |
| Tony Lipiec | P.Eng. (ON) | Global VP, Minerals & Metallurgical Processing | SNC-Lavalin | Yes | N/A | 1.14, 1.19.5, 17, 26.5 |
| Serfio Hernandez | P.Eng. (QC) | Project Controls Manager | Progesys | No | September 28, 2022 | 24, 25.13 |
| Tommaso Roberto Raponi | P.Eng. (NL)<br>P.Eng. (ON) | Principal Metallurgist | Ausenco Engineering Canada Inc. | Yes | N/A | 1.1, 1.3, 1.17.1, 1.17.2, 1.18, 1.19.1, 1.20, 2, 5, 21.1, 21.2.1, 21.2.3, 21.2.6 to 21.2.11, 21.3.6 to 21.3.9, 21.4.1, 21.4.3, 21.4.5, 21.4.6, 22, 25.11, 25.12, 26.1, 27 |

### 2.4.2 Abbreviations & Acronyms

| Acronym/ Abbreviation | Definition | Acronym/ Abbreviation | Definition |
|---|---|---|---|
| ABA | acid base accounting | Agency | Impact Assessment Agency of Canada |
| AMD | acid mine drainage | ANFO | ammonium nitrate fuel oil |
| AP | acidity potential | BAPE | Bureau d'audiences publiques sur l'environnement |
| CCME | Canadian Council of Ministers of the Environment | CND | contaminated neutral drainage |
| CNWA | Canadian Navigable Waters Act | | |
| DFO | Fisheries and Oceans Canada | ECCC | Environment and Climate Change Canada |
| EIA | Environmental Impact Assessment | EIARP | Environmental Impact Assessment and Review Process |
| EIS | Environmental Impact Statement | EQA | Environmental Quality Act |
| IA | impact assessment | IAA | Impact Assessment Act, 2019 |
| LQE | Loi sur la qualité de l'environnement | MDMER | Metal and Diamond Mining Effluent Regulations |
| MEFCC | Ministry of Environment and Fight Against Climate Change | MELCC | Ministère de l'Environnement et de la Lutte contre les changements climatiques |
| NP | neutralization potential | NPR | Neutralization potential ratio |
| ON | Ontario | PCA | Parks Canada Agency |
| PM2.5 | fine particulate matter | PM10 | inhalable particulate matter |
| SARA | Species at Risk Act | TC | Transport Canada |
| µm | micron | km | kilometer |
| °C | degree Celsius | $km^2$ | square kilometer |
| °F | degree Fahrenheit | L | litre |
| ° | azimuth/dip in degrees | m | meter |
| µg | microgram | m | meter |
| a | annum | M | mega (million) |
| Au | gold | $m^2$ | square meter |
| C$ or CAD | Canadian dollars | $m^3$ | cubic meter |
| cal | calorie | min | minute |
| cm | centimeter | masl | meters above sea level |
| d | day | mm | millimeter |
| ft | foot or feet | $NO_x$ | nitrogen oxide gases produced by diesel vehicles |
| g | gram | oz/t, oz/st | ounce per short ton |
| G | giga (billion) | oz | Troy ounce (31.1035 g) |
| g/L | gram per litre | ppb | parts per billion |
| g/t | gram per tonne | ppm | part per million |
| ha | hectare | % | percent |
| hp | horsepower | s | second |
| in | inch or inches | ton, st | short ton |
| kg | kilogram | t, tonne | metric tonne |
| km | kilometer | US$ or USD | United States dollar |
| $km^2$ | square kilometer | yr | year |

# 3 RELIANCE ON OTHER EXPERTS

While the authors have carefully reviewed, within the scope of their technical expertise, all the available information presented to them, they cannot guarantee its accuracy and completeness. The authors reserve the right, but will not be obligated to, revise the technical report and its conclusions if additional information becomes known to them after the effective date of this report.

The authors are not experts with regard to legal, socio-economic, land title, or political issues, and are therefore not qualified to comment on issues related to the status of permitting, legal agreements, and royalties.

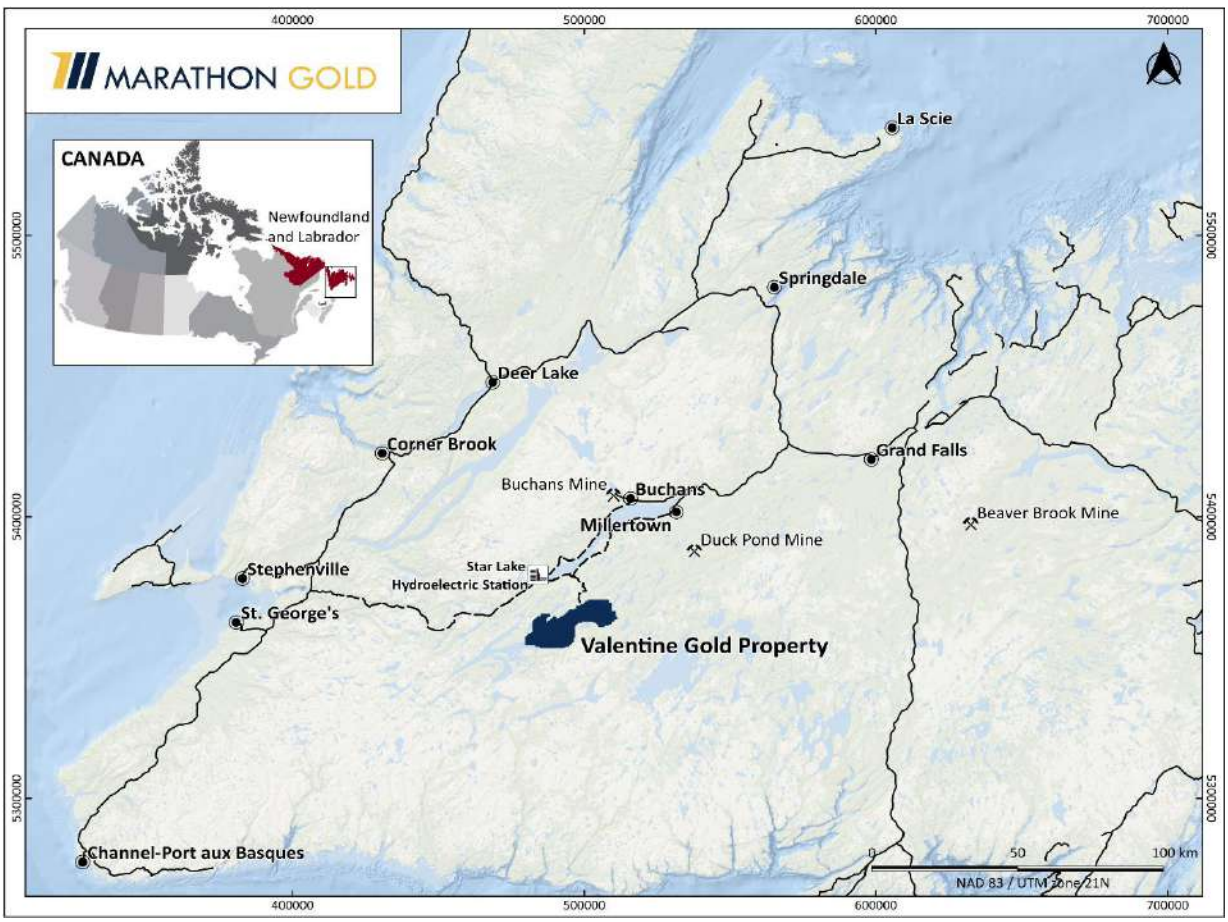
# 4 PROPERTY DESCRIPTION AND LOCATION

## 4.1 Location

The Valentine Lake property is in the west-central region of the island of Newfoundland, Canada, within National Topographic System map sheets: 12A/06 and 12A/07 (Figure 4-1). The center of the property is located at Universal Transverse Mercator 494550 m Easting and 5362789 m Northing, Zone 21, North American Datum 1983, (NAD83 Zone 21).

The property is 100% owned by Marathon Gold and hosts five gold deposits, namely Leprechaun, Sprite, Berry, Marathon and Victory as well as several other early-stage gold prospects. The collective deposits and occurrences are located within a 32 km long northeast-trending zone known as the Valentine Gold Project.

**Figure 4-1: Island of Newfoundland & Location of the Valentine Lake Property**




Source: Marathon Gold, 2022.

## 4.2 Property Description

### 4.2.1 Governance

The Newfoundland-Labrador (NL) Mineral Lands Division of the Department of Natural Resources is responsible for the administration of mineral land tenure, which includes issuance of mineral licenses, exploration approvals, and mining leases. A mineral license grants the licensee exclusive right to explore for minerals in, on, or under the area of land described in the license. Mineral licenses are registered through the Mineral Claims Recorders Office. Mineral licenses are comprised of individual 500 $m^2$ claim blocks that are arranged on a standard reference.

Mineral licenses can be grouped if the following conditions are met:

- they are held by one company/individual
- the licenses are adjoining and total no more than 256 claims
- the first-year assessment work report has been filed
- no 12-month extensions exist on any license.

The acquisition of mineral rights in NL is by online map staking using the Province's MIRIAD system. Each claim in a mineral license requires a fee of C$65; this includes a C$15/claim staking fee and a C$50/claim security deposit, which is refunded upon completion and submission of the first-year assessment requirements.

Each mineral license is issued for a five-year term and may be held for a maximum of 30 years if the annual assessment work is completed, and renewal fees are paid. The minimum expenditure per claim increases each year from Years 1 to 5 and is then subject to increases in five-year increments (Table 4-1). Renewal fees are due on the anniversary date in assessment Years 5, 10, 15, and Years 20 to 30 (Table 4-1). For the mineral license to remain in good standing, the minimum annual assessment work must be completed on or before the anniversary date. The assessment report must then be submitted within 60 days after the anniversary date.

**Table 4.1: NL Mineral Claim Renewal Fees & Minimum Expenditures**

| Assessment Year(s) | Minimum Expenditure per Year (C$ per claim) | Renewal Fees (C$ per claim) |
|---|---|---|
| 1 | 200 | - |
| 2 | 250 | - |
| 3 | 300 | - |
| 4 | 350 | - |
| 5 | 400 | 25 |
| 6 through 10 | 600 | 50 (Payable in Year 10) |
| 11 through 15 | 900 | 100 (Payable in Year 15) |
| 16 through 20 | 1,200 | - |
| 21 through 25 | 2,000 | 200 (Payable every year) |
| 26 through 30 | 2,500 | |

Excess assessment work above what is required in any one year is carried forward as a credit to the mineral license. Excess expenditure credit incurred in Years 1 to 20 can be carried forward for a maximum of nine years; however, no excess credits can be carried past Year 20. Excess expenditure incurred in Years 21 to 30 can be carried forward for a maximum of five years.

The mineral license holder may convert any part of a mineral license to a mining lease, providing the following conditions are met:

- The equivalent of the first three years of assessment work has been completed and accepted by the Department of Natural Resources and the claim is in good standing.
- The applicant demonstrates to the satisfaction of the Minister of Natural Resources that a mineral resource exists under the area of application and that the mineral resource is of significant size and quality to be potentially economic.
- Confirmation by a Qualified Person that the mineral resource exists and is of significant size and quality to be potentially economic.
- The application for a mining lease is accompanied by a legal survey of the relevant area.

Mining leases are charged an annual rental of C$120/ha, payable in advance. In addition, the first-year rental must be paid, and the lease boundary surveyed before the lease is issued by the minister. A mining lease issued under the *Mineral Act* confers upon the lessee the exclusive right to develop, extract, remove, sell, mortgage, or otherwise dispose of all unalienated minerals described in the lease, subject to registration under NL's *Environmental Protection Act* and in compliance with applicable regulations.

Mineral licenses do not include surface rights. For a mining project, the license holder must obtain surface rights, including rights of way, sufficient to cover the entire footprint of the mine and related infrastructure. Provisions for granting surface rights are included in the *Mineral Act*. The surface lease application is reviewed by the Minister of Natural Resources in consultation with the Minister appointed to administer the *Lands Act*.

### 4.2.2 Valentine Lake Property

The Valentine Lake property consists of 14 contiguous mineral licenses for a landholding of 240 km$^2$ or 24,000 hectares (Figure 4-2). The status of the Valentine Gold mineral licenses, numbers, renewal dates, and annual exploration expenditures is shown in Table 4-2. The mineral licenses in Table 4-2 are all 100% controlled by Marathon Gold and are in good standing as of the effective date of this report (as per mineral land tenure records at the NL Department of Natural Resources).

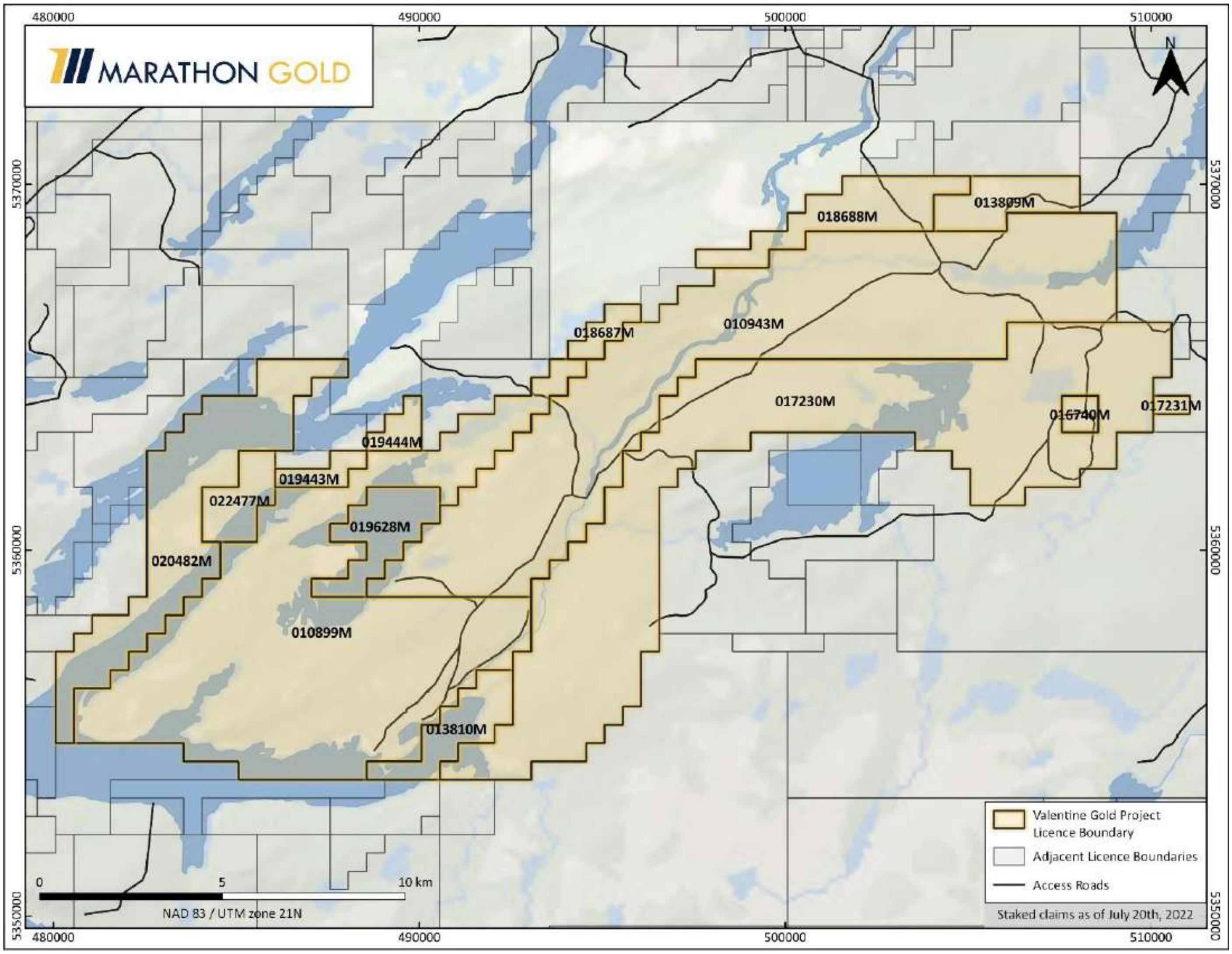
## 4.3 Exploration Program Permits and Approvals

An Application for Exploration Approval and Notice of Planned Mineral Exploration Work must be submitted for approval by the NL Department of Natural Resources prior to conducting exploration on a mineral license.

Exploration work requiring a Mineral Exploration Approval Permit includes fly camps (occupation period of less than 90 days), water use, prospecting, mapping, line cutting, drilling, trenching, bulk sampling, geochemical surveys, airborne geophysical surveys, motorized vehicle use, and fuel storage.

For camps with occupancy of more than 90 days, a Temporary License to Occupy must be approved by the Department of Environment and Conservation. Information provided in the Application for Exploration Approval is used to approve a Water Use License.

**Figure 4-2: Marathon Gold Project Mineral Licenses**




Source: Marathon Gold, 2022.

**Table 4.2: Valentine Lake Property License Summary**

| License ID | Issuance Date | Years Held | Renewal Date | No. Claims | Area km2 | Expenditures Required (C$) | Expenditure Due Date |
|---|---|---|---|---|---|---|---|
| 010899M | 27-Apr-04 | 19 | 27-Apr-24 | 246 | 61.50 | 492,000.00 | 27-Apr-25 |
| 010943M | 27-Apr-04 | 19 | 27-Apr-24 | 256 | 64.00 | 512,000.00 | 27-Apr-25 |
| 013809M | 6-Sep-07 | 16 | 06-Sep-27 | 18 | 4.50 | 17,591.11 | 6-Sep-26 |
| 013810M | 6-Sep-07 | 16 | 06-Sep-27 | 19 | 4.75 | 8,840.77 | 6-Sep-25 |
| 016740M | 26-Nov-09 | 13 | 26-Nov-26 | 4 | 1.00 | 1,622.33 | 26-Nov-29 |
| 017230M | 9-Feb-10 | 13 | 09-Feb-25 | 256 | 64.00 | 161,255.93 | 9-Feb-29 |
| 017231M | 9-Feb-10 | 13 | 09-Feb-25 | 2 | 0.50 | 18.55 | 9-Feb-28 |
| 018687M | 29-Mar-11 | 12 | 30-Mar-26 | 6 | 1.50 | 5,119.76 | 29-Mar-29 |
| 018688M | 29-Mar-11 | 12 | 30-Mar-26 | 29 | 7.25 | 33,517.73 | 29-Mar-29 |
| 019443M | 17-Oct-11 | 11 | 19-Oct-26 | 6 | 1.50 | 3,427.05 | 17-Oct-29 |
| 019444M | 17-Oct-11 | 11 | 19-Oct-26 | 6 | 1.50 | 3,427.05 | 17-Oct-29 |
| 019628M | 29-Dec-11 | 11 | 29-Dec-26 | 21 | 5.25 | 24,068.93 | 29-Dec-31 |
| 020482M | 8-Oct-12 | 11 | 08-Oct-27 | 77 | 19.25 | 68,502.96 | 08-Oct-28 |
| 022477M | 6-Nov-14 | 9 | 06-Nov-24 | 14 | 3.50 | 6,648.05 | 6-Nov-30 |
| | | | **Totals** | **960** | **240** | **1,338,040.22** | |

Source: Newfoundland-Labrador, Department of Natural Resources, Mineral License Status Report, October 26, 2022.

Exploration activities are subject to the permits described in Section 20.4. Under the provisions of the *Mineral Act* (1990), Marathon Gold has the right to conduct exploration for minerals on the property. Marathon Gold has indicated that all the necessary permits are in place to conduct mineral exploration and complete their annual assessment work.

## 4.4 Surface Rights

Marathon Gold currently has a surface lease covering 2,129 ha and will need to apply for approximately 500 ha of additional area to take in the proposed Berry pit, associated stockpiles, and water management infrastructure. In NL, a "surface lease" for a mining project can only be obtained once the proposed project has been released from environmental assessment. The additional surface lease area required to encompass Berry is immediately adjacent to the existing Valentine Gold Project surface lease and with existing mineral licenses held and maintained by Marathon. There are no known rights or interests that would impede Marathon obtaining the surface lease to cover the Berry pit expansion.

## 4.5 Royalties & Other Agreements

On March 14, 2022, Marathon Gold purchased for cancellation the historical 7.5% net profit interest (NPI) royalty that covered certain mineral resource areas at the Company's Valentine Gold Project in central Newfoundland. These properties were initially granted to the Reid Newfoundland Company Limited (Reid) in the early part of the last century in connection with the development of the Newfoundland railway. The NPI royalty, which was initially reserved in 1905 and amended in 1948 to provide for a 7.5% NPI royalty on all minerals, continues to apply today for the areas of the Leprechaun and Sprite deposits and part of the Berry deposit.

As consideration for the NPI royalty, Marathon paid $500,000 in cash and issued 1,341,607 common shares (having a value of $4,000,000 based on the five-day volume weighted average price) at closing to Reid, the private third-party vendor. Marathon also paid additional cash consideration of $3 million to Reid following the formal release of the project from the provincial and federal environmental assessment processes, including receipt of final Ministerial or Cabinet approval, and confirmation that the project has satisfied the terms of the respective provincial and federal environmental assessment processes and that the project may proceed to permitting for mine construction, subject to conditions.

Gold production from the property is subject to the following royalty agreements:

- A 2% net smelter return (NSR) is payable to Mr. Kevin Keats for gold recovered from mineral license 016740M for which no mineral resource estimate is available.
- In February 2019, Marathon Gold announced the company had sold a 2% NSR royalty to Franco-Nevada Corporation; the NSR royalty applies to the entire Valentine Lake property and covers the sale of precious and base metals and minerals (Marathon Gold, 2019). Marathon Gold has the option to buy back 0.5% of the NSR royalty until December 31, 2022 for a price of US$7 million.

APEX is not aware of any other royalties, back-in rights, payments, or other agreements and encumbrances to which the property is subject.

## 4.6 Environmental Liabilities

The NL Environmental Assessment Regulations (2003) states that all undertakings that will be engaged in the mining, beneficiating, and preparing of a mineral as defined in the *Mineral Act* shall be registered for environmental assessment. Federally, a condition of the Valentine Gold Project Decision Statement requires that any change to the designated project must be presented to federal regulators for review. The environmental assessment process ensures that projects proceed in an environmentally acceptable manner, and mining projects are asked to describe the anticipated impact of their project on businesses and employment in the province.

The project area is generally a greenfield site with some areas of the site affected by exploration activities (clearing, drill trails, exploration camp) conducted over the past 12 plus years. Prior to exploration activities, an access road network had existed to the project area to support forestry operations and the construction of the nearby Victoria Dam (1960s). A former camp and area for equipment, equipment maintenance, materials laydown existed along the southern edge of project area between the TMF and the Victoria Dam. NL Hydro has indicated this camp was decommissioned upon completion of the dam. Marathon's contractors have completed groundwater wells downhill/downstream of this area and completed water sampling in the downstream area (Victoria River), and there is no indication of any water quality issues. No construction is required for mine development at the location of the former camp.

The property is located within the Victoria Lake Steadies Waterfowl area. For known waterfowl staging areas, a minimum of 30 m must be left as a buffer from the water's edge with at least 20 m of established forest. Exploration activity within a waterfowl-sensitive area that may cause disturbance (e.g., drilling, line cutting, or blasting) should be avoided during May to mid-July. There is no information available at the Department of Natural Resources regarding the location or species proximal to or within the property, therefore Marathon Gold has completed a local waterfowl baseline study. The NL Environmental Protection Guidelines (2018) states that no clearing activity is to occur within 800 m of a bald eagle or osprey nest during the nesting season (May 15 to July 31) and 200 m outside of the nesting season. All hardwoods within 30 m of a body of water occupied by beavers are to be left standing. Caribou on the island of Newfoundland have been assessed as special concern by COSEWIC (COSEWIC, 2014). The project area overlaps or is in proximity to the ranges of caribou herds including the Buchans, Grey River, Gaff Topsails, and La Poile herds. The project area overlaps with the Grey River Caribou Management Area. Caribou from the Buchans herd migrate through the mine site semi-annually (see Figures 20-2 and 20-3), while resident caribou from the Grey River herd, can occur year-round within the project area. Project design, construction, operation and closure includes mitigations to reduce effects on caribou.

With respect to regulations pertaining to protected water supply areas, any development of protected or unprotected public water supply areas requires written approval from the Water Resources Division, Provincial Department of Environment and Climate Change. Stream alterations require approval from the Water Resources Division, Provincial Department of Environment and Climate Change and the Federal Department of Fisheries and Oceans (i.e., authorization for works or undertakings affecting fish habitat). The project has avoided deposition of mine waste in water frequented by fish and thereby avoided an MDMER Schedule 2 trigger. Project water management design has maintained a 15 m setback from waterbodies.

Several acts and regulations are applicable to the project, as noted in Section 20, Environmental Studies, Permitting and Social or Community Impact, and these will be addressed throughout the permitting process for the project and an anticipated EA for the Berry pit complex expansion of the project.

## 4.7 Significant Risks

At the Effective Date of this report, the QP is not aware of any other significant factors and risks that may affect access, title, or the right or ability to perform work on the Valentine Gold Property that has not been discussed in this technical report.

# 5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

## 5.1 Accessibility

Access to the site is via existing roads. An 63 km gravel road from site leads to the Town of Millertown (see Figure 5-1). From Millertown, the Buchans Highway can be accessed, which itself is connected to the Trans-Canada highway. The Trans-Canada highway crosses the island of Newfoundland from east to west, connecting the major cities and towns. Using this route, the Marathon Gold regional office in Grand Falls Windsor (central Newfoundland) can be accessed as well.

Total travel time by road from Grand Falls Windsor to site is approximately four hours. The nearest airport is in Gander. Helicopter access to site is also possible, from Gander. With reference to Figure 5-1, the project site can be identified by the marker “Valentine Lake Property”.

There are two potential shipping ports, one to the west (Turf Point Port at the Town of St. George’s) and one to the north (Goodyear’s Cove Port at the Town of South Brook) of the site. The former was used to ship copper and zinc concentrates for the Duck Pond Mine between 2007 and 2015. Other major shipping ports on the island of Newfoundland are in St Johns and Port O’Basques.

## 5.2 Proximity to Population Center

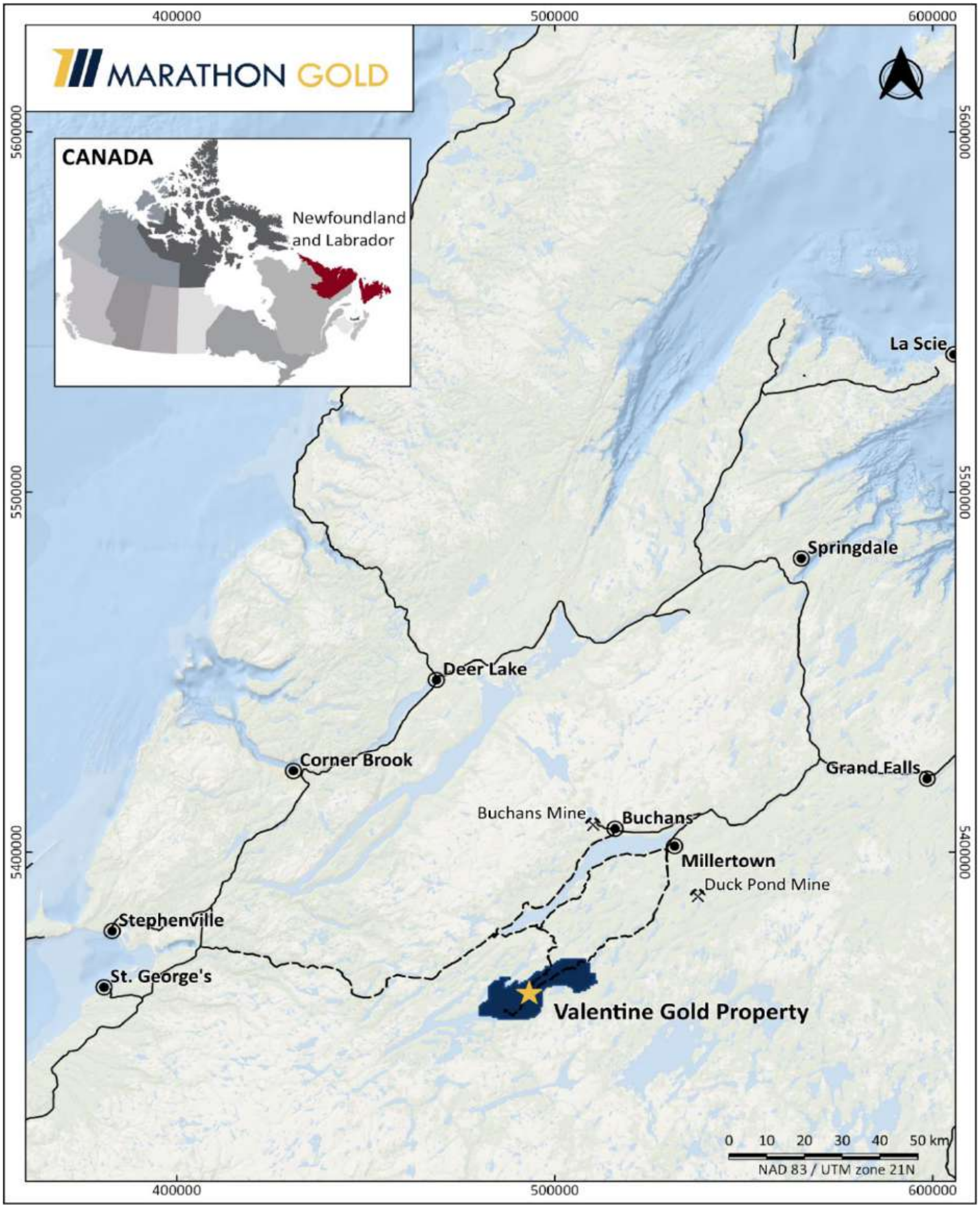
Newfoundland and Labrador is a province with a population of 520,000, of which more than half is on the Avalon Peninsula on the eastern side of the province. The largest town in Newfoundland is its capital, St. John’s and the largest regional town is Grand Falls-Windsor. Several towns between the project site and Grand Falls-Windsor will service the mining operation, such as Buchans, Millertown. Buchans Junction and Badger.

## 5.3 Physiography

The project is typified by gentle to moderately steep, hilly terrain. The project is situated at the southern end of Valentine Lake. Numerous small ponds occur within the property, and a distinct northeast-trending ridge occurs along the length of the property, dissected by shallowly incised ephemeral streams.

Elevation in the property varies from 320 masl (level of Victoria Lake) to 480 masl. Boggy ground covers a plateau in the central part and the northwest of the ridgeline. The remainder of the central ridgeline is mostly spruce and fir forest, with grassy clearings. Outcrops are mostly in streambeds and banks, with some occurrences along the ridgeline. However, the overburden layer along ridge areas is thin, providing abundant outcrop exposure in numerous excavated trenches (see Figure 5-2).

**Figure 5-1: Infrastructure & Accessibility at the Valentine Gold Project**




Source: Marathon Gold, 2020.

**Figure 5-2: Marathon Deposit looking SW to the Sprite Zone, including Visible Outcrops of QTP-Au Veining**

Source: Marathon Gold, 2020.

## 5.4 Climate

Local climate is temperate maritime, which means it has typically mild summers and cold winters. The weather station at Buchans shows an annual average precipitation of 1,100 mm, of which slightly more than one-fourth falling as snow with up to 1 m or more of accumulation. Regarding temperatures, the historical average summer temperature is 14°C, and average winter temperature is -6°C. At times, short-term extreme temperatures can be observed at the project site, which have been accounted for in the project design, for a winter minimum of -26°C and the summer maximum temperature of 30°C.

## 5.5 Infrastructure

The property is already equipped with an exploration camp in the south with a maximum occupancy of 65 people. Power for the existing camp is provided by a diesel generator and includes back-up generators in the event the main generator fails. The camp consists of accommodation quarters, a mess hall, cold/dry storage, core cutting, core shed and offices. Permitted and gated access roads from the camp to the exploration points have been developed by Marathon Gold and their predecessors.

In addition to the original exploration camp, a 120-person temporary camp has been installed to support the early works construction that will take place until the permanent camp is completed.

Regarding power sources for the project, NL Hydro has advised that the hydroelectric power stations 40 km north at Star Lake are the nominated source of incoming power for the project, as developed with NL Hydro. Sufficient raw water is available for potential mining operations, notwithstanding the relevant permitting requirements.

## 5.6 Local Resources

Mining is not a new industry in Newfoundland and Labrador, with numerous operations in production around the province. Skilled personnel are available in the province, as well as suppliers and contractors in central Newfoundland communities, such as Millertown, Springdale, Grand Falls-Windsor, Badger and Buchans. Mineral exploration companies and local government are practicing strategies to attract, recruit, diversify, and retain skilled mining workers.

# 6 HISTORY

## 6.1 Exploratory Ownership History

The property has historically been explored by several companies since the 1960s (see Table 6-1). The region was originally explored for base metals exploration by ASARCO Inc. and Hudson's Bay Oil and Gas Company; this exploration was consistent with historically significant base metal discoveries in the Dunnage Zone (e.g., Buchan's and Duck Pond-Boundary Cu-Zn±Au past-producing deposits).

The Valentine Lake property was first recognized as a potential gold prospect by Abitibi in 1983 before it was acquired by BP in 1985. Noranda acquired the property from BP in 1992, prior to entering into a joint venture agreement with Mountain Lake Resources (MOA) in 1998.

**Table 6.1: Summary of Ownership History**

| Date | Operator |
|---|---|
| 1960s | ASARCO Inc. |
| 1970s to 1983 | Hudson's Bay Oil and Gas Company |
| 1983-1985 | Abitibi Price Inc. |
| 1985-1992 | BP Canada Inc. |
| 1992-1998 | Noranda Inc. |
| 1998-2003 | Mountain Lake Resources Inc. |
| 2003-2007 | Richmont Mines Inc. |
| 2007-2009 | Mountain Lake Resources Inc. |
| 2009-2010 | Marathon PGM Corporation |
| 2010-Present | Marathon Gold Corporation |

In 2002, MOA earned a 50% interest in the property and retained an option to acquire a 100% interest by expending $2.5 million on exploration within five years, and either paying $1 million or issuing one million shares to Noranda. Noranda retained a 2% NSR royalty on base metal production, and a 3% NSR royalty on precious metal production. A 7.5% NPI royalty was retained by Reid Newfoundland Company Inc. on Reid Lots 227 and 229.

In November 2003, Richmont entered into an option agreement with MOA, whereby Richmont had the option to acquire a 70% interest in the property by expending $2.5 million in exploration by October 31, 2007. Richmont relinquished its role as operator in October 2007 to MOA. In March 2008, MOA acquired the remaining interest in the property from Noranda.

In February 2009, an agreement was reached between Richmont and MOA in which MOA had the option to acquire a 100% interest in the property. Subsequently, in December 2009, MOA entered into an option and joint venture agreement with Marathon PGM Corporation (MAR), under which MAR was granted the option to earn a 50% interest in the property. MAR became the operator in 2010.

In November 2010, MAR was acquired by Stillwater Mining Company. The gold properties held by MAR, including the subject property, were amalgamated into a new company, Marathon Gold Corp. (Marathon Gold), which commenced trading in December 2010. In January 2011, Marathon Gold funded MOA's commitments to Richmont under the February 2009 agreement. Marathon Gold later acquired a 100% interest in the property upon acquiring all outstanding shares in MOA in July 2012.

## 6.2 Historical Exploration

Between 1960 and 2010, the various historical operators completed a variety of soil sampling, surface stripping and channel sampling, ground and airborne geophysical surveys, and geological mapping (Murahwi, 2017) which are summarized in Sections 6.2.1 to 6.2.6. In addition, the NL Department of Natural Resources, Mines and Energy Branches conducted 1:50,000-scale geological mapping from 1970 to 1983.

Drilling for gold mineralization was first conducted in the late 1980s by BP (see Table 6-2). This ultimately led to an initial mineral resource estimate on the Leprechaun deposit by Richmont in 2004 (Murahwi, 2017).

**Table 6.2: Summary of Historic Drillholes Completed by Other Companies**

| Operator | Date | No. of Drill Collars | Meters |
|---|---|---|---|
| BP Canada Inc. | 1986-1991 | 47 | 5,974 |
| Mountain Lake | 1998-1999 | 29 | 3,861 |
| | 2002 | 9 | 1,041 |
| Richmont | 2003-2004 | 24 | 6,965 |
| | 2005 | 8 | 1,746 |
| | 2007 | 8 | 2,280 |
| Mountain Lake | 2009 | 11 | 1,908 |
| Totals | | 136 | 23,775 |

Between 2010 and the present, MAR and later Marathon Gold, continued to expand the mineral resource at Leprechaun and made significant new discoveries at the Marathon, Sprite, and Victory deposits. Mineral resource estimates were subsequently issued for each of these new discoveries (see Section 6.3). Marathon Gold's exploration work and drill programs from 2010 onwards are presented in Sections 9 and 10 of this report.

A summary of work completed by the historical operators is provided in the subsections below, as summarized from the Micon Report (Murahwi, 2017). The summary provides details about exploration work conducted largely within the boundaries of the current Valentine Lake property.

### 6.2.1 ASARCO Inc. and Hudson's Bay Oil and Gas (1960 to 1983)

Between 1960 and 1983, ASARCO and Hudson's Bay targeted base metal mineralization at the Valentine Lake property. Reconnaissance geological mapping and soil and stream sediment sampling completed by ASARCO resulted in the identification of a 1 m wide quartz-pyrite-chalcopyrite vein, which was tested with four short diamond drillholes (lengths not known), a 1 $km^2$ soil sampling, and very low frequency electromagnetic (VLF-EM) survey. ASARCO determined that the vein pinched out 30 m below surface. The vein is in the brook draining from Frozen Ear Pond although exact coordinates are unknown. In 1966, an airborne EM magnetic survey was flown by Canadian Aero Mineral Surveys Ltd., but the results were not publicly reported.

Hudson's Bay commissioned an Aerodat airborne EM magnetic survey in 1980; however, the area that was surveyed and survey results are not known. Follow-up work did not produce significant results.

### 6.2.2 Abitibi Price Inc. (1983 to 1985)

Abitibi completed a 400 m x 25 m spaced soil sampling survey targeting gold mineralization over the Valentine Lake Intrusion, southeast of Valentine Lake. The survey defined gold anomalies; however, Abitibi did not follow up on the anomalies. Results and locations of the Abitibi surveys are not known.

### 6.2.3 BP Canada Inc. (1985 to 1992)

BP advanced the gold-in-soil anomalies identified by Abitibi through grab rock sampling and geological mapping over a 20 km strike length. A 13 km long zone was prioritized and subjected to 100 m spaced line cutting to allow further geological mapping, soil sampling, and VLF-EM and magnetic geophysical surveys.

BP identified gold prospects at the Leprechaun and Victory deposits (Victory was formerly known as Valentine East). A While working for BP, Tim Froude and Gerald Harris identified gold prospects at the Leprechaun and Victory deposits (Victory was formerly known as Valentine East) in 1986. A diamond drillhole program that drilled 47 drillholes totalling 5,974 m was completed at Leprechaun. Significant intercepts from this program included 23.1 m at 4.6 g/t gold and 9.6 m at 0.1 g/t gold (estimated true widths). Overall, the drilling identified gold mineralization over a strike length of 3 km. A small-scale induced polarization survey was conducted at Leprechaun by BP; however, the results and locations of the survey are unknown.

### 6.2.4 Noranda Inc. (1992 to 1998)

Noranda's exploration programs between 1992 and 1998 included a soil and till sampling program over the Quinn Lake area; line cutting, geological mapping, an airborne EM survey and resampling of historical drill core in the Long Lake area, as well as compilation of historical grab sampling and drill core data. The soil and till sampling programs defined a large area of gold and base metal anomalies proximal to Quinn Lake.

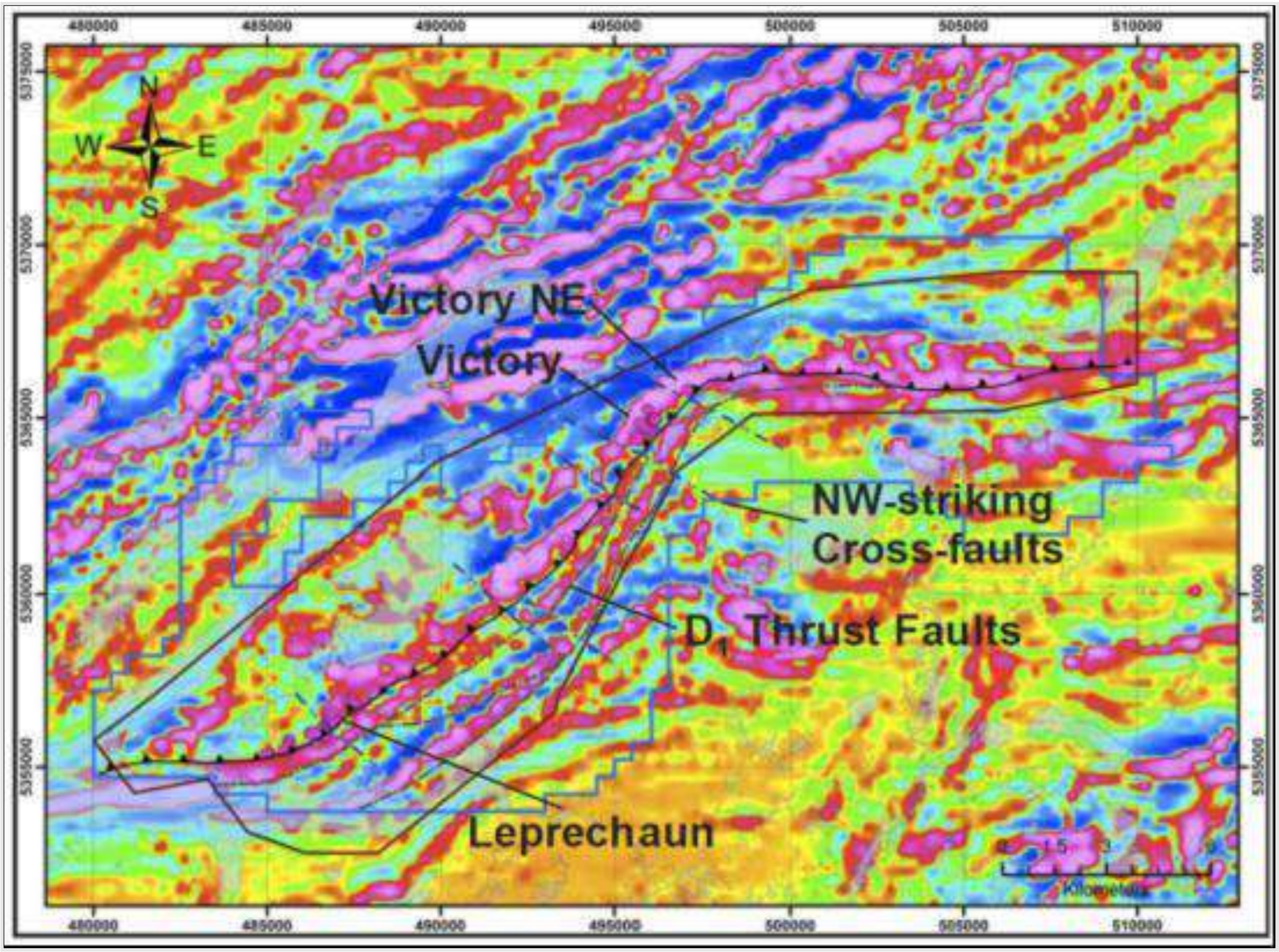
### 6.2.5 Mountain Lake Resources Inc. and Richmont (1998 to 2007)

MOA and Richmont conducted several drill programs between 1998 and 2007 totalling 78 diamond drillholes for 15,676.5 m. The drilling was focused on the Leprechaun and Valentine East zones, as well as exploratory holes elsewhere along the 32 km long mineralized trend, including the Sprite prospect and along-strike extensions of the Leprechaun and Valentine Lake prospects. In December 2004, the results of drilling were used to prepare a maiden resource estimate for Leprechaun.

MOA conducted a helicopter-borne magnetic, radiometric, and VLF-EM survey over the entire project area in 2007. Interpretation of the magnetic data (see Figure 6-1) has identified the large-scale structural features of the property, including the regional scale Valentine Lake Shear Zone and late northwest striking normal faults. Other results and interpretations of the geophysical surveys are discussed in more detail in Section 9, Exploration.

The historical mineral resource estimate in Table 6-3 is superseded by the mineral resource estimate presented in Section 14 and is not considered relevant. A qualified person has not done sufficient work to classify the historical estimate as current mineral resource and the issuer and the authors of this report are not treating the historical estimate as a current mineral resource.

**Figure 6-1: First Vertical Derivative Aeromagnetic Data for the Valentine Lake Property**




Source: SRK, 2014.

**Table 6.3: Historical Mineral Resource Estimate, Leprechaun Deposit**

| Effective Date | Operator | Deposit | Category | Tonnage (Mt) | Grade (Au g/t) | Contained Gold (koz) | Reference |
|---|---|---|---|---|---|---|---|
| December 15, 2004 | Richmont | Leprechaun | Inferred | 1.3 | 8.5 | 359 | Pilgrim, 2005 |

Notes: 1. CIM definitions were followed for mineral resources. 2. The estimate was carried out using the polygonal method. 3. Mineral resources are estimated at a cut-off grade of 0.5 g/t gold. 4. A long-term gold price of US$425 per ounce was used for this mineral resource estimate. 5. A minimum mining width of 3 m was used. 6. A top cut of 58 g/t gold was applied to composites based on statistical analysis. 7. Numbers may not add due to rounding.

In 2007, Geophysics GPR International was commissioned to conduct an airborne magnetic, radiometric, and VLF-EM survey comprising 1766-line kilometers at a 100 m line spacing. Results are discussed in Section 9, Exploration.

As part of the 78 drillholes (1998-2007) previously mentioned, eight diamond drillholes were completed in 2007 to test mineralization identified outside of the VLIC, with one significant intercept of 7.4 m at 1.3 g/t gold (394.1 m to 401.5 m, VL07-123) including 0.9 m at 8.3 g/t gold (400.6 to 401.5 m).

### 6.2.6 Mountain Lake and Marathon PGM (2007 to 2010)

Exploration work between late 2007 and 2008 was limited to geological mapping, prospecting, and soil sampling at Quinn Lake and Victoria Dam. The results of this work were insignificant, and no follow-up work was conducted.

In 2009, 11 drillholes totalling 1,908 m were completed (see Table 6-2 above) to test exploration targets north of Leprechaun; however, this drilling did not return any significant results.

Micon was retained by Marathon PGM to prepare a mineral resource estimate for the Leprechaun deposit, with an effective date of December 11, 2010 (see Table 6-4). The mineral resource estimate in Table 6-4 was prepared in accordance with CIM Definition Standards but is superseded by the mineral resource estimates in Section 14 of this Technical Report. In the opinion of the QP, the reliability of the historical estimate is considered reasonable. The historical resource considered relevant because it represents Marathon Gold's first resource estimation at the Valentine Gold Project. The QP has not done sufficient work to classify the historical estimate as current mineral resources, and therefore, the QP and the Issuer are not treating the historical estimate as current mineral resources.

**Table 6.4: Historical Mineral Resource Estimate for the Leprechaun Deposit, December 11, 2010**

| Effective Date | Deposit | Category | Tonnage (Mt) | Grade (Au g/t) | Contained Gold (koz) | Reference |
|---|---|---|---|---|---|---|
| December 11, 2010 | Leprechaun Pond | Measured | 2.1 | 2.8 | 187 | Gowans, Murahwi and Shoemaker, 2011 |
| | | Indicated | 1.2 | 2.4 | 90 | |
| | | Inferred | 4.4 | 2.0 | 285 | |

Notes: **1.** CIM definitions were followed for mineral resources. **2.** The estimate was carried out using a kriging method. **3.** Mineral resources are estimated at a cut-off grade of 0.5 g/t gold. **4.** A long-term gold price of US$1,000 per ounce was used for this mineral resource estimate. **5.** A minimum mining width of 3 m was used. **6.** Composites were based on uncapped assays, but the influence of high-grade gold assays was limited by conditions applied to the search ellipse. **7.** Numbers may not add due to rounding.

## 6.3 Previous Mineral Resource Estimates Issued by Marathon Gold

Between 2012 and 2020, Marathon Gold issued a total of 10 mineral resource estimations. As shown in Table 6-4, the Leprechaun deposit represented the first Valentine Gold Project deposit that was classified as a mineral resource by Marathon Gold. Subsequent historical mineral resources were first defined for the Victory deposit in 2013, and Marathon and Sprite deposits in 2015.

The November 20, 2020 historical mineral resource estimations are presented in Table 6-5 and are considered relevant by the QP because they represent the last historical mineral resources disclosed by Marathon Gold. The mineral resources were prepared by BOYD and were estimated using CIM definition standards and best practice guidelines (2014, 2019).

**Table 6.5: Summary of Previous Mineral Resource Estimate (Prepared by Robert Farmer P.Eng. of John T. Boyd Company; Staples et al., 2021).**

| Measured & Indicated Mineral Resource Estimate | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Material/ Category | Open Pit | | | Underground | | | Total | | |
| | Tonnes (kt) | Grade (g/t) | Gold (koz) | Tonnes (kt) | Grade (g/t) | Gold (oz) | Tonnes (kt) | Grade (g/t) | Gold (koz) |
| **Leprechaun Deposit** | | | | | | | | | |
| Measured | 8,498 | 2.207 | 602.9 | 98 | 3.567 | 11.2 | 8,596 | 2.222 | 614 |
| Indicated | 8,278 | 1.691 | 450.1 | 197 | 3.149 | 19.9 | 8,475 | 1.725 | 470 |
| **M+I** | **16,776** | **1.952** | **1,053** | **295** | **3.279** | **31.1** | **17,071** | **1.975** | **1,084** |
| **Sprite Deposit** | | | | | | | | | |
| Measured | 0 | 0.000 | 0 | 0 | 0.000 | 0 | 0 | 0.000 | 0 |
| Indicated | 695 | 1.737 | 38.8 | 6 | 2.196 | 0.4 | 701 | 1.741 | 39.2 |
| **M+I** | **695** | **1.737** | **38.8** | **6** | **2.196** | **0.4** | **701** | **1.741** | **39.2** |
| **Marathon Deposit** | | | | | | | | | |
| Measured | 23,578 | 1.650 | 1,250.5 | 413 | 4.169 | 55.4 | 23,991 | 1.693 | 1,305.9 |
| Indicated | 13,354 | 1.419 | 609.2 | 454 | 3.351 | 48.9 | 13,808 | 1.482 | 658.1 |
| **M+I** | **36,932** | **1.566** | **1,859.7** | **867** | **3.741** | **104.3** | **37,799** | **1.616** | **1,964** |
| **Victory Deposit** | | | | | | | | | |
| Measured | 0 | 0.000 | 0 | 0 | 0.000 | 0 | 0 | 0.000 | 0 |
| Indicated | 1,084 | 1.459 | 50.8 | 1.3 | 1.803 | 0.1 | 1,085 | 1.460 | 50.9 |
| **M+I** | **1,084** | **1.459** | **50.8** | **1.3** | **1.803** | **.01** | **1,085** | **1.460** | **50.9** |
| **All Deposits** | | | | | | | | | |
| Measured | 32,076 | 1.797 | 1,853.4 | 511 | 4.054 | 66.6 | 32,587 | 1.833 | 1,920 |
| Indicated | 23,411 | 1.526 | 1,148.9 | 658.3 | 3.277 | 69.3 | 24,069 | 1.574 | 1,218.2 |
| **M+I** | **55,487** | **1.683** | **3,002** | **1,169.3** | **3.616** | **135.9** | **56,656** | **1.723** | **3,138.2** |
| **Inferred Mineral Resource Estimate** | | | | | | | | | |
| **Deposit Name** | **Open Pit** | | | **Underground** | | | **Total** | | |
| | **Tonnes (t)** | **Grade (g/t)** | **Gold (oz)** | **Tonnes (t)** | **Grade (g/t)** | **Gold (oz)** | **Tonnes (t)** | **Grade (g/t)** | **Gold (oz)** |
| Leprechaun | 2,667 | 1.439 | 123.4 | 325 | 3.233 | 33.8 | 2,992 | 1.633 | 157.2 |
| Sprite | 1,189 | 1.199 | 45.9 | 61 | 2.468 | 4.8 | 1,250 | 1.261 | 50.7 |
| Marathon | 9,770 | 1.534 | 481.7 | 1,910 | 3.521 | 216.2 | 11,680 | 1.859 | 697.9 |
| Victory | 2,200 | 1.157 | 81.8 | 130 | 3.050 | 12.7 | 2,330 | 1.262 | 94.5 |
| Berry | 10,711 | 1.645 | 566.4 | 622 | 3.616 | 72.3 | 11,333 | 1.753 | 638.7 |
| All Deposits | 26,537 | 1.523 | 1,299.2 | 3,048 | 3.469 | 339.8 | 29,585 | 1.723 | 1,639 |

Notes: **1.** The effective date for this historical mineral resource estimate is November 20, 2020 for the Leprechaun, Sprite, Marathon, and Victory deposits, and April 15, 2021 for the Berry deposit, and is reported on a 100% ownership basis. The qualified person for the mineral resource estimate is Robert Farmer, P.Eng. of John T. Boyd Company. **2.** Mineral resources are calculated at a gold price of US$1,500 per troy ounce. **3.** The mineral resources presented above are global and do not include detailed pit or underground designs; only an economic open pit shell was used to determine the in-pit mineral resources. The underground mineral resources are that material outside of the in-pit mineral resources above the stated underground cut-off grade. **4.** The mineral resources presented here were estimated using a block model with a block size of 6 m x 6 m x 6 m sub-blocked to a minimum block size of 2 m x 2 m x 2 m using ID3 methods for grade estimation. All mineral resources are reported using an open pit gold cut-off of 0.30 g/t Au and an underground gold cut-off of 1.44 g/t Au. Higher gold grades were capped by mineralized domain. 5**.** The mineral resources presented here were estimated using the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council May 10, 2014. **7.** Figures are rounded, and totals may not add correctly.

The reliability of the historical mineral resource estimations is considered reasonable, but the QP has not done sufficient work to classify the historical estimate as current mineral resources, and therefore, the QP and the Issuer are not treating the historical estimates as current mineral resources. Note: Marathon Gold's previous mineral resource estimates are superseded and replaced by the mineral resource estimations presented in Section 14 of this report.

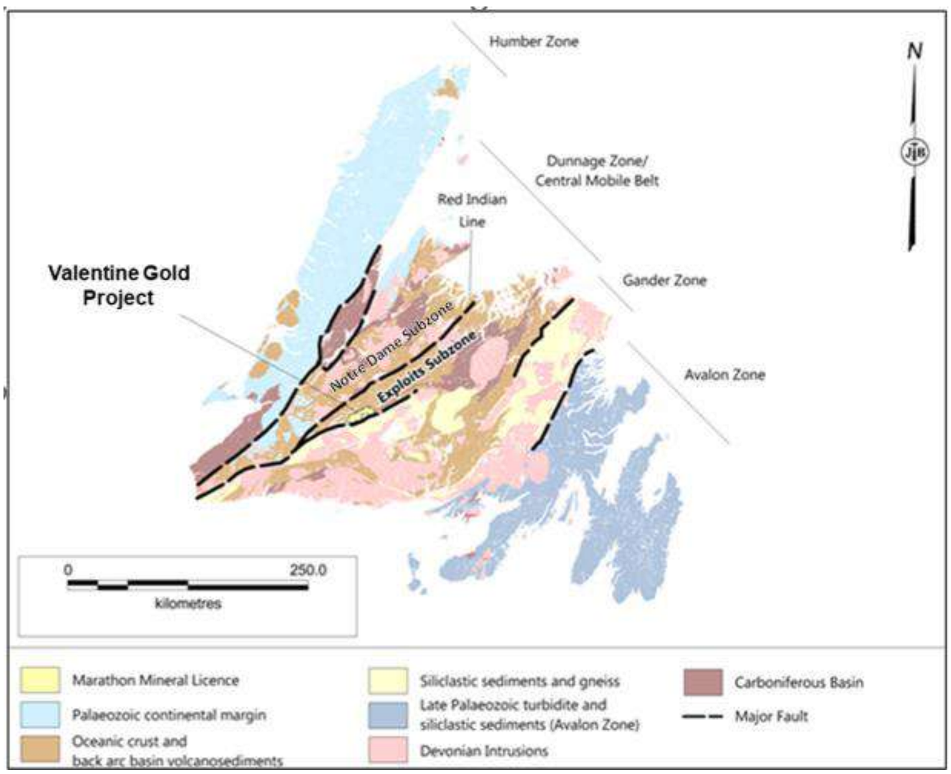
# 7 GEOLOGICAL SETTING AND MINERALIZATION

## 7.1 Geotectonic Setting

The Valentine Lake property is located within the Newfoundland Appalachian system, which displays typical southwest to northeast alignment, and was formed during closure of the Iapetus Ocean in the Cambrian to Ordovician periods, resulting in the accretion of Laurentia and Gondwana (Piercey et al., 2014). The island of Newfoundland is divided into four major tectonostratigraphic zones that are juxtaposed by major regional sutures (see Figure 7-1). The Humber Zone located in the west, is comprised of Palaeozoic sedimentary rocks deposited on the Grenvillian basement of the eastern margins of the Laurentian continent. The Gander Zone in the east is comprised of Ordovician volcano-sedimentary sequences that formed proximal to the Gondwanan continental margin (Coleman-Sadd, 1980; Blackwood, 1982). The Avalon Zone which lies east of the Dover-Hermitage Bay Fault is comprised of Precambrian volcanic and sedimentary rocks (King et al., 1990).

Situated between these two continental margin terranes, the Dunnage Zone comprises a structurally controlled assemblage of ophiolitic and arc to back-arc volcanics, volcaniclastic to epiclastic sedimentary rocks representing remnants of early to middle Palaeozoic oceanic terranes.

**Figure 7-1: Major Tectonic Subdivisions of Newfoundland & Location of Valentine Gold Project**




Source: Modified from Colman-Sadd, Hayes and Knight (2000) and Piercey et al. (2014).

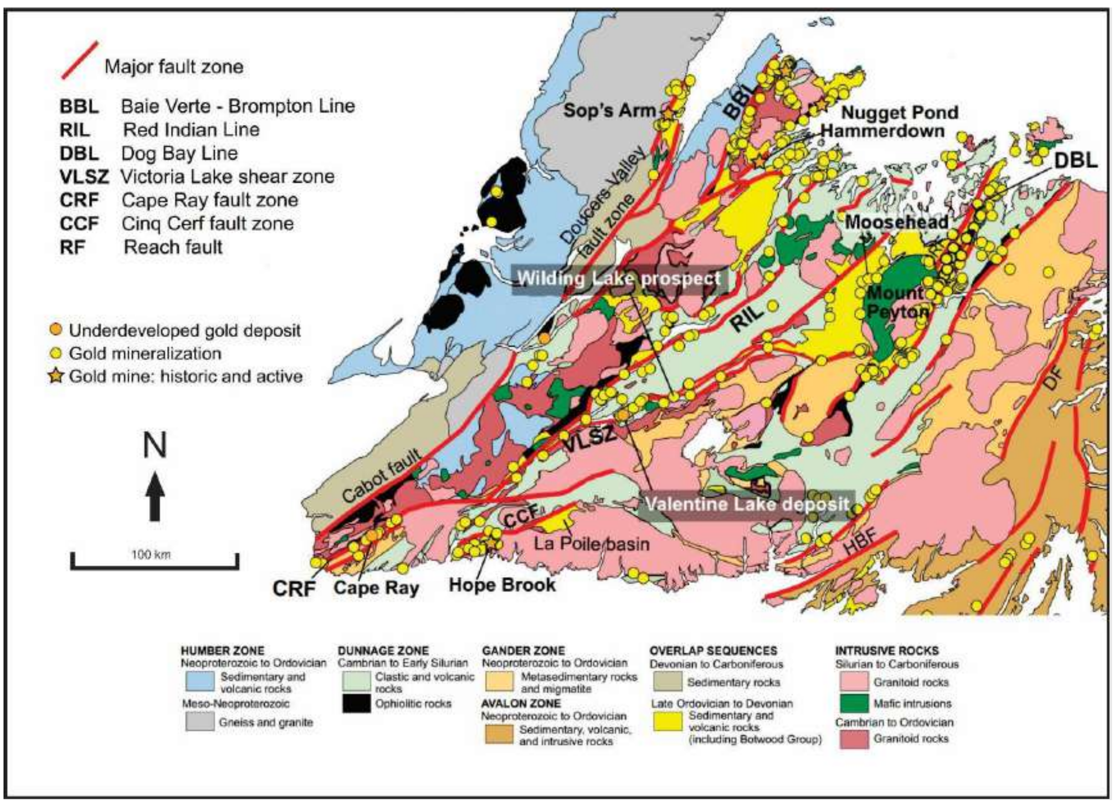
Widespread magmatism and deformation characterize the Appalachian and pre-Appalachian tectonic evolution of the Newfoundland Orogeny. Formation of largescale gold bearing hydrothermal alteration systems accompanied localized magmatism. This system hosts gold systems in both the late Proterozoic and Palaeozoic rocks commonly associated with major crustal structures and range from epithermal, orogenic, sediment hosted and intrusive related deposit types (e.g., Evans, 1993; Tuach et al., 1988; Wardle, 2005).

The Dunnage Zone, host to the Valentine Lake property, is further subdivided into two subzones by the Red Indian Line which represents the major crustal suture zone in this area of the Appalachian Orogen. The Notre Dame Subzone and the Exploits Subzone occur north and south of the Red Indian Line, respectively, and are characterized by island arc volcano-sedimentary sequences and ophiolite lenses that formed during the Middle to Late Ordovician accretion of Cambro-Ordovician rocks associated with the Taconic, and Penobscot orogenies.

Hence, these subzones preserve a complex and protracted record of orogenic accretion and tectonic assembly. The Dunnage Zone was further subjected to later deformation during the Silurian Salinic orogeny and was intruded by Devonian granitoid plutons, and mafic stocks and dykes.

Gold mineralization within the Dunnage Zone occurred coincident with late syn- to post-Salinic orogenic events (Murahwi, 2017) and is typically spatially related to major structural features and proximal to, or hosted within, intrusive bodies. The Dunnage Zone also hosts past producing Buchans and Duck Pond copper-zinc volcanogenic massive sulphide (VMS) deposits and several other VMS occurrences (see Figure 7-2).

**Figure 7-2: Geology, Major Structures & Gold Occurrences in the Central Newfoundland Gold Trend**

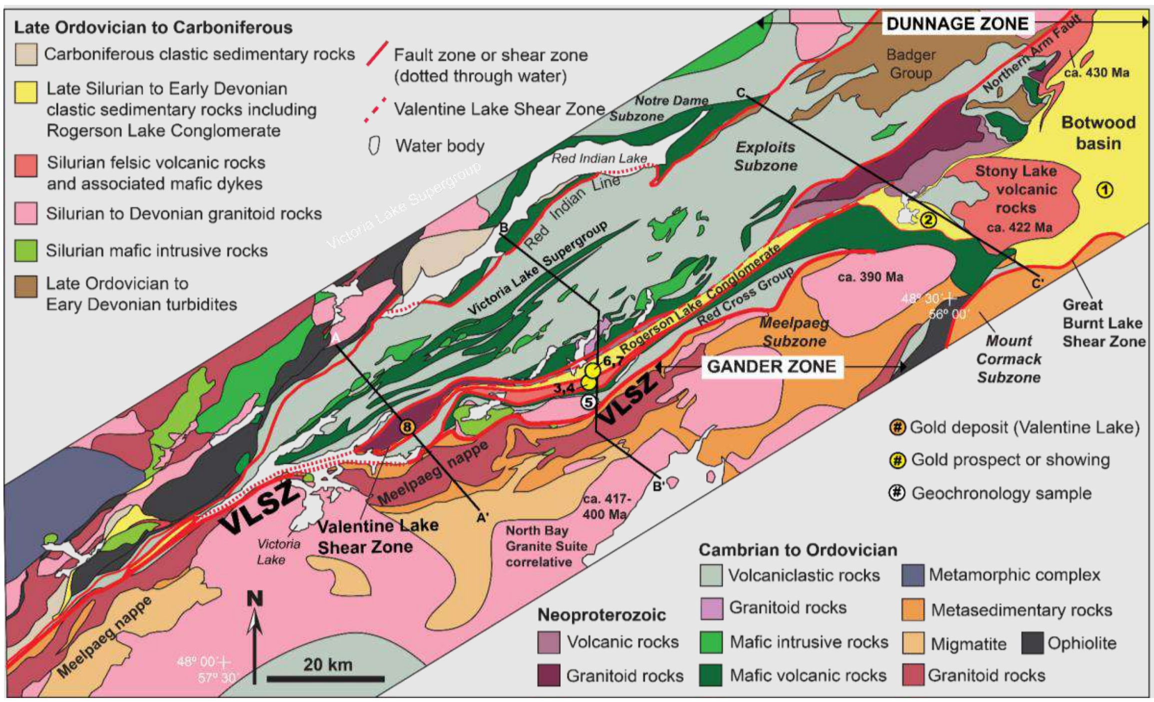



Source: Modified from Honsberger et al., 2020.

## 7.2 Regional Geology

The Valentine Lake property is located within The Victoria Lake Group which constitutes part of the Exploits Subzone of the Dunnage Zone and is composed of mainly low-grade Cambro-Ordovician (513 to 462 Ma; e.g., Rogers et al., 2007) island arc and back arc volcanic, volcaniclastic and epiclastic rocks of the Talley Pond volcanic assemblage (513±2 Ma; Dunning et al., 1991) and the Tulks Hill volcanic assemblage (498 +6/-4 Ma; Evans et al., 1990) (see Figure 7-3). These assemblages are volcanically dominant with one or more sequences of clastic sedimentary rocks. Localized younger Middle Ordovician sedimentary rocks are present (Evans and Kean 2002). These assemblages consist of rocks of varied age and geochemical properties representing various tectonic environments intruded by granodioritic to gabbroic intrusions, metamorphosed to lower greenschist facies and subjected to heterogeneous regional deformation (Evans et al., 1990; Pollack et al., 2002).

**Figure 7-3: Regional Geology of the Valentine Lake Property**




Source: Modified from Honsberger et al., 2020.

Large plutonic bodies on the south-southeast margin of the Victoria Lake Supergroup are significantly older than the volcanic rocks and include the Precambrian Valentine Lake and Crippleback Lake intrusive complexes.

The Victoria Lake Group is bounded to the south- east by the Rogerson Lake Conglomerate and to the north-west by the Middle Ordovician Harbour Round and Sutherlands Pond assemblages (Rogers and van Staal, 2002) and is structurally complex.

The Valentine Lake property occurs within the large multiphase, trondhjemite (566 Ma), quartz-eye porphyry (573 Ma), and gabbroic Valentine Lake Intrusive Complex (VLIC) and forms the structural inlier within the Victoria Lake Group volcano-sedimentary rocks (Layne et al, in preparation). More specifically, the Valentine Lake gold deposits occur proximal to the unconformable contact between two structural domains, the Neoproterozoic VLIC (NW) and the Silurian

Rogerson Lake Conglomerate. These are in contact along a NE-SW lithotectonic boundary of the locally sheared and faulted Valentine Lake Shear Zone (VLSZ), which is documented as exhibiting sinistral reverse transpressive deformation that is corelated with the Salinic (450-423 Ma) Appalachian Orogenic event (vanStaal et al., 2009).

The VLSZ has a kinematic history with multiple pulses of Appalachian orogenesis and exhibits a NW to subvertical dip. At the Valentine Lake property, the Precambrian VLIC forms a rigid inlier that correlates with a structural flexure point in which the overall trend of the VLSZ was deflected.

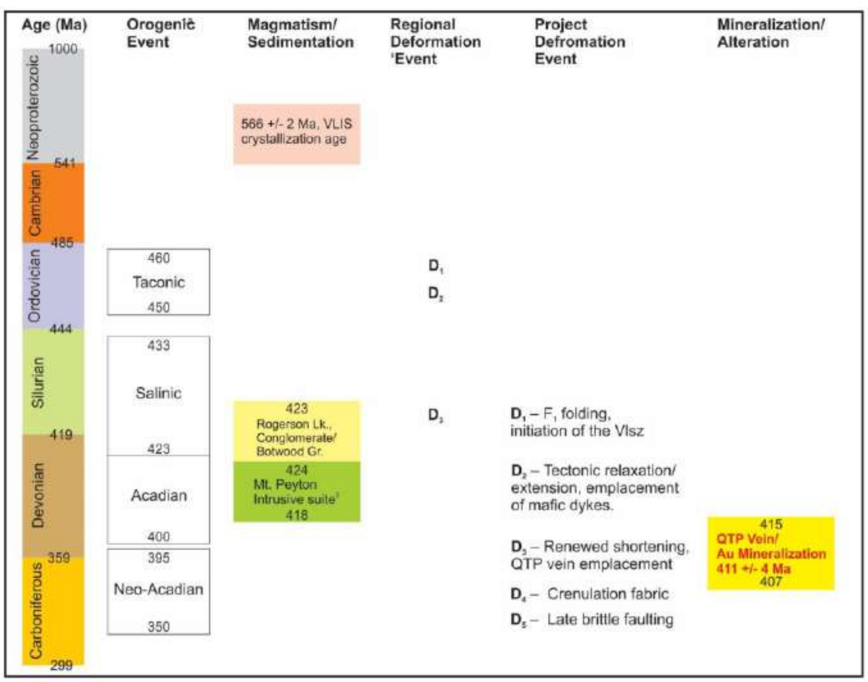
The VLIC predates the surrounding host volcanic and sedimentary rocks which are similar in age to the Roti Bay Granodiorite at Hope Brook (Woods, 2009), and comprises an elongate northeast-trending body of Upper Precambrian igneous rocks ranging from trondhjemitic through to gabbroic and minor pyroxenitic compositions.

The Silurian Rogerson Lake Conglomerate forms a long narrow elongated belt that extends for approximately 160 km and lies southeast margin of the VLIC. Unsorted, pebble- to cobble-sized polymictic conglomerate characterize the unit with layers of finer grained sedimentary sequences.

Regional metamorphism in the Valentine Lake area ranges from lower to upper greenschist facies with the higher grades in the southern portion of the property. Deformation of the VLIC is ductile transitioning to late-stage brittle deformation. Heterogeneous ductile deformation is characteristic of the Rogerson Lake Conglomerate.

Recent project-scale structural investigations by Kruse (2020) for Marathon, and more regionally by Honsberger et al. (2020) and others, has established a geotectonic chronology for the deformation within the project area, within which Kruse (2020) recognizes five phases of deformation (see Figure 7-4).

**Figure 7-4: Regional geochronology of the Dunnage Zone & Valentine Lake Property**



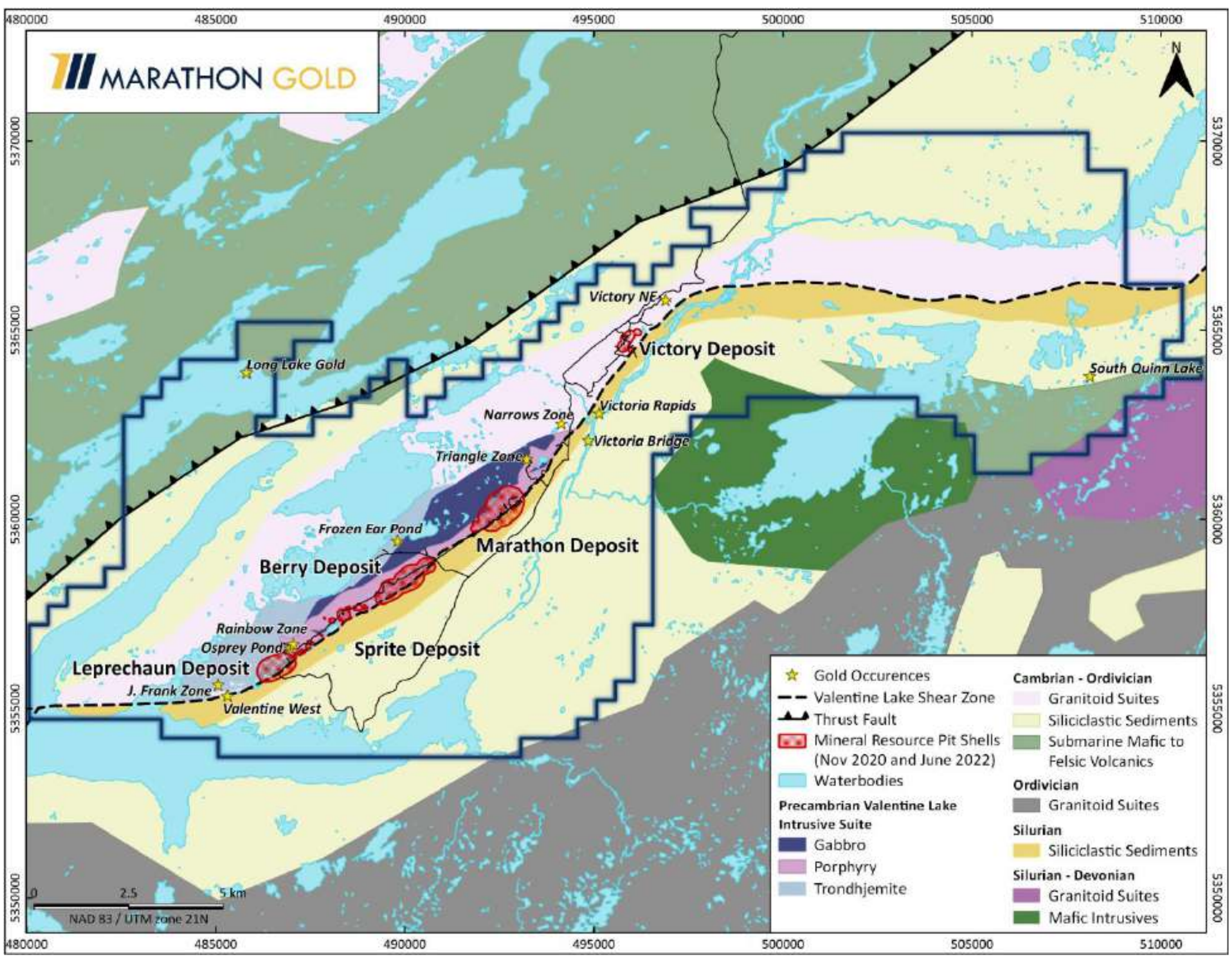

Source: Kruse (2020) and incorporating Barbour (1990), Barrington et al. (2016), Dunning (2017), Honsberger et al. (2020), Sandeman (2017) and van Staal et al. (2009).

A penetrative ductile fabric associated with initiation of the VLSZ and characterized by a strong $S_1$ foliation and $L_1$ stretching lineation is observed in both the Rogerson Lake Conglomerate and in the VLIC, with a southwest strike and steep dip to the northwest, paralleling the larger structure. Gold mineralization is associated with mineralized veining within the VLIC during a $D_3$ phase of renewed crustal shortening following a period of regional $D_2$ relaxation. Overprinting fabrics include a late $D_4$ crenulation fabric and a $D_5$ brittle fault set (Kruse 2020).

## 7.3 Property Geology

The bedrock geology at the Valentine Lake property is comprised of five major lithological units including, from northwest to southeast, the Victoria Lake Supergroup (bimodal volcanic rocks, volcanogenic and siliciclastic sedimentary units), the VLIC, the Rogerson Lake Conglomerate, the Victoria Lake Supergroup metasedimentary units and lesser gabbroic and mafic volcanic rocks and the Red Cross lake intrusion (see Figure 7-5).

**Figure 7-5: Geology & Gold Deposits of the Valentine Gold Project**




Source: Marathon Gold, 2017

The Victoria Lake Supergroup outcropping along the northwest boundary of the Valentine Lake property area consists mainly of low-grade Cambrio-Ordovician volcanic and sequences of clastic sedimentary rocks of the Tulks Hill assemblage. This assemblage represents two packages of bimodal volcanic and clastic sedimentary rocks referred to as the Long Lake volcanic belt and the Tulks sequence of banded to finely laminated siltstone, argillite, and tuffaceous siltstone with minor intercalated mafic tuff. License 020482M covers a portion of the Long Lake volcanic belt and is dominantly underlain by felsic and mafic volcanic rocks. In this area, the Long Lake volcanic belt is underlain by a thick sequence of black graphitic shale which separates the Long Lake volcanic belt from volcaniclastic sedimentary units of the Stanley Waters Formation.

The VLIC hosts all five of Marathon Gold's major gold deposits and numerous early-stage prospects and occurrences on the Valentine Lake property (Figure 7-5). The VLIC is an elongated northeast trending intrusion consisting dominantly of fine- to medium-grained trondhjemite and quartz-eye porphyry with lesser aphanitic quartz porphyry, gabbro and minor pyroxenite units of the Upper Precambrian (Layne et al, in preparation). All intrusive rocks demonstrate varying degrees of sausseritization of plagioclase and strong alteration of mafic minerals to chlorite and epidote. The east end of the VLIC consists of medium- to coarse-grained, equigranular quartz monzonite to monzonite.

Abundant mafic dyke systems on the scale of tens of centimeters to tens of meters thick cut the trondhjemite and quartz porphyry units on a NE-SW orientation and exhibit strong ductile deformation and boudinage.

The Silurian Rogerson Lake Conglomerate forms a narrow linear unit extending NS-SW for 160 km through central Newfoundland, lies unconformably (overturned) on the southeast margin of the VLIC, and is interpreted to have infilled a fault bounded paleo-topographic depression (Kean, 1977; Kean et al., 1982). An unsorted, pebble- to cobble-sized, polymictic conglomerate with interbedded coarse sandstone dominates the unit. A high percentage of the clasts are trondhjemite, quartz porphyry and mafic intrusive rocks of the VLIC. Also common are fine-grained foliated mafic, epidote-quartz, white and red chert, and black, fine-grained sedimentary clasts in a fine-grained, schistose matrix.

The conglomerate has undergone penetrative ductile deformation resulting in a strong NE striking and steep NW dipping to sub-vertical S1 foliation, and most clasts showing strong elongation parallel to the regional penetrative L1 fabric and sinistral rotation.

The Victoria Lake Supergroup outcropping along the southeast boundary of the Valentine Lake property area consists of Ordovician-aged mixed sedimentary, gabbroic, and mafic volcanic sequence. These units have been strongly deformed, resulting in a complex intercalated, tightly folded, boudinaged and sheared package of rocks. Sedimentary units are generally metamorphosed and argillaceous to sandy and/or tuffaceous rocks with minor metaconglomerate and represent the bulk of the sequence. The gabbroic units are generally medium-grained, strongly foliated gabbro, which grades into fine-grained schist. The gabbro and schist are interspersed with pillowed and massive basalt units.

The Red Cross Lake intrusion consists of a mafic phase, comprised of well-layered peridotite and gabbro along with a medium- to coarse-grained granite phase.

The entire project area is overlain by glacial till surficial deposits with thicknesses of between 1 and 5 m, as well as deeper boggy areas and ponds, with only rare bedrock exposures along the ridge and in stream beds.

## 7.4 Structure

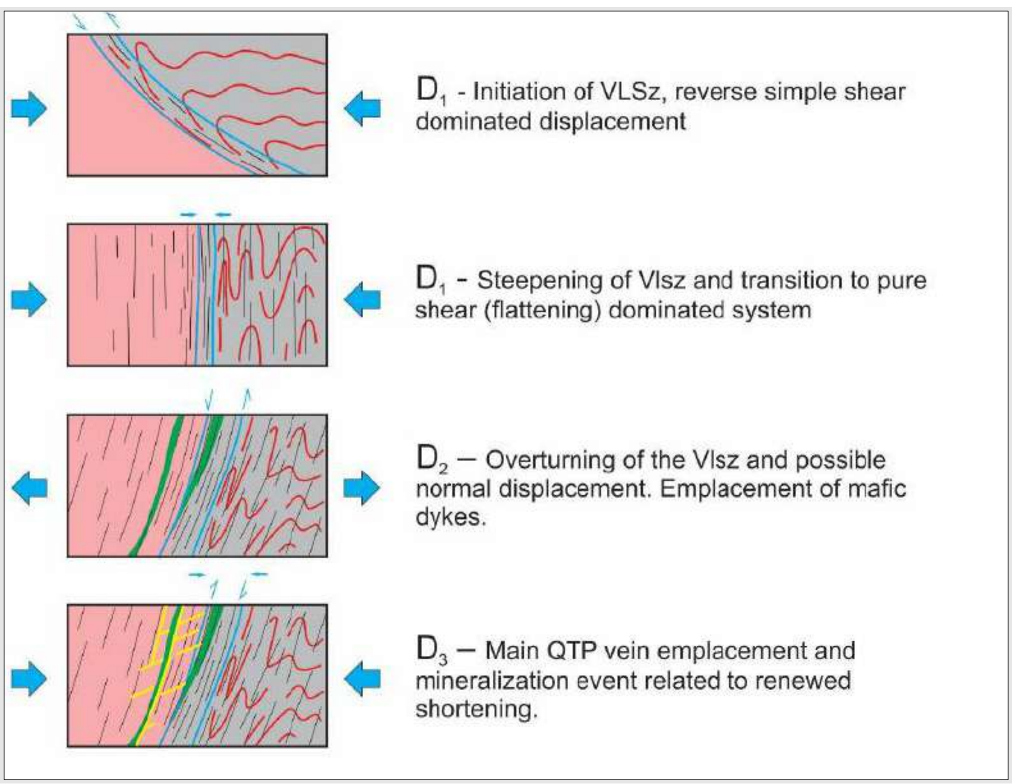
The Valentine Gold Project is one of several structurally hosted gold deposits within the central Newfoundland Dunnage Zone that are associated with the Salinic Appalachian Orogenic event. At the Valentine Lake property, mineralization is associated with deformation across the VLSZ. This large-scale crustal structure is one of several, such as the Cape Ray

Fault, the Dog Bay Line and the Red Indian Line, which are currently the target of broad exploration programs by several gold exploration companies across a large swath of central Newfoundland.

On a property scale, the Valentine gold deposits occur proximal to the VLSZ and the unconformable contact between two structural domains, the Neoproterozoic VLIC, and the Silurian Rogerson Lake Conglomerate. The VLIC is generally characterized by lower strain, brittle-ductile deformation with the Rogerson Lake Conglomerate exhibiting more intense penetrative foliation and shearing. The competency contrast between these two domains and the crustal scale nature of the VLSZ provide an ideal environment for mesothermal fluid flow and the development of gold mineralization within local deformational traps.

On behalf of Marathon, Kruse (2020) developed a kinematic model and deformational history for the property that identified five phases of deformation (see Figure 7-6). In this model the Silurian Rogerson Lake Conglomerate is interpreted as forming in a sedimentary basin bounded to the NW by a listric boundary fault. Onset of Salinic-aged crustal shortening reactivates the main boundary fault as a low angle reverse thrust which is rotated into a steep orientation during a transition to a pure shear dominated flattening phase. This phase of crustal shortening is correlated with the $S_1$ fabrics that dominate the property. The Rogerson Lake Conglomerate exhibits strongly developed $S_1$ penetrative foliation, tight $F_1$ isoclinal folds, and locally preserved $S_0$ bedding (Kruse 2020). Flattened and stretched, primary conglomerate clasts are indicative of the pure shear regime. Within the intrusive rocks of the VLIC, $S_1$ is manifested as a spaced fracture cleavage.

**Figure 7-6: Phases of Deformation shown by Northwest-Southeast Oriented Section**




Notes: This schematic illustrates the kinematic evolution of the VLSZ along the boundary of the VLIS (pink) and Rogerson Lake Conglomerate LC (grey). The red lines represent the trace of bedding ($S_0$) and black lines represent the $S_1$ foliation. Source: Kruse, 2020.

A period of relaxation during shortening and lithospheric extension ($D_2$) is evidenced by the suite of mafic dykes intruded within the VLIC and locally within the Rogerson Lake Conglomerate. This extensional event is further evidenced by the late Silurian magmatism of the gold-mineralized Windsor Point Group in the Cape Ray deposit area, and the contemporaneous Mount Peyton Intrusive suite (dated at 424-418 Ma; Sandeman et al., 2017). Accordingly, the $D_2$ extensional event occurred before the Acadian Orogeny. At the Valentine Lake property, two sets of mafic dykes are associated with this event: a WSW-SW striking main set parallel to the main $S_1$ foliation and the VLSZ, and dipping to the NW. A second, subordinate set, oriented at a high angle to the first set in a “ladder rung” pattern, have shorter strike extent and are strongly folded. Larger (>1m) dykes are commonly sheared at their contacts and undeformed internally. The dykes are rheologically weak compared to the host granitoid rocks of the VLIC.

Mineralization of quartz-tourmaline-pyrite-Au (QTP-Au) veins are associated with a renewed $D_3$ shortening phase correlated with the late Acadian Orogeny. Recent geochronological studies by Honsberger et al., (2020) suggest a main pulse of hydrothermal gold mineralization between 415 Ma and 407 Ma. Up to three separate QTP-Au vein sets – defined as a distinct zone of QTP-Au veining and mineralization – are recognized at the Marathon and Leprechaun deposit areas. Up to four separate QTP-Au vein sets occur at the Berry deposit. Previous descriptions of these QTP-Au vein sets (Robert and Poulsen, 2001) has described the first two as “extensional” and “shear” respectively based on the orientation of the veins to the $S_1$ foliation and in the parlance of the classic shear zone hosted gold deposit model. All three vein sets are observable in outcrop and drill core within the granitoid rocks of the VLIC, but the Set 1 extensional veins, dipping at a low angle to the SW, are the dominant set associated with the bulk of gold mineralization. These vein sets are described further in Section 7.5.

Finally, additional brittle-ductile to fully brittle fabrics and structures ($D_4$ and $D_5$) occurred post-mineralization and are associated with late Acadian to Neo-Acadian deformation. The first of these is a broad crenulation fabric and the latter a brittle fault set. Neither of these later deformational events impact the deposit-scale development of gold mineralization, other than the potential for $D_5$ structures to locally create fault offsets in areas of $D_3$ vein development.

## 7.5 Mineralization

Gold mineralization at the Valentine Lake property is developed within QTP-Au vein sets associated with $D_3$ extensional and shear deformation within granitoid rocks of the VLIC in contact with the Rogerson Lake conglomerate across the NE-SW oriented VLSZ (Kruse, 2020).

The QTP-Au veins are identified in prospecting samples, outcrop, trenching and drilling at numerous locations long the 32 km strike extent of the VLIC and VLSZ within the Valentine Lake property. Significant QTP-Au veining occurs dominantly within the trondhjemite, quartz-eye porphyry and to a lesser degree, mafic dyke units along and proximal to the sheared contact with the Rogerson Lake Conglomerate. Minor amounts of gold-bearing QTP veining extend across the VLSZ contact and into the Rogerson Lake Conglomerate. Gold-bearing QTP veining is also exposed in the VLIC at 500 m and 1000 m from the VLIC-conglomerate contact at the Steve Zone and Scott Zones, respectively. All the gold occurrences share similar general mineralogical characteristics, with coarse gold mineralization occurring predominantly within the quartz-tourmaline-pyrite veins, and lesser amounts in alteration selvages. Visible gold is common.

Individual QTP-Au veins range in thickness from a few millimeters and centimeters to meters but are typically 2 to 30 cm thick. QTP-Au veins developed within brittle extensional fractures and dipping at a low angle to the SW (Set 1 veins) represent the dominant structural control on mineralization at the property and within the mineral resource models for each of the Marathon, Leprechaun, Sprite, Victory and Berry deposits.

The gold mineralization at the Valentine Lake property occurs as structurally controlled, orogenic gold deposits consisting dominantly of en-echelon stacked SW dipping extensional QTP-Au vein sets (Set 1) and lesser shear parallel QTP-Au vein sets (Set 2) proximal to the VLSZ. This style of mineralization occurs intermittently along the defined strike length of the main gold zone in which a series of deposits and occurrences have been, and continue to be, discovered. Discoveries to date include the Marathon, Leprechaun, Sprite, Victory and Berry gold deposits, and the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW and Victory NE occurrences.

At the deposit scale, a pervasively altered, intensely QTP veined core complex, which is referred to by Marathon Gold as the "Main Zone", has been delineated at the Marathon, Leprechaun and Berry deposits. The Main Zones of the Marathon and Leprechaun deposits are well defined by thorough outcrop investigation and densely spaced subsurface drillhole information. At Leprechaun, the Main Zone transitions into the associated hanging wall and footwall mineralization. Further exploration work is required at the other deposits and occurrences to determine if the Main Zone model is present at these locales. A field based structural study (Kruse, 2020) followed by a program of optical televiewer analysis of oriented drill core (Kruse and Bartsch, 2021) has provided recent, comprehensive structural data on the orientation and frequency of up to three vein sets at the Leprechaun and Marathon gold deposits and up to four vein sets at the Berry deposit.

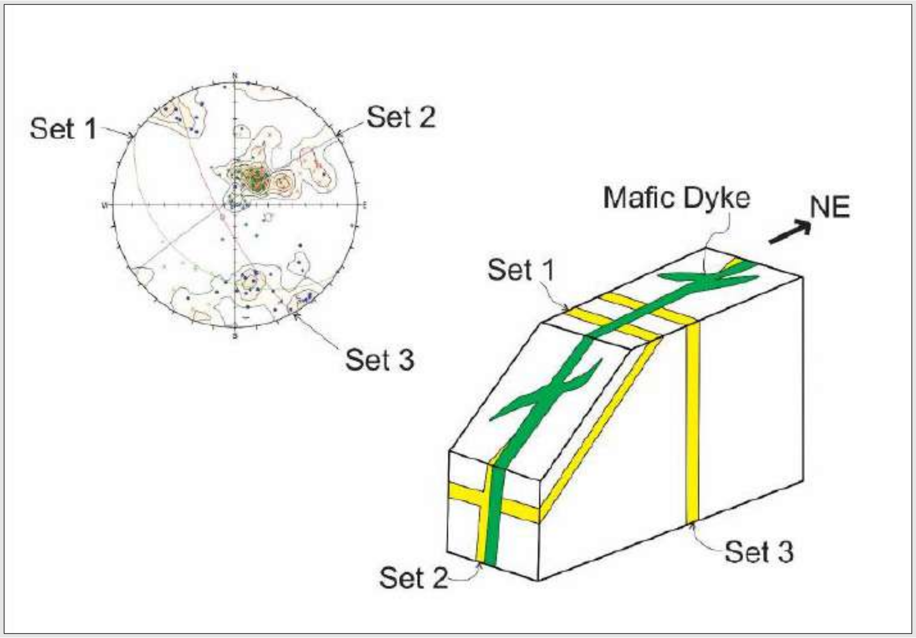
A schematic model of the QTP-Au vein sets and their geometrical relationship with mafic dykes is presented in Figure 7-7 and include:

- Set 1 QTP-Au veins occur as uniformly shallow southwest dipping, en-echelon arrays orientated at high angle to the regional penetrative S1 foliation and cleavage fracture, (Figure 7 7).
- Lesser Set 2 QTP-Au veins are steeply northwest dipping to subvertical, parallel the regional S1 shear fabric, and commonly developed at contacts with mafic dykes or as localized zones of intense stockwork veining.
- Rare Set 3 QTP-Au veins are steeply dipping with a NW-SE orientation orthogonal to the strike of the S1 foliation (Kruse, 2020).
- At the Berry deposit, a fourth vein set has been identified with a very low angle dip to the NNE (Kruse and Bartsch, 2021). Each vein set is mineralized, with a strong dominance in frequency of occurrence and gold content exhibited by Set 1.

The Set 1 extensional and Set 2 shear-parallel QTP-Au veins are up to 1.5 m thick and have been traced in trenched outcrop exposures for over 280 m of continuous strike length; however, the observed strike length of individual veins is typically in the range of meters to tens of centimeters (see Figures 7-8 to 7-11).

The visible gold in QTP veining occurs as grains, ranging in size from <0.1 mm and up to 1-2 mm, hosted by quartz, tourmaline masses, within and along the margins of pyrite, or associated with minor tellurides. Highest gold grades are commonly associated with large (1-3 cm), euhedral and occasionally subhedral pyrite in QTP veining. In weathered surfaces, the gold is observed in limonite patches derived from weathering of the pyrite (Barbour, 1999). Other sporadically observed sulphides, in decreasing order of abundance, include chalcopyrite, pyrrhotite, sphalerite and galena. These minerals form minor components to the overall mineralization.

**Figure 7-7: Schematic Illustration of the Geometrical Relationship between Mafic Dykes and Veins**




Source: Kruse, 2020.

**Figure 7-8: Sheeted, Shallow Southwest-Dipping Quartz Tourmaline Pyrite Vein Array (Set 1), Marathon Deposit**

**Figure 7-9: Gold-bearing Quartz-Tourmaline-Pyrite Veins at the Frank Zone**

**Figure 7-10: Stockwork Quartz Tourmaline Pyrite Veins Hosted in Strongly Sericite-Silica Altered Quartz Porphyry, Marathon Deposit**

**Figure 7-11: Field Relationship Between Set 1 (Extensional) and Set 2 (Shear Parallel) Veins, Leprechaun Deposit**


Source for the above photos: Marathon Gold, 2021.

In addition to structural studies, the relationship between high-grade gold mineralization and the location of the dykes supports the theory that the mafic dykes provide a rheologic contrast that (1) promotes brittle fracturing of the granitoid unit and therefore, acts as a controlling factor of mineralized fluid flow, and (2) incites the eventual emplacement of zones of gold enrichment.

The individual characteristics of mineralization at the Marathon, Leprechaun and Berry deposits are described below. The information in the following sections is summarized from Murahwi (2017), Dunsworth et al. (2017), and Capps and Dunsworth (2019). Downhole surveys were conducted on all drillholes, and the azimuth and dip were measured at varying intervals such that the drillholes could be plotted in real space. Measurements were typically taken every 25 m for holes drilled prior to 2019 and every 2 to 5 m for anything drilled during 2019 or later. Consequently, the relationship between the sample length and the true thickness of the mineralization is well documented and all assay sample intervals are given as core length unless noted as true thickness.

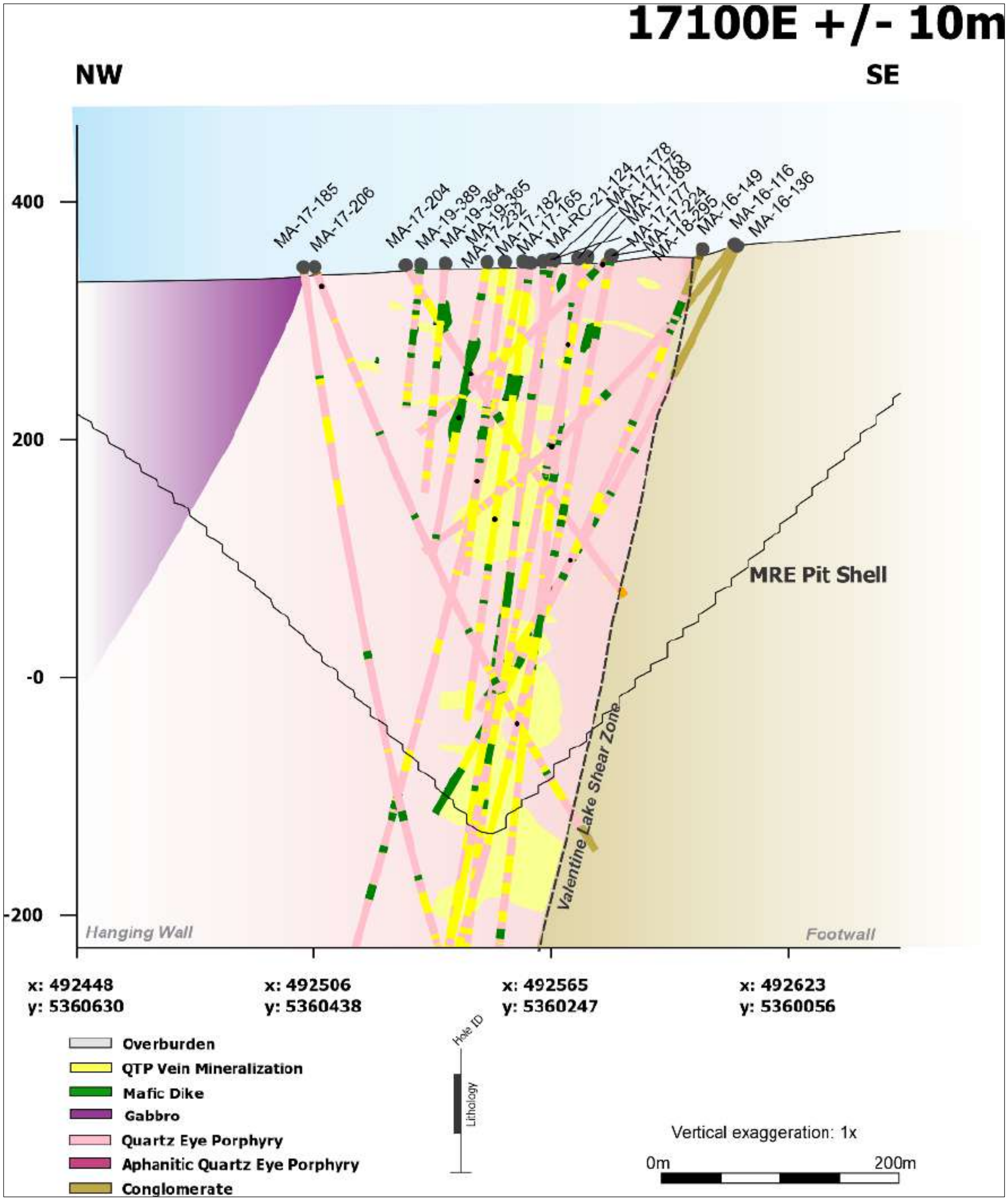
## 7.6 Marathon Deposit

The Marathon deposit is located 6 km northeast of the Leprechaun deposit and consists dominantly of shallow, southwest-dipping en-echelon stacked QTP gold veins that intrude dominantly quartz-porphyry and lesser aphanitic quartz-porphyry and mafic dykes of the VLIC. The gold-bearing QTP veining occurs up to 250 m to the northwest of the VLSZ.

The Main Zone of gold-bearing QTP veining forms a northeast-trending sub-vertical mineralized corridor of intense QTP gold veining that ranges between 50 to 200 m in width, occurs over a strike length of more than 1.5 km, and has been observed in outcrop and drill-observed to a downhole depth of 1,000 m (Dunsworth, et al.; 2017; see Figure 7-12).

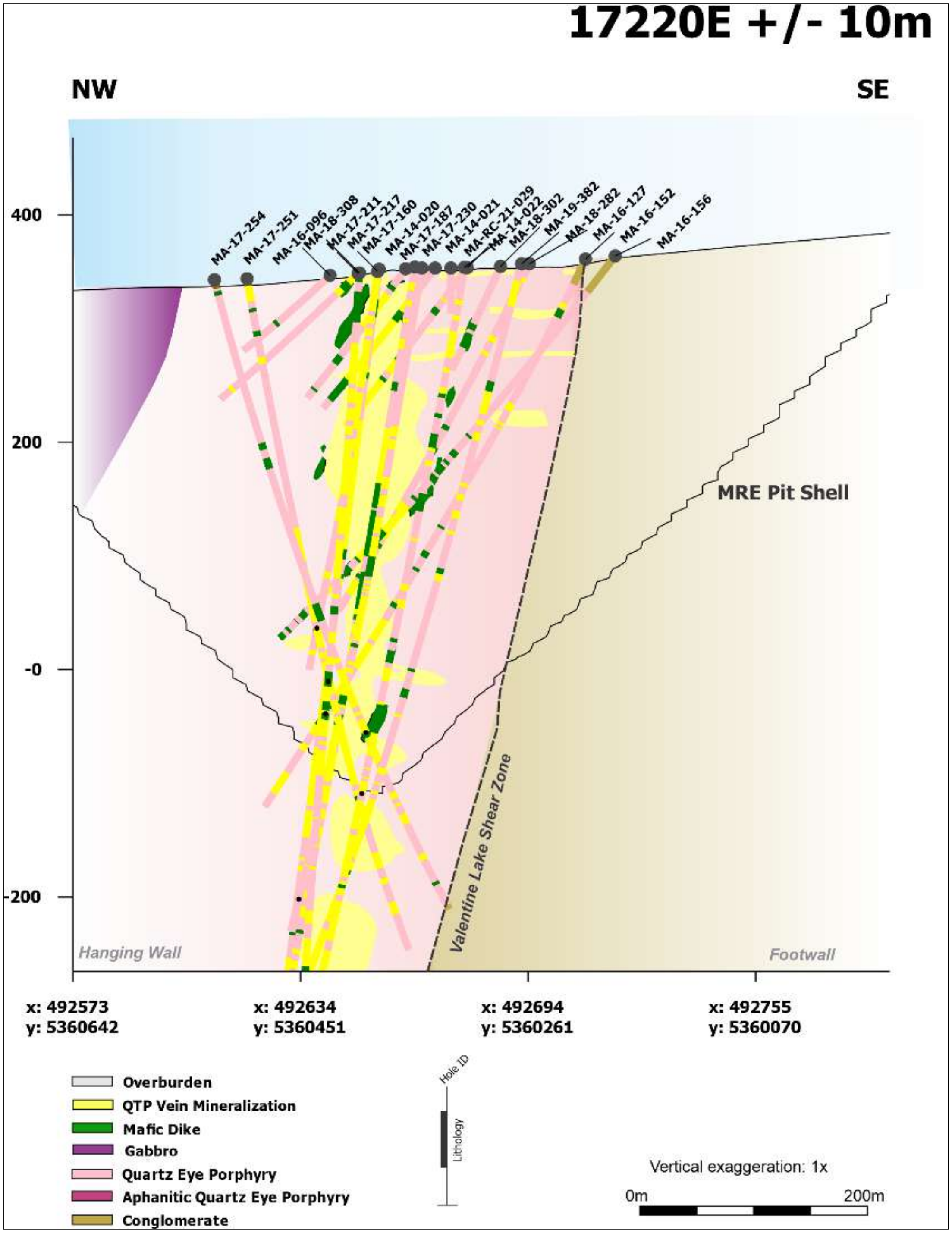
The Main Zone contains a lenticular series of shallow, SW-dipping, gold-bearing QTP veining and is open at depth. Figure 7-13 highlights select gold grade intervals within the gold-bearing QTP veining. Characteristic gold intervals from drillholes that penetrated downward at high angle through the shallow, SW-dipping, en-echelon stacked QTP-Au vein swarms of the Marathon deposit are presented in Table 7-1.

**Figure 7-12: Section 17100 Showing Geology of the Marathon Deposit**




Note: Elevation in 200 m Increments. Source: Marathon Gold, 2022.

**Figure 7-13: Section 17260 E showing the Geology & Mineralized Zones of Quartz-Tourmaline-Pyrite-Gold-Bearing Veins at the Marathon Deposit**




Source: Marathon Gold, 2022.

**Table 7.1: Selection of Significant Fire Assay Gold Intervals, Marathon Deposit**

| DDH | Section | Az | Dip | From | To | Core Length (m) | True Thickness (m) | Gold g/t (Uncut) | Gold g/t (Cut) |
|---|---|---|---|---|---|---|---|---|---|
| **MA-19-442** | 16750 | 343 | -87 | 168 | 220 | 52 | 49.4 | 2.17 | |
| including | | | | 215 | 220 | 5 | 4.8 | 7.14 | |
| **MA-19-372** | 17220 | 345 | -80 | 17 | 62 | 45 | 42.8 | 3.52 | 3.48 |
| including | | | | 30 | 34 | 4 | 3.8 | 14.25 | 13.90 |
| **MA-18-303** | 17350 | 163 | -85 | 100 | 249 | 149 | 141.6 | 1.54 | |
| including | | | | 129 | 134 | 5 | 4.8 | 6.60 | |
| including | | | | 185 | 191 | 6 | 5.7 | 6.35 | |
| **MA-18-295** | 17110 | 343 | -79 | 437 | 496 | 59 | 56.1 | 7.97 | 4.13 |
| including | | | | 489 | 494 | 5 | 4.8 | 57.74 | 22.11 |
| **MA-17-239** | 17260 | 343 | -61 | 183 | 282 | 99 | 79.2 | 1.85 | |
| included | | | | 183 | 189 | 6 | 4.8 | 10.42 | |
| **MA-17-220** | 17260 | 342 | -82 | 6 | 227 | 221 | 210.0 | 1.32 | |
| including | | | | 15 | 22 | 7 | 6.7 | 3.37 | |
| including | | | | 140 | 150 | 10 | 9.5 | 3.18 | |
| **MA-17-218** | 17210 | 344 | -82 | 4 | 213 | 209 | 198.6 | 1.36 | |
| including | | | | 4 | 32 | 28 | 26.6 | 3.63 | |
| **MA-17-217** | 17230 | 340 | -82 | 24 | 195 | 171 | 162.5 | 1.51 | 1.49 |
| including | | | | 51 | 63 | 12 | 11.4 | 4.68 | |
| **MA-17-213** | 17160 | 334 | -83 | 17 | 242 | 225 | 213.8 | 1.88 | |
| including | | | | 17 | 42 | 25 | 23.8 | 3.38 | |
| including | | | | 171 | 196 | 25 | 23.8 | 4.87 | |
| **MA-17-188** | 17190 | 343 | -80 | 21 | 347 | 326 | 309.7 | 2.13 | |
| including | | | | 78 | 139 | 61 | 58.0 | 3.36 | |
| including | | | | 209 | 241 | 32 | 30.4 | 4.04 | |
| including | | | | 317 | 339 | 22 | 20.9 | 3.18 | |
| **MA-17-186** | 17330 | 342 | -82 | 195 | 386 | 191 | 181.5 | 1.61 | |
| including | | | | 279 | 306 | 27 | 25.7 | 3.16 | |
| **MA-17-176** | 17330 | 343 | -81 | 141 | 259 | 118 | 112.1 | 1.56 | |
| including | | | | 204 | 226 | 22 | 20.9 | 3.58 | |
| **MA-17-162** | 17170 | 343 | -82 | 35 | 160 | 125 | 118.75 | 2.12 | |
| including | | | | 109 | 125 | 16 | 15.2 | 4.34 | |
| | | | | 210 | 253 | 43 | 40.9 | 4.18 | 4.08 |
| including | | | | 239 | 244 | 5 | 4.8 | 9.11 | |
| **MA-17-160** | 17270 | 343 | -82 | 134 | 209 | 75 | 71.3 | 3.92 | 2.29 |
| including | | | | 183 | 188 | 5 | 4.8 | 33.4 | 8.96 |
| **MA-17-159** | 17240 | 343 | -82 | 88 | 138 | 50 | 47.5 | 3.43 | 2.30 |
| including | | | | 131 | 138 | 7 | 6.7 | 15.36 | 7.24 |
| | | | | 161 | 211 | 50 | 47.5 | 2.57 | |
| including | | | | 161 | 173 | 12 | 11.4 | 6.10 | |

Note: Assays cut to 30 g/t Au.

At present, the peripheries of the Marathon deposit mineralized zone are relatively poorly defined, with a preliminarily observed outward gradational decrease in quartz vein density northwest and southeast from the central, dense vein zone. Limited drilling on the northeast and southwest margins suggest that deposit is cut-off at surface in these directions, but with high grade intercepts at depth suggesting potential continuity of mineralization below surface.

## 7.7 Leprechaun Deposit

The Leprechaun deposit consists of QTP gold-bearing extensional and lesser shear parallel veins that intrude the variably sheared and fractured trondhjemite, as well as sheared mafic dykes of the VLIC.

Mineralization at Leprechaun occurs over a strike length of greater than 900 m and has been identified at surface in outcrop in drilling at depths of up to 400 m. The Leprechaun deposit differs from the Marathon deposit in the relatively tight concentration of mineralization in Main Zone type configurations of en-echelon stacked QTP-Au vein sets. These Main Zones range from 30 to 120 m wide, dip to the northwest, and are located proximal to the VLSZ contact within the VLIC trondhjemite. In the characteristic fashion, the dominant en-echelon stacked, southwest-dipping extensional QTP-Au (Set 1) veins occur at high angle to the penetrative regional L1 stretching lineation, while the lesser shear parallel QTP-Au veins strike subparallel to slightly oblique to the VLSZ (Dunsworth, 2011; Dunsworth et al. 2017; Lincoln et al., 2018a, 2018b). Set 1 extensional QTP-Au veins at Leprechaun appear to have a moderately steeper SW dip than at Marathon (Kruse and Bartsch, 2021).

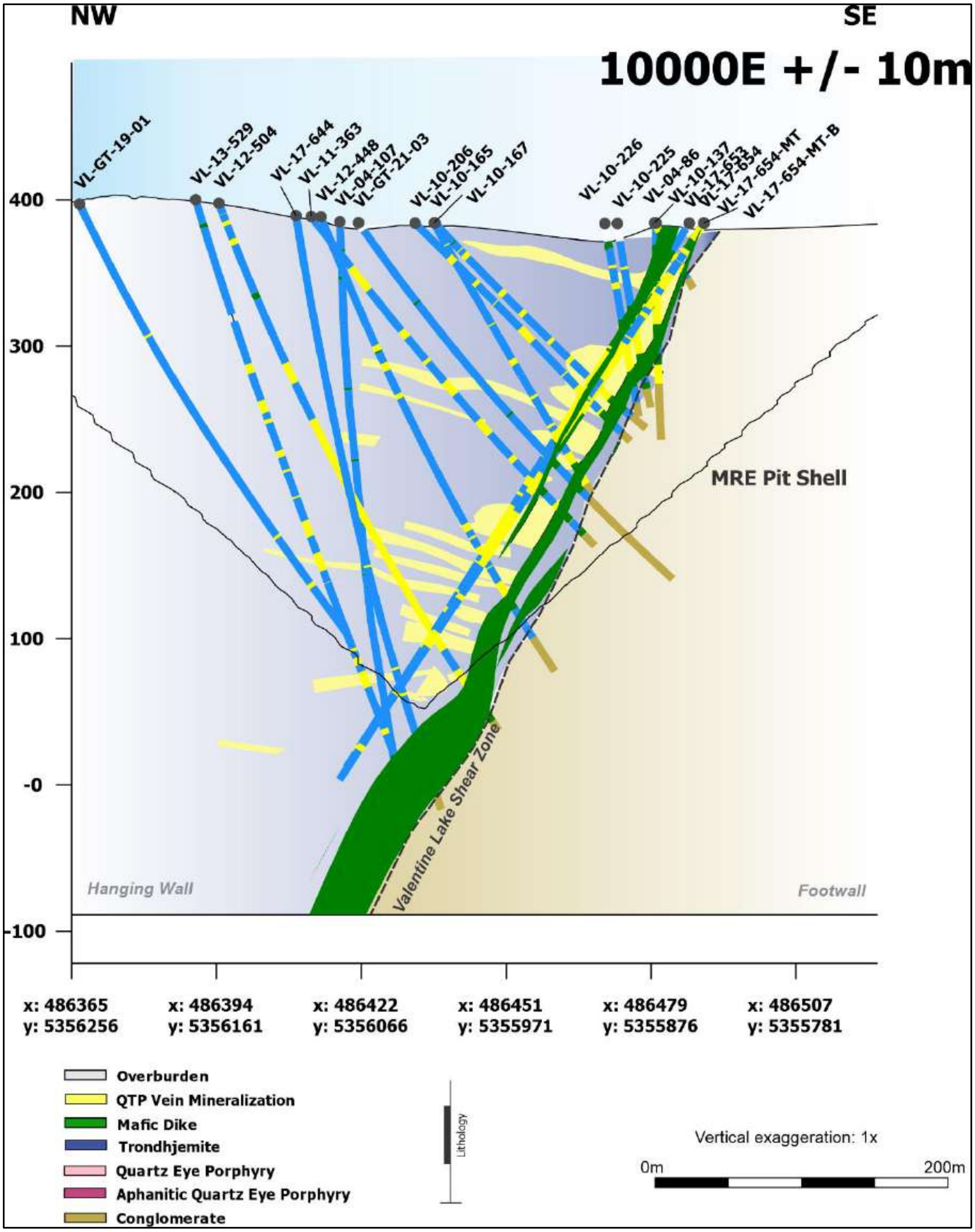
The QTP-Au mineralization at Leprechaun has been modelled in three zones from west to east: Hanging Wall Zone, Main Zone and Footwall Zone (Lincoln et al., 2018; see Figure 7-14). The Main Zone is open at depth and is constrained to the southeast by the VLSZ (Figure 7-15) with a gradational transition to the Hanging Wall to the northwest. A high-grade central core exists within the Main Zone, bounded by mafic dykes to the northwest and the Rogerson Lake Conglomerate to the southeast, forming a lenticular body of dense QTP veining open at depth.

The Hanging Wall Zone occurs transitionally west of the Main Zone and consists of a series of variably shallow to moderately dipping, stacked en-echelon extensional QTP tension gashes with minor steeper-dipping QTP veins that extend up to 350 m northwest into the hanging wall. The vein density and concentration of vein arrays increases toward the east, proximal to the Main Zone, and remains open to the northwest.

The Footwall Zone is a minor component of the Leprechaun deposit and comprises localized extensional QTP veins that extend into the structurally underlying Rogerson Lake Conglomerate. Toward the southern part of the deposit, the Main Zone appears to peel slightly further away from the fault contact which spatially coincides with a marked increase in the volume of wide, discontinuous mafic dykes observed near the contact in this area. The gold-bearing mineralizing fluids appear to have localized flooding along the mafic dyke contacts and regular breaching and brecciation within.

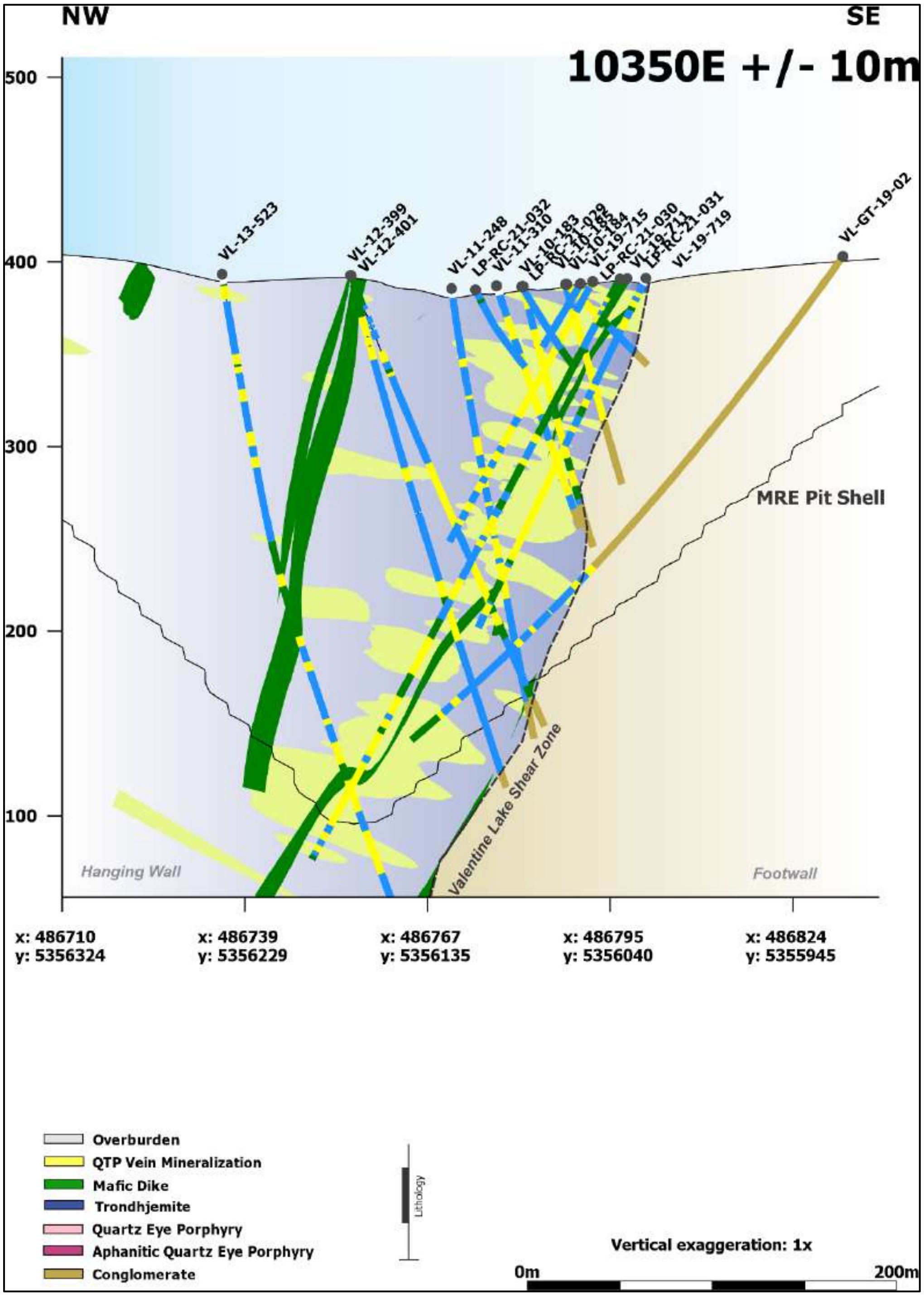
The QTP-Au mineralization at Leprechaun occurs as visible gold grains, up to 2 mm in size, occurring in quartz and along the margins as well as within tourmaline masses and pyrite. A selection of significant gold intervals from drillholes that penetrated downward at high angle through the en-echelon stacked QTP-Au vein swarms of the Leprechaun deposit are presented in Table 7-2.

**Figure 7-14: Section 10000 Showing Geology of the Leprechaun Deposit**




Source: Marathon Gold, 2022.

**Figure 7-15: Section 10350 E showing the Geology & Mineralized Zones of Quartz-Tourmaline-Pyrite-Gold-Bearing Veins at the Leprechaun Deposit**




Source: Marathon Gold, 2022.

**Table 7.2: Selection of Significant Fire Assay Gold Intervals, Leprechaun Deposit**

| DDH | Section | Azimuth | Dip | From (m) | To (m) | Core Length (m) | Gold g/t (Uncut) | Gold g/t (Cut) |
|---|---|---|---|---|---|---|---|---|
| VL-10-165 | 10000 | 162.6 | -45 | 164 | 173 | 9 | 13.4 | |
| VL-10-225 | 10012 | 169 | -80 | 64 | 91 | 19 | 6.53 | |
| VL-10-226 | 10000 | 164.5 | -80 | 78 | 103 | 17 | 6.94 | |
| VL-10-226 | 10000 | 164.5 | -80 | 90 | 103 | 13 | 11.81 | |
| VL-11-246 | 10513 | 161 | -72 | 79 | 146 | 37.5 | 3.75 | |
| VL-11-261 | 10538 | 165 | -48 | 167 | 183 | 12.8 | 9.68 | |
| VL-11-288 | 10500 | 165 | -75 | 155 | 237 | 65.6 | 2.09 | |
| VL-11-306 | 9938 | 160 | -54 | 196 | 210 | 13.3 | 16.15 | |
| VL-11-352 | 10288 | 161 | -45 | 136 | 165 | 26.1 | 13.95 | |
| VL-12-401 | 10350 | 164 | -75 | 176 | 206 | 30 | 3.93 | |
| VL-12-403 | 10175 | 164 | -57 | 210 | 232 | 22 | 7.23 | |
| VL-12-407 | 10125 | 164 | -62 | 289 | 304 | 15 | 9.19 | |
| VL-12-408 | 10000 | 160 | -42 | 153 | 172 | 19 | 13.81 | |
| VL-12-416 | 9988 | 163 | -30 | 52 | 60 | 8 | 15.8 | |
| VL-12-465 | 10100 | 161 | -63 | 328 | 341 | 13 | 13.2 | |
| VL-12-504 | 10010 | 161 | -71 | 314 | 321 | 7 | 45.58 | |
| VL-13-523 | 10360 | 162 | -81 | 261 | 264 | 3 | 52.73 | |
| VL-13-526 | 9960 | 163 | -70 | 228 | 264 | 36 | 4.26 | |
| VL-13-537 | 10080 | 164 | -63 | 268 | 271 | 3 | 39.55 | |
| VL-17-653 | 10000 | 342 | -58 | 102 | 283 | 181 | 3.42 | 3.17 |
| VL-17-654 | 10000 | 340 | -57 | 6 | 307 | 301 | 2.65 | 2.63 |
| VL-17-655 | 10120 | 342 | -59 | 280 | 431 | 151 | 2.34 | |
| VL-17-656 | 10250 | 341 | -55 | 69 | 76 | 7 | 19.01 | |
| VL-17-656 | 10250 | 341 | -55 | 3 | 36 | 33 | 3.72 | |
| VL-19-679 | 10060 | 341 | -61 | 8 | 14 | 6 | 25.78 | 8.69 |
| VL-19-679 | 10060 | 341 | -61 | 152 | 174 | 22 | 9.02 | 7.55 |
| VL-19-679 | 10060 | 341 | -61 | 189 | 211 | 22 | 11.83 | 8.95 |
| VL-19-680 | 10080 | 344 | -59 | 21 | 92 | 71 | 2.52 | |
| VL-19-681 | 10100 | 344 | -59 | 179 | 305 | 126 | 4.27 | |
| VL-19-681 | 10100 | 344 | -59 | 334 | 376 | 42 | 4.11 | |
| VL-19-686 | 10040 | 344 | -61 | 246 | 399 | 153 | 3.02 | |
| VL-19-688 | 9960 | 342 | -55 | 245 | 275 | 30 | 5.06 | |
| VL-19-688 | 9960 | 342 | -55 | 299 | 323 | 24 | 5.04 | |
| VL-19-695 | 10020 | 343 | -63 | 42 | 140 | 98 | 2.41 | |
| VL-19-697 | 9940 | 344 | -60 | 169 | 205 | 36 | 5.45 | |
| VL-19-700 | 10190 | 344 | -65 | 62 | 91 | 29 | 4.39 | |
| VL-19-703 | 10280 | 342 | -59 | 52 | 71 | 19 | 10.03 | |
| VL-19-711 | 10350 | 345 | -62 | 256 | 330 | 74 | 4.24 | |
| VL-19-711 | 10350 | 345 | -62 | 219 | 243 | 24 | 6.94 | |
| VL-19-719 | 10350 | 343 | -64 | 99 | 140 | 41 | 4.49 | |

Note: Assays cut to 30 g/t Au.

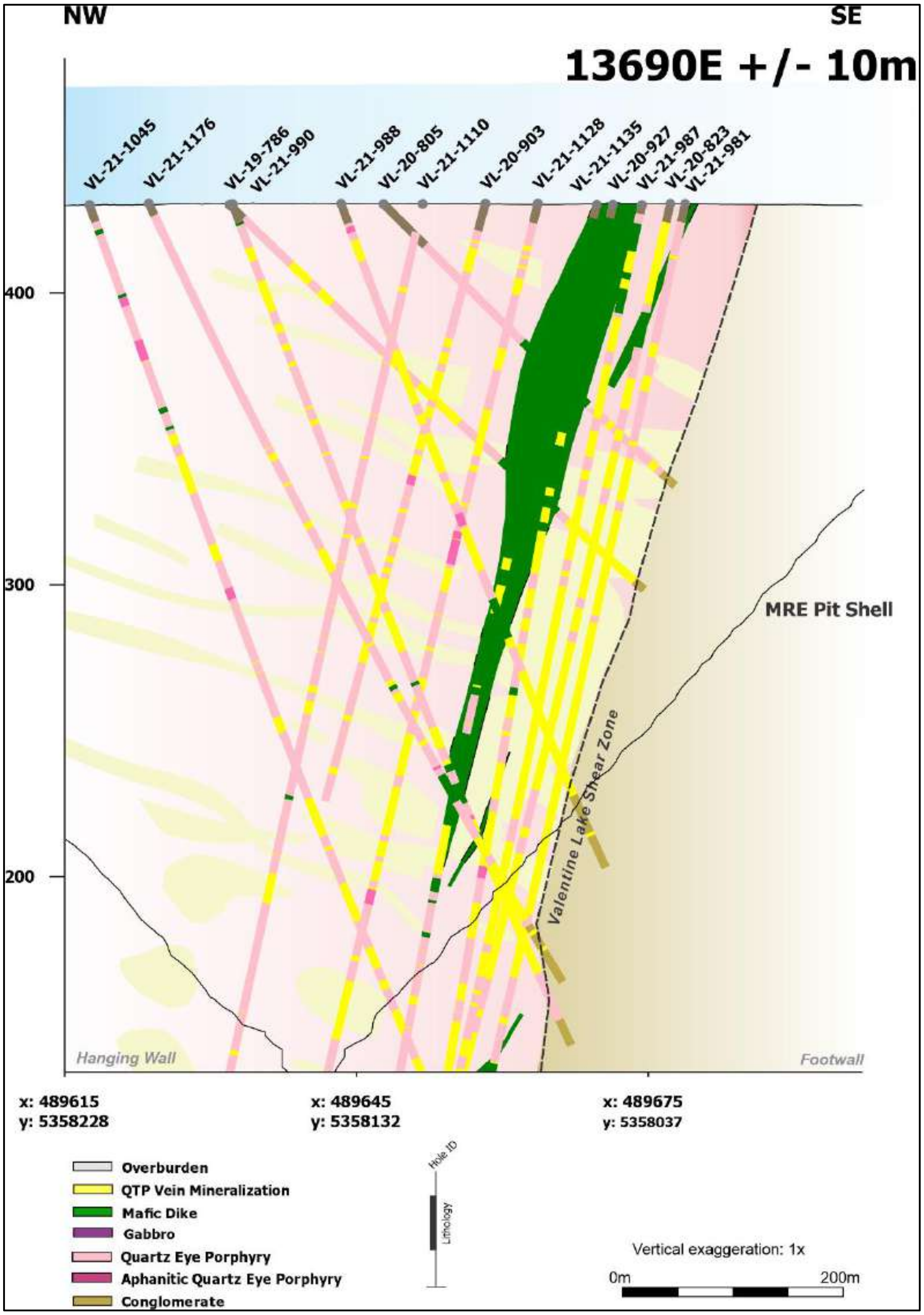
## 7.8 Berry Zone

The Berry deposit is located approximately 3 km northeast of the Leprechaun deposit and 2 km southwest of the Marathon deposit and spans a strike length of 1.5 km. This recently discovered area consists of dominantly shallowly southwest-dipping, en-echelon, extensional QTP veining hosted in quartz-eye porphyry and lesser mafic dykes and aphanitic quartz porphyry. The mineralized corridors are generally 20 to 60 m wide and have been traced to depths of over 350 m. In localized zones, mineralization penetrates across the VLSZ and is found up to 20 m into the Rogerson Lake Conglomerate. Mineralization at the Berry deposit is found in tight QTP vein set packages bounded to the southeast by the VLSZ and the NW by a series of mafic dykes oriented sub-parallel to the shear zone (see Figure 7-16 on the following page). This style and configuration of mineralization is reminiscent of the tightly concentrated mineralized QTP vein set packages of the Leprechaun deposit.

The dominant vein orientation in the Berry deposit was found to be the extensional Set 1 veining dipping shallowly to the southwest, like that found in Leprechaun and Marathon deposits. In addition to the three vein sets found in Leprechaun and Marathon, Kruse (2020) documented a fourth orientation of mineralized veining at Berry which dips shallowly to the NNE. This QTP-Au vein set, referred to as “Set 3” of the four vein sets, is unique to Berry and appears to have a moderate (yet secondary) association with gold mineralization.

Drilling at the Berry deposit has defined multiple intervals of high-grade gold, with visible gold throughout up to 3 mm in size. A summary of best results from the Berry deposit to date can be found in Table 7-3.

**Figure 7-16: Section showing the Geology & Mineralized Zones of Quartz-Tourmaline-Pyrite-Gold-Bearing Veins at the Berry Deposit**




Source: Marathon Gold, 2022.

**Table 7.3: Berry Zone Drilling Results**

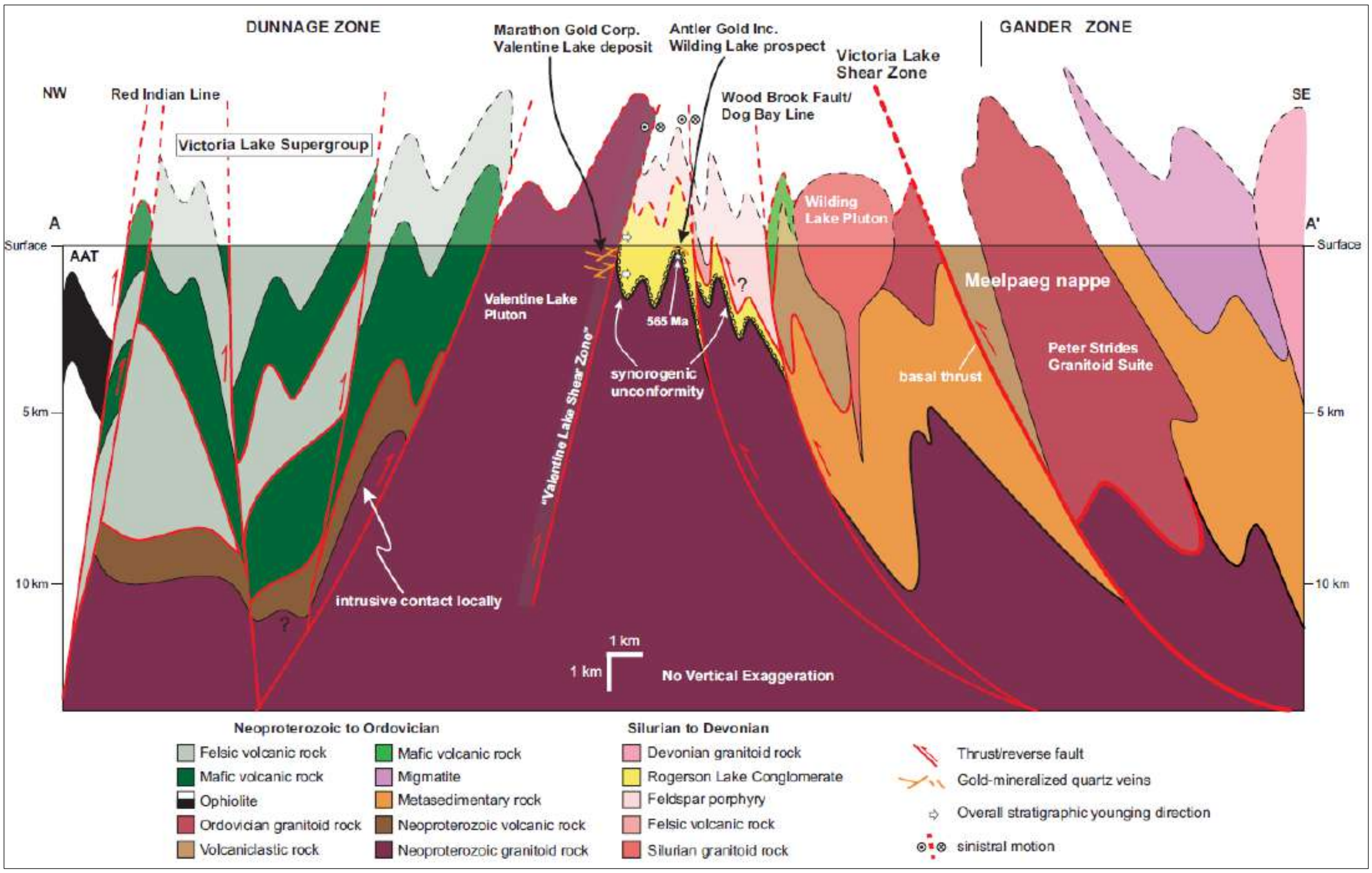
| DDH | Section | Azimuth | Dip | From (m) | To (m) | Core Length (m) | True Thickness (m) | Gold g/t (Uncut) | Gold g/t (Cut) |
|---|---|---|---|---|---|---|---|---|---|
| VL-18-676 | 13410 | 163 | -75 | 145 | 194 | 49 | 41.7 | 6.17 | 5.86 |
| VL-19-776 | 14740 | 162 | -46 | 9 | 14 | 5 | 3.5 | 10.43 | |
| VL-19-778 | 13430 | 342 | -80 | 183 | 189 | 6 | 5.7 | 9.74 | |
| VL-19-779 | 13380 | 337 | -80 | 85 | 96 | 11 | 10.5 | 5.54 | |
| | | | | 50 | 63 | 13 | 12.4 | 3.82 | |
| VL-19-780 | 14740 | 163 | -45 | 121 | 131 | 10 | 7 | 7.25 | |
| VL-19-786 | 13700 | 163 | -44 | 165 | 187 | 22 | 15.4 | 7.6 | 6.97 |
| VL-20-799 | 13500 | 343 | -82 | 113 | 168 | 55 | 52.3 | 2.24 | |
| VL-20-806 | 13730 | 163 | -45 | 155 | 169 | 14 | 9.8 | 8.06 | |
| VL-20-813 | 13380 | 163 | -69 | 165 | 177 | 12 | 10.2 | 8.03 | |
| VL-20-823 | 13690 | 343 | -77 | 87 | 207 | 120 | 114 | 3.33 | 3.31 |
| VL-20-824 | 13720 | 344 | -80 | 19 | 23 | 4 | 3.8 | 51.52 | 8.18 |
| | | | | 107 | 143 | 36 | 34.2 | 3.37 | 3.2 |
| VL-20-835 | 13420 | 343 | -83 | 166 | 213 | 47 | 44.65 | 2.96 | 2.41 |
| VL-20-838 | 13650 | 345 | -73 | 121 | 232 | 111 | 94.35 | 1.47 | 1.43 |
| VL-20-839 | 13940 | 163 | -45 | 12 | 21 | 9 | 6.3 | 14.39 | 7.69 |
| VL-20-873 | 13740 | 343 | -75 | 6.74 | 92 | 85.26 | 81.04 | 2.61 | 2.6 |
| VL-20-876 | 14700 | 164 | -45 | 87 | 109 | 22 | 15.4 | 4.91 | 3.85 |
| VL-20-889 | 13580 | 342 | -77 | 37 | 79 | 42 | 39.9 | 3.7 | 2.67 |
| VL-20-907 | 13680 | 344 | -76 | 97 | 104 | 7 | 6.65 | 18.16 | 6.69 |
| VL-21-955 | 14840 | 163 | -65 | 119 | 122 | 3 | 2.4 | 14.93 | 10.36 |
| | | | | 232 | 254 | 22 | 17.6 | 6.57 | 5.45 |
| VL-21-987 | 13710 | 342 | -77 | 55 | 211 | 156 | 140.4 | 1.69 | 1.66 |
| VL-21-973 | 13640 | 343 | -78 | 149 | 194 | 45 | 40.5 | 1.84 | 1.79 |
| VL-21-995 | 14150 | 336 | -83 | 105 | 124 | 19 | 18.05 | 5.07 | |
| VL-21-1010 | 13560 | 163 | -57 | 28 | 49 | 21 | 16.8 | 5.59 | 4.33 |
| | | | | 161 | 187 | 26 | 20.8 | 1.58 | |
| VL-21-1027 | 13650 | 164 | -70 | 30 | 52 | 22 | 18.7 | 3.04 | |
| VL-21-1050 | 14200 | 343 | -81 | 85 | 89 | 4 | 3.8 | 7.64 | |
| VL-21-1072 | 14120 | 352 | -74 | 108 | 130 | 22 | 19.8 | 2.25 | |
| VL-21-1088 | 13770 | 350 | -79 | 11 | 12 | 1 | 0.9 | 83.07 | 30 |
| VL-21-1102 | 13650 | 346 | -75 | 196 | 218 | 22 | 19.8 | 1.33 | |
| VL-21-1150 | 14120 | 342 | -75 | 162 | 183 | 21 | 18.9 | 7.17 | 4.58 |

Note: Assays cut to 30 g/t Au.

# 8 DEPOSIT TYPES

A schematic model for gold mineralization in central Newfoundland within the Dunnage Zone of the Newfoundland Appalachian system is shown in Figure 8-1. This figure also depicts the geological setting of the Valentine Gold Project.

**Figure 8-1: Gold Mineralization in Central Newfoundland, Dunnage Zone**




Source: Modified from Honsberger et al., 2020.

There are four principal types of gold mineralization found in Newfoundland: orogenic (or mesothermal); epithermal; sediment-hosted; and VMS-related gold (e.g., Swinden et al., 1991; Evans, 1993; Evans and Wilson, 1994; Evans, 1996; Evans and Wilton, 2000; Wardle, 2005; Sandeman et al., 2010; Barrington et al., 2016). In central Newfoundland, numerous examples of mesozonal to epizonal, orogenic gold mineralizing systems appear to be spatially related to vein-hosted gold in association with crustal-scale fault zones and faults, late orogenic timing and possible wall rock alteration as manifested by extensive carbonate alteration (Tuach et al., 1988; Evans, 1996, 1999; Groves et al., 2003; Wardle, 2005). The ultimate genetic origin is uncertain; in some occurrences, gold mineralization may be intrusion-related and/or have textures suggestive of epithermal styles.

The gold mineralization at the Valentine Lake property occurs as structurally controlled orogenic gold deposits associated with Salinic aged crustal shortening and deformation. Recent field-based and oriented drill core structural studies (Kruse, 2020; Kruse and Bartsch, 2021) has advanced the structural model at the Valentine Lake property. Gold mineralization is developed within QTP vein sets associated with brittle-ductile deformation of granitoid rocks of the Neoproterozoic VLIC in contact with the Silurian Rogerson Lake Conglomerate. This contact coincides with the VLSZ, a major crustal-scale, NE-SW lithotectonic boundary. The VLIC and VLSZ are fundamental elements of the Dunnage Zone of the Newfoundland Appalachian system.

Development of en-echelon stacked SW dipping extensional vein sets (Set 1), with lesser shear parallel vein sets (Set 2) have been delineated at the Leprechaun, Sprite, Berry, Marathon, and Victory deposits, and at the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW and Victory NE occurrences (see Section 7.5). In addition to the Set 1 and Set 2 veins, the Marathon, Leprechaun and Berry deposits also include localized, intensely QTP veined core complexes (Main Zones). This vein morphology and structural framework is commonly observed in shear zone hosted gold deposits where the shallow dipping extension veins are less laterally extensive, and the steeper fault-fill veins may display a large vertical extent. However, at the Valentine Lake property the QTP-Au en-echelon stacked, extensional Set 1 veins represent the dominant structurally controlled mineralization style at the property.

Individual QTP-Au veins range in thickness from a few millimeters and centimeters to meters but are typically 2 to 30 cm thick. The extensional Set 1 and shear-parallel Set 2 QTP-Au veins are up to 1.5 m thick and have been traced in trenched outcrop exposure for over 280 m continuous strike length; however, the observed strike length of individual veins is typically in the range of meters to tens of centimeters. At the Marathon deposit, where mineralization has been traced to at least 1,000 m below surface within an approximately 150 m wide mineralized corridor, individual southwest-dipping Set 1 extensional veins have been traced laterally in outcrop and trenches for tens of meters and sometimes over 100 m.

# 9 EXPLORATION

## 9.1 Introduction

Since 2010, Marathon Gold has conducted extensive exploration programs across the Valentine Lake property, including diamond drilling, trenching, channel sampling, mapping, prospecting, and ground-based geophysical surveys (including IP, magnetics and seismic). These programs have been approached with the primary goal of increasing the gold resources at the Valentine Gold Project.

Five gold deposits with mineral resource estimations have been delineated, the Leprechaun, Sprite, Berry, Marathon, and Victory deposits, as well as the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW and Victory NE mineral occurrences. In addition, the Eastern Arm and Western Peninsula occurrences were discovered in 2022 extending the overall strike-length of the Valentine Gold Projects mineralized trend to 32 km (see Section 9.3). The Marathon, Berry, and Leprechaun deposits are the focus of the current mine development plan and feasibility study.

No new diamond drilling at the Marathon and Leprechaun deposits has been completed since the end of the 2019 infill drill program. Rather, Marathon Gold has focused on new discoveries along the mineralized VLSZ. Exploration drilling during 2020 and the first quarter of 2021 focussed on areas of new discovery, such as the Berry deposit and the Narrows occurrence. A summary of the drilling at the Berry deposit is presented in Section 10.

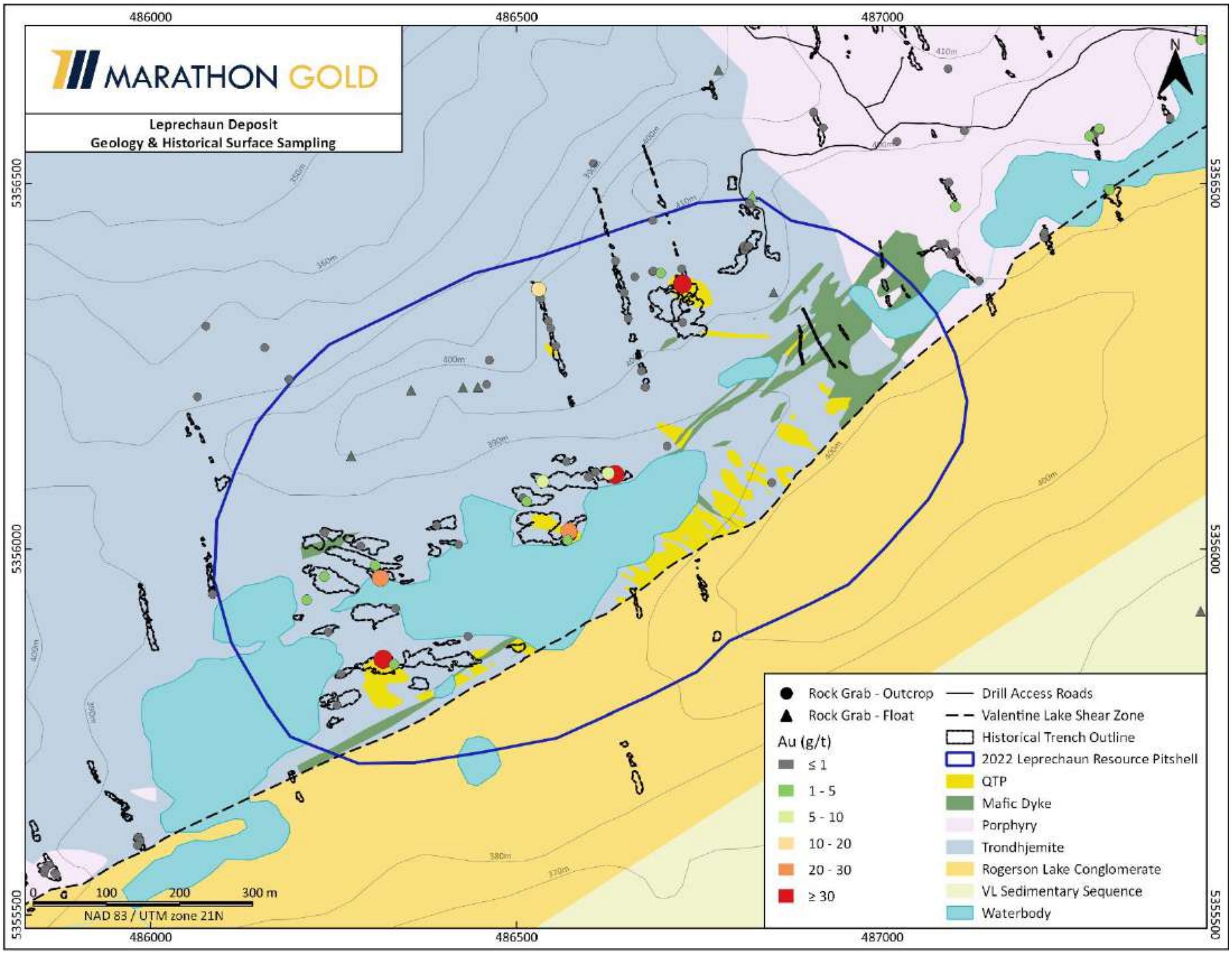
A summary of ground exploration work completed by Marathon Gold since 2010 is described in this section. This information is summarized from Murahwi (2017), Dunsworth et al. (2017), Capps and Dunsworth (2020), Staples et al. (2021) and additional programs ongoing since 2020. The collective ground exploration work completed by Marathon Gold has formed the basis for understanding the geology at the property, and these data were considered during the construction of the 3D geological model and mineral resource estimations presented in this report. However, none of the groundwork assay data was used in the actual estimation processes. Rather, the assay file used in this report and the mineral resource estimations are restricted to the drill core analytical dataset; all drilling information is summarized in Section 10. The metallurgical testwork is described in Section 13.

## 9.2 Geological Mapping (2010 to Present)

Marathon Gold has routinely conducted detailed 1:5000 scale geological mapping along cut grid lines in areas of exposed outcrop and across excavated trenches. Selected rock exposures were channel sampled and/or grab sampled for lithogeochemistry, petrography, and thin section study. Thin sections were prepared and analyzed at Memorial University of Newfoundland. Petrographic samples were prepared and analyzed by Vancouver Petrographic Inc. in Vancouver, British Columbia. Lithogeochemical samples were prepared and analyzed by Activation Laboratories Ltd. in Ancaster, Ontario. The results of the detailed mapping, lithogeochemistry, and petrographic studies were used to prepare 1:5000 scale detailed geological maps for each deposit area (Figures 9-1 to 9-4).

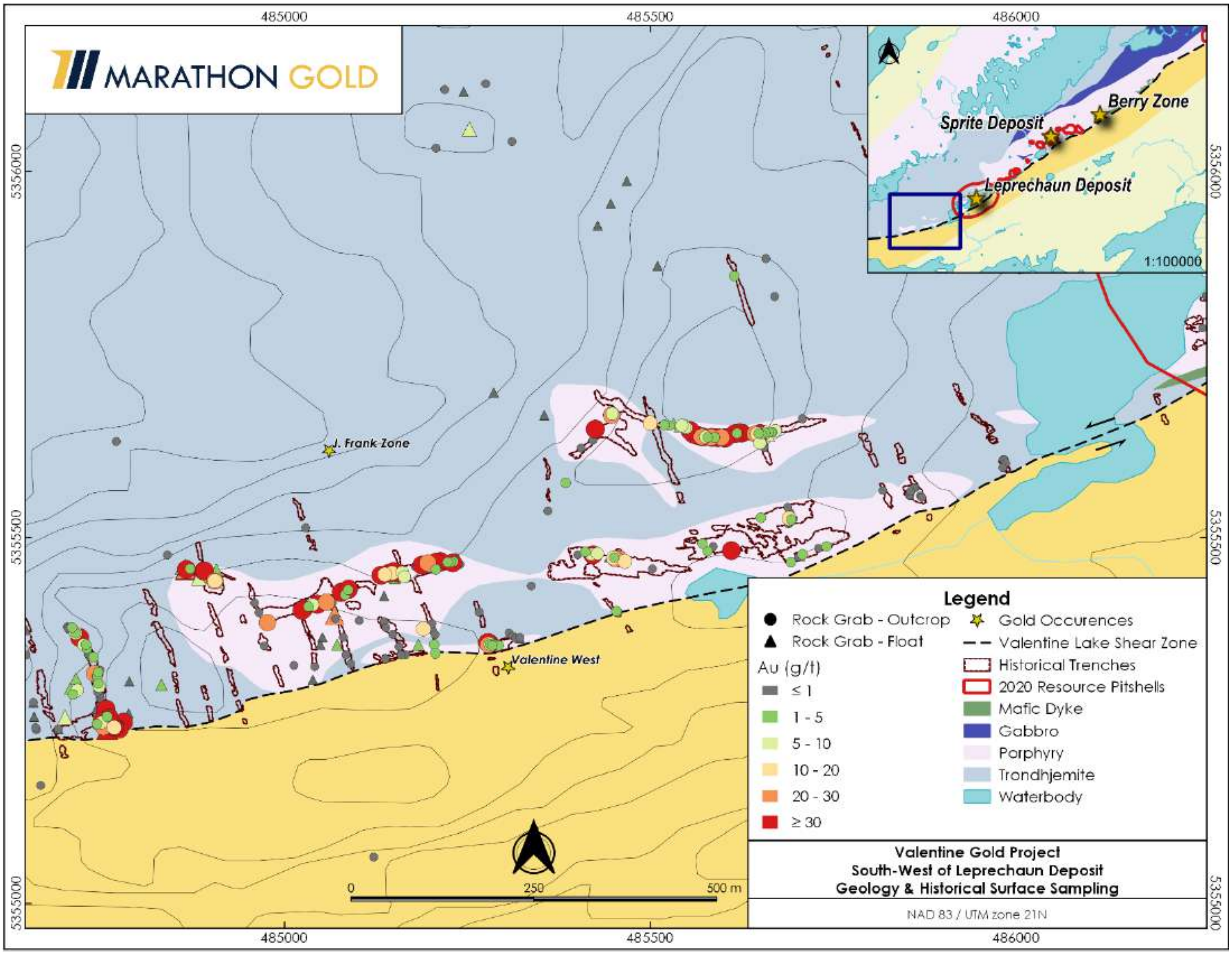
Marathon Gold engaged SRK Consulting in 2014 to conduct a structural geology investigation of the property, which included field mapping, diamond drill core logging, and geophysical data review. The study concluded that the gold mineralization at the Valentine Gold Project is hosted in the hanging wall of the VLIC-Rogerson Lake conglomerate contact and is related to sinistral shear movement and extensional and fault fill veining along the VLSZ. Mineralization is inferred to have formed proximal to sub-units of the VLIC that display greater magnetic intensity, where mineralization is associated with fault splays, duplexes and bends.

**Figure 9-1: 1:5000-Scale Geological Map of the Leprechaun Area**



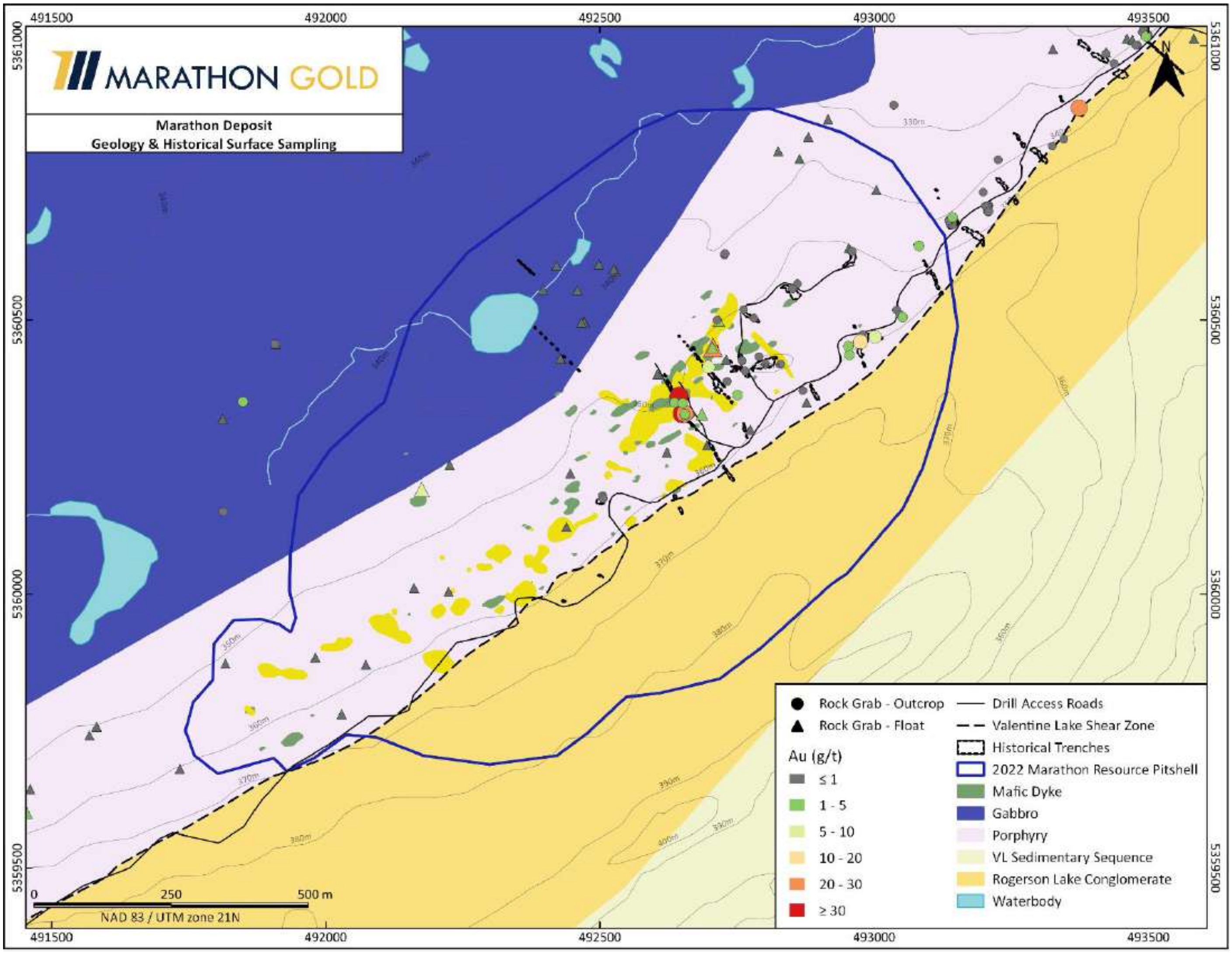

Source: Marathon Gold, 2022.

**Figure 9-2: Geological Map of the Frank Zone**



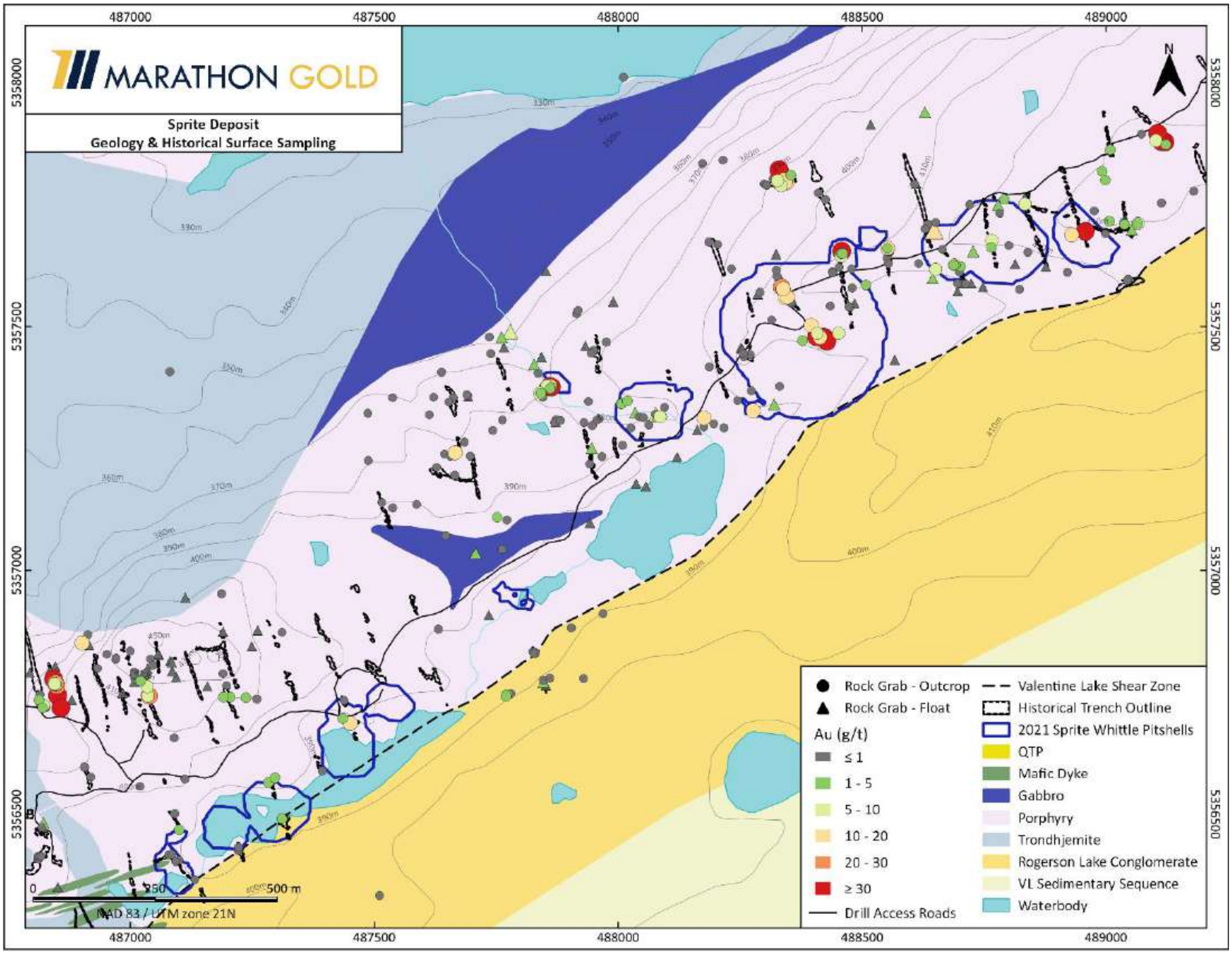

Source: Marathon Gold, 2022.

**Figure 9-3: Geological Map of the Marathon Area**




Source: Marathon Gold, 2022.

**Figure 9-4: Geological Map of the Sprite Zone**




Source: Marathon Gold, 2022.

Terrane Geosciences Inc. was retained in the spring of 2020 to conduct a field assessment of the current structural model, focusing on the Leprechaun, Berry and Marathon deposits. The assessment included a review of previous structural literature, lineament analysis and field-based structural mapping and analysis. This study established a revised kinematic model for the property and identified five phases of deformation. A penetrative ductile fabric associated with initiation of the Valentine Lake Shear Zone and characterized by a strong S1 foliation and L1 stretching lineation is observed in both the Rogerson Lake Conglomerate and in the Valentine Lake Intrusive Complex, with a southwest strike and steep dip to the northwest, paralleling the larger structure. Gold mineralization is associated with veining within the Valentine Lake Intrusive Complex during a D3 phase of renewed crustal shortening following a period of regional D2 relaxation. Overprinting fabrics include a late D4 crenulation fabric and a D5 brittle fault set (Kruse 2020). These observations are consistent with regional geotectonic and geochronological models being developed by Honsberger et al., (2020) and others within the Dunnage Zone of Central Newfoundland.

The 2020 field-based structural study (Kruse, 2020) and a follow-up program of optical televiewer analysis of oriented drill core (Kruse and Bartsch, 2021) identified up to three distinct mineralized QTP-Au vein sets at the Leprechaun and Marathon gold deposits and up to four QTP-Au vein sets at the Berry deposit. In both studies, QTP-Au veins developed within brittle extensional fractures dipping at a low angle to the SW (Set 1 veins) were identified as the dominant mineralization style at the property. The Set 1 veins represent the principal structural control on gold mineralization in the mineral resource models for the Leprechaun, Berry and Marathon deposits, consistent with previous interpretation (see section 7.5). Recommendations for further refinement of vein set attitudes form additional televiewer measurements, and manual modelling of mafic dykes within the deposit-scale geological models, to highlight their importance in the localization of gold mineralization.

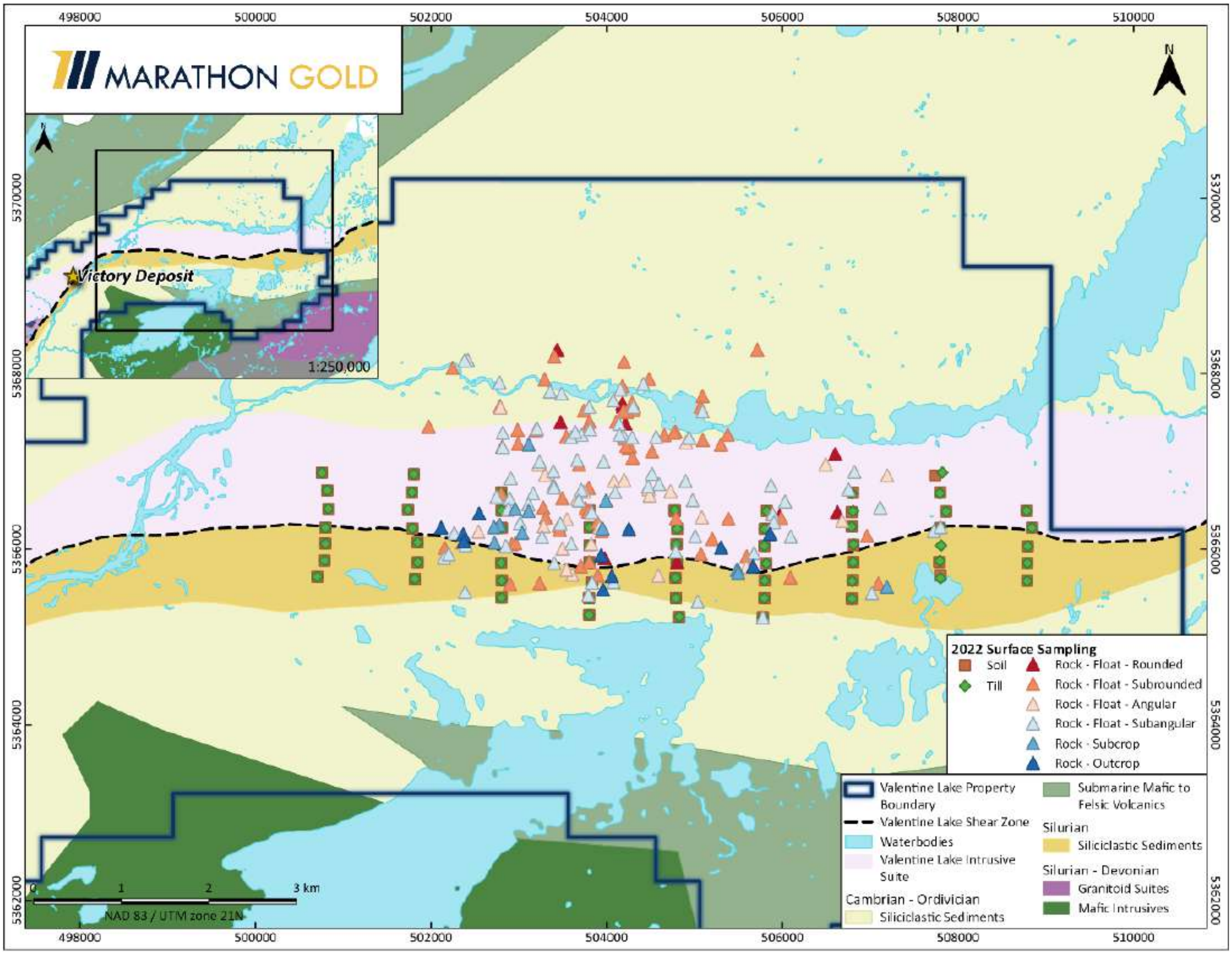
## 9.3 Grab Rock Sampling (2010 to Present)

Marathon Gold collected 2,063 grab rock samples throughout the property during prospecting and geological mapping. Grab samples were collected as rock chip samples from outcrop, subcrop and float, with a target sample size of 1 to 2 kg. The grab samples were generally selected as representative material, but some bias may be introduced as grab samples could potentially represent a microcosm of any given sample location. Samples were submitted to Eastern Analytical Ltd. in Springdale, NL, for preparation and analysis by fire assay (see Section 11).

Rock chip sample analytical results have not been used as part of the assay database used in the mineral resource estimations presented in this report. However, the results of grab sampling are a useful exploration tool and, in conjunction with geological mapping, have assisted Marathon Gold with prioritizing targets for follow up exploration.

During the 2022 exploration program, a prospecting program was undertaken in the previously unexplored Eastern Arm of the property, an area that runs from the Victory deposit in the west to the property boundary in the east. This program included collection of 60 soil and 60 till samples at 1 km line spacing and 200 m sample spacing, as well as a total of 225 grab rock samples (Figure 9-5). These grab samples uncovered QT and QTP veining in both outcrop and float, indicating a new high-potential area for further exploration. Granitoid rocks which appear similar in nature to the Crippleback Granite were discovered throughout the area, where regional mapping in the past had indicated mafic volcanics. This granitoid discovery further increases the potential for orogenic gold mineralization as it provides a competency contrast with the Rogerson Lake conglomerate to the south.

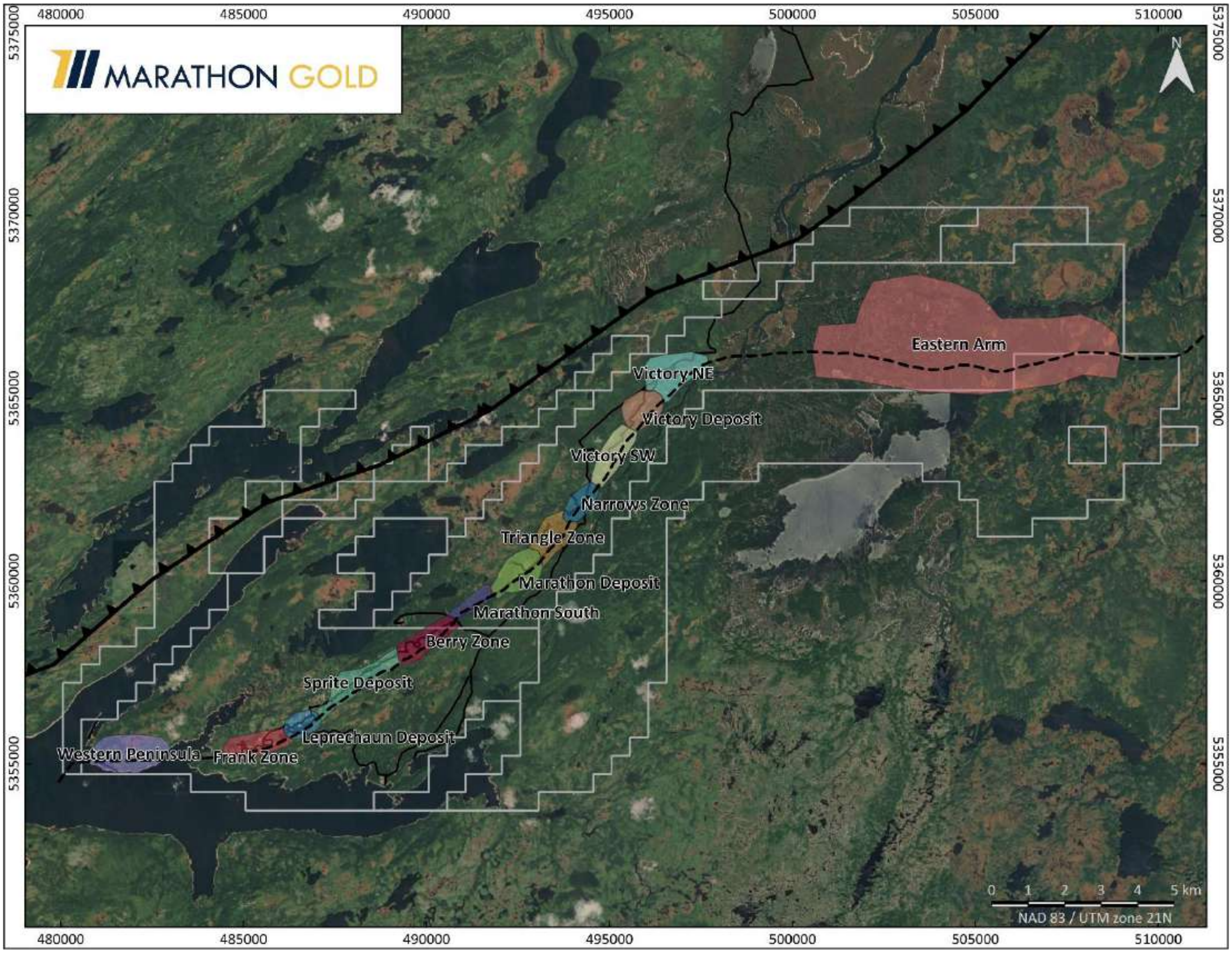
**Figure 9-5: Grab, Soil and Till Samples in the Eastern Arm**




Source: Marathon Gold, 2022.

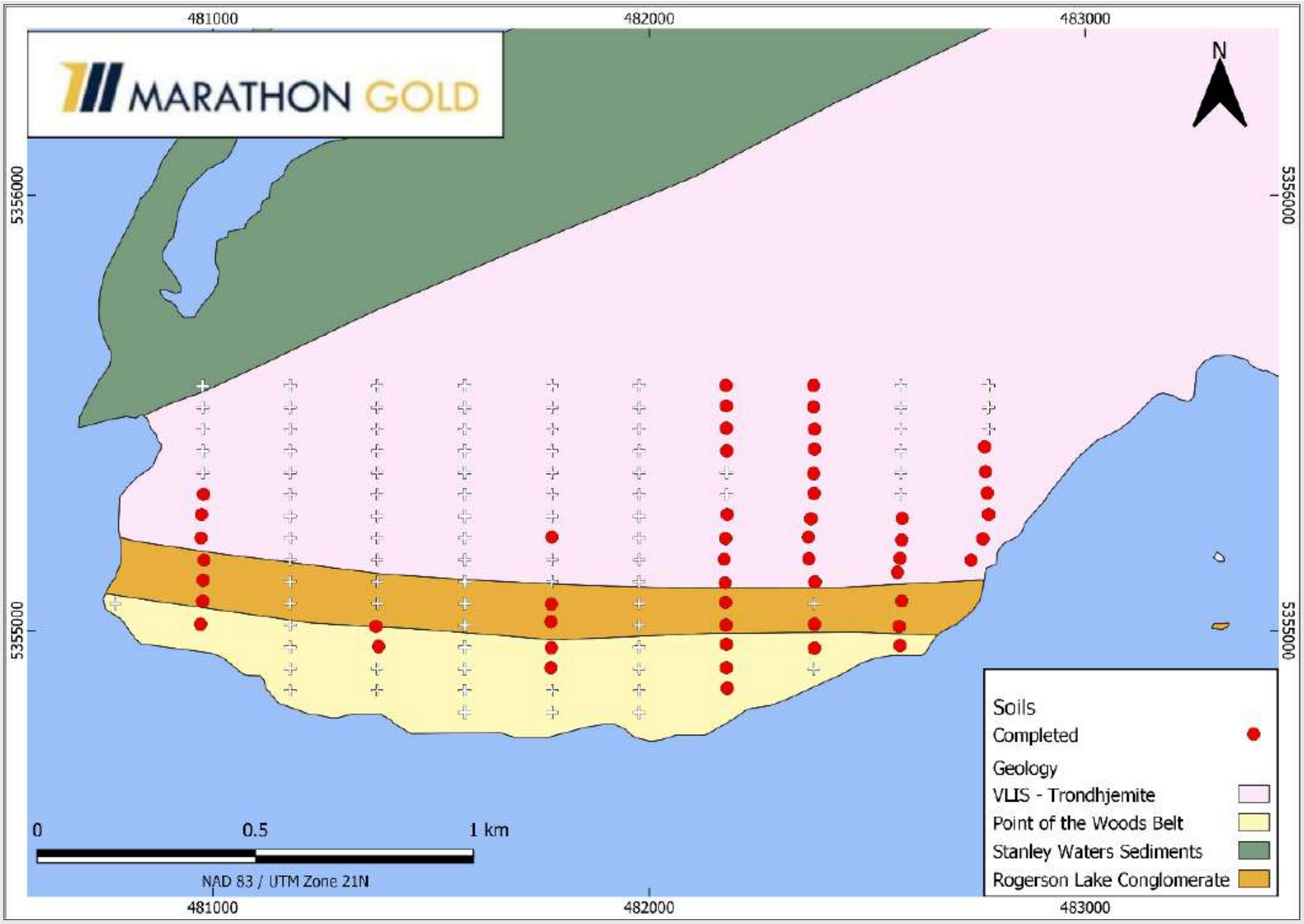
In addition to the work completed in the Eastern Arm, a new prospect called the Western Peninsula (Figure 9-6) has recently been discovered. Work in the area is very preliminary with 52 soil samples on 200 m line spacing and 50 m sample spacing and 5 grab samples (Figure 9-7) collected to date, but significant QT and QTP veining has been discovered in outcrop in numerous locations. Results are outstanding but follow up will be planned for the 2023 exploration program. Lithologies appear consistent with the regionally mapped units, with granitoids to the north and conglomerate to the south of the mapped contact. Veins, deformation and contacts all appear to be significantly shallower in the area, dipping moderately to the north.

**Figure 9-6: Location of Prospect Areas and Other Deposits**




Source: Marathon Gold, 2022.

**Figure 9-7: Sampling of the Western Peninsula to Date**




Source: Marathon Gold, 2022.

## 9.4 Channel Rock Sampling (2010 to Present)

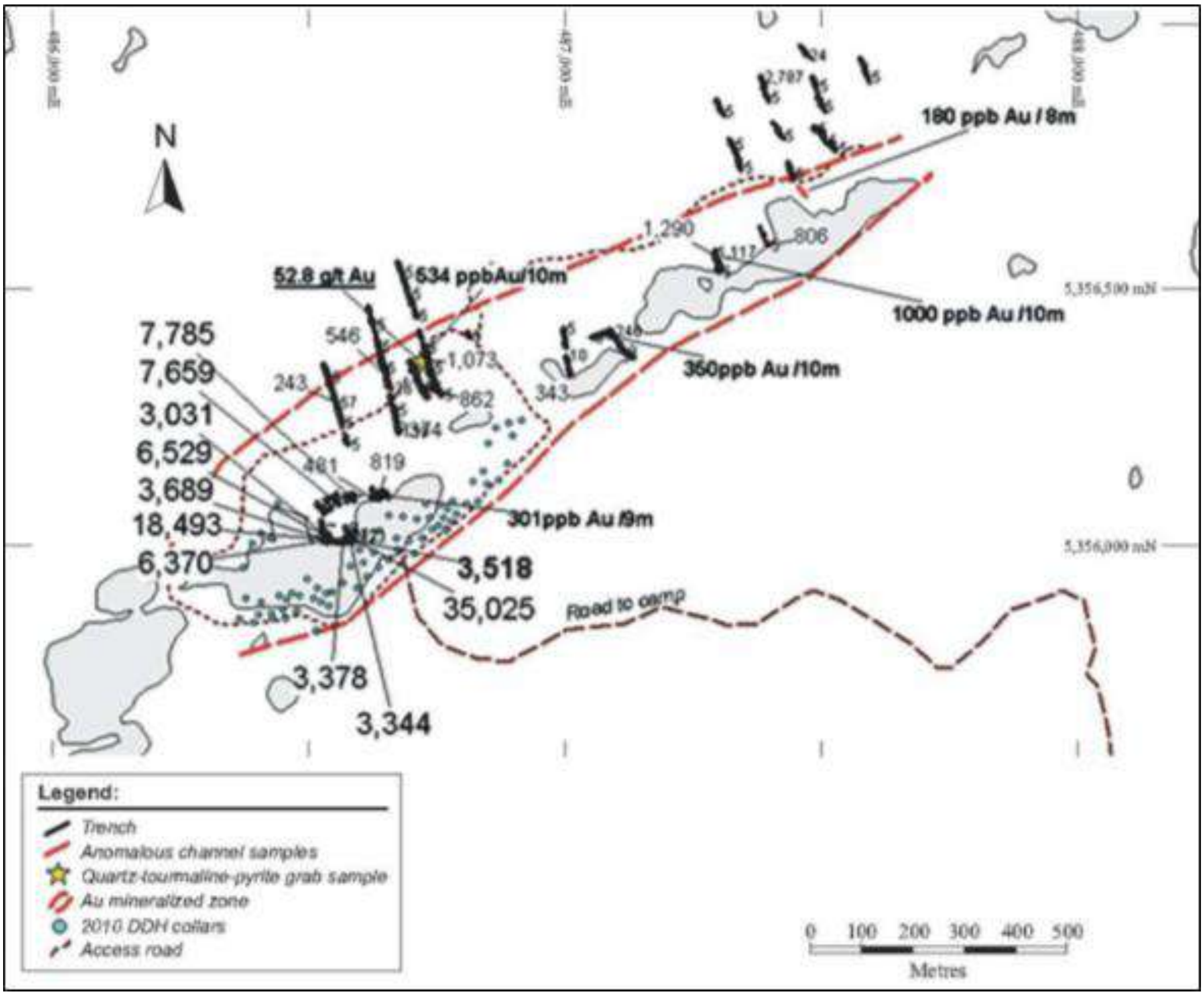
Marathon Gold has channel-sawed 207 outcrops and collected 5,854 channel rock samples from throughout the property. The locations of the channel samples are shown on Figures 9-1 to 9-4 above. Channel sample sites were typically stripped of vegetation and/or glacial surficial material using a backhoe and washed with water to clear debris and leave a clean surface. The location of the channel was then marked by the geologist and was typically oriented perpendicular to the strike of mineralization. The channel was mechanically sawn using a portable saw with a diamond blade, to create a channel approximately 5 cm wide and 10 cm deep.

The channel rock samples were taken at continuous intervals of between 1 and 2 m in length using a hammer and chisel. Samples were placed into plastic bags, tied, and labelled prior to dispatch for sample preparation and gold fire assay. The channel sample was logged like a drillhole, using the ‘from’ and ‘to’ meterage with lithological and geological descriptions recorded in an Excel datasheet.

The analytical results of the channel sampling have been used by Marathon Gold to define drill targets and are considered representative of the mineralization with no evidence of bias. For example, the 2010 channel rock sampling results from Leprechaun and Sprite channel sampling were used to define drill targets in 2010 to 2011 (Figure 9-5). Channel sampling was also used to successfully identify significant mineralization at the Marathon deposit. Results from channel sampling including 16.5 m at 5.79 g/t Au, 16.5 m at 2.53 g/t Au and 9.0 m at 4.84 g/t Au were used to define the initial drill targets that led to the discovery of the Marathon deposit.

The channel rock sample data were not incorporated into the assay dataset used to prepare the mineral resource estimations presented in this report.

**Figure 9-5: Channel Sample Results at the Leprechaun & Sprite Deposits (2010)**




Source: Murahwi, 2017.

## 9.5 Geophysical Surveys

Marathon Gold conducted induced polarization (IP) surveys at Leprechaun and Victory deposits, ground magnetic surveys along the length of the main mineralized trend, and a seismic survey at the Marathon deposit. Marathon Gold also has the data acquired from an aeromagnetic survey conducted across the entire property by Richmont in 2007.

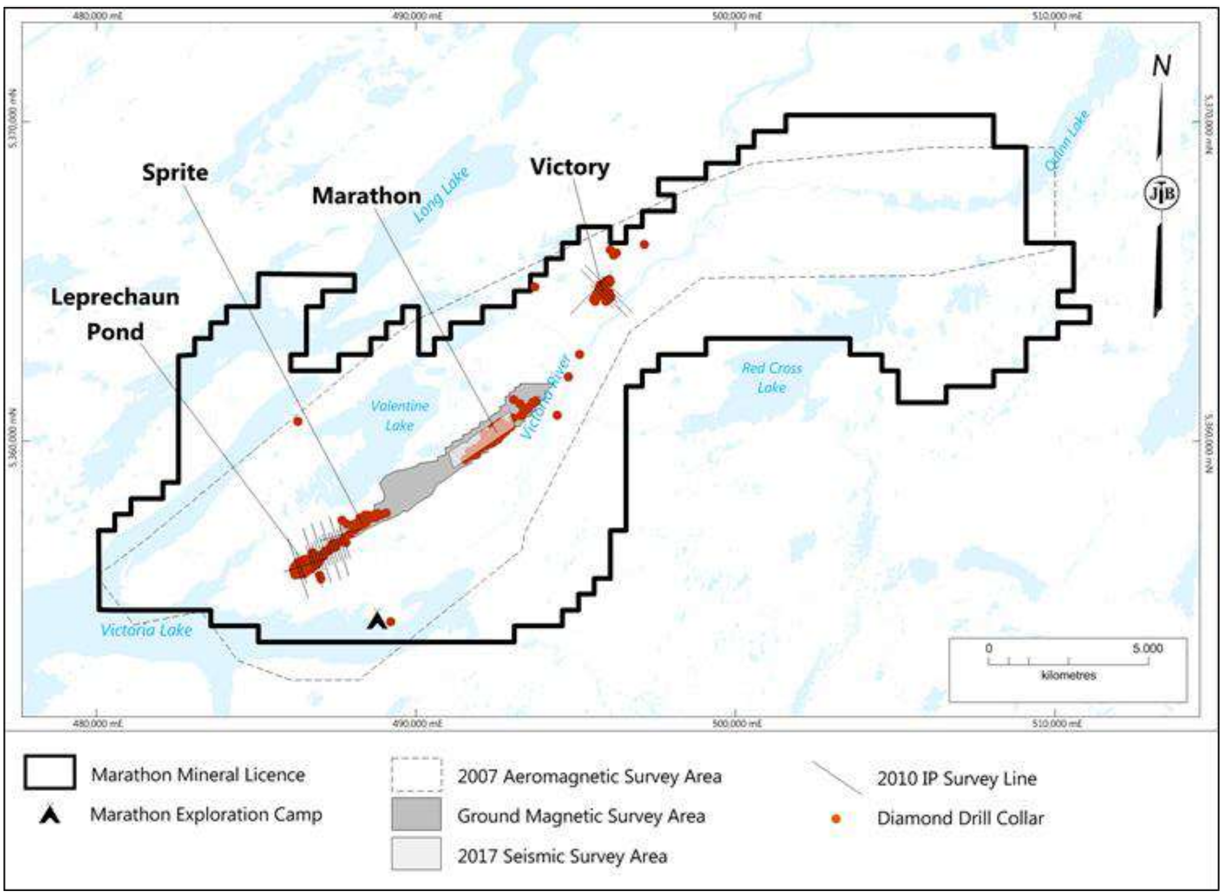
The locations of the geophysical surveys conducted at the project are shown in Figure 9-6, and the individual surveys are described below.

### 9.5.1 Induced Polarization Data

#### 9.5.1.1 Ground Induced Polarization Survey

Insight Geophysics Inc. (IGI) of Oakville, Ontario, completed time domain IP and resistivity orientation surveys at the Leprechaun-Sprite (16.25-line km) and Victory (5-line km) deposits in July-August 2010, for a total of 21.25-line km (see Figure 9-6).

**Figure 9-6: Geophysical Survey Locations at the Valentine Lake Property**




Source: BOYD, 2018.

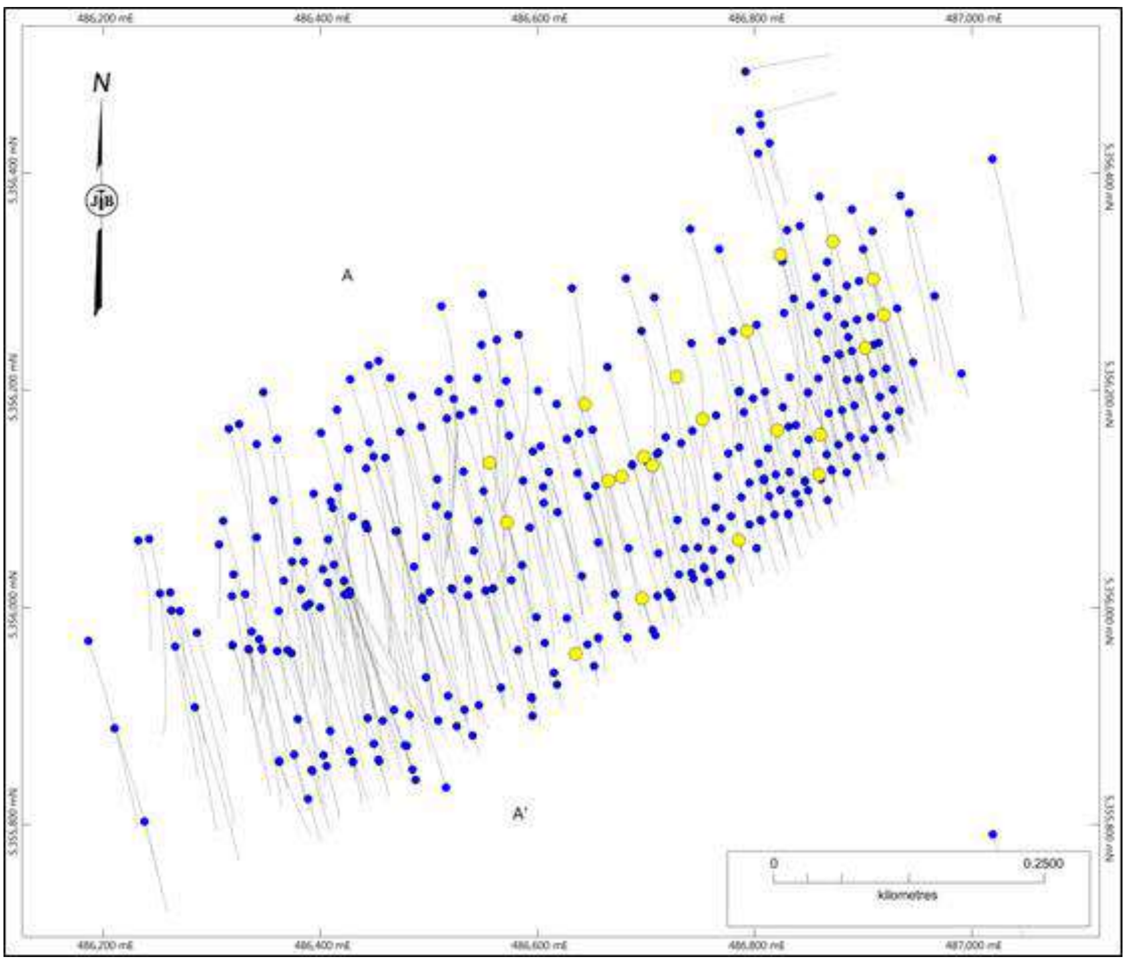
The surveys were conducted using Tx dipole spacing of 200 to 3,000 m, Rx dipole spacing of 12.5 m and 25 m, and a sampling interval of 12.5 m and 25 m (Pawluk, 2010). Survey lines were oriented perpendicular to the mapped trend of mineralization at each area.

IGI produced a section displaying chargeability and resistivity for each line that was surveyed and Marathon Gold used the results to identify anomalies that were potentially related to QTP vein hosted mineralization. Marathon Gold drill tested the anomalies; however, no significant results were obtained (Dunsworth, pers. comm., 2017).

#### 9.5.1.2 Downhole Spectral Induced Polarization Survey

Downhole Spectral IP (DSIP) surveys were conducted on 21 drillholes (see Figure 9-7) by JVX Ltd. (JVX) of Richmond Hill, Ontario, in April 2012, with the aim of mapping high-grade lenses and the overall mineralized envelope at the Leprechaun deposit (Webster and Jelenic, 2012). Apparent resistivity and chargeability were measured using pole dipole and gradient arrays to produce 2D and 3D models of chargeability and resistivity.

**Figure 9-7: Leprechaun Drill Collars (blue) & Holes Selected for Downhole Spectral IP Surveys (Yellow)**




Source: BOYD, 2018.

JVX produced a set of 2D sections and 3D models with exploration targets, where anomalous zones of chargeability and resistivity were inferred to represent alteration and/or geological structures. A general trend of significant gold intercepts that correlated with fine-grained chargeable sources associated with moderate apparent resistivity was identified by JVX in 17 of the 21 drillholes surveyed (Webster and Jelenic, 2012). Two exceptions to the trend were also noted where a moderately chargeable source with moderate apparent resistivity did not correlate with significant gold mineralization despite presenting as a valid geophysical target.

The IP survey identified two geophysical anomalies with potential for gold mineralization and these zones have since been drilled by Marathon Gold. Overall, the survey results confirmed the presence of chargeability and resistivity anomalies coincident with known mineralization but did not yield sufficient exploration targets to warrant more extensive use of the DSIP survey across the rest of the property.

### 9.5.2 Magnetic Data

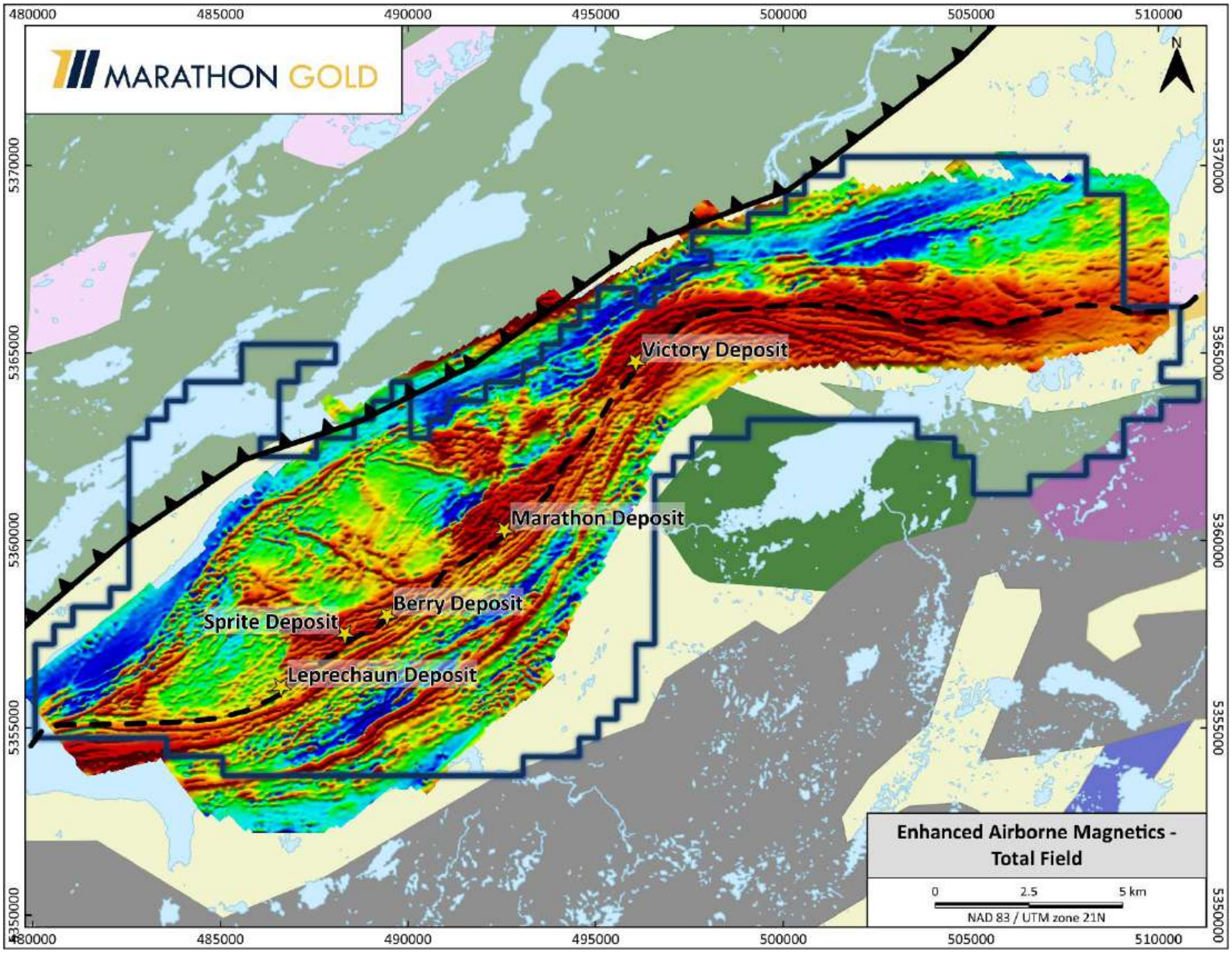
#### 9.5.2.1 Aeromagnetic Magnetic Survey

In 2007, Richmont Mines conducted a detailed, 1,766 line-kilometer, aeromagnetic survey, with line spacing of 100 meters and tie-in lines at 1,000 meters, across the entire project area (Figure 9-8). The results show that there is a complex structural geological history on the property, particularly at the Leprechaun, Marathon, Sprite, Victory and Berry deposits. Distinct magnetic splays off the regional structural fabric at the Leprechaun and Sprite deposits are evident (SRK, 2014; Figure 9-9) and represent high-potential exploration targets. Further, the detailed aeromagnetic data collected by Richmont illustrates a potential zonation to the VLIC, where multiple intrusive phases can be inferred from the magnetic response (SRK, 2014).

#### 9.5.2.2 Ground Magnetic Surveys

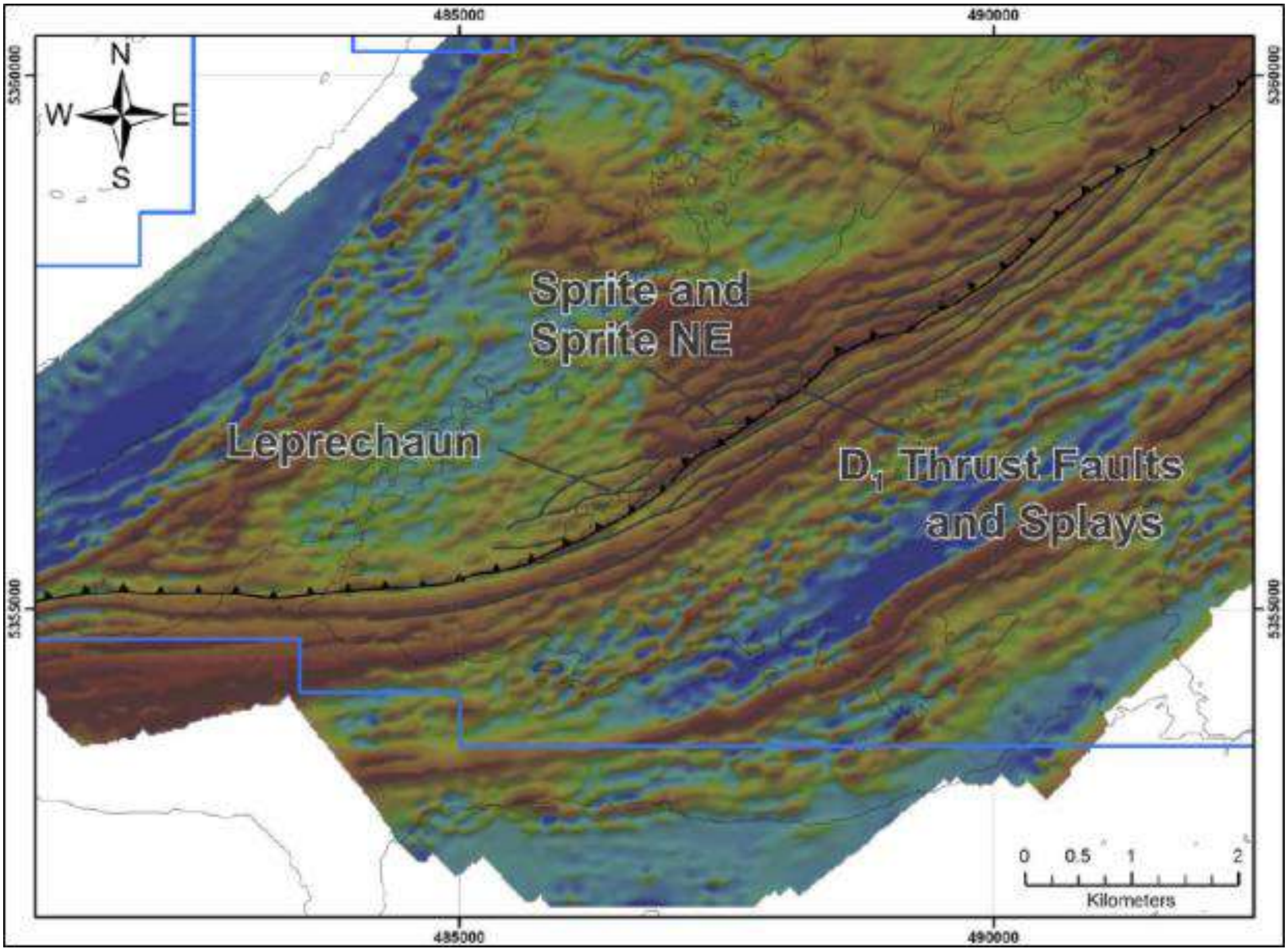
Between 2014 and 2017, Marathon Gold has conducted numerous ground magnetic geophysical surveys at the Sprite and Marathon deposits, using two Overhauser Magnetometers supplied by MTEC Geophysics Inc. The surveys were conducted using a 50 m line spacing and comprised 27-line km at Sprite and 11.9 line-km at the Marathon deposit. The results indicate that mineralization at these deposits is spatially associated with low magnetic intensity, inferred to result from the magnetite destructive sericite quartz alteration associated with the QTP vein arrays. If this hypothesis is true, then the survey results show there are several areas of low magnetic intensity that may represent exploration targets between the Sprite and Marathon deposits (see Figure 9-10).

**Figure 9-8: Airborne Magnetic (Reduced to Pole) Data from Richmond Mines (2007)**



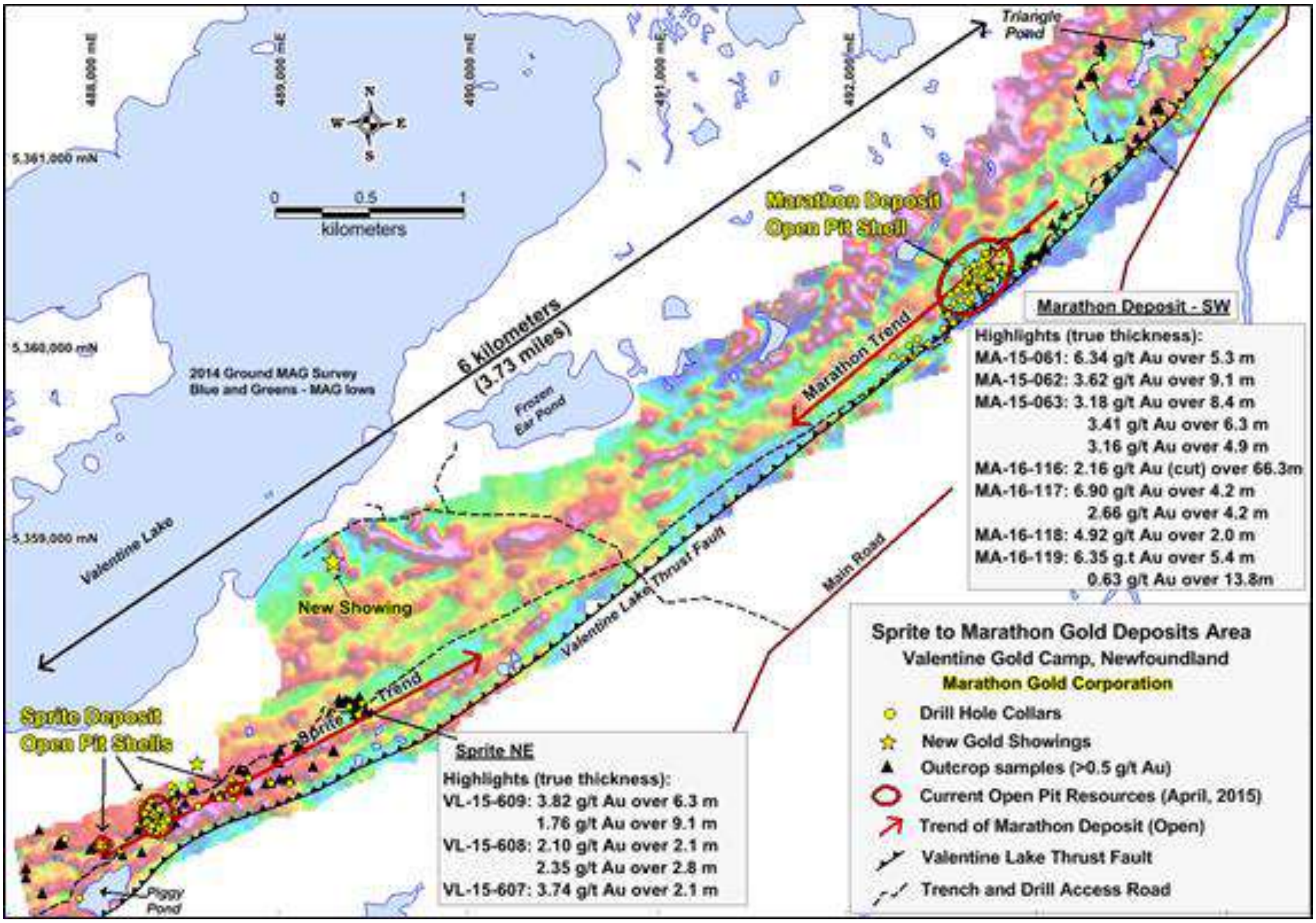

Source: Marathon Gold, 2021.

**Figure 9-9: Detailed Total Magnetic Field Data at the Leprechaun & Sprite Deposits**




Source: SRK, 2014.

**Figure 9-10: Ground Magnetic Data & Drill Highlights**




Source: Marathon Gold, 2018.

### 9.5.3 Seismic Survey

During 2017, a seismic survey was carried out by Acoustic Zoom Inc. (AZI) of Paradise, NL, across a southwest-oriented 500 m wide by 2 km long zone at the property. The aim of the survey was to define any geological structures in the area with an emphasis on quartz vein systems.

A total of 89 receiver lines were cut to lengths of approximately 500 m at 25 m spacing with 44 source lines coincident to the receiver lines but at double the spacing. Seismic data collection began on February 25 and concluded on March 6. Glacier Exploration Surveys Ltd. of Calgary, Alberta, were subcontracted by AZI to complete the survey, with supervision from AZI staff. Due to insufficient depth of frost in the ground, only 74% of the survey grid was covered by the seismic vibrator truck, which was escorted by an excavator across the wetter sections of ground.

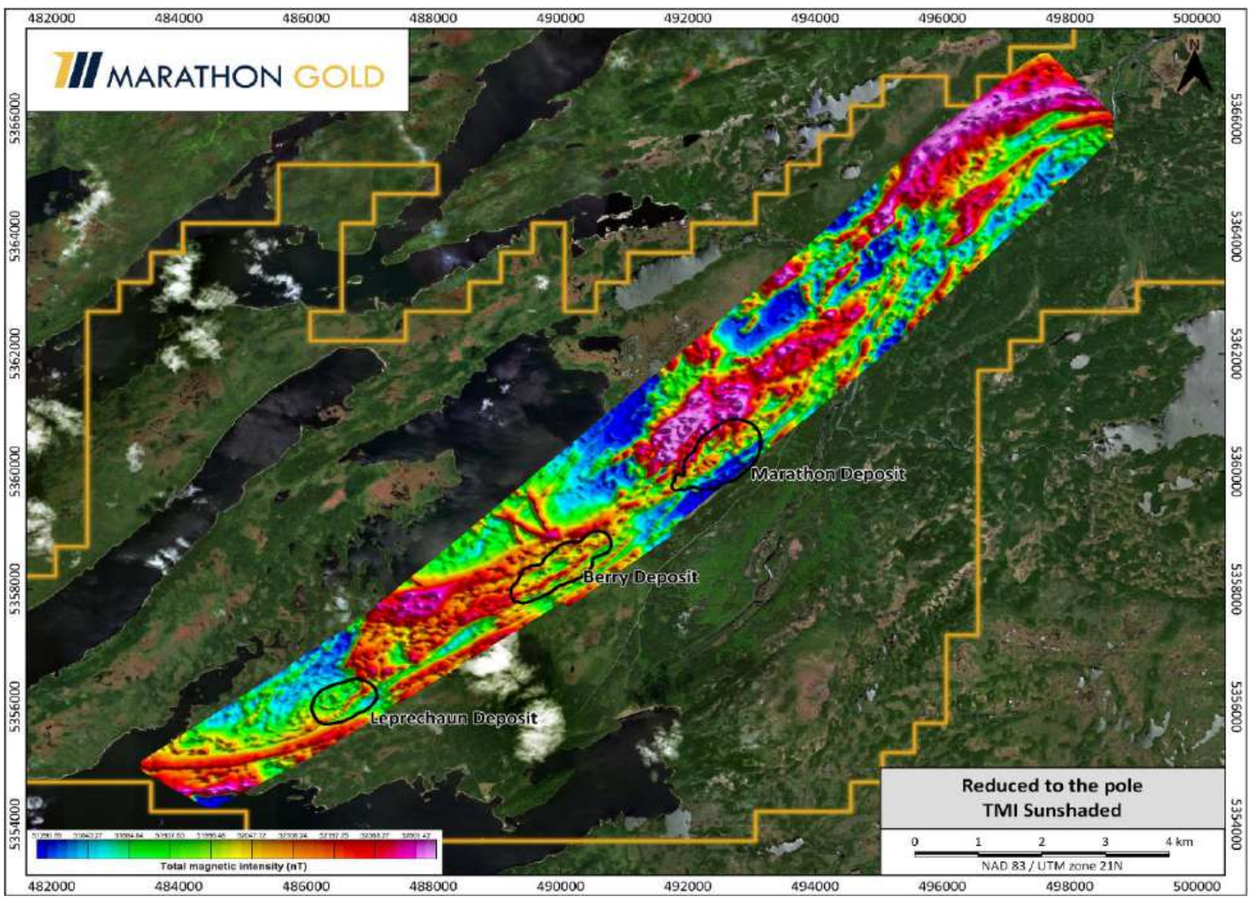
Unfortunately, the seismic survey failed to provide any substantial information on geologic structures within the survey area including the VLSZ. It is believed that the survey was unable to detect the VLSZ because of its steep nature. The inability to detect the veins and vein packages is likely due in part to the small-scale nature of the veins but also from the lack of physical property contrast between the quartz veins and quartz-rich granitoid. Consequently, no further emphasis is being placed on seismic methods for current or future exploration.

### 9.5.4 Aeromagnetic Drone Survey

During the summer of 2021, Marathon Gold contracted RPM Aerial Services to complete a 32 km$^2$, drone-mounted, aeromagnetic survey of the project area (Figure 9-11). The survey was completed at 25 m line spacings with 1,449 line-km flown at an altitude of 23 m. This survey produced the highest resolution magnetic data of the area flown to date, possibly due to the close line spacing, the drone capabilities, and the use of light detection and ranging (LiDAR) data to map out the elevations and flight plans. The survey covered the VLSZ from Frank Zone in the southwest to Victory in the northeast.

The survey identified the numerous areas of magnetics highs, associated with large gabbro bodies, as well as the trace of the VLSZ. This survey data will be used in planning further exploration along the VLSZ.

**Figure 9-11: 2021 Aeromag Survey of Valentine Gold Project Area**




Source: Marathon Gold, 2022.

# 10 DRILLING

## 10.1 Introduction

Historical drilling at the Valentine Lake property includes 136 drillholes (23,775 m) drilled by different companies from Marathon Gold prior to 2010. The historical drill information is summarized in Section 6. Historical drillholes utilized in the current MREs pertain predominantly to the Leprechaun deposit where 25 historical drillholes and 4,755 historical assays were utilized in the MREs (5.2% and 6.7% of the total drillhole and assay files). The Marathon deposit does not utilize any historical drillholes and assays.

In 2021, Marathon Gold completed the company's largest drill program (259 diamond drillholes totalling 74,141 m) in the history of the Valentine Gold property. This drill program focused predominantly on the expansion and definition of the Berry deposit, with additional exploration drilling in the Victory, Marathon South and Narrows areas.

Between 2010 and 2022, Marathon Gold drilled 1,936 diamond drillholes totalling 438,622 m. The majority of the 2010-2022 subsurface drillhole information was concentrated at the Marathon deposit (149,705 m, or 36%), Leprechaun deposit (90,794 m, or 22%) and Berry deposit (99,986 m, or 24%) followed by Sprite (16,571 m, or 4%), Victory (18,964 m, or 4%), and other areas including the Frank, Marathon South, Narrows, Victory SW, and the Victory NE occurrences, the Scott and Steve zones, the proposed Marathon, Leprechaun and Berry WRSF, and the TMF (42,185 m, or 10%). Assays from holes drilled in 2022 had not been received and verified by the resource database cut-off and therefore were not used in the MREs. See Table 10-1 for additional details.

During 2022, Marathon Gold conducted condemnation, geotechnical, and infill drilling at the Berry deposit which included 76 drillholes totalling 14,895 m. The infill program was designed to define additional mineralization and reduce the strip ratio in the current mine plan. The 2022 infill drilling of the Berry deposit is ongoing and most assays were outstanding; therefore, the results are not included in the mineral resource update presented in this report.

The updated MREs for the Leprechaun, Berry and Marathon deposits rely on the historical and Marathon Gold drillhole information through to 2021 (i.e., none of Marathon Gold's 2022 drillhole program work is included in the estimates). However, the cut-off of the assay database is extended to April 14, 2022 for the Leprechaun deposit; to May 14, 2022 for the Marathon deposit; and June 2, 2022 for the Berry deposit. The current drillhole and assay files are summarized in Table 10-2 and consist of the following:

- Leprechaun deposit – 483 drillholes totalling approximately 99,976 m with 70,912 gold assays
- Marathon deposit – 713 drillholes totalling approximately 159,104 m with 109,456 gold assays
- Berry deposit – 421 drillholes totalling approximately 99,845 m with 72,474 gold assays.

A summary of the drillhole collar locations at the Marathon, Leprechaun, and Berry deposits is presented in Figures 10-1, 10-2, and 10-3, respectively. The updated 2021 drillhole and current assay files (April to June 2022) form the basis for the new resource estimates at the Leprechaun, Berry and Marathon deposits as presented in Section 14.

A summary of the diamond drilling and reverse circulation (RC) drilling procedures used at the Valentine Gold Project, followed by drilling results, is discussed in the subsections that follow.

## Table 10.1: Summary of Drilling Completed by Marathon Gold (2010 to 2022)

| Year | Area | DDH's | DDH ID Summary | 2010 (m) | 2011 (m) | 2012 (m) | 2013 (m) | 2014 (m) | 2015 (m) | 2016 (m) | 2017 (m) | 2018 (m) | 2019 (m) | 2020 (m) | 2021 (m) | 2022 (m) | Total (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | LGD | 96 | VL-10-137 to 231 | 10943 | | | | | | | | | | | | | |
| 2011 | LGD | 124 | VL-11-232 to 253, 255, 257, 258, 259, 261, 263, 265, 266, 268, 269, 271, 273 to 276, 278, 280 to 365 | | 21453 | | | | | | | | | | | | |
| | FZ | 12 | VL-11-366 to 377 | | 1038 | | | | | | | | | | | | |
| | SZ | 8 | VL-11-260, 262, 264, 267, 270, 272, 277, 279 | | 1146 | | | | | | | | | | | | |
| | VGD | 6 | VE-11-001 to 006 (VE) | | 1307 | | | | | | | | | | | | |
| | LWD | 2 | VL-11-254 and 256 | | 307 | | | | | | | | | | | | |
| 2012 | LGD | 72 | VL-12-378 to 418, 421, 435 to 453, 462 to 468, 502 to 505 | | | 21134 | | | | | | | | | | | |
| | FZ | 55 | VL-12-420, 422 to 434, 454 to 461, 469 to 501 | | | 8199 | | | | | | | | | | | |
| | SZ | 1 | VL-12-419 | | | 218 | | | | | | | | | | | |
| 2013 | VGD | 20 | VE-13-007 to 013, VE-13-015 to 027 (VE) | | | | 2032 | | | | | | | | | | |
| | SZ | 13 | VL-13-506 to 516, 528, 530 | | | | 1152 | | | | | | | | | | |
| | LGD | 22 | VL-13-517 to 527, 529, 531 to 540 | | | | 7208 | | | | | | | | | | |
| 2014 | VGD | 10 | VGD-14-028 to 037 | | | | | 1120 | | | | | | | | | |
| | SZ | 54 | VL-14-541 to 577, 589 to 605 | | | | | 7308 | | | | | | | | | |
| | MA | 25 | MA-14-001 to 025 | | | | | 4133 | | | | | | | | | |
| | RB | 11 | VL-14-578 to 588 (Rainbow) | | | | | 937 | | | | | | | | | |
| 2015 | MA | 41 | MA-15-026 to 078 | | | | | | 7494 | | | | | | | | |
| | MA | | Extended MA-14-016, MA-15-028, 044, 069 | | | | | | 428 | | | | | | | | |
| | TR | 12 | MA-15-052 to 057, MA-15-072 to 076, MA-15-078 (Triangle Pond) | | | | | | 1266 | | | | | | | | |
| | BZ | 7 | VL-15-607, 608, 609, 611 to 614 | | | | | | 716 | | | | | | | | |
| | SZ | 2 | VL-15-606, VL-15-610 | | | | | | 199 | | | | | | | | |
| | VSW | 4 | VSW-15-001 to 004 (VSW) | | | | | | 383 | | | | | | | | |
| 2016 | MA | 76 | MA-16-079 to 157 | | | | | | | 17590 | | | | | | | |
| | MA | | Extended MA-15-032, 034, 039, 047, MA-16-095, 109, 115 | | | | | | | 1194 | | | | | | | |
| | MAS | 3 | MA-16-086, 088, 089 | | | | | | | 499 | | | | | | | |
| | VGD | 3 | VGD-16-042 to 044 | | | | | | | 192 | | | | | | | |
| | VNE | 4 | VGD-16-038 to 041 (VNE) | | | | | | | 428 | | | | | | | |
| | LGD | 2 | VL-16-615 and 617 | | | | | | | 181 | | | | | | | |
| | RB | 1 | VL-16-616 (Rainbow) | | | | | | | 110 | | | | | | | |
| 2017 | MA | 105 | MA-17-158 to 262 | | | | | | | | 45495 | | | | | | |
| | MA | | Extended MA-14-010, MA-15-070, 071, MA-16-134, 141, 157, MA-17-160, 161, 163, 173, 177, 178, 185, 249 | | | | | | | | 1180 | | | | | | |
| | LGD | 23 | VL-17-618 TO 624, 641 TO 656 | | | | | | | | 9366 | | | | | | |
| | SS | 10 | VL-17-625, 627, 629. 630. 632, 634, 635, 637, 638. 640 (Scott Zone) | | | | | | | | 1190 | | | | | | |
| | SS | 6 | VL-17-626, 628. 631, 633, 636 (Steve Zone) | | | | | | | | 984 | | | | | | |
| 2018 | MA | 82 | MA-18-263 to 291, 295 to 347 | | | | | | | | | 32961 | | | | | |
| | MA | | Extended MA-15-065, MA-16-157, MA-17-212, MA-17-257, MA-17-258, MA-17-216, MA-18-263 | | | | | | | | | 1442 | | | | | |
| | MAS | 3 | MA-18-292, MA-18-293, MA-18-294 | | | | | | | | | 206 | | | | | |
| | BZ | 22 | VL-18-657 to 678 | | | | | | | | | 4974 | | | | | |
| | VGD | 7 | VGD-18-050, 052 to 057 | | | | | | | | | 1007 | | | | | |
| | VSW | 6 | VGD-18-045 to 049, 051 (VSW) | | | | | | | | | 825 | | | | | |
| 2019 | MA | 141 | MA-19-348 to 487 | | | | | | | | | | 37788 | | | | |
| | MAS | 1 | VL-19-768 | | | | | | | | | | 128 | | | | |
| | LGD | 69 | VL-19-679 to 747 | | | | | | | | | | 20511 | | | | |
| | SZ | 24 | VL-19-748 to 764, 766, 767, 770, 772, 775, 792, 793 | | | | | | | | | | 2847 | | | | |
| | BZ | 21 | VL-19-765, 769, 771, 773, 774, 776 to 791 | | | | | | | | | | 4198 | | | | |
| 2020 | P-TMF | 49 | V-C-20-001 TO 049 | | | | | | | | | | | 6782 | | | |
| | BZ | 159 | VL-20-794 to 952 | | | | | | | | | | | 31740 | | | |
| | MWD | 21 | MA-C-20-001 TO 021 | | | | | | | | | | | 2937 | | | |
| | LWD | 30 | VL-C-20-001 TO 030 | | | | | | | | | | | 4195 | | | |
| | NA | 14 | NR-20-001 TO 014 | | | | | | | | | | | 2260 | | | |
| | MAS | 24 | MAS-20-001 TO 024 | | | | | | | | | | | 5767 | | | |
| 2021 | BZ | 215 | VL-21-953 to VL-21-1183 | | | | | | | | | | | | 58221 | | |
| | BZ | | Extended VL-20-895 | | | | | | | | | | | | 138 | | |
| | VGD | 28 | VGD-21-058 to VGD-21-085 | | | | | | | | | | | | 8337 | | |
| | MWD | 24 | MA-C-21-022 to MA-C-21-045 | | | | | | | | | | | | 3744 | | |
| | SZ | 16 | VL-21-1103, 1104, 1107, 1109, 1112, 1114, 1116, 1118, 1120, 1122, 1124, 1126, 1127, 1129, 1131, 1133 | | | | | | | | | | | | 3701 | | |
| 2022 | BZ | 76 | VL-22-1184 to VL-22-1258 | | | | | | | | | | | | | 14895 | |
| | BZ | 55 | Berry Zone Condemnation VL-C-22-031 to VL-C-22-085 | | | | | | | | | | | | | 5522 | |
| | VGD | 19 | VGD-22-086 to VGD-22-103 | | | | | | | | | | | | | 4969 | |
| **Totals** | | **1936** | | **10943** | **25251** | **29550** | **10392** | **13498** | **10486** | **20194** | **58215** | **41414** | **65470** | **53681** | **74141** | **25386** | **438622** |
| **Historical DDH's** | | **136** | | | | | | | | | | | | | | | **23775** |
| | | | | | | | | | | | | | | | **Total** | | **462397** |

Prospect Legend

| | |
|---|---|
| BZ | Berry Zone |
| FZ | Frank Zone |
| LGD | Leprechaun Deposit |
| LWD | Leprechaun Waste Dump |
| MA | Marathon Deposit |
| MAS | Marathon South |
| MWD | Marathon Waste Dump |
| NA | Narrows |
| RB | Rainbow |
| SS | Scott & Steve Zones |
| SZ | Sprite Deposit |
| P-TMF | Tailings Management Facility |
| TR | Triangle |
| VGD | Victory Deposit |
| VNE | Victory North East |
| VSW | Victory South West |

Chart Totals

| | Marathon | Leprechaun | Berry | Victory | Sprite | Other* | Total |
|---|---|---|---|---|---|---|---|
| Metres | 149705 | 90794 | 114881 | 18964 | 16571 | 47707 | 438622 |
| Percentage | 34% | 21% | 26% | 4% | 4% | 11% | 100% |
| # of DDH | 470 | 408 | 500 | 93 | 118 | 347 | 1936 |

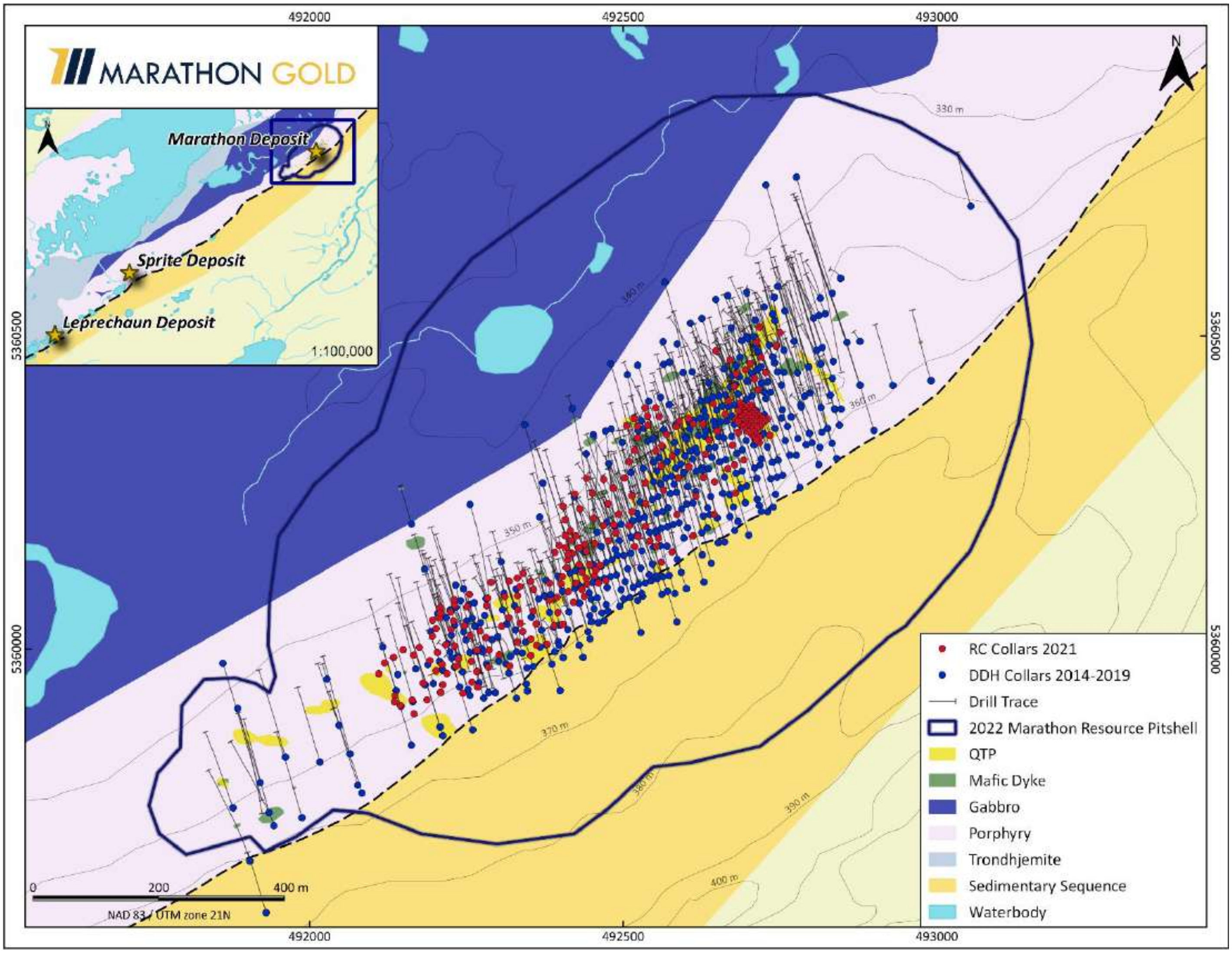
* Includes FZ, LWD, MAS, MWD, NA, RB, SS, P-TMF, TR, VNE, VSW, and Berry Zone Condemnation

**Table 10.2: Summary of the Marathon, Leprechaun, and Berry 2022 Geological Databases used in the Updated Mineral Resource Estimations**

| Exploration Activity | Marathon (to 14 May 2022) | Leprechaun (to 14 April 2022) | Berry (to 12 June 2022) |
|---|---|---|---|
| Drillholes | 713 drillholes totalling 151,663 m in total length drilled | 483 drillholes totalling 99,976 m in total length drilled | 421 drillholes totalling 99,845 m in total length drilled |
| Gold Assays | 109,456 assays totalling 159,104 m of total assayed length (96.4% of the total length drilled) | 70,912 assays totalling 96,749 m of total assayed length (96.8% of the total length drilled) | 72,474 assays totalling 95,829 m of total assayed length (96.0% of the total length drilled) |
| Geological Records | 16,838 geological records | 8,617 geological records | 8,736 geological records |
| Survey Records | 25,218 survey records | 24,709 survey records | 22,290 survey records |
| Visible Gold Records | 1,444 visible gold records | 1,252 visible gold records | 537 visible gold records |
| QTPV Records | 3,907 QTPV records | 2,892 QTPV records | 4,919 QTPV records |

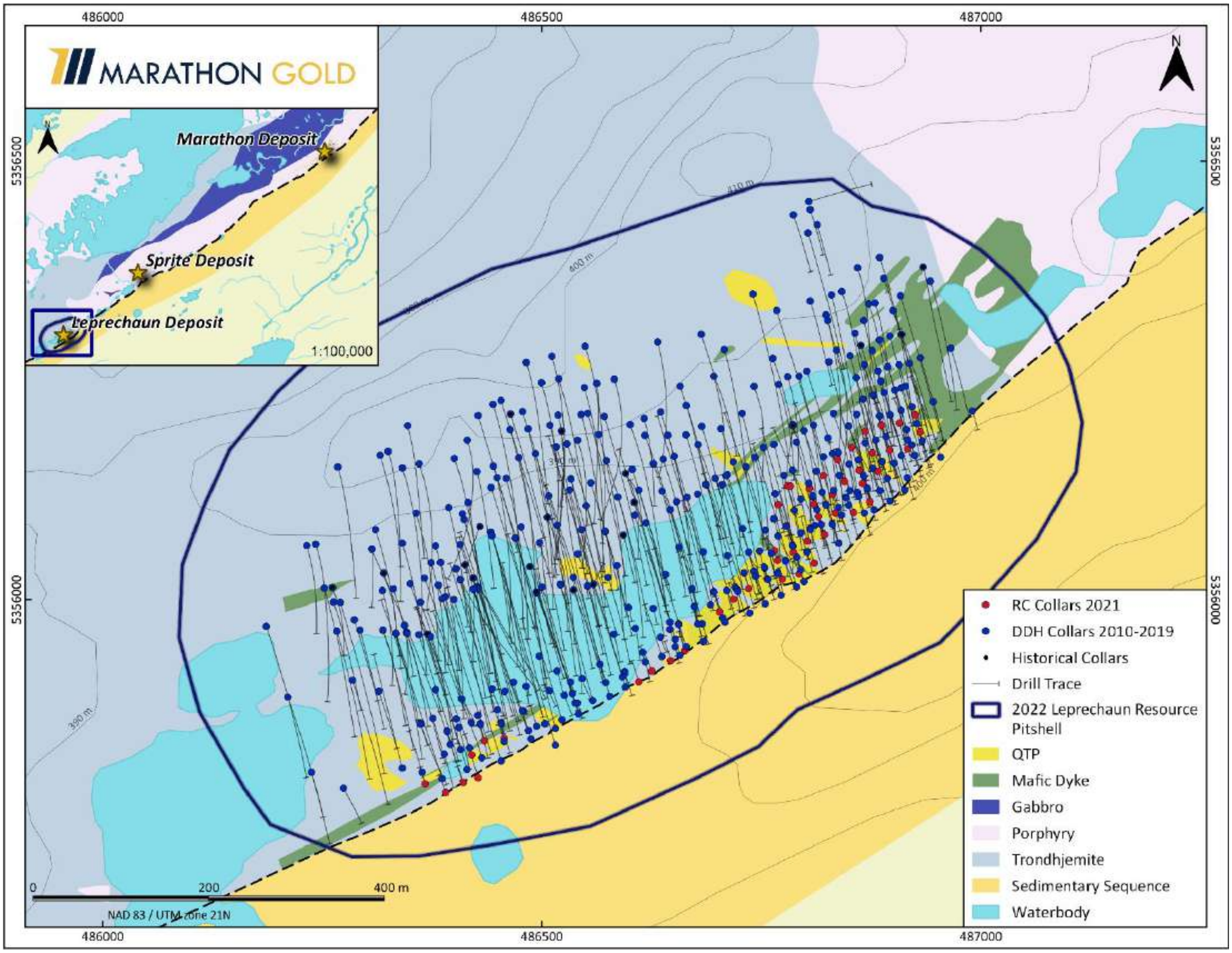
Note: QTPV = quartz-tourmaline-pyrite zones. Dates listed reflect assay data cut-off. All drillholes summarized were drilled prior to 2022.

**Figure 10-1: Diamond Drillholes Completed by Marathon Gold at the Marathon Deposit**



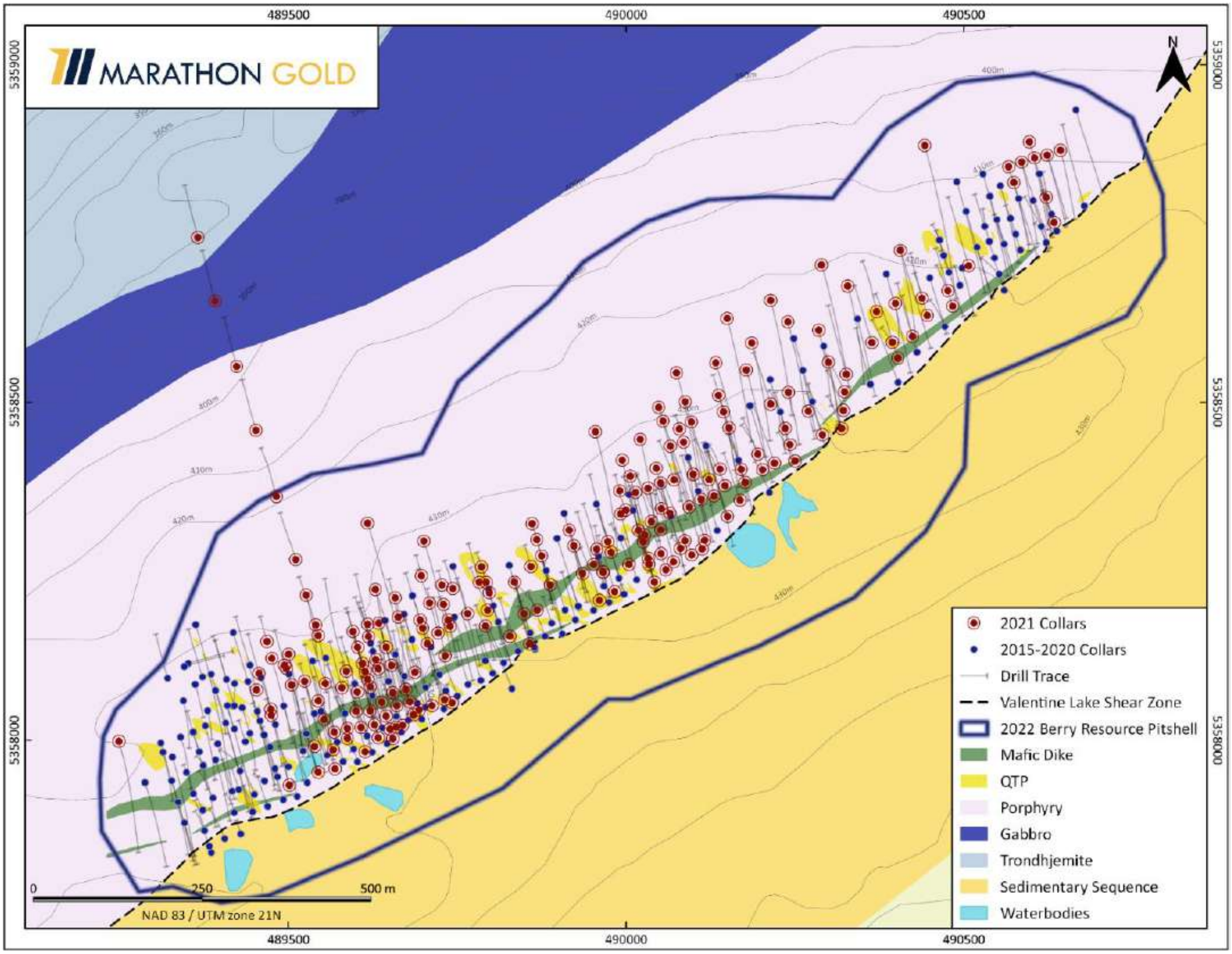

Source: Marathon Gold, 2022.

**Figure 10-2: Diamond Drillholes Completed by Marathon Gold at the Leprechaun Deposit**




Source: Marathon Gold, 2022.

**Figure 10-3: Diamond Drillholes Completed by Marathon Gold at the Berry Deposit (to end of November 2021)**




Source: Marathon Gold, 2022.

## 10.2 Diamond Drilling Procedures

Diamond drilling was conducted by Springdale Forestry of Springdale, NL, between 2010 and 2011, and by RNR Drilling Ltd. (Rob's Grader Services) of Springdale from 2012 onward.

Collars were positioned using a TopCon Hiper HR GPS unit and were aligned to the designated azimuth using a Reflex TN-14 gyroscopic compass. This unit uses a fibre-optic gyroscope to determine the azimuth and dip of the rig. Upon completion of each drillhole, the TopCon HR was used to record the final UTM coordinates of the collar location, spatial referencing in NAD83 UTM coordinate system. All drillholes undergo downhole surveys to obtain drillhole deviation data using the Reflex Sprint-IQ instrument, since it is not affected by magnetism which is variable in some of the local rock units, particularly the mafic dykes and gabbros. This Sprint-IQ use two north-seeking gyroscopes to determine the azimuth and dip at varying intervals, typically every 2 to 5 m, during the downhole survey.

Consequently, the relationship between the sample length and the true thickness of the mineralization is well-documented and all assay sample intervals are given as core length unless noted as true thickness.

Diamond drilling was conducted using wireline NQ-size double tube barrels typically producing 3 m runs of core except in areas of poor recovery. Core splits are archived for future geological confirmation and QA/QC work. Drilling has been conducted as both inclined and sub-vertical holes to accommodate the variable dip of mineralized domains. Inclined holes were typically drilled at an inclination of 45° to 80° and were oriented either southeast or northwest to intercept the shallowly southeast-dipping QTP veins, the steeply northwest-dipping shear parallel QTP veins and the steeply northwest-dipping contact between the VLIC and the Rogerson Lake Conglomerate.

Exploration drilling has been conducted on nominal 100 m spaced lines with 30 m spaced holes, closing to 25 m x 25 m and up to 10 to 15 m drill centers at the Marathon and Leprechaun deposits.

At the end of each run, drill core was placed by the driller into core boxes which were marked with a box number. The driller inserted a block marked with the run depth in meters at the end of each run. The drill core was then transported to the core logging facility at the end of each 12-hour shift.

Following completion of the hole, collars were marked with a wooden pole, which was labelled with the hole number. Drill collar positions were surveyed after completion of the drillhole using either a Trimble or a TopCon GPS system. The Trimble is comprised of an R8 base station and rover and a hand-held Geo XM while the TopCon uses two Hiper HR units, both with base station correction. These machines yielded an accuracy of <10 cm on collar locations and have been used to survey the location of historic drill collars wherever the historic collar could be found.

At the core logging facility, each run was marked with an orientation line and geotechnically logged. The core was then photographed, geologically logged and marked for sampling by the geologist prior to cutting in half with a core saw along the orientation line. After sampling was complete, the core boxes containing half core were stacked and stored at Marathon Gold's exploration camp. Logging and sampling procedures are described in Sections 10.2.1 and 10.2.2.

### 10.2.1 Diamond Drill Logging

Geotechnical logging by Marathon Gold geologists included a description of the fractures, such as number of fractures, fracture index, type and roughness, alteration, and core recovery. Geological logging included an initial summary log of the principal rock types and mineralized intervals, followed by a detailed geological log that described a pre-determined index of rock type, detailed lithology, alteration type and degree, mineralization type and percentage, and structural observations in both written and graphical form. The geological log also contains the sample intervals and numbers.

### 10.2.2 Diamond Drill Core Sampling

The core cutting was done with heavy duty DeWalt 10″ wet tile saws using very thin, continuous rim, diamond porcelain blades and aluminum oxide conditioning sticks. Drill core samples were taken from half cut core, except in rare zones of intense fracturing where the core was split manually. Sample intervals were determined by the geologist based on changes in lithology, alteration, and fracture intensity, and were nominally taken at 1 m intervals in mineralized zones and 2 m intervals in barren zones. Sample locations were noted on the geological drill log. One half of the drill core was placed in a plastic sample bag, tagged with a unique sample number, tied and placed in batches for dispatch to the laboratory for preparation and analysis. Marathon Gold sampled the entire length of each hole excepting large zones of mafic dyke or conglomerate that contained no visible veining.

Specific gravity values have been systematically measured by Marathon Gold geologists using the Archimedes method. Samples were selected from half core and were chosen to represent the different lithologies, alteration types, and mineralized domains observed.

A detailed specific gravity program was initiated by Marathon Gold in the fall of 2021 that measures densities for all sample intervals and lithologies. The work included checks of all previous density measurements collected for the Leprechaun, Marathon and Berry deposits.

### 10.2.3 Diamond Drill Sample Recovery

Diamond drill core recovery was routinely measured during core logging and recorded on geotechnical log sheets. Drill core recovery was excellent, averaging 95%. There is no evidence of bias or any relationship between core recovery and assayed gold grade.

### 10.2.4 Diamond Drill Database

Geotechnical and geological logging data, as well as sample chain of custody data, were entered directly into Microsoft Excel worksheets per hole and were manually updated into a master worksheet by Marathon Gold's exploration manager. More recently, Marathon Gold geologists recorded geological and geotechnical information directly into the cloud-based database, MX Deposit, which was customized to record all the same information found in the Excel workbooks. Following the introduction of the MX Deposit database, numerous deficiencies were noted, leading to the introduction of the acQuire database for recording and analyzing all drill data collected on site. Templates for logging were developed with acQuire support staff, and all Marathon and historical data was migrated to acQuire.

Assay results were appended to the geological worksheets using the automatic VLookup function in Excel, with the sample number providing a unique reference. This minimized the risk of data transcription errors when receiving analytical results. When Marathon Gold began logging using the MX deposit database, and while using Acquire, assay certificates were automatically uploaded into the program which further reduced the potential for human error.

## 10.3 Reverse Circulation Drilling Procedure

Reverse circulation (RC) drilling was conducted by Brewster during the summer of 2021.

Collars were positioned using a TopCon Hiper HR GPS unit and any non-vertical holes were aligned to the designated azimuth using a Reflex TN-14 gyroscopic compass, mentioned in the previous section. Upon completion of each drillhole, the TopCon HR was used to record the final UTM coordinates of the collar location, spatial referencing in NAD83 UTM coordinate system. Only non-vertical drillholes undergo downhole surveys to obtain drillhole deviation data using the

Reflex Sprint-IQ instrument. The Sprint-IQ uses two north-seeking gyroscopes to determine the azimuth and dip at varying intervals, typically every 2 to 5 m, during the downhole survey.

RC drillholes were drilled using a 5.5-inch-wide tungsten carbide drill bit which produced rock chips ranging from fine sand to medium gravel. Two samples were collected at 2 m composites and split to the desired weight of 4 to 5 kg using a cyclone splitter drill attachment. One sample was utilized for chip logging and stored on site for a reference. The second sample was sent to the assay lab for analysis. The remainder of the sample is discarded.

Drillhole positions were surveyed after completion of the drillhole using a TopCon RTK GPS system. The TopCon unit includes a Hiper HR base station along with a portable rover carried by the surveyor. The device yielded an accuracy of <10 cm on hole locations.

### 10.3.1 Reverse Circulation Logging

Rock chips were logged by geologists at the drill site before samples were bagged and transported back to the storage facility. A representative sample is placed into a stainless-steel sieve and chips are rinsed of dust. Information is recorded for each sample including the major lithology, quartz percentage, pyrite percentage, and presence of visible gold. The drill log also contains the sample number and depth interval. A small portion, roughly a few tablespoons, is collected and stored in a chip tray for future reference.

### 10.3.2 Reverse Circulation Database

Geological information was collected by a geologist at the drill site with a field notebook then entered into the cloud-based database, MX Deposit, by the geologist once returning from the field. Sample information was also entered into MX Deposit at this time.

All information has since been transferred into the acQuire database.

## 10.4 Results of Marathon Gold’s 2021 and 2022 Diamond and Reverse Circulation Drilling Programs

Drilling by Marathon Gold has defined five gold deposits (Leprechaun, Sprite, Berry, Marathon, and Victory) at the property. The resource estimates of these deposits are based on drill data collected up to and including the results from the 2022 drill program (see Table 10-2). Because the 2021 and 2022 drill programs are exclusive of one another, the two programs are discussed separately in the text that follows.

### 10.4.1 Summary of 2021 Drilling Results

Drilling during the 2021 program focused on the Berry deposit, with the RC program occurring in the Leprechaun and Marathon deposits. All 2021 exploration and RC drilling has been utilized in the mineral resource estimates presented in this report.

The Valentine Lake property hosts structurally controlled, orogenic gold deposits consisting of dominantly shallow southwest-dipping, en-echelon stacked extensional and lesser shear parallel gold-bearing quartz-tourmaline-pyrite veining. The gold-bearing QTP-veining is hosted within trondhjemite, quartz-eye porphyry and lesser aphanitic and mafic dykes of the Valentine Intrusive Suite as well as the Rogerson Lake Conglomerate. The individual characteristics of mineralization at the Leprechaun, Berry and Marathon deposits, which are the focus of the updated mineral resource estimates, are described in Section 7.5, Mineralization.

The focus of the 2021 drilling campaign was to infill and further extend the mineralization discovered in the Berry deposit over the previous seasons and to increase confidence in the initial MRE released by Marathon in April 2021. Drillholes were planned in one of two main orientations, with the first dipping moderately to the southeast to define the VLSZ and cut across the mineralization, providing and approximate thickness, and the second dipping steeply to the northwest. These northwest drillholes intersected the S1 extensional veins near-perpendicularly, which allowed for estimations of the continuity of the main zone mineralized corridor.

By the conclusion of the 2021 drilling program, gold-bearing QTP mineralization had been defined over a strike length of approximately 1.5 km, including a well-developed Main Zone of mineralization similar to that found at the Leprechaun deposit. In addition to the mineralization, several large mafic dykes were discovered running sub-parallel to the VLSZ. These mafic dykes are continuous throughout the 1.5 km long Berry Zone, apart from a 300 m section which shows both mineralization and mafic dykes to be less present at surface. Further drilling has discovered mineralization and dykes at depth in this area.

The relationship between high-grade gold mineralization and the location of the dykes supports the interpretation that the mafic dykes provide a rheologic contrast that (1) promotes brittle fracturing of the granitoid unit and therefore, acts as a controlling factor of mineralized fluid flow, and (2) incites the eventual emplacement of zones of gold enrichment.

The 2021 drill results, along with previous Berry deposit drilling, have now been utilized in the updated mineral resource estimates that are discussed in Section 14, Mineral Resource Estimates. Best examples of true thickness assay intervals from Leprechaun, Marathon and Berry are presented in Tables 10-3, 10-4 and 10-5, respectively.

During 2021, Marathon Gold drilled 215 drillholes at Berry, together with smaller drill programs at the Victory (n=28 drillholes) and Sprite (n=16 drillholes) deposits and the proposed Marathon waste pile (n=24 drillholes). Drilling at Victory discovered additional low-grade mineralization proximal to the VLSZ contact, with pockets of higher grade locally. Further drilling in the Victory deposit is warranted as follow-up to the 2021 program.

Sprite deposit drilling attempted to amalgamate the current small pit shells into a single larger pit shell, and to discover any potential mineralization proximal to the VLSZ. The majority of the 2021 drilling completed in Sprite did not encounter significant mineralization, and a large mafic dyke was discovered to be butted up against the VLSZ, potentially reducing the potential for “Main Zone” style mineralization in this area.

Marathon waste pile drilling was a further follow up to a small (~200 m strike length) zone of mineralization discovered in a raft of QEP in the larger gabbro unit under the MWD. This drilling further constrained the mineralization, and while several significant intervals were discovered, no further drilling is required, and the area has been sterilized for planned infrastructure.

**Table 10.3: Summary of Best Gold Assay Highlights of Drilling Completed by Marathon Gold at the Leprechaun Deposit between 2010 & 2019**

| 2010 | | | 2011 | | | 2012 | | | 2013 | | | 2017 | | | 2019 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) |
| VL-10-165 | 9 | 13.4 | VL-11-246 | 37.5 | 3.75 | VL-12-401 | 30 | 3.93 | VL-13-523 | 3 | 52.73 | VL-17-653 | 181 | 3.42 | VL-19-679 | 6 | 25.78 |
| VL-10-225 | 19 | 6.53 | VL-11-261 | 12.8 | 9.68 | VL-12-403 | 22 | 7.23 | VL-13-526 | 36 | 4.26 | VL-17-654 | 301 | 2.65 | VL-19-679 | 22 | 9.02 |
| VL-10-226 | 17 | 6.94 | VL-11-288 | 65.6 | 2.09 | VL-12-407 | 15 | 9.19 | VL-13-537 | 3 | 39.55 | VL-17-655 | 151 | 2.34 | VL-19-679 | 22 | 11.83 |
| VL-10-226 | 13 | 11.81 | VL-11-306 | 13.3 | 16.15 | VL-12-408 | 19 | 13.81 | | | | VL-17-656 | 7 | 19.01 | VL-19-680 | 71 | 2.52 |
| | | | VL-11-352 | 26.1 | 13.95 | VL-12-416 | 8 | 15.8 | | | | VL-17-656 | 33 | 3.72 | VL-19-681 | 126 | 4.27 |
| | | | | | | VL-12-465 | 13 | 13.2 | | | | | | | VL-19-681 | 42 | 4.11 |
| | | | | | | VL-12-504 | 7 | 45.58 | | | | | | | VL-19-686 | 153 | 3.02 |
| | | | | | | | | | | | | | | | VL-19-688 | 30 | 5.06 |
| | | | | | | | | | | | | | | | VL-19-688 | 24 | 5.04 |
| | | | | | | | | | | | | | | | VL-19-695 | 98 | 2.41 |
| | | | | | | | | | | | | | | | VL-19-697 | 36 | 5.45 |
| | | | | | | | | | | | | | | | VL-19-700 | 29 | 4.39 |
| | | | | | | | | | | | | | | | VL-19-703 | 19 | 10.03 |
| | | | | | | | | | | | | | | | VL-19-711 | 74 | 4.24 |
| | | | | | | | | | | | | | | | VL-19-711 | 24 | 6.94 |
| | | | | | | | | | | | | | | | VL-19-719 | 41 | 4.49 |

**Table 10.4: Summary of Best Gold Assay Highlights of Drilling Completed by Marathon Gold at the Marathon Deposit between 2014 & 2019**

| Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA-14-002 | 111 | 1.71 | MA-15-036 | 47 | 3.02 | MA-16-047 | 11 | 20.166 | MA-17-159 | 50 | 3.434 | MA-18-282 | 13 | 18.66 | MA-19-357 | 13 | 12.49 |
| MA-14-021 | 68 | 2.006 | | | | MA-16-101 | 65 | 2.185 | MA-17-160 | 75 | 3.92 | MA-18-295 | 59 | 7.97 | MA-19-370 | 75 | 2.61 |
| | | | | | | MA-16-107 | 105 | 2.382 | MA-17-161 | 60 | 3.835 | MA-18-303 | 149 | 1.54 | MA-19-372 | 45 | 3.52 |
| | | | | | | MA-16-109 | 47 | 3.012 | MA-17-162 | 125 | 2.12 | MA-18-305 | 105 | 1.41 | | | |
| | | | | | | MA-16-116 | 102 | 2.305 | MA-17-162 | 43 | 4.18 | | | | | | |
| | | | | | | MA-16-149 | 47 | 2.928 | MA-17-163 | 82 | 1.905 | | | | | | |
| | | | | | | MA-16-154 | 14 | 25.33 | MA-17-165 | 71 | 2.92 | | | | | | |
| | | | | | | | | | MA-17-165 | 136 | 1.88 | | | | | | |
| | | | | | | | | | MA-17-175 | 101 | 1.766 | | | | | | |
| | | | | | | | | | MA-17-176 | 118 | 1.56 | | | | | | |
| | | | | | | | | | MA-17-178 | 89 | 1.84 | | | | | | |
| | | | | | | | | | MA-17-183 | 82 | 1.82 | | | | | | |
| | | | | | | | | | MA-17-186 | 191 | 1.61 | | | | | | |
| | | | | | | | | | MA-17-188 | 326 | 2.13 | | | | | | |
| | | | | | | | | | MA-17-213 | 225 | 1.88 | | | | | | |
| | | | | | | | | | MA-17-217 | 171 | 1.51 | | | | | | |
| | | | | | | | | | MA-17-218 | 209 | 1.36 | | | | | | |
| | | | | | | | | | MA-17-220 | 221 | 1.32 | | | | | | |
| | | | | | | | | | MA-17-225 | 52 | 2.8 | | | | | | |
| | | | | | | | | | MA-17-226 | 87 | 1.95 | | | | | | |
| | | | | | | | | | MA-17-237 | 99 | 1.43 | | | | | | |
| | | | | | | | | | MA-17-239 | 99 | 1.85 | | | | | | |
| | | | | | | | | | MA-17-242 | 48 | 3.43 | | | | | | |

**Table 10.5: Summary of Best Gold Assay Highlights of Drilling Completed by Marathon Gold at the Berry Deposit between 2018 & 2021**

| 2018 | | | 2019 | | | 2020 | | | 2021 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) | Drillhole | Core Interval (m) | Gold Assay (g/t) |
| VL-18-676 | 49 | 6.17 | VL-19-776 | 5 | 10.43 | VL-20-799 | 55 | 52.30 | VL-21-968 | 5 | 1.84 |
| | | | VL-19-778 | 6 | 9.74 | VL-20-806 | 14 | 8.06 | VL-21-984 | 122 | 2.71 |
| | | | VL-19-779 | 11 | 5.54 | VL-20-813 | 12 | 8.03 | VL-21-1000 | 21 | 5.19 |
| | | | VL-19-779 | 13 | 3.82 | VL-20-823 | 120 | 3.33 | VL-21-1027 | 22 | 3.04 |
| | | | VL-19-780 | 10 | 7.25 | VL-20-824 | 4 | 51.52 | VL-21-1063 | 2 | 12.57 |
| | | | VL-19-786 | 22 | 7.6 | VL-20-824 | 36 | 3.37 | VL-21-1083 | 8 | 7.77 |
| | | | | | | VL-20-835 | 47 | 2.96 | VL-21-1099 | 12 | 7.47 |
| | | | | | | VL-20-838 | 111 | 1.47 | VL-21-1139 | 48 | 1.8 |
| | | | | | | VL-20-839 | 9 | 14.39 | VL-21-1150 | 21 | 7.17 |
| | | | | | | VL-20-873 | 92 | 2.61 | VL-21-1183 | 2 | 43.88 |
| | | | | | | VL-20-876 | 22 | 4.91 | | | |
| | | | | | | VL-20-889 | 42 | 3.70 | | | |
| | | | | | | VL-20-907 | 7 | 18.16 | | | |

### 10.4.2 Summary of 2022 Drilling Results

Following the success of the 2021 exploration drilling program, the 2022 drilling program focused on further progression of design and infrastructure. The main goal of the 2022 drill program was to advance the confidence level of the Berry deposit to the mine planning stage. The objectives of the Berry deposit drill program were to better define the geotechnical characteristics of potential pit walls along with additional infill drilling in the hanging wall of the Berry deposit to attempt to reduce the strip ratio.

In addition, 2022 exploration drilling is ongoing in the Victory deposit, focusing on adding additional ounces and confidence to the currently modelled resource. Drill data presented below includes drillholes completed as of October 28, 2022.

The Berry sterilization, or condemnation, drill program consisted of 55 drillholes totalling 5,523 m of NQ drill core in an area northwest of the deposit. This area has been proposed as the waste rock pile for the Berry pit (if Berry is added to the Valentine Gold Project mine plan). While some results are still pending, drilling in the waste rock pile uncovered little mineralization and it is assumed the area will be condemned for development of infrastructure. Drillhole depths were an average of 100 m and oriented at a dip of 60° toward an azimuth of 343°. This orientation coincides with the drilling orientations that were used for discovery and definition of mineralization in the main Valentine Gold Project deposit areas. No further work is planned or deemed necessary for the Berry deposit waste rock pile.

Geotechnical drilling at the Berry deposit through the 2022 season consisted of 13 HQ diameter drillholes totalling 2,992 m of core around the perimeter of the Berry deposit. These holes were planned by Terrane Geosciences, who are responsible for the geotechnical design of the pit, and ranged significantly in dip, azimuth and depth depending on geotechnical rationale. Additional information on the geotechnical drilling and design conclusions is discussed in Section 16.

Infill drilling in the Berry deposit comprised a total of 14,269 m of core in 74 NQ diamond drillholes. These holes were mainly focused on the hanging wall of the Berry deposit to define additional mineralization which would in turn reduce the strip ratio in the current mine design. Drilling was generally oriented either steeply to the northwest to intersect mineralized Set 1 QTP-Au veins at a high angle, or more shallowly to the southeast to define the thickness of mineralized zones. Drillhole depths ranged from 23 to 410 m. The 2022 infill drilling of the Berry deposit is not included in the mineral resource update presented in this report and is still ongoing at the time of writing.

Other exploration drilling during the 2022 program was focused on the Victory deposit, the northeastern deposit in the Valentine Gold Project trend. At the effective date of this report, 5,020 m had been drilled over 20 holes. The objective of the drilling at Victory is to further define mineralization discovered during the 2021 exploration program which was proximal to the VLSZ in comparison to the bulk of mineralization previously discovered. The geometry of the VLSZ, and in turn the mineralization, in the Victory deposit differs from the other deposits in that it is not overturned and dips steeply to the southeast. The mineralization discovered in this area is generally more diffuse and of slightly lower grade than other main zones. Drilling is planned to be completed in Victory by the end of October 2022, following restrictions due to caribou migration patterns.

## 10.5 Benefit of the RC Drilling Program Results in Mining Grade Control

During the summer of 2021, Marathon completed 12,141 m of drilling over 302 drillholes in its RC drill program (Figure 10-4). The program was designed to validate the project’s mineral reserve block model within the Phase 1 pits of each of the Marathon and Leprechaun deposits and to help develop plans for mining grade control. The primary purpose was to identify any areas of risk in the estimate of gold content, especially in the early benches of the two mineral reserve pits.

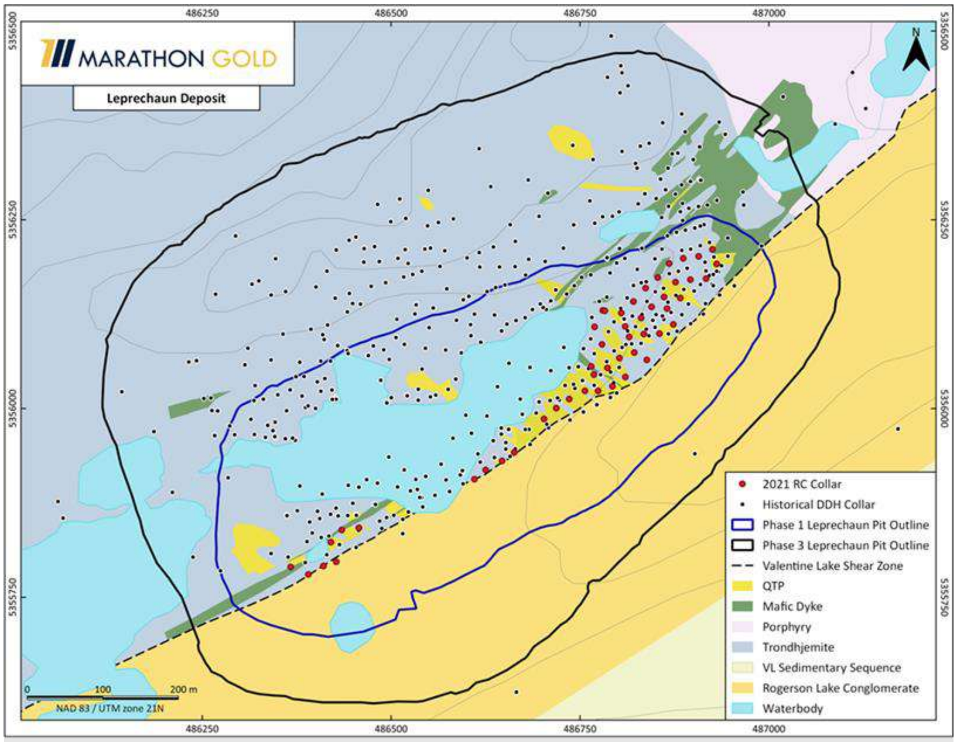
Three separate analyses were completed, including an average grade test at Leprechaun, an average grade test at Marathon, and a continuity test at Marathon.

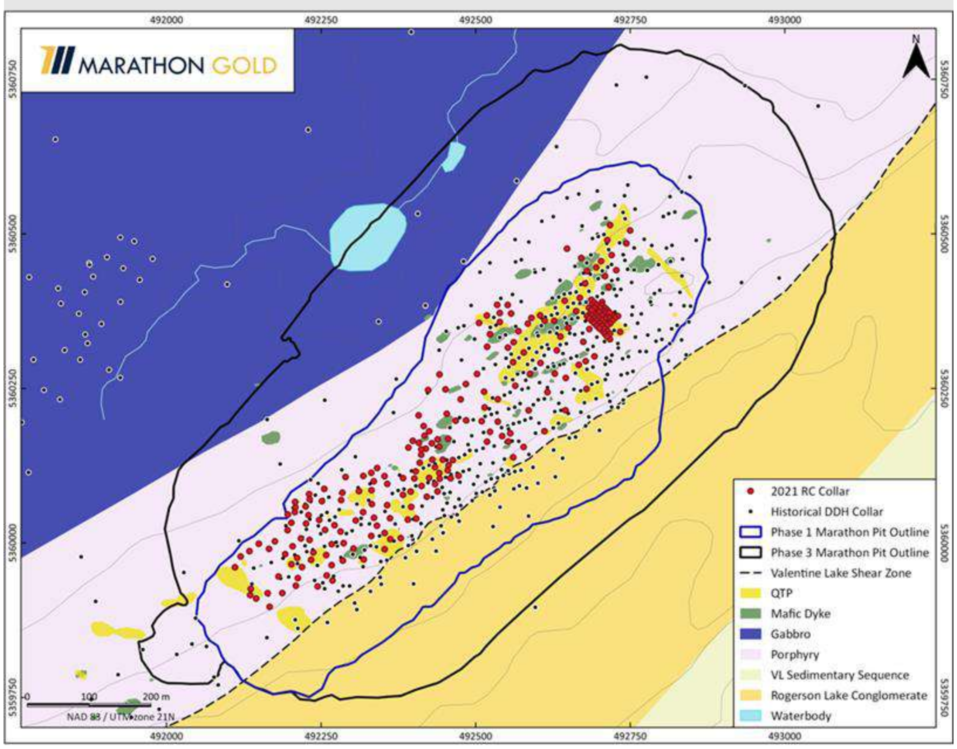
For the average grade tests, the RC drillholes were planned to provide broad coverage of the mineral reserve block models within Phase 1 pits of each the Leprechaun and Marathon deposits. RC holes were drilled to an average depth of 30 to 60 m and spaced 15 to 20 m apart. An 18 m buffer was generated around the RC drillholes and the average grade within the buffer was determined using assays from only the RC program. The grade determined by the RC drilling was then compared against the average grade of the blocks within the same buffer, which was determined by diamond drilling completed to date. For this analysis, the full metallic fire assay was used, and a cut-off of zero g/t Au was defined. The test was completed on the then-current 2021 block model and again with the updated 2022 block model. The details of the test are summarized in Table 10-6 below.

**Table 10.6: Summary of Grade Reconciliation Tests Completed within Phase 1 Pit Shells of Leprechaun and Marathon**

| Leprechaun Deposit | | |
|---|---|---|
| **Description** | **Grade (g/t Au)** | **Comments** |
| 2021 6 m Block Model | 0.43 | 2.4 Mt Represented |
| 2022 6 m Block Model | 0.47 | 2.4 Mt Represented |
| DDH | 0.45 | Cap at 50 g/t Au |
| RC | 0.51 | All Metallic Screens |
| 2021 Difference | 19% | |
| 2022 Difference | 9% | |
| **Marathon Deposit** | | |
| **Description** | **Grade (g/t Au)** | **Comments** |
| 2021 6 m Block Model | 0.41 | 2.4 Mt Represented |
| 2022 6 m Block Model | 0.30 | 2.4 Mt Represented |
| DDH | 0.32 | Cap at 50 g/t Au |
| RC | 0.38 | All Metallic Screens |
| 2021 Difference | -7% | |
| 2022 Difference | 27% | |

**Figure 10-4: Location of RC Drillholes at the Leprechaun (Top) and Marathon (Bottom) Deposits**

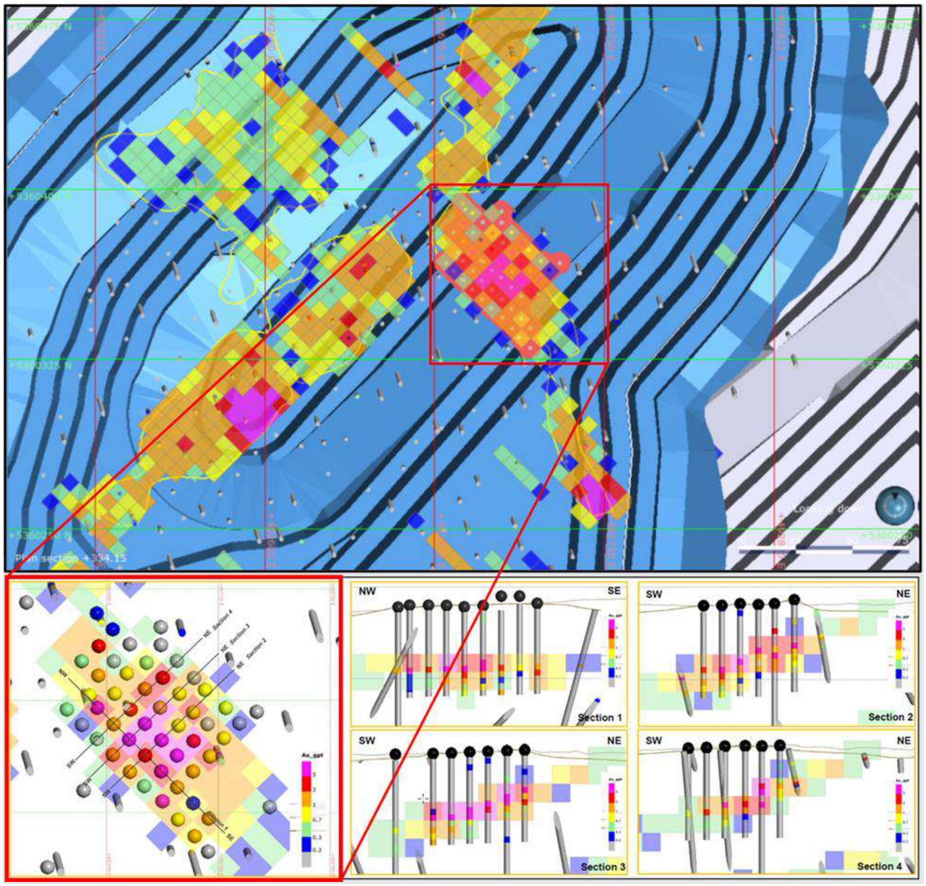



Source: Marathon Gold, 2022.

The continuity test was conducted at the Marathon deposit only. The test utilized a 35 x 45 m "postage stamp" drilled at the 6 m SMU scale. The objective was to assess the grade reconciliation and continuity of mineralization between the more broadly spaced diamond drillholes. Figure 10-5 shows the RC drill results against 6 m re-blocking of the 2022 mineral resource block model.

**Figure 10-5: Plan Map (Top, Bottom Left) and Cross-Section (Bottom Right) of RC "Postage Stamp" Testing Continuity of Mineralized Zones**




Source: Marathon Gold, 2022.

In general, good qualitative visual validation as well as quantitative validation was achieved between the RC drill results and the underlying block model, which was developed based on the extensive diamond drilling achieved on the deposits to date. This is evident across both deposits in a variety of mineralized settings. It is clear from the continuity study that mineralized zones have significant lateral extent and therefore interpolating zones between the more broadly spaced diamond drillholes is justifiable.

While there is strong confidence in the core "Main Zone" mineralization, the RC program highlighted a few areas within the 2021 MRE block model, particularly along the fringes of mineralized zones, where caution was recommended as part of future modelling. This led to further restrictions on the search ellipse parameters for the block model as used during the development of the 2022 MRE, along with explicitly modelling mafic dykes and QTP zones. The results yielded better correlation between the 2022 block model and RC results (see Table 10-6).

# 11 SAMPLE PREPARATION, ANALYSES, AND SECURITY

## 11.1 Introduction

This section includes a discussion on the security, sample preparation, analytical techniques, and quality assurance / quality control (QA/QC) data from diamond drill core and reverse circulation (RC) chip samples that were collected by Marathon Gold between January 1, 2010, and December 31, 2021. The majority (97%) of exploration samples collected by Marathon Gold were subsequently prepared and analyzed at Eastern Analytical Ltd. (Eastern Analytical) in Springdale, NL. Eastern Analytical is ISO 17025 accredited and is independent of Marathon Gold. In 2021, samples from the Victory Gold Deposit (VGD) and Marathon condemnation samples were sent to SGS in Lakefield, ON, for an accelerated return of results. SGS is ISO 17025 accredited and independent of Marathon Gold. The analytical results are maintained by Marathon Gold in an AcQuire database and the assay files used in the current mineral resource estimates are presented and discussed in Section 14.

A QA/QC protocol was established by Marathon Gold to ensure the reliability and validation of the exploration data. These measures include written field procedures such as drilling, surveying, sampling, and assaying, data management, and database integrity.

Analytical control measures involve internal and external laboratory control measures implemented to monitor the precision and accuracy of the sampling, preparation, and assaying process. They are also important to prevent sample mix-up and to monitor the voluntary or inadvertent contamination of samples.

Assaying protocols involve duplicating and replicating assays and inserting certified reference material (CRM) and blank samples to monitor the reliability of the assay results throughout the sampling and assaying process. Check assaying is normally performed as an additional test of the reliability of assaying results. It generally involves re-assaying a set number of sample rejects and pulps at a secondary umpire laboratory. A summary of QA/QC submittals from the Valentine Gold Project by year are presented in Table 11-1. For the 26,1190 samples analyzed between 2010 and 2021, Marathon Gold has inserted 6,409 sample blanks (2.5%) and 11,477 CRMs (4.4%). Coarse blanks were inserted into the sampling steam in 2021 by Marathon Gold totalling 140 blank samples (0.27% of the total samples for 2021). During 2021, the number of sample blank and CRM inserts totalled 10% of the overall analytical sample stream.

## 11.2 Chain of Custody

Samples were transported by Marathon Gold directly from the Valentine Lake exploration camp to Eastern Analytical by company vehicle in sample batches that were contained in sealed rice sacks. Upon Chain of Custody receipt of samples, laboratory personnel checked the seals on both the rice sacks and individual sample bags to ensure that sample integrity had been maintained during transport.

**Table 11.1: Summary of Valentine Gold Project 2010-2021 QA/QC Samples Submitted for Analyses**

| Year | Drillholes | Total Samples | Blanks | CRMs | Coarse Duplicates |
|---|---|---|---|---|---|
| 2010 | 96 | 8,907 | 254 | 356 | - |
| 2011 | 152 | 15,600 | 363 | 724 | - |
| 2012 | 128 | 15,363 | 423 | 834 | - |
| 2013 | 55 | 7,131 | 143 | 289 | - |
| 2014 | 100 | 8,425 | 191 | 377 | - |
| 2015 | 66 | 6,493 | 151 | 305 | - |
| 2016 | 89 | 11,259 | 189 | 451 | - |
| 2017 | 144 | 40,288 | 606 | 1,578 | - |
| 2018 | 120 | 27,116 | 411 | 1,058 | - |
| 2019 | 263 | 46,876 | 717 | 1,789 | - |
| 2020 | 319 | 22,713 | 546 | 1,151 | - |
| 2021 | 601 | 51,019 | 2,415 | 2,565 | 140 |
| 2021 (SGS) | 41 | 6,880 | 385 | 360 | - |
| Total | 2,174 | 268,070 | 6,794 | 11,837 | 140 |

## 11.3 Sample Preparation and Data Management

Drilling completed by Marathon Gold (2010 to 2021) was a combination of surface diamond drilling and RC drilling with the RC drilling introduced in 2021. Both drilling methods were operated by contractors.

Diamond drill core was placed in labelled, covered wooden core boxes at the drill site and transported by vehicle or helicopter to the exploration camp's core logging facility. The drill core is archived in well maintained core racks at the exploration camp. Representative samples of the drill core are bagged and stored in a container at the exploration camp. The RC chips were logged and sampled in the field with archived RC returns stored in a sea-can at the exploration camp.

In 2020, Marathon initiated the migration of drill, logging, sampling, and analytical data from excel files to an industry standard relational database (acQuire Technology Solutions Pty. Ltd. mining software). The process involved setting up logging templates, building importers and exporters, setting up permissions and data validation checks. The data was validated over several months and any data that could not be verified was assigned a code to indicate it is not valid for the mineral resource estimates process.

All Marathon Gold's drill, core, logging, sample information, and analytical results, are now maintained within an acQuire database. This includes lithology, RQD, alteration, VG, sample intervals and insertions of CRM, blanks, coarse duplicates, and newly implemented umpire samples.

All drill core was cut on site by Marathon Gold employees, bagged and transported directly by Marathon Gold staff to the Eastern Analytical laboratory for analyses.

At the laboratory, individual samples were prepared by drying, if necessary. The entire sample was crushed to a nominal minus 10 mesh (1.7 mm), riffle split to obtain a representative sample, and pulverized to at least 95% minus 150 mesh (106 μm).

## 11.4 Analyses

Eastern Analytical analyzed each prepared sample for gold by fire assay. All samples that assayed greater than or equal to 300 ppb gold were subjected to a total pulp metallic sieve procedure. Samples that fall within mineralized zones that are <300 ppb are also reanalyzed by screen metallics. The analytical results are captured in an acQuire database, which is programmed to utilize the screen metallic values over the standard fire assays if data is available.

Eastern Analytical also analyzed samples by multi-element (34) inductively coupled plasmometry (ICP).

The fire assay, total pulp metallic sieve and ICP-34 analytical procedures are described in the text that follows.

### 11.4.1 Fire Assay

Eastern Analytical used a 30 g crucible for rock and core samples, and a 20 g crucible for soil samples. Samples are analyzed in batches of 24, including one sample blank and one internal standard. Eastern Analytical performed lead collection fire assay with atomic absorption finish. The minimum limit of detection is <5 ppb Au.

### 11.4.2 Total Pulp Metallic Sieve

Eastern Analytical describe their metallic sieve (MS) procedure as follows:

- The entire sample (original pulp is approximately 250 g) was crushed to 80% passing -10 mesh and pulverized to 95% passing -150 mesh, prior to being sieved through a 150 mesh screen. The +150 mesh fraction was fire assayed as one sample.
- The -150 mesh fraction was rolled and weighed, with a 30 g sub-sample submitted for fire assay. The fire assay results of the +150 and -150 mesh fractions were calculated to produce a weighted average gold assay for the sample.

### 11.4.3 Inductively Coupled Plasma-34

Eastern Analytical describe their inductively coupled plasma-34 (ICP-34) procedure as follows:

- Each analytical sample is comprised 200 mg of -150 mesh sample pulp which was placed in a test tube with nitric and hydrochloric acid prior to being heated on a hot plate.
- Samples were then cooled to room temperature, topped to volume with de-ionized water, stirred to homogenize, and left to settle for one hour prior to analysis by multi-element (n=34 elements) ICP.
- Samples were prepared and analyzed in batches of 40 including two duplicates, one blank and one standard.

## 11.5 Quality Assurance and Quality Control

Marathon Gold has implemented QA/QC testing since the beginning of the exploration project in 2010 and has consistently worked to improve the QA/QC protocol to ensure high data confidence. QA/QC issues over the course of project include sample identification, analytical, and reporting; these issues have been identified and rectified based on the QA/QC protocols that have evolved along with the project.

Nepheline syenite sand, which is barren of gold, has been used as the sample blank material, A variety of CRMs were incorporated throughout the development and advancement of the project as summarized in Table 11-2.

**Table 11.2: Summary of CRM Control Sample IDs that were Used from 2010 to 2021**

| CRM | Cert. Date | Assay Technique | Finish | Expected Value (ppm) | S.D. (ppm) | Active Dates |
|---|---|---|---|---|---|---|
| GS-3F | 20-Oct-09 | FA | 2011 | 3.1 | 0.12 | 2010, 2011 |
| GS-3H | 04-Jan-11 | FA | 2012 | 3.04 | 0.23 | 2011, 2012 |
| GS-3J | 17-Jun-11 | FA | 2014 | 2.71 | 0.26 | 2012, 2013, 2014 |
| GS-3K | 27-Apr-12 | FA | 2015 | 3.19 | 0.26 | 2014, 2015 |
| GS-3L | 24-Jun-13 | FA | 2017 | 3.18 | 0.22 | 2015, 2016, 2017 |
| GS-3Q | Jan, 2016 | FA | 2018 | 3.3 | 0.26 | 2017, 2018 |
| GS-3T | 08-Jan-18 | FA | 2021 | 3.05 | 0.19 | 2018, 2019, 2020, 2021 |
| GS-3U | 24-Jan-20 | FA | 2022 | 3.29 | 0.26 | 2021, 2022 |
| GS-5X | 30-Mar-20 | FA | Current | 5.04 | 0.33 | 2021, 2022 |
| GS-8A | 15-Jul-09 | FA | 2012 | 8.25 | 0.6 | 2010, 2011, 2012 |
| GS-9A | 11-Oct-11 | FA | 2017 | 9.31 | 0.69 | 2012, 2013, 2014, 2015, 2016, 2017 |
| GS-9B | 26-Apr-16 | FA | Current | 9.02 | 0.75 | 2017, 2018, 2019, 2020, 2021, 2022 |
| GS-P5C | 12-Aug-14 | FA | 2019 | 0.571 | 0.048 | 2016, 2017, 2018, 2019 |
| GS-P5G | 25-Sep-18 | FA | 2021 | 0.562 | 0.054 | 2019, 2020, 2021 |
| GS-P5H | 16-Nov-20 | FA | Current | 0.497 | 0.056 | 2021, 2022 |

Notes: FA – fire assay.

The CRMs were purchased directly from CDN Resource Laboratories and divided into individual packets by Marathon Gold staff at the exploration camp (and in a site other than the core logging and sampling facility). Marathon Gold inserts a blank, CRM, or coarse duplicate sample at the rate of 1 in every 20 samples (until 2021) with the first control sample of every hole being placed as the $10^{th}$ sample. The blank and CRM packets are placed randomly in the core boxes by a Marathon Gold geologist or geotechnician.

In 2021, Marathon increased insertion rate of the QA/QC test samples to one in every 10 samples (from 1 in 20), alternating between a blank and one of three CRM's. In addition, the on-site, blank and CRM's storage containers were relocated to distinct sections of the core logging room and colored identifiers were added to each CRM receptacle, corresponding to a colored identifier added to the sample tag book. The geologist responsible for completing the sample tagging procedure prepares and places the blank or CRM sample in the core box prior to the collection of all core and QA/QC samples CRM and blanks, duplicates and umpire samples are identified in the sampling sequence in the acQuire database.

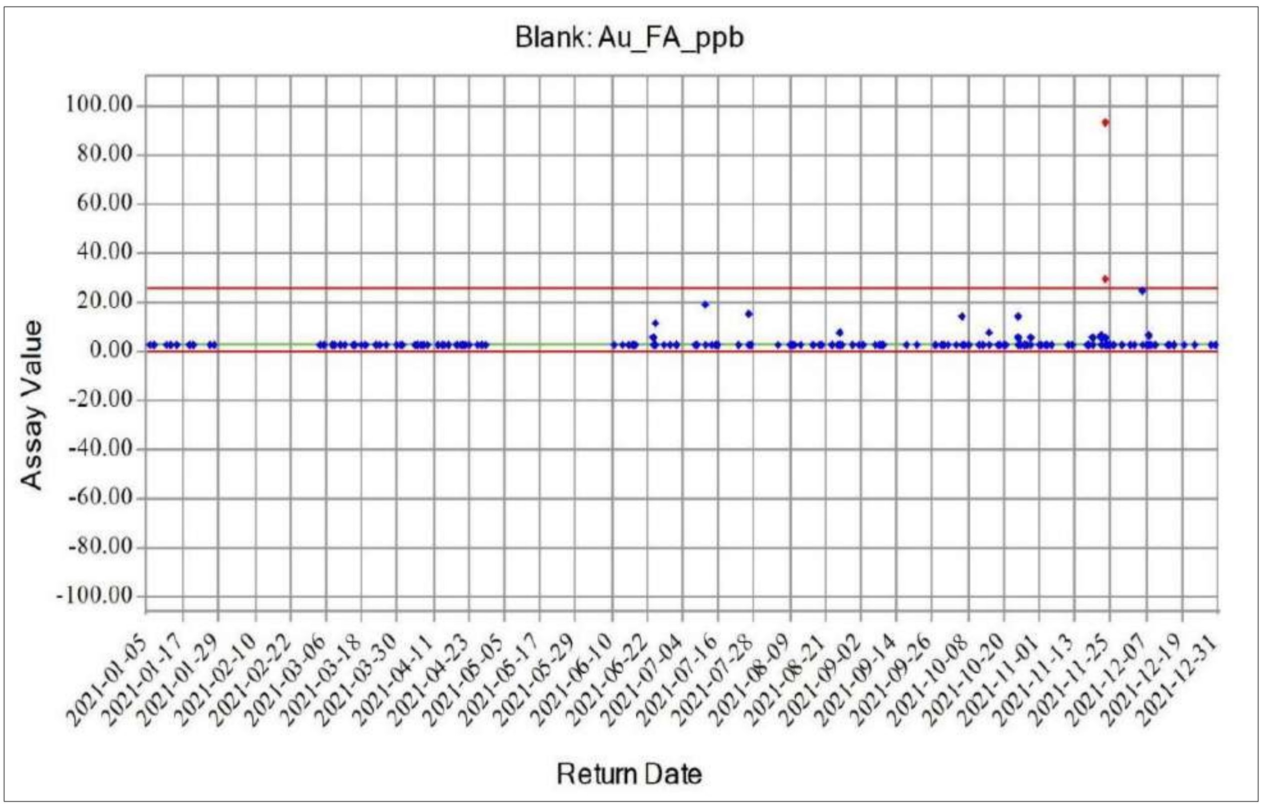
For each QA/QC sample, control charts are produced within acQuire to monitor contamination, analytical precision, and accuracy of the analytical process. Warning limits are set at ±2 standard deviations, and control limits are set at ±3 standard deviations. Control samples that report outside limits are internally reviewed. A first pass review identifies possible internal errors (e.g., mis-labelled sample ID). The failed QA/QC sample is also identified in placement of mineralization and sequence of calculated intercepts. Intercepts are never disclosed if a failed control sample falls within a mineralized zone, or as outliers on the ends of the mineralized zone. Any suspect analytical results are always re-assayed before public release or use for mineral resource estimation. Two in sequence cautionary control samples that both fail high or fail low are treated as a failed control sample.

### 11.5.1 Sample Blanks

Sample blanks are used to assess contamination during sample preparation, laboratory preparation and to identify sample numbering errors. The blank material is a nepheline syenite sand (sourced from SME Sandblasting Sales & Services, Mount Pearl, Newfoundland. A total of 6,409 blank samples were submitted to Eastern Analytics between January 2010 to December 2021 and 385 blank samples were submitted to SGS in 2021.

Failed blank sample material was investigated if values were greater than three times the lower detection limit failing at a 15 ppb gold value up until 2021, at which time the limit was increased to 5 times the lower detection limit failing at a gold value of 25 ppb. It was also considered a failed control check if there were consecutive warnings on the upper limits. An example of the 2021 sample blank analyses is presented in Figure 11-1, which shows 0.5% of the blanks analyzed yielded >25 ppm gold from 2021 data.

**Figure 11-1: Example Control Chart of 2021 Gold Assay Results for Blank Sample Material**




Source: APEX, 2020.

Upon review of Marathon Gold's QA/QC data, APEX concludes that the QA/QC sample blank analytical results indicate that minimal sample contamination has occurred during the preparation of the Marathon Gold samples.

### 11.5.2 Certified Reference Material (CRM)

Results from certified reference materials (standards) are used to identify problems with specific sample batches, and biases associated with the primary assay laboratory. Marathon sourced certified reference material (CRM) from CDN Resource Laboratories (CDN) in Langley British Columbia. The technique used to assay the material, expected values, number of analyses, and standard deviation of the analytical variance for each CRM is listed in Table 11-2 above. A summary of CRM performance on the Valentine Gold Project is listed in Table 11-3. A summary of the 2021 analytical results of the CRM standard GS-P5H versus the CRM mean, and 2 and 3 SDs, is presented in Figure 11-2.

CRM material was included by Marathon in the sample stream at a rate of 1 in 20 from 2010 to 2020 and 1 in 10 during 2021. Failure rates are defined as a gold value reporting more than three standard deviations (SD) from the expected value, or two consecutive gold values reporting more than two SD from the expected values.

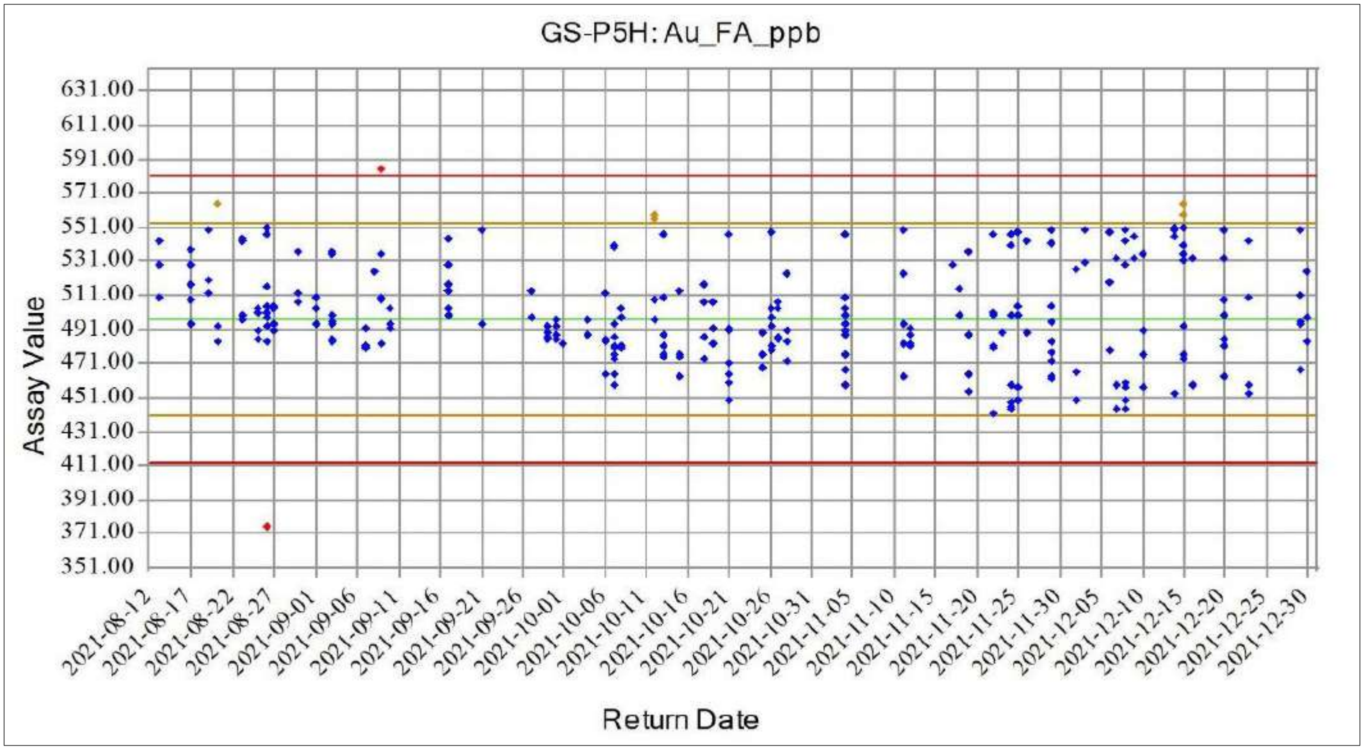
Most CRMs used since the start of the exploration program possess a low failure rate, with several exceptions. For example, GS-3F and GS-3J used between 2010 and 2014 had a failure rate of 7.5% and 6.7%, respectively. All failures returned a grade below acceptable value. However, subsequent CRMs within a similar Au grade have higher success rate. It is worth noting that these CRMs were amongst the least amount submitted to Eastern Analytical for analysis.

An example of the 2021 CRM GS-P5H presented in Figure 11-2 has a low rate of failure with 2 samples (0.7%) falling outside acceptable 3SD limits.

**Table 11-3: Summary of 2010-2021 CRM Performance at Eastern Analytics**

| CRM | Expected Value (ppm) | EAL | |
|---|---|---|---|
| | | No. of Failures | No. of CRM samples |
| GS-3F | 3.1 | 12 | 401 |
| GS-3H | 3.04 | 7 | 549 |
| GS-3J | 2.71 | 8 | 257 |
| GS-3K | 3.19 | 5 | 230 |
| GS-3L | 3.18 | 8 | 282 |
| GS-3Q | 3.3 | 11 | 855 |
| GS-3T | 3.05 | 8 | 1,277 |
| GS-3U | 3.29 | 5 | 594 |
| GS-5X | 5.04 | 0 | 263 |
| GS-8A | 8.25 | 1 | 727 |
| GS-9A | 9.31 | 10 | 893 |
| GS-9B | 9.02 | 3 | 2286 |
| GS-P5C | 0.571 | 6 | 1288 |
| GS-P5G | 0.562 | 11 | 989 |
| GS-P5H | 0.497 | 4 | 586 |
| Total | | 99 | 11,477 |

**Figure 11-2: Control Chart of 2021 Gold Assay Results for CRM GS-P5H**




A failed CRM standard sample is reviewed internally to identify if the QA/QC sample is internally mislabeled. Occasionally a blank or CRM has returned a value outside of the error limits but falls within a known value of another CRM or a blank. This is identified as an in-house error rather than a laboratory error. Between 2010 and 2021, Marathon Gold has assessed all CRM failures and identified 63 mislabeled CRM samples out of a total of 11,477 CRM sample inserts (or 0.5%). The misidentified CRM samples are flagged within the AcQuire database. Accordingly, Marathon Gold has reviewed its QA/QC CRM sample insert protocol and implemented changes to reduce the number of mislabeled CRM samples in future QA/QC work.

### 11.5.3 Field Duplicates

Field duplicates were originally discussed in Murahwi (2017). During 2021, Marathon Gold re-introduced duplicate sample analyses into the QA/QC protocol.

In December 2021, a total of 140 identically sized, half-core duplicates were submitted to Eastern Analytical. The sample duplicates included 44, 46, and 50 sample duplicates from Leprechaun, Marathon, and Berry, respectively. The field duplicate samples were intended to assess the variability introduced by sampling the same interval and were used to assess the field sample preparation and analytical precision. The samples were bagged separately with separate sample numbers.

Results were as expected for half core duplicates taken from a gold deposit with coarse gold.

### 11.5.4 Sample Reanalyses

Marathon Gold routinely analyzed the results of the QA/QC samples in real time against set of acceptable limits. If the assay value falls outside of the control limits, the sample was reanalyzed.

Both the original and re-assayed analytical result are captured in the acQuire relational database where the passing re-assay value are issued a priority validation number of "1". Values without a validation number of 1 are not permitted to be used in the mineral resource estimation process.

QA/QC failures are analyzed, reported, and rectified based on their sequential placement within the mineralization, number of failed QA/QA samples in a batch, number of failed QA/QC samples in sequence, values of failed results and location of the drillhole.

## 11.6 Qualified Person Opinion

The QP has reviewed the sample preparation, analyses, and security and found no significant issues or inconsistencies to question the adequacy of the data. The QA/QC methods employed by Marathon Gold both historically, and with additional protocols established during 2021, shows that the analytical data have reasonable and acceptable degrees of contamination, analytical precision, and accuracy. In the opinion of the QP, the geological and analytical data are sufficient for use within the resource modelling and estimations presented in this technical report.

# 12 DATA VERIFICATION

## 12.1 Introduction

The author of this chapter conducted several steps to verify the ongoing site activity; describe the visual, physical, and geological characteristics of the property; and prepare the mineral resource estimates presented in Section 14. A description of the site inspection, drill database verification, and independent analytical testwork is provided below.

## 12.2 Qualified Person Site Inspections

APEX conducted site inspections at the Valentine Lake property in 2017 and 2019, with the most recent visit on April 15, 2022. The purpose of the most current inspection was to verify the project's active workings, validate 2021 drill collars, observe select 2019-2021 drill core intercepts, collect samples for independent analytical testwork, and discuss the geology and mineralization with Marathon Gold's senior technical team. The most recent site inspection placed emphasis on field inspection and core review of the Berry deposit.

During the April 2022 site inspection, the QP carried out the following:

- Observed by air the most recent and active exploration activity at the Valentine Gold property.
- Visited Marathon Gold's exploration camp where core from five drillholes from the Berry property was reviewed by the QP (drillholes VL-20-823, VL-20-919, VL-21-1042, VL-20-830, and VL-19-786). Collected a total of 9 core and/or outcrop samples for independent fire assay analysis to confirm the gold mineralization that is the subject of the property and the Berry deposit.
- Stood on the ground of the Berry deposit where the QP observed the drilling grid patterns and outcrop and collected independent GPS coordinate readings on randomly selected drill collars at the Berry deposit to verify the accuracy of the collar locations.

Previous inspections placed emphasis on the Marathon and Leprechaun deposits. The site inspections, and subsequent review of the Marathon Gold licenses at the NL Department of Natural Resources, allowed the author to verify the location and good standing of the property, current operations, infrastructure, and to confirm the geological interpretations made in support of the mineral resource estimations. No significant errors were found in relation to the site visit.

## 12.3 Drillhole Database

To verify the exploration data supplied by Marathon Gold, BOYD checked the database using Vulcan software for unique, missing, and overlapping intervals, a total depth comparison, duplicate holes, property boundary limits, and a visual search for extreme or deviant survey values. Minor discrepancies, when present, were identified and corrected. Drillhole assay files were verified by checking the gold results in the database against the original laboratory certificates. In concert, APEX validated Marathon Gold's digital drillhole database in comparison with information presented in Section 10. No issues were encountered with the drillhole database verification.

## 12.4 Independent Analytical Testwork Results

APEX has collected a total of 19 samples for independent analytical testwork as part of three separate site inspections. In 2017, the author collected three samples from drill core and four from outcrop. In 2019, three samples were collected from 2019 drill core. In 2022, the author collected eight samples from 2019-2021 drill core and one from outcrop (see Table 12-1 on the following page).

The samples were collected, bagged, sealed, and couriered by the author to an independent laboratory, ALS Canada Ltd. (ALS). At the independent laboratory, the samples were subjected to ALS's standard sample preparation and analytical practices, as follows:

- Rock preparation (Code PREP-31D) that is designed for drill core and rock that contain high-grade or coarse gold. The method is to crush to 90% less than 2 mm, riffle split off 1 kg, and then pulverise the split to better than 85% passing 75 µm.

- Fire assay and atomic absorption spectrometry (Code Au-AA26) using a 50-gram nominal sample weight. Samples that analyse over 100,000 ppb are subjected to a 50-gram analysis by fire assay with a gravimetric finish.

The author's three randomly collected 2017 core samples from the Marathon deposit yielded 780 ppb, 37,000 ppb, and 51,000 ppb Au. Two outcrop samples from the Marathon deposit yielded 330 ppb and 8,960 ppb Au; the latter sample was taken near the discovery outcrop at the Marathon deposit. The remaining two outcrop samples were taken from the Frank Zone occurrence and yielded 100 ppb and 251,000 ppb Au (the latter sample analysed by fire assay with a gravimetric finish).

The author's three 2019 core grab samples from the Marathon deposit yielded 10,250 ppb, 1,250 ppb, and 10 ppb Au. The purpose of the grab sample analyses was to test Marathon Gold's core logging lithological descriptions. All three samples were of quartz-eye porphyry, but the analytical results corresponded positively with the inclusion and intensity of the gold-bearing QTP veining (see Table 12-1).

In 2022, samples collected by the author from the Berry deposit's main zone mineralization, defined as quartz-tourmaline-pyrite with abundant quartz veins and occur within bleached and altered quartz-eye porphyry, yielded the highest gold results – between 14,300 ppb Au and 701,000 ppb Au (the latter analytical result analysed by fire assay with a gravimetric finish). A Berry deposit outcrop grab sample of quartz-tourmaline-pyrite yielded 6,430 ppb Au. A Berry deposit representative quartz-eye porphyry sample and two quartz-eye porphyry samples collected from either side of a mafic dyke, yielded 40 ppb Au and 1,180 ppb Au (Table 12-1).

In summary, the APEX samples collected by the independent author, and the results of analytical work conducted at an independent laboratory, confirm the gold mineralisation at Marathon Gold's Valentine Gold Property. It is the author's opinion that the drillhole collar, lithological descriptions, and assay databases are sufficient and reasonable for domain resource modelling at the Valentine Gold Project.

## 12.5 Qualified Person's Opinion

The QP has reviewed the adequacy of the exploration information and the visual, physical, and geological characteristics of the property and has found no significant issues or inconsistencies that would cause one to question the validity of the data. The QP is satisfied to include the exploration data including the drilling, drill litho-logs, and sample assays for the purpose of resource modelling, evaluation and estimations as presented in this report.

**Table 12.1: Analysis Results of 19 Samples Collected during 2017, 2019, and 2022 Site Inspections**

| Site Visit Year | Sample ID | Drillhole or Outcrop Occurrence ID | Easting (m; Z21; Nad83) | Northing (m; Z21; Nad83) | Description | From (m) | To (m) | QP Site Visit: Assay Results [1] APEX Au-AA26 (ppb) | APEX Au-GRA22 (ppb) |
|---|---|---|---|---|---|---|---|---|---|
| 2017 | RE17-MA-001 | Drillhole MA-17-176 | 492739 | 5360466 | Quartz-eye porphyry and quartz-tourmaline-pyrite vein(s) | 198 | 199 | 780 | / |
| | RE17-MA-002 | Drillhole MA-17-176 | 492739 | 5360466 | Quartz-eye porphyry and quartz-tourmaline-pyrite vein(s) | 225 | 226 | 37,000 | / |
| | RE17-MA-003 | Drillhole MA-16-149 | 492593 | 5360122 | Quartz-eye porphyry and quartz-tourmaline-pyrite vein(s) | 402 | 403 | 51,000 | / |
| | RE17-MA-004 | Marathon deposit outcrop | 492708 | 5360454 | Quartz-tourmaline-pyrite vein | / | / | 8,960 | / |
| | RE17-MA-005 | Marathon deposit outcrop | 492765 | 5360403 | Quartz-tourmaline-pyrite vein (stockwork) | / | / | 330 | / |
| | RE17-FR-001 | Frank zone (Galley) outcrop | 484705 | 5355230 | Quartz-tourmaline-pyrite vein | / | / | 100 | / |
| | RE17-FR-002 | Frank zone (Vein) outcrop | 485035 | 5355400 | Quartz-pyrite-tourmaline vein | / | / | >100,000 | 251,000 |
| 2019 | RE19-MA-001 | Drillhole MA-19-442 | 492276 | 5359995 | Quartz-eye porphyry and intense quartz-tourmaline-pyrite vein(s) | Grab sample (185.5-186.2) | | 10,250 | / |
| | RE19-MA-002 | Drillhole MA-19-442 | 492276 | 5359995 | Quartz-eye porphyry and quartz-tourmaline-pyrite vein(s) | Grab sample (190.1-190.3) | | 1,250 | / |
| | RE19-MA-003 | Drillhole MA-19-442 | 492276 | 5359995 | Quartz-eye porphyry | Grab sample (207.0-207.15) | | 10 | / |
| 2022 | RE22-MG-B001 | VL-20-823 | 489678 | 5358030 | Quartz veins, Quartz-eye porphyry and quartz-tourmaline-pyrite | 126.60 | 127.40 | / | 701,000 |
| | RE22-MG-B002 | VL-20-823 | 489678 | 5358030 | Quartz veins, Quartz-eye porphyry and quartz-tourmaline-pyrite | 170.60 | 171.40 | 14,300.00 | / |
| | RE22-MG-B003 | VL-20-823 | 489678 | 5358030 | Quartz veins, Quartz-eye porphyry and quartz-tourmaline-pyrite | 182.83 | 183.58 | 17,500.00 | / |
| | RE22-MG-B004 | VL-20-919 | 490630 | 5358779 | Quartz-tourmaline-pyrite | 134.75 | 135.55 | 69,800.00 | / |
| | RE22-MG-B005 | VL-21-1042 | 490202 | 5358400 | Quartz-eye porphyry | 285.90 | 286.60 | 1,040.00 | / |
| | RE22-MG-B006 | VL-20-830 | 489952 | 5358192 | Quartz-tourmaline-pyrite | 86.18 | 86.98 | 1,180.00 | / |
| | RE22-MG-B007 | VL-19-786 | 489643 | 5358177 | Uppermost mafic dyke (directly below contact) | 127.60 | 128.35 | 110.00 | / |
| | RE22-MG-B008 | VL-19-786 | 489643 | 5358177 | Quartz-eye porphyry (directly below mafic dyke) | 159.12 | 160.17 | 40.00 | / |
| | RE22-MG-B009 | Outcrop | 489390 | 5358112 | Quartz-tourmaline-pyrite | Grab sample | | 6,430.00 | / |

Notes: 1. Analytical work conducted at ALS Canada Ltd.; Au-AA26 is Ore grade Au 50 g FA-AA finish; Au-GRA22 is Au 50 g FA-GRAV finish (finalized 2017-11-14).

# 13 MINERAL PROCESSING AND METALLURGICAL TESTING

## 13.1 Introduction

Marathon Gold Corporation (Marathon) commissioned various programs of metallurgical testwork on mineralized samples from the Leprechaun and Marathon deposits of the Valentine gold resource between 2006 and 2021, as referenced in Section 13.2. Samples from the Berry deposit were first metallurgically tested in 2022 with results summarized in this updated NI 43-101 report.

During the 2019 Pre-feasibility Study, the testwork was focused on a gravity-flotation-leach flowsheet comprising:

- coarse primary grind ($P_{80}$ 150 µm) to reduce capital cost and energy demand
- gravity concentration to recover coarse gold and intensive cyanidation to extract the gold
- froth flotation to produce low mass pull concentrate
- ultra-fine grinding of flotation concentrates to liberate fine gold contained in telluride-pyrite mineralization followed by carbon-in-leach (CIL) to extract the gold
- leach-CIL of flotation tails combined with tailings from concentrate leach
- cyanide destruction.

During the 2021 Feasibility Study, the flotation flowsheet design was progressed; however, the testwork program focussed on the simpler, lower capital cost gravity-leach flowsheet comprising:

- finer primary grind ($P_{80}$ 75 µm)
- gravity concentration of gold and intensive cyanidation for gold extraction
- leach-CIL of gravity tailings
- cyanide destruction.

As now designed, the gravity-leach flowsheet will be operated in Phase 1 of the operation to be followed, after approximately 3 years, by Phase 2 in which throughput will be increased and equipment will be added to allow operation of the gravity-flotation-leach flowsheet.

The recent metallurgical work described in this section has focussed on mineralized material from the Berry deposit. The testing has been intended to demonstrate whether the Berry mineralized material is similar to that of the proximate Marathon and Leprechaun deposits and therefore can be processed using the same metallurgical processes developed for these feeds and as described in the 2021 Technical Report. As such, given that the deposit lithology and other characteristics are identical to those at Marathon and Leprechaun, testwork has been largely limited to comminution, beneficiation, and leaching tests. Some testwork was also undertaken on lower grade material from the Marathon and Leprechaun deposits to better define the relationship between feed grade and gold recovery.

## 13.2 Historical Testwork Programs

A list of the historical testwork campaigns and reports is presented in Table 13-1. Additional detail can be found in the NI 43-101 Technical Report & Pre-feasibility Study on the Valentine Gold Project (2019 Pre-Feasibility Study) and the NI 43-101 Technical Report & Feasibility Study on the Valentine Gold Project (2021 Feasibility Study).

**Table 13.1: Listing of Historical Testwork**

| Year | Laboratory | Testwork Performed |
|---|---|---|
| 2010 | G&T Metallurgical Services KM2578 | Preliminary flowsheet development – Marathon ore characterization; gravity and cyanide leach extraction; gravity, sulphide flotation and cyanide extraction; ore hardness |
| 2012 | G&T Metallurgical Services KM3028 | Preliminary flowsheet development – Leprechaun ore characterization; gravity and cyanide leach extraction; gravity, sulphide flotation and cyanide extraction; ore hardness |
| 2015 | Thibault & Associates 6536 Phase I | Leprechaun master composite – gravity and grind size sensitivity; gravity leach and gravity-float-leach |
| 2017 | Thibault & Associates 6536 Phase II | Leprechaun and Marathon ore – grade and grind size variability; gravity-leach, gravity-float-leach, and heap leach |
| 2019 | SGS-Lakefield 16863 | Comminution, gravity-flotation-regrind-leach, gravity-leach, heap leach, cyanide destruction, solid-liquid separation |
| 2019 | Outotec 324217 | Solid-liquid separation – dynamic settling and filtration |
| 2019 | FLSmidth Rev 4 | Gravity recoverable gold modelling |
| 2021 | Base Metallurgical Laboratories BL639 | Comminution, gravity-flotation-regrind-leach, gravity-leach, cyanide destruction, solid-liquid separation |

## 13.3 2022 Testwork Campaign

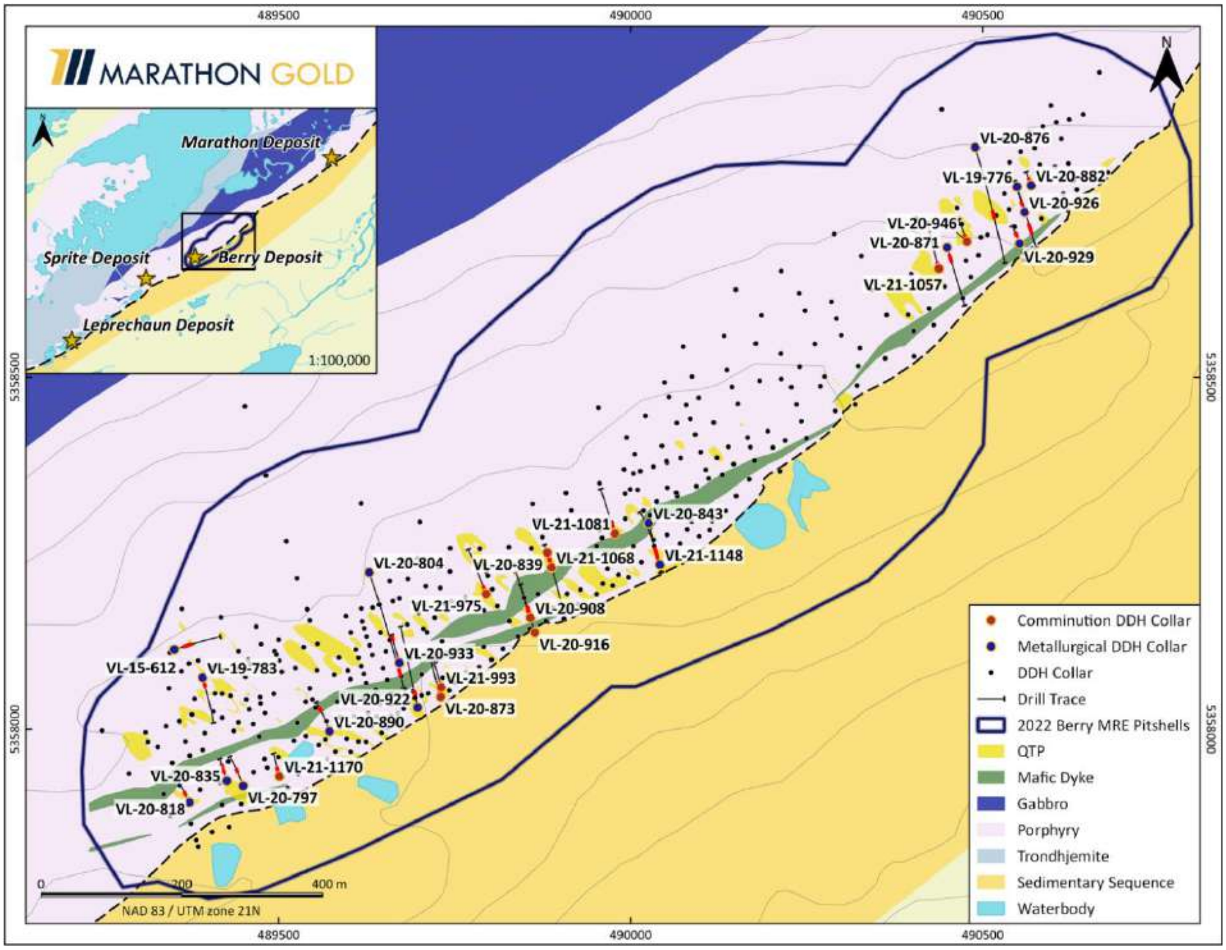
Marathon engaged Base Metallurgical Laboratories (BaseMet) to undertake metallurgical testwork on Berry mineralized material in 2022; some work was also performed at SGS Lakefield. The programs were developed and managed by John Goode, consultant to Marathon Gold on behalf of Marathon. All of the required test data have been received. The testwork will be reported under BaseMet project numbers BL1020 and BL1021 and SGS Lakefield project number 19047-01.

### 13.3.1 Sample Selection

Twenty-three Berry variability samples consisting of half NQ core and eleven comminution samples consisting of half HQ core were retrieved from storage in Newfoundland and delivered to BaseMet in May 2022. The NQ material came from drilling campaigns in 2015, 2019, 2020, and 2022 and the HQ core from the 2020 and 2021 drilling campaigns.

The samples were selected to represent the Berry deposit geographically along the strike of the deposit. Selection criteria included the need to approximate the planned mine grade, a minimum 10 m long interval, and for samples to be within the indicated pit shell. Samples were kept separately to allow determination of variability. Drillhole locations are provided in Figure 13-1. An area of the Berry deposit with very limited quartz-tourmaline-pyrite (QTP) mineralization (yellow areas in Figure 13-1) was not sampled. Table 13-2 summarizes NQ core sample information and Table 13-3 summarizes HQ core sample data.

**Figure 13-1: Berry Sample Locations**




Source: Marathon Gold, 2022.

Table 13-2 summarizes NQ core sample information and Table 13-3 summarizes HQ core sample data.

**Table 13.2: Samples Used for Metallurgical Testwork – NQ ½ Core**

| Sample ID | Hole ID | From (m) | To (m) | Mass (kg) |
|---|---|---|---|---|
| Var-1 | VL-15-612 | 21 | 32 | 23.3 |
| Var-2 | VL-19-776 | 81 | 96 | 29.5 |
| Var-3 | VL-19-783 | 26 | 36 | 23.5 |
| Var-4 | VL-20-804 | 221 | 231 | 21.0 |
| Var-5 | VL-20-818 | 87 | 99 | 27.0 |
| Var-6 | VL-20-835 | 104 | 114 | 22.5 |
| Var-7 | VL-20-835 | 164 | 174 | 20.9 |
| Var-8 | VL-20-843 | 61 | 71 | 21.9 |
| Var-9 | VL-20-871 | 18 | 28 | 19.1 |
| Var-10 | VL-20-876 | 134 | 144 | 22.5 |
| Var-11 | VL-20-882 | 37 | 47 | 22.4 |
| Var-12 | VL-20-890 | 125 | 135 | 23.4 |
| Var-13 | VL-20-922 | 68 | 78 | 22.0 |
| Var-14 | VL-20-926 | 66 | 76 | 21.7 |
| Var-15 | VL-20-929 | 79 | 89 | 21.4 |
| Var-16 | VL-20-933 | 128 | 138 | 23.8 |
| Var-17 | VL-20-958 | 185 | 195 | 21.4 |
| Var-18 | VL-20-988 | 51 | 61 | 21.0 |
| Var-19 | VL-20-1072 | 11 | 21 | 21.7 |
| Var-20 | VL-20-1090 | 8 | 18 | 21.9 |
| Var-21 | VL-20-1110 | 130 | 142 | 23.3 |
| Var-22 | VL-21-1148 | 70 | 80 | 20.6 |
| Var-23 | VL-20-797 | 131 | 141 | 23.1 |

**Table 13.3: Samples Used for Comminution Testwork – HQ Core**

| Sample ID | Hole ID | From (m) | To (m) | Mass (kg) |
|---|---|---|---|---|
| CCOM-1 | VL-20-839 | 11 | 27 | 34.7 |
| CCOM-2 | VL-20-873 | 10 | 26 | 36.6 |
| CCOM-3 | VL-20-908 | 46 | 62 | 35.3 |
| CCOM-4 | VL-20-916 | 47 | 63 | 36.5 |
| CCOM-5 | VL-20-946 | 31 | 47 | 32.4 |
| CCOM-6 | VL-21-975 | 13 | 29 | 37.8 |
| CCOM-7 | VL-21-993 | 9 | 25 | 35.8 |
| CCOM-8 | VL-21-1057 | 16 | 32 | 42.0 |
| CCOM-9 | VL-21-1068 | 41 | 57 | 39.2 |
| CCOM-10 | VL-21-1081 | 57 | 73 | 35.8 |
| CCOM-11 | VL-21-1170 | 44 | 59 | 32.9 |

A 340 kg Berry composite sample was prepared by combining 10 kg sub-samples from each of the 23 variability samples and 11 comminution samples. This sample was processed through grinding, gravity separation, flotation, and cyanide leaching of the gravity and flotation concentrates and the flotation tailings. A portion of the flotation concentrate was sent to SGS Lakefield for fine grinding testwork in a HIGmill. After processing through the proposed processing steps, the tailings from the Berry composite were used for cyanide destruction testwork and thickening tests on treated tailings. Flotation products were also tested for thickening properties.

### 13.3.2 Head Analysis

Berry metallurgical and comminution variability samples were submitted for the following suite of assays:

- gold by direct fire assay on all samples and by screen metallic method (SM) at 106 µm on the metallurgical samples
- Ag and Hg by direct assay
- sulphur (total, sulphate, sulphide)
- carbon (total and total organic carbon (TOC))
- ICP for minor metals.

Key assays for the samples tested are presented in Tables 13-4, 13-5, and 13-6.

Observations from the zone composite head assay results are provided below:

- The samples tested had gold assays ranging from 0.3 to 6.3 g/t.
- All but one sample had silver grades of less than 1 g/t.
- Almost all sulphur occurs as sulphides.
- All samples had low levels of total organic carbon (TOC).
- All samples showed low levels of mercury, less than 5 µg/t (ppb).
- Tellurium occurred in all samples, ranging from 1 to 16 g/t.
- Mercury was measured in ppb (mg/t) and was less than 5 ppb in all cases.
- Arsenic, copper and zinc averaged 3 g/t, 26 g/t, and 38 g/t, respectively.
- Total sulphur ranged from 0.1 to 1.6% and average 0.6%.

**Table 13.4: Head Assays – Berry Metallurgical Sample**

| Sample | | Assays – Percent or g/t | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Au | Au SM | Ag | S | SO4 | S2- | C | TOC | Hg |
| Method | FAAS | FAAS | FAAS | LECO | GRAV | GRAV | LECO | LECO | CV |
| Units | g/t | g/t | g/t | % | % | % | % | % | ppb |
| Var-1 | 1.68 | 1.74 | 0.9 | 1.45 | 0.01 | 1.44 | 0.4 | 0.01 | <5 |
| Var-2 | 7.74 | 6.10 | 0.2 | 0.5 | 0.01 | 0.49 | 0.78 | <0.01 | <5 |
| Var-3 | 0.31 | 0.63 | <0.1 | 0.87 | 0.02 | 0.85 | 0.28 | 0.01 | <5 |
| Var-4 | 2.59 | 1.08 | <0.1 | 0.75 | 0.04 | 0.71 | 0.37 | 0.01 | <5 |
| Var-5 | 0.22 | 0.74 | <0.1 | 0.17 | 0.02 | 0.15 | 0.57 | 0.01 | <5 |
| Var-6 | 1.30 | 1.84 | <0.1 | 0.69 | 0.02 | 0.66 | 0.46 | 0.01 | <5 |
| Var-7 | 29.40 | 4.60 | 0.7 | 0.64 | 0.02 | 0.62 | 0.43 | 0.01 | <5 |
| Var-8 | 0.52 | 0.56 | 0.2 | 0.44 | <0.01 | 0.46 | 0.33 | 0.01 | <5 |
| Var-9 | 1.98 | 3.20 | 1.1 | 0.88 | 0.01 | 0.87 | 0.3 | 0.01 | <5 |
| Var-10 | 4.13 | 3.14 | 0.3 | 1.18 | 0.01 | 1.17 | 0.38 | 0.01 | <5 |
| Var-11 | 0.58 | 0.62 | 0.2 | 0.72 | <0.01 | 0.72 | 0.37 | 0.01 | <5 |
| Var-12 | 2.57 | 5.96 | 0.5 | 0.21 | 0.01 | 0.2 | 0.37 | 0.02 | <5 |
| Var-13 | 4.77 | 6.32 | 0.6 | 0.86 | <0.01 | 0.86 | 0.56 | <0.01 | <5 |
| Var-14 | 0.92 | 2.87 | 0.4 | 1.16 | <0.01 | 1.16 | 0.44 | <0.01 | <5 |
| Var-15 | 0.57 | 0.75 | <0.1 | 0.49 | 0.01 | 0.48 | 0.41 | <0.01 | <5 |
| <Var-16 | 0.95 | 1.03 | <0.1 | 0.23 | 0.01 | 0.22 | 0.44 | 0.01 | <5 |
| Var-17 | 2.14 | 1.50 | <0.1 | 0.91 | 0.02 | 0.89 | 0.35 | 0.01 | <5 |
| Var-18 | 0.45 | 0.93 | <0.1 | 1.15 | 0.01 | 1.14 | 0.5 | 0.01 | <5 |
| Var-19 | 0.45 | 1.51 | <0.1 | 0.2 | 0.01 | 0.19 | 0.39 | 0.01 | <5 |
| Var-20 | 0.45 | 1.15 | <0.1 | 0.74 | 0.02 | 0.72 | 0.4 | <0.01 | <5 |
| Var-21 | 0.94 | 0.80 | 0.1 | 0.56 | 0.02 | 0.54 | 0.5 | <0.01 | <5 |
| Var-22 | 1.90 | 1.06 | <0.1 | 0.62 | 0.02 | 0.6 | 0.23 | 0.01 | <5 |
| Var-23 | 2.35 | 2.77 | <0.1 | 0.4 | <0.01 | 0.4 | 0.45 | 0.01 | <5 |
| Variability: Overall Statistics | | | | | | | | | |
| Minimum | 0.22 | 0.56 | 0.1 | 0.17 | 0.01 | 0.15 | 0.23 | <0.01 | - |
| Average | 2.99 | 2.21 | 0.47 | 0.69 | 0.02 | 0.68 | 0.42 | 0.01 | - |
| Maximum | 29.4 | 6.32 | 1.1 | 1.45 | 0.04 | 1.44 | 0.78 | 0.02 | - |

**Table 13.5: Head Assays – Berry Comminution Samples**

| Sample | | Assays – Percent or g/t | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Au | Ag | S | SO4 | S2- | C | TOC | Hg |
| Method | FAAS | FAAS | LECO | GRAV | GRAV | LECO | LECO | CV |
| Units | g/t | g/t | % | % | % | % | % | ppb |
| CCOM-1 | 5.49 | 0.6 | 1.06 | 0.01 | 1.05 | 0.53 | 0.02 | <5 |
| CCOM-2 | 1.90 | 0.1 | 0.57 | 0.02 | 0.55 | 0.5 | 0.02 | <5 |
| CCOM-3 | 0.27 | <0.1 | 0.19 | <0.01 | 0.19 | 0.58 | 0.12 | <5 |
| CCOM-4 | 0.44 | <0.1 | 0.26 | 0.04 | 0.21 | 0.51 | 0.08 | <5 |
| CCOM-5 | 1.64 | <0.1 | 0.33 | 0.01 | 0.32 | 0.39 | 0.01 | <5 |
| CCOM-6 | 1.05 | 0.1 | 0.25 | 0.01 | 0.24 | 0.53 | 0.19 | <5 |
| CCOM-7 | 1.90 | <0.1 | 0.36 | 0.01 | 0.35 | 0.42 | 0.03 | <5 |
| CCOM-8 | 1.44 | 0.1 | 0.69 | 0.01 | 0.68 | 0.39 | 0.03 | <5 |
| CCOM-9 | 0.32 | <0.1 | 0.65 | 0.01 | 0.64 | 0.6 | 0.01 | <5 |
| CCOM-10 | 1.38 | 0.2 | 0.95 | <0.01 | 0.94 | 0.37 | <0.01 | <5 |
| CCOM-11 | 0.50 | <0.1 | 0.19 | 0.02 | 0.17 | 0.35 | 0.07 | <5 |
| Variability: Overall Statistics | | | | | | | | |
| Minimum | 0.27 | 0.1 | 0.19 | 0.01 | 0.17 | 0.35 | <0.01 | - |
| Average | 1.48 | 0.3 | 0.5 | 0.01 | 0.48 | 0.46 | 0.057 | - |
| Maximum | 5.49 | 0.60 | 1.06 | 0.04 | 1.05 | 0.60 | 0.19 | - |

**Table 13.6: ICP Assays – Berry Samples**

| Analyte | Ag | As | Cd | Cu | Fe | Ni | S | Te | Zn |
|---|---|---|---|---|---|---|---|---|---|
| Unit | ppm | ppm | ppm | ppm | % | ppm | % | ppm | ppm |
| Detection Limit | 0.200 | 1.00 | 1 | 1 | 0.01 | 1.0 | 0.01 | 1.00 | 2 |
| Analysis Method | AR-ICP | AR-ICP | AR-ICP | AR-ICP | AR-ICP | AR-ICP | AR-ICP | AR-ICP | AR-ICP |
| Var-1 | 1.3 | 3 | 2 | 40 | 2.65 | 7 | 1.57 | 6 | 231 |
| Var-2 | 0.7 | 3 | 1 | 68 | 2.34 | 11 | 0.56 | 5 | 21 |
| Var-3 | 0.2 | 2 | 1 | 20 | 1.94 | 3 | 0.93 | 2 | 34 |
| Var-4 | 0.3 | 4 | 1 | 18 | 2.17 | 3 | 0.75 | 4 | 33 |
| Var-5 | 0.2 | 2 | 1 | 34 | 2.21 | 2 | 0.13 | 5 | 30 |
| Var-6 | 0.3 | 3 | 1 | 18 | 2.34 | 3 | 0.65 | 3 | 43 |
| Var-7 | 0.7 | 3 | 1 | 16 | 1.89 | 5 | 0.67 | 9 | 21 |
| Var-8 | 0.2 | 2 | 1 | 80 | 2.42 | 2 | 0.49 | 3 | 29 |
| Var-9 | 1.0 | 2 | 1 | 7 | 2.50 | 2 | 0.90 | 7 | 22 |
| Var-10 | 0.2 | 2 | < 1 | 7 | 2.05 | 2 | 1.30 | 5 | 20 |
| Var-11 | 0.2 | 2 | < 1 | 24 | 2.11 | 2 | 0.74 | 7 | 92 |
| Var-12 | 0.5 | 2 | < 1 | 60 | 1.91 | 2 | 0.21 | 9 | 17 |
| Var-13 | 0.8 | 4 | 1 | 130 | 2.28 | 2 | 0.90 | 10 | 40 |
| Var-14 | 0.4 | 2 | 1 | 26 | 2.61 | 2 | 1.15 | 5 | 52 |
| Var-15 | 0.4 | 2 | 1 | 5 | 2.11 | 2 | 0.51 | 2 | 37 |
| Var-16 | < 0.2 | 2 | 1 | 15 | 2.32 | 2 | 0.23 | 2 | 22 |
| Var-17 | 0.2 | 2 | 1 | 24 | 2.24 | 2 | 0.84 | 2 | 17 |
| Var-18 | 0.2 | 5 | 1 | 26 | 3.26 | 2 | 1.19 | 2 | 66 |
| Var-19 | < 0.2 | 2 | 1 | 8 | 1.75 | 2 | 0.13 | 3 | 22 |
| Var-20 | 0.3 | 2 | 1 | 12 | 1.95 | 3 | 0.57 | 2 | 22 |
| Var-21 | 0.2 | 2 | 1 | 12 | 2.09 | 2 | 0.23 | 2 | 25 |
| Var-22 | < 0.2 | 1 | 1 | 14 | 1.61 | 2 | 0.44 | 2 | 14 |
| Var-23 | 51.6 | 2 | 2 | 17 | 1.68 | 1 | 0.26 | 3 | 18 |
| CCOM-1 | 1.0 | 5 | < 1 | 15 | 2.74 | 51 | 0.87 | 16 | 39 |
| CCOM-2 | 0.3 | 4 | 1 | 13 | 1.97 | 5 | 0.49 | 5 | 23 |
| CCOM-3 | 0.3 | 5 | 1 | 16 | 2.65 | 4 | 0.20 | 1 | 68 |
| CCOM-4 | 0.2 | 3 | < 1 | 6 | 2.61 | 3 | 0.25 | 2 | 22 |
| CCOM-5 | 0.2 | 3 | < 1 | 11 | 2.28 | 3 | 0.33 | 3 | 31 |
| CCOM-6 | 0.2 | 3 | < 1 | 12 | 2.31 | 5 | 0.27 | 3 | 32 |
| CCOM-7 | 0.2 | 4 | 1 | 33 | 2.26 | 4 | 0.33 | 2 | 27 |
| CCOM-8 | 0.2 | 2 | < 1 | 4 | 2.23 | 3 | 0.56 | 2 | 18 |
| CCOM-9 | 0.2 | 6 | 1 | 20 | 2.87 | 3 | 0.58 | 3 | 36 |
| CCOM-10 | 0.5 | 5 | 2 | 25 | 2.12 | 4 | 0.84 | 6 | 57 |
| CCOM-11 | 0.3 | 1 | 1 | 38 | 2.06 | 7 | 0.22 | 4 | 16 |
| Average | 2.0 | 3 | 1 | 26 | 2.25 | 5 | 0.60 | 4 | 38 |
| Min | 0.2 | 1 | 1 | 4 | 1.61 | 1 | 0.13 | 1 | 14 |
| Max | 51.6 | 6 | 2 | 130 | 3.26 | 51 | 1.57 | 16 | 231 |

### 13.3.3 Comminution

BaseMet undertook comminution testing to determine the variability of the Berry material. Testing of HQ core comprised SAG mill comminution (SMC) testing, Bond rod mill (RWi), Bond ball mill (BWi) work index tests at two closing screen sizes, and Bond abrasion index (Ai) testing.

The Bond ball mill tests were conducted using a 106 µm screen targeting a Phase 1 $P_{80}$ of 75 µm and a 212 µm closing screen size targeting a Phase 2 grind $P_{80}$ of 150 µm. The average $P_{80}$ values attained were 82 µm and 158 µm, respectively. Table 13-7 summarizes the results of the comminution tests on the Berry samples along with averages for Marathon and Leprechaun as developed during the 2021 Feasibility Study.

**Table 13.7: Summary of Comminution Test Results**

| Sample ID | Grade (g/t) | Relative Density | Ai (g) | RWi | BWi $P_{80}$~82 µm | BWi $P_{80}$~158 µm | Axb (SMC) |
|---|---|---|---|---|---|---|---|
| CCOM-1 | 5.49 | 2.69 | 0.39 | 13.8 | 14.7 | 14.2 | 50.2 |
| CCOM-2 | 1.90 | 2.60 | 0.41 | 12.3 | 14.7 | 12.8 | 54.9 |
| CCOM-3 | 0.27 | 2.66 | 0.31 | 14.1 | 16.0 | 13.8 | 47.7 |
| CCOM-4 | 0.44 | 2.68 | 0.41 | 13.5 | 15.6 | 14.2 | 47.4 |
| CCOM-5 | 1.64 | 2.66 | 0.41 | 13.1 | 15.0 | 12.8 | 51.1 |
| CCOM-6 | 1.05 | 2.70 | 0.43 | 12.9 | 15.6 | 15.4 | 46.9 |
| CCOM-7 | 1.90 | 2.68 | 0.48 | 12.2 | 14.9 | 12.7 | 54.9 |
| CCOM-8 | 1.44 | 2.67 | 0.48 | 12.0 | 14.8 | 13.2 | 58.9 |
| CCOM-9 | 0.32 | 2.69 | 0.44 | 13.8 | 14.5 | 12.8 | 41.0 |
| CCOM-10 | 1.38 | 2.67 | 0.50 | 12.2 | 15.0 | 12.2 | 52.2 |
| CCOM-11 | 0.50 | 2.67 | 0.50 | 12.5 | 15.8 | 13.6 | 47.9 |
| Berry Comminution Statistics | | | | | | | |
| Average | 1.48 | 2.67 | 0.43 | 12.9 | 15.1 | 13.4 | 50.3 |
| Standard Deviation | 1.47 | 0.03 | 0.06 | 0.76 | 0.51 | 0.92 | 4.89 |
| Minimum | 0.27 | 2.60 | 0.31 | 12.0 | 14.5 | 12.2 | 41.0 |
| 25th Percentile | 0.47 | 2.67 | 0.41 | 12.3 | 14.8 | 12.8 | 47.6 |
| 75th Percentile | 1.77 | 2.69 | 0.48 | 13.7 | 15.6 | 14.0 | 53.6 |
| Maximum | 5.49 | 2.70 | 0.50 | 14.1 | 16.0 | 15.4 | 58.9 |
| Average Marathon data | - | 2.68 | 0.41 | 12.2 | 17.1 | 14.8 | 48.0 |
| Average Leprechaun data | - | 2.68 | 0.34 | 13.7 | 15.8 | 15.6 | 42.8 |

The results show the following:

- At 0.43 g, the abrasion index for the Berry samples is slightly higher than the average values for the Marathon and Leprechaun deposits. The variability of the Ai values at Berry was high (range from 0.3 to 0.5 g) as was also observed for the other two deposits.
- The average RWi for Berry material is very similar to that from the Marathon and Leprechaun deposits.
- The average BWi at a $P_{80}$ of ~75 µm (Phase 1 design criteria) for the Berry samples is slightly lower than that of Marathon and Leprechaun material. This means that a grinding circuit designed for a mixture of Marathon and Leprechaun, as described in the 2021 Feasibility Study, will be able to handle a mixture of all three materials.

- At a $P_{80}$ of ~150 µm, required for Phase 2 operations in which feed is floated, the BWi for the Berry samples is significantly lower than that of Marathon and Leprechaun. This again means that the feasibility study grinding circuit designed for Marathon and Leprechaun feed material would be able to cope with the mixture including Berry feed.
- The BWi at a finer grind is frequently higher than that at a coarser grind. All three Valentine materials show the expected trend with the BWi for the three materials increasing by about 10% as the grind is changed from a $P_{80}$ of about ~150 µm to a $P_{80}$ of ~75 µm.
- Material competency, as indicated by the average Axb values, are similar for all three deposits with Berry having a slightly higher value meaning that Berry material is easier to grind than the other materials. This is also evidenced by the other grinding parameters.

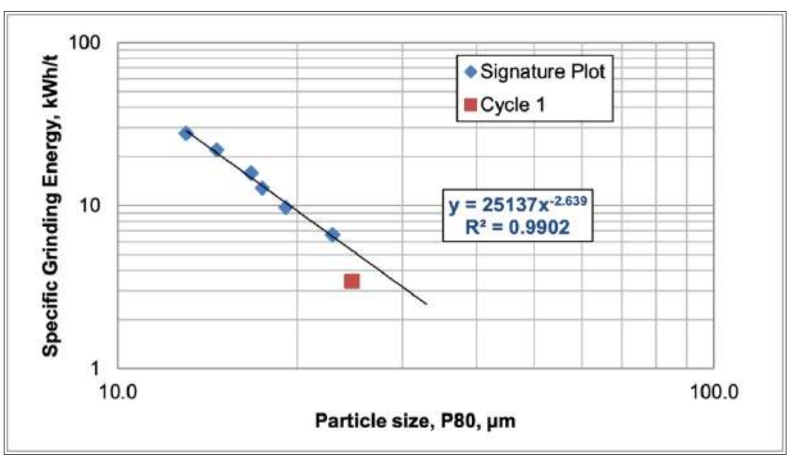
The SMC data were reviewed by JKTech in a report entitled JKTech Job No: 22008/P12. JKTech considered the Berry samples to be “soft” with SAG circuit specific energy (SCSE) values ranging from 8.3 to 9.7 kWh/t with an average of 8.9 kWh/t. This average can be compared to the average SCSE for Marathon material which was estimated to be 9.2 kWh/t and that for Leprechaun at 9.6 kWh/t as reported in the earlier feasibility study. This again indicates that Berry material can be handled in a circuit designed for Marathon-Leprechaun feed material.

### 13.3.4 Flotation Concentrate Regrind

A sample of flotation concentrate produced from the Berry bulk composite was tested by SGS Lakefield for its fine-grinding characteristics using a HIG5 high-intensity grinding mill.

The test was carried out in a single stage using a charge composed of 3 to 4 mm (40%), 2 to 3 mm (35%) and 1 to 2 mm (25%) grinding media. The feed material had a $F_{80}$ of 58 µm and a $P_{98}$ of 222 µm. The HIG mill signature plot of product $P_{80}$ versus the energy requirement, as approved by HIGmill manufacturer Metso-Outotec, is shown in Figure 13-2.

**Figure 13-2: HIGmill Signature Plot for Berry Flotation Concentrate**




Source: SGS Canada Inc., 2022.

The results for the Berry concentrate indicate that 19.8 kWh/t is required to achieve size reduction from $F_{80}$ of 58 µm to target $P_{80}$ of 15 µm. The HIGmill testwork done earlier on flotation concentrate from a blend of Leprechaun and Marathon feed material indicated that 17.8 kWh/t is required to grind from an $F_{80}$ of 93 µm to a $P_{80}$ of 15 µm. The difference between the two values is small and probably reflects the finer starting size in the test on Berry concentrate.

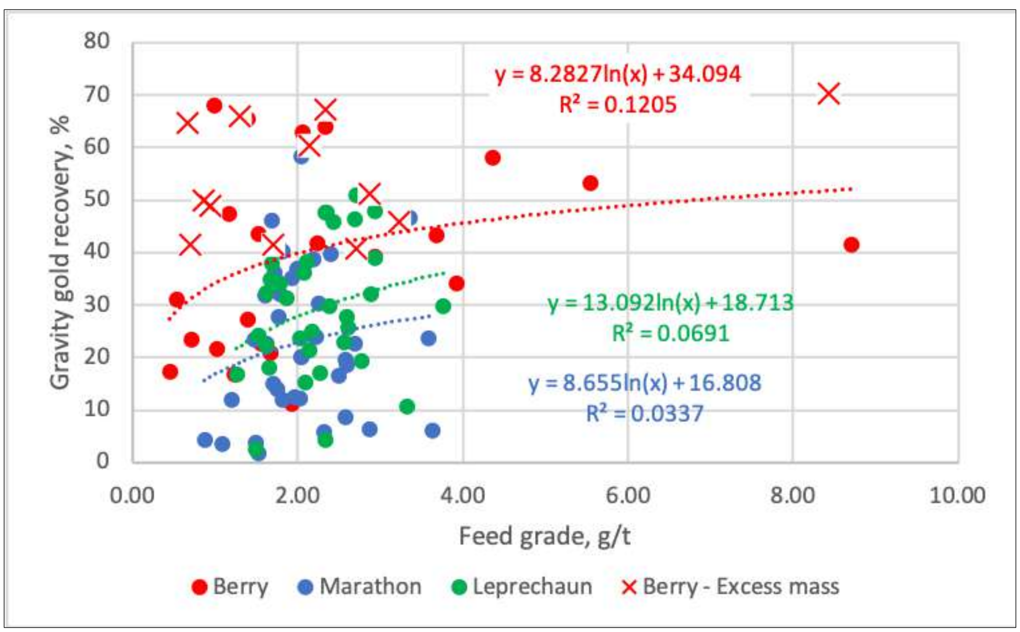
### 13.3.5 Gravity Concentration

Due to the coarse gold content seen in drill core and high gravity recoverable gold observed in all earlier testwork phases, all metallurgical tests on the Berry material included gravity concentration prior to flotation and/or leaching. The procedure generally included grinding the feed to target grind size, a single pass through a Knelson laboratory concentrator, then upgrading the concentrate to a low-mass concentrate on a Mozley mineral separator. Mass recovery was targeted at 0.03% to 0.05% to replicate plant practice. A summary of the batch gravity separation results for Berry samples at a grind $P_{80}$ of 150 µm is provided in Table 13-8. The Berry data, with the Marathon and Leprechaun data presented in the 2021 Feasibility Study, are presented in Figure 13-3 below. Some of the gravity recovery tests on Berry had mass pull values greater than 0.1%; these are shown in Figure 13-3 but are not included in the regression line.

Observations from batch gravity tests are as follows:

- Gravity recovery is highly variable and typical of material with coarse gold.
- The relationship between gravity recovery and head grade is weak although there is a definite trend.
- There seems to be a general trend in which Marathon gives low gravity recovery (~23% at 2 g/t head), Leprechaun has slightly higher gravity recovery (28% at 2 g/t) and Berry markedly higher recovery (40% at 2 g/t).

**Figure 13-3: Batch Gravity Recovery vs. Calculated Head Grade**




Source: BaseMet 2022.

**Table 13.8: Batch Gravity Tests for Berry Variability Samples (Left); and Comminution and Bulk Samples (Right)**

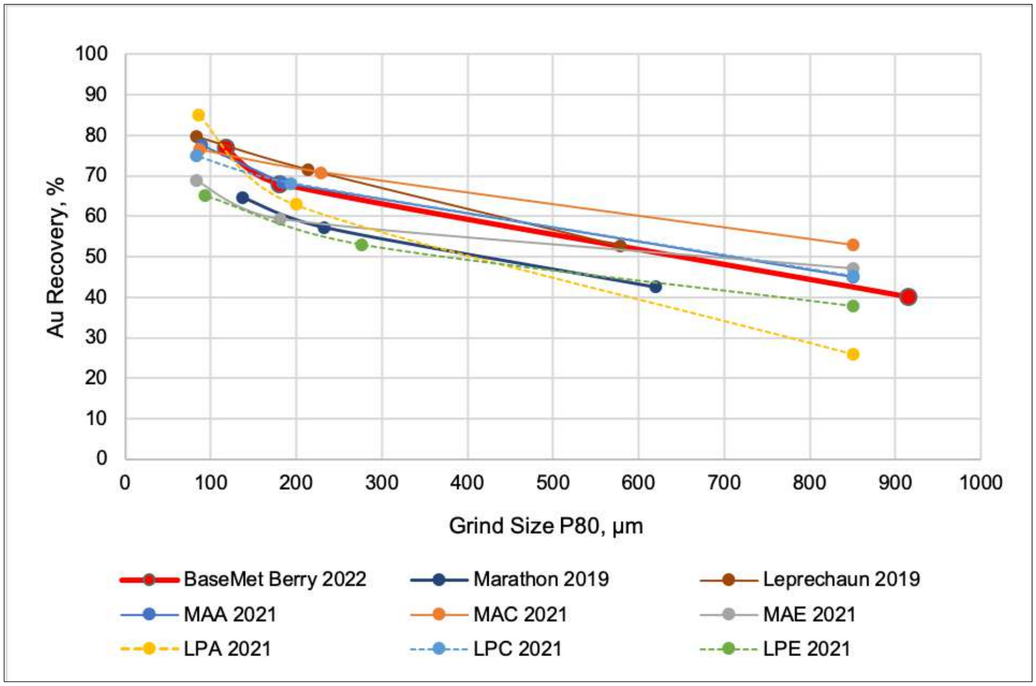
| Variability Samples | | | | | | Comminution and Bulk Samples | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Comp | Test | Feed grade | Grav Conc | | | Comp | Test | Feed grade | Grav Conc | |
| | | Au (cal) | Mass, % | Rec, % | | | | Au (cal) | Mass, % | Rec, % |
| Var-1 | R01B | 1.93 | 0.07 | 11.2 | | CCOM-1 | CN25 | 8.44 | 0.18 | 70.4 |
| Var-2 | R02B | 3.68 | 0.07 | 43.4 | | CCOM-2 | CN26 | 3.23 | 0.19 | 45.9 |
| Var-3 | R03B | 0.45 | 0.09 | 17.2 | | CCOM-3 | CN27 | 0.70 | 0.09 | 41.5 |
| Var-4 | R04B | 1.40 | 0.06 | 27.2 | | CCOM-4 | CN28 | 2.34 | 0.14 | 67.3 |
| Var-5 | R05B | 1.55 | 0.03 | 22.6 | | CCOM-5 | CN29 | 1.71 | 0.18 | 41.4 |
| Var-6 | R06B | 1.53 | 0.05 | 43.5 | | CCOM-6 | CN30 | 0.67 | 0.12 | 64.7 |
| Var-7 | R07B | 4.36 | 0.09 | 57.9 | | CCOM-7 | CN31 | 2.13 | 0.14 | 60.4 |
| Var-8 | R08B | 0.54 | 0.06 | 31.1 | | CCOM-8 | CN32 | 1.29 | 0.19 | 65.9 |
| Var-9 | R09B | 2.93 | 0.08 | 39.1 | | CCOM-9 | CN33 | 0.86 | 0.23 | 49.8 |
| Var-10 | R10B | 3.92 | 0.09 | 34.1 | | CCOM-10 | CN34 | 2.70 | 0.36 | 40.6 |
| Var-11 | R11B | 2.06 | 0.14 | 62.9 | | CCOM-11 | CN35 | 0.94 | 0.12 | 48.8 |
| Var-12 | R12B | 5.55 | 0.06 | 53.1 | | | | | | |
| Var-13 | R13B | 8.71 | 0.09 | 41.5 | | Bulk | CN24 | 2.87 | 0.07 | 51.1 |
| Var-14 | R14B | 1.76 | 0.12 | 40.9 | | Comminution and Bulk Samples: Statistics | | | | |
| Var-15 | R15B | 1.17 | 0.09 | 47.4 | | Minimum | | 0.67 | 0.07 | 40.63 |
| Var-16 | R16B | 1.39 | 0.06 | 65.5 | | Average | | 2.32 | 0.17 | 53.98 |
| Var-17 | R17B | 1.67 | 0.07 | 20.9 | | Maximum | | 8.44 | 0.36 | 70.37 |
| Var-18 | R18B | 2.33 | 0.08 | 63.9 | | | | | | |
| Var-19 | R19B | 0.99 | 0.04 | 68.1 | | | | | | |
| Var-20 | R20B | 1.02 | 0.06 | 21.6 | | | | | | |
| Var-21 | R21B | 1.23 | 0.06 | 16.7 | | | | | | |
| Var-22 | R22B | 0.71 | 0.05 | 23.3 | | | | | | |
| Var-23 | R23B | 2.25 | 0.05 | 41.8 | | | | | | |
| Variability: Statistics | | | | | | All Berry Samples: Overall Statistics | | | | |
| Minimum | | 0.45 | 0.03 | 11.15 | | Minimum | | 0.45 | 0.03 | 11.15 |
| Average | | 2.31 | 0.07 | 38.90 | | Average | | 2.32 | 0.11 | 44.07 |
| Maximum | | 8.71 | 0.14 | 68.06 | | Maximum | | 8.71 | 0.36 | 70.37 |

An extended gravity recoverable gold (E-GRG) test was conducted on a Berry composite to determine the gravity recoverable gold at different grinds. The results of this test are compared with E-GRG tests conducted on composites by SGS in 2019 and tests on variability samples by BaseMet in 2021 in Figure 13-4.

The E-GRG result for Berry falls comfortably in the grouping of all other E-GRG tests done on material from the different deposit. It seems that there is no significant difference between the gravity concentration performance of Berry, Marathon and Leprechaun materials despite the apparent differences seen in the small-scale gravity separation tests.

Modelling based on the E-GRG tests was conducted by FLSmidth as reported in the 2021 Feasibility Study. Given the similarity of the E-GRG data for Berry with that for the other deposits, modelling of the circuit has not been repeated and the earlier results can be utilized. These are reproduced below in Table 13-9 from the 2021 report.

**Figure 13-4: E-GRG Test Results – Berry 2022 and Marathon & Leprechaun Zone Data from 2019 and 2021**




Source: BaseMet 2022.

**Table 13.9: Gravity Circuit Modelling Results at $P_{80}$ 75 & 150 µm Grind**

| Sample | % of Mill Discharge | Target Grind Size $P_{80}$ µm | e-GRG% | Modelled Gravity Recovery % |
|---|---|---|---|---|
| Marathon | 23 | 75 | 66 | 49 |
| Leprechaun | 23 | 75 | 62 | 47 |
| Marathon | 28 | 150 | 66 | 46 |
| Leprechaun | 28 | 150 | 62 | 42 |

### 13.3.6 Intensive Leaching of Gravity Concentrates

In the 2019 program at SGS, intensive leach tests were performed on Leprechaun and Marathon gravity concentrates using 20 g/L NaCN, 1 g/L of LeachAid, 25% solids, over 48 h leach time. Extraction in these tests was not very satisfactory at 93% for Leprechaun and 97% for Marathon concentrate. At that time, it was planned to float a concentrate, regrind it to ~15 µm and intensively leach it. It was also planned that the intensive leach tailings would be added to the flotation concentrate and be ground to -15 µm. This was tested on the gravity concentrate intensive leach tailings and was very successful in increasing extraction to more than 99.8%.

A single gravity leach test was performed by BaseMet in its 2021 program. Gravity concentrate assaying 2,063 g/t gold produced from a Leprechaun-Marathon blend ground to a $P_{80}$ of 150 µm was leached for 48 h with 20 g/L NaCN and with oxygen. Gold extraction was 97% leaving a tailing containing 63 g/t Au again showing that gold extraction through intensive leaching of gravity concentrate is not complete.

In the planned phased development of the Valentine Gold project there is a simple gravity-leach circuit for the first phase so the ability to intensively regrind and further leach the gravity leach tailings is absent. Hence a program of intensive leach was initiated at SGS Lakefield. The results of the earlier work and the 2022 work are summarized in Table 13-10.

**Table 13.10: Gravity Concentrate Leach Test Data**

| Feed | Laboratory | Year | Test No. | Pre-treat | Feed g/t Au | Tails g/t Au | Ext'n % | IL Tails Treatment | Final Tail g/t | O'all Ext'n % |
|---|---|---|---|---|---|---|---|---|---|---|
| M-L blend | BaseMet | 2021 | CN84A | None | 2,063 | 63 | 96.9 | None | 63 | 96.9 |
| Marathon | SGS | 2019 | CN19 | None | 2,189 | 75.1 | 96.6 | -15 m grind & IL | 1.8 | 99.9 |
| Leprechaun | SGS | 2019 | CN20 | None | 3,309 | 232 | 93.0 | -15 m grind & IL | 6.8 | 99.8 |
| Berry | BaseMet | 2022 | CN24E | None | 2,095 | 36 | 98.3 | None | 36 | 98.3 |
| 19047-1 | SGS | 2021 | IL1 | None | 3,750 | 142 | 96.2 | None | 142 | 96.2 |
| M-L blend | SGS | 2022 | IL2 | None | 3,187 | 127 | 96.0 | None | 127 | 96.0 |
| M-L blend | SGS | 2022 | IL5 | +150 µm only | 3,140 | 32.4 | 99.0 | None | 32.4 | 99.0 |
| M-L blend | SGS | 2022 | IL6 | -150+75 µm | 2,100 | 103 | 95.1 | None | 103 | 95.1 |
| M-L blend | SGS | 2022 | IL7 | -75 µm only | 5,246 | 345 | 93.4 | None | 345 | 93.4 |
| M-L blend | SGS | 2022 | IL3 | -15 µm grind | 2,703 | 7.4 | 99.7 | None | 7.4 | 99.7 |
| M-L blend | SGS | 2022 | IL2 - IL4 | None | 3,187 | 127 | 96.0 | -75 m grind & IL | 62.7 | 98.0 |
| M-L blend | SGS | 2022 | IL2 - CL1 | None | 3,187 | 127 | 96.0 | Grav. tails leach | 47.0 | 98.5 |
| M-L blend | SGS | 2022 | IL2 - CL2 | None | 3,187 | 127 | 96.0 | Grav. tails leach | 49.3 | 98.5 |
| M-L blend | SGS | 2022 | IL3 - CL3 | None | 2,703 | 7.4 | 99.7 | Grav. tails leach | 3.1 | 99.9 |
| M-L blend | SGS | 2022 | IL4 - CL4 | None | 3,187 | 62.7 | 98.0 | Grav. tails leach | 19.3 | 99.4 |

The test data shows:

- Tests in which the gravity concentrate receives neither pre-treatment nor post-treatment but is simply intensively leached give a gold recovery averaging 96% with tailings in the 40 to 230 g/t range (Tests CN84A, CN19, CN20, CN24E, Il1, IL2, IL5, IL6, IL7). The weighted recovery for the three size fractions that were tested (Tests IL5, IL6, and IL7) is 96.6% and a tailings grade of 111 g/t.

- The coarser fractions of the gravity concentrate leach faster and more extensively than the finer fractions (Tests IL5, IL6, and IL7). This unexpected finding might suggest that the coarse fractions are dominantly metallic gold particles that leach well and that the finer material gold associated with sulphides and tellurides that leach more slowly.

- If the gravity concentrate is ground to pass 15 µm ahead of the intensive leach process, gold extraction is 99.7% (Test IL3). In Phase 1 this would require installation of an ultrafine grinding system which is presently not allowed for.

- If the gravity concentrate leach residue is ground to -75 µm, as it would be if it was sent back to the ball mill in Phase 1, and was then recaptured by the gravity concentrators and re-leached, recoveries increase to 98.0% (Test IL2-IL4). Additional extraction is likely as the leached gravity concentrate subsequently entered the gravity tailings leach circuit.

- If the gravity concentrate leach tailings are simply sent to the gravity tailings leach circuit of Phase 1, the overall recovery from the gravity concentrate is increased to 98.5% (Tests IL2-CL1 and IL2-CL2).
- Only about 25% of the feed flow goes to the gravity concentrators but because of the high recirculating load of gold (due to its high density and its preferential flow to cyclone underflow), close to 100% of the gravity recoverable gold goes to intensive leach system. Sending gravity concentrate leach tailings to the grinding circuit will result in the concentrate leach tailings size being further reduced and the reground tailings being again captured and processed through intensive cyanidation. Any gold particles escaping this system will report to the gravity tailings leach system very much like the IL4-CL4 test described above and which gave 99.4% gold recovery from gravity concentrate. The estimate of gravity recoverable gold from feed is 48% in Phase 1. Thus, the potential loss of gold during Phase 1 is about 0.3% of the total gold in the feed.
- In Phase 2, all of the gravity concentrate intensive leach tailings is sent to the HIGmill in the flotation concentrate leach circuit for ultra-fine grinding and then intensively leached with overall recovery of gold from the gravity concentrate expected to be 99.8% based on testwork (CN19 and CN20).
- Cyanide consumption during gravity concentrate intensive leaching is in the order of 20 kg/t of concentrate.

### 13.3.7 Gravity-Flotation-Leach Flowsheet

The response of the Berry variability samples to processing through the gravity-flotation-leach flowsheet of Phase 2 was tested. In this flowsheet, coarsely ground feed material is processed through gravity concentration then subjected to froth flotation to gather most of the gold into a low mass concentrate. The concentrate is finely ground then intensively leached. The flotation concentrate leach tailings are combined with the flotation tailings and the mixture subjected to additional cyanide leaching.

Test conditions are presented in Table 13-11. The finely ground flotation concentrate was leached separately, and flotation concentrate leach tailings were not combined with the flotation tailings for additional leaching as is planned for the production plant. Thus, the overall recovery from the flotation concentrate would be higher than in the tests reported here.

**Table 13.11: Float-Regrind-Leach Test Target Parameters**

| Item | Parameter | Item | Parameter |
|---|---|---|---|
| Primary Grind | $P_{80}$ 150 µm | Concentrate Leach Time | 36 h |
| Flotation Reagents | PAX, R208, W31 | Concentrate Leach Cyanide Concentration | 10 g/L |
| Rougher Flotation Time | 15-25 min | Flotation Tail Leach Grind | As received |
| Flotation pH | 8 to 8.5 | Tail Leach Density | 50 wt% solids |
| Concentrate Regrind | 15-17 µm | Tail Leach Dissolved Oxygen | 20 |
| Concentrate Leach Density | 40 wt% solids | Tail Leach Time | 26 h |
| Concentrate Leach Dissolved Oxygen | 20 ppm | Tail Leach Cyanide Concentration | 400 mg/L |

Note: Tailings leach erroneously done at 1000 mg/L NaCN.

The results are summarized in Table 13-12.

**Table 13.12: Summary of Gravity-Flotation-Leach Tests**

| Comp | Test | Feed Assays | | Grav Conc. | | Flotation Concentrate | | | Recovery, % | Cyanide Leach Rec'y, % | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mass % | Recovery, % | | | | | |
| | | Au, g/t (Cal) | S, % | Mass, % | Rec'y, % | | Au | S | Grav. + Flot. | Ro Conc | Ro Tail | Rec'y, % |
| Var-1 | R01B | 1.93 | 1.03 | 0.071 | 11.2 | 4.9 | 82.4 | 99.5 | 93.6 | 96.5 | 78.5 | 95.7 |
| Var-2 | R02B | 3.68 | 0.42 | 0.070 | 43.4 | 3.9 | 53.7 | 96.4 | 97.1 | 97.5 | 75.6 | 98.0 |
| Var-3 | R03B | 0.45 | 0.77 | 0.094 | 17.2 | 4.0 | 76.4 | 99.4 | 93.6 | 94.8 | 57.8 | 93.3 |
| Var-4 | R04B | 1.40 | 0.66 | 0.061 | 27.2 | 4.1 | 70.1 | 94.2 | 97.3 | 95.8 | 75.8 | 96.4 |
| Var-5 | R05B | 1.55 | 0.25 | 0.033 | 22.6 | 5.6 | 76.1 | 41.6 | 98.8 | 95.7 | 63.1 | 96.2 |
| Var-6 | R06B | 1.53 | 0.59 | 0.048 | 43.5 | 3.7 | 54.0 | 91.9 | 97.5 | 95.7 | 63.8 | 96.8 |
| Var-7 | R07B | 4.36 | 0.57 | 0.086 | 57.9 | 3.4 | 35.9 | 92.8 | 93.8 | 97.4 | 89.3 | 98.4 |
| Var-8 | R08B | 0.54 | 0.34 | 0.064 | 31.1 | 3.4 | 63.5 | 94.3 | 94.6 | 94.9 | 87.3 | 96.1 |
| Var-9 | R09B | 2.93 | 0.75 | 0.080 | 39.1 | 4.0 | 51.4 | 95.1 | 90.5 | 96.8 | 79.4 | 96.4 |
| Var-10 | R10B | 3.92 | 1.18 | 0.088 | 34.1 | 4.8 | 64.0 | 96.8 | 98.1 | 97.5 | 86.6 | 98.1 |
| Var-11 | R11B | 2.06 | 0.68 | 0.139 | 62.9 | 3.6 | 32.0 | 94.3 | 94.9 | 95.4 | 84.2 | 97.7 |
| Var-12 | R12B | 5.55 | 0.13 | 0.060 | 53.1 | 3.4 | 44.8 | 96.4 | 97.9 | 97.5 | 79.3 | 98.4 |
| Var-13 | R13B | 8.71 | 0.79 | 0.093 | 41.5 | 4.2 | 56.4 | 99.4 | 97.9 | 97.5 | 85.9 | 98.3 |
| Var-14 | R14B | 1.76 | 0.84 | 0.125 | 40.9 | 4.5 | 55.9 | 99.4 | 96.8 | 95.7 | 90.5 | 97.3 |
| Var-15 | R15B | 1.17 | 0.39 | 0.088 | 47.4 | 3.4 | 51.0 | 98.7 | 98.4 | 95.4 | 95.2 | 97.6 |
| Var-16 | R16B | 1.39 | 0.15 | 0.065 | 65.5 | 2.6 | 29.6 | 96.7 | 95.1 | 95.3 | 85.7 | 97.9 |
| Var-17 | R17B | 1.67 | 0.76 | 0.075 | 20.9 | 4.7 | 76.8 | 99.4 | 97.7 | 96.1 | 81.1 | 96.5 |
| Var-18 | R18B | 2.33 | 1.08 | 0.084 | 63.9 | 4.3 | 33.2 | 99.6 | 97.1 | 95.4 | 91.8 | 98.2 |
| Var-19 | R19B | 0.99 | 0.12 | 0.042 | 68.1 | 3.8 | 29.0 | 95.9 | 97.1 | 94.7 | 92.2 | 98.2 |
| Var-20 | R20B | 1.02 | 0.72 | 0.060 | 21.6 | 4.2 | 69.9 | 98.7 | 91.5 | 95.4 | 87.2 | 95.7 |
| Var-21 | R21B | 1.23 | 0.29 | 0.063 | 16.7 | 3.4 | 81.7 | 90.1 | 98.4 | 96.2 | 92.7 | 96.8 |
| Var-22 | R22B | 0.71 | 0.49 | 0.046 | 23.3 | 3.4 | 75.3 | 98.0 | 98.6 | 95.3 | 84.9 | 96.2 |
| Var-23 | R23B | 2.25 | 0.33 | 0.055 | 41.8 | 4.0 | 49.3 | 85.5 | 91.0 | 96.1 | 81.8 | 96.4 |
| Gravity-Flotation-Leach Extraction Statistics | | | | | | | | | | | | |
| Average | | 2.31 | 0.58 | 0.07 | 38.90 | 3.96 | 57.07 | 93.66 | 95.97 | 96.03 | 82.16 | 96.99 |
| Minimum | | 0.45 | 0.12 | 0.03 | 11.15 | 2.57 | 29.03 | 41.57 | 90.51 | 94.72 | 57.82 | 93.31 |
| Maximum | | 8.71 | 1.18 | 0.14 | 68.06 | 5.56 | 82.45 | 99.56 | 98.79 | 97.50 | 95.21 | 98.45 |

Besides the tests on Berry variability samples, a bulk sample of Berry material containing 2.87 g/t Au was prepared and processed to generate sufficient flotation concentrate for HIGmill testing and detoxification work. Gravity recovery was 51% to an 0.07% mass and the flotation concentrate had a mass of 5.4% of feed and contained 47% of the gold. Cyanidation of the products, including a combined leach of the rougher concentrate leach tailings and flotation tailings, gave an overall extraction of 96.9%.

The variability data of Table 13-12 are plotted in Figure 13-5, along with data for processing Leprechaun and Marathon feed material as provided in the 2021 Feasibility Study.

**Figure 13-5: Overall Extraction for Berry Samples Using the Gravity-Flotation-Leach Flowsheet**

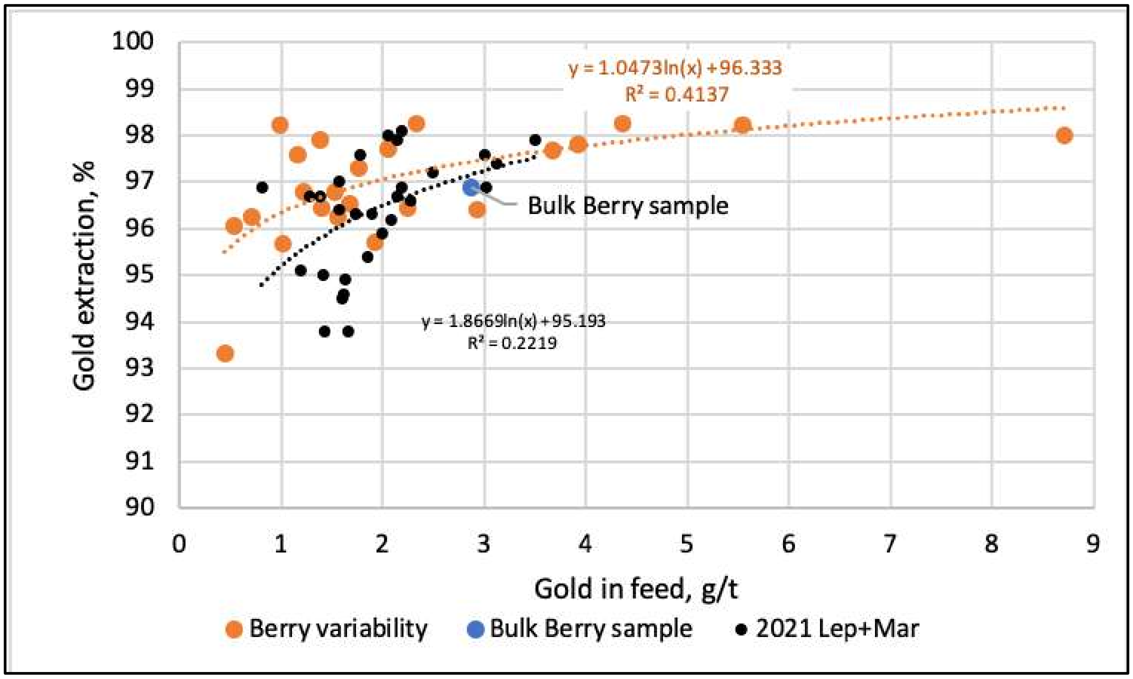



Figure 13-5 makes it clear that Berry feed material responds well to the gravity-flotation-leach process and that, at a given feed grade, Berry gives similar or better extraction to that obtained from the Leprechaun-Marathon feed material of the 2021 Feasibility Study.

The NaCN and $Ca(OH)_2$ consumptions for Berry material processed by the gravity-flotation-leach route were estimated to be 0.6 kg/t and 0.8 kg/t, respectively. These values can be compared to the 0.6 kg/t of NaCN and 0.3 kg/t of $Ca(OH)_2$ reported for Marathon and Leprechaun material in the 2021 Feasibility Study.

The gold extraction from the rougher concentrate and from the rougher tailings are further discussed below.

#### 13.3.7.1 Cyanide Leaching of Flotation Concentrate

Flotation concentrate from the variability samples were combined to form four flotation concentrate blends which were subjected to regrind and cyanide leaching (tests CN37, CN38, CN39, CN40). The four reground concentrates had an average $P_{80}$ of 18.9 µm which is slightly coarser than the 15 µm target size. The results of these tests are summarized in

Table 13-13. Additional concentrate leach tests were done as part of the grade recovery work discussed in Section 13.3.9.1.

**Table 13.13: Results of Berry Flotation Concentrate Composite Leaching**

| Sample ID | Test ID | Gold Assays, g/t | | Ext'n, % | Reagent Cons'n, kg/t Feed | |
|---|---|---|---|---|---|---|
| | | Feed | Tailings | | NaCN | $Ca(OH)_2$ |
| Conc. Comp A | CN37 | 34.1 | 0.61 | 97.6 | 6.3 | 6.0 |
| Conc. Comp B | CN38 | 41.1 | 1.93 | 94.1 | 7.9 | 6.1 |
| Conc. Comp C | CN39 | 13.4 | 0.51 | 94.7 | 7.8 | 6.0 |
| Conc. Comp D | CN40 | 34.2 | 0.85 | 97.9 | 7.1 | 6.9 |
| Average | - | 30.7 | 0.97 | 96.1 | 7.3 | 6.2 |

The above results were used to generate a relationship between gold in concentrate and gold extraction for the tested samples and that relationship (Extraction in % = 94.2+0.07 x g/t Au in concentrate), capped at 97.5% extraction, was used to attribute gold extraction from flotation concentrates as presented in Table 13-12.

The corresponding extraction equation for the Leprechaun and Marathon flotation concentrate leach tests of the 2021 Feasibility Study is similar (Extraction in % = 97.0+0.022 x g/t Au in concentrate) as is data for the 2022 investigation of recovery from lower grade samples (Extraction in % = 96.1 + 0.031 x g/t Au in concentrate). The average of 72 flotation concentrate leach tests, mainly on Marathon and Leprechaun material, is a feed grade of 25 g/t Au and 97.1% gold extraction.

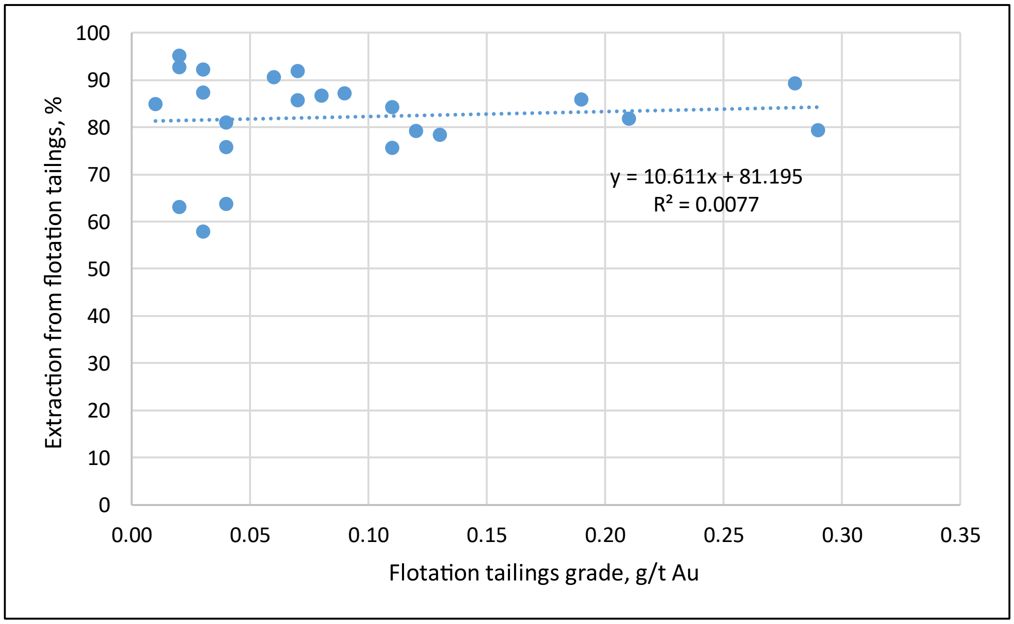
#### 13.3.7.2 Cyanide Leach of Flotation Tail

The average total extraction of gold to the Berry gravity and flotation concentrates is 95.97%, as indicated in Table 13-12. The total gold extraction averaged 96.99%, meaning that on average the flotation tailings leach contributes 1% to the overall gold extraction. The gold extraction from the Berry flotation tail as a function of flotation tailings grade is plotted in Figure 13-6 showing that there is much scatter, but extraction is greater than 60% and the average extraction is 80% for the data set.

The flotation tailings leach tests were erroneously done at 1000 mg/L NaCN instead of 400 mg/L. Reserve flotation tailings samples from five Berry flotation-leach tests were subjected to a repeat leach under the original conditions (1000 mg/L NaCN) and a leach at 400 mg/L. The flotation tailings grades ranged from 0.16 g/t and 0.03 g/t and averaged 0.11 g/t Au. The original leach tailings assay averaged 0.021 g/t. The repeat leach tests at 1000 mg/L NaCN gave a tailings containing 0.018 g/t gold while the tests at 400 mg/L NaCN gave average tailings of 0.017 g/t. The data suggest that the erroneous initial cyanide concentration had minimal effect on leaching of flotation tailings. The different initial cyanide consumption did influence cyanide consumption which averaged 0.25 kg/t in the original leach tests with 1000 mg/L NaCN, 0.24 kg/t in the repeat test and 0.10 kg/t following a 400 mg/L NaCN concentration.

The average stage recovery of the flotation tailings leach tests in Table 13-12 is 82%. Data from SGS Lakefield testwork of 2020 showed that with flotation tailings containing 0.18 g/t gold, 200 and 400 mg/L NaCN leaches gave 66 and 70% extraction, respectively. The testwork of the 2021 Feasibility Study included 32 flotation tailings leach tests which gave an average gold extraction if 73% from feed grades of 0.16 g/t gold. Given that the tailings leach only accounts for 1% of total extraction and that the extractions seen in the Berry work are very similar to those of the earlier tests, we believe that the erroneous reagent dose would have minimal impact on overall extraction.

**Figure 13-6: Berry Flotation Tail Leach Extraction**




### 13.3.8 Gravity-Leach Flowsheet Tests

The Berry Variability samples, as well as the comminution samples, were subjected to gravity-leach tests to obtain an estimate of the response of the Berry material to the Phase 1 flowsheet used in the 2021 Feasibility Study.

The leach conditions for the gravity-leach flowsheet are shown in Table 13-14.

**Table 13.14: Gravity-Leach Design Conditions**

| Item | Parameter |
|---|---|
| Primary Grind | $P_{80}$ 75 µm |
| Total Leach-CIL Time | 32 h |
| Leach Density | 43 wt% solids |
| pH | 12 |
| Dissolved Oxygen | 20 ppm |

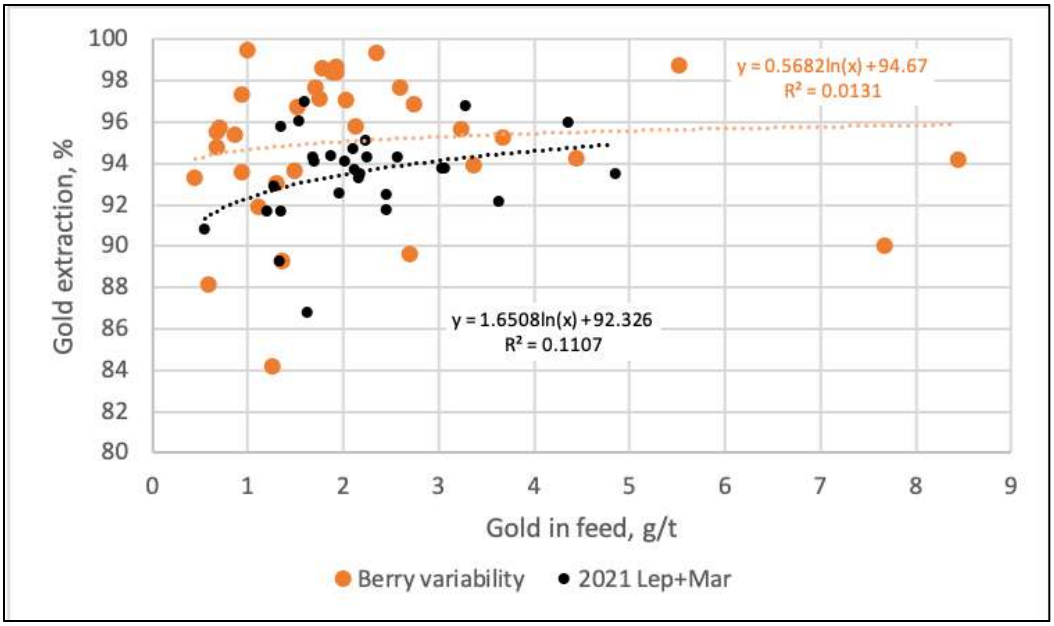
Due to a misunderstanding, the leach time for the gravity tailings tests was 48 h. Several tests were performed to measure the effect of the erroneous leach time and it is concluded that the impact is not significant. These tests and the impact of the error are discussed later in this section. The results of the tests are presented in Table 13-15 and plotted in Figure 13-7 along with data provided for the Leprechaun-Marathon mixture in the 2021 Feasibility Study.

The results of the leach tests on Var-04 and Var-13 seemed unexpectedly low and so were repeated but the results were essentially the same. Averages of the duplicate tests are provided in Table 13-15. The specific overall extraction numbers were 83.9% and 84.5% for Var-04 and 89.3% and 90.7% for Var-13 indicating reasonable reproducibility.

**Table 13.15: Results of Gravity-Leach Process on Berry Samples**

| Sample ID | Test ID | Head Grade | | | Recovery, % | | Reagent Cons'n, kg/t | |
|---|---|---|---|---|---|---|---|---|
| | | Au (Calc) g/t | C % | S % | Gravity | O'all, 48 h | NaCN | $Ca(OH)_2$ |
| Var-1 | CN01C | 1.89 | 0.40 | 1.45 | 11.3 | 98.4 | 0.90 | 2.26 |
| Var-2 | CN02C | 3.37 | 0.78 | 0.50 | 46.9 | 93.9 | 0.62 | 2.23 |
| Var-3 | CN03C | 0.45 | 0.28 | 0.87 | 17.1 | 93.3 | 0.87 | 2.22 |
| Var-4 | CN04C | 1.26 | 0.37 | 0.75 | 29.6 | 84.2 | 0.93 | 2.02 |
| Var-5 | CN05C | 0.94 | 0.57 | 0.17 | 36.9 | 97.4 | 0.67 | 2.09 |
| Var-6 | CN06C | 1.53 | 0.46 | 0.69 | 43.1 | 96.7 | 0.90 | 2.52 |
| Var-7 | CN07C | 4.44 | 0.43 | 0.64 | 56.4 | 94.3 | 1.14 | 2.42 |
| Var-8 | CN08C | 0.67 | 0.33 | 0.44 | 24.5 | 94.8 | 1.04 | 1.82 |
| Var-9 | CN09C | 2.73 | 0.30 | 0.88 | 42.4 | 96.9 | 0.94 | 2.01 |
| Var-10 | CN10C | 3.67 | 0.38 | 1.18 | 36.0 | 95.2 | 1.10 | 1.58 |
| Var-11 | CN11C | 1.79 | 0.37 | 0.72 | 71.5 | 98.6 | 1.05 | 1.48 |
| Var-12 | CN12C | 5.52 | 0.37 | 0.21 | 53.2 | 98.7 | 0.95 | 1.53 |
| Var-13 | CN13C | 7.67 | 0.56 | 0.86 | 47.0 | 90.0 | 0.96 | 1.73 |
| Var-14 | CN14C | 1.75 | 0.44 | 1.16 | 40.6 | 97.1 | 1.12 | 1.89 |
| Var-15 | CN15C | 1.49 | 0.41 | 0.49 | 37.8 | 93.6 | 1.13 | 1.41 |
| Var-16 | CN16C | 1.93 | 0.44 | 0.23 | 47.5 | 98.7 | 1.18 | 1.52 |
| Var-17 | CN17C | 1.92 | 0.35 | 0.91 | 18.0 | 98.4 | 1.00 | 1.85 |
| Var-18 | CN18C | 2.60 | 0.50 | 1.15 | 56.5 | 97.7 | 1.20 | 1.95 |
| Var-19 | CN19C | 1.00 | 0.39 | 0.20 | 67.3 | 99.5 | 1.07 | 1.55 |
| Var-20 | CN20C | 1.11 | 0.40 | 0.74 | 19.5 | 91.9 | 1.20 | 1.52 |
| Var-21 | CN21C | 1.36 | 0.50 | 0.56 | 15.5 | 89.3 | 0.89 | 1.33 |
| Var-22 | CN22C | 0.59 | 0.23 | 0.62 | 28.2 | 88.2 | 1.13 | 1.66 |
| Var-23 | CN23C | 2.04 | 0.45 | 0.40 | 46.0 | 97.1 | 1.07 | 1.57 |
| CCOM-1 | CN25 | 8.44 | 0.53 | 1.06 | 70.4 | 94.2 | 0.64 | 2.23 |
| CCOM-2 | CN26 | 3.23 | 0.50 | 0.57 | 45.9 | 95.7 | 0.80 | 1.69 |
| CCOM-3 | CN27 | 0.70 | 0.58 | 0.19 | 41.5 | 95.7 | 0.46 | 2.02 |
| CCOM-4 | CN28 | 2.34 | 0.51 | 0.26 | 67.3 | 99.4 | 0.62 | 2.08 |
| CCOM-5 | CN29 | 1.71 | 0.39 | 0.33 | 41.4 | 97.7 | 0.62 | 2.08 |
| CCOM-6 | CN30 | 0.67 | 0.53 | 0.25 | 64.7 | 95.5 | 0.48 | 2.20 |
| CCOM-7 | CN31 | 2.13 | 0.42 | 0.36 | 60.4 | 95.8 | 0.71 | 2.44 |
| CCOM-8 | CN32 | 1.29 | 0.39 | 0.69 | 65.9 | 93.0 | 0.60 | 2.35 |
| CCOM-9 | CN33 | 0.86 | 0.60 | 0.65 | 49.8 | 95.4 | 0.67 | 2.12 |
| CCOM-10 | CN34 | 2.70 | 0.37 | 0.95 | 40.6 | 89.6 | 0.69 | 2.06 |
| CCOM-11 | CN35 | 0.94 | 0.35 | 0.19 | 48.8 | 93.6 | 0.51 | 2.36 |
| Averages | | 2.26 | 0.44 | 0.63 | 43.80 | 94.99 | 0.88 | 1.94 |

**Figure 13-7: Extraction of Gold from Berry Samples Using Gravity-Leach Process**




The grade-recovery data for the processing of Leprechaun and Marathon feed material, as provided in the 2021 Feasibility Study, has been included in Figure 13-7. Both data sets show a high level of scatter as can be expected given the nuggety nature of the gold mineralization and the presence of gold encapsulated in pyrite. A statistical analysis of the leach stage extraction data showed zero correlation between gold extraction and the ore analysis for total carbon, total organic carbon, sulphur, or tellurium and the leach stage gold content. Of particular importance is that Berry ore can be processed under the same conditions as Leprechaun and Marathon and deliver the same, or slightly higher, gold extraction.

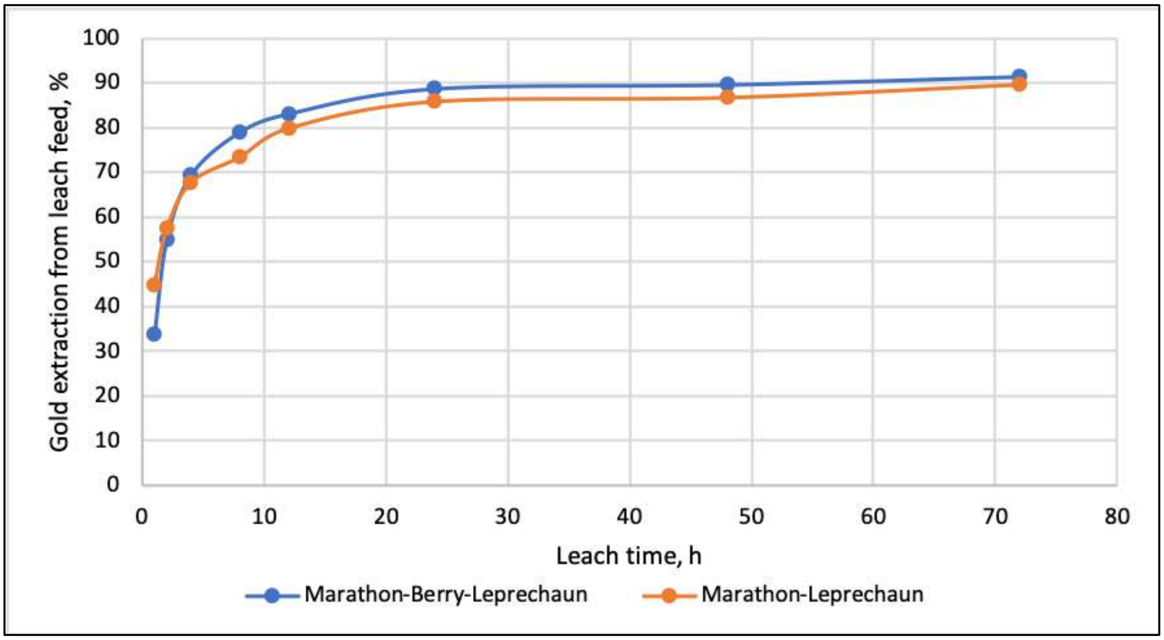
The average consumption of NaCN for 46 gravity-leach tests on Berry feed was 0.8 kg/t. This can be compared with the 0.27 kg/t reported in the 2021 Feasibility Study for Marathon and Leprechaun feed using data from BaseMet's BL639 project. The reason for the higher cyanide consumption from Berry material is not clear. Berry feed may indeed consume more cyanide or perhaps differences in test feed mass led to the higher cyanide consumption for the Berry tests (1 kg feed) compared to the 2021 Feasibility Study cyanidation tests (2 kg feed). There was no evident change in pH or other factors that might explain the higher cyanide demand.

Lime consumption in treating Berry material through the gravity-leach system averaged 2.3 kg/t which is essentially the same as the 2.2 kg/t for Marathon and Leprechaun material as discussed in the 2021 Feasibility Study. As noted earlier, the Berry gravity tailings were leached for 48 h instead of the 32 h of the 2021 Feasibility Study. Several data sources have been used to determine the impact of the difference in leach times on overall gold recovery.

SGS has recently performed two detailed kinetic leach tests on gravity tailings, one using a Marathon-Leprechaun blend and the other a Marathon-Berry-Leprechaun blend, as part of its project 19407-1. The results are presented in Figure 13-8 and demonstrate very little extraction taking place between 32 and 48 h.

Examination of the detailed data shows that for both kinetic tests extending the leach time from 32 h to 48 h would increase extraction by 0.6%. Given that approximately 50% of the gold in the mill feed is recovered by gravity, only half of the gold recovery is due to the gravity tailings leach. The above data therefore suggests that the 48 h leach data might have overstated the overall gold extraction by 0.3%.

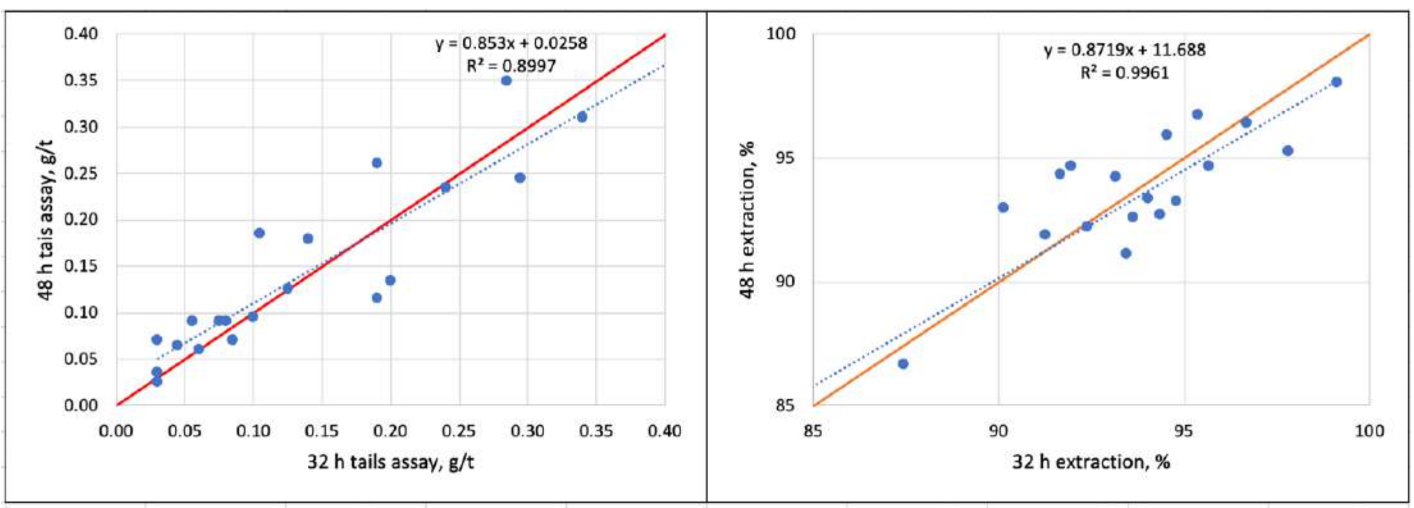
**Figure 13-8: Kinetics of Gold Extraction from Gravity Tailings (SGS Project 19407-01)**




After the error in leach time was detected, 21 pairs of gravity tailings leach tests were performed to determine the impact of the longer leach time on gold extraction. The test covered samples from all three deposits and a range in feed grade of 0.4 to 4 g/t. The results are presented in Figure 13-9.

The data evident in Figure 13-9 strongly indicate that, on average, there is no significant difference in overall gold extraction in moving from a 32 h to 48 h leach residence time.

**Figure 13-9: Impact of Gravity Tailings Leach Time on Tailings Assay and Overall Gold Extraction**



#### 13.3.8.1 Oxygen Uptake Tests

SGS performed five oxygen uptake tests on a mixture of material from Berry (39%), Marathon (35%) and Leprechaun (26%). Feed material was ground to a $P_{80}$ of 75 µm, coarse gold recovered by gravity, and 1000 g aliquots slurried to 43% solids in solution. An oxygen uptake test was then performed using either air or oxygen in a pre-aeration or leach configuration. Results are summarized in Table 13-16.

**Table 13.16: Oxygen Uptake Data – Berry-Marathon-Leprechaun Mixture**

| Test | Duty | Medium | $O_2$ Source | Oxygen Uptake Rate, mg/L/min at Stated Time in Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 24 |
| OU-1 | Pre-aeration | Water | Air | 0.13 | 0.05 | 0.06 | 0.05 | 0.06 | 0.05 | 0.04 | 0.07 |
| OU-2 | | Detox. Sol'n | Air | 0.01 | 0.11 | 0.15 | 0.07 | 0.06 | 0.05 | 0.04 | 0.03 |
| OU-3 | | Detox. Sol'n | $O_2$ ~20 mg/L | 0.01 | 0.71 | 0.11 | 0.11 | 0.10 | 0.07 | 0.07 | 0.07 |
| OU-4 | Leaching | Water+NaCN | $O_2$ ~20 mg/L | 0.02 | 0.17 | 0.10 | 0.09 | 0.08 | 0.09 | 0.10 | 0.05 |
| OU-5 | | Detox.+NaCN | $O_2$ ~20 mg/L | 0.04 | 0.09 | 0.06 | 0.04 | 0.05 | 0.04 | 0.03 | 0.02 |

As planned, the gravity-leach circuit (Phase 1) of the Valentine gold mill will use detoxified barren solution as process solution and include a single pre-aeration tank (providing 4 h residence time) that is equipped with air sparging facilities. Over the initial 4 h of the pre-aeration in test OU-2, the average oxygen uptake rate was approximately 0.1 mg/L/min. Proposed facilities for pre-aeration and leaching are discussed in Section 17.

### 13.3.9 Overall Grade-Recovery Relationships

The available grade-recovery data for the gravity-flotation-leach and the gravity-leach flowsheets as determined for Berry material has been presented above and will be further discussed in sub-section 13.3.9.2. Additionally, BaseMet was engaged to evaluate the leach and flotation characteristics of several Leprechaun and Marathon samples covering, in part, lower grades than had been previously tested. In addition, there are the grade-recovery data presented in the 2021 Feasibility Study. All such data can be consolidated to form grade recovery formulae for the two flowsheets.

#### 13.3.9.1 New Data for Marathon and Leprechaun Material

The 2019 program at SGS Lakefield included low-grade samples that had been selected for heap leach testing. These, and other samples from the 2019 program were taken from storage and sent to BaseMet for evaluation of the response of these samples to the gravity-leach and gravity-flotation-leach processes. The origin, and other details concerning the samples, are provided in earlier NI 43-101 reports. Results are summarized in Tables 13-17 and 13-18, respectively.

The average $P_{80}$ for the reground flotation concentrates in the tests of Table 13-18 was 20.7 µm, which was somewhat coarser than the target grind. A regression analysis showed that the regrind $P_{80}$ had a statistically significant effect with a coefficient of 0.35 meaning that a 3 µm change in the $P_{80}$ leads to a change of 1% in the cyanide leach extraction from flotation concentrate.

**Table 13.17: Results of Gravity-Leach Tests for Extended Grade-Recovery Relationship**

| Deposit | Sample ID | Test ID | Head Grade | Recovery, % | | Reagent Cons'n, kg/t | |
|---|---|---|---|---|---|---|---|
| | | | g/t Au | Gravity | Overall | NaCN | $Ca(OH)_2$ |
| Marathon | MG2 | CN01C | 1.17 | 53.18 | 94.82 | - | 2.44 |
| | MD2 | CN02C | 1.51 | 36.18 | 95.03 | - | 2.48 |
| | MHQC-13 | CN06C | 0.83 | 46.14 | 95.33 | - | 2.35 |
| | MHQC-14 | CN07C | 0.36 | 25.01 | 92.79 | - | 2.30 |
| | MHQC-15 | CN08C | 3.21 | 13.63 | 88.43 | - | 2.25 |
| | MHQC-16 | CN09C | 0.79 | 24.86 | 92.72 | - | 2.28 |
| | MHQC-17 | CN10C | 1.06 | 22.31 | 94.99 | - | 2.29 |
| | Comp A | CN14C | 0.45 | 22.92 | 90.51 | 0.69 | 3.87 |
| | Comp B | CN15C | 0.70 | 15.95 | 92.52 | 0.90 | 3.81 |
| | Comp C | CN16C | 0.70 | 28.31 | 93.33 | 0.90 | 3.96 |
| | Sample 1 | CN20C | 0.38 | 16.45 | 87.79 | 0.74 | 3.98 |
| | Sample 2 | CN21C | 0.63 | 18.59 | 88.22 | 0.75 | 4.00 |
| | Sample 3 | CN22C | 1.91 | 46.10 | 95.66 | 0.96 | 3.89 |
| | Sample 5 | CN24C | 2.67 | 43.06 | 96.60 | 1.03 | 3.86 |
| | Sample 4 | CN23C | 0.46 | 29.96 | 96.07 | 0.93 | 4.00 |
| | Sample 7 | CN25C | 0.52 | 63.11 | 97.01 | 1.07 | 3.98 |
| | Sample 8 | CN26C | 0.40 | 36.91 | 98.68 | 0.99 | 4.00 |
| | Sample 10 | CN27C | 1.18 | 14.10 | 93.07 | 1.02 | 3.79 |
| Leprechaun | LPHQ-1 | CN03C | 2.48 | 57.06 | 92.73 | - | 2.44 |
| | LPHQ-6 | CN13C | 0.66 | 21.09 | 92.00 | 0.53 | 3.26 |
| | LPHQ-7 | CN11C | 3.20 | 29.65 | 93.06 | 0.57 | 3.45 |
| | LPHQ-9 | CN12C | 2.71 | 48.21 | 95.92 | 0.44 | 3.28 |
| | LPHQ-11 | CN04C | 1.58 | 10.36 | 77.15 | - | 2.45 |
| | LPHG-12 | CN05C | 1.24 | 30.81 | 94.10 | - | 2.45 |
| | Comp D | CN17C | 0.30 | 29.41 | 95.79 | 1.78 | 3.92 |
| | Comp E | CN18C | 0.54 | 16.17 | 91.13 | 0.53 | 3.77 |
| | Comp F | CN19C | 0.63 | 43.24 | 94.21 | 0.59 | 3.85 |
| | Sample 11 | CN28C | 0.49 | 38.41 | 97.19 | 0.53 | 3.99 |
| | Sample 12 | CN29C | 2.92 | 38.40 | 96.42 | 0.67 | 3.91 |
| | Sample 13 | CN30C | 0.48 | 46.24 | 95.88 | 0.66 | 3.99 |
| | Sample 14 | CN31C | 0.27 | 34.15 | 95.08 | 0.42 | 4.00 |
| | Sample 15 | CN32C | 3.53 | 51.35 | 96.87 | 0.66 | 3.95 |
| | Sample 16 | CN33C | 1.27 | 23.96 | 93.05 | 0.73 | 3.99 |
| | Sample 18 | CN34C | 0.77 | 7.900 | 92.38 | 0.81 | 3.93 |
| | Sample 20 | CN35C | 0.22 | 42.44 | 95.45 | 0.48 | 3.95 |
| | Sample 21 | CN36C | 0.42 | 31.76 | 91.28 | 0.70 | 4.02 |
| Statistics | Average | | 1.18 | 32.15 | 93.42 | 0.77 | 3.45 |
| | Minimum | | 0.22 | 7.900 | 77.15 | 0.42 | 2.25 |
| | Maximum | | 3.53 | 63.11 | 98.68 | 1.78 | 4.02 |

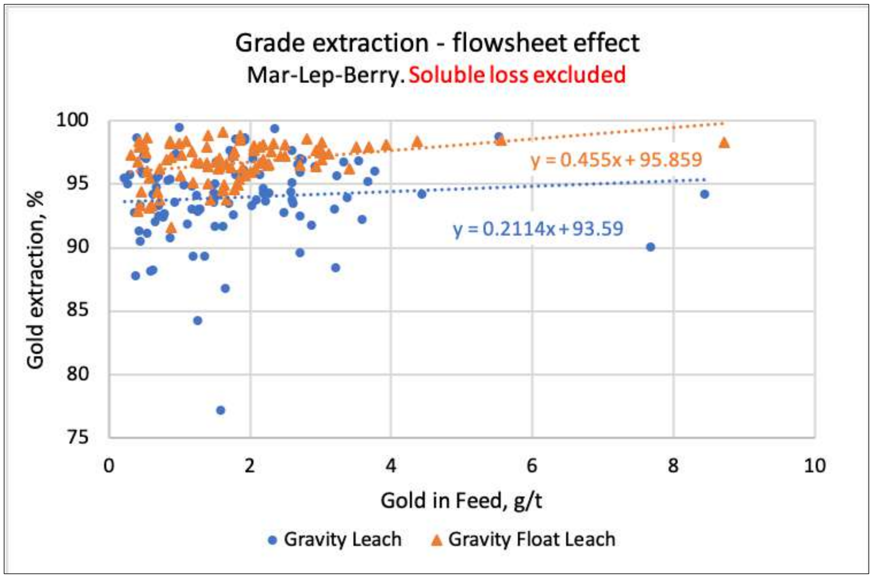
**Table 13.18: Results of Gravity-Flotation-Leach Tests for Extended Grade-Recovery Relationship**

| Deposit | Comp | Test | Feed Assays | | Grav Conc. | | Mass, % | Recovery, % | | Recovery, % | Cyanide Leach Rec'y, % | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Au, g/t (Cal) | S, % | Mass, % | Rec'y, % | | Au | S | Grav.+Flot. | Ro Conc | Ro Tail | Rec'y, % |
| Marathon | MG2 | R01B | 2.29 | 0.63 | 0.079 | 49.1 | 5.4 | 45.9 | 95.2 | 95.1 | 97.1 | 78.2 | 97.6 |
| | MD2 | R02B | 2.06 | 0.62 | 0.069 | 35.2 | 6.9 | 60.8 | 94.5 | 95.9 | 98.0 | 73.1 | 97.7 |
| | MHQC-13 | R06B | 1.86 | 0.86 | 0.063 | 48.1 | 6.2 | 49.3 | 95.5 | 97.5 | 98.0 | 91.9 | 98.8 |
| | MHQC-14 | R07B | 0.49 | 0.42 | 0.049 | 24.9 | 4.3 | 65.4 | 97.5 | 90.3 | 98.2 | 92.6 | 98.1 |
| | MHQC-15 | R08B | 3.41 | 0.59 | 0.054 | 12.9 | 7.5 | 77.4 | 94.5 | 90.2 | 97.7 | 78.4 | 96.2 |
| | MHQC-16 | R09B | 0.86 | 0.72 | 0.076 | 25.9 | 4.8 | 68.6 | 94.8 | 94.5 | 98.0 | 92.2 | 98.2 |
| | MHQC-17 | R10B | 1.41 | 0.70 | 0.063 | 22.1 | 8.0 | 76.0 | 94.6 | 98.0 | 98.4 | 98.2 | 98.8 |
| | Comp A | R14B | 0.58 | 0.31 | 0.120 | 23.1 | 3.4 | 70.2 | 98.5 | 93.3 | 91.1 | 91.3 | 93.1 |
| | Comp B | R15B | 0.88 | 0.57 | 0.147 | 15.8 | 4.6 | 71.2 | 99.2 | 87.0 | 90.3 | 88.2 | 91.6 |
| | Comp C | R16B | 0.89 | 0.72 | 0.097 | 31.1 | 4.5 | 64.6 | 99.3 | 95.7 | 95.9 | 94.9 | 97.1 |
| | Sample 1 | R20B | 0.46 | 0.31 | 0.117 | 16.3 | 5.1 | 75.4 | 98.5 | 91.7 | 94.8 | 79.4 | 94.4 |
| | Sample 2 | R21B | 0.42 | 0.29 | 0.105 | 20.7 | 4.4 | 67.8 | 98.3 | 88.6 | 92.3 | 83.8 | 92.9 |
| | Sample 3 | R22B | 2.50 | 0.58 | 0.150 | 46.8 | 4.3 | 45.6 | 99.2 | 92.3 | 96.8 | 94.0 | 98.1 |
| | Sample 4 | R23B | 0.52 | 0.51 | 0.134 | 29.3 | 4.5 | 65.1 | 99.1 | 94.5 | 96.7 | 92.6 | 97.5 |
| | Sample 5 | R24B | 3.02 | 0.58 | 0.140 | 50.3 | 6.9 | 44.8 | 99.2 | 95.1 | 97.9 | 85.0 | 98.3 |
| | Sample 7 | R25B | 1.87 | 0.67 | 0.104 | 73.4 | 5.1 | 24.0 | 99.3 | 97.5 | 95.1 | 87.3 | 98.5 |
| | Sample 8 | R26B | 1.62 | 0.44 | 0.129 | 34.5 | 3.9 | 63.1 | 98.9 | 97.6 | 98.9 | 92.4 | 99.1 |
| | Sample 10 | R27B | 1.82 | 0.98 | 0.114 | 13.9 | 4.8 | 70.4 | 99.5 | 84.4 | 97.2 | 79.8 | 94.9 |
| Leprechaun | LPHQ-1 | R03B | 2.99 | 0.65 | 0.094 | 56.0 | 4.6 | 41.1 | 87.5 | 97.1 | 94.5 | 92.3 | 97.5 |
| | LPHQ-6 | R13B | 0.72 | 0.24 | 0.012 | 12.5 | 5.3 | 83.5 | 88.4 | 96.0 | 93.6 | 77.2 | 93.8 |
| | LPHQ-7 | R11B | 2.43 | 0.61 | 0.024 | 19.5 | 4.4 | 75.8 | 95.3 | 95.3 | 97.9 | 74.7 | 97.2 |
| | LPHQ-9 | R12B | 2.71 | 0.30 | 0.020 | 51.9 | 4.5 | 36.9 | 91.4 | 88.7 | 98.6 | 73.3 | 96.5 |
| | LPHQ-11 | R04B | 1.77 | 0.53 | 0.114 | 11.4 | 7.5 | 83.4 | 91.8 | 94.8 | 94.6 | 82.2 | 94.6 |
| | LPHG-12 | R05B | 1.10 | 0.34 | 0.073 | 40.9 | 5.8 | 53.1 | 83.0 | 94.0 | 97.9 | 91.5 | 98.4 |
| | Comp D | R17B | 0.31 | 0.08 | 0.075 | 26.9 | 6.0 | 58.0 | 93.9 | 84.9 | 98.9 | 86.4 | 97.3 |
| | Comp E | R18B | 0.58 | 0.22 | 0.070 | 15.7 | 3.9 | 69.4 | 97.8 | 85.1 | 97.8 | 79.6 | 95.5 |
| | Comp F | R19B | 0.60 | 0.17 | 0.100 | 37.3 | 6.6 | 51.9 | 97.3 | 89.1 | 91.7 | 77.6 | 93.3 |
| | Sample 11 | R28B | 0.54 | 0.12 | 0.094 | 38.2 | 4.6 | 52.9 | 96.1 | 91.1 | 99.0 | 91.2 | 98.7 |
| | Sample 12 | R29B | 2.93 | 0.35 | 0.089 | 32.9 | 4.6 | 58.7 | 98.6 | 91.5 | 98.5 | 83.3 | 97.7 |
| | Sample 13 | R30B | 0.86 | 0.18 | 0.114 | 32.6 | 3.0 | 40.3 | 97.3 | 72.9 | 98.1 | 96.9 | 98.4 |
| | Sample 14 | R31B | 0.40 | 0.22 | 0.093 | 34.4 | 4.7 | 58.5 | 97.8 | 92.9 | 97.9 | 71.9 | 96.8 |
| | Sample 15 | R32B | 2.81 | 0.29 | 0.097 | 46.7 | 3.0 | 50.2 | 98.3 | 96.9 | 98.5 | 78.6 | 98.6 |
| | Sample 16 | R33B | 1.03 | 0.58 | 0.038 | 23.3 | 5.1 | 70.2 | 99.2 | 93.6 | 98.0 | 80.3 | 97.3 |
| | Sample 18 | R34B | 0.69 | 0.34 | 0.058 | 9.0 | 3.7 | 72.8 | 98.6 | 81.9 | 98.4 | 75.5 | 94.4 |
| | Sample 20 | R35B | 0.43 | 0.16 | 0.031 | 43.4 | 4.5 | 52.2 | 97.0 | 95.6 | 98.3 | 83.9 | 98.4 |
| | Sample 21 | R36B | 0.43 | 0.28 | 0.064 | 33.5 | 3.1 | 55.4 | 96.6 | 88.9 | 97.4 | 93.7 | 97.9 |
| Statistics | Average | | 1.40 | 0.45 | 0.09 | 31.65 | 4.98 | 60.27 | 96.14 | 91.93 | 96.73 | 85.09 | 96.75 |
| | Minimum | | 0.31 | 0.08 | 0.01 | 9.02 | 2.98 | 24.04 | 82.95 | 72.94 | 90.34 | 71.94 | 91.58 |
| | Maximum | | 3.41 | 0.98 | 0.15 | 73.42 | 8.02 | 83.52 | 99.52 | 98.04 | 98.99 | 98.22 | 99.13 |

#### 13.3.9.2 Consolidated Grade-Recovery Curves

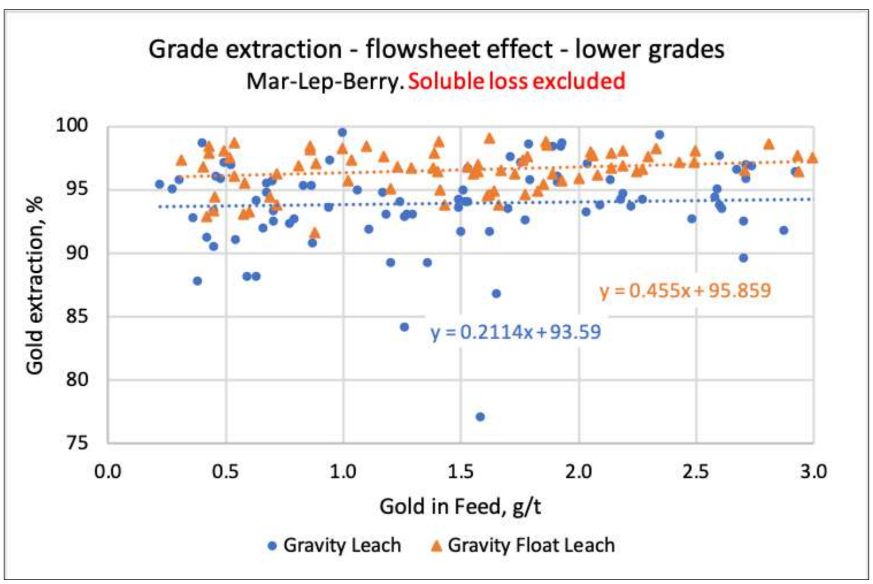
All available data from the 2021 Feasibility Study and 2022 testwork described above are plotted in Figures 13-10 and 13-11. The graphs plot the extraction data for 99 gravity-leach tests (34 Berry, 32 Leprechaun, and 33 Marathon samples) and 88 gravity-flotation-leach tests (23 Berry, 32 Leprechaun, and 33 Marathon samples).

**Figure 13-10: Grade-Extraction Curve for Consolidated Data – Effect of Flowsheet**




A close-up of the graph covering the lowest grades is provided in Figure 13-11.

**Figure 13-11: Grade-Extraction Curve – Effect of Flowsheet – Focus on Lower Grades**



The data for the individual feed sources are plotted for the two flowsheets in Figures 13-12 and 13-13.

**Figure 13-12: Grade Extraction for Gravity-Float-Leach Flowsheet Showing Deposit Effect**

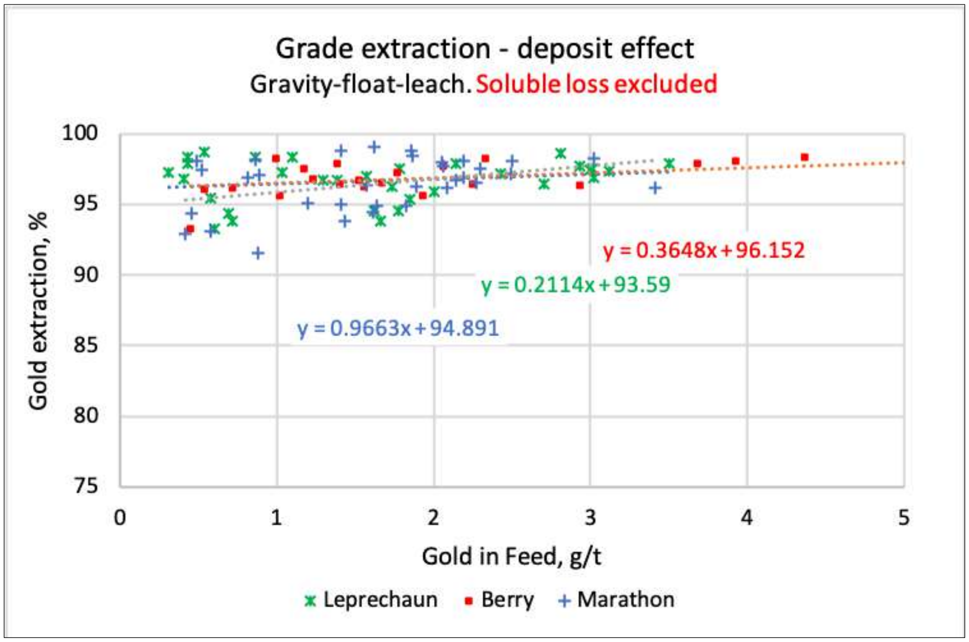



**Figure 13-13: Grade Extraction for Gravity-Leach Flowsheet Showing Deposit Effect**

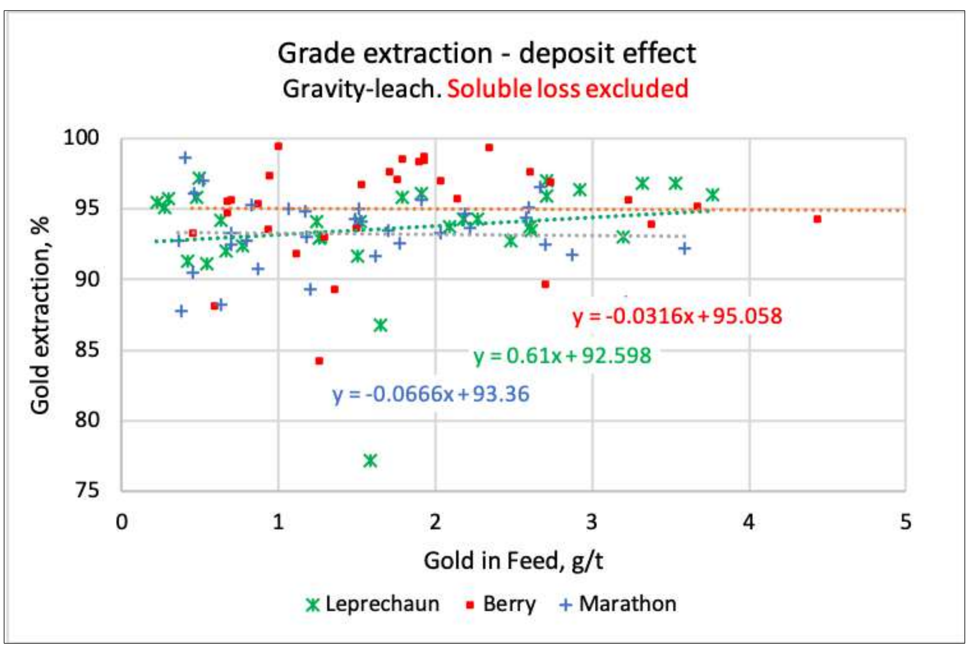


**Table 13.19: Regression Lines and Extraction Predictions – Excluding Soluble Losses**

| Data Set | Regression | Extraction Predicted at Stated Feed Grade, g/t Au<br>Gravity-Leach Circuit – Soluble Losses Excluded | | | | |
|---|---|---|---|---|---|---|
| | | 0.5 g/t Au | 1 g/t Au | 2 g/t Au | 3 g/t Au | 4 g/t Au |
| **Consolidated** | **y = 0.2114x + 93.59** | **93.7** | **93.8** | **94.0** | **94.2** | **94.4** |
| Berry | y = -0.0316x + 95.058 | 95.0 | 95.0 | 95.0 | 95.0 | 94.9 |
| Leprechaun | y = 0.61x + 92.598 | 92.9 | 93.2 | 93.8 | 94.4 | 95.0 |
| Marathon | y = -0.0666x + 93.36 | 93.3 | 93.3 | 93.2 | 93.2 | 93.1 |
| **Sum of Individuals** | | **93.8** | **93.8** | **93.8** | **94.2** | **94.4** |
| 2021 Feasibility Study | y = 1.36x + 90.7 | 91.4 | 92.1 | 93.4 | 94.8 | 96.1 |
| | | Gravity-Flotation-Leach Circuit - Soluble Losses Excluded | | | | |
| **Consolidated** | **y = 0.455x + 95.859** | **96.1** | **96.3** | **96.8** | **97.0** | **97.0** |
| Berry | y = 0.3648x + 96.152 | 96.3 | 96.5 | 96.9 | 97.0 | 97.0 |
| Leprechaun | y = 0.3334x + 96.135 | 96.3 | 96.5 | 96.8 | 97.0 | 97.0 |
| Marathon | y = 0.9663x + 94.891 | 95.4 | 95.9 | 96.8 | 97.0 | 97.0 |
| **Sum of Individuals** | | **96.0** | **96.3** | **96.8** | **97.0** | **97.0** |
| 2021 Feasibility Study | y = 1.043x + 94.3 | 94.8 | 95.3 | 96.4 | 97.0 | 97.0 |

Note: Gravity-leach capped at 96 extraction, gravity-flotation-leach capped at 97% extraction.

In Table 13-19, the consolidated equations define the best-fit line through all the available feed grade-extraction data points, covering all three deposits, for each of the two process flowsheets as shown in Figure 13-10.

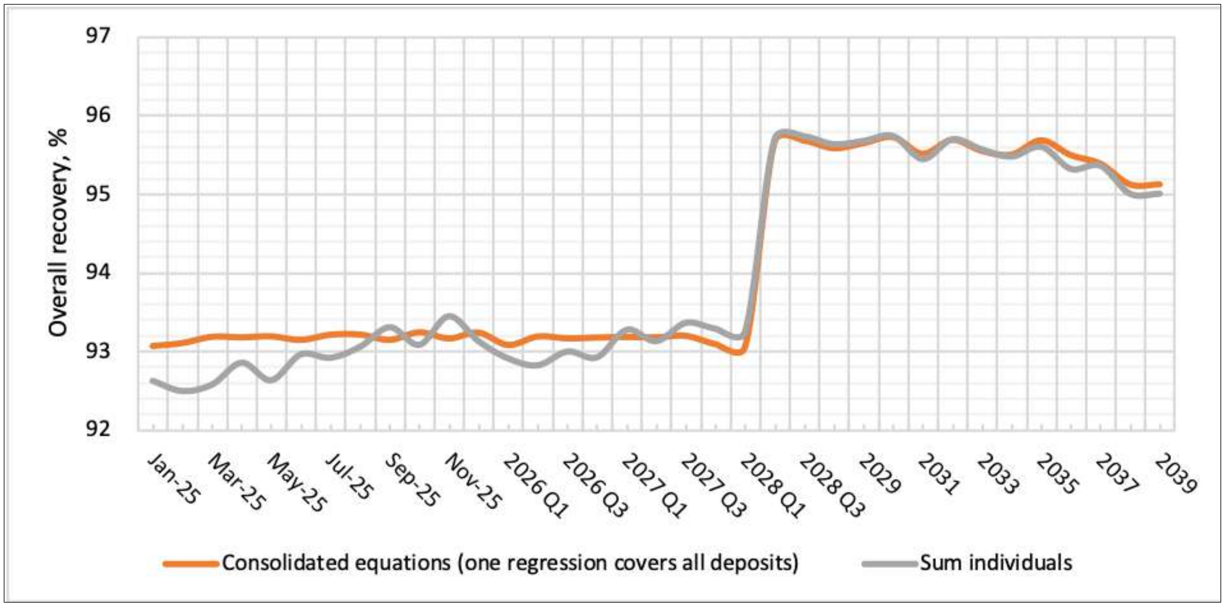
The Berry, Leprechaun and Marathon equations and projections are for the specified deposit only as shown in Figures 13-12 and 13-13.

The data provided in the Sum of Individuals row are the mathematically calculated extraction for when processing a mixture made from equal parts of feed from each deposit. It will be noticed that the values calculated this way are generally the same as the extraction value calculated using the consolidated regression equation.

Finally, Table 13-19 presents the relationships developed in the 2021 Feasibility Study. The values predicted from the 2022 equations and the 2021 predictions are very close—at around 2 g/t feed—but the 2021 equation predicts lower recovery at low grades and higher recovery at high grades.

If the three deposits are not mined at an equal rate, and especially if proportions vary by year, then the rigorous way of calculating overall recovery is to apply the regression equation to each source of feed material. As an illustration of how the consolidated and sum of the individual estimates compare, Figure 13-14 plots the overall process recovery for each method using the mine production schedule data presented in Section 16 of this report. In this graph, soluble losses have been included at 1% of gold in mill feed as was done in the 2021 Feasibility Study. Recovery is calculated on a month-by-month basis for the first year, then quarterly for two years, and then annually for the rest of the mine life.

**Figure 13-14: Predictions of Overall Gold Recovery with 1% Soluble Losses – Open Pit Mining Schedule Scd5a**




Although the consolidated regression overstates the recovery slightly compared to the recovery estimated from the individual equations, the difference is generally small. As a point of interest, the change in recovery from about 93% to about 95.5% in 2027 is due to commissioning of the Phase 2 gravity-flotation-leach expansion.

### 13.3.10 Cyanide Detoxification

A 340 kg Berry composite was created from equal masses of material from 34 drillholes distributed across the Berry deposit. The composite was processed through gravity separation, flotation, and cyanidation of the gravity and reground flotation concentrates and flotation tailings. The tailings from this procedure were subjected to continuous cyanide detoxification tests using the air/$SO_2$ method. A series of five continuous runs were completed, all at 50% solids at ambient temperature and using oxygen gas.

All treatment conditions achieved a $CN_{WAD}$ <1 mg/L. Testing was initiated using standard cyanide detoxification test conditions with an 8:1 ratio of $SO_2$ to $CN_{WAD}$ and 100 ppm Cu using 60 minutes retention. Conditions were optimized by adjusting key parameters which ultimately confirmed that with the addition of $SO_2$ at a 3.5:1 ratio of $SO_2$ to $CN_{WAD}$ and 15 ppm Cu, a 60-minute retention time was sufficient to reduce $CN_{WAD}$ to a target value of <1 mg/L. Cyanide detoxification feed and product results are presented in Table 13-20.

The 2021 Feasibility Study reported on tests performed on both gravity-leach and gravity-flotation leach tailings resulting from processing a Marathon-Leprechaun mixture as feed. The gravity-leach tailings had a high pH, due to the high alkalinity of that leach operation, and required acid to bring the detoxification feed into the favourable pH range of around pH 10. With acidification, the detoxification process gave $CN_{WAD}$ below 1 mg/L with 12 mg/L of Cu, an $SO_2/CN_{WAD}$ of 5, and 45 minutes of residence time. The Marathon-Leprechaun gravity-float-leach tailings, which had a starting pH of 11, gave <1 mg/L $CN_{WAD}$ with 50 mg/L Cu added, an $SO_2/CN_{WAD}$ of 5 and 45 minutes, and 1.2 mg/L when the copper was reduced to 12.5 mg/L.

**Table 13.20: Cyanide Detoxification Test Results for Gravity-Leach Flowsheet**

| Test | Retention Time min | pH | Discharge Chemistry (Solution) | | | | Pulp Vol. Treated | Reagent Addition | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CNt | $CN_{WAD}$ | Cu | Fe | | $SO_2$ | Lime | Cu |
| | | | mg/L | mg/L | mg/L | mg/L | L | g/g $CN_{WAD}$ | | mg/L sol. |
| Feed | | 11 | 599 | 529 | 9 | 25 | | | | |
| CND-C1 | 45 | 8 | 27.1 | 0.3 | 0.11 | 9.6 | 7.7 | 5 | 8.5 | 25 |
| CND-C2 | 30 | 8.1 | 32.1 | 0.3 | 0.1 | 11.4 | 5.8 | 5 | 3.4 | 25 |
| CND-C3 | 30 | 8.2 | 30.8 | 0.3 | 0.16 | 10.88 | 5.8 | 3.5 | 1.7 | 25 |
| CND-C4 | 30 | 8.3 | 42.7 | 0.4 | 0.17 | 15.14 | 5.8 | 3.5 | 2.2 | 15 |
| CND-C5 | 360 | 8.1 | 47.5 | 0.2 | 0.08 | 16.9 | 40 | 3.5 | 4.3 | 15 |

Notes: Cu added as copper sulphate ($CuSO_4.5H_20$); $SO_2$ added as sodium metabisulphite ($Na_2S_2O_3$).

The results for Berry gravity-flotation-leach tailings presented in Table 13-20 show that the Berry tailings respond well to the process and similarly to the Marathon-Leprechaun tailings of the 2021 Feasibility Study.

## 13.4 Solid Liquid Separation

BaseMet completed thickening testwork on rougher concentrate, rougher tailings and cyanide destruction tailings produced from the Berry bulk composite. Thickening characteristics of the sample were studied beginning with small-scale flocculant scoping tests followed by static settling tests in cylinders and dynamic bench-scale thickening tests. BaseMet also measured the rheological properties of thickener underflow produced in the dynamic thickening tests.

### 13.4.1 Sample Characterization

Particle size determinations were conducted on representative samples by screen analyses and using a Malvern laser diffraction instrument. Details of the particle size determination are summarized in Table 13-21.

**Table 13.21: Properties of Materials Tested**

| Sample | Solids Specific Gravity | $K_{80}$, µm (Screen) | $K_{80}$, µm (Malvern) |
|---|---|---|---|
| T24 Rougher Concentrate | 3.14 | 53 | 28.6 |
| T24 Rougher Tailing | 2.75 | 158 | 143 |
| Detoxified Tailing | 2.74 | 157 | 155 |

### 13.4.2 Flocculant Scoping and Static Settling Tests

Flocculant scoping tests were conducted using the bulk composite rougher concentrate and rougher tailings and cyanide destruction tailings. A total of five flocculant reagents were evaluated using small scale settling tests in 250 mL cylinders; flocculants included Magnafloc 10, 336, 351, 156, AN913.

Flocculant was prepared to 0.1 g/L and dosed at 20 g/t; performance was measured semi-quantitatively. Results were compared for slurry samples at a constant volume of 250 mL and feed density of 15% solids. Scoping tests suggested AN913 and MF 156 were the most promising and the latter was for the balance of the settling testwork.

Static settling tests using the standard Kynch method were completed on each sample to determine suitable dosages of the MF156 flocculant. The feed solids were diluted to approximately 15% solids. Testing was completed in 2L glass cylinders, thickened solids were raked after passing the critical settling point. A summary of results is shown in Table 13-22. Static testing of the samples suggested thickening operating parameters between 20 and 30 g/t of MF156 and provided sufficient static settling information to undertake dynamic thickening tests.

**Table 13.22: Static Settling Test Data**

| Test | Sample | Grind | Flocculant | | pH | Density (%) | | Free Settling |
|---|---|---|---|---|---|---|---|---|
| | | (µm) | Type | g/t | | Initial | Final | Velocity (m/h) |
| S1 | T24 Rougher Concentrate (Reground) | 17 | MF156 | 20 | 8.0 | 12.0 | 50.5 | 8.4 |
| S2 | | | | 30 | 8.0 | 12.0 | 46.9 | 9.9 |
| S3 | | | | 10 | 8.0 | 11.9 | 39.0 | 7.3 |
| S4 | T24 Rougher Tailings | 150 | MF156 | 20 | 7.8 | 13.6 | 66.3 | 18.5 |
| S5 | | | | 10 | 7.8 | 13.7 | 66.5 | 12.5 |
| S6 | | | | 30 | 7.8 | 13.6 | 63.6 | 21.7 |
| S7 | | | | 20 | 10.0 | 13.6 | 63.4 | 18.6 |
| S8 | Detoxified Tailings | 151 | MF156 | 20 | 8.2 | 13.3 | 63.8 | 9.2 |
| S9 | | | | 40 | 8.2 | 13.2 | 62.2 | 14.5 |
| S10 | | | | 30 | 8.2 | 13.1 | 62.0 | 10.4 |
| S11 | | | | 20 | 8.2 | 13.1 | 61.9 | 10.6 |

### 13.4.3 Dynamic Settling Tests

The results of the preliminary static settling-thickening tests were used to determine the pre-optimized conditions for dynamic testing. Semi-continuous dynamic testing was conducted using a custom test unit which consisted of a 100 mm diameter laboratory thickener equipped with feedwell, dilution system, rake and pumps.

General conditions established during static testing were applied prior to optimization during the dynamic testing. The feedwell solids density was diluted with water prior to continuously introducing feed slurry. Criteria tested included feed flux loading rate and flocculant dosage.

Unsheared yield stress measurements were conducted on settled solids with a Brookfield DV2T Viscometer test apparatus, using a vane spindle. Key thickener test data including unit areas, hydraulic loading, reagent consumptions, rise rates, and underflow yield stress values are summarized by test in Table 13-23.

The test on T24 rougher concentrate delivered an optimum underflow density of 61.1% and turbidity of 246 mg/L when flocculated with 30 g/t MF156 and at a loading rate of 0.5 $t/m^2$ /h loading rate. Similarly, the flotation tailings sample gave underflow density of 64.3% and turbidity of 674 mg/L with 30 g/t of MF156 at 0.7 $t/m^2$ /h loading rate. For detoxified tailings, an underflow density of 62.2% and turbidity of 124 mg/L was achieved with 40 g/t MF156 at 0.5 t/m$^2$ /h loading rate.

**Table 13.23: Dynamic Settling Test Conditions and Results**

| Test | Sample | Grind | Density (%) | | Flocculant | | pH | Rise Rate | Loading Rate | Turbidity | Yield Stress |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (μm) | Feed | U/F | Type | g/t | | m/h | t/m$^2$/h | mg/L | Pa |
| D1-A | T24 Rougher Concentrate (Reground) | 17 | 15 | 61.1 | MF156 | 30 | 8.0 | 3.1 | 0.5 | 247 | 76 |
| D1-B | | | 15 | 54.4 | | 30 | 8.0 | 4.3 | 0.7 | 579 | 32 |
| D1-C | | | 15 | 43.4 | | 30 | 8.0 | 6.1 | 1.0 | 444 | 11 |
| D1-D | | | 15 | 37.9 | | 20 | 8.0 | 3.0 | 0.5 | 559 | 7 |
| D1-E | | | 15 | 47.9 | | 40 | 8.0 | 3.1 | 0.5 | 162 | 61 |
| D1-A | T24 Rougher Tailings | 150 | 15 | 63.4 | MF156 | 30 | 7.8 | 3.1 | 0.5 | 392 | 93 |
| D1-B | | | 15 | 64.3 | | 30 | 7.8 | 4.3 | 0.7 | 674 | 23 |
| D1-C | | | 15 | 59.3 | | 30 | 7.8 | 6.2 | 1.0 | 628 | 12 |
| D1-D | | | 15 | 62.5 | | 50 | 7.8 | 4.4 | 0.7 | 399 | 29 |
| D1-E | | | 15 | 66.5 | | 10 | 7.8 | 4.3 | 0.7 | 1073 | 23 |
| D1-A | Detoxified Tailings | 151 | 15 | 62.2 | MF156 | 40 | 7.9 | 3.1 | 0.5 | 124 | 26 |
| D1-B | | | 15 | 61.4 | | 40 | 7.9 | 4.4 | 0.7 | 137 | 43 |
| D1-C | | | 15 | 58.4 | | 40 | 7.9 | 6.2 | 1.0 | 112 | 38 |
| D1-D | | | 15 | 58.2 | | 50 | 7.9 | 4.4 | 0.7 | 96 | 21 |

Note: Values are direct measurements without scale-up factors.

The 2021 Feasibility Study reported on dynamic settling tests on two Marathon-Leprechaun streams. The gravity-float-leach rougher tailings, at a feed rate of 0.5 t/m2/h, gave a 67% solids underflow and an overflow turbidity of 401 when flocculant dose was 40 g/t. These data are reasonably consistent with the data of Table 13-23 and indicate that Berry feed behaves much as the Marathon-Leprechaun mixture studied earlier.

The 2021 Feasibility Study reported that the gravity-leach detoxified tailings gave an underflow containing 65% solids when fed at a rate of 0.5 t/m$^2$/h and dosed with 30 g/t of flocculant. This is close to the value reported for the detoxified Berry gravity-float-leach tailings.

## 13.5 Ongoing Testwork

At the time of writing, several programs of testwork are ongoing with conclusions expected in the near future. The testwork programs will be used to confirm or refine detailed designs and no major changes or impacts to capital or operating costs are expected. Items under study include mercury deportment and various environment-related tests.

## 13.6 Conclusions

The purpose of the testwork under discussion was to determine if mineralized material from the Berry deposit could be processed through the previously designed processing facilities or if design modifications would be needed. To that end, various characteristics of multiple samples from the Berry deposit have been evaluated through laboratory testwork.

The comminution properties of Berry material are very similar to the corresponding properties of material from the Marathon and Leprechaun deposits. The earlier-designed comminution facilities will be able to handle a Marathon-Leprechaun mixture, or a Marathon-Leprechaun-Berry mixture, without a significant change in circuit performance.

The gravity concentration properties of Berry material are very similar to those of Marathon and Leprechaun material and the previously designed facilities will be equally suitable with or without the addition of Berry material to the circuit feed.

The response of Berry material during flotation and the cyanidation of finely ground concentrate, flotation tailings and gravity tailings are sufficiently similar for Berry feed to be processed with Marathon and Leprechaun material without significant change in operating parameters.

The thickening data indicated minor differences between Berry and the other material sources but nothing significant. Detoxification requirements also seem very similar.

The recovery of gold from Marathon and Leprechaun feed materials with lower gold contents than earlier studied has been examined. The grade-recovery equations for Marathon and Leprechaun have been revised with the new data.

The minor differences in process performance parameters noted in this section should be reviewed by detailed design engineers to confirm that the present designs are adequate for the intended throughput and performance.

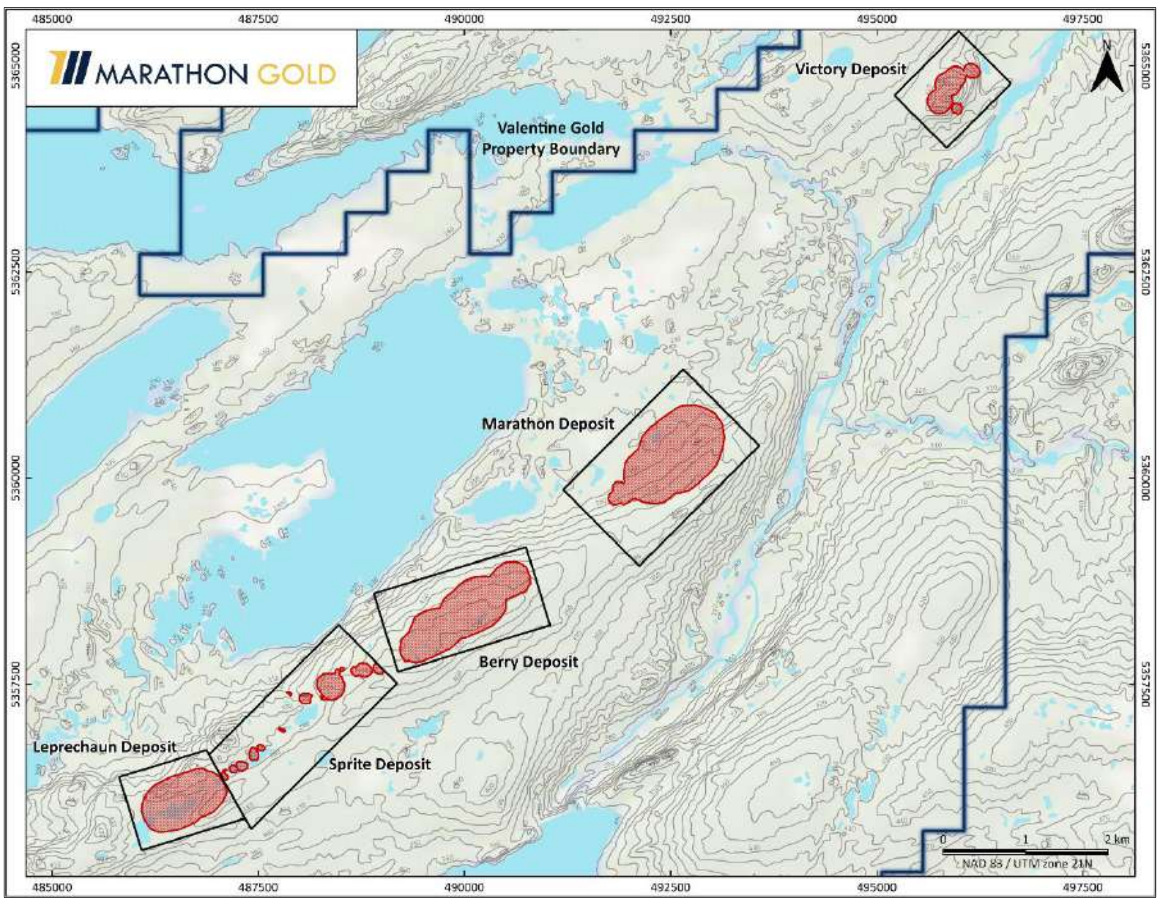
# 14 MINERAL RESOURCE ESTIMATES

## 14.1 Overview

This section describes the preparation of mineral resource estimations (MREs) for the Valentine Gold Project. The MREs were prepared by the John T. Boyd Company (BOYD) and take into consideration the five identified gold deposits—Leprechaun, Sprite, Berry, Marathon, and Victory—that comprise the Valentine Gold Project. The MREs reported herein were prepared under the supervision of Mr. Roy Eccles, P.Geo. (PEGNL), in accordance with standards set out by National Instrument (NI) 43-101 and the Canadian Institute of Mining (CIM) Definition Standards and Guidelines (2014, 2019). Mr. Eccles is a Senior Consultant with APEX Geoscience Ltd. (APEX), and an independent Qualified Person (QP) as defined in section 1.5 of 43-101 CP and takes responsibility for Section 14, among others.

The location of the five deposits with mineral resource estimates is presented in Figure 14-1.

**Figure 14-1: Valentine Mineral Resource Areas**




Source: Marathon, 2022

MREs for the five deposits were previously provided by BOYD in a technical report (Farmer, 2021) filed on SEDAR. The MREs reported herein supersede those of the previous BOYD estimates and are the result of revised technical parameters and/or new exploration work. The effective date of the revised MREs for the Leprechaun, Berry, and Marathon deposits is June 15, 2022. The MREs for the Sprite and Victory deposits remain unchanged since the previous technical report and are effective as of November 20, 2020.

#### 14.1.1 Mineral Resource Estimation Procedures

Three-dimensional (3D) geological models for each of the deposits were developed in either Seequent's Leapfrog or Maptek Pty. Ltd.'s Vulcan software. All block modelling was carried out in Vulcan. The procedures used to model and prepare the MREs are generally the same for each of the deposits and consist of the following steps:

1. Assemble and validate the exploration (drillhole) database.
2. Load the exploration database into Vulcan and validate the results.
3. Import and review client provided 3D wireframe models of the mineralized domains and surrounding rock masses. These were reviewed and accepted by Boyd and APEX.
4. Examine the various sampling lengths and establish a composite length for assay composites.
5. Create a block model flagged by geology and mineralized domains developed in Step 3 above.
6. Determine, based on lognormal probability charts of the assay data, the threshold gold grade to limit the area of influence of high-grade gold assays.
7. Flag the sample composites by geological domain as developed in Step 3 above.
8. Using the composites from Step 7, develop variograms for gold grade in each potentially mineralized domain.
9. Develop grade estimation parameters and interpolate block grades.
10. Flag the blocks located above or below topography.
11. Run the post-interpolation script that determines mineral resource classification, block density, and rock codes for use in pit optimization.
12. Validate the block grade estimates using quantile-quantile (QQ) plots and visual inspection against the drillhole samples.
13. Export the block model to Geovia's GEOVIA's Whittle pit optimizer.
14. Import the block model into the Whittle pit optimizer.
15. Determine economic pit limits to constrain the open pit MREs using Whittle's pit optimization tools.
16. Import the pit optimization results into Vulcan.
17. Report MREs inside the Whittle pit shell and underground MREs outside of the Whittle pit shell.

For the Sprite and Victory deposits, Step 3 involved the interpretation of overburden and sediment boundaries on every cross-section through the deposit on 10 m (25 m for Victory) intervals. These boundaries were then used to develop 3D models of the overburden surfaces and sediment wireframes. Mafic dykes and quartz-tourmaline-pyrite veins (QTPV) were constructed using Vulcan's implicit modelling tools. The wireframe models were used as boundaries for constraining the MREs.

The MREs reported herein were prepared under the supervision of Mr. Roy Eccles P.Geo., in accordance with the Canadian Institute of Mining (CIM) Definition Standards and Guidelines (2014, 2019) and the disclosure rule National Instrument (NI) 43-101.

This report represents Marathon Golds current technical report and supersedes and replaces the previous Valentine Gold Project MREs effectively dated April 15, 2021.

### 14.1.2 Mineral Resource Classification Definitions

This sub-section states the CIM Definition Standards on Mineral Resources and Reserves (2014) that are used in this technical report.

A *measured mineral resource* is that part of a mineral resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of modifying factors to support detailed mine planning and final evaluation of the economic viability of the deposit.

A measured mineral resource has a higher level of confidence than that applying to either an indicated mineral resource or an inferred mineral resource. It may be converted to a proven mineral reserve or to a probable mineral reserve.

An *indicated mineral resource* is that part of a mineral resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with sufficient confidence to allow the application of modifying factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit.

An indicated mineral resource has a lower level of confidence than that applied to a measured mineral resource and may only be converted to a probable mineral reserve.

An *inferred mineral resource* is that part of a mineral resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity.

An inferred mineral resource has a lower level of confidence than that applying to an indicated mineral resource and must not be converted to a mineral reserve. It is reasonably expected that the majority of inferred mineral resources could be upgraded to indicated mineral resources with continued exploration.

### 14.1.3 Mineral Resource Reporting Format

The MREs for the five individual deposits are presented in the text that follows and in the following order, from southwest to northeast: Leprechaun (Section 14.2), Sprite (Section 14.3), Berry (Section 14.4), Marathon (Section 14.5), and Victory (Section 14.6).

Measured and indicated mineral resources, when combined, are referred to as “M+I” in Tables in this report.

## 14.2 Leprechaun Deposit Mineral Resource Estimate

Marathon Gold completed additional exploration, advanced grade control drilling, and a Televiewer study on the Leprechaun deposit since the previous MRE. This additional information was incorporated into an updated MRE using an improved geological interpretation. Additionally, there were updates to the technical and economic parameters used to determine the in-pit MRE.

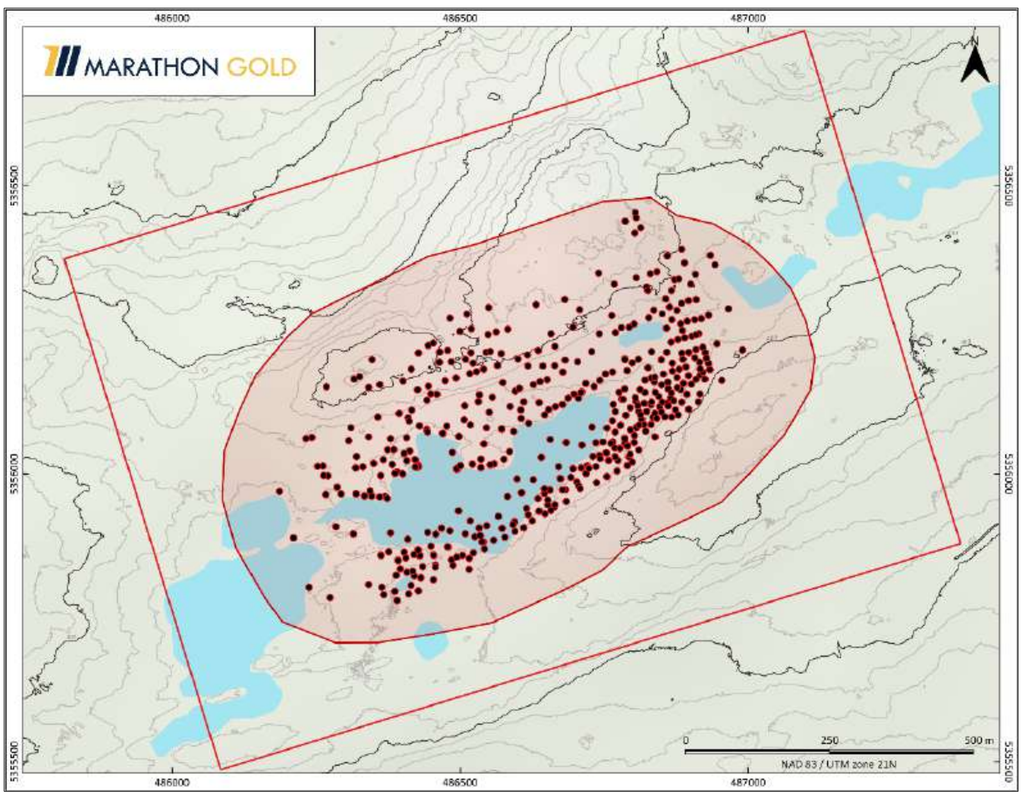
The Leprechaun MRE is contained in a series of flat-lying, gold-bearing quartz-tourmaline-pyrite veins (QTPV) with an azimuth of 150°, a plunge of -5°, and a dip of -20° (Maptek Vulcan rotations). The highest-grade (Main Zone) gold mineralization is in the flat-lying QTPV adjacent to a steeply dipping shear zone along the contact with the footwall sediment (SED) unit. This area of mineralization is bounded in the hanging wall by a series of mafic dykes. Northwest of the mafic dykes, the flat-lying, gold-bearing QTPV continue into the hanging wall. Gold mineralization is encountered in all major rock units (trondhjemite, mafic dykes, and lesser sediments) and although the majority of the MRE is contained in QTPV within these rock units, some mineralization occurs in areas with no significantly logged QTPV mineralization. Many of the areas note minor amounts of QTPV in the descriptive geological logs.

### 14.2.1 Leprechaun Deposit Data

#### 14.2.1.1 Drillholes

The MREs for the Leprechaun deposit reported herein are based on all drillholes whose assays were available as of April 14, 2022 and consist of 483 diamond core and RC drillholes totalling 99,976 m. Figure 14-2 shows the collars of these drillholes.

**Figure 14-2: Leprechaun Drillhole Locations & Topography**




Source: Marathon, 2022

#### 14.2.1.2 Assays

Of the 70,912 gold assays available as of April 14, 2022, all were used. For unsampled intervals, gold grade values were set to zero. All gold grades were determined from fire or metallic screened assays. Total assayed sample length is 96,749 m.

#### 14.2.1.3 Density

For this estimate, 165 density measurements were used for the Leprechaun deposit. The results of these measurements are shown in Table 14-1. Block densities were assigned based on the block domain or lithology type.

**Table 14.1: Leprechaun Density Measurements**

| Domain | No. Samples | Density t/m$^3$ |
|---|---|---|
| Mafic Dykes (MD) | 39 | 2.84 |
| Quartz-Tourmaline- Pyrite Veins (QTPV) | 50 | 2.68 |
| Sediments (SED) | 34 | 2.79 |
| Trondhjemite (TRJ) | 42 | 2.69 |
| Overburden (OVB) | - | 1.50 |

#### 14.2.1.4 Topography

The topography of the area around the Leprechaun deposit is shown on Figure 14-2. The Leprechaun deposit sits on a flat-topped ridge in a shallow, water-filled depression. Towards the north, the topography falls off steeply, while towards the south, the topography slopes gently downhill.

A Lidar topographic survey was completed in 2019. This survey is the topographic basis for all mineral resource related work described in this section.

#### 14.2.1.5 Leprechaun Resource Database Quality Control

BOYD, APEX, and Marathon validated the data pertaining to the MRE. Checks on the drillhole database included a search for unique, missing, and overlapping intervals, a total depth comparison, duplicate holes, property boundary limits, and a visual search for extreme or deviant survey values. A few minor discrepancies were identified and corrected.

### 14.2.2 Leprechaun Deposit Data Analysis

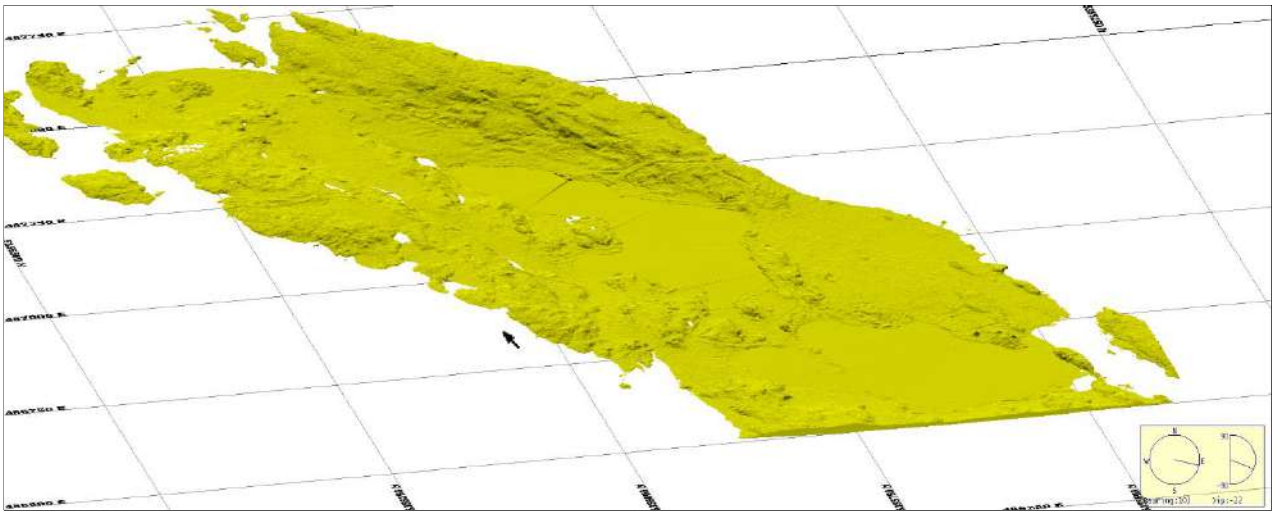
#### 14.2.2.1 Geological Modelling

The Leprechaun deposit contains four potentially mineralized domains: sediments (SED), trondhjemite (TRJ), flat-lying, quartz-tourmaline-pyrite veins (QTPV), and mafic dykes (MD) intruding into the TRJ and QTPV domains (Figures 14-3 to 14-7).

Geological modelling of these units, and an overburden domain, is based on the logged geology and interpretations made by Marathon Gold staff using the Leapfrog software. The QTPV wireframe used both logging and gold assays to support the interpretation. The models were exported to Vulcan and transferred to BOYD for review. BOYD and APEX concurred with Marathon Gold's interpretation as provided.

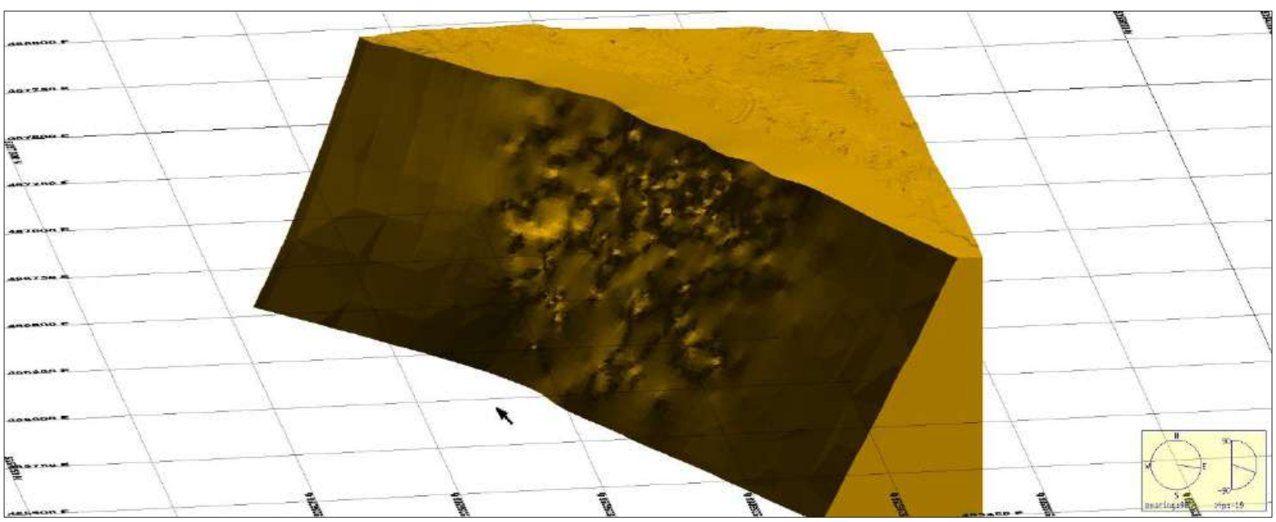
The SED, MD, TRJ, and QTPV wireframes can be mineralized and were used to flag drillholes used to construct the composites for later variography and statistics.

**Figure 14-3: Leprechaun Overburden Solid**



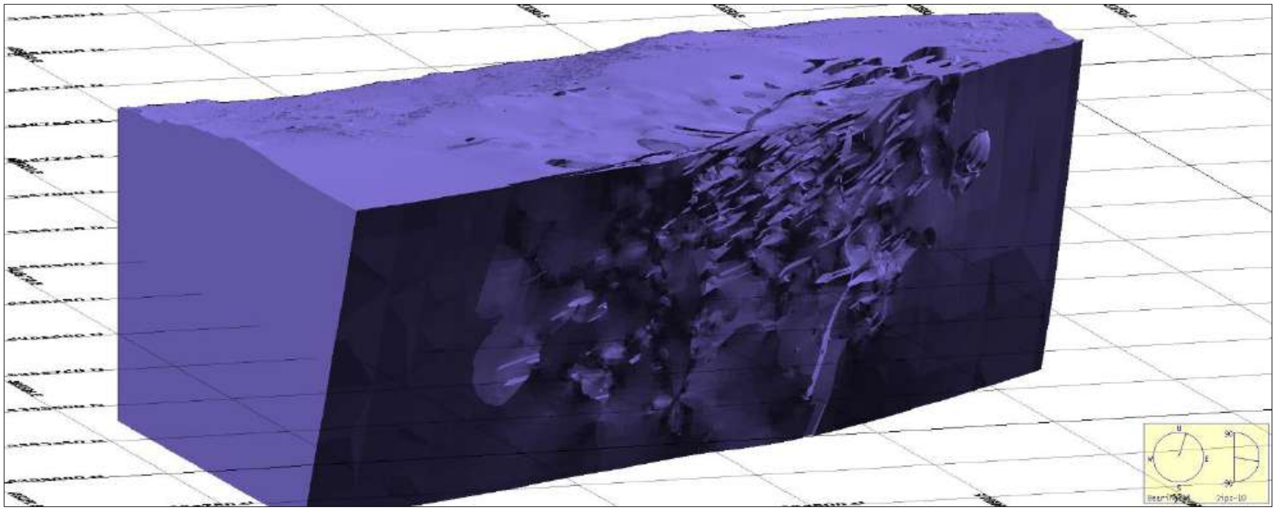
Source: BOYD, 2022

**Figure 14-4: Leprechaun SED Domain**



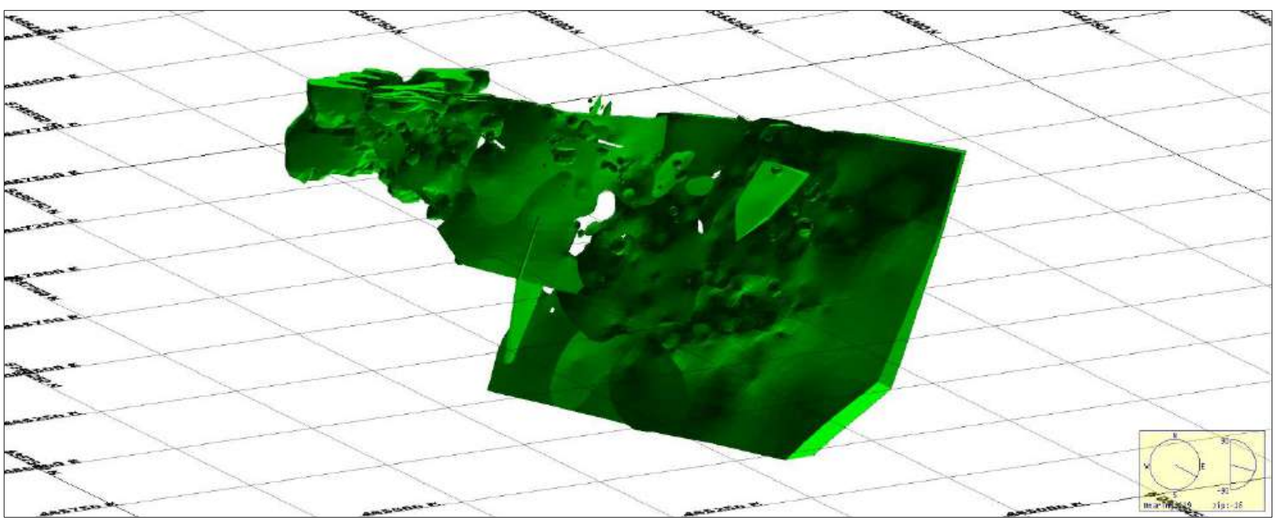
Source: BOYD, 2022

**Figure 14-5: Leprechaun TRJ Domain**



Source: BOYD, 2022

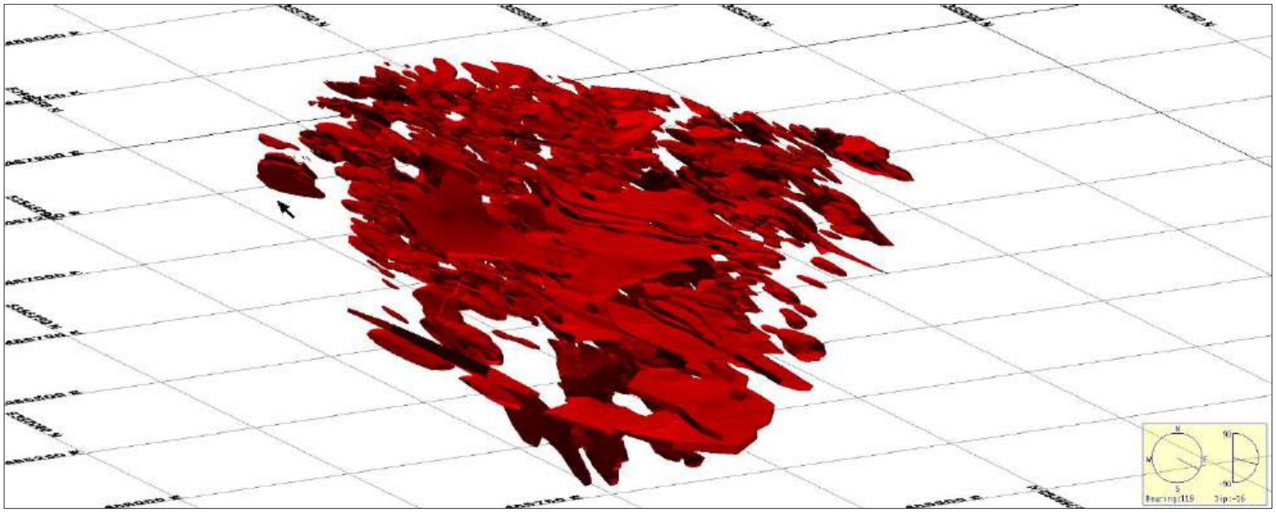
**Figure 14-6: Leprechaun MD Domain**



Source: BOYD, 2022

For the QTPV domain, two Leapfrog modelling tools were used, the vein system tool and the implicit intrusion tool with appropriate implicit controls. Thirty-one wireframes representing Set 1 QTP veins as described in Section 7 were modelled. The other vein sets, for example Set 2 and Set 3, were not modelled given that they are less volumetrically significant and too obscured by the numerous Set 1 veins. A vein mid-surface plane was generated for each domain wireframe to be used to flag individual block search orientations. This allowed the use of a local anisotropy model during grade estimation. The average orientation used an azimuth of 150° with a plunge of -5°. The resulting domain wireframe was then clipped by the sediments and mafic dykes. The QTPV wireframe is a more refined domain than the previously used 100 Au ppb implicit shell and provides a significantly improved constraint for mineralization. The QTPV wireframes are shown in Figure 14-7.

**Figure 14-7: Leprechaun QTPV Wireframes**



Source: BOYD, 2022

#### 14.2.2.2 Drillhole Descriptive Statistics

Descriptive statistics were generated for each individual domain, as well as the overall exploration database for gold. The results of this analysis are summarized in Table 14-2.

**Table 14.2: Leprechaun Raw Assay Descriptive Statistics**

| Item | Domain | | | | |
|---|---|---|---|---|---|
| | All | QTPV | Mafic Dykes (MD) | Sediment (SED) | Trondhjemite (TRJ) |
| Number of Samples | 29,269 | 13,539 | 1,044 | 245 | 14,199 |
| Minimum (g/t Au) | 0.10 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 375.78 | 375.78 | 18.97 | 4.76 | 98.60 |
| Average (g/t Au) | 1.37 | 2.58 | 0.28 | 0.27 | 0.300 |
| Standard Deviation (g/t Au) | 6.14 | 8.63 | 1.09 | 0.72 | 1.92 |
| Coefficient of Variance | 4.49 | 3.35 | 3.94 | 2.68 | 6.38 |

Note: Assays ≥ 0.01 g/t Au reported.

#### 14.2.2.3 Compositing

Sample length statistics were run on the assay database examining the number of samples for sample lengths in 0.5 m increments through a total length of 4.0 m. The purpose of this analysis is to determine what sample length was associated with the total number of samples.

The statistical analysis showed that most samples with elevated gold mineralization were collected at a length of 1.0 m or less. A total of 63% of all assays were collected at 1 meter or less containing 97% of the total contained metal. Based on this, a composite length of 1.0 m was selected and applied within the confines of the mineralized domains. Composites less than 1.0 m were divided by the run length (1.0 m). This composite length was selected to better reflect the actual breakdown of the mineralization in the individual drillholes within each mineralized zone.

#### 14.2.2.4 High Value Grade Limits and Capping

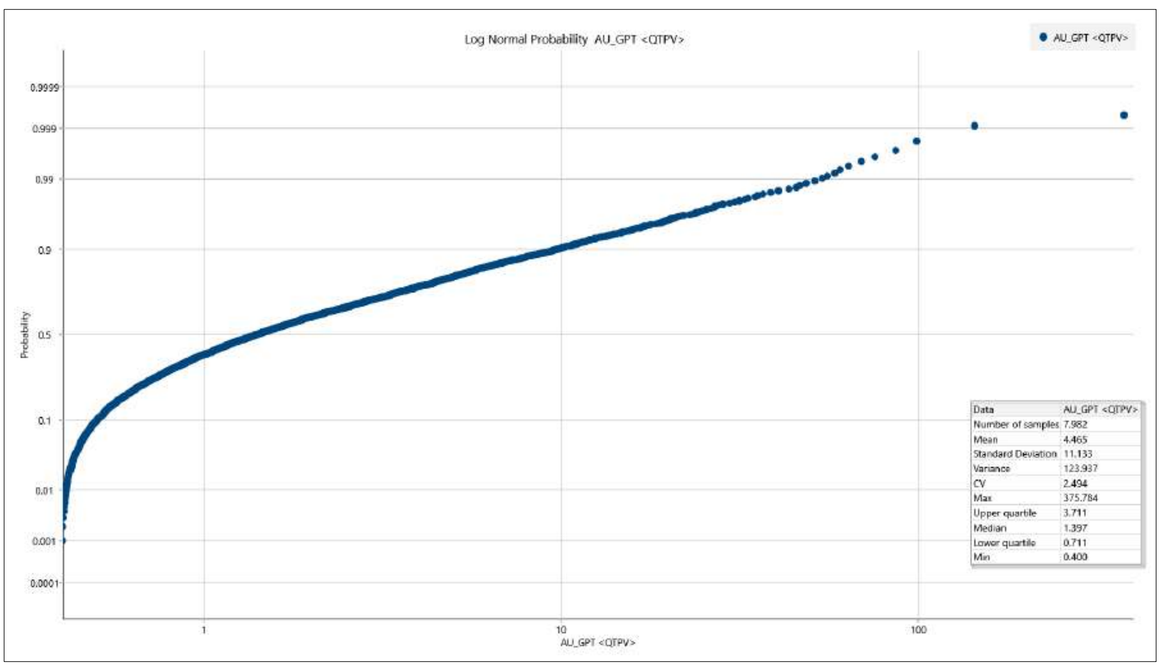
High outlier gold assays can skew the block grade estimate if they are not accounted for with some sort of limitation or grade capping applied to the assay database.

To determine high-value gold grade outliers, several methods were considered. These included a 1 troy ounce gold grade cap, the mean plus the standard deviation, four times the mean, five times the mean, lognormal, and decile analysis. These methods were reviewed, and the resulting potential grade caps/threshold were selected. For the Leprechaun deposit, the lognormal graph was considered to establish a capping value.

Extreme outlier gold capping levels were selected from the lognormal plot at the point where the data starts to break up or where there is a significant slope change in the plot. The lognormal probability plots for gold found in each mineralized domain are shown in Figures 14-8 through 14-11.

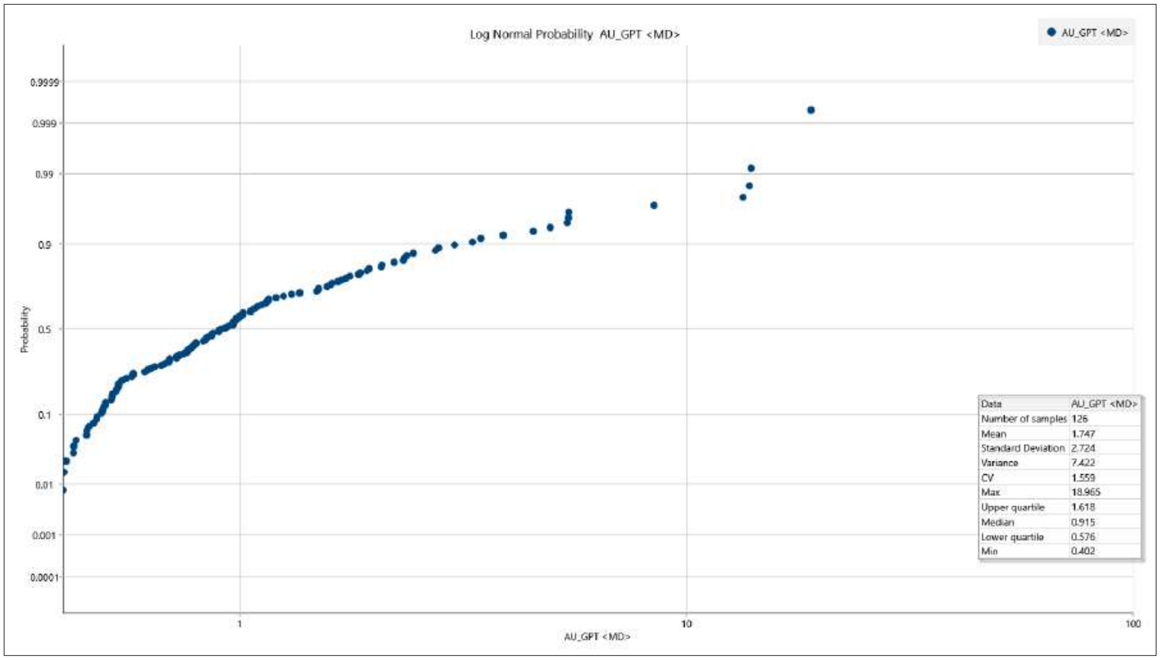
To further reduce the influence of high-grade composites, after the assays were capped, composite grades greater than a selected threshold level are restricted to smaller search distances. The threshold grade levels were chosen from lognormal probability graphs. The restricted search distances were selecting using indicator variograms. This process was completed for all potentially mineralized domains. Results are summarized in Table 14-3.

**Figure 14-8: Leprechaun QTPV Domain Lognormal Plot**



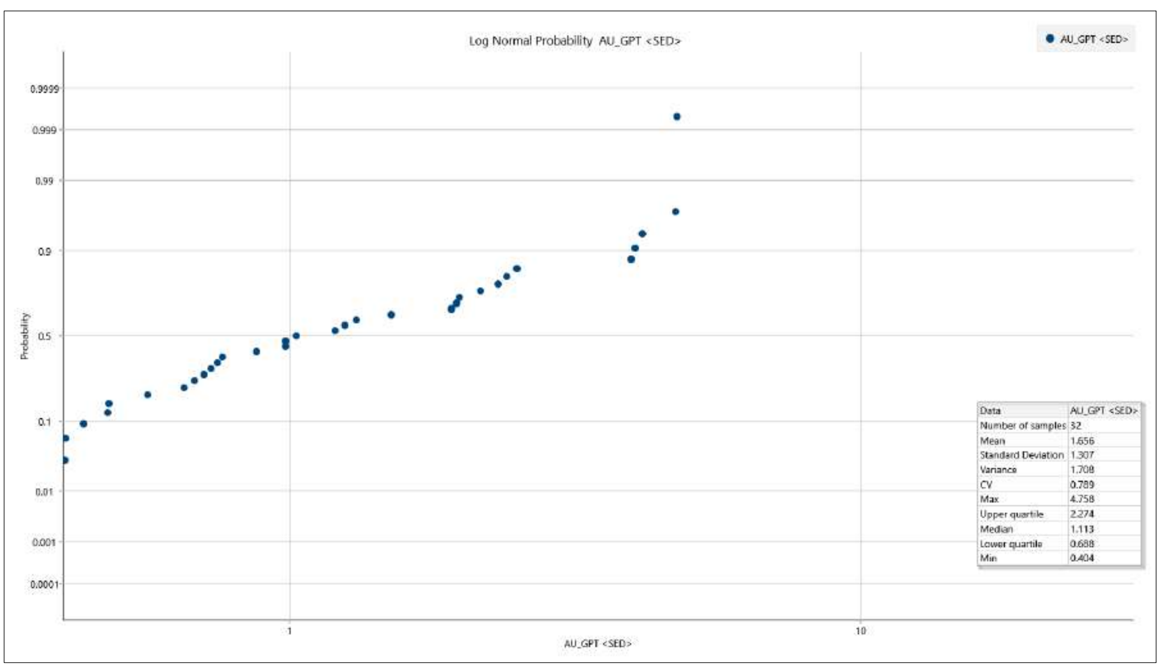

Source: BOYD, 2022

**Figure 14-9: Leprechaun MD Domain Lognormal Plot**



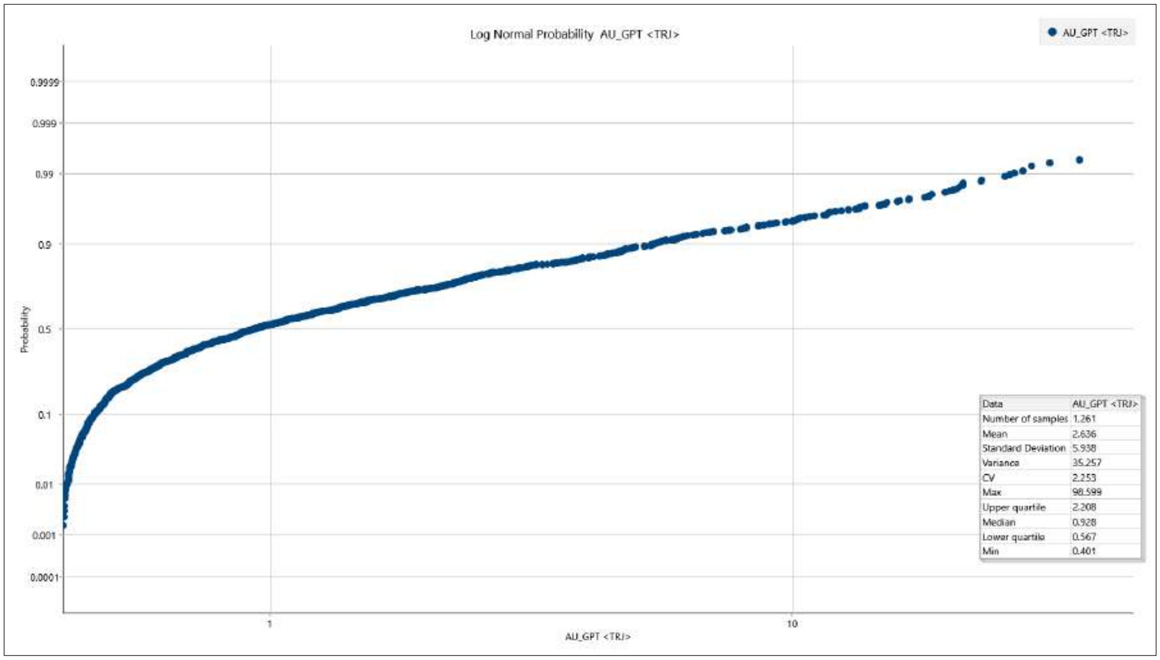

Source: BOYD, 2022

**Figure 14-10: Leprechaun SED Domain Lognormal Plot**




Source: BOYD, 2022

**Figure 14-11: Leprechaun TRJ Domain Lognormal Plot**




Source: BOYD, 2022

**Table 14.3: Leprechaun Gold Threshold Grades and Limited Search Criteria**

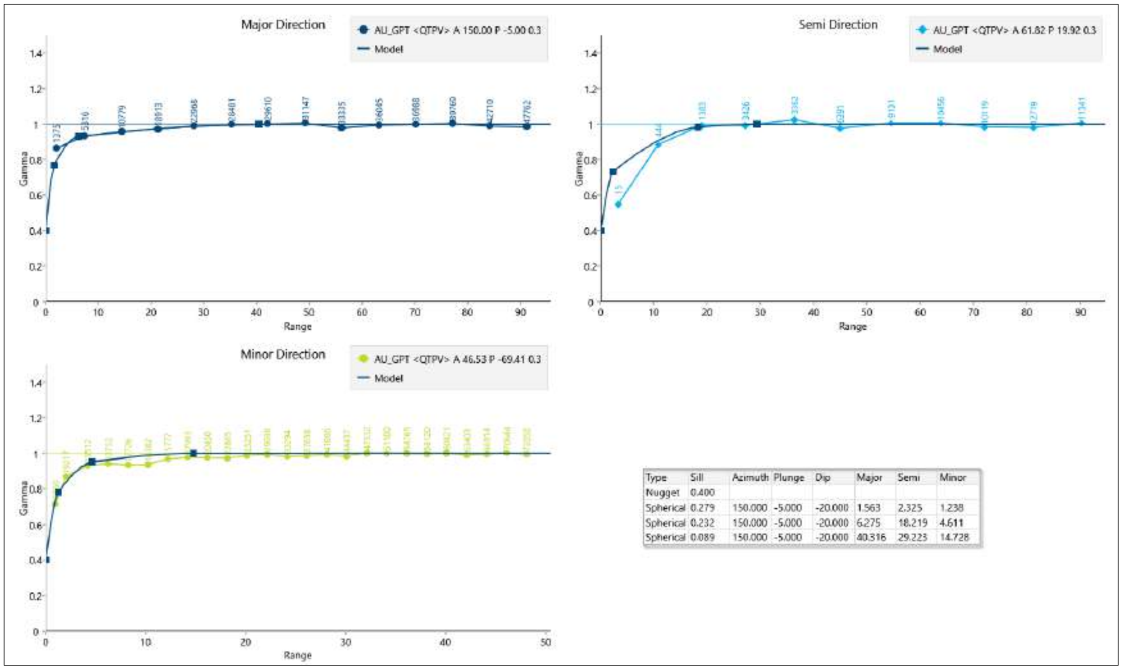
| Item | Mineralized Domain | | | |
|---|---|---|---|---|
| | QTPV | MD | SED | TRJ |
| Extreme Outlier Gold Cap (g/t) | 150.0 | 7.5 | 1.9 | 50.0 |
| Spatial Restriction Threshold Grade (g/t) | 55.0 | 5.4 | 1.9 | 22.0 |
| Azimuth (degrees) | 150.0 | 150.0 | 150.0 | 150.0 |
| Plunge (degrees) | -5.0 | -5.0 | -5.0 | -5.0 |
| Dip (degrees) | -20.0 | -20.0 | -20.0 | -20.0 |
| Major Axis (m) | 11.17 | 10.60 | --- | 20.55 |
| Semi-Major Axis (m) | 11.75 | 25.82 | --- | 11.81 |
| Minor Axis (m) | 4.16 | 5.90 | --- | 5.00 |

### 14.2.3 Variography and Search Ellipsoids

The search ellipsoids for grade estimation were chosen based on variograms of each domain. Variograms were generated for each domain in the same structural orientations used to develop the mineralized domain wireframes. Gold grade variograms for each domain are shown in Figures 14-12 through 14-15.

Based on these analyses, the search ellipsoid for each mineralized domain was established. Selected search ellipse distances and directions are listed in Section 14.2.7.

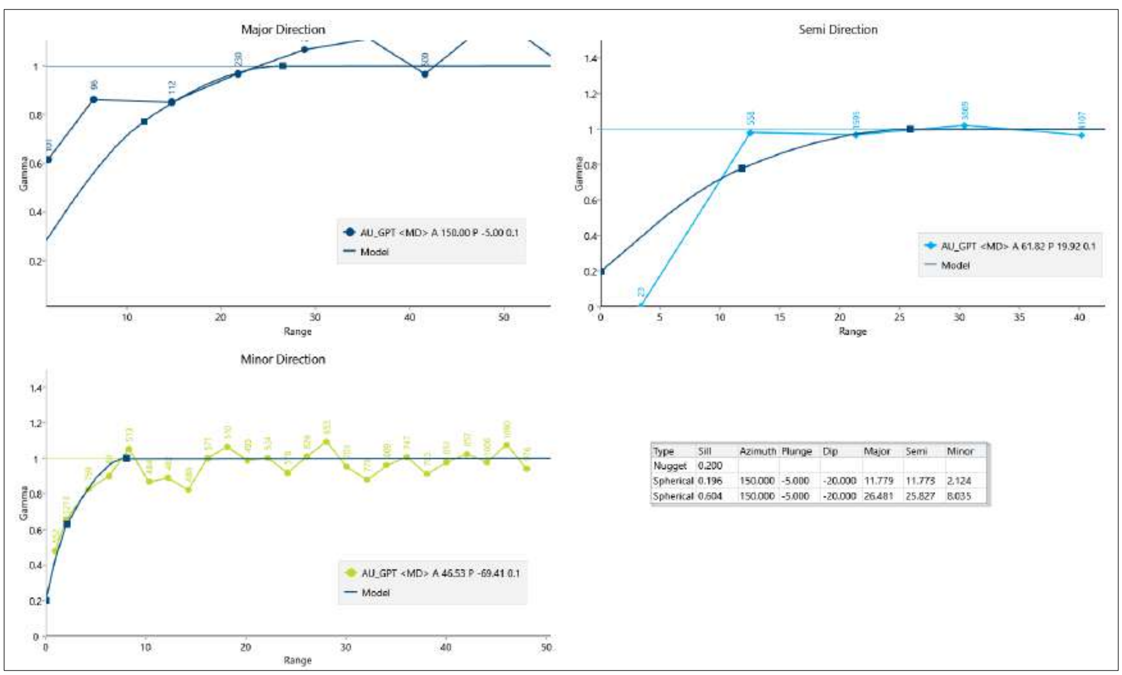
**Figure 14-12: Leprechaun QTPV Variograms**




| Type | Sill | Azimuth | Plunge | Dip | Major | Semi | Minor |
|---|---|---|---|---|---|---|---|
| Nugget | 0.400 | | | | | | |
| Spherical | 0.279 | 150.000 | -5.000 | -20.000 | 1.563 | 2.325 | 1.238 |
| Spherical | 0.232 | 150.000 | -5.000 | -20.000 | 6.275 | 18.219 | 4.611 |
| Spherical | 0.089 | 150.000 | -5.000 | -20.000 | 40.316 | 29.223 | 14.728 |

Source: BOYD, 2022

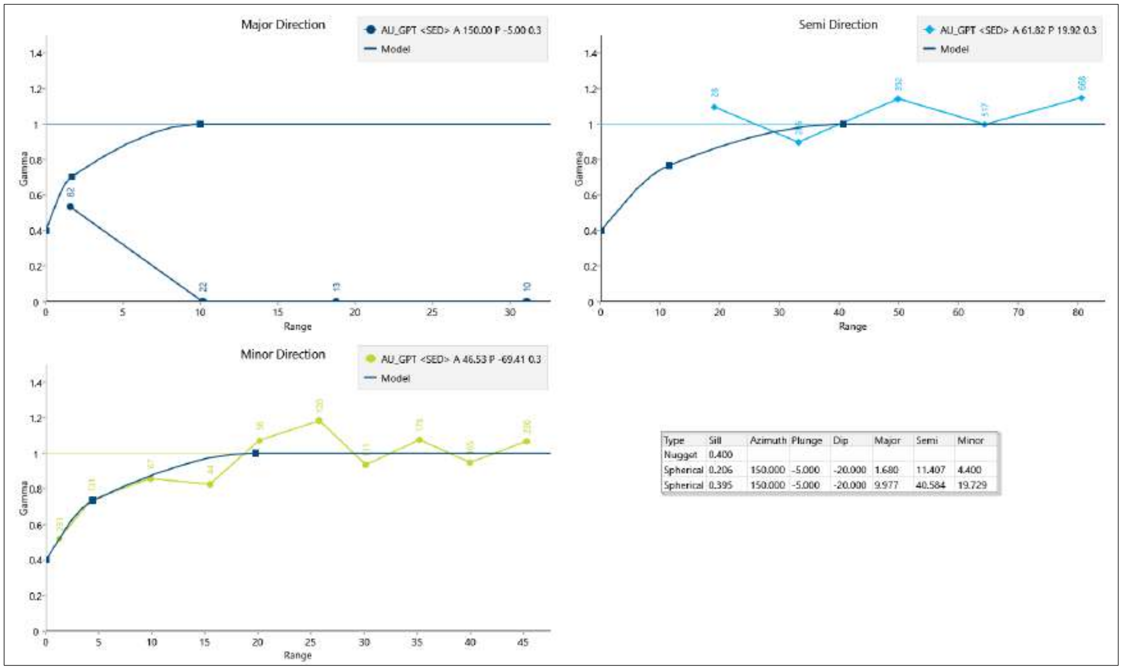
**Figure 14-13: Leprechaun MD Variograms**




| Type | Sill | Azimuth | Plunge | Dip | Major | Semi | Minor |
|---|---|---|---|---|---|---|---|
| Nugget | 0.200 | | | | | | |
| Spherical | 0.196 | 150.000 | -5.000 | -20.000 | 11.779 | 11.773 | 2.124 |
| Spherical | 0.604 | 150.000 | -5.000 | -20.000 | 26.481 | 25.827 | 8.035 |

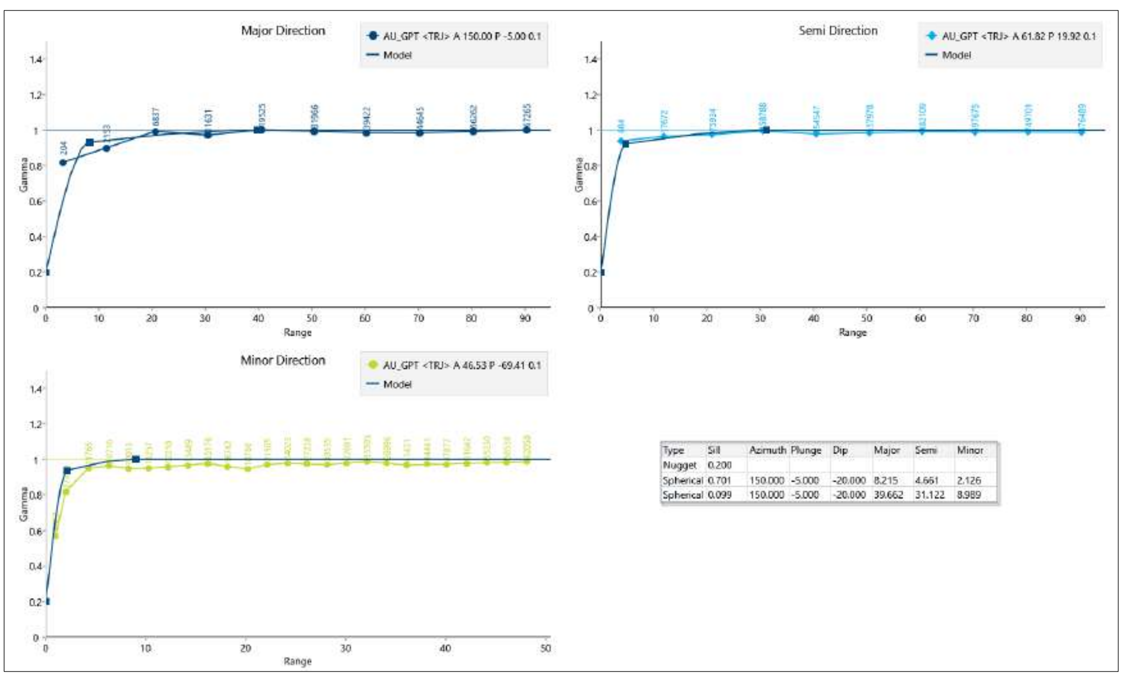
Source: BOYD, 2022

**Figure 14-14: Leprechaun SED Variograms**




Source: BOYD, 2022

**Figure 14-15: Leprechaun TRJ Variograms**




Source: BOYD, 2022

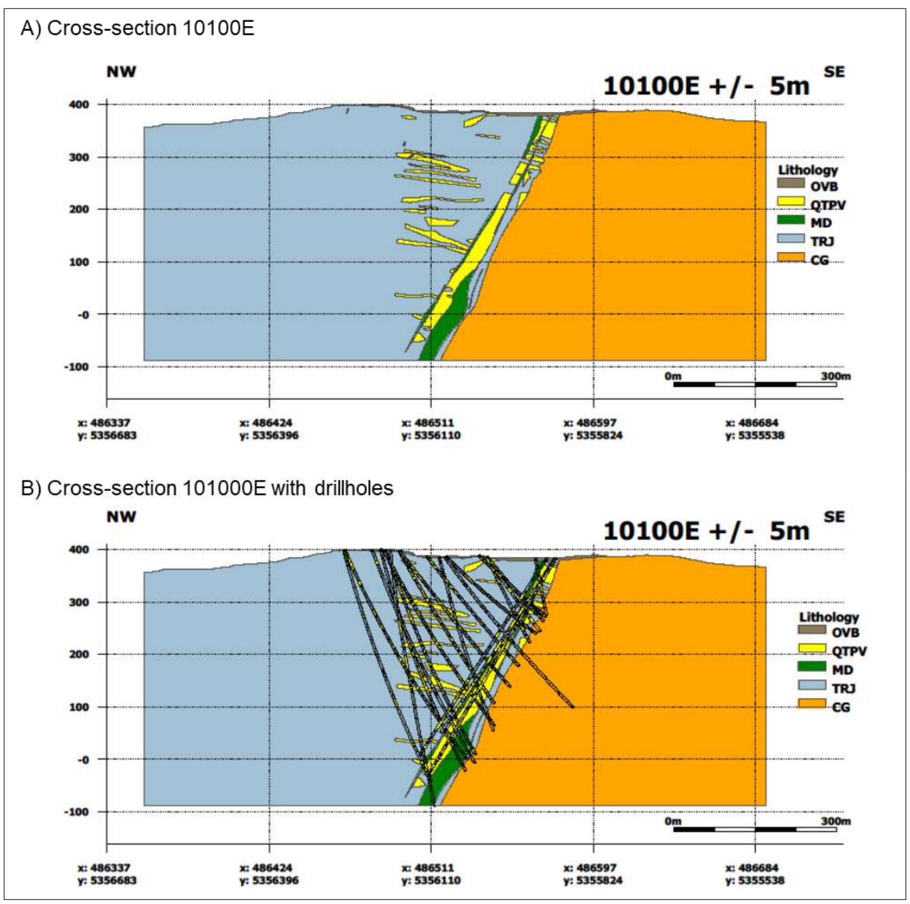
### 14.2.4 Leprechaun Deposit Block Model

Table 14-4 shows the Leprechaun block model extents. Figure 14-16 shows a typical block model section of the mineralized domain.

**Table 14.4: Block Model Extents**

| Item | X | Y | Z |
|---|---|---|---|
| Origin (m) | 486,084.374 | 5,355,484.861 | -100.000 |
| Offset Minimum | - | - | - |
| Offset Maximum (m) | 1,344 | 930 | 552 |
| Parent Block size (m) | 6.0 | 6.0 | 6.0 |
| Child Block size (m) | 2.0 | 2.0 | 2.0 |
| Bearing/Dip/Plunge (deg) | 73.0 | - | - |

**Figure 14-16: Leprechaun Typical Mineralized Domain Block Model Cross-Section**




Notes: OVB (Overburden), QTPV (Quartz-Tourmaline-Pyrite Veins), MD (Mafic Dyke), TRJ (Trondhjemite), CG (Conglomerate). Source: BOYD, 2022

Four different block models were created for the MREs. The purpose of these different block models was to consider the impact of gold grade capping on the total contained metal content in the block models. The four block models included:

- No Cap Model – This block model assumed that no gold grade capping was applied.
- Hard Cap Model – This block model used a fixed hard cap to minimize the impact of high-grade outliers.
- Threshold Cap Model – This block model used a gold grade cap in each domain above which a limited area of influence was applied.
- Hybrid Cap Model – This block model used both a threshold gold cap and an extreme outlier hard gold cap to limit the impact of higher gold grades. This model was used as the basis for the Leprechaun MRE.

The four block models were used to examine the impact of gold grade capping on the final MREs.

The hard-capped block model contained 96% compared to the no capping block model contained gold ounces. The threshold capped block model contained 93% of the no capping block model contained ounces. The hybrid capped model contained 93% of the no capping block model contained ounces. It is the opinion of APEX that the hybrid capped model represents the best estimate of the in-situ mineralization at Leprechaun, and this was selected for the MRE.

### 14.2.5 Leprechaun Block Estimations

The Vulcan-constructed block model was constrained by the mineralized domains described above. The current topographic surface was used to flag the topographic variable (vtopo). This variable is set to 100% for a block completely below the surface and to 0% for a block completely above the surface. Blocks at the topographic surface were assigned a proportion that lies below topography. A topo-adjusted density (rdensity) was assigned using the following formula:

$$rdensity = density * \left(\frac{vtopo}{100}\right)$$

This procedure ensures that blocks along the topographic surface have the correct density applied during pit optimization functions.

No attempt was made to apply a block percentage (percent of the block that is mineralized material and waste). Blocks are in or out of the mineralized domain. Grade interpolation runs were set up for only that material within the mineralized domain for gold. All domains were run for gold except for the overburden domain, which is assumed to not be mineralized.

Using the composited assays, block grade interpolations were run in each mineralized domain for gold. Runs were completed using inverse distance (ID), inverse distance squared ($ID^2$), inverse distance cubed ($ID^3$), inverse distance to the fifth ($ID^5$), ordinary kriging (OK), and nearest neighbour (NN). Three passes were run to allow for use in resource classification. Only composites and blocks flagged as within the same mineralized domain were considered in the grade estimation. Grade estimation parameters are shown in Tables 14-6 through 14-9.

### 14.2.6 Leprechaun Deposit Model Validation

The gold grade populated block model was reviewed to ensure reasonableness. These checks included:

- an overall review of the estimated metal values

- the impact of gold grade capping on the MRE
- QQ plots of the block model versus the composites
- a section-by-section comparison between the estimated $ID^3$ block grades and assays
- a statistical comparison of the raw assay values versus the composite values versus the block values.

The estimated block grades were visually examined to confirm that the estimation parameters were honoured and kept within the individual mineralized domains. Cross-sections were reviewed and the drillholes were checked to determine that the grades reasonably matched the estimated block grades. A statistical comparison of the raw assays, composites, and estimated block grades is shown in Table 14-5.

**Table 14.5: Leprechaun Mineral Resource Estimation Model Statistics**

| Item | Domains | | | | |
|---|---|---|---|---|---|
| | All | QTPV | Mafic Dykes | Sediment | Trondhjemite |
| 1-Meter Composite Data | | | | | |
| Number of Samples | 35,853 | 14,312 | 1,529 | 380 | 19,386 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 212.71 | 212.71 | 13.89 | 4.74 | 98.60 |
| Average (g/t Au) | 1.10 | 2.39 | 0.21 | 0.196 | 0.22 |
| Standard Deviation | 4.92 | 7.42 | 0.83 | 0.566 | 1.33 |
| Coefficient of Variance | 4.49 | 3.11 | 4.01 | 2.89 | 6.10 |
| Block Model Results | | | | | |
| Number of Blocks | 1,452,201 | 1,103,866 | 30,021 | 10,479 | 307,835 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 131.57 | 131.57 | 7.50 | 1.90 | 38.71 |
| Average (g/t Au) | 1.25 | 1.62 | 0.10 | 0.08 | 0.11 |
| Standard Deviation | 2.87 | 3.20 | 0.24 | 0.18 | 0.43 |
| Coefficient of Variance | 2.29 | 1.98 | 2.526 | 2.24 | 3.95 |

### 14.2.7 Leprechaun Mineral Resource Classification Methodology

The mineral resource classification used for the Leprechaun deposit is based on which pass generated the block grade estimate and the distance to the nearest neighbour sample (measured and indicated only). The mineral resource classifications assigned include:

- Measured Mineral Resource – Blocks estimated in Pass 1 (minimum of five composites) with a maximum nearest neighbour distance of 12 m are classified as measured. Only QTPV blocks could be flagged as measured.
- Indicated Mineral Resource – Blocks estimated in Pass 2 (minimum of three composites) with a maximum nearest neighbour distance of 40 m are classified as indicated. Only QTPV blocks could be flagged as indicated using a nearest neighbour distance of 40 m. Blocks in the TRJ domain with the same criteria as in the QTPV domain with a nearest distance of 15 m or less can be considered as indicated.
- Inferred Mineral Resource – Blocks estimated in Pass 3 or Pass 4 (minimum of two composites) are classified as inferred.

**Table 14.6: Leprechaun QTPV Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 150 | 150 | 150 | 150 |
| Plunge (Plunge of the Azimuth in Degrees) | -5 | -5 | -5 | -5 |
| Dip (Degrees) | -20 | -20 | -20 | -20 |
| Major (m) | 41.0 | 41.0 | 41.0 | 102.5 |
| Semi-Major (m) | 30.0 | 30.0 | 30.0 | 75.0 |
| Minor (m) | 15.0 | 15.0 | 15.0 | 15.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | Measured | Indicated | Inferred | Inferred |

**Table 14.7: Leprechaun MD Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 150.0 | 135.0 | 135.0 | 135.0 |
| Plunge (Plunge of the Azimuth in Degrees) | -5.0 | -10.0 | -10.0 | -10.0 |
| Dip (Degrees) | -20.0 | -20.0 | -20.0 | -20.0 |
| Major (m) | 27.0 | 27.0 | 27.0 | 67.5 |
| Semi-Major (m) | 26.0 | 26.0 | 26.0 | 65.0 |
| Minor (m) | 9.0 | 9.0 | 9.0 | 9.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | --- | --- | Inferred | Inferred |

**Table 14.8: Leprechaun SED Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 150.0 | 135.0 | 135.0 | 135.0 |
| Plunge (Plunge of the Azimuth in Degrees) | -5.0 | -10.0 | -10.0 | -10.0 |
| Dip (Degrees) | -20.0 | -20.0 | -20.0 | -20.0 |
| Major (m) | 10.0 | 10.0 | 10.0 | 25.0 |
| Semi-Major (m) | 41.0 | 41.0 | 41.0 | 102.5 |
| Minor (m) | 20.0 | 20.0 | 20.0 | 20.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | --- | --- | Inferred | Inferred |

**Table 14.9: Leprechaun TRJ Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 150.0 | 135.0 | 135.0 | 135.0 |
| Plunge (Plunge of the Azimuth in Degrees) | -5.0 | -10.0 | -10.0 | -10.0 |
| Dip (degrees) | -20.0 | -20.0 | -20.0 | -20.0 |
| Major (m) | 40.0 | 40.0 | 40.0 | 100.0 |
| Semi-Major (m) | 32.0 | 32.0 | 32.0 | 80.0 |
| Minor (m) | 9.0 | 9.0 | 9.0 | 9.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 15 | --- | --- |
| Resource Classification | --- | Indicated | Inferred | Inferred |

### 14.2.8 Leprechaun Mineral Resource Reporting and Evaluation of Reasonable Prospects of Economic Extraction

The Leprechaun mineral resources may be amenable to a combination of open pit and underground mining methods. BOYD developed a conceptual pit shell (the economic open pit shell) using the Lerchs-Grossman method as provided by the GEOVIA Whittle software. Portions of the block model within the pit shell demonstrate "reasonable prospects for eventual economic extraction" by open pit mining. From this shell, a conceptual open pit mine was designed and used to constrain the mineral resources. Portions of the block model which are external to the conceptual pit shell but satisfy cut-off grade criteria for an appropriate underground extraction method, are considered to show "reasonable prospects for eventual economic extraction" by underground mining methods.

#### 14.2.8.1 Economic Assumption Parameters Used for Pit Optimization and Underground Cut-off

The operating assumptions for the preliminary Whittle open pit optimization used to report potentially open pit mineral resources are shown in Table 14-10. The operating assumptions used for the calculation of an underground cut-off grade is shown in Table 14-11.

For mineral resource reporting, a cut-off grade of 0.30 g/t gold was used for open pit, and a cut-off grade of 1.36 g/t gold was used for underground. The assumed overall pit slope in Whittle was assumed to be 48°. The slope does not include an allowance for ramps. Using these assumptions, a Whittle economic pit optimization was completed, and a potentially economic open pit shell was generated (Figure 14-17).

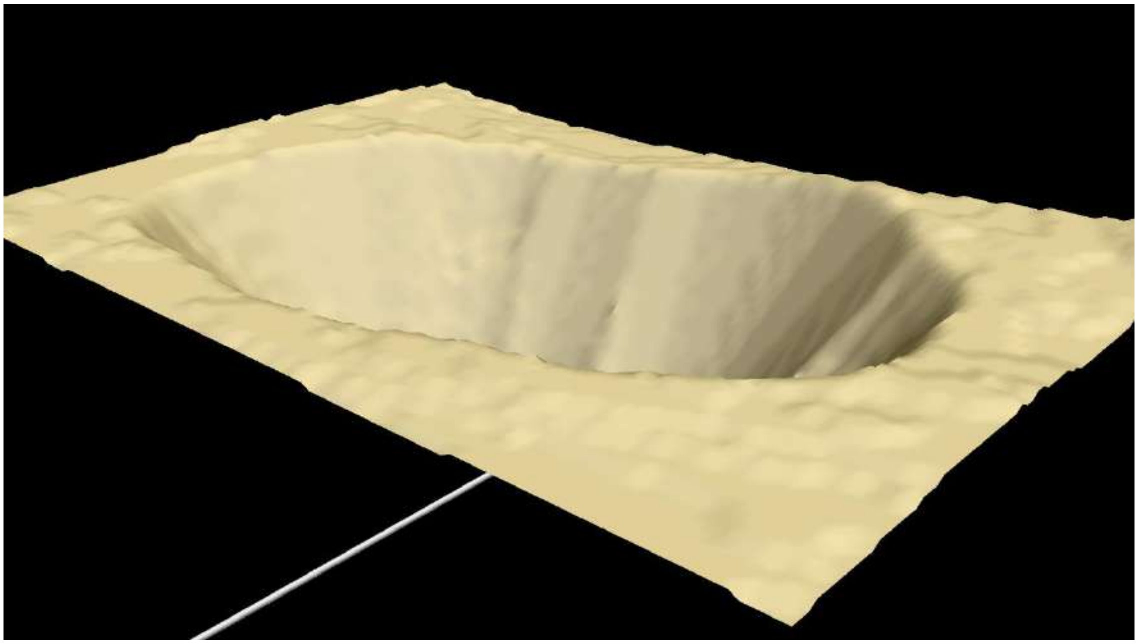
**Table 14.10: Leprechaun Open Pit Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Waste Mining Cost | 2.70 | C$/t waste |
| Mill Feed Mining Cost | 3.80 | C$/t mill feed |
| Mill Processing Cost | 15.20 | C$/t mill feed |
| G&A Cost | 5.30 | C$/t mill feed |
| Mill Gold Recovery (at cut-off) | 93.9 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,800 | US$/troy oz |
| Mill Cut-off | 0.30 | g/t Au |

**Table 14.11: Leprechaun Underground Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Mill Feed Mining Cost | 75.00 | C$/t mill feed |
| Processing Cost | 15.20 | C$/t mill feed |
| G&A Cost | 5.30 | C$/t mill feed |
| Recovery (at cut-off) | 94.8 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,800 | US$/troy oz |
| Calculated Cut-off | 1.36 | g/t Au |

**Figure 14-17: Leprechaun Whittle Open Pit Shell**



Source: BOYD, 2022

#### 14.2.8.2 Opinion on Reasonable Prospects

The QP considers the Whittle pit parameters appropriate to evaluate the reasonable prospects for eventual economic extraction of the Leprechaun deposit for the purpose of providing an MRE. The resources presented herein are not mineral reserves, and they do not have demonstrated economic viability. There has been an insufficient level of exploration to define the indicated and inferred resources as a measured mineral resource, and it is uncertain if further exploration will result in upgrading them to a measured resource category. There is no guarantee that any part of the resources identified herein will be converted to a mineral reserve in future.

### 14.2.9 Leprechaun Mineral Resource Statement

The Leprechaun deposit's measured, indicated, and inferred MREs were reported in accordance with CIM Definition Standards and Best Practice Guidelines for Mineral Resources and Reserves (CIM, 2014, 2019) and the disclosure rule NI 43-101. The effective date for the Leprechaun Deposit MRE (Table 14-12) is June 15, 2022.

The mineral resources presented here were estimated using a block model with a block size of 6 m by 6 m by 6 m sub-blocked to a minimum block size of 2 m by 2 m by 2 m using $ID^3$ methods for grade estimation.

All MREs are reported using an open pit gold cut-off of 0.30 g/t Au and an underground gold cut-off of 1.36 g/t Au. Material between a 0.30 Au g/t value and 0.70 Au g/t is assumed to be low grade material. Material above a 0.70 Au g/t is assumed to be high grade material. Samples with high gold grades were given a limited area of influence which was applied during grade estimation.

The MREs do not include a detailed pit or underground design. Only an economic pit shell was used to determine the in-pit mineral resources. The underground mineral resources are that material outside of the in-pit mineral resources above the stated underground cut-off grade.

The 2022 Marathon Gold's Leprechaun deposit MREs are classified as measured, indicated, and inferred resources according to CIM Definition Standards (CIM, 2014). The classification of the Leprechaun deposit resources was based on geological confidence, data quality and grade continuity. All reported open pit MREs occur within a pit shell optimized using a gold price of US$1,800 per troy ounce.

The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 14.12: Leprechaun Mineral Resource Statement**

| Mining Method | Classification | Cut-off (g/t) | Tonnes | Au (g/t) | Au (ounces) |
|---|---|---|---|---|---|
| Open Pit – High Grade | Measured | 0.70 | 4,981,000 | 3.53 | 565,300 |
| Open Pit – High Grade | Indicated | 0.70 | 4,933,000 | 2.55 | 404,300 |
| Open Pit – High Grade | M+I | 0.70 | 9,914,000 | 3.04 | 969,600 |
| Open Pit – High Grade | Inferred | 0.70 | 2,026,000 | 2.14 | 139,300 |
| Open Pit – Low Grade | Measured | 0.30 | 2,334,000 | 0.48 | 36,100 |
| Open Pit – Low Grade | Indicated | 0.30 | 3,090,000 | 0.47 | 46,700 |
| Open Pit – Low Grade | M+I | 0.30 | 5,424,000 | 0.47 | 82,800 |
| Open Pit – Low Grade | Inferred | 0.30 | 2,105,000 | 0.45 | 30,200 |
| Total Open Pit | Measured | 0.30 | 7,315,000 | 2.56 | 601,400 |
| Total Open Pit | Indicated | 0.30 | 8,023,000 | 1.75 | 451,000 |
| Total Open Pit | M+I | 0.30 | 15,338,000 | 2.13 | 1,052,400 |
| Total Open Pit | Inferred | 0.30 | 4,131,000 | 1.28 | 169,500 |
| Underground | Measured | 1.36 | 57,000 | 3.38 | 6,200 |
| Underground | Indicated | 1.36 | 194,000 | 3.18 | 19,800 |
| Underground | M+I | 1.36 | 251,000 | 3.22 | 26,000 |
| Underground | Inferred | 1.36 | 725,000 | 3.28 | 76,500 |
| Open Pit + Underground | Measured | | 7,372,000 | 2.56 | 607,600 |
| Open Pit + Underground | Indicated | | 8,217,000 | 1.78 | 470,800 |
| Open Pit + Underground | M+I | | 15,589,000 | 2.15 | 1,078,400 |
| Open Pit + Underground | Inferred | | 4,856,000 | 1.58 | 246,000 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Leprechaun deposit MREs is June 15, 2022. The independent Qualified Person, as defined under section 1.5 of 43-101 CPis Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves. **4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** A minimum mining width of three meters was used. **6.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 Standards for Mineral Resources and Mineral Reserves (MRMR). **7.** The Mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available. **8.** Numbers may not add or multiply correctly due to rounding.

## 14.3 Sprite Deposit Mineral Resource Estimate

No additional exploration data were available to update the Sprite deposit geological model and MRE. The Sprite MREs remain the same as reported in the April 15, 2021 Technical Report. The Sprite MRE has an effective date of November 20, 2020. A description of the previous Sprite MREs from the BOYD Technical Report (Farmer, 2020) is duplicated below.

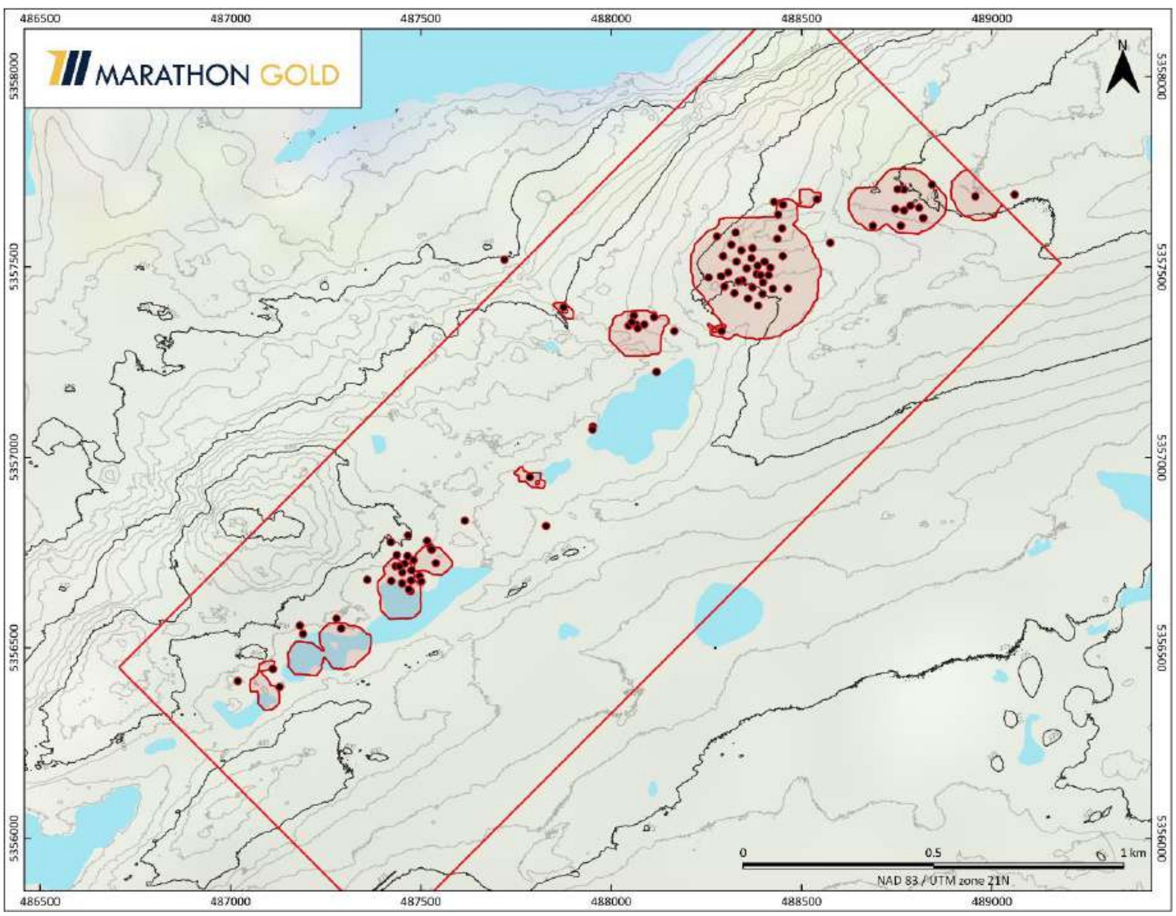
The Sprite deposit MRE is contained in a series of flat-lying, gold-bearing QTPV with an azimuth of 135°, a plunge of -10°, and a dip of -20° (Vulcan rotations). Gold mineralization is associated at the intersection of the QTPV zones with a steeply dipping VLSZ. Potentially economic gold mineralization is encountered in the QTPV and TRJ domains.

### 14.3.1 Sprite Deposit Data

#### 14.3.1.1 Drillholes

Geologic modelling of the Sprite deposit is based on all drillholes whose assays were available by March 12, 2015 and consists of 97 diamond core drillholes totalling approximately 13,134 m. Figure 14-18 shows the collars of these drillholes.

**Figure 14-18: Sprite Deposit Drillhole Locations & Topography**




Source: Marathon, 2022.

#### 14.3.1.2 Assays

Of the 6,635 gold assays available, all were used for the MRE. For unsampled intervals, grades were set to zero. All assays used were fire or metallic sieved assays. Total assayed sample length is 9,463 m.

#### 14.3.1.3 Density

There have been 552 density measurements completed for the Sprite deposit. The results of these measurements are shown in Table 14-13. Block densities were assigned based on the block's domain or lithology type.

**Table 14.13: Sprite Density Measurements**

| Domain | No. Samples | Density $t/m^3$ |
|---|---|---|
| Mafic Dykes (MD) | 77 | 2.73 |
| Quartz-Tourmaline- Pyrite Veins (QTPV) | 120 | 2.64 |
| Sediments (SED) | 17 | 2.73 |
| Trondhjemite (TRJ) | 338 | 2.63 |
| Overburden (OB) | --- | 1.50 |

#### 14.3.1.4 Topography

The topography of the area around the Sprite deposit is shown on Figure 14-18. The Sprite deposit sits on a flat-topped ridge extending northeast from the Leprechaun area. Towards the north, the topography falls off steeply, while towards the south, the topography slopes gently downhill.

#### 14.3.1.5 Sprite Resource Database Quality Control

BOYD, APEX, and Marathon validated the data pertaining to the MRE. Checks on the drillhole database included a search for unique, missing, and overlapping intervals, a total depth comparison, duplicate holes, property boundary limits, and a visual search for extreme or deviant survey values. A few minor discrepancies were identified and corrected.

### 14.3.2 Sprite Deposit Data Analysis

#### 14.3.2.1 Geological Modelling

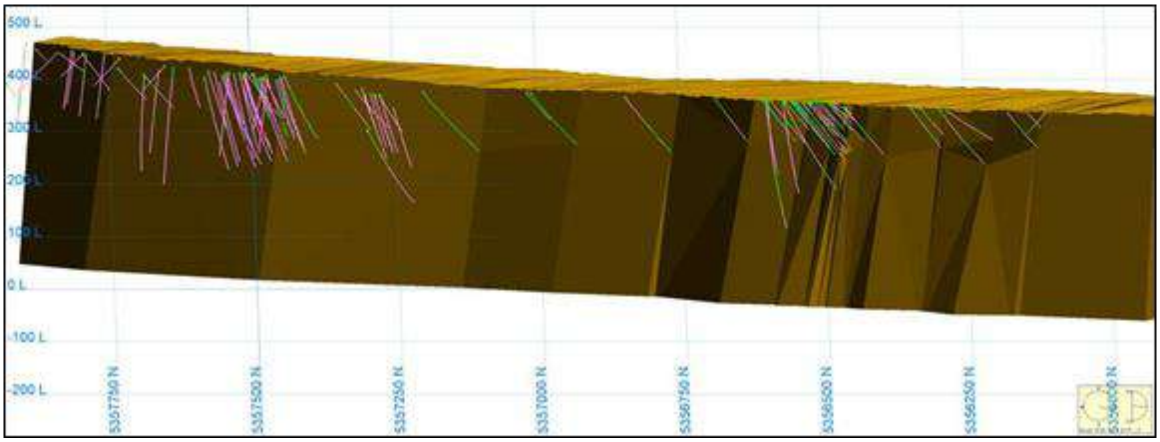
The Sprite deposit contains four potentially mineralized domains:  SED, hanging-wall TRJ, flat-lying QTPV, and the MD domain. Additionally, surface overburden was also noted in the drill logs, but was not considered as a potentially mineralized host.

Geological modelling of these units is based on the logged geology as well as interpretations made by Marathon Gold staff. On every 10 m cross-section through the deposit, a line was drawn reflecting the actual or projected overburden surface below the topography. These lines were then used to construct the rock/overburden surface to constrain compositing, geological implicit models, as well as block modelling.

The SED/TRJ contact was determined by drillhole intercepts or projections between intercepts and a surface constructed to represent this geologic contact. This was completed on every 10 m section through the deposit where data were available. This contact was then used to construct a wireframe model of the SED domain below the overburden horizon. The SED unit is shown in Figure 14-19.

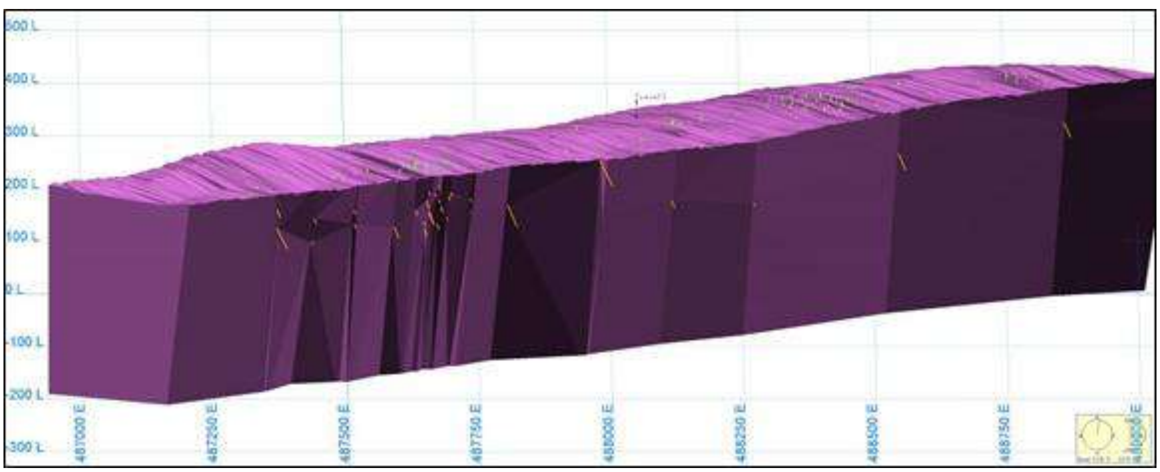
The TRJ domain is the remaining rock mass northwest of the sediment wireframe and below the overburden horizon. The TRJ domain is shown in Figure 14-20.

**Figure 14-19: Sprite Deposit SED Domain**




Source: BOYD, 2018

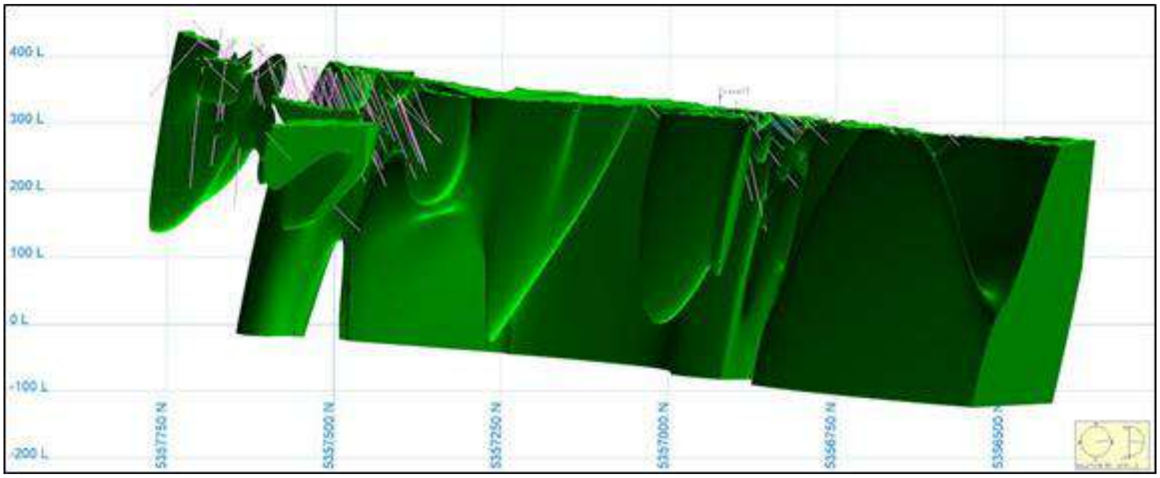
**Figure 14-20: Sprite Deposit TRJ Domain**




Source: BOYD, 2018

For the MD domain, implicit modelling was used to develop a geological solid based on the drillhole intercepts. The implicit model used an azimuth of 235°, plunge of 0°, and a dip of -75° (Vulcan rotations). Based on discussions with Marathon Gold staff, the mafic dykes have been truncated by the sediments and cut the QTPV zones; as such, mafic dyke solid is clipped by the sediments. The MD domain is shown in Figure 14-21.

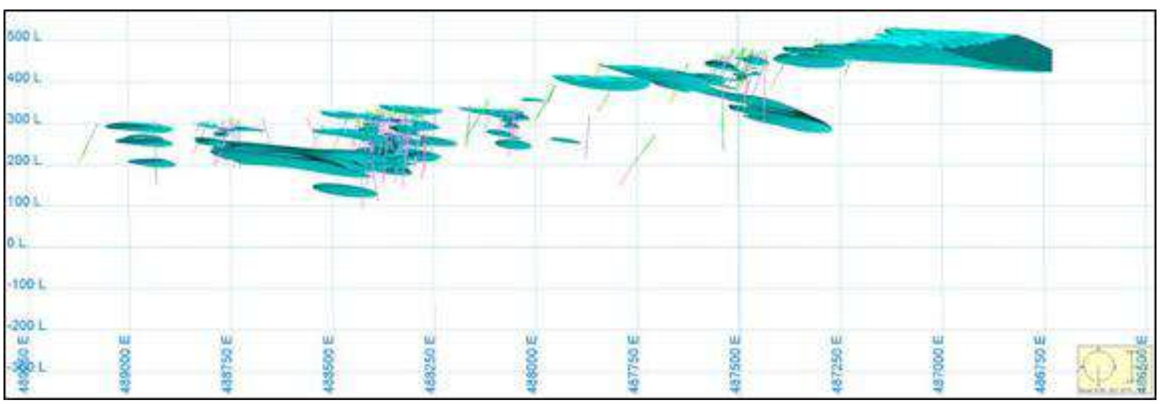
**Figure 14-21: Sprite Deposit MD Domain**




Source: BOYD, 2018

For the QTPV domain, the same implicit modelling approach was used to develop the mineralized solid as the mafic dykes. The implicit model used an azimuth of 135°, plunge of -10°, and a dip of -20°. The resulting solid was then clipped by the sediments. The QTPV domain is shown in Figure 14-22.

**Figure 14-22: Sprite Deposit QTPV Domain**




Source: BOYD, 2018

The TRJ and QTPV domains can be mineralized and were used to flag the drillholes used to construct the composites for variography and statistics.

#### 14.3.2.2 Drillhole Descriptive Statistics

Descriptive statistics of gold assays were generated for each domain. The results of this analysis are summarized in Table 14-14.

**Table 14.14: Sprite Raw Assay Descriptive Statistics**

| Item | All | QTPV | Trondhjemite |
|---|---|---|---|
| Number of Samples | 6,635 | 1,308 | 4,683 |
| Minimum (g/t Au) | 0.002 | 0.005 | 0.002 |
| Maximum (g/t Au) | 72.09 | 72.09 | 29.17 |
| Average (g/t Au) | 0.27 | 0.84 | 0.15 |
| Standard Deviation (g/t Au) | 1.84 | 3.62 | 1.00 |

#### 14.3.2.3 Compositing

Sample length statistics were run on the assay database examining the number of samples for sample lengths in 1.0 m increments through to 4.0 m. The purpose of this analysis is to determine what sample length was associated with the total number of samples.

Most samples with elevated gold mineralization were collected at a length of 1.0 m or less. A composite length of 1.0 m was selected and applied within the confines of the mineralized domains. Composites less than 1.0 m were divided by the run length (1.0 m). This composite length was selected to better reflect the actual breakdown of the mineralization in the individual drillholes within each mineralized zone.

#### 14.3.2.4 High Value Grade Limits

High outlier gold assays can skew the block grade estimate if they are not accounted for with some sort of limitation or grade capping applied to the assay database.

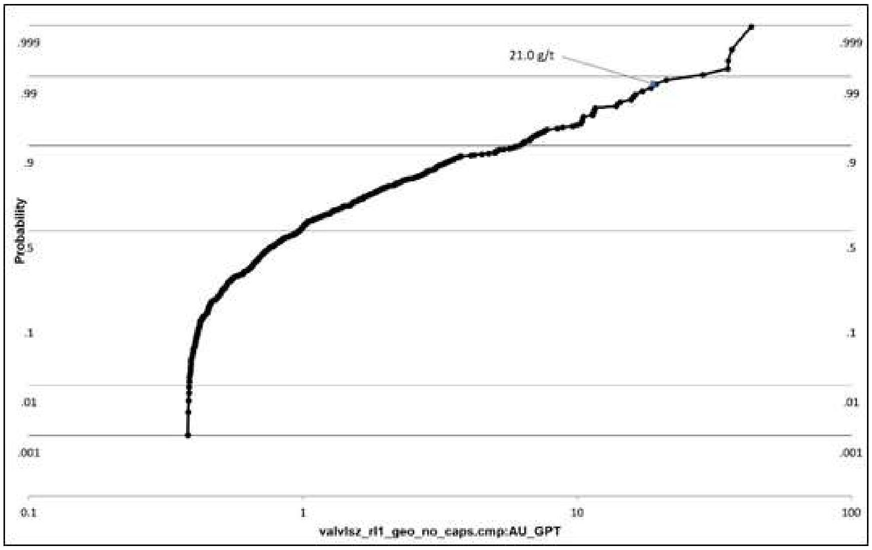
Lognormal graphs were used to review the assay distribution within each domain. Capping and threshold grade levels were selected at the point where the data start to break up or where there is a change in slope (Figures 14-23 and 14-24 on the following page).

To further reduce the influence of high-grade composites, after the assays were capped, composite grades greater than a selected threshold level are restricted to smaller search distances. The threshold grade levels were chosen from lognormal probability graphs. The area of influence was developed using the Vulcan Implicit Modeller to determine the size and extents of above threshold gold-bearing areas by producing a high gold grade wireframe. This process was completed for all potentially mineralized domains. Results are summarized in Table 14-15.

**Table 14.15: Sprite Deposit Gold Capping Grades and Limited Search Criteria**

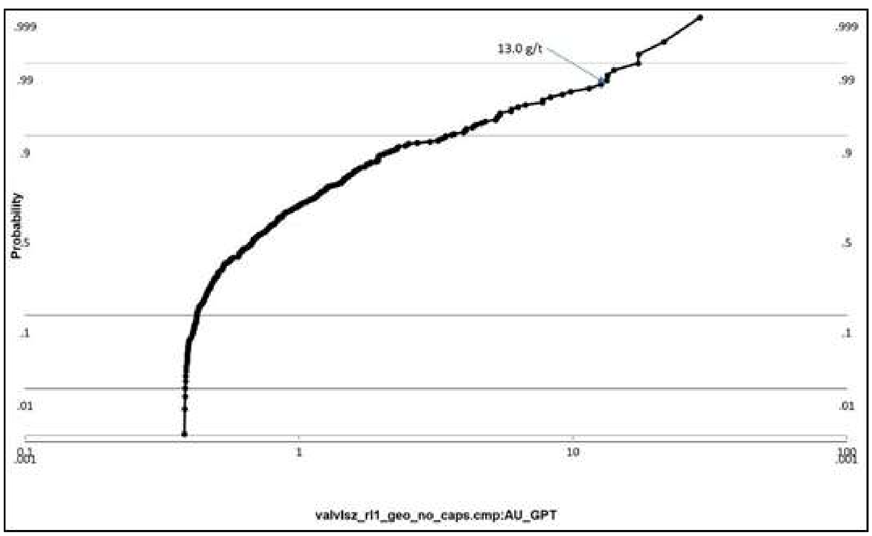
| Domain | Limited Search Ellipsoid | | | |
|---|---|---|---|---|
| | Grade Threshold (Au g/t) | Major (m) | Semi-Major (m) | Minor (m) |
| QTPV | 21.0 | 10.0 | 10.0 | 5.0 |
| Trondhjemite (TRJ) | 13.0 | 10.0 | 10.0 | 5.0 |

**Figure 14-23: Sprite QTPV Domain Lognormal Plot**




Source: BOYD, 2018.

**Figure 14-24: Sprite TRJ Domain Lognormal Plot**

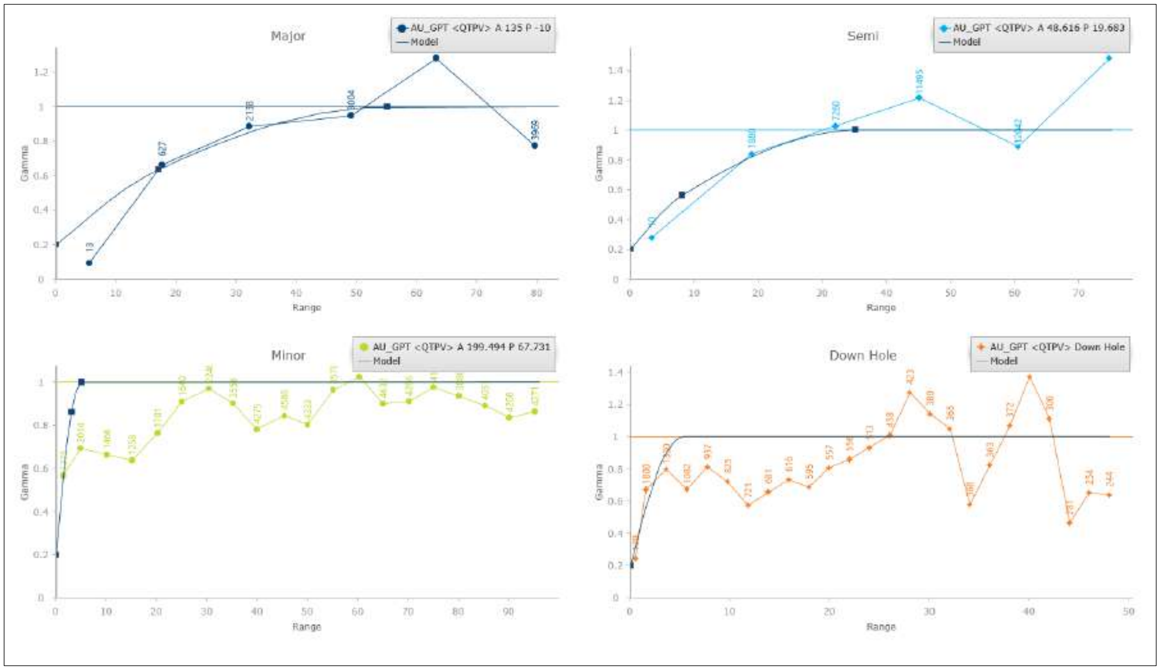



Source: BOYD, 2018.

### 14.3.3 Variography and Search Ellipsoids

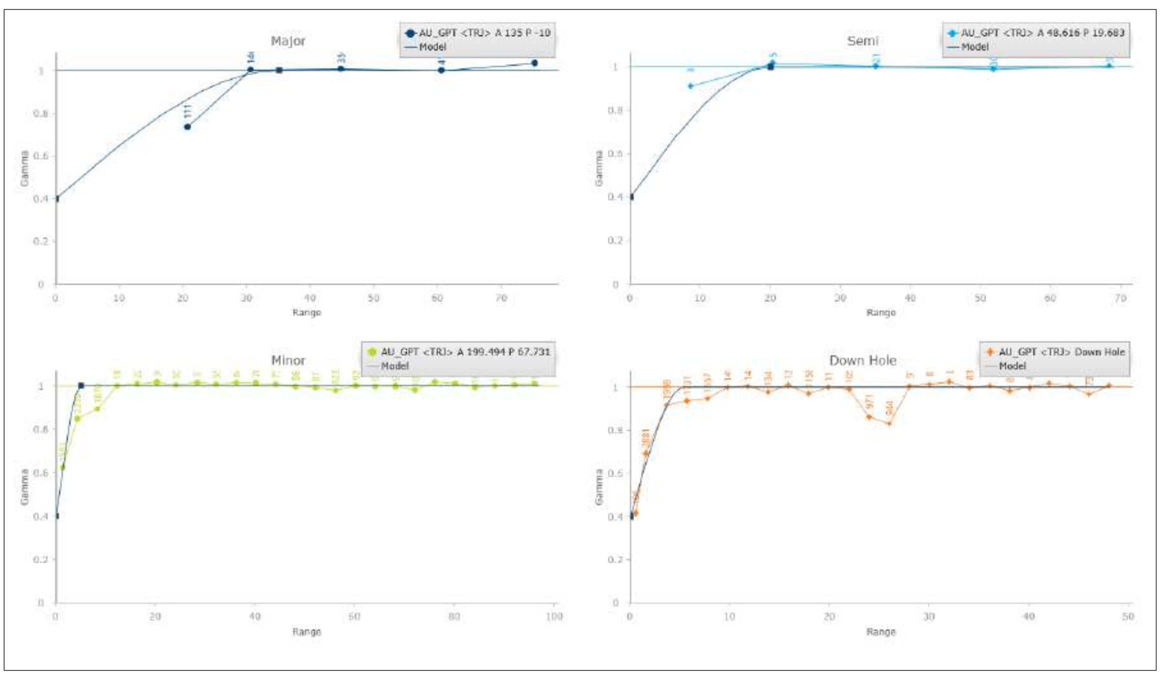
The search ellipsoids for grade estimation were chosen based on variograms of each domain. Variograms were generated for each domain in the same structural orientations used to develop the mineralized domain wireframes. Gold grade variograms for each domain are shown in Figure 14-25 and 14-26.

**Figure 14-25: Sprite Deposit QTPV Variograms**




Source: BOYD, 2018

**Figure 14-26: Sprite Deposit Trondhjemite Variograms**




Source: BOYD, 2018

Based on these analyses, the search ellipsoid for each mineralized domain was established. Selected search ellipse distances and directions are listed in Section 14.6.7.

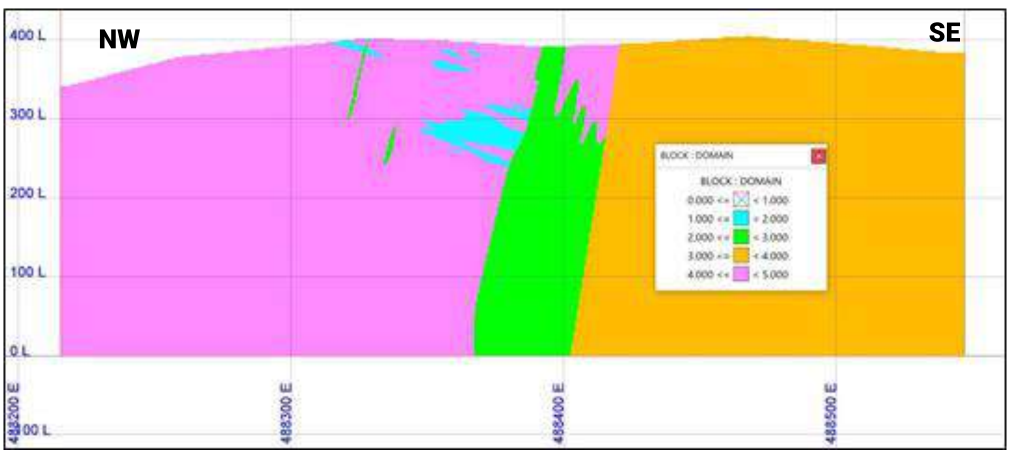
### 14.3.4 Sprite Deposit Block Model

Table 14-16 shows the Sprite block model extents. Figure 14-27 shows a typical block model section of the mineralized domain.

**Table 14.16: Block Model Extents**

| Item | X | Y | Z |
|---|---|---|---|
| Origin (m) | 487,415.320 | 5,355,737.199 | 0.0 |
| Offset Minimum | - | - | - |
| Offset Maximum (m) | 2,502 | 1,002 | 450 |
| Parent Block Size (m) | 6.0 | 6.0 | 6.0 |
| Child Block Size (m) | 2.0 | 2.0 | 2.0 |
| Bearing/Dip/Plunge (degree) | 45.0 | - | - |

**Figure 14-27: Sprite Deposit Typical Mineralized Domain Block Model Cross-Section**




Source: BOYD, 2018

### 14.3.5 Sprite Block Estimations

The Vulcan-constructed block model was constrained by the mineralized domains. The current topographic surface was used to flag the block model attribute vtopo. This variable is set to 100% for a block completely below the surface and to 0% for a block completely above the surface. Blocks at the topographic surface were assigned a proportion that lies below topography. An attribute named rdensity was assigned using the following formula:

$$rdensity = density * \left(\frac{vtopo}{100}\right)$$

This procedure ensures that blocks along the topographic surface have the correct density applied during pit optimization functions.

No attempt was made to apply a block percentage (percent of the block that is material and waste). Blocks are in or out of the mineralized domain. Grade interpolation runs were set up for only that material within the mineralized domain for gold. All domains were run for gold with the exception of the overburden domain, which is assumed to not be mineralized.

Using the composited assays, block grade interpolations were run in each mineralized domain for gold using $ID^3$ weighting. Four passes were run to allow for use in resource classification. Only composites and blocks flagged as within the mineralized domain were considered in the grade estimation. The block model interpolation parameters are summarized in Table 14-17 and Table 14-18.

**Table 14.17: Sprite Deposit QTPV Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -10 | -10 | -10 | -10 |
| Dip (Degrees) | -20 | -20 | -20 | -20 |
| Major (m) | 55.0 | 55.0 | 55.0 | 82.5 |
| Semi-Major (m) | 35.0 | 35.0 | 35.0 | 52.5 |
| Minor (m) | 5.0 | 5.0 | 5.0 | 7.5 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 4 | 3 | 2 | 2 |
| Maximum Number of Composites | 6 | 6 | 6 | 6 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |

**Table 14.18: Sprite Deposit Trondhjemite Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -10 | -10 | -10 | -10 |
| Dip (Degrees) | -20 | -20 | -20 | -20 |
| Major (m) | 35.0 | 35.0 | 35.0 | 52.5 |
| Semi-Major (m) | 20.0 | 20.0 | 20.0 | 30.0 |
| Minor (m) | 5.0 | 5.0 | 5.0 | 7.5 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 4 | 3 | 2 | 2 |
| Maximum Number of Composites | 6 | 6 | 6 | 6 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |

### 14.3.6 Sprite Deposit Model Validation

The grade populated block model was reviewed to ensure reasonableness. This review included:

- an overall review of the estimated metal values
- QQ plots of the block model versus the composites
- a section-by-section comparison between the $ID^3$ metal values and the drillhole assays
- a statistical comparison of the raw assay values versus the composite values versus the block values.

The estimated block grades were visually examined to confirm that the estimation parameters were honoured and kept within the individual mineralized domains. Cross-sections were reviewed and the drillholes were checked to determine that the grades reasonably matched the estimated block grades. A statistical comparison of the raw assays, composites, and estimated block grades is shown in Table 14-19.

The block model checks indicate that the MRE slightly underestimates the composites at lower gold grade values. At higher gold grades, the block model gold grades are underestimated relative to the composites.

**Table 14.19: Sprite Deposit Mineral Resource Estimation Model Statistics**

| Item | Domain | | |
|---|---|---|---|
| | All | QTPV | Trondhjemite (TRJ) |
| 1-Meter Composites | | | |
| Number of Samples | 6,635 | 1,308 | 4,683 |
| Minimum (g/t Au) | 0.002 | 0.005 | 0.002 |
| Maximum (g/t Au) | 72.09 | 72.09 | 29.17 |
| Average (g/t Au) | 0.27 | 0.84 | 0.15 |
| Standard Deviation (g/t Au) | 1.84 | 3.62 | 1.00 |
| Coefficient of Variance | 6.83 | 4.319 | 6.63 |
| Block Model Results | | | |
| Number of Blocks | 137,949 | 41,863 | 96,083 |
| Minimum (g/t Au) | 0.000 | 0.000 | 0.000 |
| Maximum (g/t Au) | 39.29 | 39.29 | 17.32 |
| Average (g/t Au) | 0.23 | 0.49 | 0.11 |
| Standard Deviation (g/t Au) | 0.84 | 1.26 | 0.15 |
| Coefficient of Variance | 3.62 | 2.56 | 1.36 |

### 14.3.7 Sprite Mineral Resource Classification Methodology

The mineral resource classification used on the Sprite deposit is based on which pass generated the grade estimate and the distance to the nearest neighbour (measured and indicated only). The mineral resource classifications assigned include:

- Measured – Blocks estimated in Pass 1 (minimum of four composites) with a maximum nearest neighbour distance of 15 m are classified as measured. For the Sprite deposit, no blocks could be considered as measured.
- Indicated – Blocks estimated in Pass 2 (minimum of three composites) with a maximum nearest neighbour distance of 25 m are classified as indicated. Only blocks flagged as QTPV could be considered as indicated.
- Inferred – Blocks estimated in Pass 3 (minimum of two composites) are classified as inferred.

Blocks flagged during Pass 4 are not considered in the MRE and were populated to provide future exploration guidance to Marathon Gold. Any material flagged with a classification of 4 is considered as waste material.

### 14.3.8 Sprite Mineral Resource Reporting and Evaluation of Reasonable Prospects of Economic Extraction

The Sprite mineral resources may be amenable to a combination of open pit and underground mining methods. BOYD developed a conceptual pit shell (the economic open pit shell) using the Lerchs-Grossman method as provided by the GEOVIA Whittle software. Portions of the block model within the pit shell demonstrate "reasonable prospects for eventual economic extraction" by open pit mining. From this shell, a conceptual open pit mine was designed and used to constrain the mineral resources. Portions of the block model which are external to the conceptual pit shell but satisfy cut-off grade criteria for an appropriate underground extraction method, are considered to show "reasonable prospects for eventual economic extraction" by underground mining methods.

#### 14.3.8.1 Economic Assumption Parameters Used for Pit Optimization and Underground Cut-off

The operating assumptions (economic and gold recovery) used for the Whittle economic open pit optimization are listed in Table 14-20. The operating assumptions (economic and gold recovery) used to calculate the underground cut-off grade are shown in Table 14-21.

**Table 14.20: Sprite Open Pit Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Waste Mining Cost | 2.35 | C$/t waste |
| Mill Feed Mining Cost | 3.60 | C$/t mill feed |
| Mill Processing Cost | 10.81 | C$/t mill feed |
| G&A Cost | 2.40 | C$/t mill feed |
| Mill Gold Recovery (at cut-off) | 91.1 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,500 | US$/troy oz |
| Mill Cut-off | 0.30 | g/t Au |

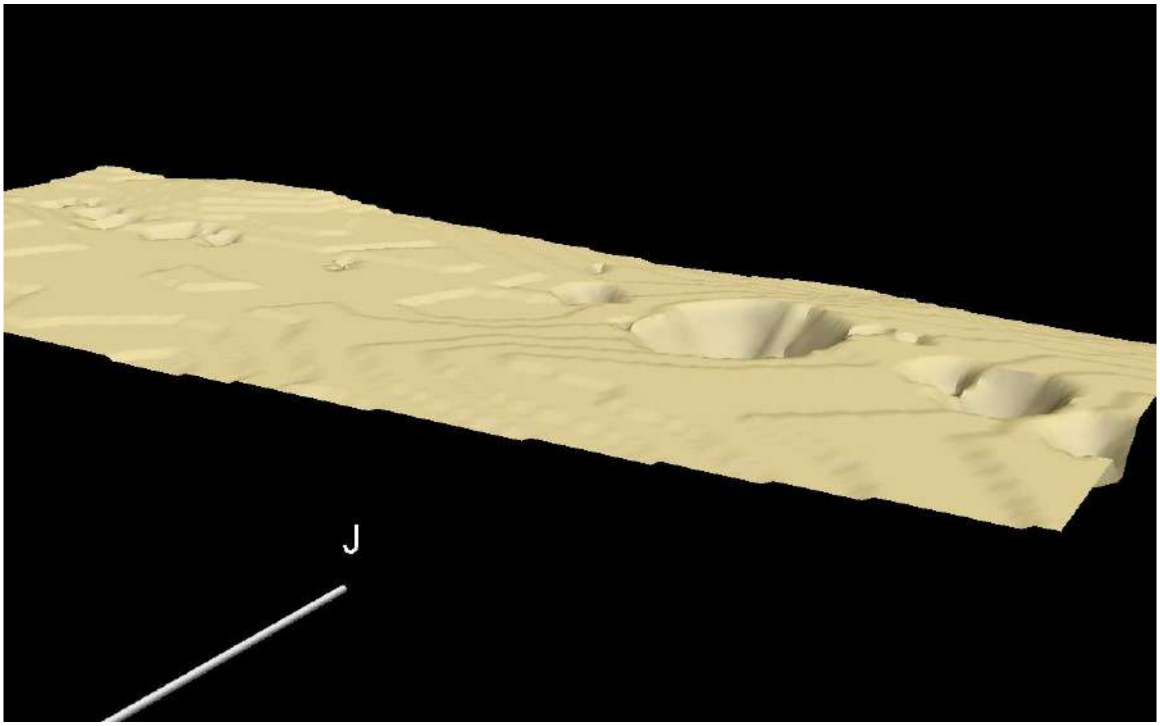
**Table 14.21: Sprite Underground Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Mill Feed Mining Cost | 71.00 | C$/t mill feed |
| Processing Cost | 10.81 | C$/t material |
| G&A Cost | 2.40 | C$/t material |
| Recovery (at cut-off) | 92.7 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,500 | US$/troy oz |
| Calculated Cut-off | 1.44 | g/t Au |

For mineral resource reporting, a cut-off grade of 0.30 g/t gold was used for open pit, and a cut-off grade of 1.44 g/t gold was used for underground. The assumed overall pit slope in Whittle was assumed to be 48° in non-sediment rocks and 42° in sediment rocks not including ramps.

Using these assumptions, a Whittle economic pit optimization was completed, and an economic open pit shell generated (Figure 14-28).

**Figure 14-28: Sprite Deposit Whittle Pit Shell**




Source: BOYD, 2020

#### 14.3.8.2 Opinion on Reasonable Prospects

The QP considers the Whittle pit parameters appropriate to evaluate the reasonable prospects for eventual economic extraction of the Sprite deposit for the purpose of providing an MRE. The resources presented herein are not mineral reserves, and they do not have demonstrated economic viability. There has been an insufficient level of exploration to define the indicated and inferred resources as a measured mineral resource, and it is uncertain if further exploration will result in upgrading them to a measured resource category. There is no guarantee that any part of the resources identified herein will be converted to a mineral reserve in future.

### 14.3.9 Sprite Mineral Resource Statement

The Sprite deposit's indicated and inferred MREs were reported in accordance with CIM Definition Standards and Best Practice Guidelines for Mineral Resources and Reserves (CIM, 2014, 2019) and the disclosure rule NI 43-101. The effective date for the Sprite deposit MRE is November 20, 2020.

The mineral resources presented here were estimated using a block model with a block size of 6 m by 6 m by 6 m sub-blocked to a minimum block size of 2 m by 2 m by 2 m using $ID^3$ methods for grade estimation.

All MREs are reported using an open pit gold cut-off of 0.30 g/t Au and an underground gold cut-off of 1.44 g/t Au. Material between a 0.30 Au g/t value and 0.70 Au g/t is assumed to be low grade material. Material above a 0.70 Au g/t is assumed to be high grade material. Samples with higher gold grades were given a limited area of influence which was applied during grade estimation by mineralized domain.

The MREs do not include a detailed pit or underground design. Only an economic pit shell was used to determine the in-pit mineral resources. The underground mineral resources are that material outside of the in-pit mineral resources above the stated underground cut-off grade.

The 2022 Sprite deposit MREs are classified as measured, indicated, and inferred resources according to recent CIM Definition Standards (CIM, 2014). The classification of the Sprite deposit resources was based on geological confidence, data quality and grade continuity. All reported open pit MREs occur within a pit shell optimized using a gold price of US$1,500 per troy ounce.

The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

Table 14-22 shows the MRE for the Sprite deposit constrained within the US$1,500 per troy ounce pit shell and with open pit and underground gold cut-offs.

**Table 14.22: Sprite Deposit Mineral Resources**

| MEASURED AND INDICATED MINERAL RESOURCE ESTIMATE | | | | | |
|---|---|---|---|---|---|
| **Mining Method** | **Classification** | **Cut-off Grade (g/t)** | **Tonnes** | **Au (g/t)** | **Au (oz)** |
| Open Pit - High Grade | Measured | 0.70 | 0 | 0.00 | 0 |
| Open Pit - High Grade | Indicated | 0.70 | 408,000 | 2.63 | 34,500 |
| Open Pit - High Grade | M+I | 0.70 | 408,000 | 2.63 | 34,500 |
| Open Pit - Low Grade | Measured | 0.30 | 0 | 0.00 | 0 |
| Open Pit - Low Grade | Indicated | 0.30 | 287,000 | 0.47 | 4,300 |
| Open Pit - Low Grade | M+I | 0.30 | 287,000 | 0.47 | 4,300 |
| Total Open Pit | Measured | 0.30 | 0 | 0.00 | 0 |
| Total Open Pit | Indicated | 0.30 | 695,000 | 1.74 | 38,800 |
| Total Open Pit | M+I | 0.30 | 695,000 | 1.74 | 38,800 |
| Underground | Measured | 1.44 | 0 | 0.00 | 0 |
| Underground | Indicated | 1.44 | 6,000 | 2.20 | 400 |
| Underground | M+I | 1.44 | 6,000 | 2.20 | 400 |
| Open Pit + Underground | Measured | | 0 | 0.00 | 0 |
| Open Pit + Underground | Indicated | | 701,000 | 1.74 | 39,200 |
| Open Pit + Underground | M+I | | 701,000 | 1.74 | 39,200 |
| **INFERRED MINERAL RESOURCE ESTIMATE** | | | | | |
| **Mining Method** | **Resource Classification** | **Gold Cut-off Grade (g/t)** | **Tonnes** | **Au (g/t)** | **Au (Troy Oz)** |
| Open Pit - High Grade | Inferred | 0.70 | 585,000 | 1.96 | 36,900 |
| Open Pit - Low Grade | Inferred | 0.30 | 604,000 | 0.46 | 9,000 |
| Total Open Pit | Inferred | 0.30 | 1,189,000 | 1.20 | 45,900 |
| Underground | Inferred | 1.44 | 61,000 | 2.47 | 4,800 |
| Open Pit + Underground | Inferred | | 1,250,000 | 1.26 | 50,700 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Sprite deposit MRE is November 20, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR. **6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available. **7.** Numbers may not add or multiply correctly due to rounding.

## 14.4 Berry Deposit Mineral Resource Estimate

Marathon Gold completed additional exploration drilling and a Televiewer structural study on the Berry deposit. This additional information was incorporated into an updated MRE using the new drilling and an improved geological interpretation. Additionally, there were updates to the technical and economic parameters used to report the in-pit MRE.

The Berry mineral resource is contained in a system of near flat-lying gold-bearing quartz-tourmaline-pyrite veins (QTPV) with an orientation with an azimuth of 135°, a plunge of -5°, and a dip of -35° (Vulcan rotations). The highest-grade gold mineralization occurs in the flat-lying QTPV veins within a steeply dipping shear zone along the contact with the footwall sediment (SED) unit. This area of mineralization is bounded in the hanging wall by a series of mafic dykes. To the northwest of the mafic dykes, the flat-lying, gold-bearing QTPV veins continue to be mineralized and make up the hanging wall mineralization at the Berry gold deposit.

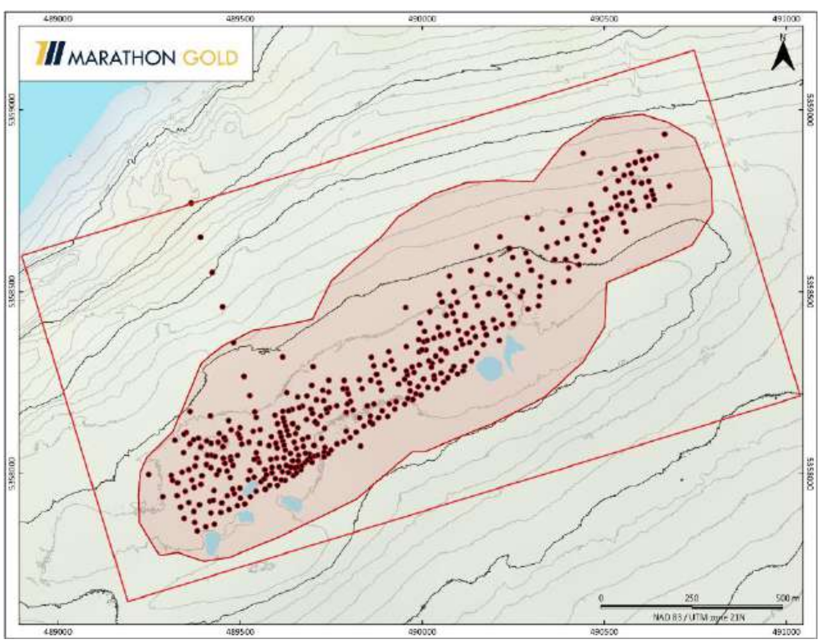
Gold mineralization can be hosted in major rock units (quartz-eye porphyry, mafic dykes, and lesser sediments) and although most of the mineral resource is contained in QTPV, some mineralization occurs in areas with no significantly logged QTPV mineralization. Many of the areas note minor amounts of QTPV in the descriptive geological logs.

### 14.4.1 Berry Deposit Data

#### 14.4.1.1 Drillholes

The MREs for the Berry deposit reported herein are based on all drillholes whose assays were available as of June 2, 2022 and consist of 421 diamond core drillholes totalling approximately 99,845 m. Figure 14-29 shows the collars of these drillholes.

**Figure 14-29: Berry Drillhole Locations & Topography**




Source: Marathon, 2022

#### 14.4.1.2 Assays

Of the 72,474 gold assays available as of June 2, 2022, all were used. For unsampled intervals, gold grade values were set to zero. All gold grades were determined from fire or metallic screened assays. Total assayed sample length is 95,829 m.

#### 14.4.1.3 Density

Bulk density for the Berry deposit was derived from the 729 measurements taken from core (Table 14-23). Block densities were assigned based on the block's domain or lithology type.

**Table 14.23: Berry Density Measurements**

| Domain | Density t/m³ |
|---|---|
| Mafic Dykes (MD) | 2.79 |
| Quartz-Tourmaline- Pyrite Veins (QTPV) | 2.69 |
| Sediments (SED) | 2.76 |
| Quartz-Eye Porphyry (QEPOR) | 2.69 |
| Overburden (OVB) | 1.50 |

#### 14.4.1.4 Topography

The topography of the area around the Berry deposit is shown on Figure 14-29. The Berry deposit sits on a sloped ridge top. Towards the north, the topography falls off steeply, while towards the south, the topography slopes gently downhill.

A Lidar topographic survey was completed in 2019. This survey is the topographic basis for all work related to mineral resource estimation described in this section.

#### 14.4.1.5 Berry Resource Database Quality Control

BOYD, APEX, and Marathon validated the data pertaining to the MRE. Checks on the drillhole database included a search for unique, missing, and overlapping intervals, a total depth comparison, duplicate holes, property boundary limits, and a visual search for extreme or deviant survey values. A few minor discrepancies were identified and corrected.

### 14.4.2 Berry Deposit Data Analysis

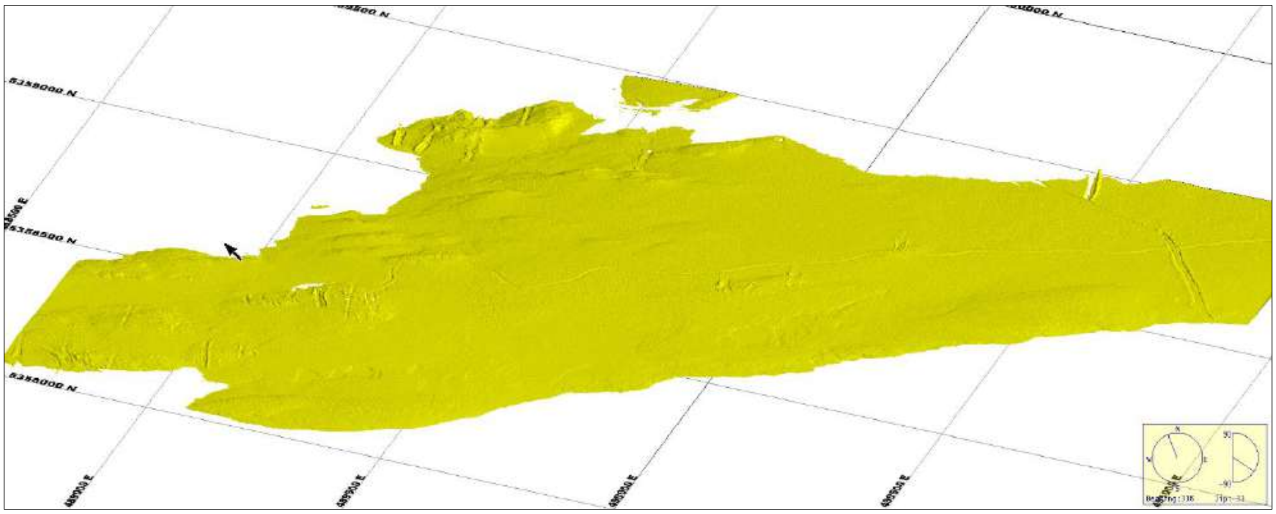
#### 14.4.2.1 Geological Modelling

The Berry deposit contains four potentially mineralized domains: sediments (SED), quartz-eye porphyry (QEPOR), flat-lying, quartz-tourmaline-pyrite veins (QTPV), and mafic dykes (MD) intruding into the QEPOR and QTPV domains. Overburden was also modelled but was not considered as mineralized host. Figure 14-30 to 14-34 illustrate the results.

Geological modelling is based on the logged geology and interpretations made by Marathon Gold staff using the Leapfrog software. The QTPV wireframe used both logging and gold assays to support the interpretation. The models were exported to Vulcan and transferred to BOYD for review. BOYD and APEX concurred with Marathon Gold's interpretation as provided.

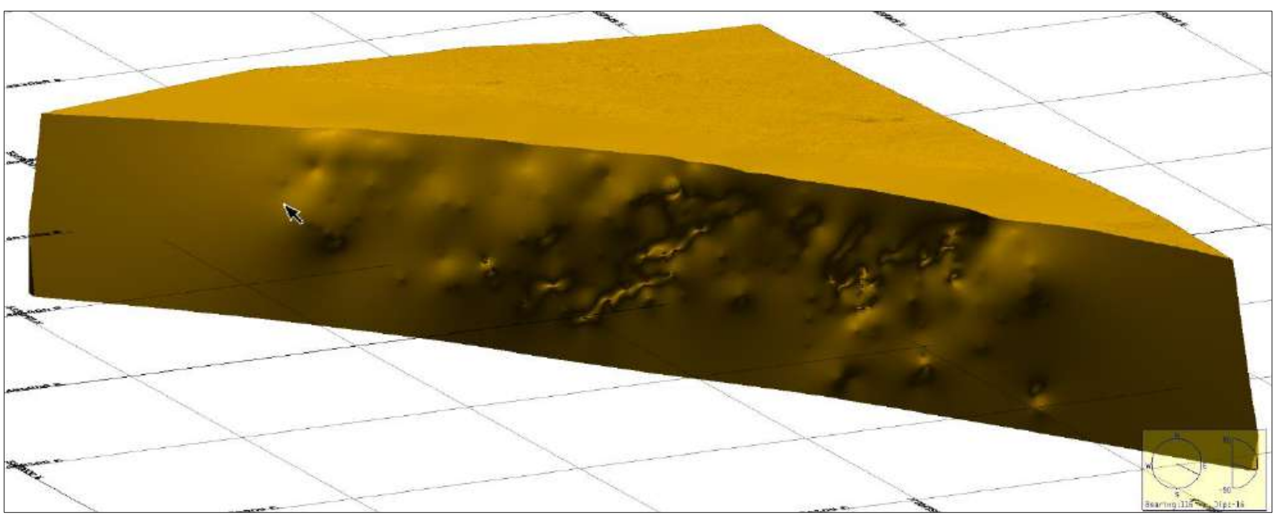
The SED, MD, QEPOR, QTPV domains can be mineralized and were used to flag drillholes used to construct the composites for later variography and geostatistics.

**Figure 14-30: Overburden Solid**



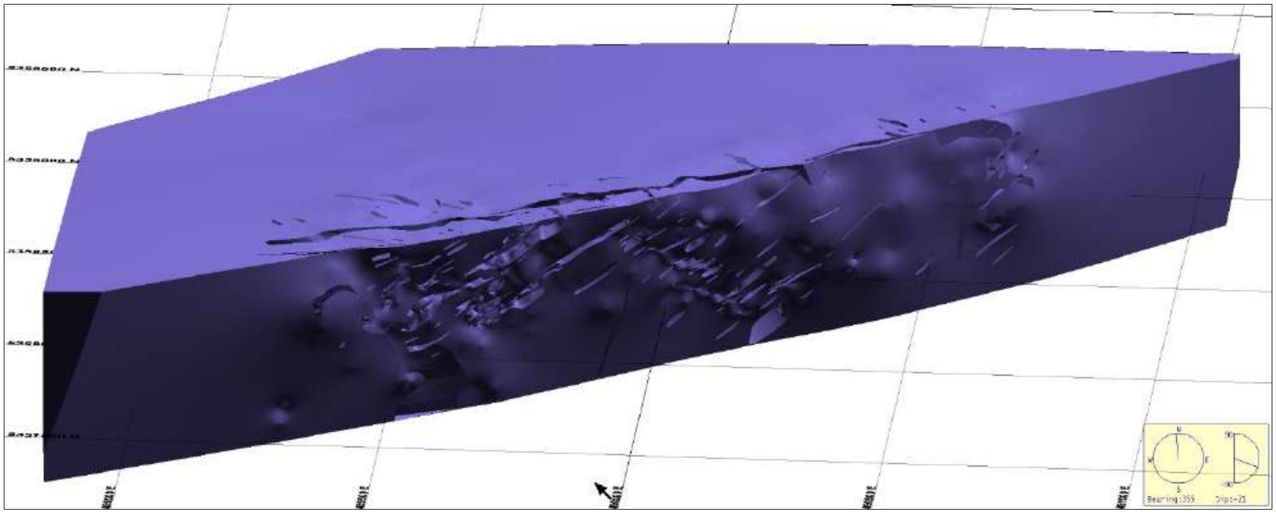
Source: BOYD, 2022

**Figure 14-31: Berry SED Domain**



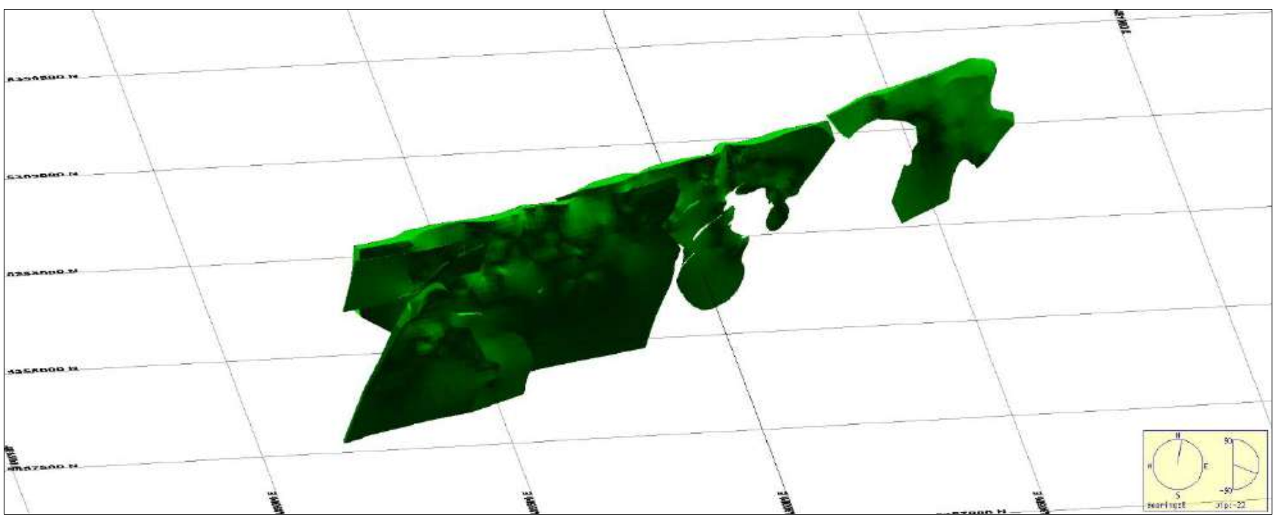
Source: BOYD, 2022

**Figure 14-32: Berry QEPOR Domain**



Source: BOYD, 2022

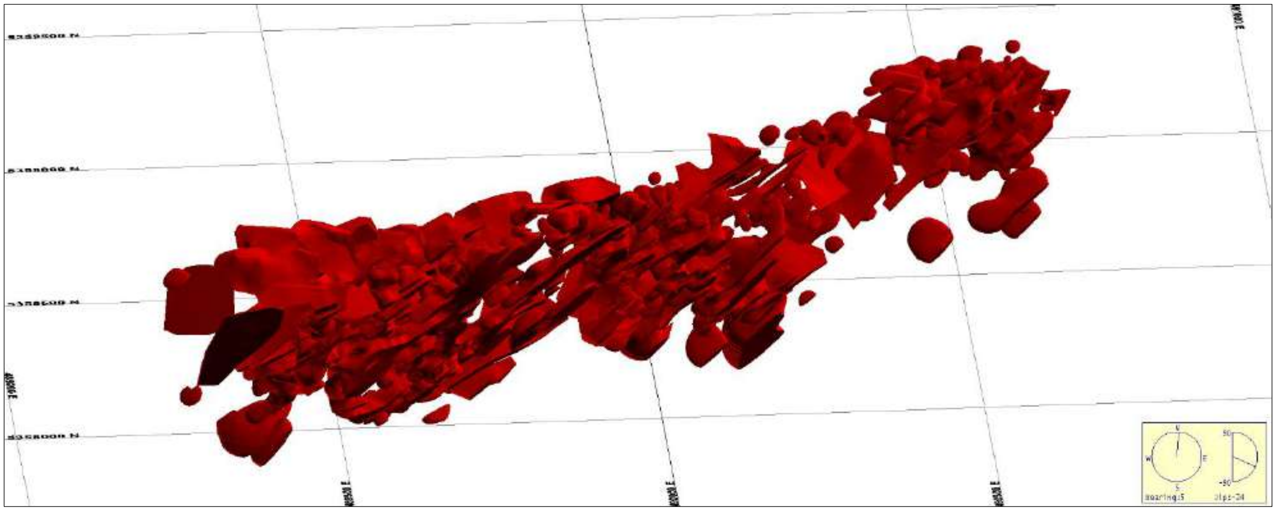
**Figure 14-33: Berry MD Domain**



Source: BOYD, 2022

For the QTPV domain, two Leapfrog modelling tools were used, the vein system tool and the implicit intrusion tool with appropriate implicit controls. Sixty-one wireframes representing Set 1 QTP veins as described in Section 7 were modelled. The other vein sets, for example Set 2 and Set 3, were not modelled given that they are less volumetrically significant and too obscured by the numerous Set 1 veins. A vein mid-surface plane was generated for each domain to be used to flag individual block search orientations. This allowed the use of a local anisotropy model during grade estimation. The average orientation used an azimuth of 135° with a plunge of -5°. The resulting wireframe was then clipped by the sediments and mafic dykes. The QTPV solid is a more refined domain than the previously used 100 ppb Au implicit shell and provides a significantly improved constraint for mineralization. The QTPV domain is shown in Figure 14-34.

**Figure 14-34: Berry QTPV Solid**



Source: BOYD, 2022

#### 14.4.2.2 Drillhole Descriptive Statistics

Descriptive statistics were generated for each individual domain, as well as the overall exploration database for gold. The results of this analysis are summarized in Table 14-24.

**Table 14.24: Berry Raw Assay Descriptive Statistics**

| Item | Domain | | | | |
|---|---|---|---|---|---|
| | All | QTPV | Mafic Dykes (MD) | Sediment (SED) | Quartz-Eye Porphyry (QEPOR) |
| Number of Samples | 39,526 | 14,084 | 1,062 | 282 | 23,954 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 490.61 | 490.61 | 17.91 | 38.02 | 105.29 |
| Average (g/t Au) | 0.91 | 2.17 | 0.23 | 0.29 | 0.20 |
| Standard Deviation (g/t Au) | 5.38 | 8.67 | 0.90 | 2.33 | 1.41 |
| Coefficient of Variance | 5.94 | 4.00 | 3.93 | 8.00 | 6.96 |

Note: Assays ≥ 0.01 g/t Au reported.

#### 14.4.2.3 Compositing

Sample length statistics were run on the assay database examining the number of samples for sample lengths in 0.5 m increments through a total length of 4.0 m. The purpose of this analysis is to determine what sample length was associated with the total number of samples.

Most samples with elevated gold mineralization were collected at a length of 1.0 m or less. A total of 67.5% of all assays were collected at 1 meter or less containing 98.0% of the total contained metal. Based on this, a composite length of 1.0 m was selected and applied within the confines of the mineralized domains. Composites less than 1.0 m were divided by the run length (1.0 m). This composite length was selected to better reflect the actual breakdown of the mineralization in the individual drillholes within each mineralized zone.

#### 14.4.2.4 High Value Grade Limits

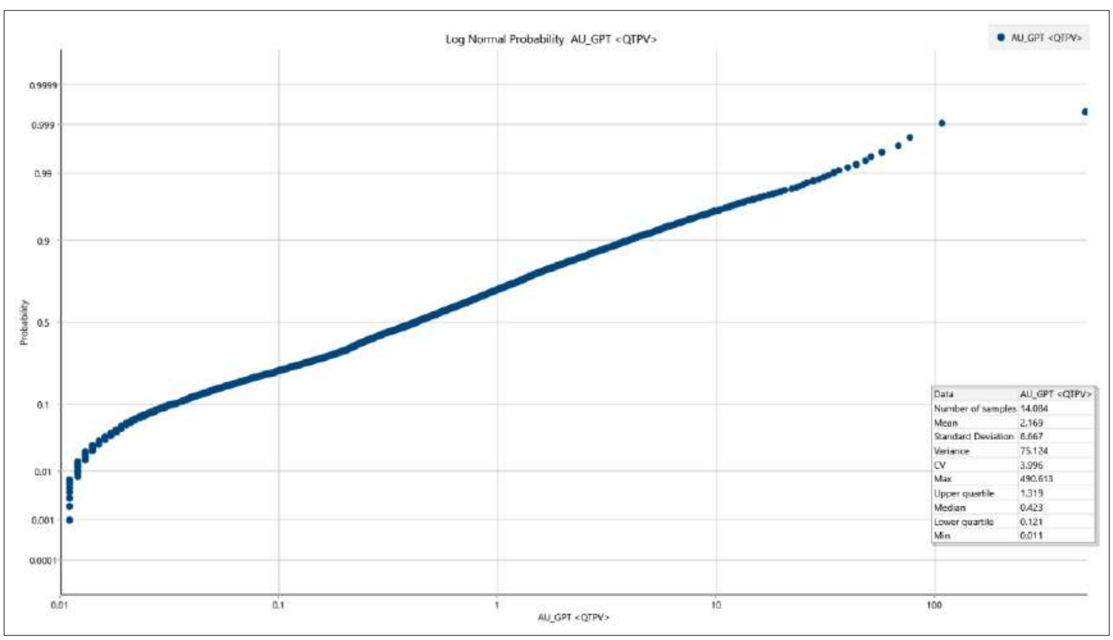
High outlier metal values can skew the resulting grade estimate if they are not accounted for with some sort of limitation or grade capping applied to the assay database.

To determine high-value gold grade outliers, several methods were considered. These included a 1 troy ounce gold grade cap, the mean plus the standard deviation, four times the mean, five times the mean, lognormal, and decile analysis. These methods were reviewed, and the resulting potential grade caps/threshold were selected. For the Berry deposit, the lognormal graph was considered to establish a capping/threshold value.

Threshold metal grades were selected from the lognormal plot at the point where the data starts to break up or where there is a significant slope change in the plot. The lognormal probability plots for gold found in each mineralized domain are shown in Figures 14-35 through 14-38.

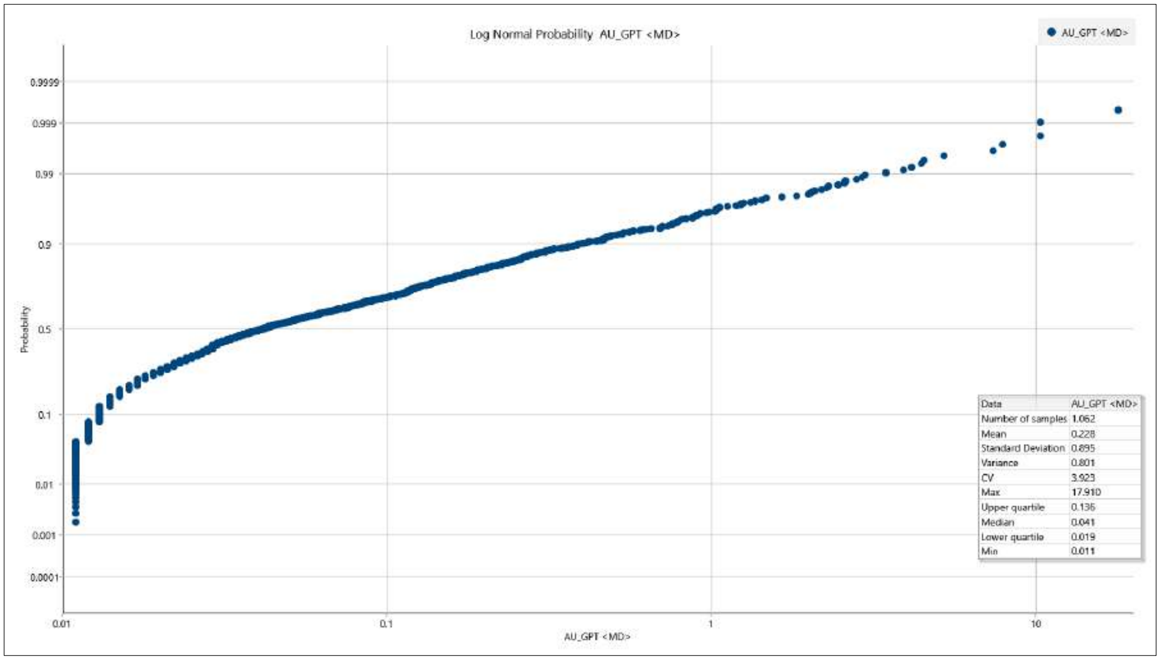
The lognormal probability graphs were also used to determine a gold threshold grade to limit the area of influence of gold grades higher than the threshold. The area of influence was developed using indicator variograms to determine the size and extents of above threshold gold-bearing areas by producing a high gold grade search ellipsoid. This search ellipsoid was used to determine the area of influence of above threshold gold grades. This process was completed on all the potentially mineralized domains and the selected metal threshold grades are shown in Table 14-25.

**Figure 14-35: Berry QTPV Domain Lognormal Plot**



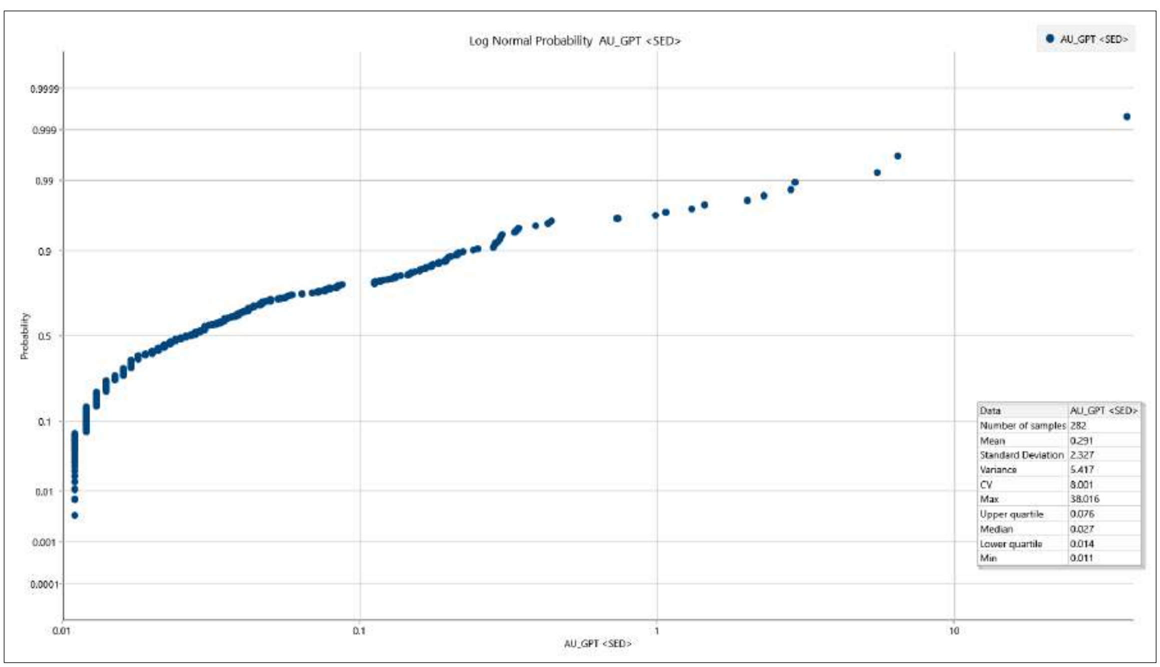

Source: BOYD, 2022

**Figure 14-36: Berry MD Domain Lognormal Plot**



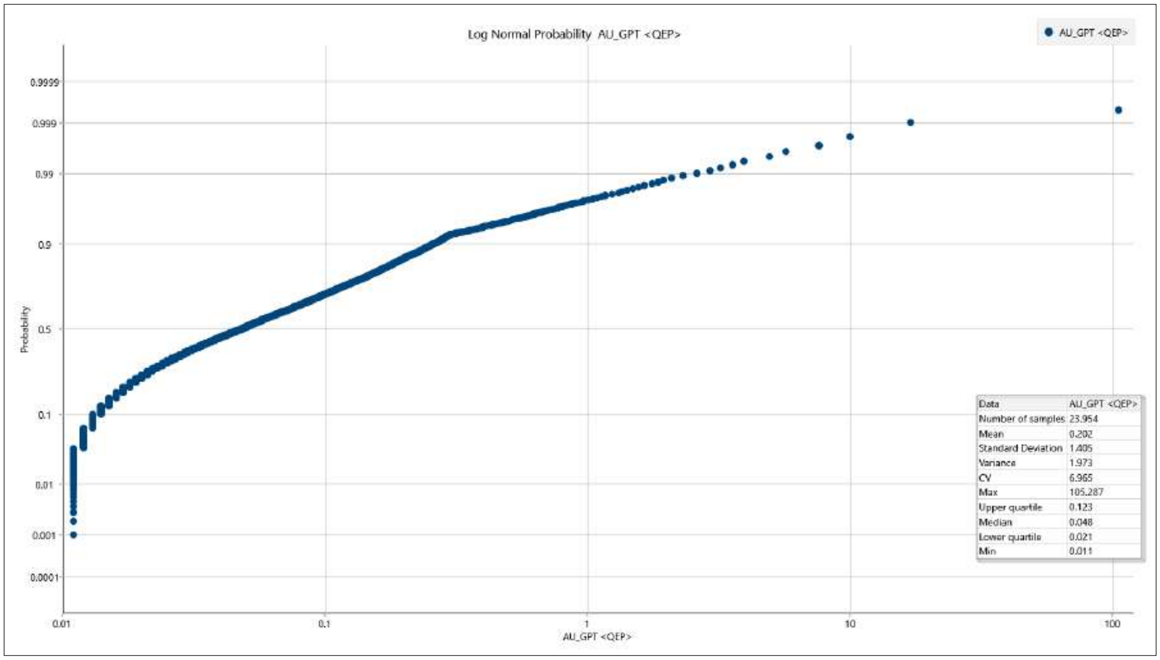

Source: BOYD, 2022

**Figure 14-37: Berry SED Domain Lognormal Plot**




Source: BOYD, 2022

**Figure 14-38: Berry QEP Domain Lognormal Plot**




Source: BOYD, 2022

**Table 14.25: Berry Gold Capping Grades and Limited Search Criteria**

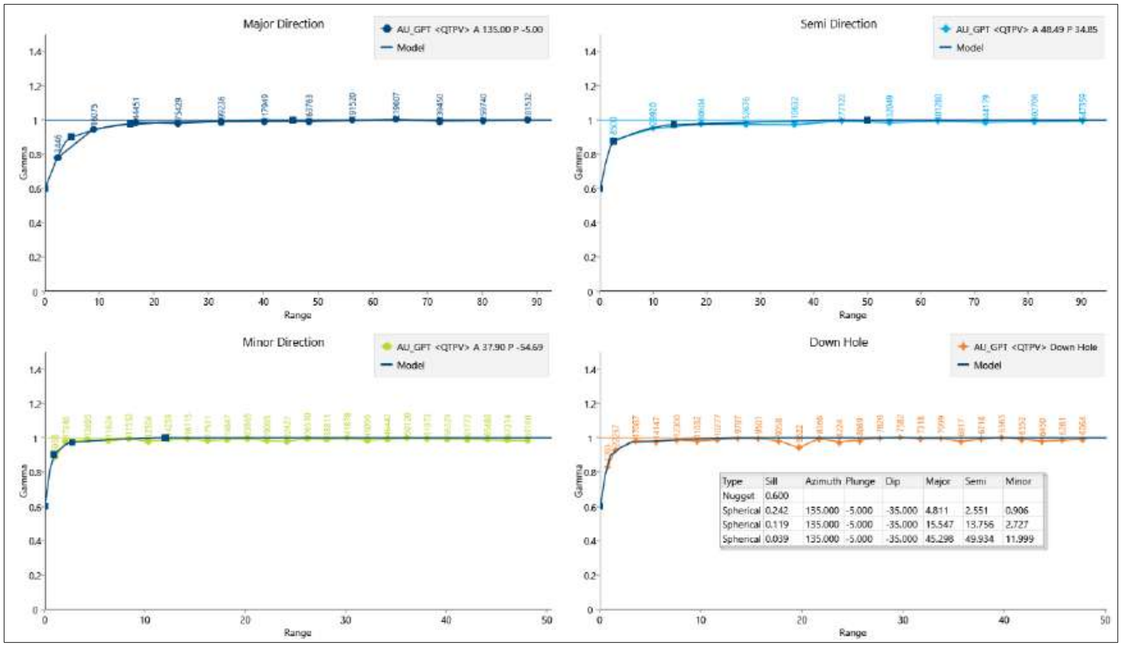
| Item | Mineralized Domain | | | |
|---|---|---|---|---|
| | QTPV | MD | SED | QEP |
| Extreme Outlier Gold Cap (g/t) | 125.0 | 7.5 | 2.5 | 38.0 |
| Spatial Restriction Threshold Grade (g/t) | 65.0 | 7.5 | 2.5 | 12.5 |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Degrees) | -5 | -5 | -5 | -5 |
| Dip (Degrees) | -35 | -35 | -35 | -35 |
| Major Axis (m) | 12 | --- | --- | 2.83 |
| Semi-Major Axis (m) | 12 | --- | --- | 10.71 |
| Minor Axis (m) | 6 | --- | --- | 2.76 |

### 14.4.3 Variography and Search Ellipsoids

The search ellipsoids for grade estimation were developed using variograms for each domain. Variograms were generated for each domain in the same structural orientations used to develop the mineralized solids. Gold grade variograms for each domain are shown in Figures 14-39 through 14-42.

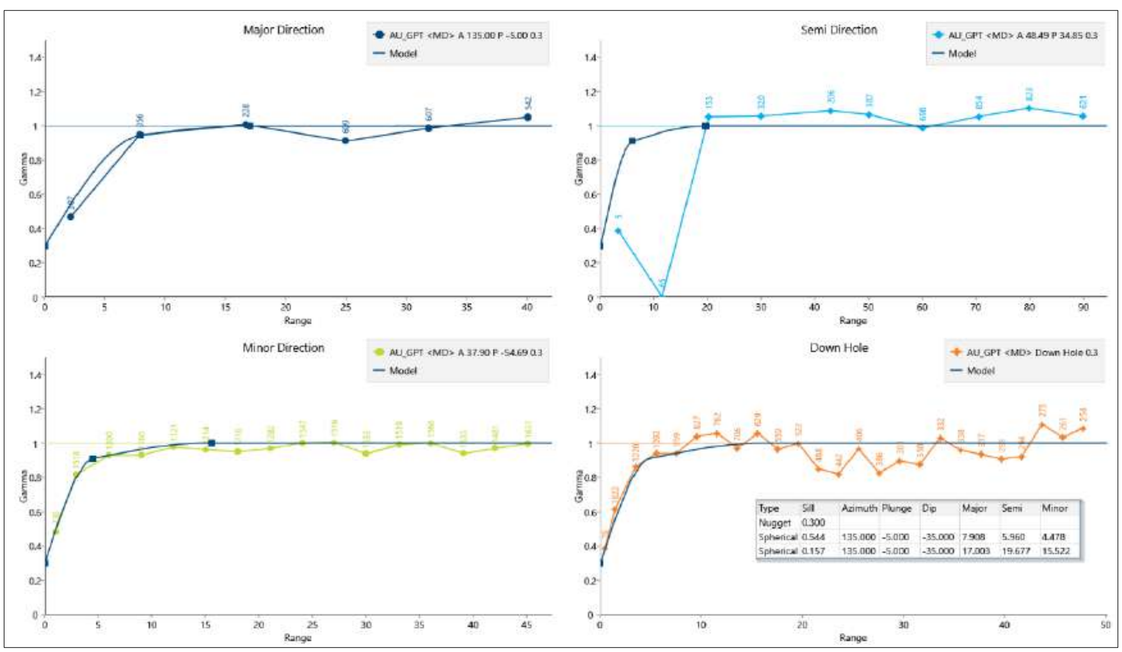
Based on these analyses, the search ellipsoid for each mineralized domain was established. Selected search ellipse distances and directions in Section 14.4.7.

### Figure 14-39: Berry QTPV Variograms



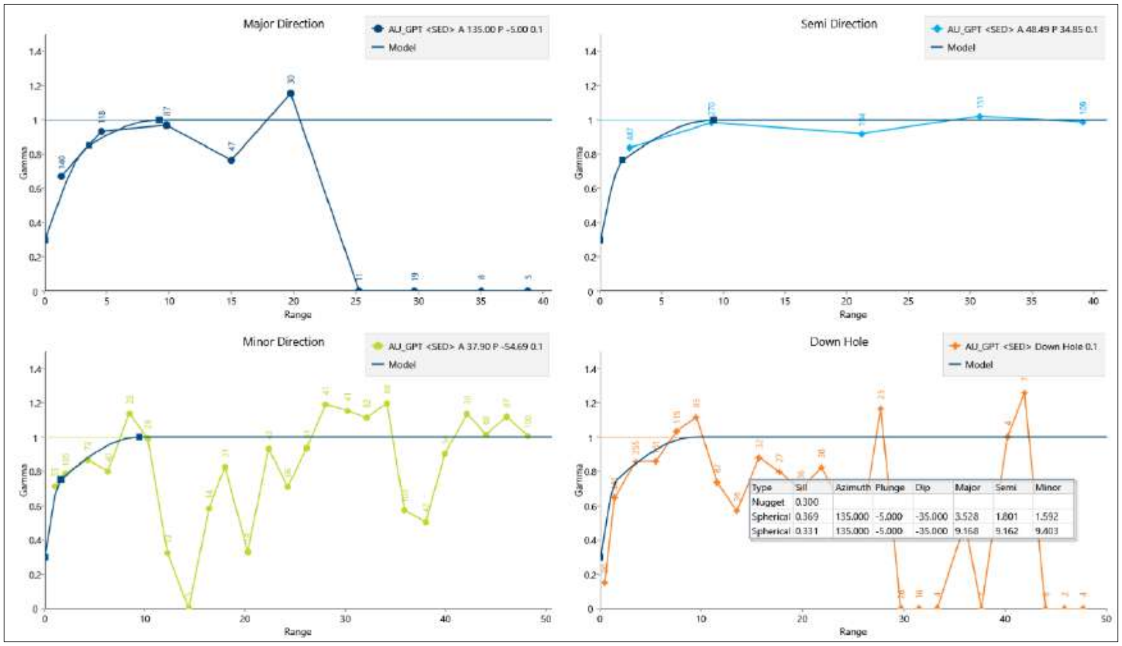

Source: BOYD, 2022

### Figure 14-40: Berry MD Variograms



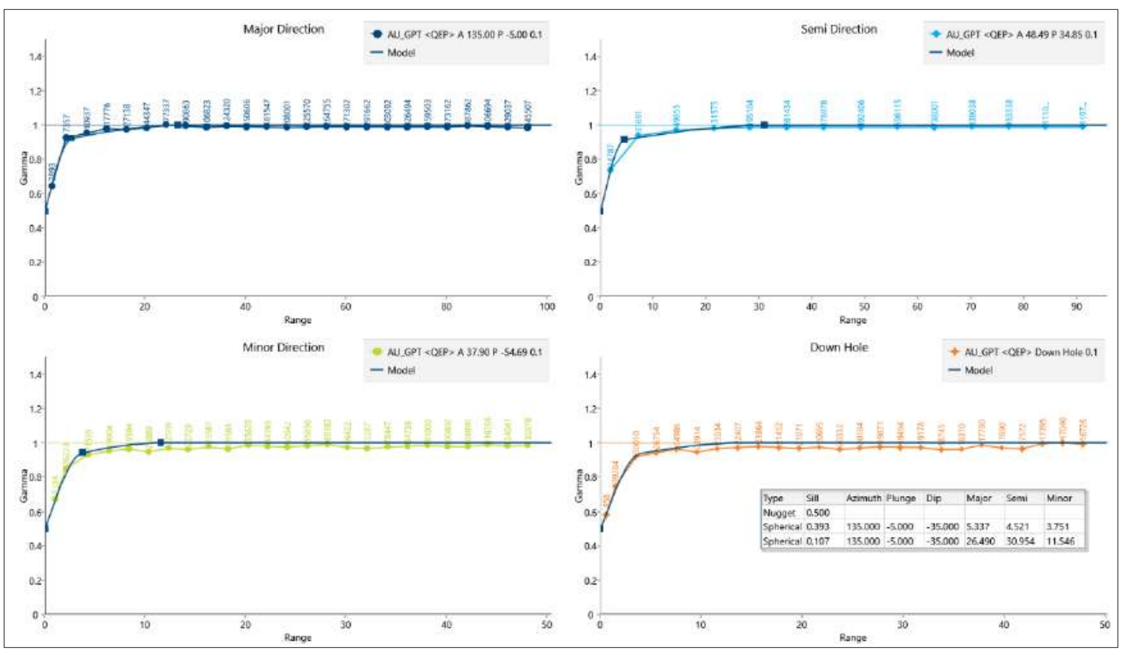

Source: BOYD, 2022

**Figure 14-41: Berry SED Variograms**




Source: BOYD, 2022

**Figure 14-42: Berry QEPOR Variograms**




Source: BOYD, 2022

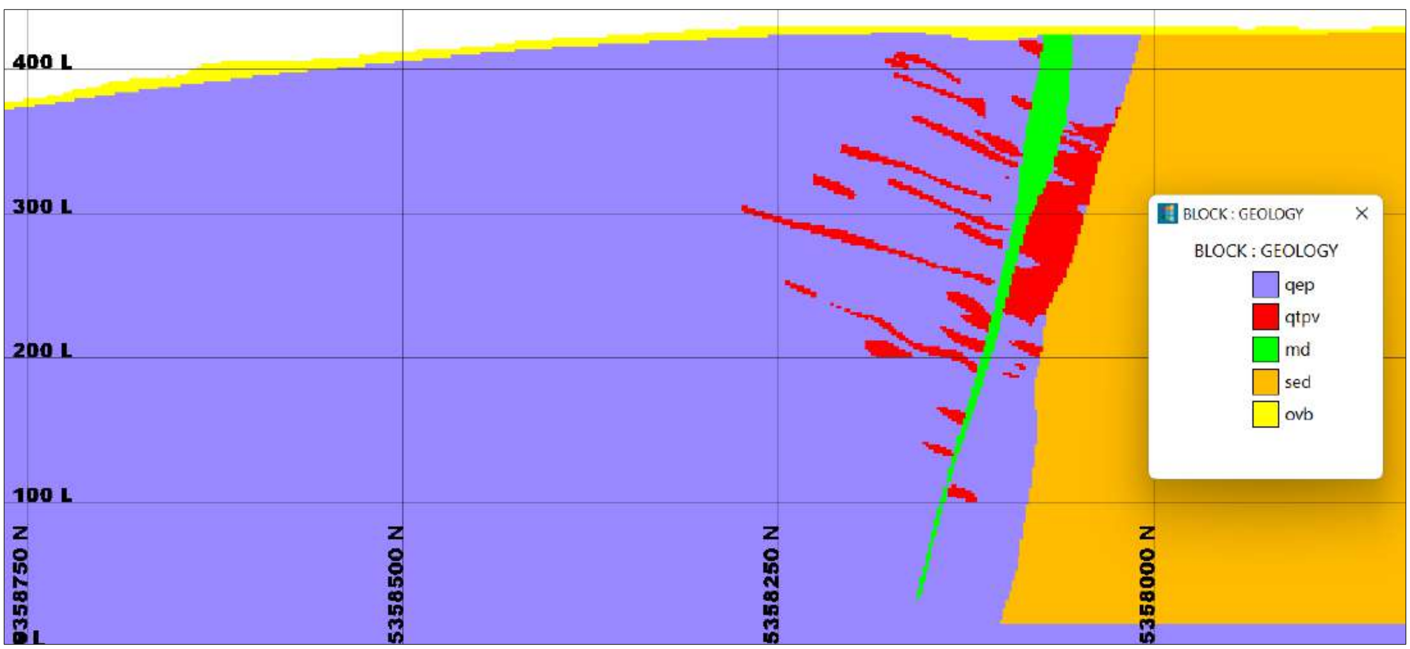
### 14.4.4 Berry Deposit Block Model

Table 14-26 shows the Berry block model extents. Figure 14-43 shows a typical block model section of the mineralized domain.

**Table 14.26: Block Model Extents**

| Item | X | Y | Z |
|---|---|---|---|
| Origin (m) | 489,150.102 | 5,357,633.584 | -100 |
| Offset Minimum (m) | - | - | - |
| Offset Maximum (m) | 1,980 | 996 | 600 |
| Parent Block Size (m) | 6.0 | 6.0 | 6.0 |
| Child Block Size (m) | 2.0 | 2.0 | 2.0 |
| Bearing/Dip/Plunge (degree) | 73.0 | - | - |

**Figure 14-43: Berry Typical Mineralized Domain Block Model Cross-Section**




Notes: qep (Quartz-Eye Porphyry), qtpv (Quartz-Tourmaline-Pyrite Veins), MD (Mafic Dyke), sed (Conglomerate), ovb (Overburden). Source: BOYD, 2022.

Similar to Leprechaun, four different block models were created for the MRE. The Hybrid Cap Model was chosen and used as the basis for the mineral resources reported for the Berry gold deposit.

### 14.4.5 Berry Block Estimations

The Vulcan-constructed block model was constrained by the mineralized domains described above. The current topographic surface was used to flag the topographic variable (vtopo). This variable is set to 100% for a block completely below the surface and to 0% for a block completely above the surface. Blocks at the topographic surface were assigned a proportion that lies below topography. A topo-adjusted density (rdensity) was assigned using the following formula:

$$rdensity = density * \left(\frac{vtopo}{100}\right)$$

This procedure ensures that blocks along the topographic surface have the correct density applied during pit optimization functions.

No attempt was made to apply a block percentage (percent of the block that is mineralized material and waste). Blocks are in or out of the mineralized domain. Grade interpolation runs were set up for only that material within the mineralized domain for gold. All domains were run for gold except for the overburden domain, which is assumed to not be mineralized.

Gold grades were interpolated from the composited assays described above using inverse distance (ID), inverse distance squared ($ID^2$), inverse distance cubed ($ID^3$), inverse distance to the fifth ($ID^5$), ordinary kriging (OK), and nearest neighbour (NN) methods. Three passes were run to assist in resource classification. Only composites flagged as within the same mineralization were considered in the grade estimation for each domain. Grade estimation parameters are shown in Tables 14.28 through 14.31 on the following page.

### 14.4.6 Berry Deposit Model Validation

The gold grade populated block model was reviewed to ensure reasonableness. These checks included:

- an overall review of the estimated metal values
- the impact of gold grade capping on the MRE
- QQ plots of the block model versus the composites
- a section-by-section comparison between the estimated $ID^3$ block grades and assays
- a statistical comparison of the raw assay values versus the composite values versus the block values.

The estimated block grades were visually examined to confirm that the estimation parameters were honoured and kept within the individual mineralized domains. Cross-sections were reviewed and the drillholes were checked to determine that the grades reasonably matched the estimated block grades. A statistical comparison of the raw assays, composites, and estimated block grades is shown in Table 14-27.

**Table 14.27: Berry Mineral Resource Estimation Model Statistics**

| Item | Domains | | | | |
|---|---|---|---|---|---|
| | All | QTPV | Mafic Dykes | Sediment | Quartz-Eye Porphyry |
| 1-Meter Composite Data | | | | | |
| Number of Samples | 47,565 | 14,668 | 1,499 | 454 | 30,804 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 490.61 | 490.61 | 13.68 | 19.10 | 65.97 |
| Average (g/t Au) | 0.76 | 2.11 | 0.17 | 0.15 | 0.16 |
| Standard Deviation | 4.84 | 8.41 | 0.65 | 0.97 | 1.09 |
| Coefficient of Variance | 6.35 | 3.99 | 3.75 | 6.65 | 6.88 |
| Block Model Results | | | | | |
| Number of Blocks | 1,691,675 | 1,183,392 | 16,040 | 6,089 | 486,154 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 124.06 | 124.06 | 5.07 | 1.91 | 18.57 |
| Average (g/t Au) | 1.12 | 1.56 | 0.11 | 0.08 | 0.08 |
| Standard Deviation | 2.76 | 3.19 | 0.27 | 0.21 | 0.23 |
| Coefficient of Variance | 2.47 | 2.05 | 2.37 | 2.51 | 2.73 |

### 14.4.7 Berry Resource Classification

The resource classifications used for the Berry deposit are based on which interpolation pass generated a block grade estimate and the distance to the nearest sample (measured and indicated only). The mineral resource classifications assigned include:

- Measured – Blocks estimated in Pass 1 (minimum of five composites) with a maximum nearest neighbour distance of 12 m are classified as measured.
- Indicated – Blocks estimated in Pass 2 (minimum of three composites) with a maximum nearest neighbour distance of 40 m in the QTPV and 15 m in the QEPOR are classified as indicated.
- Inferred – Blocks estimated in Pass 3 or 4 (minimum of two composites) are classified as inferred.

Tables 14-28, 14-29, 14-30 and 14-31 outline the Berry QTPV, MD, SED and QEP grade estimation parameters used for the MRE, respectively.

**Table 14.28: Berry QTPV Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -5 | -5 | -5 | -5 |
| Dip (Degrees) | -35 | -35 | -35 | -35 |
| Major (m) | 46.0 | 46.0 | 46.0 | 115.0 |
| Semi-Major (m) | 50.0 | 50.0 | 50.0 | 125.0 |
| Minor (m) | 12.0 | 12.0 | 12.0 | 12.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | Measured | Indicated | Inferred | Inferred |

**Table 14.29: Berry MD Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -5 | -5 | -5 | -5 |
| Dip (Degrees) | -35 | -35 | -35 | -35 |
| Major (m) | 18.0 | 18.0 | 18.0 | 45.0 |
| Semi-Major (m) | 20.0 | 20.0 | 20.0 | 50.0 |
| Minor (m) | 16.0 | 16.0 | 16.0 | 16.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | --- | --- | Inferred | Inferred |

**Table 14.30: Berry SED Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -5 | -5 | -5 | -5 |
| Dip (Degrees) | -35 | -35 | -35 | -35 |
| Major (m) | 10.0 | 10.0 | 10.0 | 25.0 |
| Semi-Major (m) | 10.0 | 10.0 | 10.0 | 25.0 |
| Minor (m) | 10.0 | 10.0 | 10.0 | 10.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | --- | --- | Inferred | Inferred |

**Table 14.31: Berry QEP Domain Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -5 | -5 | -5 | -5 |
| Dip (Degrees) | -35 | -35 | -35 | -35 |
| Major (m) | 27.0 | 27.0 | 27.0 | 67.5 |
| Semi-Major (m) | 31.0 | 31.0 | 31.0 | 77.5 |
| Minor (m) | 12.0 | 12.0 | 12.0 | 12.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 15 | --- | --- |
| Resource Classification | --- | Indicated | Inferred | Inferred |

#### 14.4.8 Berry Mineral Resource Reporting and Evaluation of Reasonable Prospects of Economic Extraction

The Berry mineral resources may be amenable to a combination of open pit and underground mining methods. BOYD developed a conceptual pit shell (the economic open pit shell) using the Lerchs-Grossman method as provided by the GEOVIA Whittle software. Portions of the block model within the pit shell demonstrate “reasonable prospects for eventual economic extraction" by open pit mining. From this shell, a conceptual open pit mine was designed and used to constrain the mineral resources. Portions of the block model which are external to the conceptual pit shell but satisfy cut-off grade criteria for an appropriate underground extraction method, are considered to show "reasonable prospects for eventual economic extraction" by underground mining methods.

#### 14.4.8.1 Economic Assumption Parameters Used for Pit Optimization and Underground Cut-off

The operating assumptions (economic and gold recovery) used for the Whittle economic open pit optimization are shown in Table 14-32; the operating assumptions (economic and gold recovery) used for the calculation of an underground cut-off grade is shown in Table 14-33.

For mineral resource reporting, a cut-off grade of 0.30 g/t gold was used for open pit, and a cut-off grade of 1.36 g/t gold was used for underground. The assumed overall pit slope in Whittle was assumed to be 48°. The slope does not include an allowance for ramps.

Using these assumptions, a Whittle economic pit optimization was completed, and an economic open pit shell generated. This pit shell was used to design a conceptual open pit, which is shown in Figure 14-44.

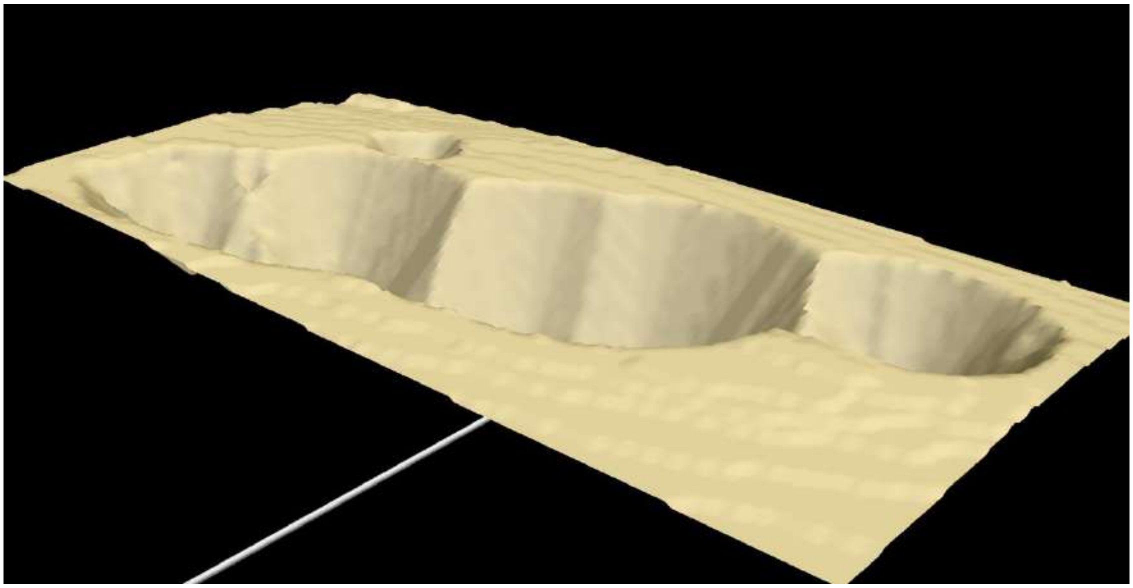
**Table 14.32: Berry Open Pit Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Waste Mining Cost | 2.70 | C$/t waste |
| Mill Feed Mining Cost | 3.80 | C$/t mill feed |
| Mill Processing Cost | 15.20 | C$/t mill feed |
| G&A Cost | 5.30 | C$/t mill feed |
| Mill Gold Recovery (at cut-off) | 93.9 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,800 | US$/troy oz |
| Mill Cut-off | 0.30 | g/t Au |

**Table 14.33: Berry Underground Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Mill Feed Mining Cost | 75.00 | C$/t mill feed |
| Processing Cost | 15.20 | C$/t material |
| G&A Cost | 5.30 | C$/t material |
| Recovery (at cut-off) | 94.8 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,800 | US$/troy oz |
| Calculated Cut-off | 1.36 | g/t Au |

**Figure 14-44: Berry Whittle Open Pit Shell**



Source: BOYD, 2022

### 14.4.9 Berry Mineral Resource Statement

Marathon Gold's Berry deposit measured, indicated, and inferred MREs were reported in accordance with CIM Definition Standards and Best Practice Guidelines for Mineral Resources and Reserves (CIM, 2014, 2019) and the disclosure rule NI 43-101. The effective date for the Berry deposit MRE is June 15, 2022.

The mineral resources presented here were estimated using a block model with a block size of 6 m by 6 m by 6 m sub-blocked to a minimum block size of 2 m by 2 m by 2 m using $ID^3$ methods for grade estimation.

All MREs are reported using an open pit gold cut-off of 0.30 g/t Au and an underground gold cut-off of 1.36 g/t Au. Material between a 0.30 Au g/t value and 0.70 Au g/t is assumed to be low grade material. Material above a 0.70 Au g/t is assumed to be high grade material. Samples with extreme high gold grades were given a limited area of influence which was applied during grade estimation by mineralized domain.

The MREs do not include a detailed pit or underground design, only an economic pit shell was used to determine the in-pit mineral resources. The underground mineral resources are that material outside of the in-pit mineral resources above the stated underground cut-off grade.

The 2022 Marathon Gold's Berry deposit MRE (Table 14-34) has been classified as measured, indicated, and inferred resources according to recent CIM Definition Standards (CIM, 2014). The classification of the Berry deposit resources was based on geological confidence, data quality, and grade continuity. All reported open pit MREs occur within a pit shell optimized using a gold price of US$1,800 per troy ounce.

The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 14.34: Mineral Resource Estimate for the Berry Deposit**

| Mining Method | Resource Classification | Gold Cutoff Grade (g/t) | Tonnes | Au (g/t) | Au (Troy Oz) |
|---|---|---|---|---|---|
| Open Pit - High Grade | Measured | 0.70 | 4,306,000 | 3.47 | 480,900 |
| Open Pit - High Grade | Indicated | 0.70 | 6,211,000 | 2.42 | 482,200 |
| Open Pit - High Grade | Measured + Indicated | 0.70 | 10,517,000 | 2.85 | 963,100 |
| Open Pit - High Grade | Inferred | 0.70 | 2,277,000 | 2.25 | 164,900 |
| Open Pit - Low Grade | Measured | 0.30 | 2,372,000 | 0.48 | 36,700 |
| Open Pit - Low Grade | Indicated | 0.30 | 3,967,000 | 0.47 | 60,500 |
| Open Pit - Low Grade | Measured + Indicated | 0.30 | 6,339,000 | 0.48 | 97,200 |
| Open Pit - Low Grade | Inferred | 0.30 | 2,463,000 | 0.45 | 35,400 |
| Total Open Pit | Measured | 0.30 | 6,678,000 | 2.41 | 517,600 |
| Total Open Pit | Indicated | 0.30 | 10,178,000 | 1.66 | 542,700 |
| Total Open Pit | Measured + Indicated | 0.30 | 16,856,000 | 1.96 | 1,060,300 |
| Total Open Pit | Inferred | 0.30 | 4,740,000 | 1.31 | 200,300 |
| Underground | Measured | 1.36 | 73,000 | 3.72 | 8,700 |
| Underground | Indicated | 1.36 | 230,000 | 2.32 | 17,100 |
| Underground | Measured + Indicated | 1.36 | 303,000 | 2.65 | 25,800 |
| Underground | Inferred | 1.36 | 592,000 | 2.87 | 54,600 |
| Open Pit + Underground | Measured | 0.30 | 6,751,000 | 2.43 | 526,300 |
| Open Pit + Underground | Indicated | 0.30 | 10,408,000 | 1.67 | 559,800 |
| Open Pit + Underground | Measured + Indicated | 0.30 | 17,159,000 | 1.97 | 1,086,100 |
| Open Pit + Underground | Inferred | 0.30 | 5,332,000 | 1.49 | 254,900 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Sprite deposit MRE is November 20, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR**. 6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available.**7.** Numbers may not add or multiply correctly due to rounding.

## 14.5 Marathon Deposit Mineral Resource Estimate

Marathon completed additional exploration, advanced grade control drilling, and a Televiewer structural study on the Marathon deposit. This additional information was incorporated into an updated MRE using and improved geological interpretation. There were also updates to the technical and economic parameters used to determine the in-pit MRE.

The Marathon mineral resource is contained in a series of flat-lying, gold-bearing QTPV with an azimuth of 135°, a plunge of 0°, and a dip of -25° (Vulcan rotations). Mineralization extends from this corridor within the QTPV zones towards the northwest and southeast along strike as well as along dip. Gold mineralization has been shown by exploration drilling to extend to 1,000 m below the topography and remains unexplored below this depth.

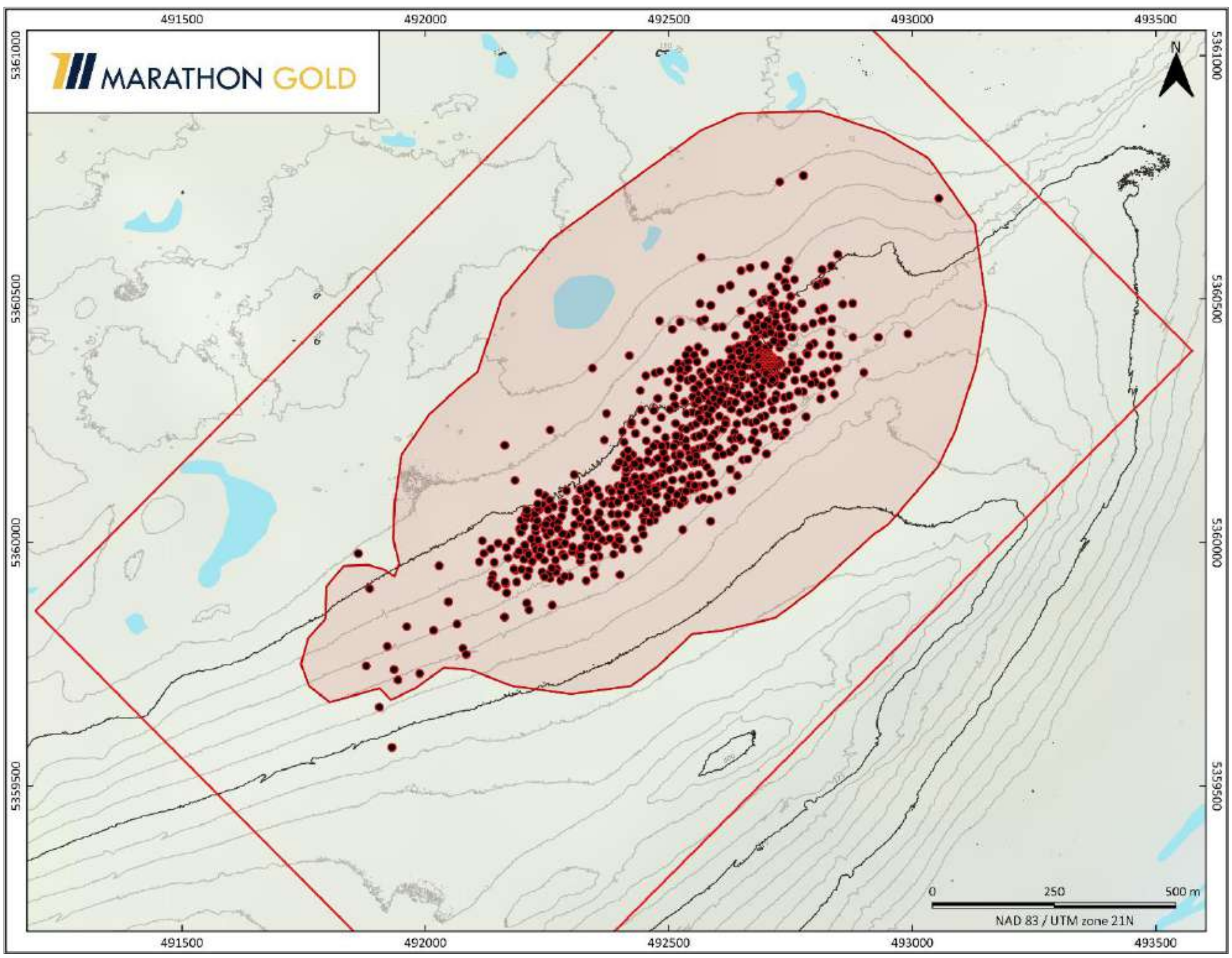
Gold mineralization is encountered in all major rock units (sediments, mafic dykes, quartz-eye porphyry, and gabbro) and although the majority of the mineral resource is contained in QTPV zones, some mineralization occurs in areas with no significantly logged QTPV mineralization. Many of the areas note minor amounts of QTPV in the descriptive geological logs.

### 14.5.1 Marathon Deposit Data

#### 14.5.1.1 Drillholes

The MRE reported herein for the Marathon deposit is based on all drillholes whose assays were available by May 14, 2022, and consists of 713 diamond core and RC drillholes totalling approximately 159,104 m (Figure 14-45).

**Figure 14-45: Marathon Drillhole Locations & Topography**




Source: Marathon, 2022

#### 14.5.1.2 Assays

Of the 109,456 gold assays available as of May 14, 2022, all were used. For unsampled intervals, gold grade values were set to zero. All gold grades were determined from fire or metallic screened assays. Total assayed sample length is 153,452 m.

#### 14.5.1.3 Density

There are 182 density measurements taken at the Marathon deposit. The results of these measurements are shown in Table 14-35. Block densities were assigned based on the block's domain or lithology type.

**Table 14.35: Marathon Density Measurements**

| Domain | No. Samples | Density t/m$^3$ |
|---|---|---|
| Mafic Dykes (MD) | 40 | 2.85 |
| Quartz-Tourmaline- Pyrite Veins (QTPV) | 51 | 2.69 |
| Sediments (SED) | 39 | 2.75 |
| Quartz-Eye Porphyry (QEPOR) | 52 | 2.69 |
| Overburden (OVB) | --- | 1.50 |

#### 14.5.1.4 Topography

The topography of the area around the Marathon deposit is shown in Figure 14-45. The Marathon deposit sits along the north edge of a northeast-trending ridge. The deposit area sits on the downward (towards the northwest) side of the ridge and is somewhat steep towards the top of the ridge while being flat towards the base of the ridge.

A Lidar topographic survey was completed in 2019. This survey is the topographic basis for all mineral resource related work described in this section.

#### 14.5.1.5 Marathon Resource Database Quality Control

BOYD, APEX, and Marathon validated the data pertaining to the MRE. Checks on the drillhole database included a search for unique, missing, and overlapping intervals, a total depth comparison, duplicate holes, property boundary limits, and a visual search for extreme or deviant survey values. A few minor discrepancies were identified and corrected.

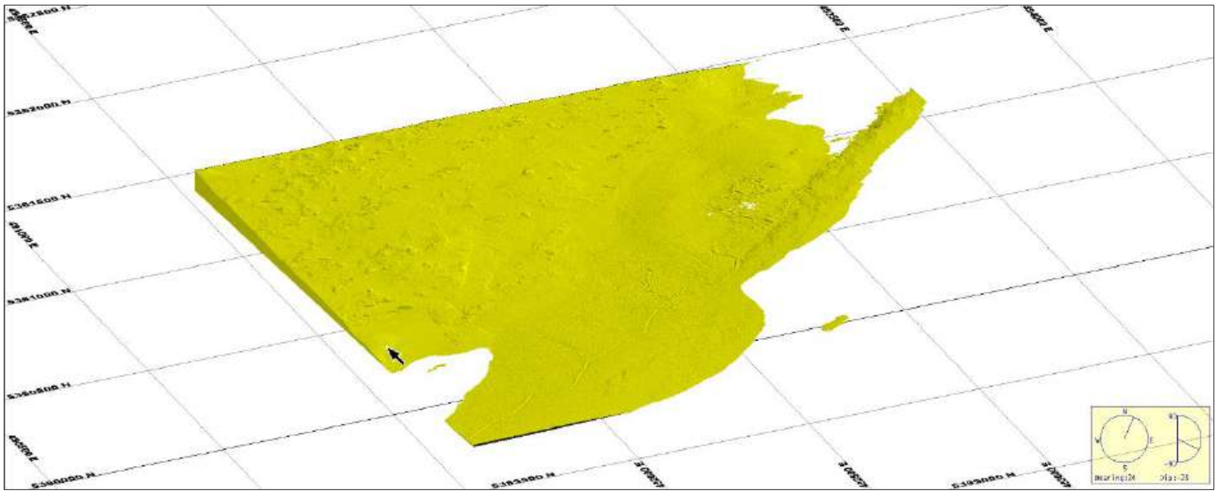
### 14.5.2 Marathon Deposit Data Analysis

#### 14.5.2.1 Geological Modelling

The Marathon deposit contains four major potentially mineralized domains: sediments (SED), quartz-eye porphyry (QEPOR), quartz-tourmaline-pyrite veins (QTPV), and mafic dyke (MD). Overburden was also modelled but is not considered as a potentially mineralized host. Figures 14-46 to 14-50 illustrate the results.

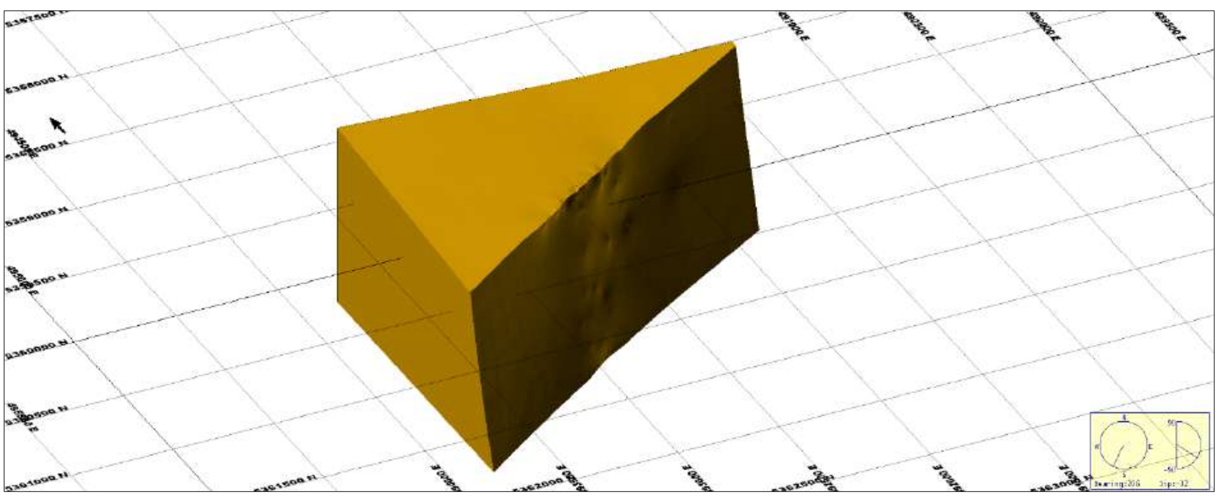
Geological modelling of these units, and the overburden domain, is based on the logged geology and interpretations made by Marathon Gold staff using the Leapfrog software. The QTPV wireframe used both logging and gold assays to support the interpretation. The models were exported to Vulcan and transferred to BOYD for review. BOYD and APEX concurred with Marathon Gold's interpretation as provided. The domain wireframes were used to flag drillholes used to construct the composites for later variography and geostatistics.

**Figure 14-46: Marathon Overburden Surface**



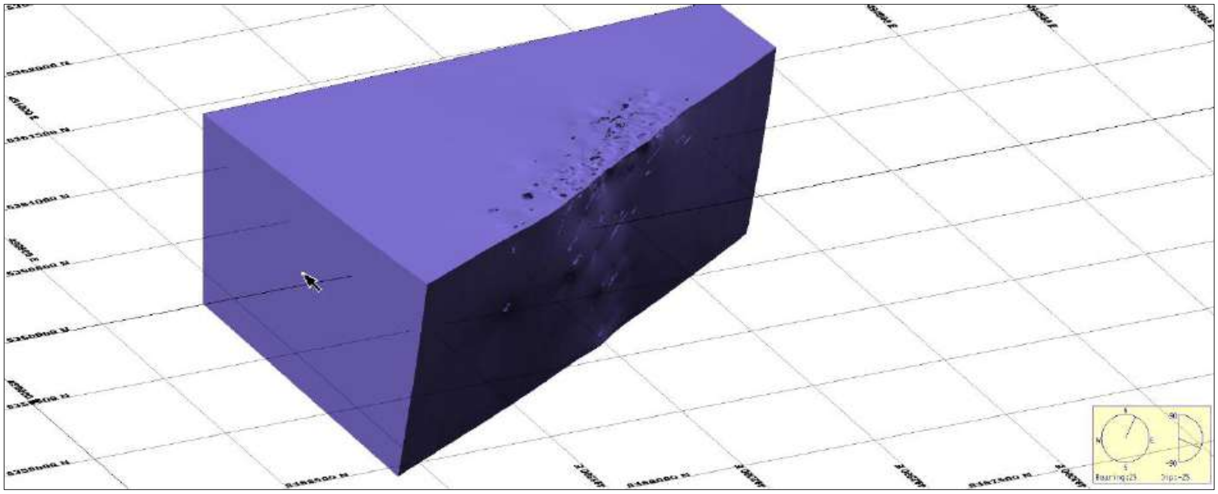
Source: BOYD, 2022

**Figure 14-47: Marathon SED Domain**



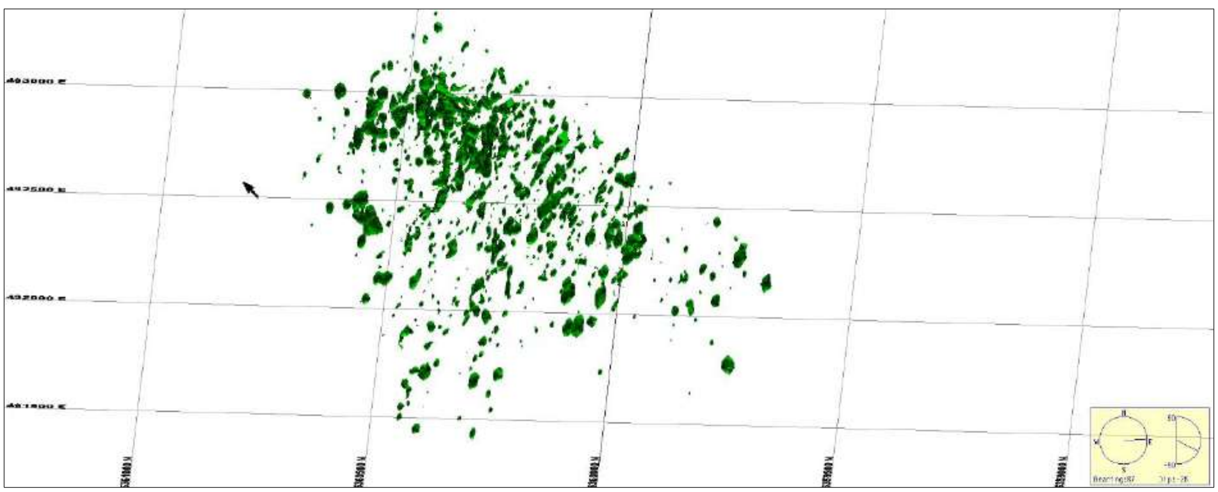
Source: BOYD, 2022

**Figure 14-48: Marathon QEPOR Domain**



Source: BOYD, 2022

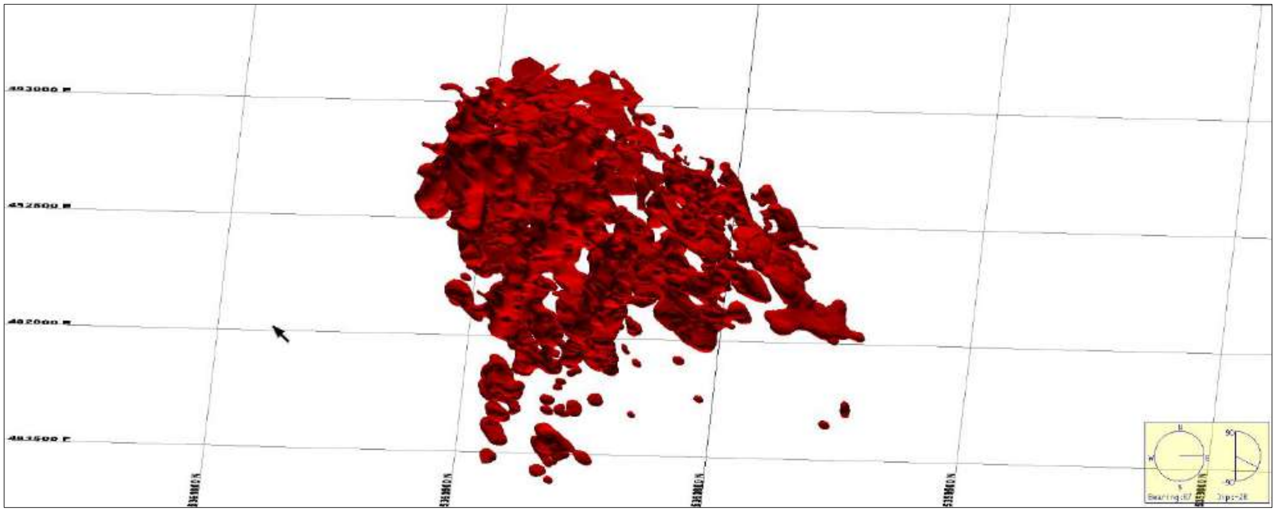
**Figure 14-49: Marathon MD Domain**



Source: BOYD, 2022

For the QTPV domain, two Leapfrog modelling tools were used, the vein system tool and the implicit intrusion tool with appropriate implicit controls. Twenty-three wireframes representing Set 1 veins as described in Section 7 were modelled. The other vein sets, for example Set 2 and Set 3, were not modelled given that they are less volumetrically significant and too obscured by the numerous Set 1 veins. A vein mid-surface plane was generated for each wireframe to be used to flag individual block search orientations. This allowed the use of a local anisotrophy model during grade estimation. The average orientation used an azimuth of 115° with a plunge of 0° (Vulcan rotations). The resulting wireframe was then clipped by the sediments and mafic dykes. The QTPV wireframe is a more refined solid than the previously used 100 ppb Au implicit shell and provides a significantly improved constraint for mineralization. The QTPV domains are shown in Figure 14-50.

**Figure 14-50: Marathon QTPV Solid**



Source: BOYD, 2022

### 14.5.2.2 Drillhole Descriptive Statistics

Descriptive statistics were generated for individual domains as well as the overall exploration database for gold grades. The results of this analysis are summarized in Table 14-36.

**Table 14.36: Marathon Raw Assay Descriptive Statistics**

| Item | Domain | | | | |
|---|---|---|---|---|---|
| | All | QTPV | Mafic Dykes (MD) | Sediment (SED) | Quartz-Eye Porphyry (QEPOR) |
| Number of Samples | 60,453 | 28,822 | 2,346 | 124 | 29,067 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 1313.71 | 1313.71 | 26.85 | 4.90 | 71.87 |
| Average (g/t Au) | 0.93 | 1.72 | 0.19 | 0.17 | 0.22 |
| Standard Deviation (g/t Au) | 8.89 | 12.77 | 1.00 | 0.51 | 1.22 |
| Coefficient of Variance | 9.54 | 7.43 | 5.31 | 3.07 | 5.62 |

Note: Assays ≥ 0.01 g/t Au reported.

### 14.5.2.3 Compositing

Sample length statistics were run on the assay database examining the number of samples for sample lengths in 0.5 m increments through a total length of 4.0 m. The purpose of this analysis is to determine what sample length was associated with the total number of samples.

In examining the results of this analysis, most samples with elevated gold mineralization were collected at a length of 1.0 m or less. A total of 60% of assays were collected at 1 meter or less containing 94% of the total contained metal. Based on this, a composite length of 1.0 m was selected and applied within the confines of the mineralized domains. Composites less than 1.0 m were divided by the run length (1.0 m). This composite length was selected to better reflect the actual breakdown of the mineralization in the individual drillholes within each mineralized zone.

#### 14.5.2.4 High-Value Grade Limits

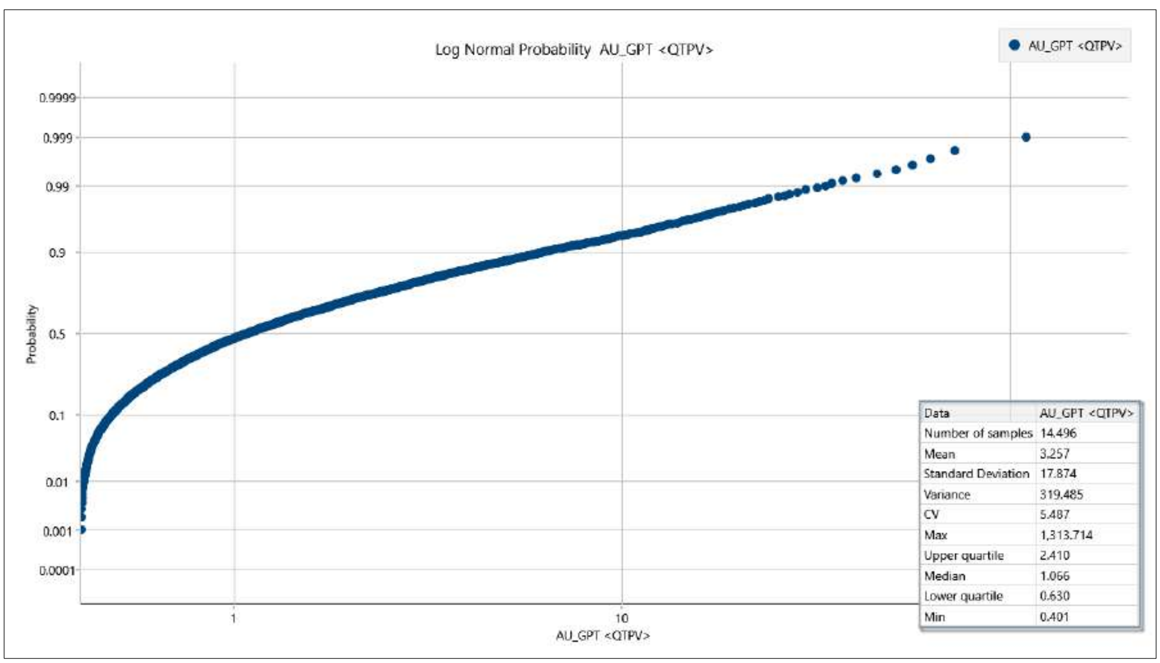
High outlier gold assays can skew the block grade estimate if they are not accounted for with some sort of limitation or grade capping applied to the assay database.

To determine high-value gold grade outliers, several methods were considered. These included a 1 troy ounce gold grade cap, the mean plus the standard deviation, four times the mean, five times the mean, lognormal, and decile analysis. These methods were reviewed, and the resulting potential grade caps/threshold were selected. For the Marathon deposit, the lognormal graph was considered to establish a capping value.

Extreme outlier gold capping levels were selected from the lognormal plot at the point where the data starts to break up or where there is a significant slope change in the plot. The lognormal probability plots for gold found in each mineralized domain are shown in Figures 14-51 through 14-54.

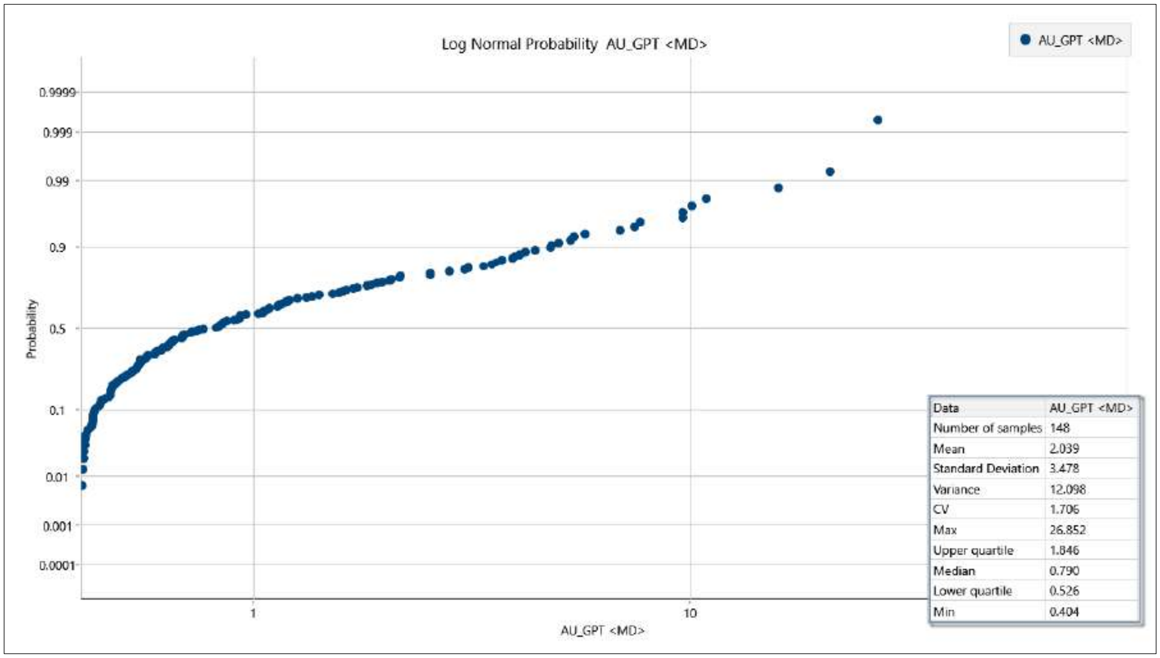
To further reduce the influence of high-grade composites, after the assays were capped, composite grades greater than a selected threshold level are restricted to smaller search distances. The threshold grade levels were chosen from lognormal probability graphs. The restricted search distances were selecting using indicator variograms. This process was completed for all potentially mineralized domains. Results are summarized in Table 14-37.

**Figure 14-51: Log Normal Probability for the QTPV Domain**



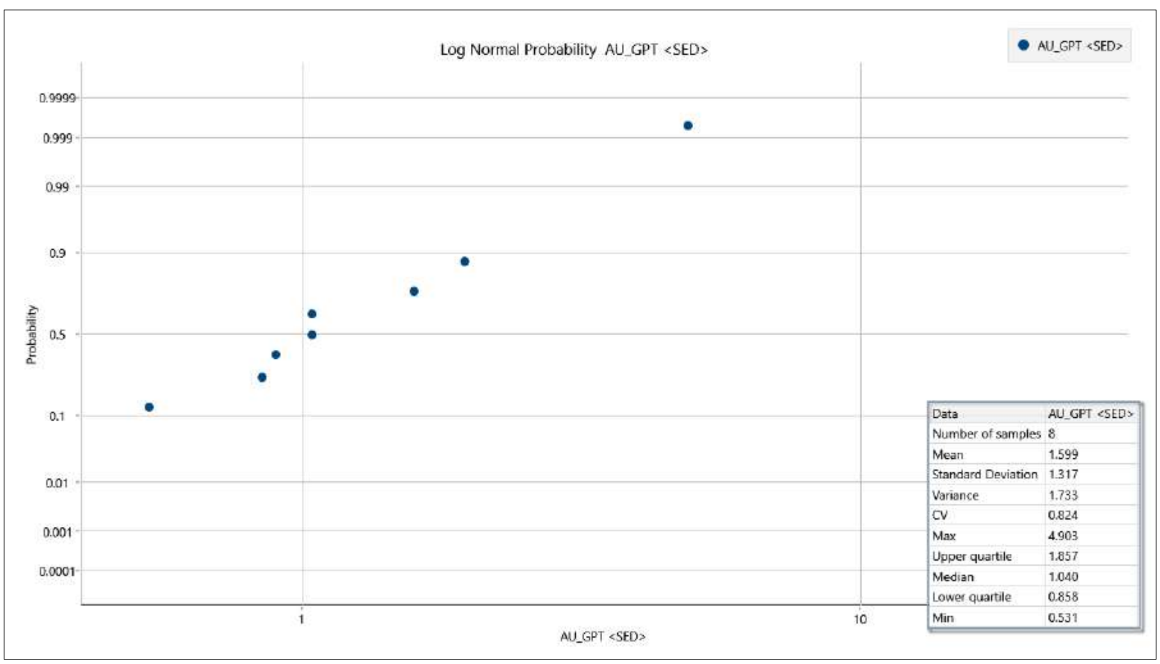

Source: BOYD, 2022

**Figure 14-52: Log Normal Probability for the MD Domain**



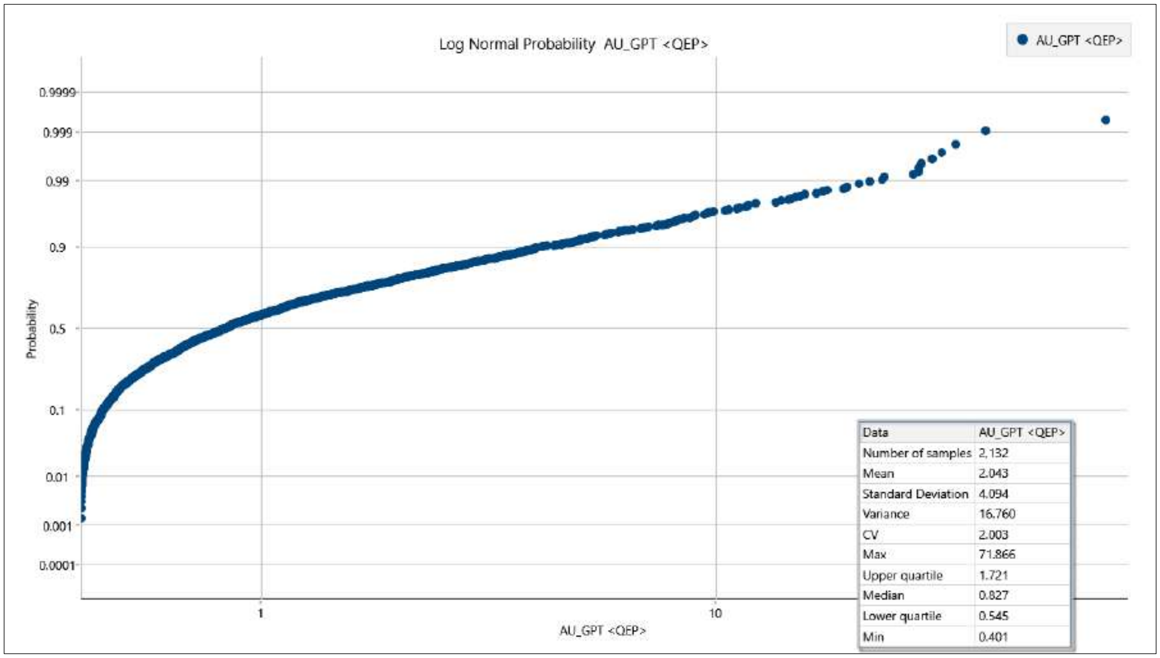

Source: BOYD, 2022

**Figure 14-53: Log Normal Probability for the SED Domain**




Source: BOYD, 2022

**Figure 14-54: Log Normal Probability for the QEPOR Domain**




Source: BOYD, 2022

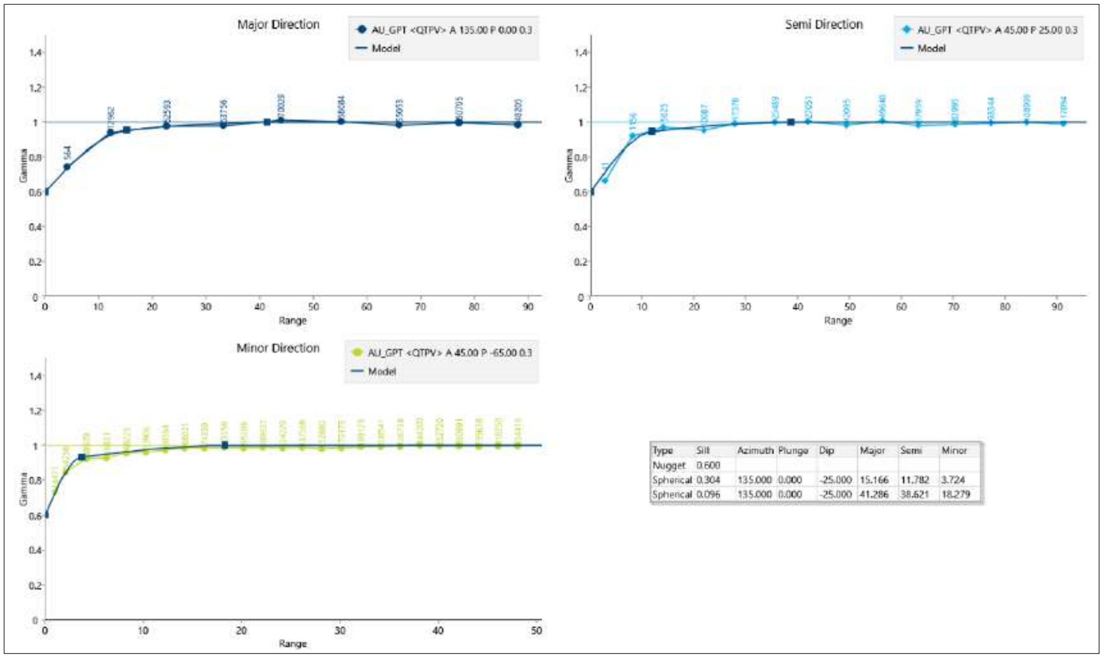
**Table 14.37: Marathon Threshold Grades and Limited Search Criteria**

| Item | Mineralized Domain | | | |
|---|---|---|---|---|
| | QTPV | MD | SED | QEP |
| Extreme Outlier Gold Cap (g/t) | 170.0 | 20.0 | 2.0 | 50.0 |
| Spatial Restriction Threshold Grade (g/t) | 55.0 | 7.0 | 2.0 | 26.0 |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Degrees) | 0 | 0 | 0 | 0 |
| Dip (Degrees) | -25 | -25 | -25 | -25 |
| Major Axis (m) | 11.46 | 44.59 | --- | 21.12 |
| Semi-Major Axis (m) | 12.07 | 2.77 | --- | 30.81 |
| Minor Axis (m) | 10.12 | 1 | --- | 4.17 |

### 14.5.3 Variography and Search Ellipsoids

The search ellipsoids for grade estimation were selected using variograms for each domain. Variograms were established in each domain for gold grades in the same structural orientations used to develop the mineralized solids. Gold grade variograms for each mineralized domain are shown in Figures 14-55 through 14-58. Based on these analyses, the search ellipsoid for each mineralized domain was established. Selected search ellipse distances and directions are listed in Section 14.5.5.

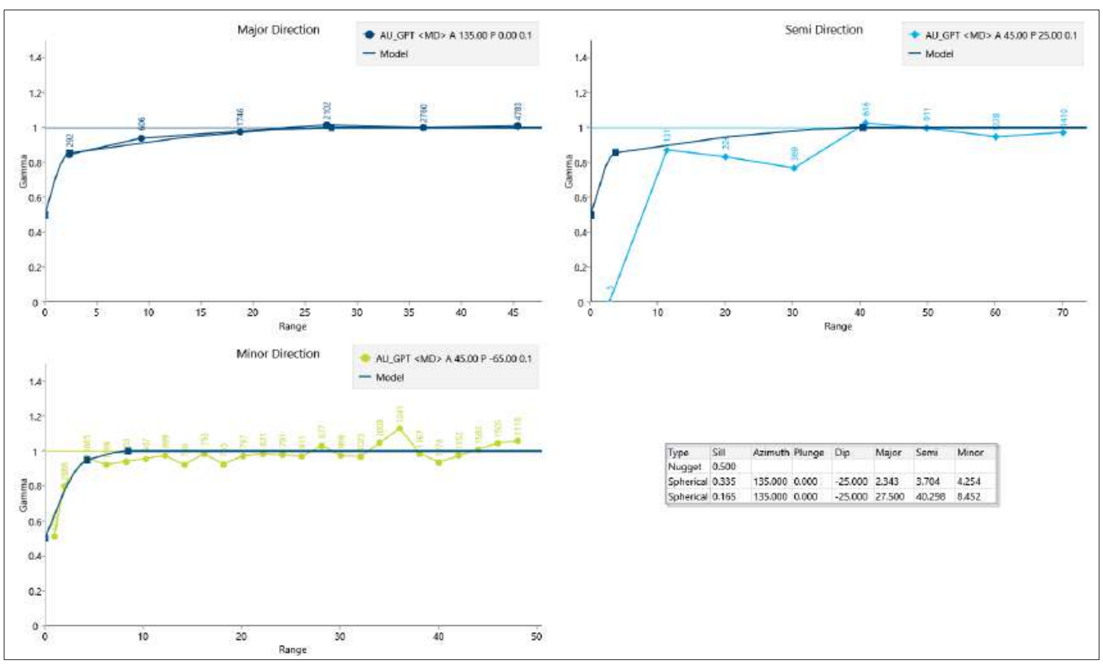
### Figure 14-55: Marathon QTPV Variograms




| Type | Sill | Azimuth | Plunge | Dip | Major | Semi | Minor |
|---|---|---|---|---|---|---|---|
| Nugget | 0.600 | | | | | | |
| Spherical | 0.304 | 135.000 | 0.000 | -25.000 | 15.166 | 11.782 | 3.724 |
| Spherical | 0.096 | 135.000 | 0.000 | -25.000 | 41.286 | 38.621 | 18.279 |

Source: BOYD, 2022

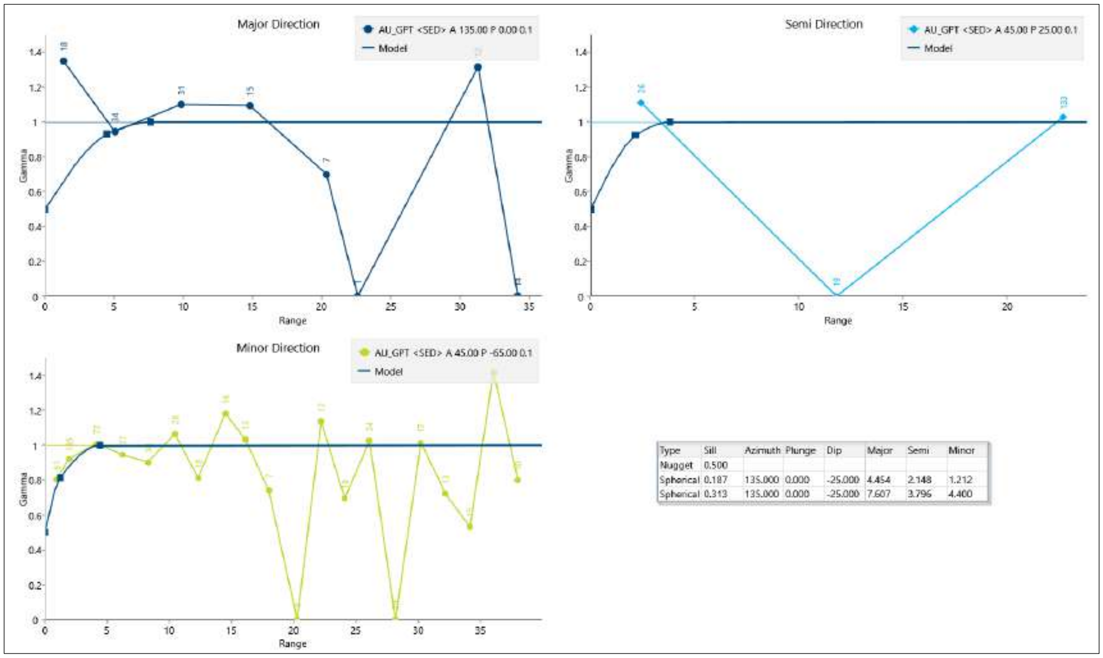
### Figure 14-56: Marathon MD Variograms




| Type | Sill | Azimuth | Plunge | Dip | Major | Semi | Minor |
|---|---|---|---|---|---|---|---|
| Nugget | 0.500 | | | | | | |
| Spherical | 0.335 | 135.000 | 0.000 | -25.000 | 2.343 | 3.704 | 4.254 |
| Spherical | 0.165 | 135.000 | 0.000 | -25.000 | 27.500 | 40.258 | 8.452 |

Source: BOYD, 2022

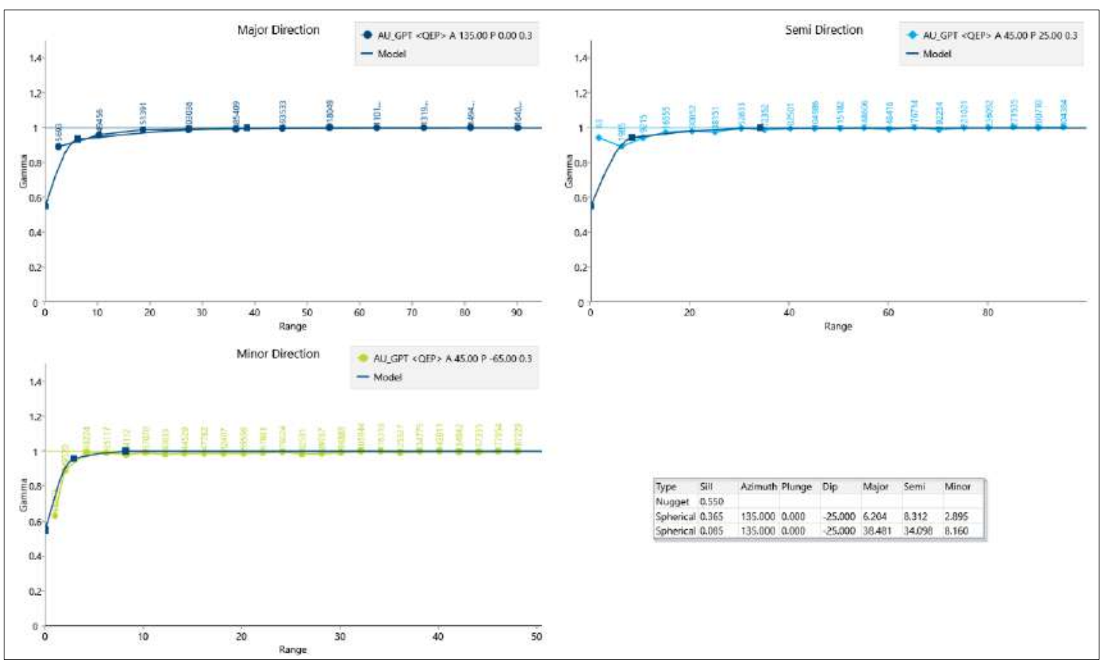
**Figure 14-57: Marathon SED Variograms**




| Type | Sill | Azimuth | Plunge | Dip | Major | Semi | Minor |
|---|---|---|---|---|---|---|---|
| Nugget | 0.500 | | | | | | |
| Spherical | 0.187 | 135.000 | 0.000 | -25.000 | 4.454 | 2.148 | 1.212 |
| Spherical | 0.313 | 135.000 | 0.000 | -25.000 | 7.607 | 3.796 | 4.400 |

Source: BOYD, 2020

**Figure 14-58: Marathon QEPOR Variograms**




| Type | Sill | Azimuth | Plunge | Dip | Major | Semi | Minor |
|---|---|---|---|---|---|---|---|
| Nugget | 0.550 | | | | | | |
| Spherical | 0.365 | 135.000 | 0.000 | -25.000 | 6.204 | 8.312 | 2.895 |
| Spherical | 0.085 | 135.000 | 0.000 | -25.000 | 38.481 | 34.098 | 8.160 |

Source: BOYD, 2022

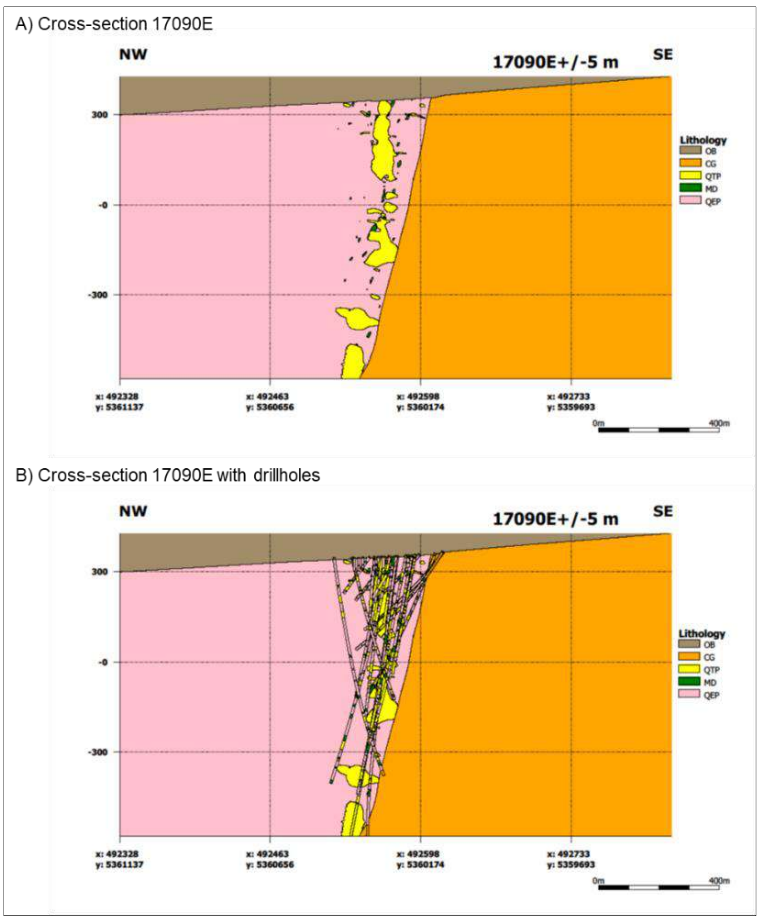
### 14.5.4 Marathon Deposit Block Model

Table 14-38 shows the Marathon block model extents. Figure 14-59 shows a typical block model section of the mineralized domain. Similar to Leprechaun and Berry, four different block models were created for the Marathon MRE. The Hybrid Cap Model was chosen and used as the basis for the mineral resources reported for the Marathon deposit.

**Table 14.38: Block Model Extents**

| Item | X | Y | Z |
|---|---|---|---|
| Origin (m) | 492,119.311 | 5,358,937.879 | -700 |
| Offset Minimum (m) | - | - | - |
| Offset Maximum (m) | 2,064 | 1,308 | 1,152 |
| Parent Block Size (m) | 6.0 | 6.0 | 6.0 |
| Child Block Size (m) | 2.0 | 2.0 | 2.0 |
| Bearing/Dip/Plunge (Degrees) | 45.0 | - | - |

**Figure 14-59: Typical Marathon Mineralized Domain Block Model Cross-Section**




Notes: ; OVB (Overburden), CG (Conglomerate), QTP (Quartz-Tourmaline-Pyrite Vein), MD (Mafic Dyke), QEP (Quartz-Eye Porphyry). Source: BOYD, 2022

### 14.5.5 Marathon Deposit Block Estimations

The Vulcan-constructed block model was constrained by the mineralized domains described above. The current topographic surface was used to flag the topographic variable (vtopo). This variable is set to 100% for a block completely below the surface and to 0% for a block completely above the surface. Blocks at the topographic surface were assigned a proportion that lies below topography. A topo-adjusted density (rdensity) was assigned using the following formula:

$$rdensity = density * \left(\frac{vtopo}{100}\right)$$

This procedure ensures that blocks along the topographic surface have the correct density applied during pit optimization functions.

No attempt was made to apply a block percentage (percent of the block that is mineralized material and waste). Blocks are in or out of the mineralized domain. Grade interpolation runs were set up for only that material within the mineralized domain for gold. All domains were run for gold except for the overburden domain, which is assumed to not be mineralized.

Using the composited assays, block grade interpolations were run in each mineralized domain for gold. Runs were completed using inverse distance (ID), inverse distance squared ($ID^2$), inverse distance cubed ($ID^3$), inverse distance to the fifth ($ID^5$), ordinary kriging (OK), and nearest neighbour (NN). Three passes were run to allow for use in resource classification. Only composites and blocks flagged as within the same mineralized domain were considered in the grade estimation. Grade estimation parameters are shown in Tables 14-39 through 14-42.

**Table 14.39: Marathon QTPV Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | 0 | 0 | 0 | 0 |
| Dip (Degrees) | -25 | -25 | -25 | -25 |
| Major (m) | 42.0 | 42.0 | 42.0 | 105.0 |
| Semi-Major (m) | 39.0 | 39.0 | 39.0 | 97.5 |
| Minor (m) | 19.0 | 19.0 | 19.0 | 19.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | Measured | Indicated | Inferred | Inferred |

**Table 14.40: Marathon Mafic Dykes Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | 0 | 0 | 0 | 0 |
| Dip (Degrees) | -25 | -25 | -25 | -25 |
| Major (m) | 28.0 | 28.0 | 28.0 | 70.0 |
| Semi-Major (m) | 41.0 | 41.0 | 41.0 | 102.5 |
| Minor (m) | 9.0 | 9.0 | 9.0 | 9.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | --- | --- | Inferred | Inferred |

**Table 14.41: Marathon Sediment Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | 0 | 0 | 0 | 0 |
| Dip (Degrees) | -25 | -25 | -25 | -25 |
| Major (m) | 8.0 | 8.0 | 8.0 | 20.0 |
| Semi-Major (m) | 4.0 | 4.0 | 4.0 | 10.0 |
| Minor (m) | 5.0 | 5.0 | 5.0 | 5.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 40 | --- | --- |
| Resource Classification | --- | --- | Inferred | Inferred |

**Table 14.42: Marathon Quartz-Eye Porphyry Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | 0 | 0 | 0 | 0 |
| Dip (Degrees) | -25 | -25 | -25 | -25 |
| Major (m) | 39.0 | 39.0 | 39.0 | 97.5 |
| Semi-Major (m) | 35.0 | 35.0 | 35.0 | 87.5 |
| Minor (m) | 9.0 | 9.0 | 9.0 | 9.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 5 | 3 | 2 | 2 |
| Maximum Number of Composites | 10 | 10 | 10 | 10 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |
| Maximum Distance to Nearest Neighbour (m) | 12 | 15 | --- | --- |
| Resource Classification | --- | Indicated | Inferred | Inferred |

### 14.5.6 Marathon Model Validation

The gold grade populated block model was reviewed to ensure reasonableness. These checks included:

- an overall review of the estimated metal values
- the impact of gold grade capping on the MRE
- QQ plots of the block model versus the composites
- a section-by-section comparison between the estimated $ID^3$ block grades and assays
- a statistical comparison of the raw assay values versus the composite values versus the block values.

The estimated block grades were visually examined to confirm that the estimation parameters were honoured and kept within the individual mineralized domains. Cross-sections were reviewed and the drillholes were checked to determine that the grades reasonably matched the estimated block grades. A statistical comparison of the raw assays, composites, and estimated block grades is shown in Table 14-43.

**Table 14.43: Marathon Composite & Mineral Resource Estimation Model Statistics**

| Item | Domains | | | | |
|---|---|---|---|---|---|
| | All | QTPV | Mafic Dykes | Sediment | Quartz-Eye Porphyry |
| 1-Meter Composite Data | | | | | |
| Number of Samples | 74,217 | 30,716 | 3,108 | 195 | 40,056 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 1313.71 | 1313.71 | 17.12 | 4.90 | 38.90 |
| Average (g/t Au) | 0.79 | 1.69 | 0.13 | 0.12 | 0.16 |
| Standard Deviation | 7.43 | 11.44 | 0.60 | 0.40 | 0.89 |
| Coefficient of Variance | 9.34 | 6.76 | 4.59 | 3.43 | 5.43 |
| Block Model Results | | | | | |
| Number of Blocks | 2,966,623 | 2,360,152 | 16,461 | 672 | 589,338 |
| Minimum (g/t Au) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Maximum (g/t Au) | 168.56 | 168.56 | 4.91 | 1.24 | 13.44 |
| Average (g/t Au) | 1.08 | 1.34 | 0.09 | 0.08 | 0.09 |
| Standard Deviation | 2.61 | 2.87 | 0.23 | 0.13 | 0.27 |
| Coefficient of Variance | 2.41 | 2.14 | 2.54 | 1.63 | 2.89 |

The impact of gold grade capping at Marathon showed that the hard-capped block model contained 91% of the no capping block model contained gold ounces. The threshold capped block model contained 91% of the no capping block model contained ounces. The hybrid capped model (used for the mineral resources) contained 89% of the no capping block model contained ounces.

### 14.5.7 Marathon Deposit Resource Classification

The mineral resource classification used on the Marathon deposit is based on which pass generated a grade estimate as well as the distance to the nearest neighbour (measured and indicated only). The mineral resource classifications assigned include:

- Measured – Blocks estimated in Pass 1 (minimum of five composites, minimum of three holes) with a maximum nearest neighbour distance of 12 m are classified as measured. Only QTPV blocks in the QTPV footwall domain could be flagged as measured.
- Indicated – Blocks estimated in Pass 2 (minimum of three composites) with a maximum nearest neighbour distance of 40 m in the QTPV domain and 15 m in the QEPOR domain are classified as indicated.
- Inferred – Blocks estimated in Pass 3 or 4 (minimum of two composites) are classified as inferred.

### 14.5.8 Marathon Mineral Resource Reporting and Evaluation of Reasonable Prospects of Economic Extraction

The Marathon mineral resources may be amenable to a combination of open pit and underground mining methods. BOYD developed a conceptual pit shell (the economic open pit shell) using the Lerchs-Grossman method as provided by the GEOVIA Whittle software. Portions of the block model within the pit shell demonstrate "reasonable prospects for eventual economic extraction" by open pit mining. From this shell, a conceptual open pit mine was designed and used to constrain the mineral resources. Portions of the block model which are external to the conceptual pit shell but satisfy cut-off grade criteria for an appropriate underground extraction method, are considered to show "reasonable prospects for eventual economic extraction" by underground mining methods.

#### 14.5.8.1 Economic Assumption Parameters Used for Pit Optimization and Underground Cut-off

The operating assumptions (economic and gold recovery) used for the Whittle economic open pit optimization are listed in Table 14-44. The operating assumptions used for the calculation of an underground cut-off grade listed in Table 14-45.

For mineral resource reporting, a cut-off grade of 0.30 g/t gold was used for open pit, and a cut-off grade of 1.36 g/t gold was used for underground. The assumed overall pit slope in Whittle was assumed to be 48°. The slope does not include an allowance for ramps.

**Table 14.44: Marathon Open Pit Economic Assumptions**

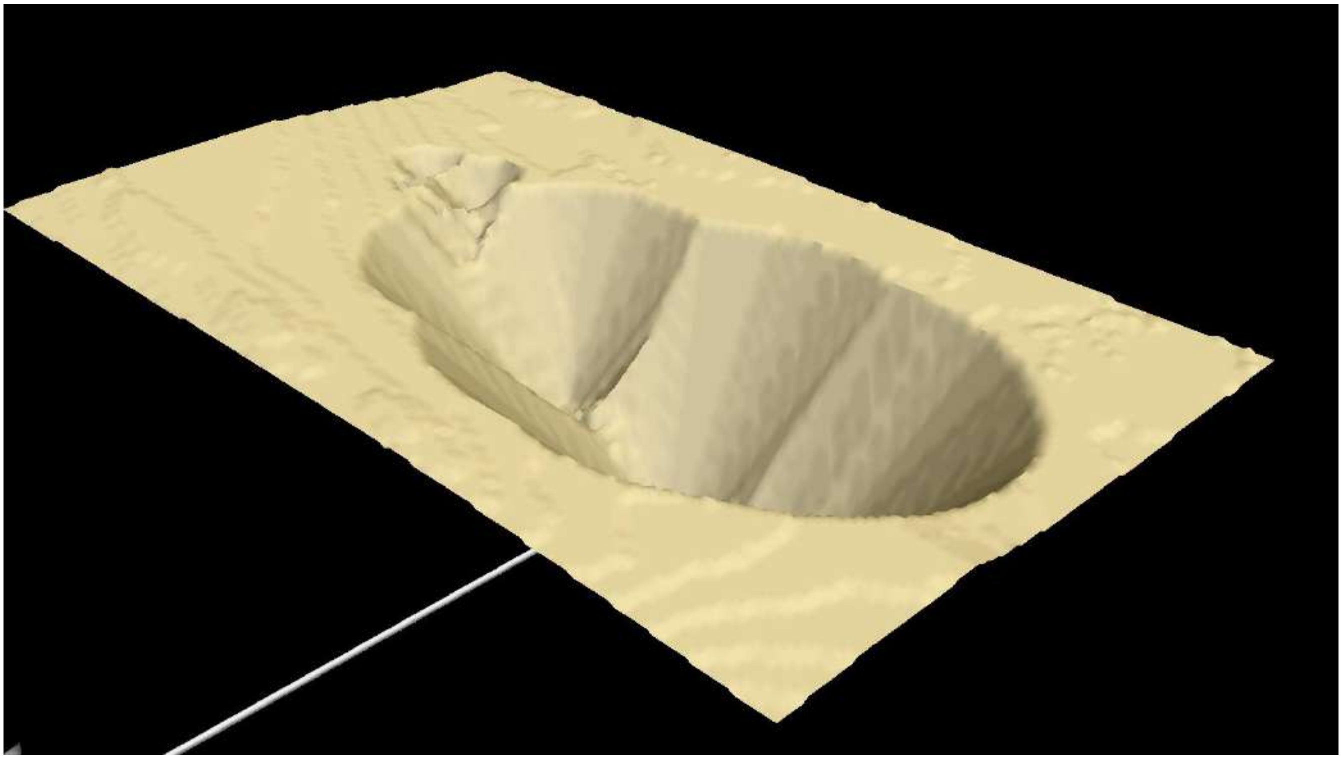
| Item | Value | Units |
|---|---|---|
| Waste Mining Cost | 2.70 | C$/t waste |
| Mill Feed Mining Cost | 3.80 | C$/t mill feed |
| Mill Processing Cost | 15.20 | C$/t mill feed |
| G&A Cost | 5.30 | C$/t mill feed |
| Mill Gold Recovery (at cut-off) | 93.9 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,800 | US$/troy oz |
| Mill Cut-off | 0.30 | g/t Au |

**Table 14.45: Marathon Underground Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Mill Feed Mining Cost | 75.00 | C$/t mill feed |
| Processing Cost | 15.20 | C$/t material |
| G&A Cost | 5.30 | C$/t material |
| Recovery (at cut-off) | 94.8 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,800 | US$/troy oz |
| Calculated Cut-off | 1.36 | g/t Au |

Using these assumptions, a Whittle economic pit optimization was completed, and an economic open pit shell generated. This pit shell was used to design a conceptual open pit, which is shown in Figure 14-60.

**Figure 14-60: Marathon Study Open Pit Shell**



Source: BOYD, 2022

#### 14.5.8.2 Opinion on Reasonable Prospects

The QP considers the Whittle pit parameters appropriate to evaluate the reasonable prospects for eventual economic extraction of the Marathon Deposit for the purpose of providing an MRE. The resources presented herein are not mineral reserves, and they do not have demonstrated economic viability. There has been an insufficient level of exploration to define the indicated and inferred resources as a measured mineral resource, and it is uncertain if further exploration will result in upgrading them to a measured resource category. There is no guarantee that any part of the resources identified herein will be converted to a mineral reserve in future.

### 14.5.9 Marathon Mineral Resource Statement

Marathon Gold's Marathon deposit measured, indicated, and inferred MREs were reported in accordance with CIM Definition Standards and Best Practice Guidelines for Mineral Resources and Reserves (CIM, 2014, 2019) and the disclosure rule NI 43-101. The effective date for the Marathon deposit MRE is June 15, 2022.

The mineral resources presented in Table 14-46 were estimated using a block model with a block size of 6 m by 6 m by 6 m sub-blocked to a minimum block size of 2 m by 2 m by 2 m using $ID^3$ methods for grade estimation.

The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 14.46: Marathon Mineral Resources**

| Mining Method | Resource Classification | Gold Cutoff Grade (g/t) | Tonnes | Au (g/t) | Au (Troy Oz) |
|---|---|---|---|---|---|
| Open Pit - High Grade | Measured | 0.70 | 9,075,000 | 2.74 | 800,600 |
| Open Pit - High Grade | Indicated | 0.70 | 8,084,000 | 2.24 | 581,900 |
| Open Pit - High Grade | Measured + Indicated | 0.70 | 17,159,000 | 2.51 | 1,382,500 |
| Open Pit - High Grade | Inferred | 0.70 | 2,543,000 | 2.62 | 213,800 |
| Open Pit - Low Grade | Measured | 0.30 | 5,776,000 | 0.48 | 89,000 |
| Open Pit - Low Grade | Indicated | 0.30 | 6,008,000 | 0.48 | 91,800 |
| Open Pit - Low Grade | Measured + Indicated | 0.30 | 11,784,000 | 0.48 | 180,800 |
| Open Pit - Low Grade | Inferred | 0.30 | 2,742,000 | 0.46 | 40,500 |
| Total Open Pit | Measured | 0.30 | 14,851,000 | 1.86 | 889,600 |
| Total Open Pit | Indicated | 0.30 | 14,092,000 | 1.49 | 673,700 |
| Total Open Pit | Measured + Indicated | 0.30 | 28,943,000 | 1.68 | 1,563,300 |
| Total Open Pit | Inferred | 0.30 | 5,285,000 | 1.50 | 254,300 |
| Underground | Measured | 1.36 | 252,000 | 4.32 | 35,000 |
| Underground | Indicated | 1.36 | 895,000 | 3.55 | 102,200 |
| Underground | Measured + Indicated | 1.36 | 1,147,000 | 3.72 | 137,200 |
| Underground | Inferred | 1.36 | 1,699,000 | 3.66 | 200,000 |
| Open Pit + Underground | Measured | 0.30 | 15,103,000 | 1.90 | 924,600 |
| Open Pit + Underground | Indicated | 0.30 | 14,987,000 | 1.61 | 775,900 |
| Open Pit + Underground | Measured + Indicated | 0.30 | 30,090,000 | 1.76 | 1,700,500 |
| Open Pit + Underground | Inferred | 0.30 | 6,984,000 | 2.02 | 454,300 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Sprite deposit MRE is November 20, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR**. 6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available.**7.** Numbers may not add or multiply correctly due to rounding.

All MREs are reported using an open pit gold cut-off of 0.30 g/t Au and an underground gold cut-off of 1.36 g/t Au. Material between a 0.30 Au g/t value and 0.70 Au g/t is assumed to be low grade material. Material above a 0.70 Au g/t is assumed to be high grade material. Samples with high gold grades were given a limited area of influence which was applied during grade estimation.

The MREs do not include a detailed pit or underground design, only an economic pit shell was used to determine the in-pit mineral resources. The underground mineral resources are that material outside of the in-pit mineral resources above the underground cut-off grade.

The 2022 Marathon Gold's Marathon deposit MREs are classified as measured, indicated, and inferred resources according to CIM Definition Standards (CIM, 2014). The classification of the Marathon deposit resources was based on geological confidence, data quality and grade continuity. All reported open pit MREs occur within a pit shell optimized using a gold price of US$1,800 per troy ounce. Mineral resources are not mineral reserves and do not have demonstrated economic viability.

## 14.6 Victory Deposit Mineral Resource Estimate

No additional exploration data were available to update the Victory deposit geological model and MRE. The Victory MREs remain the same as was reported in the previous April 15, 2021, Technical Report. The Victory mineral resource estimate has an effective date of November 20, 2020. The Victory MREs are therefore repeated in this technical report.

A description of the previous Victory MREs from the BOYD Technical Report (Farmer, 2020) is duplicated below.

The Victory MRE is contained in a series of flat-lying, gold-bearing QTPV with an azimuth of 135°, a plunge of -10°, and a dip of -20° (Vulcan rotations). Gold mineralization is associated at the intersection of the QTPV zones with a steeply dipping northeast-trending shear zone.

Potentially economic gold mineralization is encountered in the QTPV and TRJ domains. There is minor mineralization present in the other domains, but only a very limited amount of information in these areas was available and no attempt was made to include as part of the MRE.

### 14.6.1 Victory Deposit Data

#### 14.6.1.1 Drillholes

The estimates of mineral resources reported herein for the Victory deposit are based on all drillholes whose assays were available by March 6, 2014 and consist of 64 diamond core drillholes totalling approximately 8,781 m. Figure 14-61 shows the collars of these drillholes.

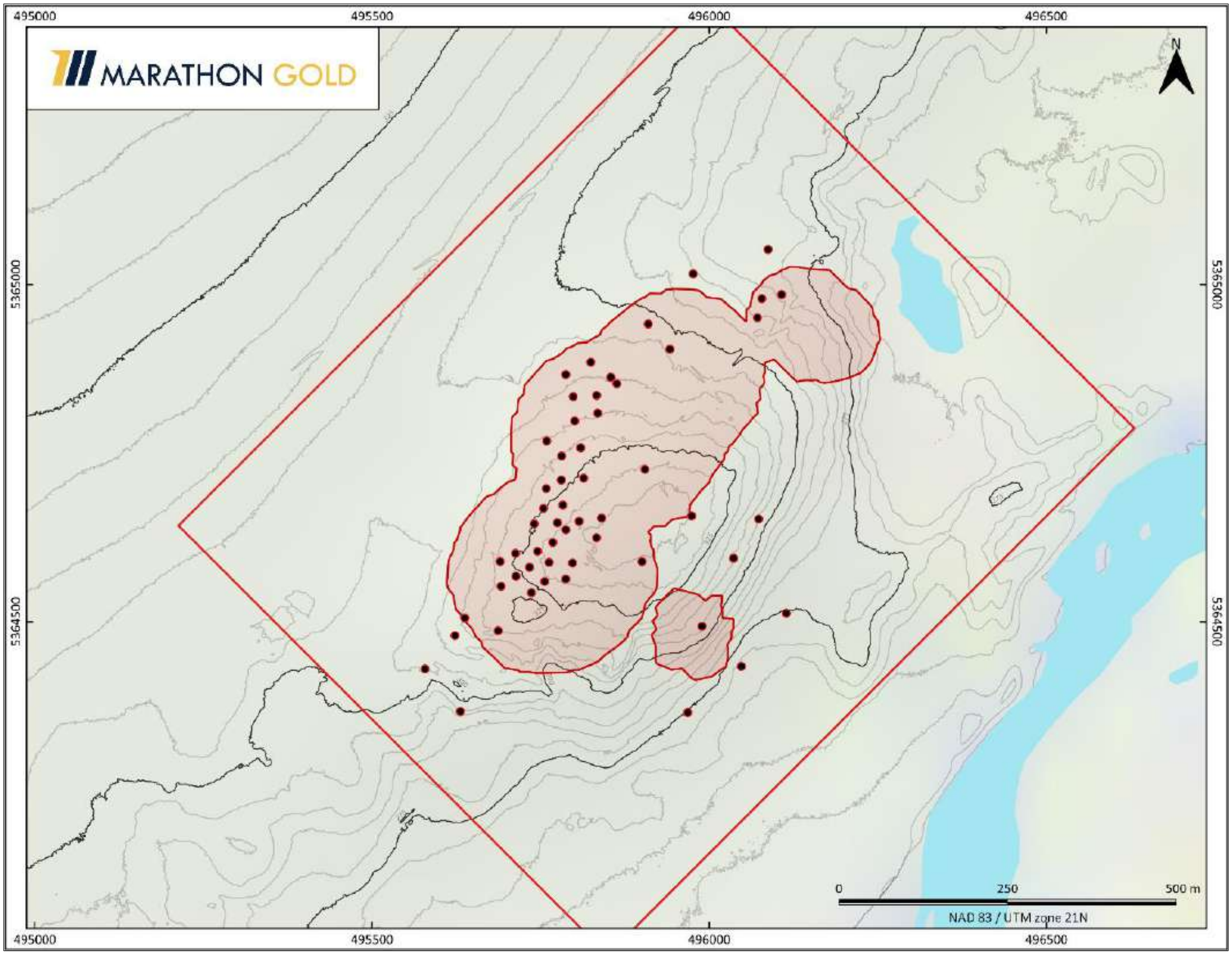
#### 14.6.1.2 Assays

Of the 4,169 gold assays available on March 6, 2014, all were used for the mineral resource estimation. For unsampled intervals, values were set to zero. All assays used were fire or metallic sieved assays. Total assayed sample length is 5,230 m.

#### 14.6.1.3 Density

There were 349 density measurements taken at the Victory deposit. The results of these measurements are shown in Table 14-47. Block densities were assigned based on the block's domain or lithology type.

**Figure 14-61: Victory Deposit Drillhole Locations & Topography**




Source: Marathon, 2018.

**Table 14.47: Victory Deposit Density Measurements**

| Domain | No. Samples | Density t/m$^3$ |
|---|---|---|
| Mafic Dykes (MD) | 56 | 2.72 |
| Quartz-Tourmaline- Pyrite Veins (QTPV) | 97 | 2.59 |
| Sediments (SED) | 2 | 2.68 |
| Trondhjemite (TRJ) | 194 | 2.60 |
| Overburden (OVB) | - | 1.50 |

#### 14.6.1.4 Topography

The topography of the area around the Victory deposit is shown on Figure 14-61. The Victory deposit sits on a steep hilltop protruding southeast from a northeast-trending ridge. Towards the south, the ridge drops steeply downward towards a creek drainage.

#### 14.6.1.5 Victory Resource Database Quality Control

BOYD, APEX, and Marathon validated the data pertaining to the MRE. Checks on the drillhole database included a search for unique, missing, and overlapping intervals, a total depth comparison, duplicate holes, property boundary limits, and a visual search for extreme or deviant survey values. A few minor discrepancies were identified and corrected.

### 14.6.2 Victory Deposit Data Analysis

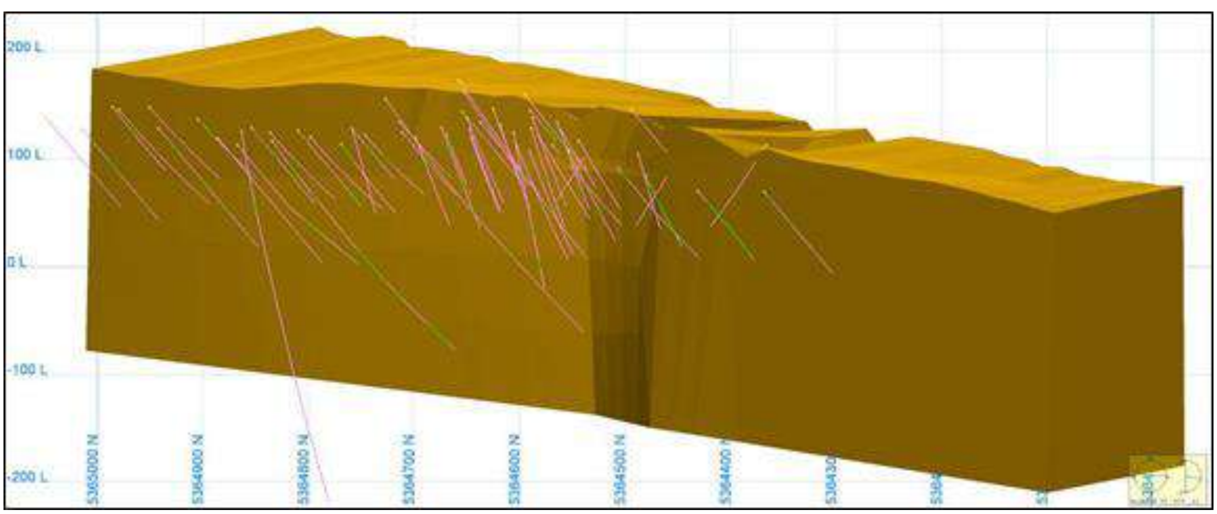
#### 14.6.2.1 Geological Modelling

The Victory deposit contains four major potentially mineralized domains. These domains are the SED, hanging wall TRJ, flat-lying QTPV, and the MD domain intruding into the TRJ and QTPV domains. Additionally, overburden was also noted in the drill logs, but was not considered as a potentially mineralized host.

Geological modelling of these domains is based on the logged geology, as well as interpretations made by Marathon Gold geologists. On every 10 m cross-section through the deposit, a line was drawn reflecting the actual or projected overburden surface below the topography. These lines were then used to construct the rock/overburden surface to constrain compositing, geological implicit models, as well as block modelling.

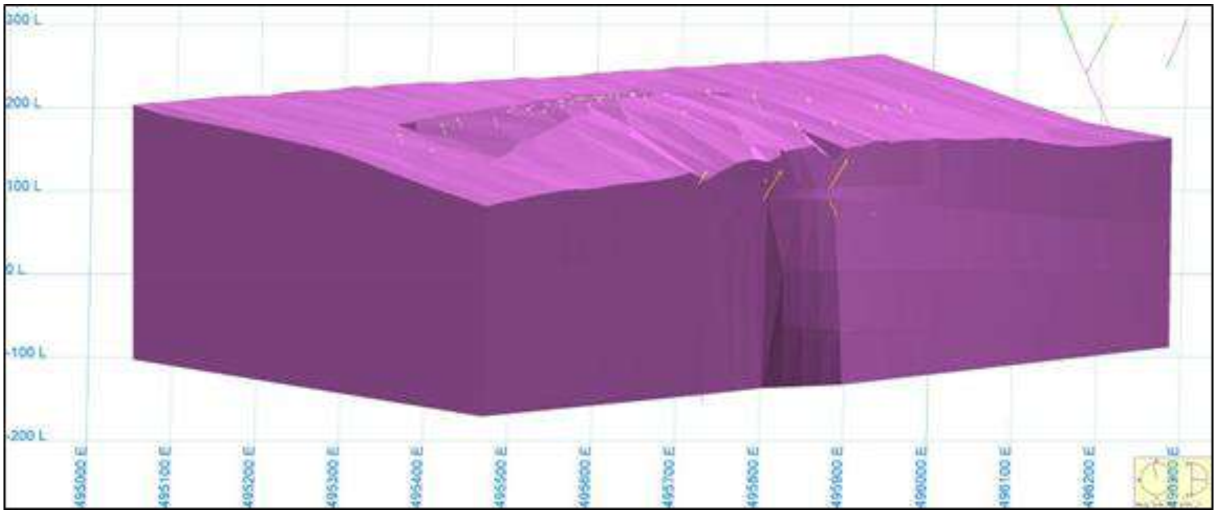
The SED domain is shown below in Figure 14-62. The TRJ domain is the remaining rock mass northwest of the SED wireframe domain and below the overburden horizon. The TRJ domain is shown in Figure 14-63.

**Figure 14-62: Victory Deposit SED Domain**




Source: BOYD, 2018

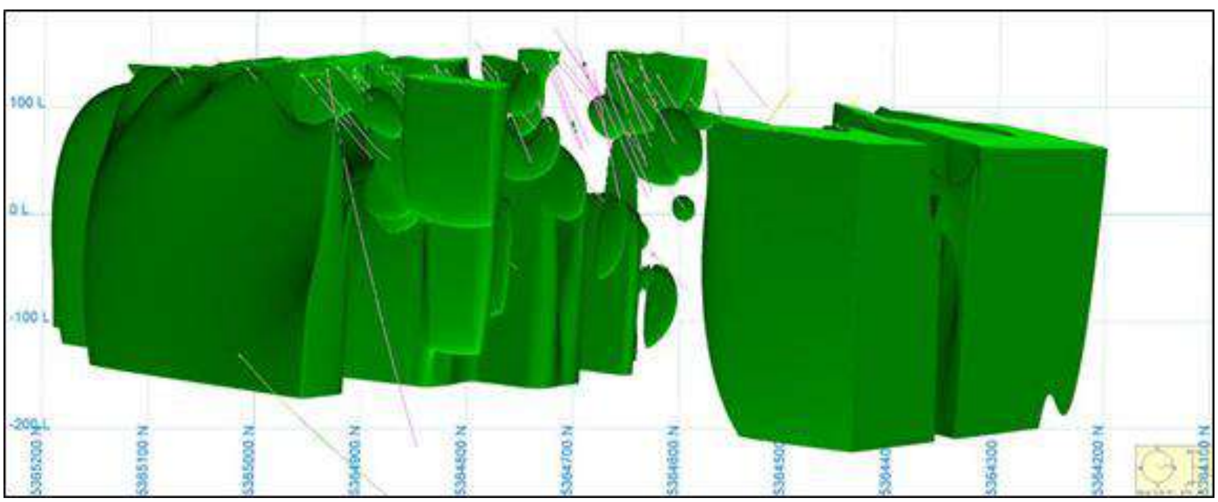
**Figure 14-63: Victory Deposit TRJ Domain**




Source: BOYD, 2018

For the MD domain, implicit modelling was used to develop a geological domain based on the drillhole intercepts within the Victory deposit drillhole database. The implicit model used an azimuth of 218°, plunge of 0°, and a dip of -85°. Based on discussions with Marathon Gold geologic staff, the mafic dykes have been truncated by the sediments and cut the QTPV zones; as such, MD domain wireframe is clipped by the sediments. The MD domain is shown in Figure 14-64.

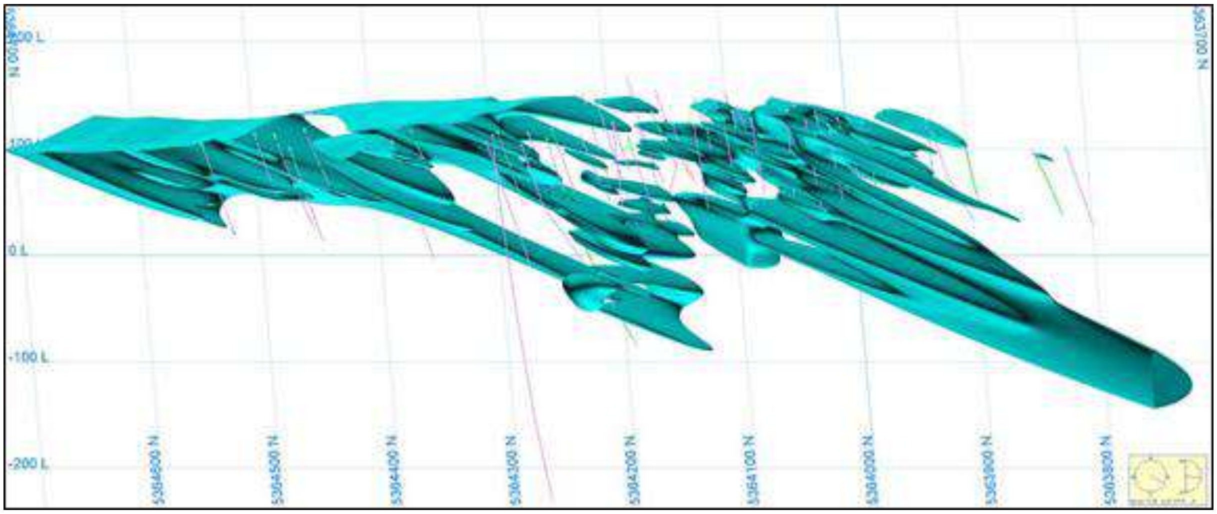
**Figure 14-64: Victory Deposit MD Domain**




Source: BOYD, 2018

For the QTPV domain, the same implicit modelling approach was used to develop the mineralized domain wireframe as the mafic dykes. The implicit model used an azimuth of 135°, plunge of -10°, and a dip of -20°. The resulting wireframe was then clipped by the sediments. The QTPV domain is shown in Figure 14-65.

**Figure 14-65: Victory Deposit QTPV Domain**




Source: BOYD, 2018

The TRJ and QTPV domains can be mineralized and were used to flag drillholes used to construct the composites for later variography and statistics.

### 14.6.2.2 Drillhole Descriptive Statistics

Descriptive statistics were generated for each individual domain, as well as for the overall exploration database for gold. The results of this analysis are summarized in Table 14-48.

**Table 14.48: Victory Deposit Raw Assay Descriptive Statistics**

| Item | All | QTPV | Trondhjemite (TRJ) |
|---|---|---|---|
| Number of Samples | 4,169 | 1,655 | 2,688 |
| Minimum (g/t Au) | 0.002 | 0.005 | 0.001 |
| Maximum (g/t Au) | 46.88 | 46.88 | 28.49 |
| Average (g/t Au) | 0.33 | 0.59 | 0.15 |
| Standard Deviation (g/t Au) | 1.83 | 2.61 | 0.91 |

### 14.6.2.3 Compositing

Sample length statistics were run on the assay database examining the number of samples for sample lengths in 1.0 m increments through a total length of 4.0 m. The purpose of this analysis is to determine what sample length was associated with the total number of samples.

Most samples with elevated gold mineralization were collected at a length of 1.0 m or less. Based on this, a composite length of 1.0 m was selected and applied within the confines of the mineralized domains. Composites less than 1.0 m were divided by the run length (1.0 m). This composite length was selected to better reflect the actual breakdown of the mineralization in the individual drillholes within each mineralized zone.

### 14.6.2.4 High-Value Grade Limits

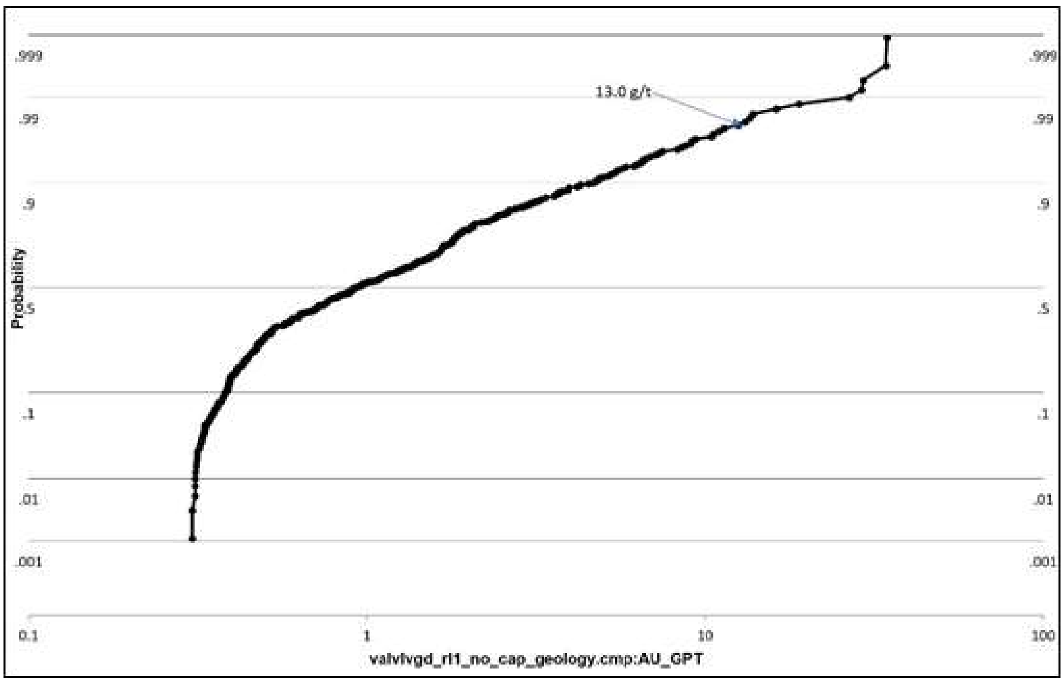
High outlier metal values can skew the resulting grade estimate if they are not accounted for with some sort of limitation or grade capping value applied to the assay database. To help develop a strategy to manage erratic high-grade assays, a lognormal probability plot was generated for gold in each mineralized domain. Threshold metal grades were selected at the point where the data start to break up or where there is a significant slope change in the plot. The lognormal probability plots for gold found in each mineralized domain are shown in Figures 14-66 and 14-67 on the following page.

The lognormal probability graphs above were used to determine a gold threshold grade to limit the area of influence of gold grades higher than the threshold. The area of influence was developed using the Vulcan Implicit Modeller to determine the size and extents of above threshold gold-bearing areas by producing a high gold grade wireframe. This process was completed for both potentially mineralized domains and the selected metal threshold grades are shown in Table 14-49.

**Table 14.49: Victory Deposit Gold Threshold Grades**

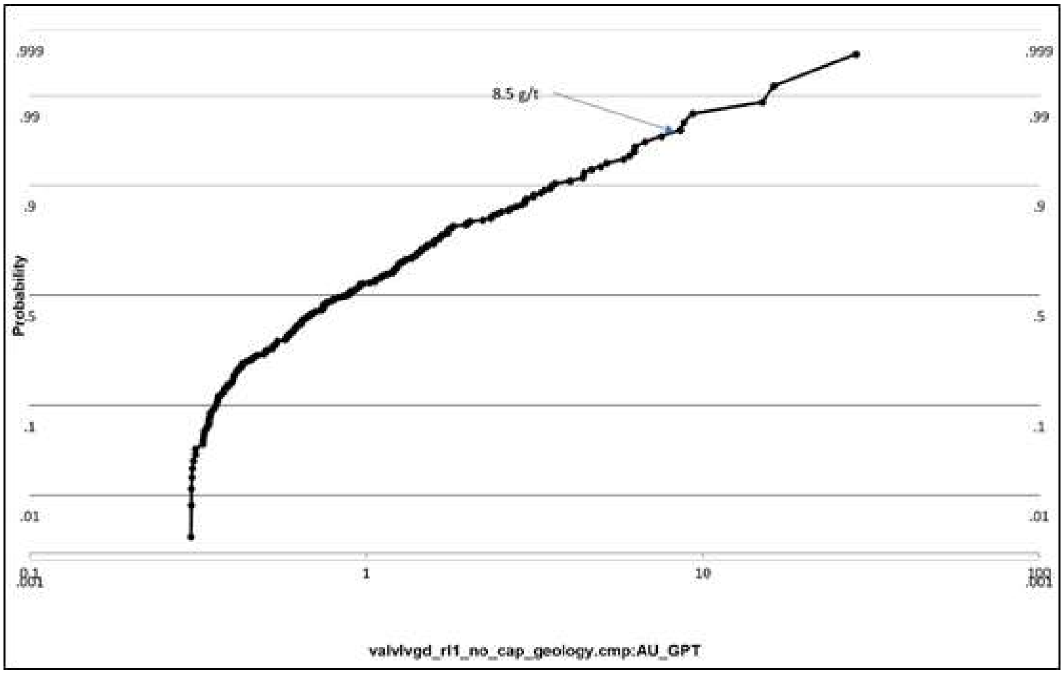
| Domain | Limited Search Ellipsoid | | | |
|---|---|---|---|---|
| | Threshold Au g/t | Major (m) | Semi-Major (m) | Minor (m) |
| QTPV | 13 | 20 | 20 | 8 |
| Trondhjemite (TRJ) | 8.5 | 20 | 20 | 10 |

**Figure 14-66: Victory Deposit QTPV Domain Lognormal Plot**




Source: BOYD, 2018

**Figure 14-67: Victory Deposit TRJ Domain Lognormal Plot**

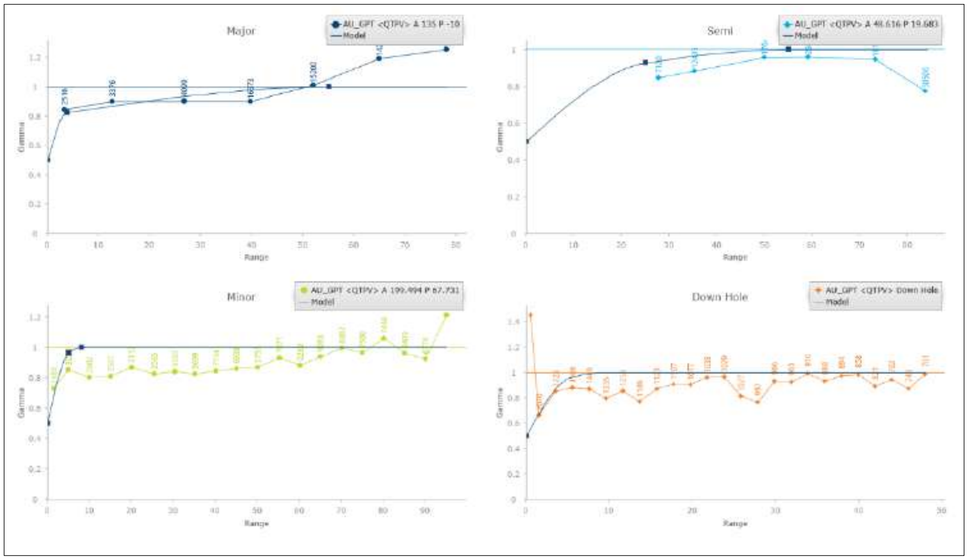



Source: BOYD, 2018

### 14.6.3 Variography and Search Ellipsoids

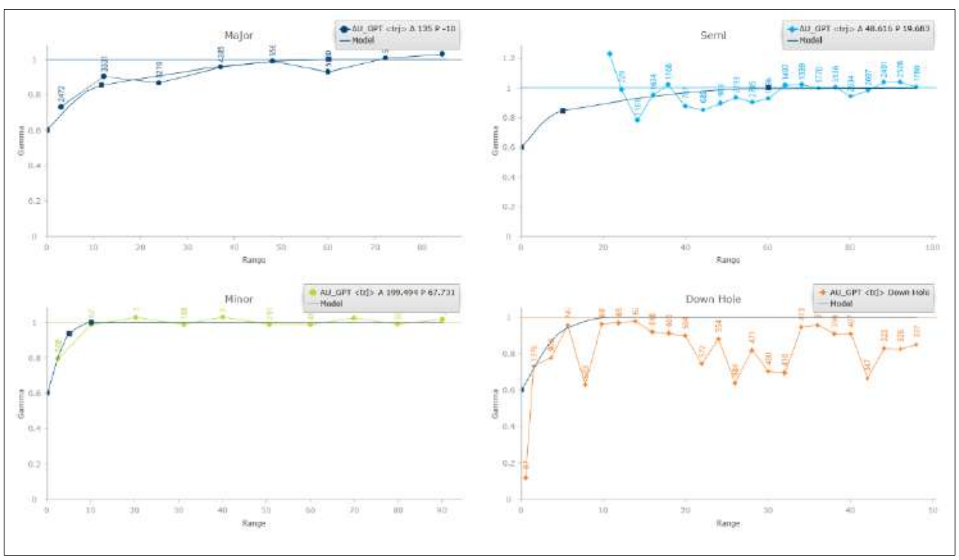
The search ellipsoids for grade estimation were chosen based on variograms of each domain. Variograms were generated for each domain in the same structural orientations used to develop the mineralized domain wireframes. Gold grade variograms for each domain are shown in Figures 14-68 and 14-69. Based on these analyses, the search ellipsoid for each mineralized domain was established.

**Figure 14-68: Victory Deposit QTPV Variograms**




Source: BOYD, 2018

**Figure 14-69: Victory Deposit TRJ Variograms**

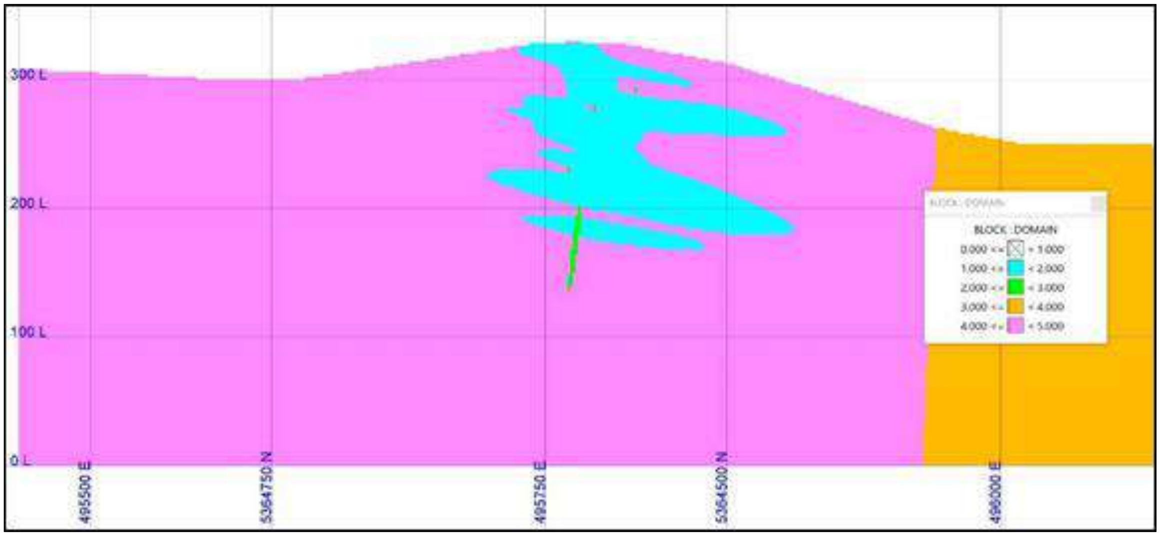



Source: BOYD, 2018

### 14.6.4 Victory Deposit Block Model

Figure 14-70 shows a typical block model section of the mineralized domain. Table 14-50 shows the Victory deposit block model extents.

**Figure 14-70: Victory Deposit Typical Mineralized Domain Block Model Cross-Section**




Source: BOYD, 2018

**Table 14.50: Block Model Extents**

| Item | X | Y | Z |
|---|---|---|---|
| Origin (m) | 495,849.97 | 5,364,004.74 | 0.0 |
| Offset Minimum (m) | 0 | 0 | 0 |
| Offset Maximum (m) | 1,104 | 900 | 450 |
| Parent Block size (m) | 6.0 | 6.0 | 6.0 |
| Child Block size (m) | 2.0 | 2.0 | 2.0 |
| Bearing/Dip/Plunge (deg) | 45 | 0 | 0 |

### 14.6.5 Victory Block Estimations

The Vulcan-constructed block model was constrained by the mineralized domains described above. The current topographic surface was used to flag the topographic variable (vtopo). This variable is set to 100% for a block completely below the surface and to 0% for a block completely above the surface. Blocks at the topographic surface were assigned a proportion that lies below topography. A topo-adjusted density (rdensity) was assigned using the following formula:

$$rdensity = density * \left(\frac{vtopo}{100}\right)$$

This procedure ensures that blocks along the topographic surface have the correct density applied during pit optimization functions.

No attempt was made to apply a block percentage (percent of the block that is material and waste). Blocks are in or out of the mineralized domain. Grade interpolation runs were set up for only that material within the mineralized domain for gold.

Using the composited assays, block grade interpolations were run in each mineralized domain for gold. Runs were completed using $ID^3$. Four passes were run to allow for use in resource classification. Only composites and blocks flagged as within the mineralized domain were considered in the grade estimation. The block model interpolation parameters are shown in Table 14-51 and Table 14-52.

**Table 14.51: Victory Deposit QTPV Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -10 | -10 | -10 | -10 |
| Dip (Degrees) | -20 | -20 | -20 | -20 |
| Major (m) | 55.0 | 55.0 | 55.0 | 82.5 |
| Semi-Major (m) | 55.0 | 55.0 | 55.0 | 82.5 |
| Minor (m) | 8.0 | 8.0 | 8.0 | 12.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 4 | 3 | 2 | 2 |
| Maximum Number of Composites | 6 | 6 | 6 | 6 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |

**Table 14.52: Victory Deposit TRJ Grade Estimation Parameters**

| Item | Pass | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Search Ellipsoid | | | | |
| Azimuth (Degrees) | 135 | 135 | 135 | 135 |
| Plunge (Plunge of the Azimuth in Degrees) | -10 | -10 | -10 | -10 |
| Dip (Degrees) | -20 | -20 | -20 | -20 |
| Major (m) | 60.0 | 60.0 | 60.0 | 90.0 |
| Semi-Major (m) | 60.0 | 60.0 | 60.0 | 90.0 |
| Minor (m) | 10.0 | 10.0 | 10.0 | 15.0 |
| Estimation Parameters | | | | |
| Minimum Number of Composites | 4 | 3 | 2 | 2 |
| Maximum Number of Composites | 6 | 6 | 6 | 6 |
| Maximum Composites Per Drillhole | 2 | 2 | 2 | 2 |

### 14.6.6 Victory Deposit Model Validation

The gold grade populated block model was reviewed to ensure reasonableness. These checks included:

- an overall review of the estimated metal values
- QQ plots of the block model versus the composites
- a section-by-section comparison between the $ID^3$ metal values and the drillhole assays
- a statistical comparison of the raw assay values versus the composite values versus the block values.

The overall block metal grades were examined to confirm that all the estimation parameters were honoured and kept within the individual mineralized domains. A visual check on a sectional basis showed this to be true with block grades being consistently below the drillhole assay value. Each of the cross-sections were reviewed and the drillholes were checked to determine that the original metal grade closely matched the estimated block metal grade without exceeding it. Cross-sections were examined, and assay intervals agreed with the overlying estimated block model metal grades. Table 14-53 compares assays, values versus the composite values versus the estimated block values was run and is shown in

The block model checks indicate that the MRE slightly underestimates the composites at lower gold grade values. At higher gold grades, the block model gold grades are underestimated relative to the composites.

**Table 14.53: Victory Deposit Mineral Resource Estimation Model Statistics**

| Item | Domain | | |
|---|---|---|---|
| | All | QTPV | Trondhjemite (TRJ) |
| 1-Meter Composites | | | |
| Number of Samples | 4,169 | 1,655 | 2,688 |
| Minimum (Au g/t) | 0.002 | 0.005 | 0.001 |
| Maximum (Au g/t) | 46.88 | 46.88 | 28.49 |
| Range (Au g/t) | 46.88 | 46.88 | 28.49 |
| Average (Au g/t) | 0.33 | 0.59 | 0.15 |
| Standard Deviation (Au g/t) | 1.83 | 2.61 | 0.91 |
| Coefficient of Variance | 5.54 | 4.43 | 5.88 |
| Block Model Results | | | |
| Number of Blocks | 122,354 | 47,184 | 75,170 |
| Minimum (Au g/t) | 0.01 | 0.01 | 0.01 |
| Maximum (Au g/t) | 25.68 | 25.68 | 21.95 |
| Range (Au g/t) | 25.67 | 25.67 | 21.94 |
| Average (Au g/t) | 0.28 | 0.46 | 0.18 |
| Standard Deviation (Au g/t) | 0.78 | 1.05 | 0.15 |
| Coefficient of Variance | 2.76 | 2.31 | 0.87 |

### 14.6.7 Victory Deposit Resource Classification

The mineral resource classification used for the Victory deposit is based on which pass generated a grade estimate and the distance to the nearest neighbour (measured and indicated only). The mineral resource classifications assigned include:

- Measured – Blocks estimated in Pass 1 (minimum of four composites) with a maximum nearest neighbour distance of 15 m are classified as measured. For the Victory deposit, no blocks could be considered as measured.
- Indicated – Blocks estimated in Pass 2 (minimum of three composites) with a maximum nearest neighbour distance of 25 m are classified as indicated. Only blocks flagged as QTPV could be considered as indicated.
- Inferred – Blocks estimated in Pass 3 (minimum of two composites) are classified as inferred.

Blocks flagged during Pass 4 are not considered in the MRE and were populated to provide future exploration guidance to Marathon Gold. Any material flagged with a classification of 4 is considered as waste material.

### 14.6.8 Victory Mineral Resource Reporting and Evaluation of Reasonable Prospects of Economic Extraction

The Victory mineral resources may be amenable to a combination of open pit and underground mining methods. BOYD developed a conceptual pit shell (the economic open pit shell) using the Lerchs-Grossman method as provided by the GEOVIA Whittle software. Portions of the block model within the pit shell demonstrate “reasonable prospects for eventual economic extraction” by open pit mining. From this shell, a conceptual open pit mine was designed and used to constrain the mineral resources. Portions of the block model which are external to the conceptual pit shell but satisfy cut-off grade criteria for an appropriate underground extraction method, are considered to show “reasonable prospects for eventual economic extraction” by underground mining methods.

#### 14.6.8.1 Economic Assumption Parameters Used for Pit Optimization and Underground Cut-off

The operating assumptions (economic and gold recovery) used for the Whittle economic open pit optimization are shown in Table 14-54; the operating assumptions (economic and gold recovery) used for the calculation of an underground cut-off grade are shown in Table 14-55. These assumptions are based on the 2021 feasibility study metallurgical and economic parameters.

**Table 14.54: Victory Deposit Open Pit Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Waste Mining Cost | 2.35 | C$/t waste |
| Mill Feed Mining Cost | 3.60 | C$/t mill feed |
| Mill Processing Cost | 10.81 | C$/t mill feed |
| G&A Cost | 2.40 | C$/t mill feed |
| Mill Gold Recovery (at cut-off) | 91.1 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,500 | US$/troy oz |
| Mill Cut-off | 0.30 | g/t Au |

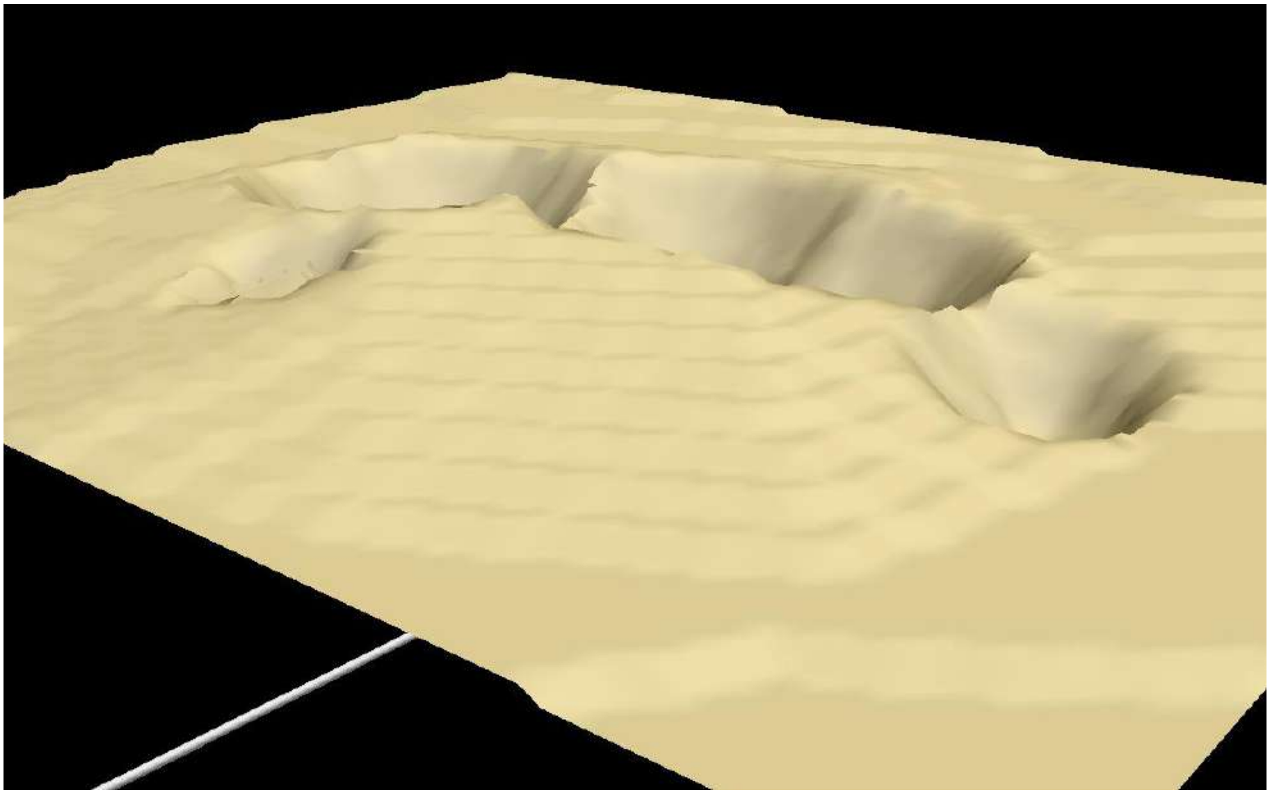
**Table 14.55: Victory Deposit Underground Economic Assumptions**

| Item | Value | Units |
|---|---|---|
| Mill Feed Mining Cost | 71.00 | C$/t mill feed |
| Processing Cost | 10.81 | C$/t mill feed |
| G&A Cost | 2.40 | C$/t mill feed |
| Recovery (at cut-off) | 92.7 | % |
| Exchange | 0.76 | USD/CAD |
| Gold Price | 1,500 | US$/troy oz |
| Calculated Cut-off | 1.44 | g/t Au |

For mineral resource reporting, a cut-off grade of 0.30 g/t gold was used for open pit, and a cut-off grade of 1.44 g/t gold was used for underground. The assumed overall pit slope in Whittle was assumed to be 47.5° in non-sediment rocks and 46.0° in sediment rocks not including ramps.

Using these assumptions, a Whittle economic pit optimization was completed, and an economic open pit shell was generated. This open pit shell was used to design the conceptual pit design shown in Figure 14-71.

**Figure 14-71: Victory Deposit Open Pit Shell**



Source: BOYD, 2020

### 14.6.9 Victory Mineral Resource Statement

Marathon Gold's Victory deposit indicated and inferred MREs were reported in accordance with CIM Definition Standards and Best Practice Guidelines for Mineral Resources and Reserves (CIM, 2014, 2019) and the disclosure rule NI 43-101. The effective date for the Victory deposit MRE is November 20, 2020.

The mineral resources presented here were estimated using a block model with a block size of 6 m by 6 m by 6 m sub-blocked to a minimum block size of 2 m by 2 m by 2 m using $ID^3$ methods for grade estimation.

All MREs are reported using an open pit gold cut-off of 0.30 g/t Au and an underground gold cut-off of 1.44 g/t Au. Material between a 0.30 Au g/t value and 0.70 Au g/t is assumed to be low grade material. Material above a 0.70 Au g/t is assumed to be high grade material. Higher gold grades were given a limited area of influence which was applied during grade estimation by mineralized domain.

The MREs do not include a detailed pit or underground design, only an economic pit shell was used to determine the in-pit mineral resources. The underground mineral resources are that material outside of the in-pit mineral resources above the stated underground cut-off grade.

The 2022 Marathon Gold's Victory deposit MREs are classified as measured, indicated, and inferred resources according to recent CIM Definition Standards (CIM, 2014). The classification of the Victory deposit resources was based on geological confidence, data quality and grade continuity. All reported open pit MREs occur within a pit shell optimized using a gold price of US$1,500 per troy ounce.

Table 14-56 MRE for the Victory deposit constrained within the US$1,500 per troy ounce pit shell and with open pit and underground gold cut-offs.

The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 14.56: Mineral Resource Estimate for the Victory Deposit**

| MEASURED AND INDICATED MINERAL RESOURCE ESTIMATE | | | | | |
|---|---|---|---|---|---|
| **Mining Method** | **Classification** | **Cut-off Grade (g/t)** | **Tonnes** | **Au (g/t)** | **Au (oz)** |
| Open Pit - High Grade | Measured | 0.70 | 0 | 0 | 0 |
| Open Pit - High Grade | Indicated | 0.70 | 621,000 | 2.20 | 43,900 |
| Open Pit - High Grade | M+I | 0.70 | 621,000 | 2.20 | 43,900 |
| Open Pit - Low Grade | Measured | 0.30 | 0 | 0 | 0 |
| Open Pit - Low Grade | Indicated | 0.30 | 463,000 | 0.47 | 6,900 |
| Open Pit - Low Grade | M+I | 0.30 | 463,000 | 0.47 | 6,900 |
| Total Open Pit | Measured | 0.30 | 0 | 0 | 0 |
| Total Open Pit | Indicated | 0.30 | 1,084,000 | 1.46 | 50,800 |
| Total Open Pit | M+I | 0.30 | 1,084,000 | 1.46 | 50,800 |
| Underground | Measured | 1.44 | 0 | 0 | 0 |
| Underground | Indicated | 1.44 | 1,300 | 1.80 | 100 |
| Underground | M+I | 1.44 | 1,300 | 1.80 | 100 |
| Open Pit + Underground | Measured | 0.30 | 0 | 0 | 0 |
| Open Pit + Underground | Indicated | 0.30 | 1,085,300 | 1.46 | 50,900 |
| Open Pit + Underground | M+I | 0.30 | 1,085,300 | 1.46 | 50,900 |
| **INFERRED MINERAL RESOURCE ESTIMATE** | | | | | |
| **Mining Method** | **Resource Classification** | **Gold Cut-off Grade (g/t)** | **Tonnes** | **Au (g/t)** | **Au (Troy Oz)** |
| Open Pit - High Grade | Inferred | 0.70 | 1,192,000 | 1.74 | 66,500 |
| Open Pit - Low Grade | Inferred | 0.30 | 1,008,000 | 0.47 | 15,300 |
| Total Open Pit | Inferred | 0.30 | 2,200,000 | 1.16 | 81,800 |
| Underground | Inferred | 1.44 | 130,000 | 3.05 | 12,700 |
| Open Pit + Underground | Inferred | 0.30 | 2,330,000 | 1.26 | 94,500 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Sprite deposit MRE is November 20, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR**. 6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available.**7.** Numbers may not add or multiply correctly due to rounding.

## 14.7 Consolidated Mineral Resource Statement for the Valentine Gold Project

The consolidated MREs for the Valentine Gold Project, which include mineral resources associated with the Leprechaun, Sprite, Berry, Marathon, and Victory deposits, is summarized in Table 14-57.

The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 14.57: Consolidated Valentine Gold Project Mineral Resources**

| Material/ Category | Open Pit | | | Underground | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tonnes (t) | Grade (g/t) | Gold (oz) | Tonnes (t) | Grade (g/t) | Gold (oz) | Tonnes (t) | Grade (g/t) | Gold (oz) |
| Leprechaun Deposit | | | | | | | | | |
| Measured | 7,315,000 | 2.56 | 601,400 | 57,000 | 3.38 | 6,200 | 7,372,000 | 2.56 | 607,600 |
| Indicated | 8,023,000 | 1.75 | 451,000 | 194,000 | 3.18 | 19,800 | 8,217,000 | 1.78 | 470,800 |
| M+I | 15,338,000 | 2.13 | 1,052,400 | 251,000 | 3.22 | 26,000 | 15,589,000 | 2.15 | 1,078,400 |
| Inferred | 4,131,000 | 1.28 | 169,500 | 725,000 | 3.28 | 76,500 | 4,856,000 | 1.58 | 246,000 |
| Sprite Deposit | | | | | | | | | |
| Measured | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 |
| Indicated | 695,000 | 1.74 | 38,800 | 6,000 | 2.20 | 400 | 701,000 | 1.74 | 39,200 |
| M+I | 695,000 | 1.74 | 38,800 | 6,000 | 2.20 | 400 | 701,000 | 1.74 | 39,200 |
| Inferred | 1,189,000 | 1.20 | 45,900 | 61,000 | 2.47 | 4,800 | 1,250,000 | 1.26 | 50,700 |
| Berry Deposit | | | | | | | | | |
| Measured | 6,678,000 | 2.41 | 517,600 | 73,000 | 3.72 | 8,700 | 6,751,000 | 2.43 | 526,300 |
| Indicated | 10,178,000 | 1.66 | 542,700 | 230,000 | 2.32 | 17,100 | 10,408,000 | 1.67 | 559,800 |
| M+I | 16,856,000 | 1.96 | 1,060,300 | 303,000 | 2.66 | 25,800 | 17,159,000 | 1.97 | 1,086,100 |
| Inferred | 4,740,000 | 1.31 | 200,300 | 592,000 | 2.87 | 54,600 | 5,332,000 | 1.49 | 254,900 |
| Marathon Deposit | | | | | | | | | |
| Measured | 14,851,000 | 1.86 | 889,600 | 252,000 | 4.32 | 35,000 | 15,103,000 | 1.90 | 924,600 |
| Indicated | 14,092,000 | 1.49 | 673,700 | 895,000 | 3.55 | 102,200 | 14,987,000 | 1.61 | 775,900 |
| M+I | 28,943,000 | 1.680 | 1,563,300 | 1,147,000 | 3.72 | 137,200 | 30,090,000 | 1.76 | 1,700,500 |
| Inferred | 5,285,000 | 1.50 | 254,300 | 1,699,000 | 3.66 | 200,000 | 6,984,000 | 2.02 | 454,300 |
| Victory Deposit | | | | | | | | | |
| Measured | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 |
| Indicated | 1,084,000 | 1.46 | 50,800 | 1,000 | 1.80 | 100 | 1,085,000 | 1.46 | 50,900 |
| M+I | 1,084,000 | 1.46 | 50,800 | 1,000 | 1.80 | 100 | 1,085,000 | 1.46 | 50,900 |
| Inferred | 2,200,000 | 1.16 | 81,800 | 130,000 | 3.05 | 12,700 | 2,330,000 | 1.26 | 94,500 |
| All Deposits | | | | | | | | | |
| Measured | 28,844,000 | 2.17 | 2,008,600 | 382,000 | 4.06 | 49,900 | 29,226,000 | 2.19 | 2,058,500 |
| Indicated | 34,072,000 | 1.60 | 1,757,000 | 1,326,000 | 3.28 | 139,600 | 35,398,000 | 1.67 | 1,896,600 |
| M+I | 62,916,000 | 1.86 | 3,765,600 | 1,708,000 | 3.45 | 189,500 | 64,624,000 | 1.90 | 3,955,100 |
| Inferred | 17,545,000 | 1.33 | 751,800 | 3,207,000 | 3.38 | 348,600 | 20,752,000 | 1.65 | 1,100,400 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Leprechaun, Berry, and Marathon MREs is June 15, 2022. The effective date for the Sprite and Victory MREs is November 30, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR**. 6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available.**7.** Numbers may not add or multiply correctly due to rounding.

## 14.8 Reconciliation of Mineral Resources at the Valentine Gold Project

The new MREs incorporate nearly 60,000 additional meters of diamond drilling completed at the Berry deposit and results of a 2021 RC drill program completed at the Marathon and Leprechaun deposits. The updated geological models, and hence MREs, at Leprechaun, Berry, and Marathon also take into consideration mafic dykes as an important control on mineralization. Tables 14-58 and 14-59 list the updated and current Leprechaun, Berry and Marathon MREs as presented in this technical report along with the per cent change of the new MREs in comparison to the former MREs of November 20, 2020 for the Leprechaun, Sprite, Marathon, and Victory deposits, and April 15, 2021 for the Berry deposit.

**Table 14.58: Changes to the Measured and Indicated Mineral Resources**

| Deposit | Category | Tonnes (Mt) | % Change | Grade (g/t Au) | % Change | Oz (Moz Au) | % Change |
|---|---|---|---|---|---|---|---|
| Marathon | Measured | 15.10 | -37% | 1.90 | +12% | 0.92 | -29% |
| | Indicated | 14.99 | +9% | 1.61 | +9% | 0.78 | +18% |
| | Total M&I | 30.09 | -20% | 1.76 | +9% | 1.70 | -13% |
| Leprechaun | Measured | 7.37 | -14% | 2.56 | +15% | 0.61 | -1% |
| | Indicated | 8.22 | -3% | 1.78 | +3% | 0.47 | +0% |
| | Total M&I | 15.59 | -9% | 2.15 | +9% | 1.08 | -1% |
| Berry | Measured | 6.75 | n/a | 2.42 | n/a | 0.53 | n/a |
| | Indicated | 10.41 | n/a | 1.67 | n/a | 0.56 | n/a |
| | Total M&I | 17.16 | n/a | 1.97 | n/a | 1.09 | n/a |
| Victory | Measured | - | | - | | - | |
| | Indicated | 1.09 | +0% | 1.46 | +0% | 0.05 | +0% |
| | Total M&I | 1.09 | +0% | 1.46 | +0% | 0.05 | +0% |
| Sprite | Measured | - | | - | | - | |
| | Indicated | 0.70 | +0% | 1.74 | +0% | 0.04 | +0% |
| | Total M&I | 0.70 | +0% | 1.74 | +0% | 0.04 | +0% |
| All Deposits | Measured | 29.23 | -10% | 2.19 | +20% | 2.06 | +7% |
| | Indicated | 35.40 | +47% | 1.67 | +6% | 1.90 | +56% |
| | Total M&I | 64.62 | +14% | 1.90 | +10% | 3.96 | +26% |

Notes: **1.** Percent change from the November 2020 (Marathon Leprechaun, Victory and Sprite) & April 2021 (Berry) MREs. **2.** Totals may not add due to rounding.

**Table 14.59: Changes of Inferred Mineral Resource**

| Deposit | Category | Tonnes (Mt) | % Change | Grade (g/t Au) | % Change | Oz (Moz Au) |
|---|---|---|---|---|---|---|
| Marathon | 6.98 | -40% | 2.02 | +9% | 0.45 | -35% |
| Leprechaun | 4.86 | +62% | 1.58 | -4% | 0.25 | +56% |
| Berry | 5.33 | -53% | 1.49 | -15% | 0.25 | -60% |
| Victory | 2.33 | +0% | 1.26 | +0% | 0.09 | +0% |
| Sprite | 1.25 | +0% | 1.26 | +0% | 0.05 | +0% |
| All Deposits | 20.75 | -30% | 1.65 | -4% | 1.10 | -33% |

Notes: **1.** Percent change from the November 2020 (Marathon Leprechaun, Victory and Sprite) & April 2021 (Berry) MREs. **2.** Totals may not add due to rounding.

There is no change at the Sprite and Victory deposits since the last resource update. With respect to reconciliation associated with the Leprechaun, Berry and Marathon deposits, Tables 14-58 and 14-59 show that none of the changes constitute a 100% change in the resources. The reconciliation of resources on a deposit basis is summarized as follows:

- Leprechaun deposit: The total M&I tonnage, grade, and contained gold changed by -9%, +9%, and -1%, respectively. The inferred mineral resource tonnage, grade, and contained ounces changed by +62%, -4%, and +56%. Overall, the difference is minor. The reasons for these changes include updated economic assumptions, additional drilling, and the new geological model.

- Berry deposit: Almost 60,000 m of additional drilling contributed to a reduced drillhole spacing and better understanding of geometric and grade continuity to permit the assignment of both indicated and measured resources. The inferred mineral resource tonnage, grade, and contained ounces changed by -53%, -15%, and -60%, respectively, reflecting the upgrade from inferred to either measured or indicated.

- Marathon deposit: The M&I tonnage, grade, and contained ounces changed by -20%, +9%, and -18%, respectively. The primary reason was an updated geological model that provided a stronger spatial restriction of QTP mineralization. There were also updates to the economic assumptions, additional RC drilling. The inferred mineral resource tonnage, grade, and contained ounces changed by -40%, +9%, and -35%, respectively, due similar reasons.

## 14.9 Discussion of Resource Modelling Risks and Uncertainties

Common to all nuggety gold deposits, there is a degree of uncertainty attributable to the estimation of mineral resources and corresponding grades dedicated to future production. Any material changes in the quantity of mineral resources or grade may affect the economic viability of the property. The existence of mineral resources should not be interpreted as an assurance of mine life or of the profitability of current or future operations. For example, future fluctuations in gold prices may materially affect the Company’s ability to advance the Valentine Gold Project. Thus, until the mineralization is mined and processed, the quantity of mineral resources and grades must be considered as estimates only.

# 15 MINERAL RESERVE ESTIMATES

## 15.1 Introduction

The mineral reserves for the Valentine Gold Project are a subset of the measured and indicated mineral resources described in Section 14 and are supported by feasibility study engineering described in subsequent sections of this report, including the mine engineering summarized in Section 16.

## 15.2 Mineral Reserves Statement

Proven and probable mineral reserves have been modified from measured and indicated mineral resources and are summarized in Table 15-1. Inferred class mineral resources are set to waste. Mineral resources from the Victory and Sprite deposits, and any underground mineral resources, have not been included in the feasibility study mine plan or mineral reserves.

Mineral reserves have been estimated using the CIM 2019 Best Practices Guidelines (CIM, 2019) and are classified using the 2014 CIM Definition Standards (CIM, 2014). Mill feed tonnes and gold grades are based on re-blocking the original resource model blocks to a selective mining unit (SMU) block size of 6 m x 6 m x 6 m. Further mining recovery parameters have been introduced, treating the following SMU blocks as waste: all isolated, mineralized blocks (blocks bounded by waste on all sides); and all blocks below 0.50 g/t gold grade that are bounded by waste on all but one side.

## 15.3 Mineral Reserves within Pit Phases

Open pits are based on the results of ultimate pit limit sensitivity analysis, with limits chosen for pit shells generated from gold price inputs of US$950/oz at Leprechaun to US$1,300/oz at Marathon and US$1,350/oz at Berry. These shell targets are then designed into detailed pit phases to develop ore and waste contents for mine production scheduling. Assumptions for this mine design process are described in Section 16. The mineral reserves for all pit phases are shown in Table 15-2, with a split by higher cutoff grade shown in Table 15-3. Table 15-4 summarizes the inferred mineral resources within the designed pits; these amounts are included in the waste tonnage totals in Table 15-2.

## 15.4 Factors that May Affect the Mineral Reserve Estimates

Mineral reserves are based on the engineering and economic analysis described in Sections 16 to 22 of this report. Changes in the following factors and assumptions may affect the mineral reserve estimate:

- metal prices
- interpretations of mineralization geometry and continuity of mineralization zones
- geotechnical and hydrogeological assumptions
- ability of the mining operation to meet the targeted annual production rate, mining dilution, and mining recovery
- operating cost assumptions
- process plant recoveries
- ability to meet and maintain permitting and environmental license conditions, and the ability to maintain the social license to operate.

**Table 15.1: Proven & Probable Mineral Reserves**

| Mine Area | Reserve Class | Mill Feed (Mt) | Diluted Gold Grade (g/t Au) | Contained Metal (Moz) |
|---|---|---|---|---|
| Marathon | Proven | 11.5 | 1.70 | 0.6 |
| | Probable | 9.9 | 1.40 | 0.4 |
| | **Marathon Total** | 21.3 | 1.56 | 1.1 |
| Leprechaun | Proven | 6.6 | 2.11 | 0.4 |
| | Probable | 8.6 | 1.44 | 0.4 |
| | **Leprechaun Total** | 15.1 | 1.73 | 0.8 |
| Berry | Proven | 5.3 | 2.03 | 0.3 |
| | Probable | 9.8 | 1.36 | 0.4 |
| | **Berry Total** | 15.1 | 1.60 | 0.8 |
| Subtotal | Proven | 23.4 | 1.89 | 1.4 |
| | Probable | 28.2 | 1.40 | 1.3 |
| Grand Total | **Total Proven & Probable** | 51.6 | 1.62 | 2.7 |

Notes: **1.** The mineral reserve estimates were prepared by Marc Schulte, P.Eng. (who is also an independent Qualified Person), reported using the 2014 CIM Definition Standards, and have an effective date of November 30, 2022. **2.** Mineral reserves are a subset of the Measured and Indicated Mineral Resources for the Marathon, Leprechaun and Berry deposits, with an effective date of June 15, 2022, summarized in Table 14-57. **3.** Mineral reserves are mined tonnes and grade; the reference point is the mill feed at the primary crusher. **4.** Mineral reserves are reported at a cut-off grade of 0.38 g/t Au. **5.** Cut-off grade assumes US$1,650/oz Au at a currency exchange rate of US$0.78 per C$1.00; 99.8% payable gold; US$5.00/oz off-site costs (refining and transport); and uses an 87% metallurgical recovery. The cut off-grade covers processing costs of $15.20/t, administrative (G&A) costs of $5.30/t, and a stockpile rehandle cost of $1.85/t. **6.** Mined tonnes and grade are based on an SMU of 6 m x 6 m x 6 m, including additional mining losses estimated for the removal of isolated blocks (surrounded by waste) and low-grade (<0.5 g/t Au) blocks bounded by waste on three sides. **7.** Numbers have been rounded as required by reporting guidelines.

**Table 15.2: Proven & Probable Mineral Reserves within Designed Pit Phases**

| Pit Phase | Pit Name | Mill Feed (Mt) | Diluted Gold Grade (g/t Au) | Waste (Mt) | Strip Ratio (t/t) |
|---|---|---|---|---|---|
| Marathon Construction Phase | M620 | 0.0 | 0.00 | 3.0 | - |
| Marathon Phase 1 | M621i | 6.9 | 1.64 | 38.9 | 5.6 |
| Marathon Phase 2 | M622i | 7.0 | 1.44 | 59.2 | 8.4 |
| Marathon Phase 3 | M623i | 7.4 | 1.61 | 112.3 | 15.2 |
| **Total Marathon** | **M623** | **21.3** | **1.56** | **213.5** | **10.0** |
| Leprechaun Construction Phase | L620 | 0.0 | 0.00 | 2.8 | - |
| Leprechaun Phase 1 | L621i | 4.5 | 1.79 | 21.8 | 4.8 |
| Leprechaun Phase 2 | L622i | 4.4 | 1.59 | 67.8 | 15.5 |
| Leprechaun Phase 3 | L623i | 6.2 | 1.78 | 68.9 | 11.0 |
| **Total Leprechaun** | **L623** | **15.1** | **1.73** | **161.3** | **10.7** |
| Berry Construction Phase | B620 | 0.0 | 0.00 | 0.8 | - |
| Berry Phase 1 | B621i | 4.7 | 1.69 | 27.6 | 5.9 |
| Berry Phase 2 | B622i | 5.7 | 1.59 | 62.7 | 11.0 |
| Berry Phase 3 | B623i | 4.7 | 1.51 | 79.5 | 16.8 |
| **Total Berry** | **B623c** | **15.1** | **1.60** | **170.6** | **11.3** |
| **Grand Total** | | **51.6** | **1.62** | **545.4** | **10.6** |

Notes: **1.** A cut-off grade of 0.38 g/t Au is applied. **2.** Mined tonnes and grade are based on an SMU of 6 m x 6 m x 6 m, including additional mining losses estimated for the removal of isolated blocks (surrounded by waste) and low-grade (<0.5 g/t Au) blocks bounded by waste on 3 sides. **3.** Mineral reserves in this Table are not additive to the mineral reserves in Table 15-1. Footnotes to Table 15-1 also apply to this table. **4.** Numbers have been rounded as required by reporting guidelines.

**Table 15.3: Proven & Probable Mineral Reserves by Grade Bin**

| Pit Phase | Mill Feed (Mt) | Diluted ROM Gold Grade (g/t Au) | Contained Metal (Moz.) |
|---|---|---|---|
| Proven (>0.70 g/t ROM Au) | 17.2 | 2.38 | 1.3 |
| Probable (>0.70 g/t ROM Au) | 18.1 | 1.88 | 1.1 |
| **Total P&P (>0.70 g/t ROM Au)** | **35.3** | **2.12** | **2.4** |
| Proven (0.38-0.70 g/t ROM Au) | 6.1 | 0.54 | 0.1 |
| Probable (0.38-0.70 g/t ROM Au) | 10.1 | 0.53 | 0.2 |
| **Total P&P (0.38-0.70 g/t ROM Au)** | **16.3** | **0.53** | **0.3** |
| Proven Total | 23.4 | 1.89 | 1.4 |
| Probable Total | 28.2 | 1.40 | 1.3 |
| **Total P&P** | **51.6** | **1.62** | **2.7** |

Notes: **1.** A cut-off grade of 0.38 g/t Au is applied. **2.** Mined tonnes and grade are based on an SMU of 6 m x 6 m x 6 m, including additional mining losses estimated for the removal of isolated blocks (surrounded by waste) and low-grade (<0.5 g/t Au) blocks bounded by waste on 3 sides. **3.** Mineral reserves in this Table are not additive to the mineral reserves in Table 15-1. Footnotes to Table 15-1 also apply to this table. **4.** Numbers have been rounded as required by reporting guidelines.

**Table 15.4: Diluted Inferred Mineral Resources within the Designed Pits**

| Mine Area | Resources (Mt) | Gold Grade (g/t Au) |
|---|---|---|
| Marathon | 1.2 | 1.15 |
| Leprechaun | 1.5 | 1.37 |
| Berry | 1.5 | 1.32 |
| **Total** | **4.1** | **1.29** |

Notes: **1.** A cut-off gold grade of 0.38 g/t Au is applied to the pit constrained inferred mineral resources. **2.** These mineral resources are not additive to the mineral resources in Table 14-57; they are a subset of overall mineral resources. **4.** Numbers have been rounded as required by reporting guidelines.

# 16 MINING METHODS

The mineral reserves stated in Section 15 are supported by the open pit mine planning summarized in this section.

Open pit mine designs, mine production schedules, mobile fleet productivities and mine capital and operating cost estimates have been developed for the Marathon, Leprechaun, and Berry deposits at a feasibility level of engineering (MMTS, 2022).

## 16.1 Key Design Criteria

The following mine planning design inputs were used:

- topography is based on a LiDAR survey of the region
- re-blocked resource block model on 6 m spacing in all three dimensions, with diluted gold grades, weight averaged specific gravities and majority coded resource classifications
- inferred mineral resources are treated as waste rock with no economic value
- a grade-dependent gold process recovery is used for the pit optimization and cut-off grade estimations:
- process recovery = 0.8773 * gold head grade + 93.576, capped at 96.5%
- a break-even economic cut-off grade of 0.38 g/t Au is used
- stockpiles and haul roads are planned to minimize wetland, waterbody, and watercourse disturbance.

### 16.1.1 Ore Loss and Dilution

The mineral resources are based on a 2 m x 2 m x 2 m resource model block size. For mine planning and mineral reserve estimation, these blocks have been combined to a selective mining unit (SMU) size of 6 m x 6 m x 6 m, which accounts for planned open pit mine operating conditions. This re-blocking to 6 m SMU blocks introduces 24% dilution and 1% loss to the Marathon resource model, 34% dilution and 3% loss to the Leprechaun resource model, and 39% dilution and 3% loss to the Berry resource model, when measured at a 0.38 g/t gold cut-off grade.

This approach to calculating dilution and loss is considered appropriate for the current mine plan, as the calculated 6 m re-blocked mill feed gold grades will be representative of the diluted run-of-mine material that the operator will be able to achieve when pursuing the throughputs targeted in this mine plan.

Further mining recovery parameters have been introduced, removing from the mineral reserves the following:

- all isolated mineralized blocks (blocks bounded by waste on all sides)
- all blocks below 0.50 g/t gold grade that are bounded by waste on all but one side

These additional parameters introduce a further 1% mining loss (on a gold ounce basis).

### 16.1.2 Bulk Mining and Selective Mining

A “selective” method of mining will be employed in certain areas of the Marathon, Leprechaun, and Berry deposits to enhance grade control.

Flitch mining along the ore/waste boundary is proposed to reduce the ore loss and dilution (Hunt and La Rosa, 2019) and follow the boundary with greater precision. The digging face angle of a small flitch (1 to 2 m) is much steeper than the digging face angle of a full bench (6 or 12 m). As well, successive flitches can be adjusted (in plan view) to follow the ore/waste boundary if it changes with depth.

Figure 16-1 shows the proposed flitch mining process along the ore/waste boundary (the “selective” mining zone). It should be noted that flitch mining is less productive than full bench mining and is more costly on a unit cost basis. Therefore, flitch mining is only proposed along the ore/waste boundary. In straight waste or straight ore, digging can be done on a full bench height utilizing larger, more efficient mining equipment (the “bulk” mining zones).

The following assumptions are made for the selective mining process:

- 6 m bench height
- 2 m flitches
- 12 $m^3$ loader in a backhoe configuration (3 m wide bucket)
- 8 m maximum digging depth for loading tool
- effective reach of backhoe is 12 m
- vertical dig face angles for 2 m flitches
- 72° dig face angle for 6 m bench with a 45° zone of influence
- the ore/waste boundary will be defined using the results of the grade control sampling, and the ore/waste boundary will be further defined in the blasted rock using material movement measurements or modelling.

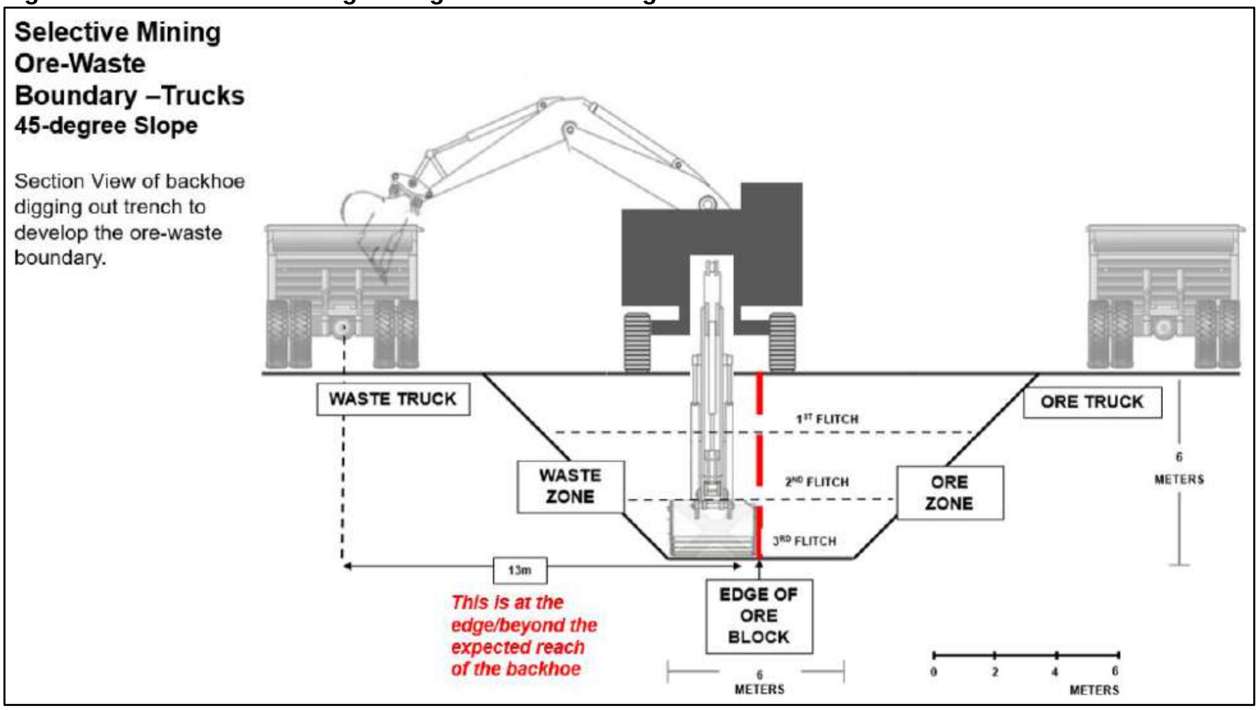
The proposed method relies on containment on each side of the selective mining zone during flitch mining. Therefore, selective mining along the ore/waste boundary should be done ahead of full bench digging in straight ore or straight waste zones.

Measurements of “selective” mined and “bulk” mined areas on each bench in each of the Marathon, Leprechaun, and Berry deposits has been completed. Figure 16-2 shows an example of these measurements on the 326 m bench of the Phase 1 Marathon pit, one of the most “selective” benches in the entire mine plan.

Global averages of selective mining measurements are 15% in the Marathon deposit, comprised of 65% of ore and 10% of waste, 17% in the Leprechaun deposit, comprised of 74% of ore and 12% of waste, and 18% in the Berry deposit, comprised of 82% of ore and 13% of waste.

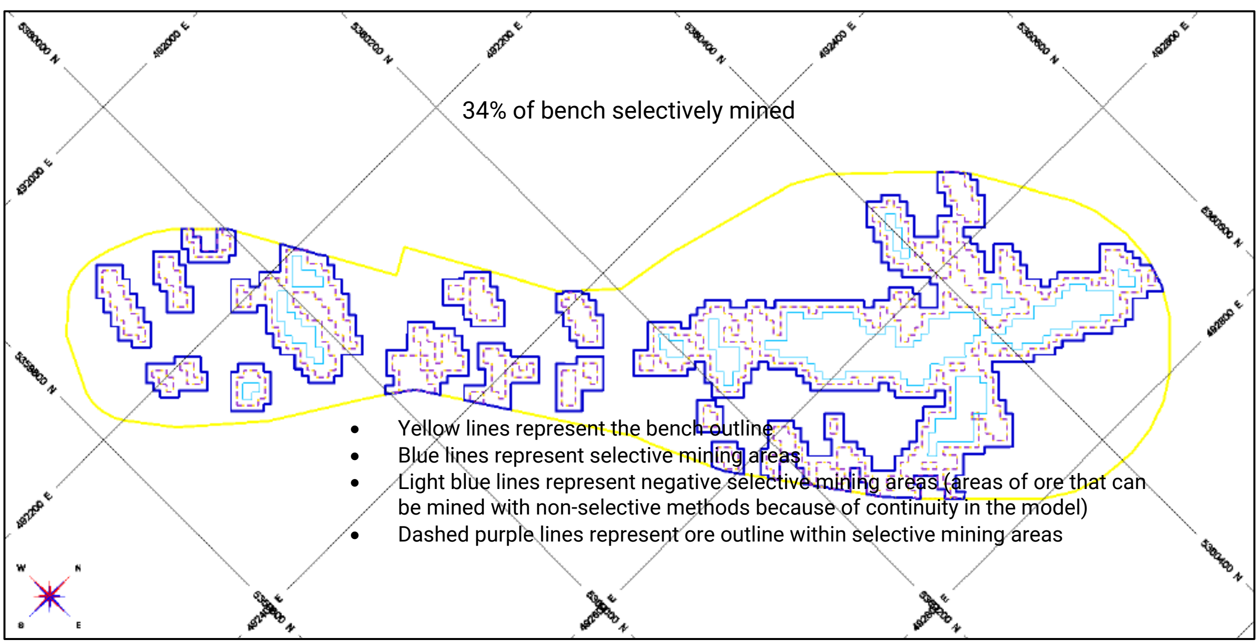
Quantities of each method are tracked through the mine production schedule and equipment fleet plans for the project. For mine fleet planning and costing, all ore, whether tagged as selective or bulk, is handled via planned selective mining methods.

**Figure 16-1: Selective Mining Configuration – Loading Trucks**




Source: MMTS, 2022.

**Figure 16-2: Selective Mining Measurements**




Source: MMTS, 2022.

### 16.1.3 Pit Slopes

The pit slope criteria are based on 2021 and 2022 geotechnical reports by Terrane Geoscience Inc. (Terrane, 2021, 2022a, 2022b). Field data collection consisted of detailed geotechnical drillhole logging, oriented core logging, index strength tests, packer testing, geomechanical sample collection, and optical/acoustic televiewer surveying. Geomechanical lab testing included unconfined compressive strength, triaxial compressive strength, direct shear, and Brazilian tensile testing.

Geotechnical models of the Marathon, Leprechaun and Berry deposit areas were compiled and consist of geological models, structural models (fabrics and major structures), rock mass models and hydrogeological models.

Feasibility-level slope design takes into consideration an analysis of the overall slope stability of a pit wall (i.e., all the benches, berms, and ramps from the pit floor to the surface), inter-ramp slope stability and the bench design (i.e., bench width, bench face angle, and bench height). The overall slope angle, inter-ramp angle, and the bench face angles are then designed based on acceptance criterion for probability of failure (PoF) and factor of safety (FOS).

Pit designs are configured on 6 m bench heights, with 8.1 m wide berms placed every three benches, or triple benching. Bench face angles, and subsequent inter-ramp angles, are varied based on prescribed geotechnical design sectors.

Bench face and inter-ramp slopes in the defined design sectors are listed in Table 16-1 for Marathon, Table 16-2 for Leprechaun, and Table 16-3 for Berry. Defined geotechnical design sectors are illustrated in Figure 16-3 for Marathon, Figure 16-4 for Leprechaun, and Figure 16-5 for Berry.

**Table 16.1: Marathon Bench Face & Inter-Ramp Angle Inputs**

| Domain | Design Sector (Figure 16-3) | Bench Face Angle (º) | Inter-Ramp Angle (º) | Overall Slope* (º) |
|---|---|---|---|---|
| Overburden | All | 25 | 25 | 25 |
| Southeast | 6 | 77 | 56 | 46 |
| NW, NE and SW | 1 to 5, 7 to 9 | 80 | 58 | 47.5 |

*Overall slope angles are inputs for pit optimizations only.

**Table 16.2: Leprechaun Bench Face Inter-Ramp Angle Inputs**

| Domain | Design Sector (Figure 16-4) | Bench Face Angle (º) | Inter-Ramp Angle (º) | Overall Slope* (º) |
|---|---|---|---|---|
| Overburden | All | 25 | 25 | 25 |
| South | 5 | 62 | 46 | 39 |
| Southeast | 4 | 70 | 51 | 41 |
| NW and End Walls | 1 to 3, 6 to 7 | 80 | 58 | 46 |

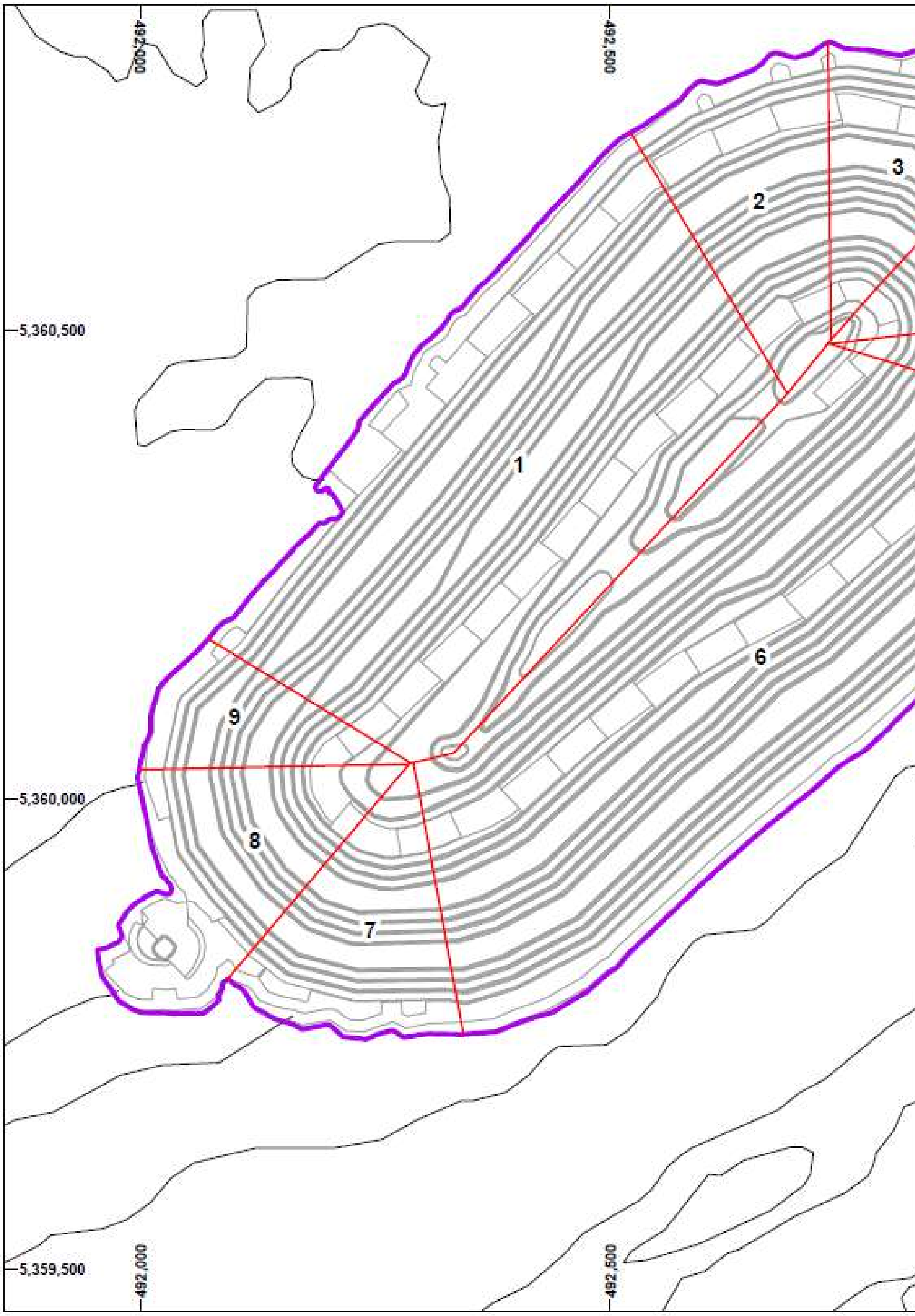
*Overall slope angles are inputs for pit optimizations only.

**Table 16.3: Berry Bench Face Inter-Ramp Angle Inputs**

| Domain | Design Sector (Figure 16-5) | Bench Face Angle (º) | Inter-Ramp Angle (º) | Overall Slope* (º) |
|---|---|---|---|---|
| Overburden | All | 25 | 25 | 25 |
| South | SW-C-1, SW-1-5, C-C-1, C-I-3, C-I-4, NE-C-1, NE-I-3, NE-1-4 | 72 | 52 | 40 |
| North | SW-I-1, SW-I-2, SW-I-3, SW-I-4, C-I-1, C-I-2, NE-I-1, NE-I-2 | 80 | 58 | 45 |
| East | C-C-2, NE-C-2 | 76 | 55 | 43 |

*Overall slope angles are inputs for pit optimizations only.

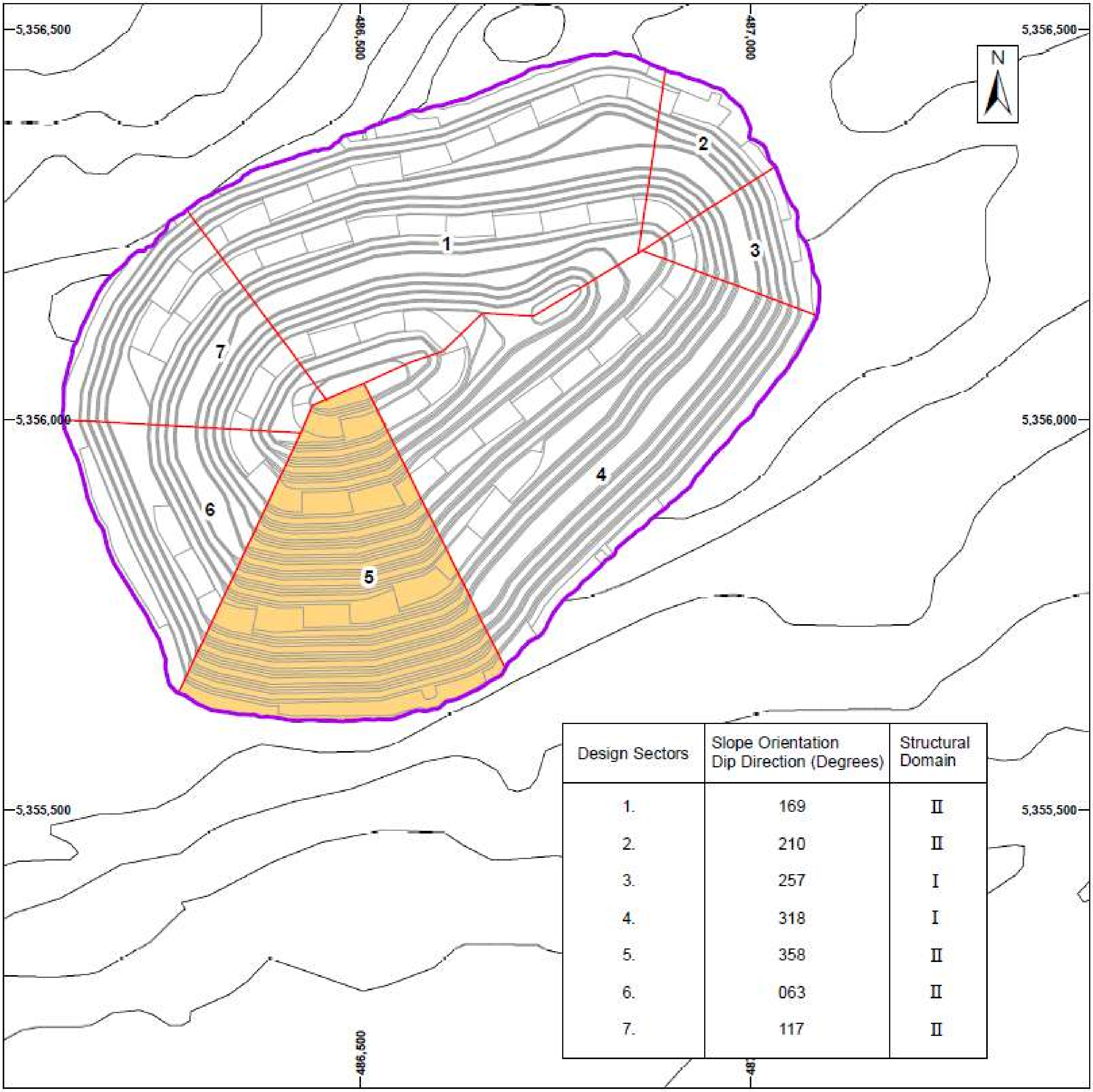
**Figure 16-3: Marathon Pit Slope Design Sectors**




| Design Sector | Slope Orientation Dip Direction (Degrees) |
|---|---|
| 1. | 134 |
| 2. | 157 |
| 3. | 197 |
| 4. | 245 |
| 5. | 278 |
| 6. | 320 |
| 7. | 012 |
| 8. | 070 |
| 9. | 105 |

Source: Terrane, 2021.

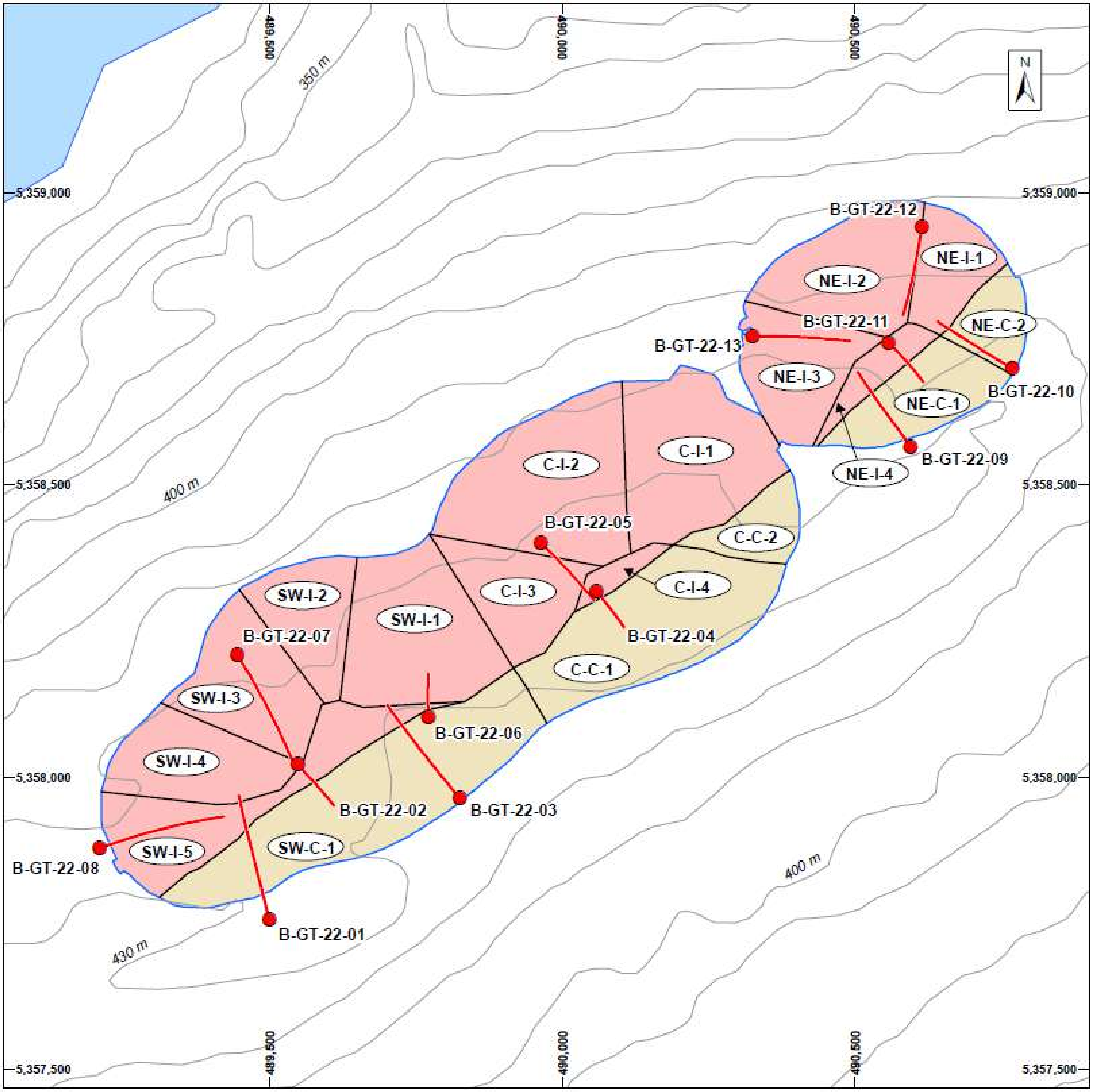
**Figure 16-4: Leprechaun Pit Slope Design Sectors**




| Design Sectors | Slope Orientation Dip Direction (Degrees) | Structural Domain |
|---|---|---|
| 1. | 169 | II |
| 2. | 210 | II |
| 3. | 257 | I |
| 4. | 318 | I |
| 5. | 358 | II |
| 6. | 063 | II |
| 7. | 117 | II |

Source: Terrane, 2022a.

**Figure 16-5: Berry Pit Slope Design Sectors**




Source: Terrane, 2022b.

In-pit haul roads and geotechnical berms (25 m wide) are added to the pit designs and flatten the overall slopes. Geotechnical berms are placed on 90 m vertical spacing for Marathon and Leprechaun, and 108 m vertical spacing for Berry, wherever in-pit ramps are not present.

A 12 m wide berm is left at the bedrock contact with overburden. Groundwater flow is estimated to be higher along this bedrock contact. This berm is added to catch potential sloughing from the overburden above, as well as to allow sufficient room for water management features to be constructed.

Designs assume that controlled blasting (pre-split and/or trim blasting), slope dewatering and slope depressurization, routine bench face maintenance, geotechnical slope monitoring, and on-going data collection will be completed throughout the life of the mine.

## 16.2 Pit Optimization

The economic pit limits are determined using the Pseudoflow algorithm. This algorithm uses the ore grades and specific gravity (SG) for each block of the re-blocked mine planning 3D block model and evaluates the costs and revenues of the blocks within potential pit shells. The algorithm uses input economic and engineering parameters and expands downwards and outwards until the last increment is at break-even economics.

Additional cases are included in the analysis to evaluate the sensitivities of resources to strip ratio and high-grade/low-grade areas of the deposit. In this study, the various cases or pit shells are generated by varying the input gold price and comparing the resultant waste and mill feed tonnages and gold grades for each pit shell.

Various generated pit cases are evaluated by adjusting the gold price input while keeping inputs for costs, metallurgical recoveries, and pit slopes constant, which determines where incremental pit shells produce marginal or negative economic returns. This reduction in economic returns is due to increasing strip ratios, decreasing gold grades, increased mining costs associated with the larger or deeper pit shells, and the value of discounting costs before revenues.

The economic margins from the expanded cases are evaluated on a relative basis to provide payback on capital and produce a return for the project. At some point, further expansion does not provide significant added value. A pit limit can then be chosen that has suitable economic return for the deposit.

For each pit shell, an undiscounted cash flow (UCF) is generated based on the shell contents and the economic parameters listed in Table 16-4. The UCFs for each case are compared to reinforce the selected point at which increased pit expansions do not increase the project value. Note that the economics are only applied for comparative purposes to assist in the selection of an optimum pit shell for further mine planning; they do not reflect the actual financial results of the mine plan.

The chosen pit shell is then used as the basis for more detailed design and economic modelling.

Price and operating cost assumptions for the Pseudoflow runs are provided in Table 16-4. A summary of the chosen pit shell targets for each deposit is included in Table 16-5.

**Table 16.4: Price & Operating Cost Inputs into Pseudoflow Shell Runs**

| Item | Unit |
|---|---|
| Gold Price | US$1,600 |
| Foreign Exchange (USD:CAD) | 0.78:1.00 |
| Payable Gold | 99.8% |
| Off-Site Costs | US$5.00/oz Au (refining and doré transport) |
| Royalties | 0% |
| Pit Rim Mining Cost | $3.45/t for bulk mining ore |
| Pit Rim 350 m at Marathon | $3.95/t for selective mining ore |
| Pit Rim 386 m a Leprechaun | $2.65/t for bulk mining waste |
| Pit Rim 420 m at Berry | $3.15/t for selective mining waste |
| Incremental Haulage Cost | $0.015 per every 6 m bench below pit rim |
| Processing Cost | $15.20/t |
| General/Administration Cost | $5.30/t |

**Table 16.5: Pit Shell Target Summary**

| Deposit | Revenue Factor for Shell Generation | Gold Price associated with Revenue Factor (US$/oz) |
|---|---|---|
| Marathon | 0.75 | $1,200 |
| Leprechaun | 0.59 | $950 |
| Berry | 0.84 | $1,350 |

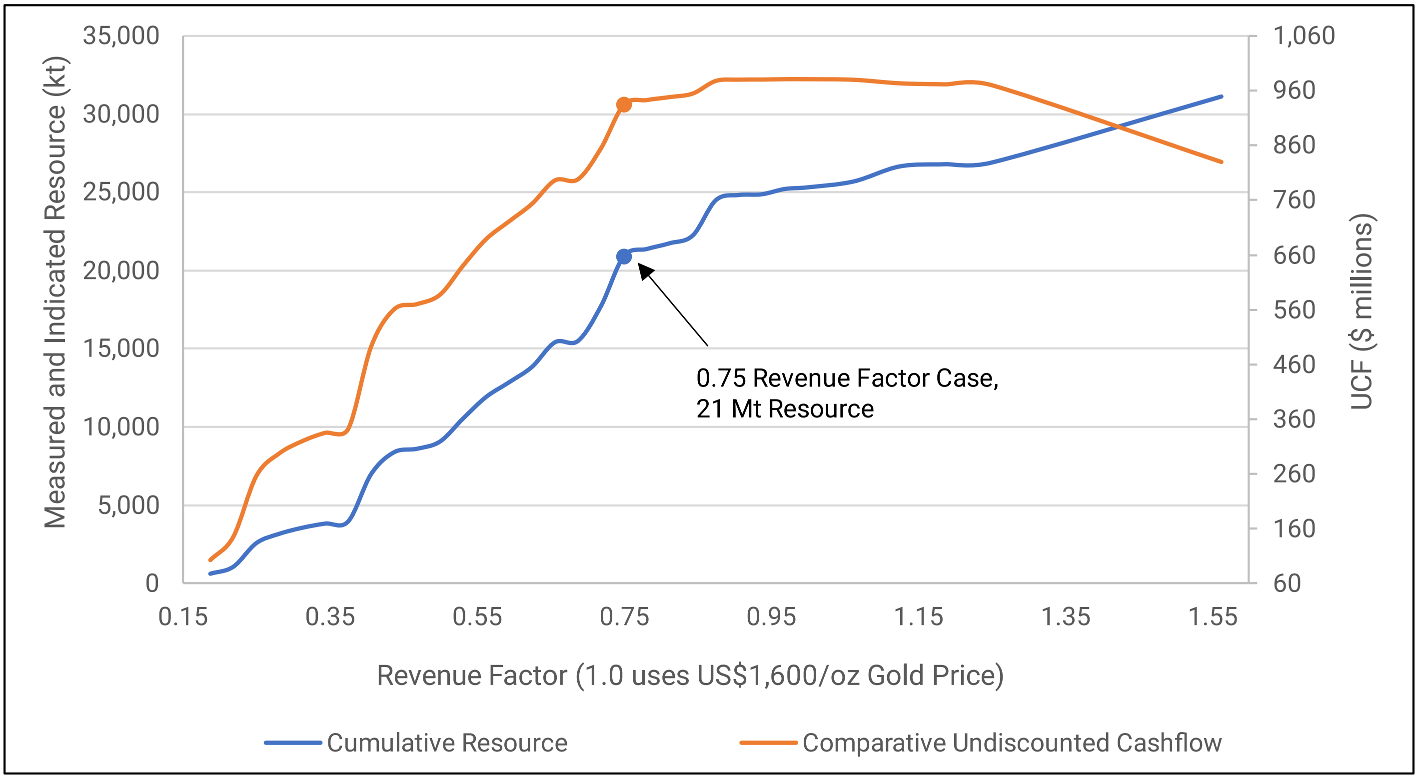
### 16.2.1 Marathon Pit Limit

Figure 16-6 shows the contents of the generated Pseudoflow pit shells for Marathon. An inflection point to a flatter curve can be seen in the curve of cumulative resources and UCF by pit case. This point indicates the shell generated from a 0.75 revenue factor (RF) input (US$1,200/oz gold price) as a point at which larger pit shells will not produce significant increases to project value.

The pit shell generated from the 0.75 RF input is selected as the ultimate pit limits for Marathon and is used for further mine planning as a target for detailed open pit designs with berms and ramps.

A trade-off mine plan and financial model was built to test the comparative NPV of the shell generated using a 0.88 RF input (inflection point to the right of selected 0.75 RF input shell in Figure 16-6). This trade-off exercise further re-enforced the economic basis for the selection of the shell using a 0.75 RF input as the ultimate pit limits for Marathon.

**Figure 16-6: Marathon Pseudoflow Pit Shell Resource Contents by Case**




Source: MMTS, 2022.

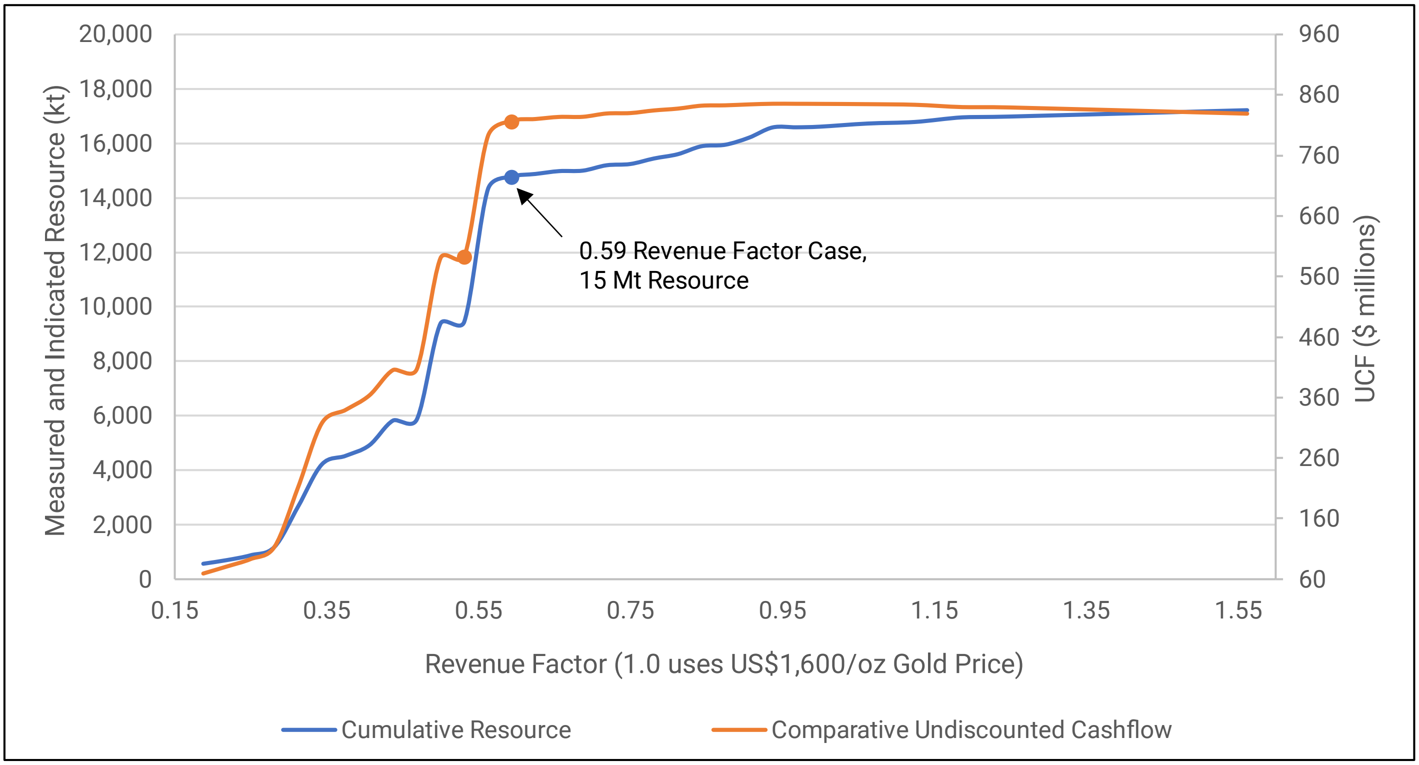
### 16.2.2 Leprechaun Pit Limit

Figure 16-7 shows the contents of the generated Pseudoflow pit shells for Leprechaun. An inflection point to a flatter curve can be seen in the curve of cumulative resources and UCF by pit case. This point indicates the shell generated from a 0.59 RF input (US$950/oz gold price) as a point at which larger pit shells will not produce significant increases to project value.

The pit shell generated from the 0.59 RF input is selected as the ultimate pit limits for Leprechaun and is used for further mine planning as a target for detailed open pit designs with berms and ramps.

A trade-off mine plan and financial model was built to test the comparative NPV of the shell generated using a 0.84 RF input (inflection point to the right of selected 0.59 RF input shell in Figure 16-7). This trade-off exercise further re-enforced the economic basis for the selection of the shell using a 0.59 RF input as the ultimate pit limits for Leprechaun.

**Figure 16-7: Leprechaun Pseudoflow Pit Shell Resource Contents by Case**




Source: MMTS, 2022.

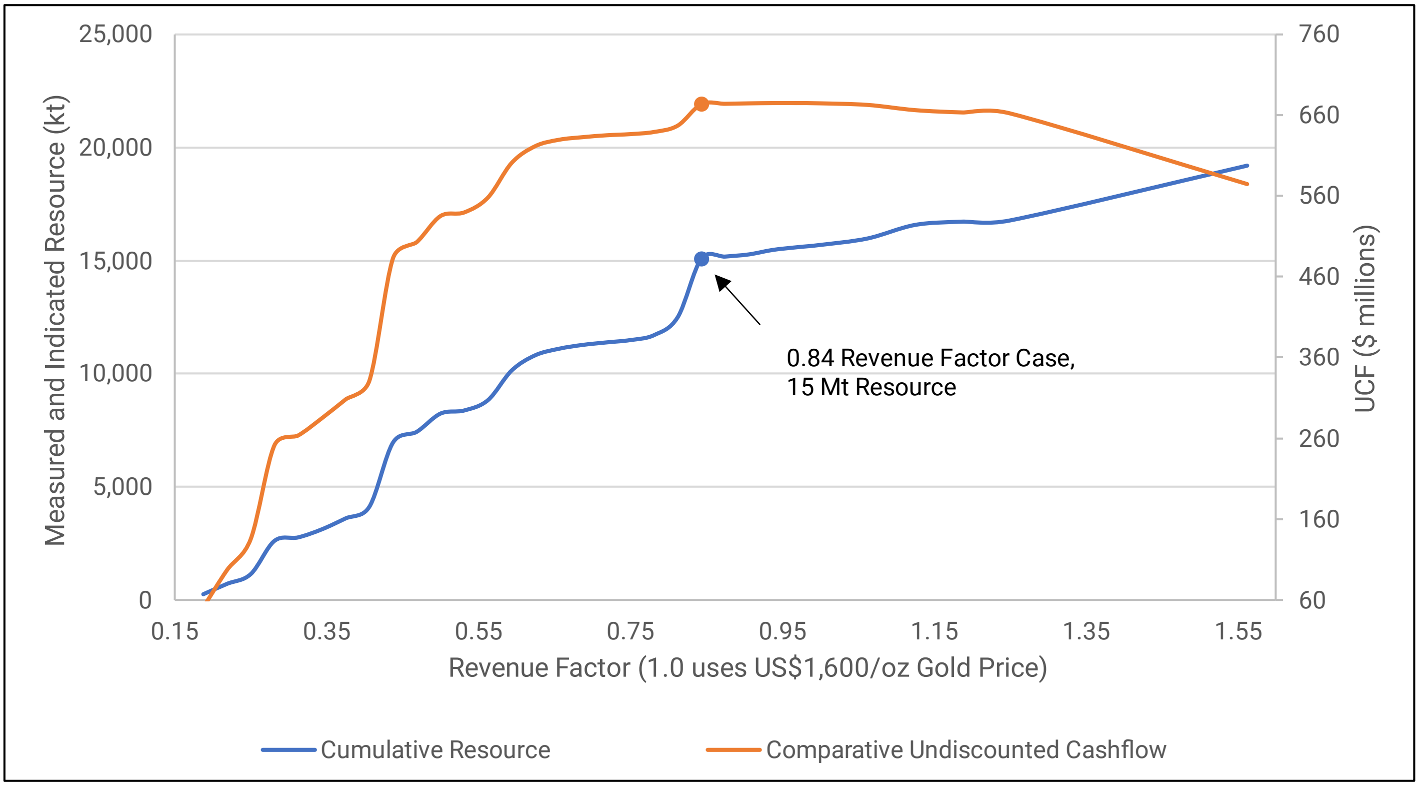
### 16.2.3 Berry Pit Limit

Figure 16-8 shows the contents of the generated Pseudoflow pit shells for Berry. An inflection point to a flatter curve can be seen in the curve of cumulative resources and UCF by pit case. This point indicates the shell generated from a 0.84 RF input (US$1,350/oz gold price) as a point at which larger pit shells will not produce significant increases to project value.

The pit shell generated from the 0.84 RF input is selected as the ultimate pit limits for Berry and is used for further mine planning as a target for detailed open pit designs with berms and ramps.

A trade-off mine plan and financial model was built to test the comparative NPV of the shell generated using a 0.66 RF input (inflection point to the left of selected 0.84 RF input shell in Figure 16-8). This trade-off exercise further re-enforced the economic basis for the selection of the shell using a 0.84 RF input as the ultimate pit limits for Berry.

**Figure 16-8: Berry Pseudoflow Pit Shell Resource Contents by Case**




Source: MMTS, 2022.

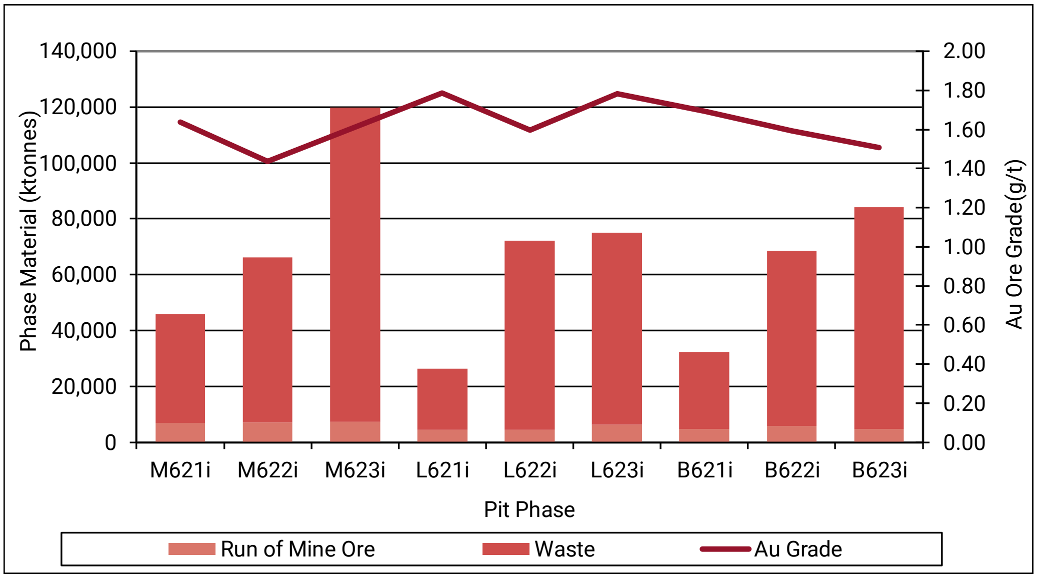
## 16.3 Pit Designs

Contents of the designed open pits are presented in Table 15-2 and discussed in Section 15.3. The contents for each designed pit phase are presented graphically in Figure 16-9.

### 16.3.1 In-Pit Haul Roads

Two-way haul roads of 28 m width are sized to handle 140-tonne payload rigid frame haul trucks. Haul road grades are limited to a maximum of 10%. Access ramps are not designed for the last two (x 6 m) benches of the pit bottom, on the assumption that the bottom ramp segment will be removed using some form of retreat mining. The bottom two ramped benches of the pit use one-way haul roads of 21 m width and 12% grade since bench volumes and traffic flow are reduced.

**Figure 16-9: Designed Phase Pit Contents (All Deposits)**




Source: MMTS, 2022.

### 16.3.2 Pit Phases

Ultimate pit limits are generally split up into phases or pushbacks to target higher economic margin material earlier in the mine life. Minimum pushback distances of 60 m are honoured to maintain productive headings. The Marathon, Leprechaun and Berry pits are all split into three phases with the higher-grade, lower-strip-ratio first phase mined ahead of the two pushbacks.

Targets for the first two phases at Marathon use Case 10 and Case 17 of the optimization runs described in Section 16.2.1. Targets for the first two phases at Leprechaun use Case 7 and Case 12 of the optimization runs described in Section 16.2.2. Targets for the first two phases at Berry use Case 10 and Case 15 of the optimization runs described in Section 16.2.3.

In each deposit, a construction phase is designed that is within the Phase 1 open pits, targeting waste rock areas with sufficient volumes for planned construction uses for haul roads, the starter tailings dam, site pads, and water management structures.

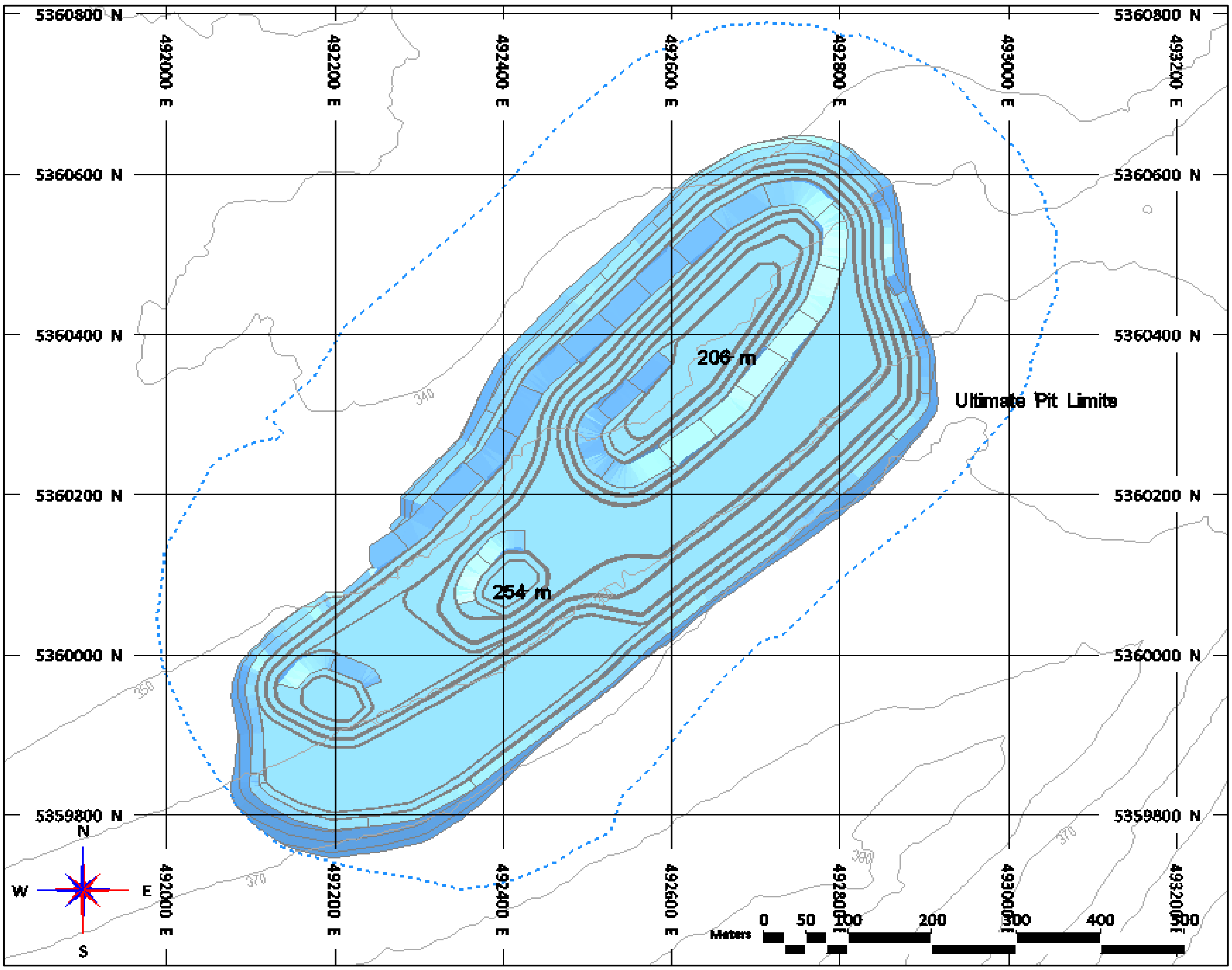
### 16.3.3 Marathon Pit Designs

The phased Marathon pit designs are discussed below and shown in Figure 16-10 to Figure 16-12. Sections through the deposit showing the 6 m re-blocked model grades are illustrated in Figure 16-13 and Figure 16-14.

- Marathon Phase 1, M621 – This phase targets the high-grade, low-strip-ratio central portion of the deposit. This phase contains about three years' worth of mill feed and mines from the pit exit at the 350 m elevation, down to the pit bottom at the 206 m elevation. The main ramp runs clockwise down from the pit exit in the northwest. The construction phase, M620 (not shown in the figures), is situated in the southwest corner of the M621 open pit, targeting waste rock for construction.

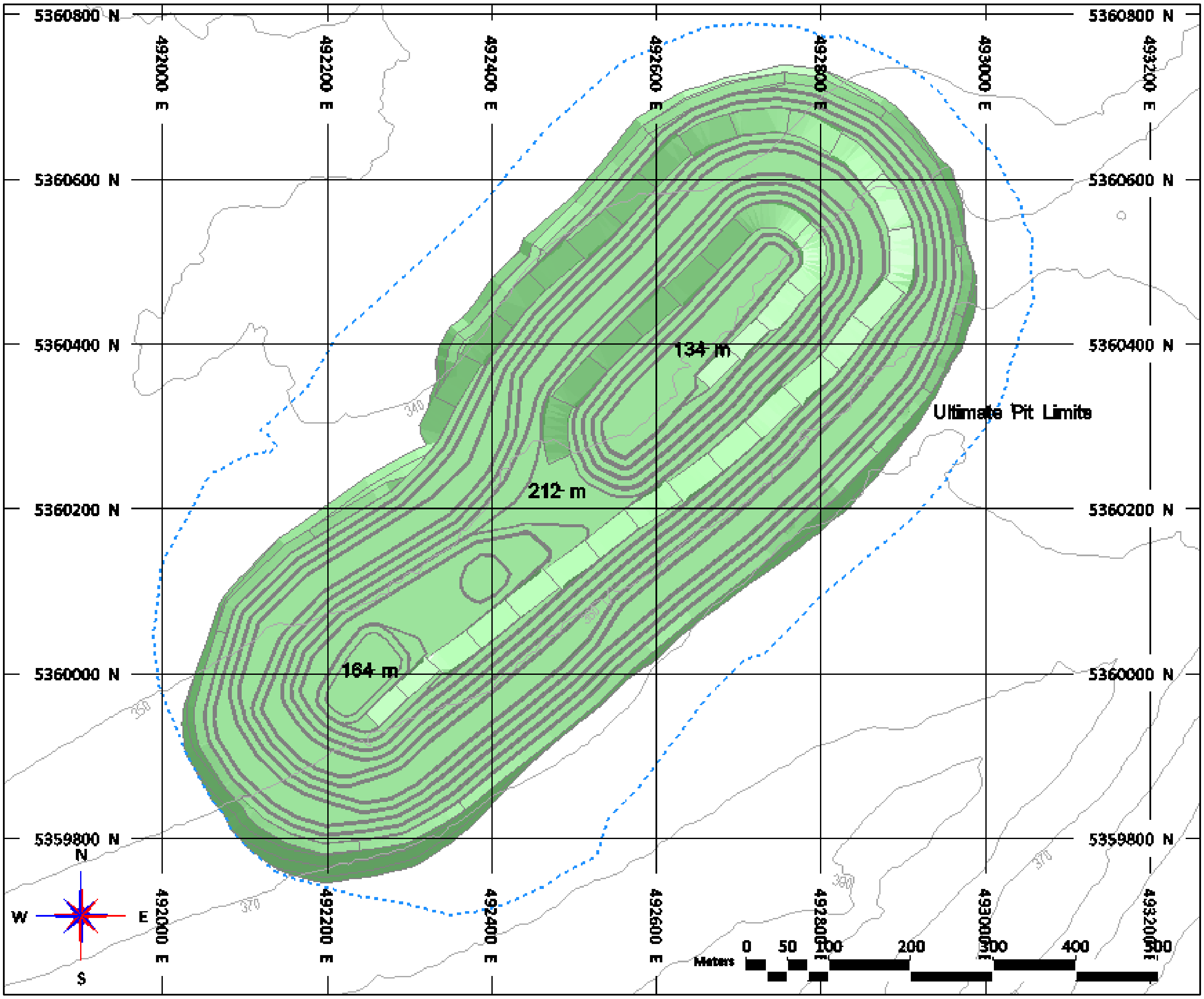
- Marathon Phase 2, M622 – This phase targets deeper, higher-strip-ratio mineralization below phase 1, pushing out in the north and east directions, while leaving enough room for a final pushback to the phase 3 pit. This phase contains about three years' worth of mill feed and mines from the pit exit at the 342 m elevation, down to the pit bottom at the 134 m elevation. The main ramp runs clockwise from the pit exit in the north of the pit. At the 212 m bench, the ramp branches off to separate pit bottom in the northeast and southwest corners of the pit. Geotechnical berms are left behind at the 314 m, 278 m, and 242 m elevations.
- Marathon Phase 3, M623 – This phase is the final phase and pushes out in the north, east, and south directions, targeted the remaining deep mineralization. This phase contains about three years' worth of mill feed and mines from the pit exit at the 338 m elevation, down to the pit bottom at the 44 m elevation. The main ramp runs clockwise down from the pit exit in the north of the pit. Geotechnical berms are left behind at various elevations.

**Figure 16-10: Marathon Phase 1 Pit, M621**



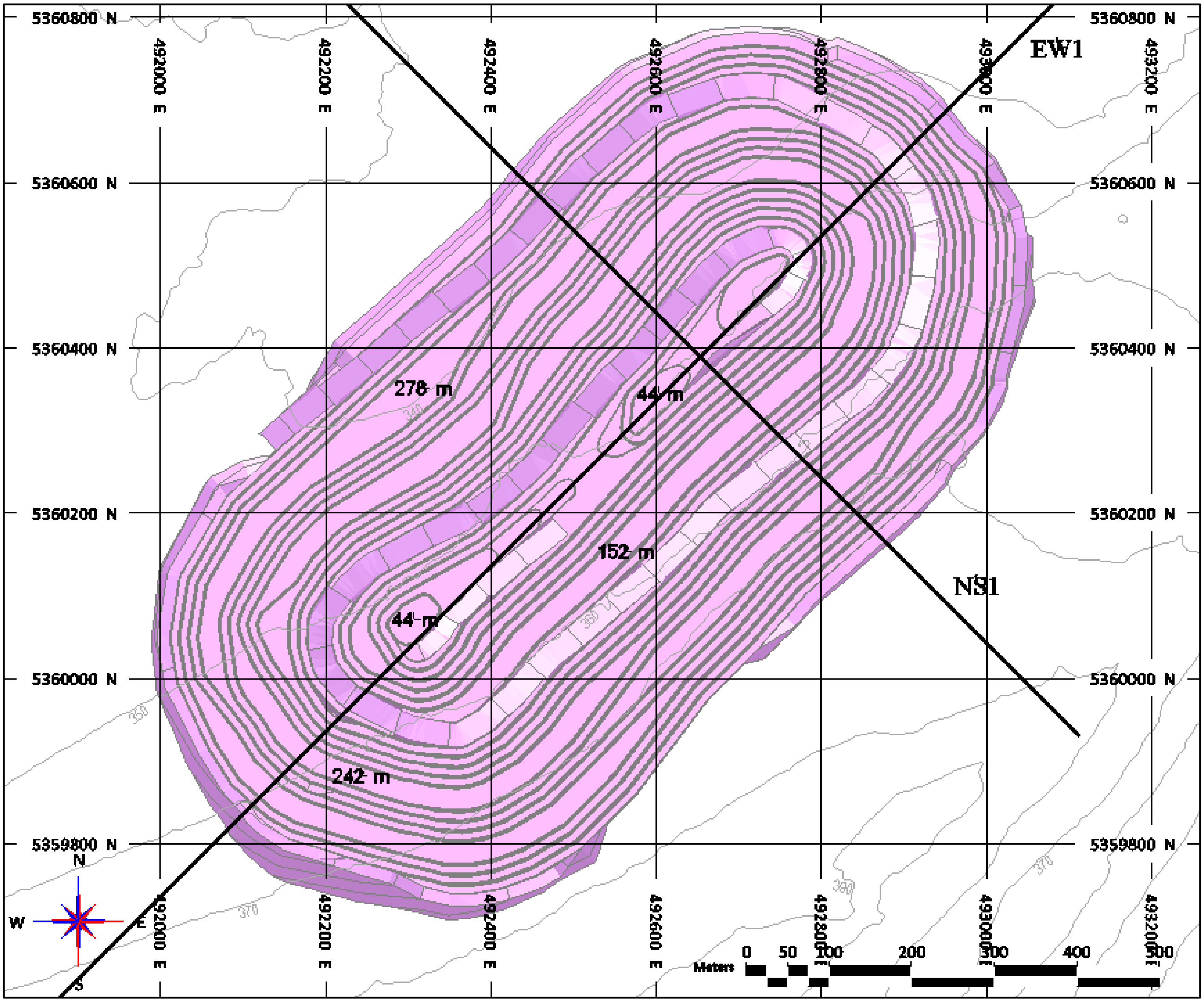

Source: MMTS, 2022.

**Figure 16-11: Marathon Phase 2 Pit, M622**



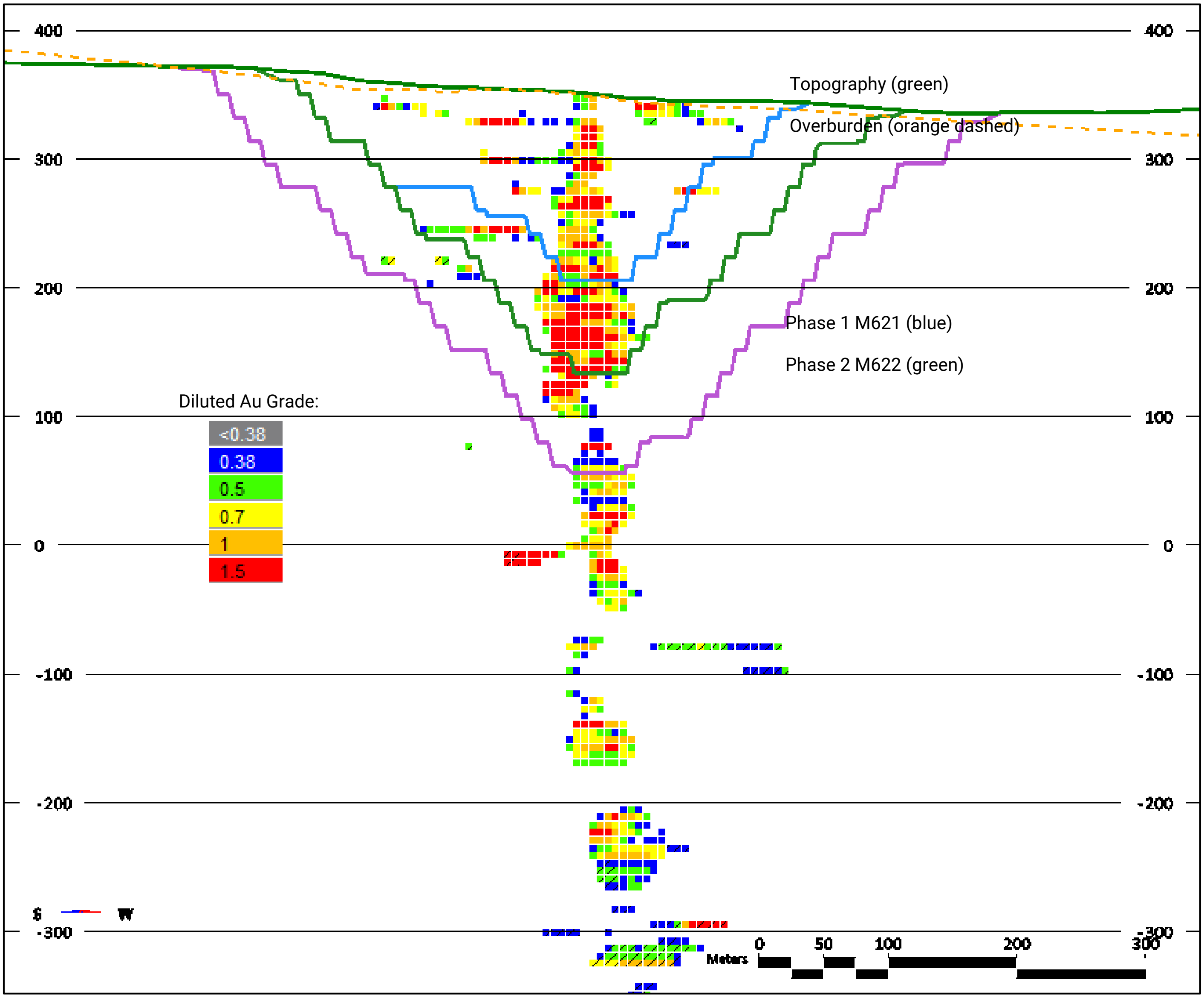

Source: MMTS, 2022.

**Figure 16-12: Marathon Phase 3 Pit, M623**



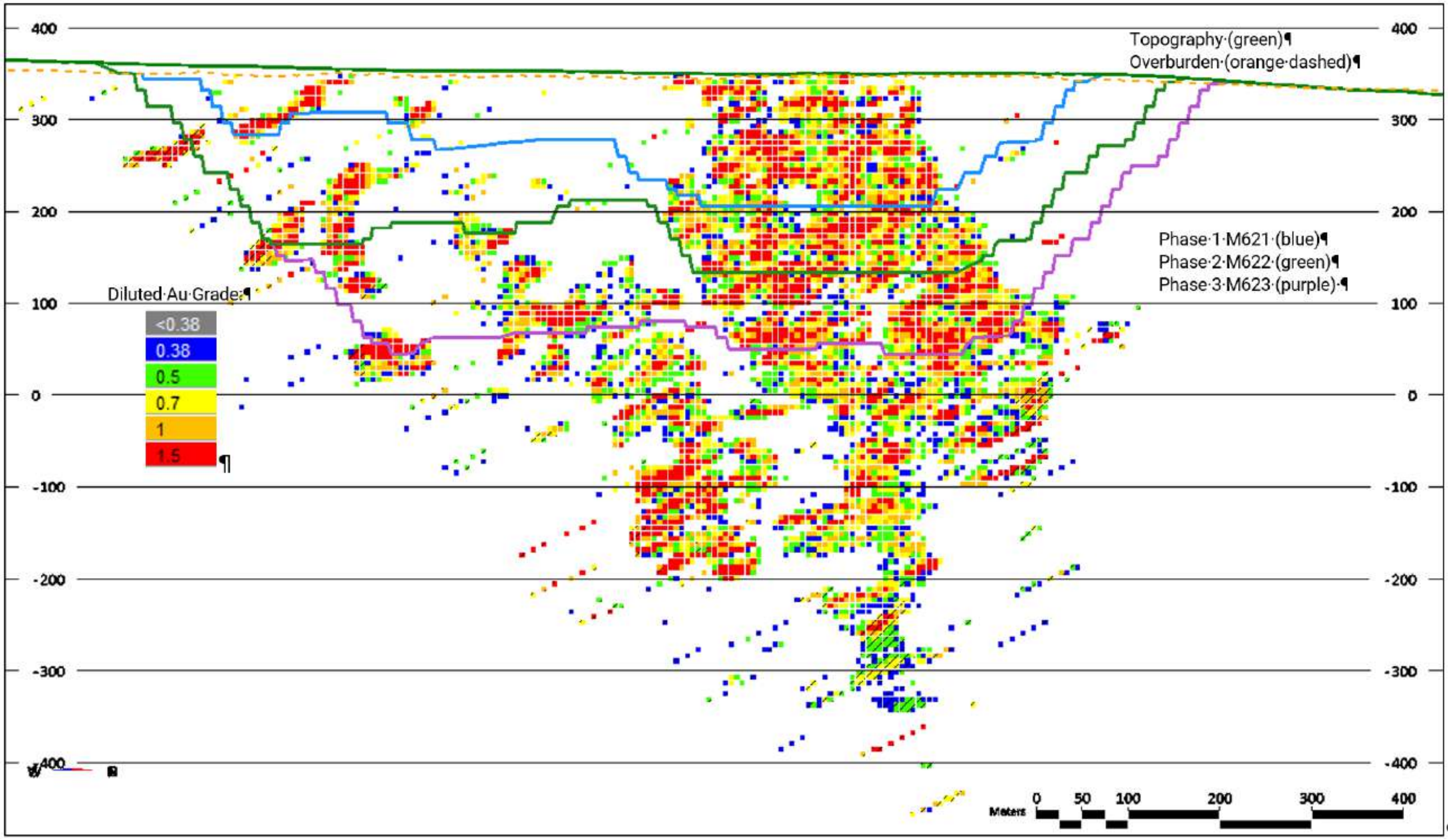

Source: MMTS, 2022.

**Figure 16-13: Marathon Pit Designs, North-South Section**




Note: NS1 as shown in Figure 16-12. Source: MMTS, 2022.

**Figure 16-14: Marathon Pit Designs, East-West Section**




Note: EW1 as shown in Figure 16-12. Source: MMTS, 2022.

#### 16.3.4 Leprechaun Pit Designs

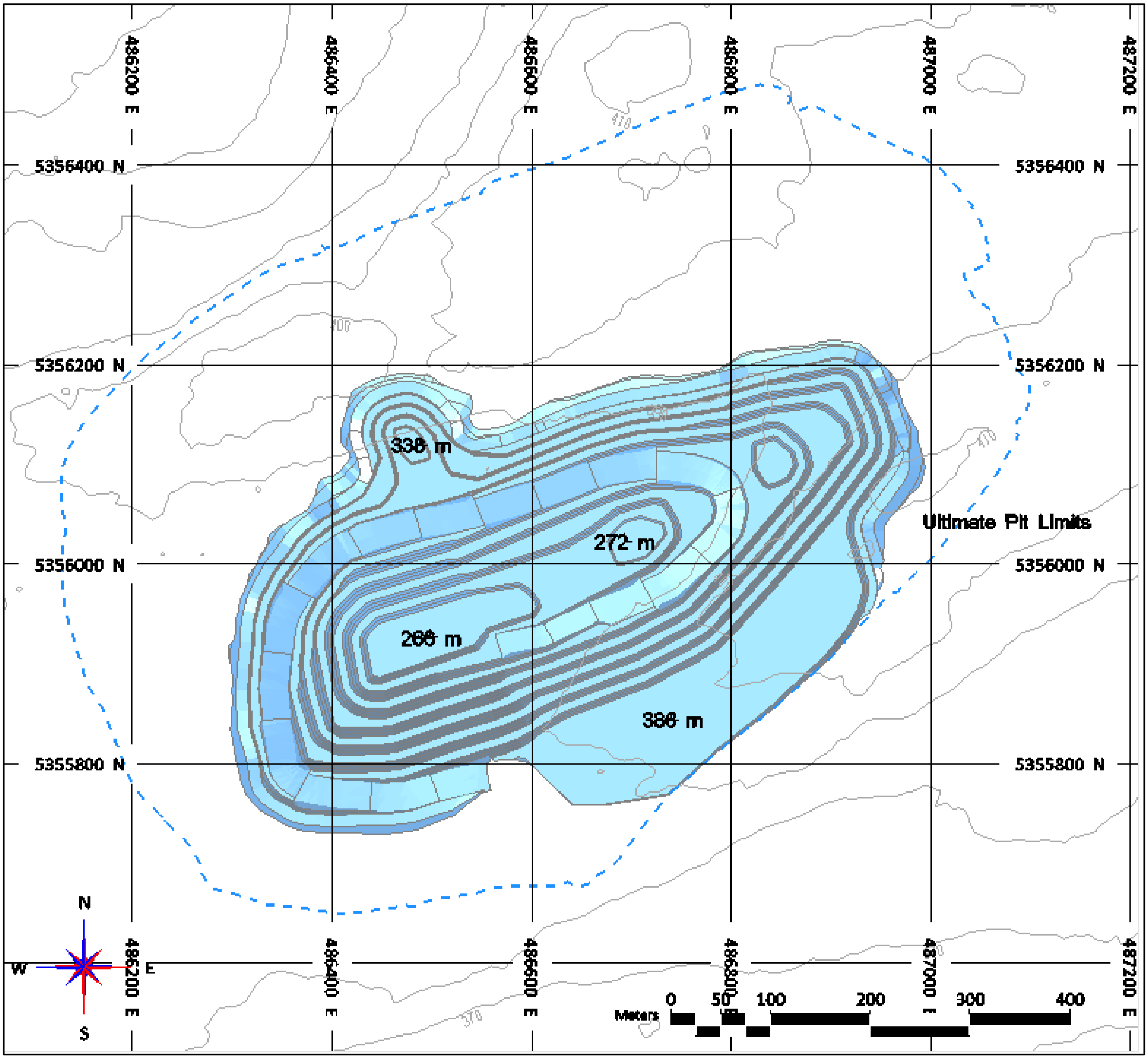
The phased Leprechaun pit designs are shown in Figure 16-15 to Figure 16-17. Sections through the deposit showing the 6 m re-blocked model grades are illustrated in Figure 16-18 and Figure 16-19.

- Leprechaun Phase 1, L621 – This phase targets the high-grade, low-strip-ratio central portion of the deposit. This phase contains about two years' worth of mill feed and mines from the pit exit at the 386 m elevation, down to the pit bottom at the 266 m elevation. The main ramp runs clockwise down from the pit exit in the south. A small sub-out in the north of the pit will be mined to the 338 m elevation. The construction phase, L620 (not shown in figures), is situated along the entire south side of the L621 open pit, targeting waste rock for construction.

- Leprechaun Phase 2, L622 – This phase targets deeper, higher-strip-ratio mineralization below phase 1, pushing out in the north, south and west directions, while leaving enough room for a final pushback to the phase 3 pit. This phase contains about two years' worth of mill feed and mines from the pit exit at the 398 m elevation, down to the pit bottom at the 170 m elevation. The main ramp runs counter-clockwise down from the pit exit in the northeast. Geotechnical berms are left behind at the 350 m and 296 m elevations.

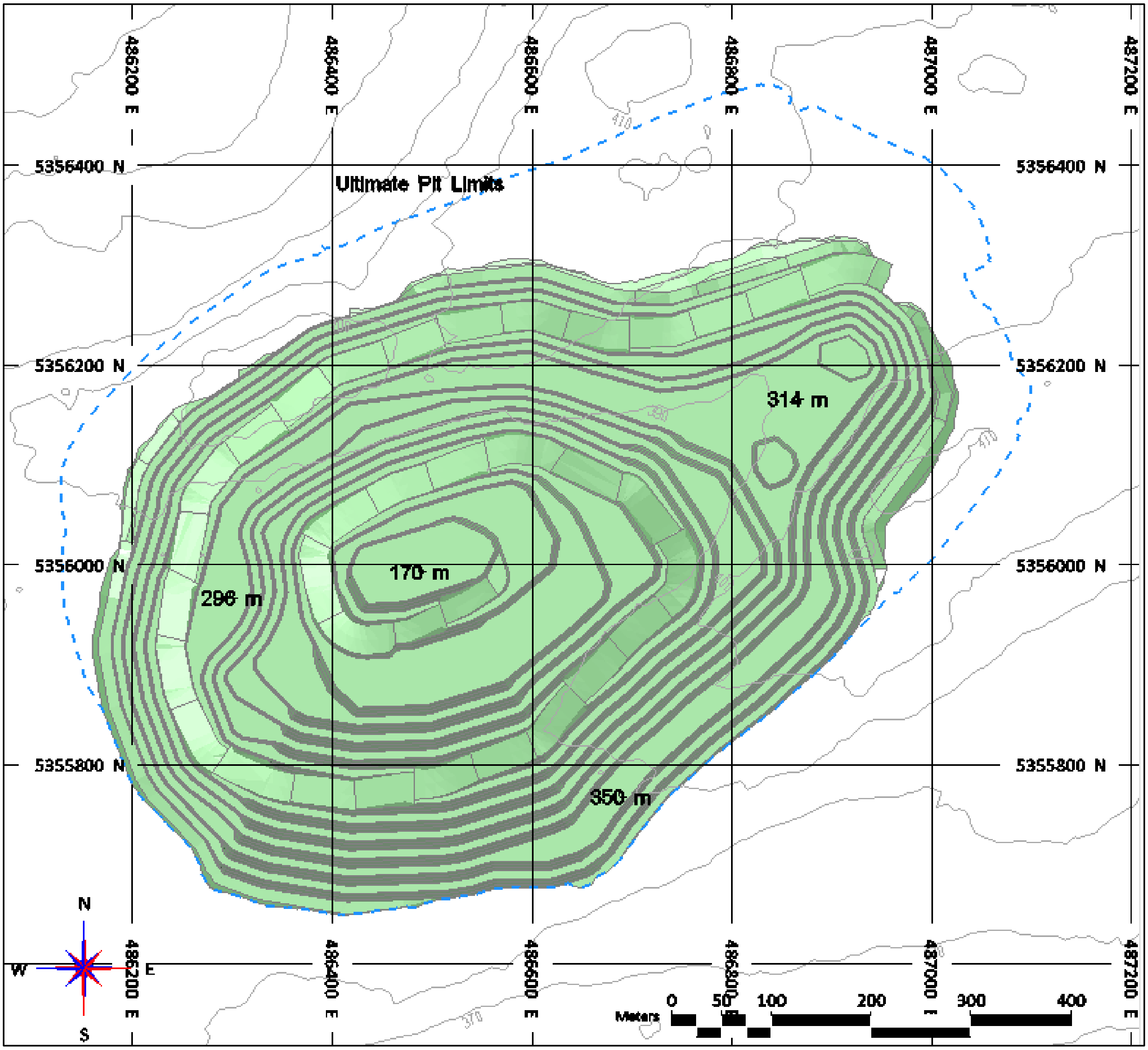
- Leprechaun Phase 3, L623 – This phase is the final phase and pushes out in the north and east directions, targeting the remaining deep mineralization. This phase contains about three years' worth of mill feed and mines from the pit exit at the 398 m elevation, down to the pit bottom at the 98 m elevation. The main ramp runs counter-clockwise down from the pit exit in the east of the pit switchbacks at the 296 m elevation, then clockwise down to the bottom of the pit. Geotechnical berms are left behind at various elevations.

**Figure 16-15: Leprechaun Phase 1 Pit, L621**



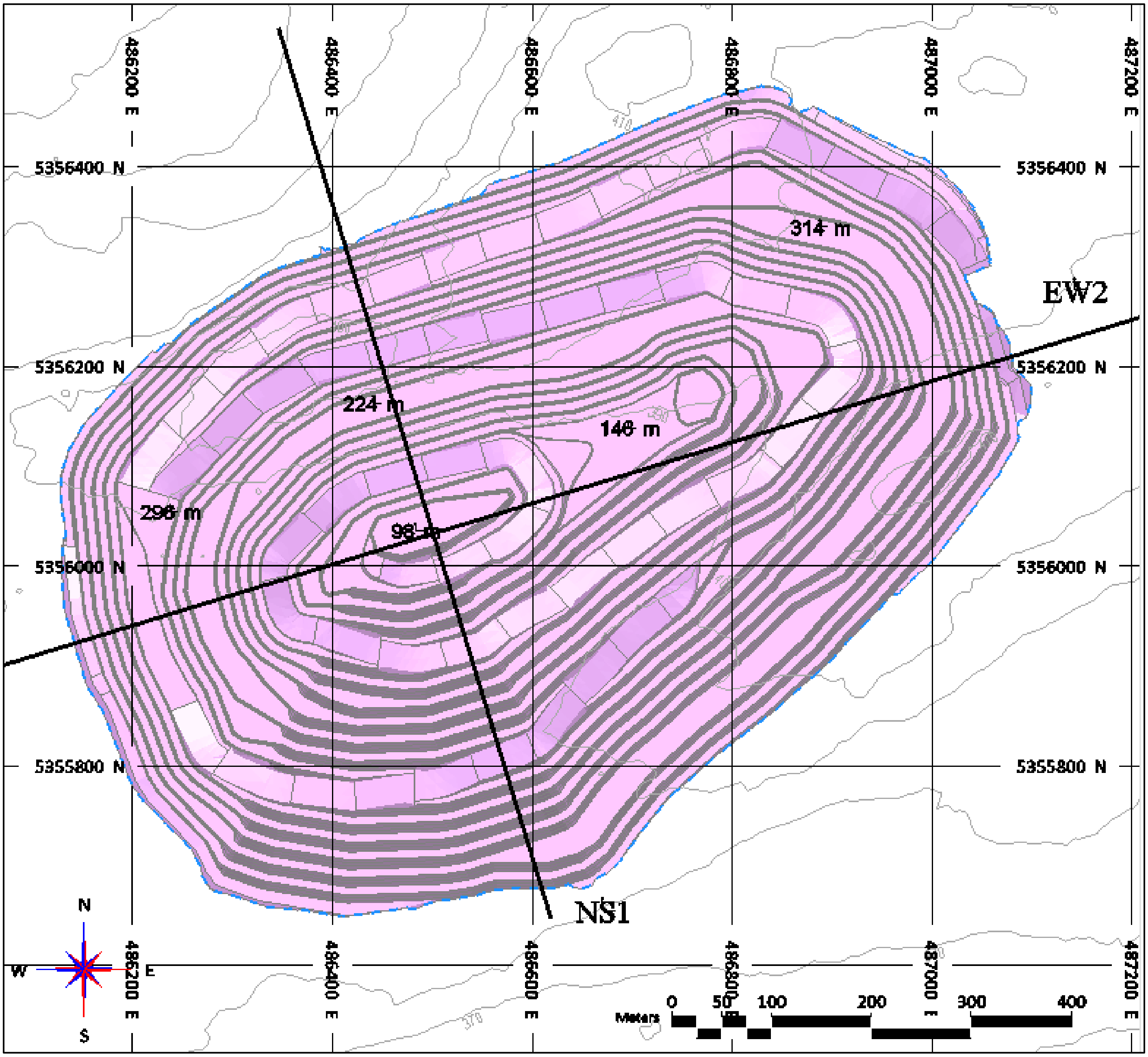

Source: MMTS, 2022.

**Figure 16-16: Leprechaun Phase 2 Pit, L622**



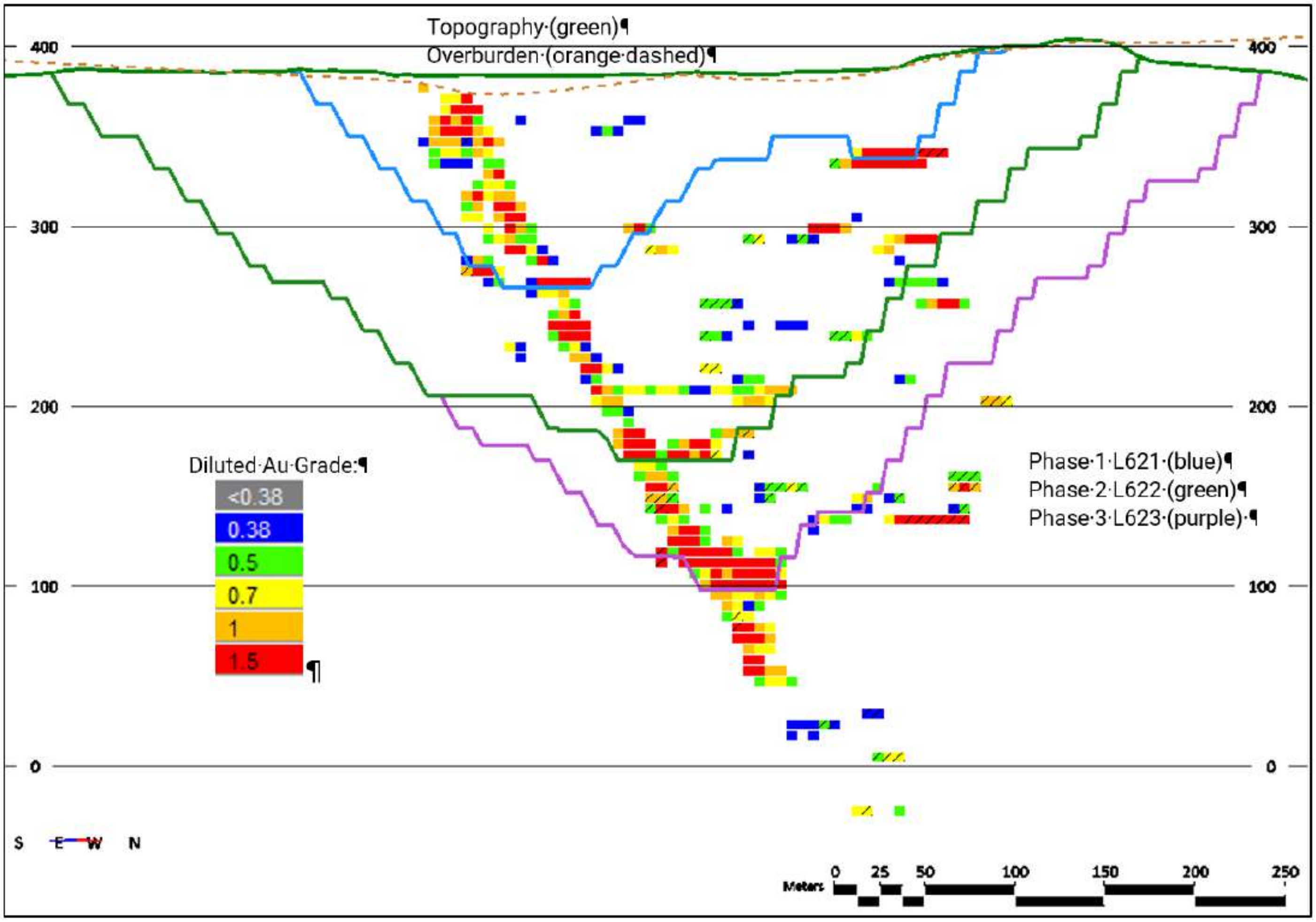

Source: MMTS, 2022.

**Figure 16-17: Leprechaun Phase 3 Pit, L623**



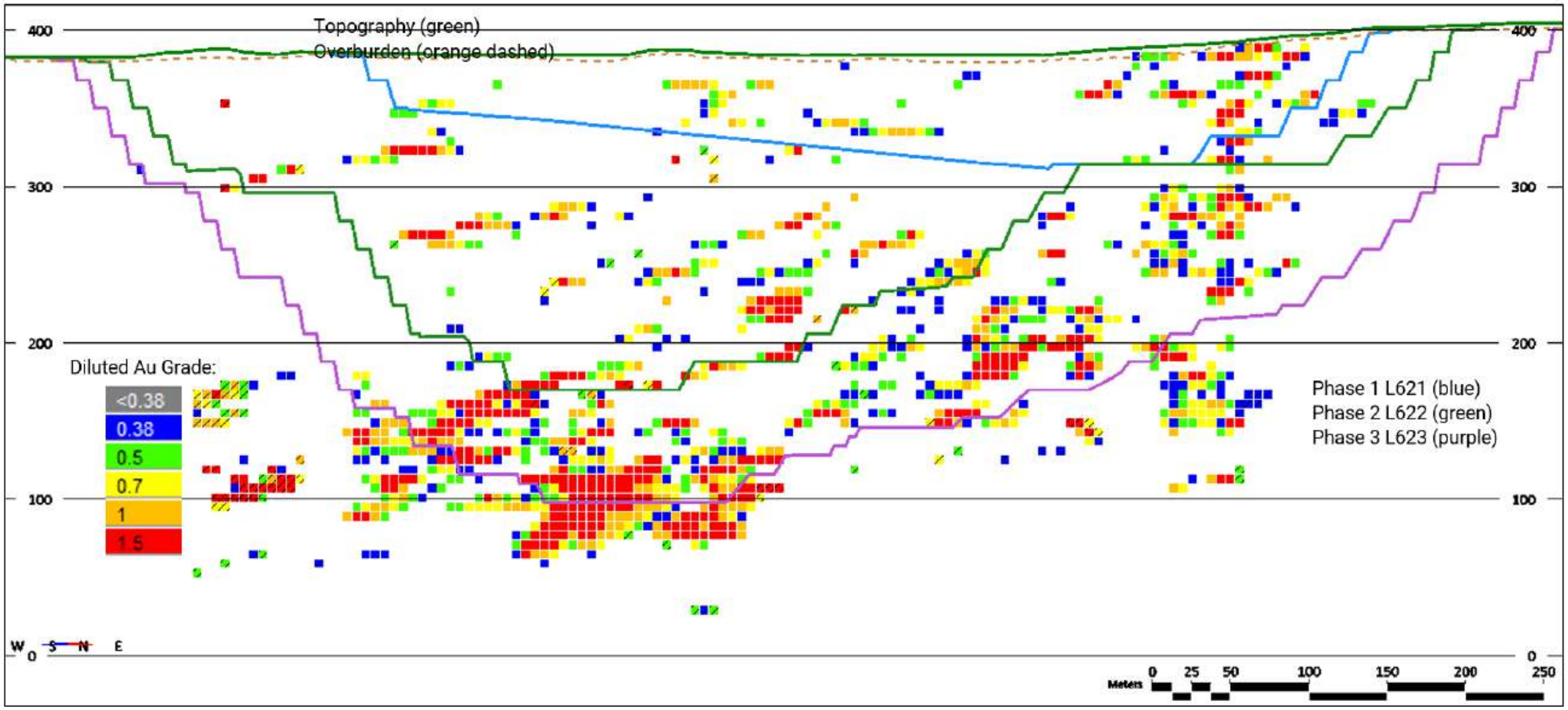

Source: MMTS, 2022.

**Figure 16-18: Leprechaun Pit Designs, North-South Section**




Note: NS1 as shown in Figure 16-17. Source: MMTS, 2022.

**Figure 16-19: Leprechaun Pit Designs, East-West Section**




Note: EW2 as shown in Figure 16-17. Source: MMTS, 2022.

### 16.3.5 Berry Pit Designs

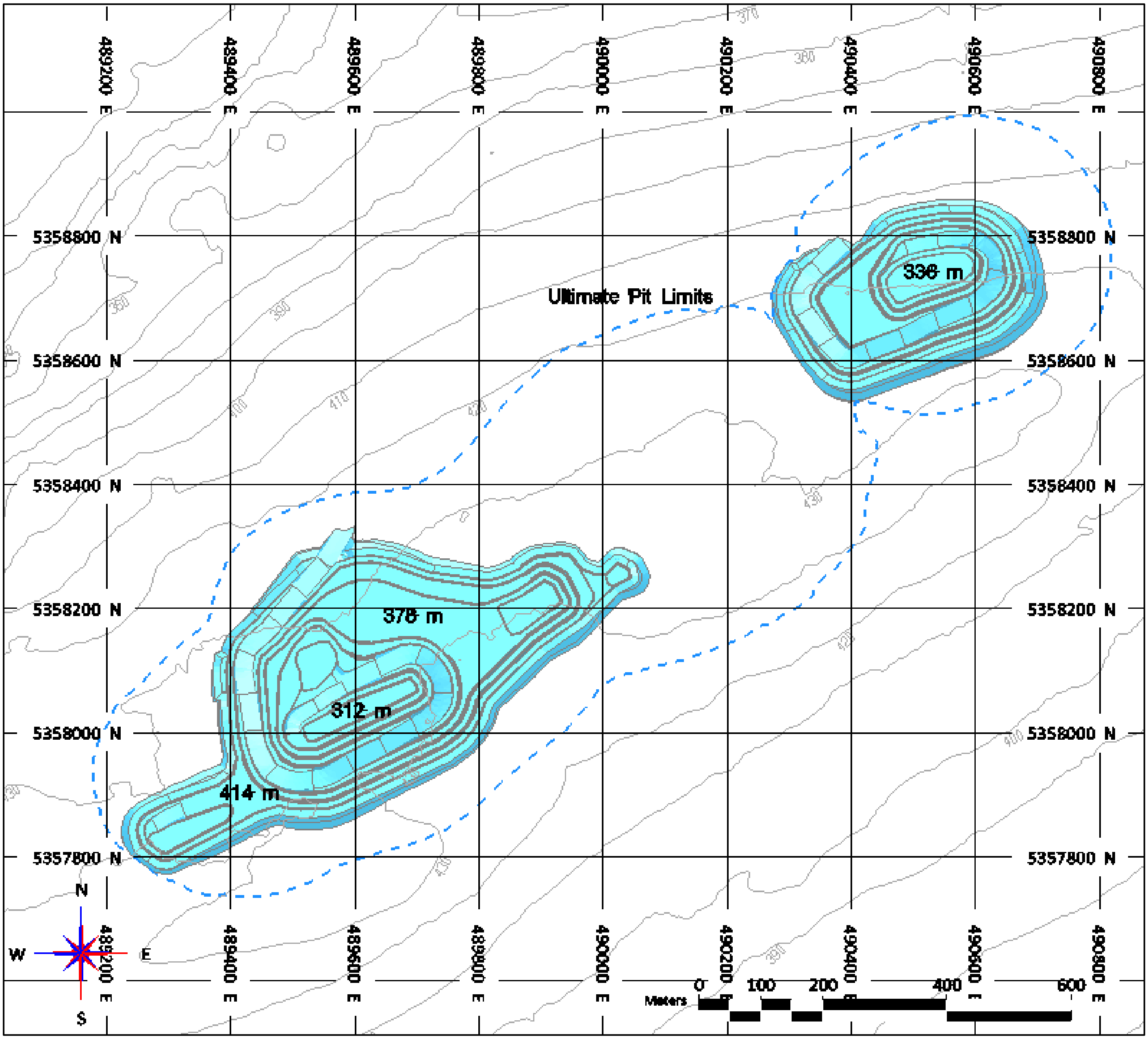
The phased Berry pit designs are shown in Figure 16-20 to Figure 16-22. Sections through the deposit showing the 6 m re-blocked model grades are illustrated in Figure 16-23 to Figure 16-28.

- Berry Phase 1, B621 – This phase targets the two separate high-grade, low-strip-ratio portions of the deposit in the southwest and northeast, both planned to be mined simultaneously. This phase contains about two years' worth of mill feed. The southwest lobe of the pit mines from the pit exit at the 426 m elevation, down to the pit bottom at the 312 m elevation. The main ramp runs counter-clockwise down from the pit exit in the north. A small sub-out in the west of the pit will be mined to the 402 m elevation. The northeast lobe of the pit mines from the pit exit at the 414 m elevation, down to the pit bottom at the 336 m elevation. The main ramp runs counter-clockwise down from the pit exit in the north. The construction phase, B620 (not shown in Figures), is situated in the north corner of the southwest lobe of the B621 open pit, targeting waste rock for ex-pit haul road construction.

- Berry Phase 2, B622 – This phase targets deeper, higher-strip-ratio mineralization below phase 1. This phase pushes out the southwest lobe of the pit to the west, east and south, while leaving enough room for a final pushback to the phase 3 pit. This phase also pushes the northeast lobe of the pit to the ultimate limits in the north, south and east directions. This phase contains about three years' worth of mill feed. The southwest lobe of the pit mines from the pit exit at the 426 m elevation, down to the pit bottom at the 264 m elevation. The main ramp runs counter-clockwise down from the pit exit in the north. A small sub-out in the east of the pit will be mined to the 324 m elevation, starting the central lobe of the ultimate Berry pit. A geotechnical berm is left behind at the 360 m elevation. The northeast lobe of the pit mines from the pit exit at the 414 m elevation, down to the pit bottom at the 258 m elevation. The main ramp runs counter-clockwise down from the pit exit in the north.

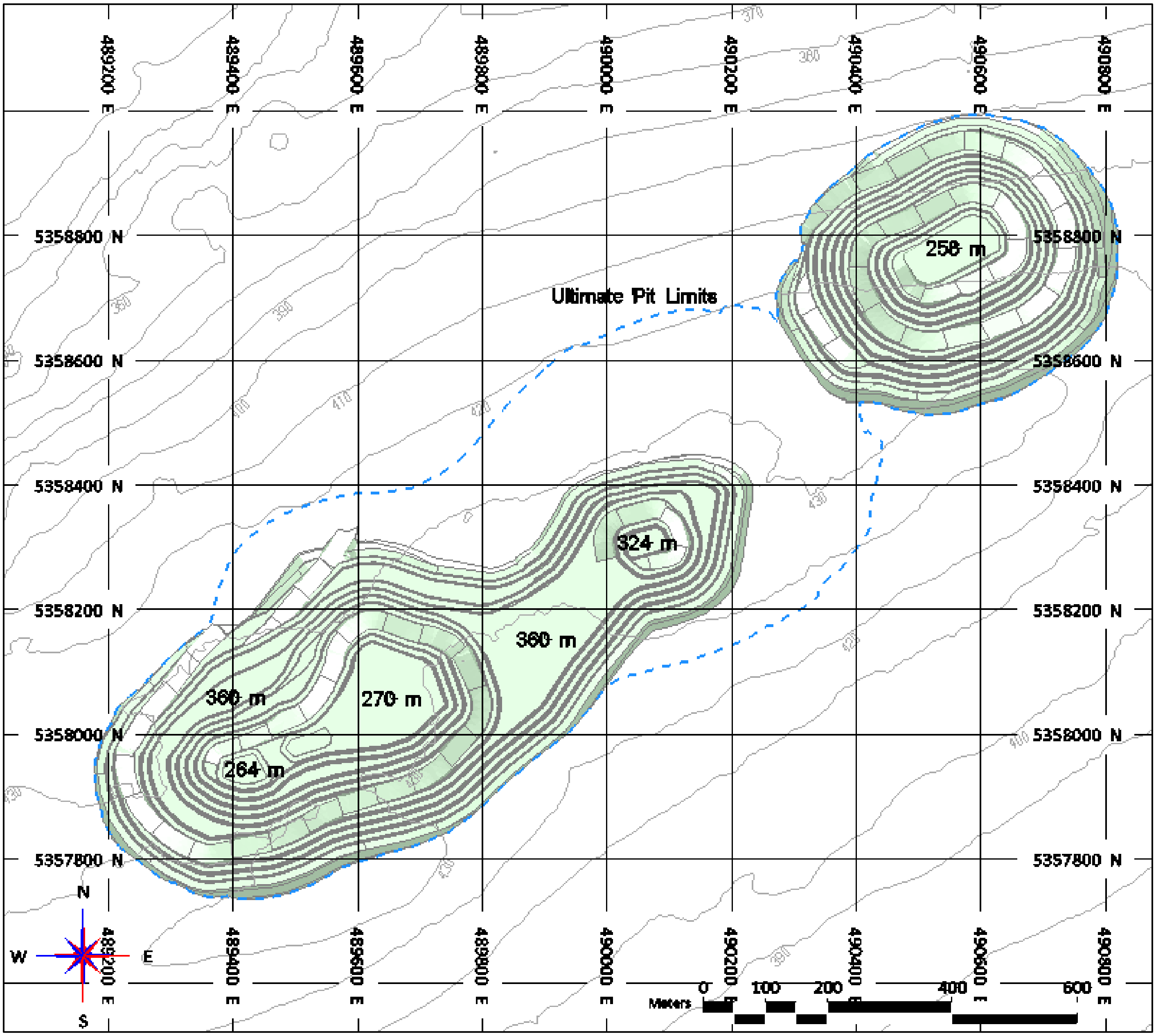
- Berry Phase 3, B623 – This phase is the final phase targeting the remaining deep mineralization. This phase pushes out in the southwest lobe of the pit to the final north limits and the central lobe of the pit to the final limits in the north, east and south directions. This phase contains about two years' worth of mill feed and mines from the pit exit at the 420 m elevation, down to the pit bottom at the 198 m elevation in the central lobe and the 210 m elevation in the southwest lobe. The main ramp runs counter-clockwise down from the pit exit in the north all the way to the central lobe pit bottom, a branch off at the 348 m elevation and switchback at the 336 m elevation runs the ramp to southwest lobe pit bottom. The pit ramp located on the west side of the southwest lobe, established for Phase 2, will also still be available for access into the bottom of the southwest lobe of the pit. The ramp in the southwest lobe will be mined out between 270 m and 282 m elevations, then filled back in for final access to the pit bottom. Geotechnical berms are left behind at the 360 m and 342 m elevations.

**Figure 16-20: Berry Phase 1 Pit, B621**



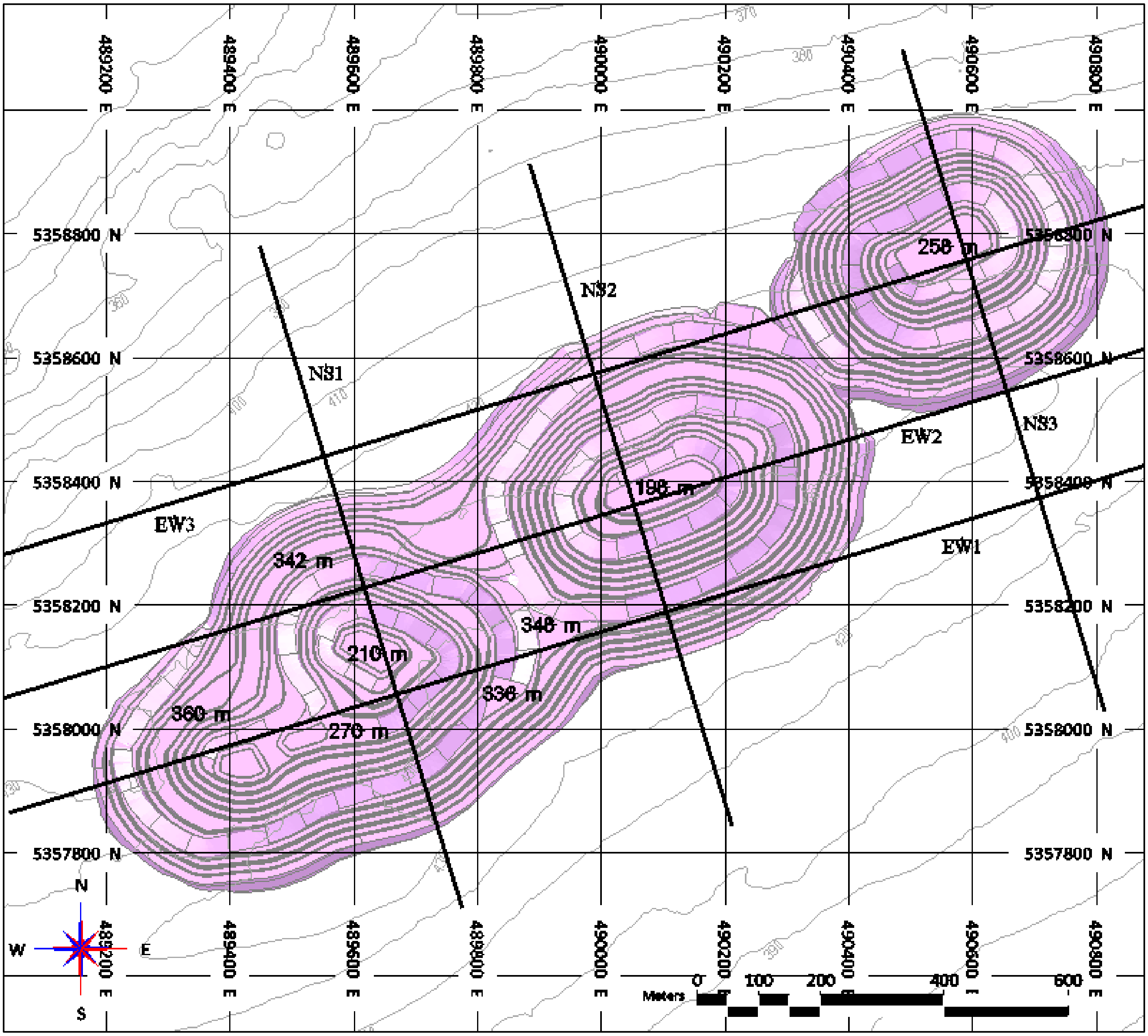

Source: MMTS, 2022.

**Figure 16-21: Berry Phase 2 Pit, B622**



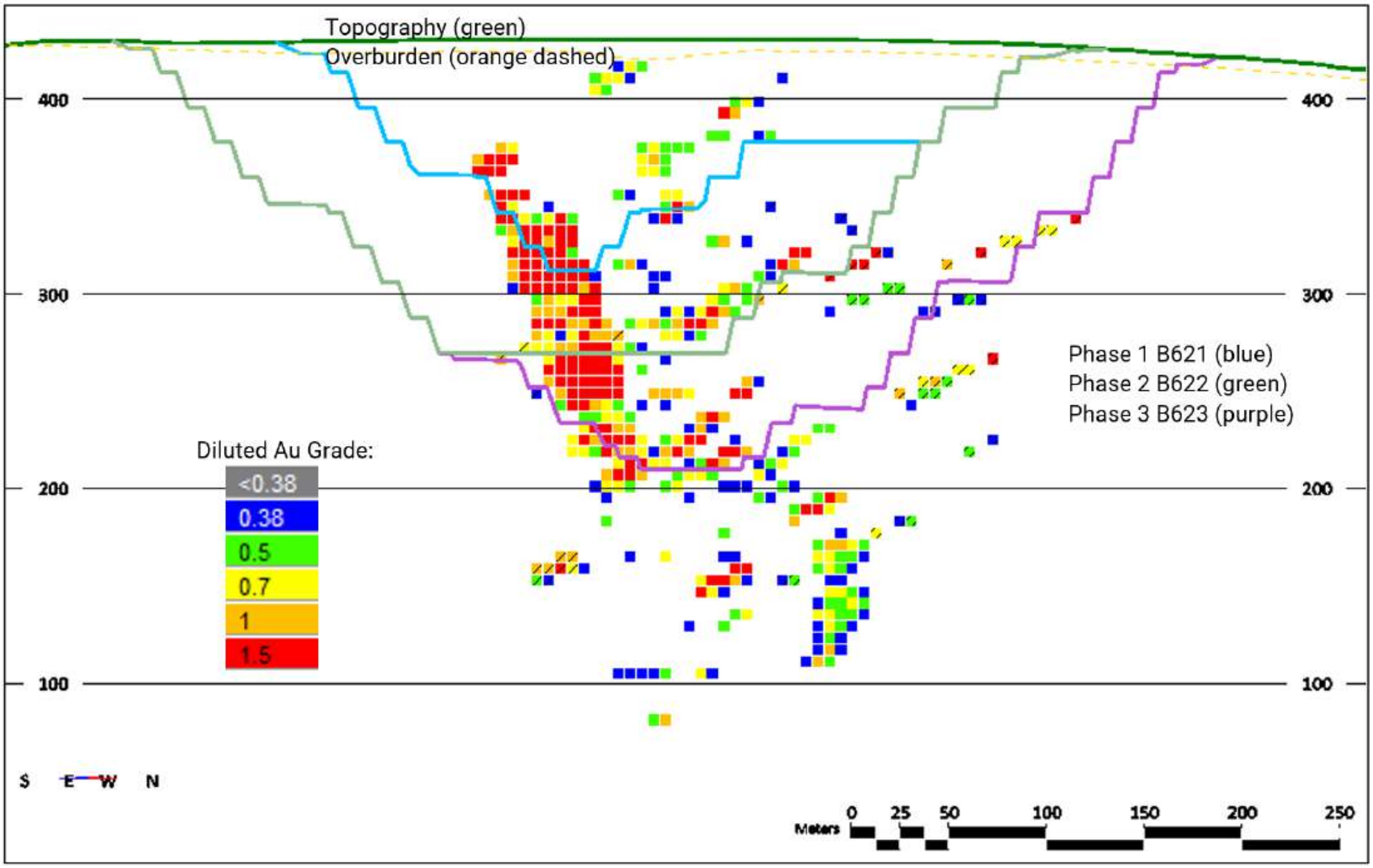

Source: MMTS, 2022.

**Figure 16-22: Berry Phase 3 Pit, B623**



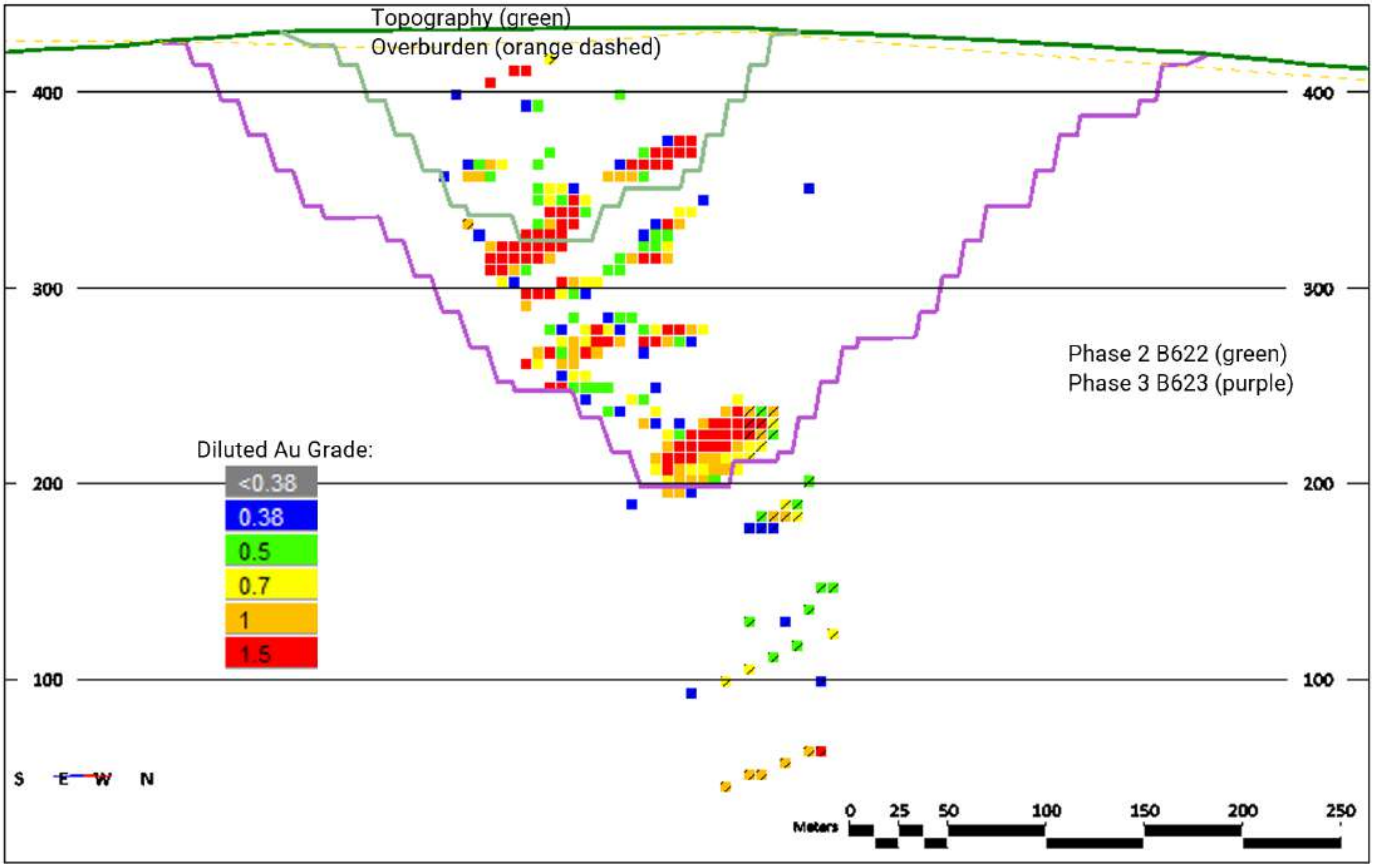

Source: MMTS, 2022.

**Figure 16-23: Berry Pit Designs, North-South Section 1**



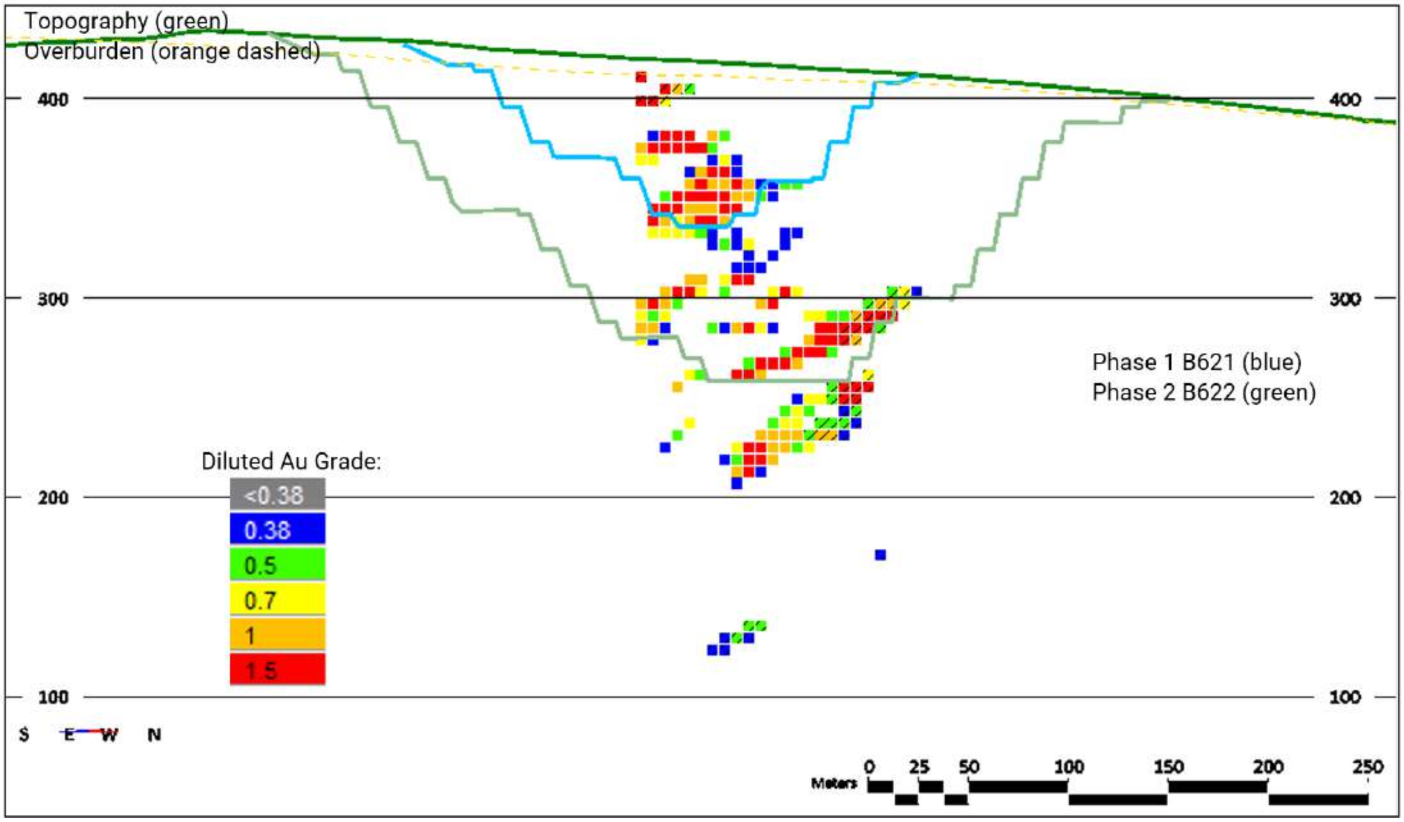

Note: NS1 as shown in Figure 16-22. Source: MMTS, 2022.

**Figure 16-24: Berry Pit Designs, North-South Section 2**



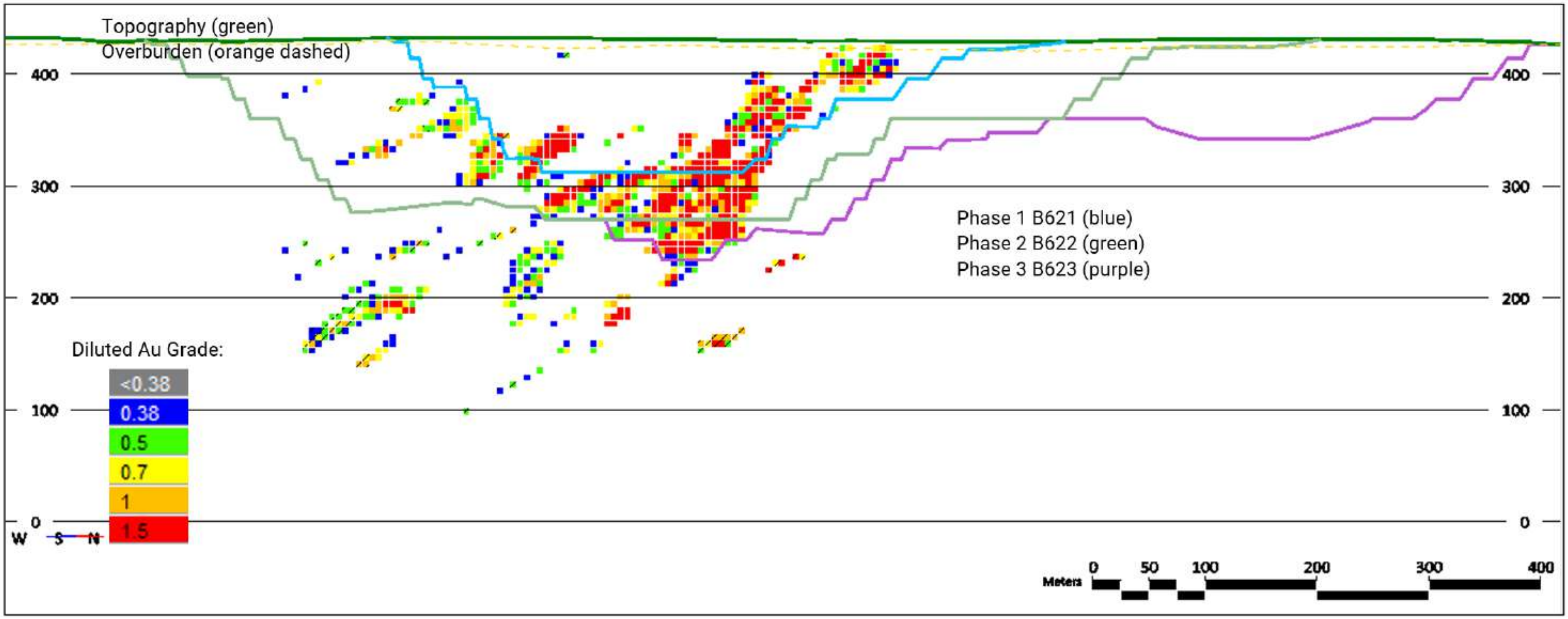

Note: NS2 as shown in Figure 16-22. Source: MMTS, 2022.

**Figure 16-25: Berry Pit Designs, North-South Section 3**



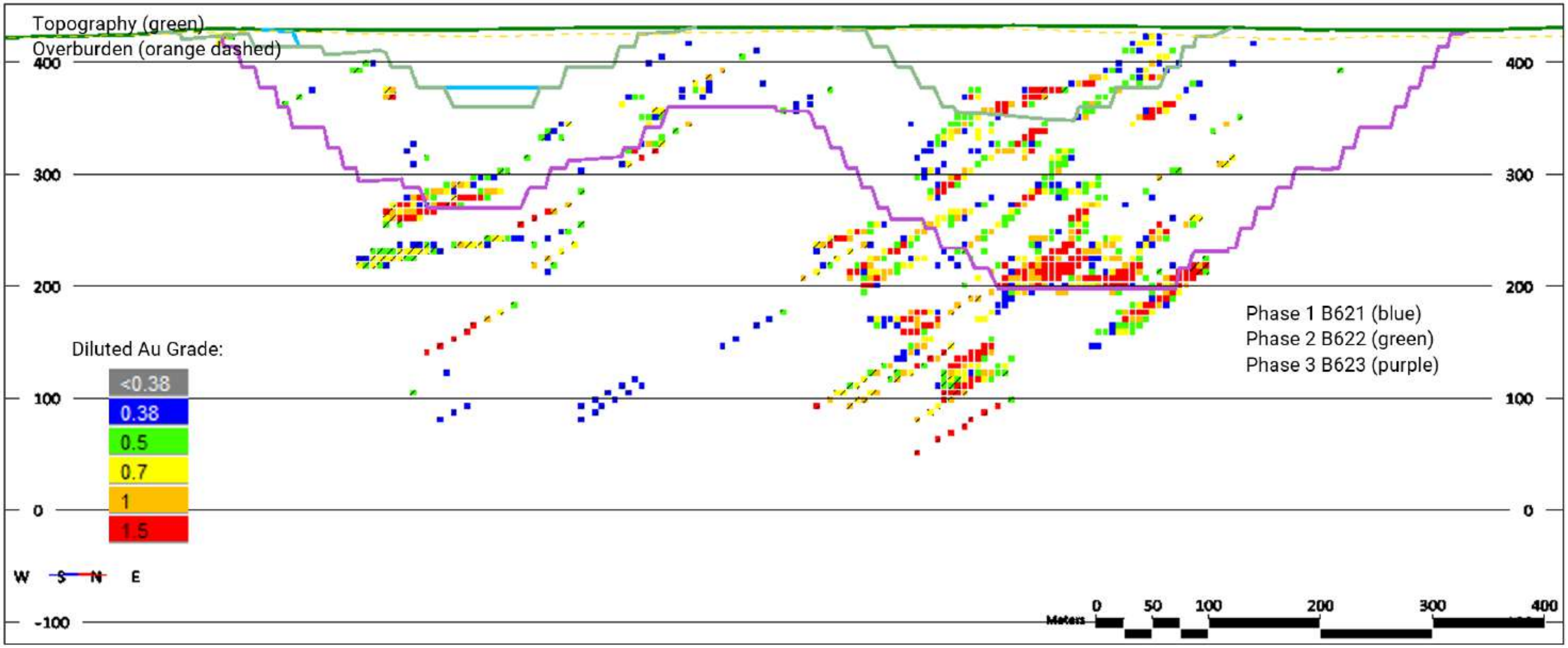

Note: NS3 as shown in Figure 16-22. Source: MMTS, 2022.

**Figure 16-26: Berry Pit Designs, East-West Section 1**



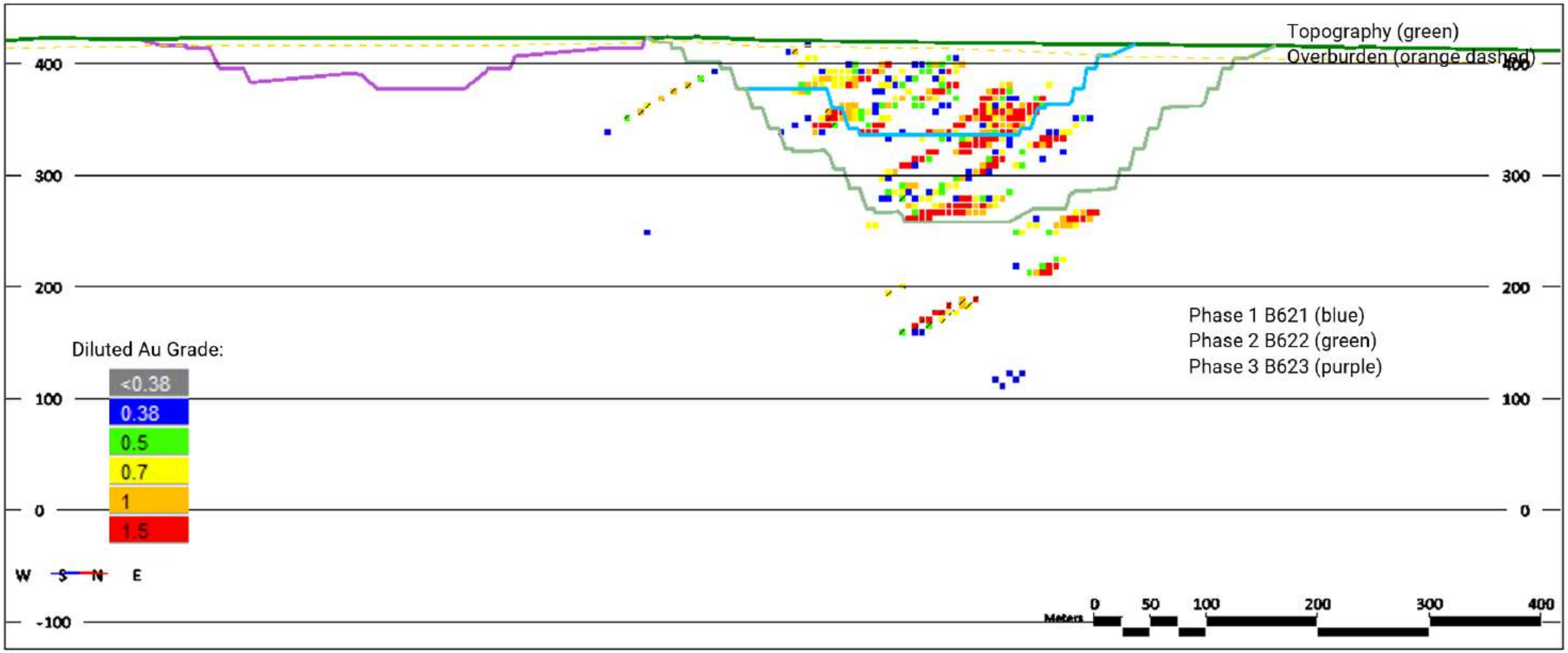

Note: EW1 as shown in Figure 16-22. Source: MMTS, 2022.

**Figure 16-27: Berry Pit Designs, East-West Section 2**




Note: EW2 as shown in Figure 16-22. Source: MMTS, 2022.

**Figure 16-28: Berry Pit Designs, East-West Section 3**




Note: EW3 as shown in Figure 16-22. Source: MMTS, 2022.

## 16.4 Ex-Pit Haul Roads

Mine haul roads external to the open pits are designed to haul ore and waste materials from the open pits to the scheduled destinations. The mine haul roads are designed with the following key inputs:

- 35 m wide ex-pit haul roads that incorporate a dual-lane running width and shoulder barriers on both edges of the haul road
- sized to handle 140-tonne payload rigid-frame haul trucks
- 8% maximum grade.

The ex-pit haul roads are shown in the project layout drawing Figure 16-29.

## 16.5 Ore Storage Facilities

When ore is mined from the pit, it will either be delivered to the crusher, the ROM stockpile located next to the crusher, or the ore stockpiles.

The crusher and ROM stockpiles are located 3.5 km southwest of the Marathon pit limits, 3.0 km northeast of the Leprechaun pit limits and 1.0 km south of the Berry pit limits.

Cut-off grade optimization has been carried out on the mine production schedule. The bottom cut-off gold grade for the mill feed is dynamically altered in each scheduled period, based on the mill throughput target and availability of ore in the open pit. Quantities of mined lower grade ore, exceeding the annual mill feed target, are stockpiled for processing later in the mine life, preferentially treating higher grade ores earlier in the mine life.

During the construction phase, prior to mill start-up, all ore mined in the pit will be stockpiled.

Throughout the life of mill operations, mined ore grading between 0.38 and up to 0.80 g/t Au that exceeds the mill throughput target will be stored in two low-grade stockpiles, each 1.5 km from the pit limits. The low-grade stockpiled ore is planned to be re-handled and fed to the crusher once the open pits are exhausted.

Mined ore above 0.80 g/t Au, exceeding the mill throughput target, is sent to a high-grade ore stockpile located directly north of the primary crusher. The mine plan rehandles this high-grade ore to the crusher during operations as a supplement to direct mill feed from the open pits; the high-grade ore stockpile is planned to be exhausted before the open pits are completed. The ore stockpiles are shown in the project layout drawing Figure 16-29.

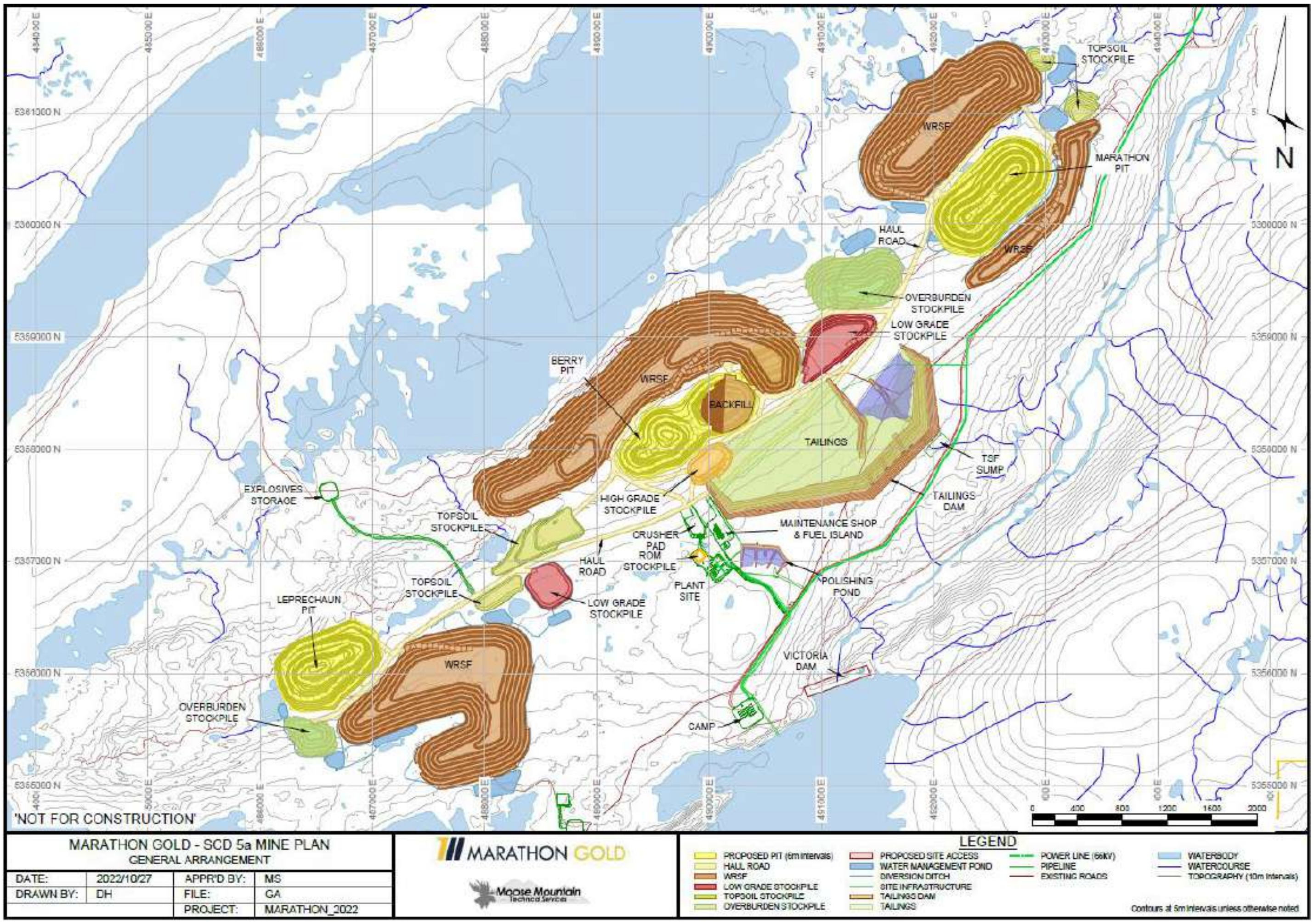
## 16.6 Waste Rock Storage Facilities

Waste rock and overburden/topsoil storage facilities are planned at each site for waste materials from the open pit. In general, design considerations assumed:

- bottom-up construction
- 10 m lift heights for overburden/topsoil

- 15 m lift heights for waste rock
- 1.5:1 active slopes of overburden/topsoil lifts
- 1.3:1 active slopes on waste rock lifts
- berm allowances push slopes out to 2.7:1 on waste rock piles
- target achievable reclamation slopes of 3.0:1
- minimize disturbance to existing waterbodies and watercourses.

**Figure 16-29: Overall Site Layout Plan**




Source: MMTS, 2022.

Testwork suggests that some of the waste rock from all three deposits is potentially acid generating. The measured proportion of waste rock with acid generating potential is 1.5% from the Marathon pit, 1.0% from the Leprechaun pit, and 5% from the Berry pits. As mining progresses, waste rock and overburden will be tested on specified intervals for acid potential. Identified acid producing materials will be placed within the WRSFs, encapsulated by non-acid producing waste rock. Otherwise there has been no consideration for segregation of different rock types in the planned stockpiles based on geochemistry.

Waste rock from the Marathon pit will be stored in two piles directly northwest and southeast of the pit limits, as well as backfilled into mined out lobes of the Berry pit. The north pile is built up to a crest elevation of 445 m, the south pile is built up to a crest elevation of 420 m. Topsoil from the pit will be stored in a pile 0.5 km north of the pit limits and overburden will be stored a pile 1.0 km southwest of the pit limits.

Waste rock from the Leprechaun pit will be stored directly southeast of the pit limits and built up to a crest elevation of 460 m. Topsoil from the pit will be stored in a pile 1.5 km east of the pit limits and overburden will be stored in a pile directly south of the pit limits to a crest elevation of 395 m.

Waste rock from the Berry pit will be stored directly north of the pit limits and built up to a crest elevation of 475 m, as well as backfilled into the mined out northeast lobe of the Berry pit. Topsoil from the pit will be stored in a pile 1.0 km southwest of the pit limits and overburden will be stored in a pile 1.0 km northeast of the pit limits. Overburden from Marathon and Berry are stored in the same facility, building up to a crest elevation of 420 m.

The waste rock storage facilities (WRSFs), overburden, and topsoil stockpiles are shown in Figure 16-29.

## 16.7 Production Schedule

### 16.7.1 Overview

Production requirements by scheduled period, mine operating considerations, product prices, recoveries, destination capacities, haul cycle times, equipment performance and operating costs are used to determine the production schedule from the pit phase mineral reserves.

The production schedule is based on the following parameters:

- The mineral reserve estimate quantities are split by phase and bench. This includes details of lithologies and percentages selectively mined on each bench.
- Mine operations construction will start in October 2022; milling will start in January 2025.
- Monthly periods are scheduled for the construction period through to the end of 2025, followed by scheduling on quarterly periods from 2026 to 2028; the remaining operations are scheduled on annual periods.
    - Production at the Marathon deposit is planned to be shut down for three weeks in April and two weeks in November for the estimated caribou migration through the mine operations area. The Leprechaun and Berry deposits are assumed to be unaffected.
- An annual mill feed rate of 2,500 kt/a is targeted for the first three years of operation, increasing to 4,000 kt/a thereafter until the end of mine life.
- Target mill throughput rates ramp up in the first year of milling, as follows:
    - January 2025 targets 125 kt (60% nameplate)

  - February 2025 targets 165 kt (80% nameplate)
  - March 2025 targets 175 kt (85% nameplate)
  - April 2025 targets 185 kt (90% nameplate)
  - May 2025 targets 195 kt (95% nameplate)
  - June 2025 at 100% nameplate capacity.
- Similarly, mill throughput rates for the expansion to 4,000 kt/a ramp up over the expansion period:
  - Q2 2028 targets 725 kt (73% nameplate)
  - Q3 2028 targets 900 kt (90% nameplate)
  - Q4 2028 at 100% nameplate capacity.
- Within a given phase, each bench is fully mined before progressing to the next bench.
- Pit phases are mined in sequence, where the second pit phase does not mine below the first pit phase.
- Pit phase vertical progression is limited to no more than 48 m in each year; average annual phase progression is 30 m.
- Pre-production mining requirements are as follows:
  - rock waste requirements of 3.8 Mt for tailings dam construction, and 0.7 Mt for ex-pit haul road construction, and 1.9 Mt for construction of pads, site roads, water management features, engineered rock.
  - any in-situ topsoil, overburden, and ore that must be moved to access this construction rock is stockpiled.
- Ore tonnes released in excess of the mill capacity are stockpiled.
- Berry pit phases are not mined until after the construction period (starting in Q2 of 2025).

The open pit mine production schedule showing production tonnages and grade forecasts is included as Table 16-5 and shown graphically as Figure 16-30; Figure 16-31 provides an illustration of the projected material mined and strip ratio. This is illustrated for each individual deposit in Figure 16-32 to Figure 16-37.

### 16.7.2 Mining Sequence

The pit operations will run from 2022 to 2037. The capitalized construction period runs from 2022 to 2025, with quantities for this period listed in Table 16-6 as “Pre-Prod”. Following pit operations in 2037, stockpile re-handling operations will continue for two more years until 2039. LOM activities are summarized in Table 16-7.

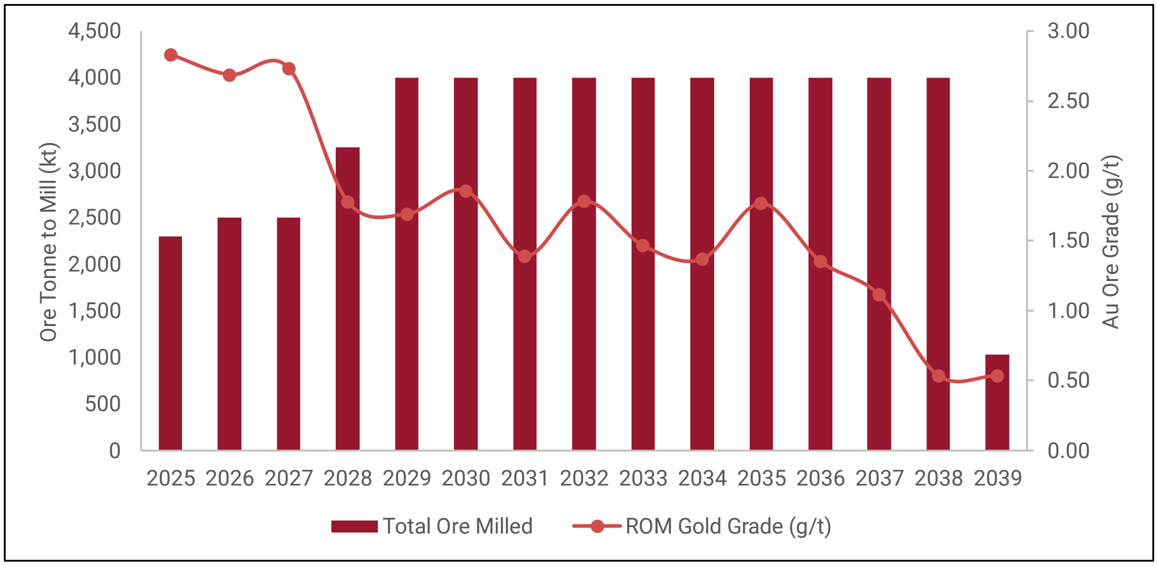
The final layout plans for Marathon, Leprechaun and Berry are illustrated in Figure 16-38, Figure 16-39, and Figure 16-40 respectively. End-of-period drawings representing the end of 2024 (start of milling), 2025, 2027, 2029, 2034 and 2037 are shown for Marathon, Leprechaun and Berry in Figure 16-41 to Figure 16-57.

**Table 16.6: Mine Production Schedule**

| Total Mine Production | Year | LOM | Pre-Prod* | Post Construction | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mill Feed Tonnes** | **kt** | **51,580** | **—** | **51,580** | **—** | **—** | **—** | **2,295** | **2,500** | **2,500** | **3,250** | **4,000** | **4,000** | **4,000** | **4,000** | **4,000** | **4,002** | **4,000** | **4,000** | **4,000** | **4,000** | **1,031** |
| **Mill Feed Grade, Au** | **g/t** | **1.62** | **—** | **1.62** | **—** | **—** | **—** | **2.83** | **2.69** | **2.73** | **1.78** | **1.69** | **1.86** | **1.39** | **1.78** | **1.46** | **1.37** | **1.77** | **1.35** | **1.11** | **0.53** | **0.53** |
| Mill Feed Contained Metal | koz | 2,689 | — | 2,689 | — | — | — | 209 | 216 | 220 | 186 | 217 | 239 | 179 | 229 | 188 | 176 | 227 | 174 | 143 | 69 | 18 |
| Ore Tonnes from Pit | kt | 51,580 | 298 | 51,282 | — | 243 | 55 | 5,164 | 5,993 | 4,345 | 3,968 | 4,627 | 4,564 | 4,000 | 4,435 | 3,117 | 2,613 | 4,000 | 3,000 | 1,455 | — | — |
| Ore Grade from Pit, Au | g/t | 1.62 | 1.20 | 1.62 | — | 1.22 | 1.12 | 1.61 | 1.53 | 1.83 | 1.50 | 1.52 | 1.68 | 1.39 | 1.64 | 1.54 | 1.74 | 1.77 | 1.63 | 2.12 | — | — |
| Stockpile Tonnes to Mill | kt | 12,006 | — | 12,006 | — | — | — | 140 | — | — | 485 | — | — | — | 100 | 1,316 | 1,389 | — | 1,000 | 2,545 | 4,000 | 1,031 |
| Stockpile Grade to Mill, Au | g/t | 0.63 | — | 0.63 | — | — | — | 1.77 | — | — | 0.96 | — | — | — | 0.96 | 0.96 | 0.67 | — | 0.53 | 0.53 | 0.53 | 0.53 |
| Waste Tonnes from Pit | kt | 545,424 | 10,347 | 535,077 | 975 | 5,182 | 4,190 | 45,858 | 47,518 | 55,120 | 66,403 | 60,539 | 60,555 | 57,427 | 51,772 | 36,339 | 28,284 | 17,479 | 6,550 | 1,234 | — | — |
| **Total Mined from Pits** | **kt** | **597,003** | **10,645** | **586,359** | **975** | **5,425** | **4,245** | **51,022** | **53,511** | **59,465** | **70,371** | **65,166** | **65,119** | **61,427** | **56,207** | **39,456** | **30,897** | **21,479** | **9,550** | **2,689** | **—** | **—** |
| Total Moved | kt | 609,010 | 10,645 | 598,365 | 975 | 5,425 | 4,245 | 51,162 | 53,511 | 59,465 | 70,856 | 65,166 | 65,119 | 61,427 | 56,307 | 40,772 | 32,287 | 21,479 | 10,550 | 5,234 | 4,000 | 1,031 |
| Marathon | | | | | | | | | | | | | | | | | | | | | | |
| Ore Tonnes Direct to Mill | kt | 21,330 | — | 21,330 | — | — | — | 884 | 1,202 | 1,024 | 840 | 1,038 | 1,449 | 1,882 | 1,351 | 929 | 1,351 | 2,158 | 3,142 | 2,337 | 1,386 | 357 |
| Ore Grade Direct to Mill, Au | g/t | 1.56 | — | 1.56 | — | — | — | 2.91 | 2.69 | 2.49 | 1.58 | 1.39 | 1.73 | 1.39 | 1.63 | 1.22 | 1.21 | 1.44 | 1.42 | 1.53 | 0.55 | 0.55 |
| Ore Tonnes from Pit | kt | 21,330 | 55 | 21,275 | — | — | 55 | 1,863 | 2,907 | 1,735 | 944 | 1,224 | 1,626 | 1,882 | 1,442 | 411 | 834 | 2,158 | 2,795 | 1,455 | — | — |
| Ore Grade from Pit, Au | g/t | 1.56 | 1.12 | 1.56 | — | — | 1.12 | 1.73 | 1.53 | 1.73 | 1.38 | 1.24 | 1.59 | 1.39 | 1.54 | 1.48 | 1.52 | 1.44 | 1.53 | 2.12 | — | — |
| Stockpile Tonnes to Mill | kt | 4,344 | — | 4,344 | — | — | — | 43 | — | — | 207 | — | — | — | 43 | 562 | 517 | — | 346 | 882 | 1,386 | 357 |
| Stockpile Grade to Mill, Au | g/t | 0.65 | — | 0.65 | — | — | — | 1.19 | — | — | 0.96 | — | — | — | 0.96 | 0.96 | 0.70 | — | 0.55 | 0.55 | 0.55 | 0.55 |
| Waste Tonnes from Pit | kt | 213,453 | 5,175 | 208,278 | — | 985 | 4,190 | 19,600 | 16,655 | 16,721 | 18,280 | 14,822 | 15,474 | 17,192 | 25,249 | 21,937 | 19,972 | 14,671 | 6,472 | 1,234 | — | — |
| Leprechaun | | | | | | | | | | | | | | | | | | | | | | |
| Ore Tonnes Direct to Mill | Kt | 15,150 | — | 15,150 | — | — | — | 969 | 706 | 528 | 491 | 802 | 1,312 | 918 | 1,174 | 1,637 | 2,180 | 1,842 | 483 | 708 | 1,114 | 287 |
| Ore Grade Direct to Mill, Au | g/t | 1.73 | — | 1.73 | — | — | — | 2.71 | 2.82 | 3.62 | 1.53 | 1.55 | 1.78 | 1.59 | 1.82 | 1.46 | 1.63 | 2.15 | 1.54 | 0.53 | 0.53 | 0.53 |
| Ore Tonnes from Pit | kt | 15,150 | 243 | 14,908 | — | 243 | — | 2,154 | 1,473 | 766 | 512 | 942 | 1,526 | 918 | 1,310 | 1,481 | 1,779 | 1,842 | 205 | — | — | — |
| Ore Grade from Pit, Au | g/t | 1.73 | 1.22 | 1.74 | — | 1.22 | — | 1.55 | 1.72 | 2.70 | 1.34 | 1.39 | 1.59 | 1.59 | 1.66 | 1.40 | 1.84 | 2.15 | 2.92 | — | — | — |
| Stockpile Tonnes to Mill | kt | 3,471 | — | 3,471 | — | — | — | 93 | — | — | 150 | — | — | — | 31 | 408 | 401 | — | 278 | 708 | 1,114 | 287 |
| Stockpile Grade to Mill, Au | g/t | 0.66 | — | 0.66 | — | — | — | 1.59 | — | — | 1.03 | — | — | — | 1.03 | 1.03 | 0.70 | — | 0.53 | 0.53 | 0.53 | 0.53 |
| Waste Tonnes from Pit | kt | 161,341 | 5,172 | 156,169 | 975 | 4,197 | — | 13,338 | 7,445 | 16,774 | 25,933 | 15,110 | 17,386 | 20,268 | 16,510 | 12,206 | 8,313 | 2,808 | 78 | — | — | — |
| Berry | | | | | | | | | | | | | | | | | | | | | | |
| Ore Tonnes Direct to Mill | Kt | 15,099 | — | 15,099 | — | — | — | 442 | 592 | 948 | 1,919 | 2,160 | 1,240 | 1,200 | 1,475 | 1,434 | 471 | — | 375 | 955 | 1,501 | 387 |
| Ore Grade Direct to Mill, Au | g/t | 1.60 | — | 1.60 | — | — | — | 2.84 | 2.51 | 2.50 | 1.93 | 1.89 | 2.08 | 1.24 | 1.89 | 1.65 | 0.63 | — | 0.53 | 0.53 | 0.53 | 0.53 |
| Ore Tonnes from Pit | kt | 15,099 | — | 15,099 | — | — | — | 1,147 | 1,613 | 1,844 | 2,512 | 2,461 | 1,413 | 1,200 | 1,683 | 1,225 | — | — | — | — | — | — |
| Ore Grade from Pit, Au | g/t | 1.60 | — | 1.60 | — | — | — | 1.51 | 1.35 | 1.58 | 1.58 | 1.71 | 1.88 | 1.24 | 1.70 | 1.71 | — | — | — | — | — | — |
| Stockpile Tonnes to Mill | kt | 4,192 | — | 4,192 | — | — | — | 3 | — | — | 127 | — | — | — | 26 | 346 | 471 | — | 375 | 955 | 1,501 | 387 |
| Stockpile Grade to Mill, Au | g/t | 0.59 | — | 0.59 | — | — | — | 0.96 | — | — | 0.94 | — | — | — | 0.94 | 0.94 | 0.63 | — | 0.53 | 0.53 | 0.53 | 0.53 |
| Waste Tonnes from Pit | kt | 170,629 | — | 170,629 | — | — | — | 12,919 | 23,419 | 21,625 | 22,190 | 30,606 | 27,695 | 19,967 | 10,012 | 2,196 | — | — | — | — | — | — |

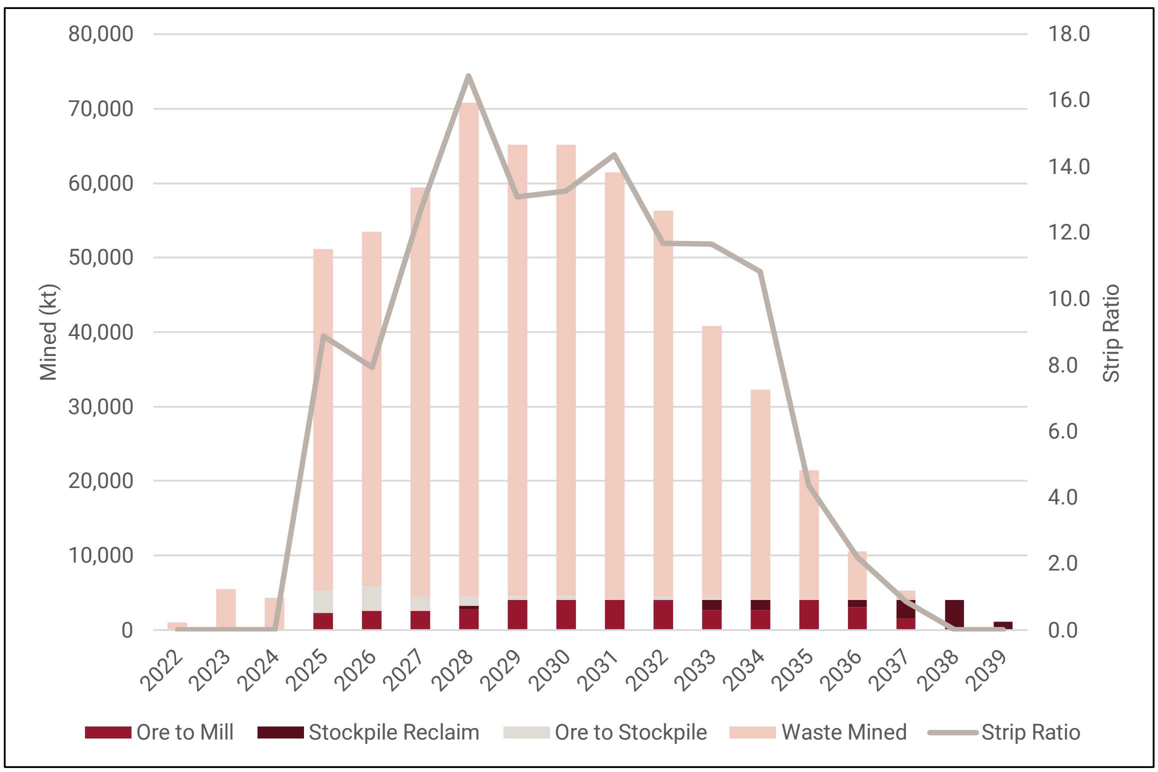
Note: Pre-production runs from 2022 to 2025.

**Figure 16-30: Production Schedule, Mill Feed Tonnes & Grade (All Deposits)**



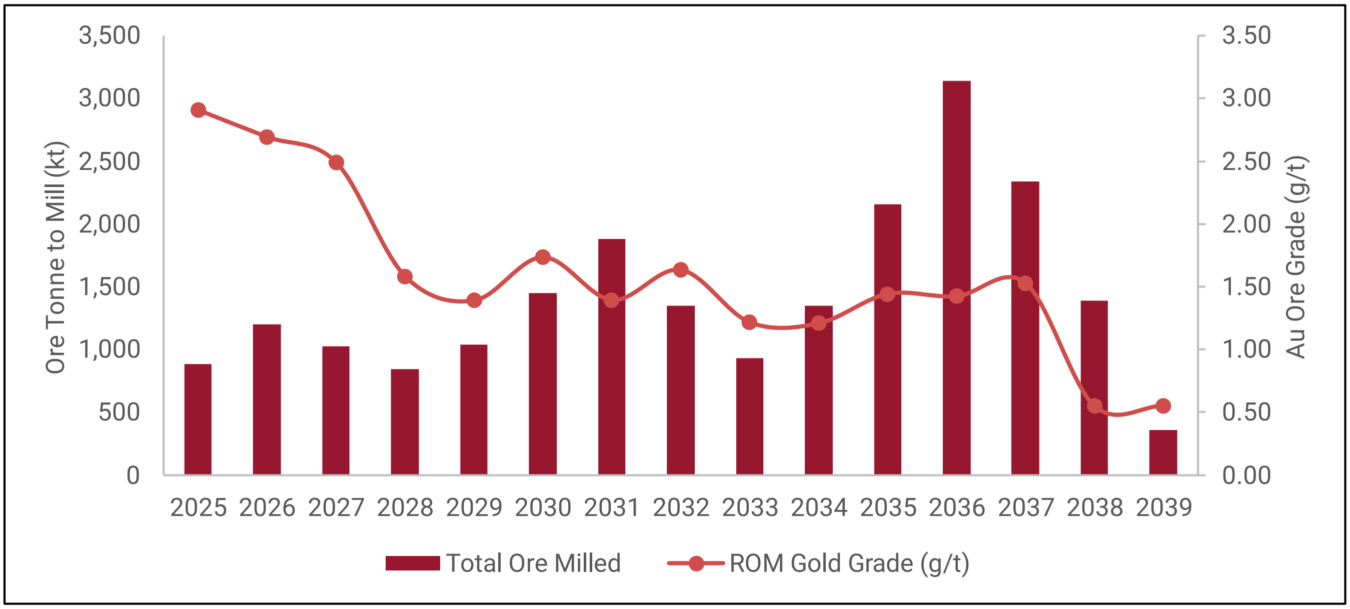

Source: MMTS, 2022.

**Figure 16-31: Mine Production Schedule, Material Mined & Strip Ratio (All Deposits)**



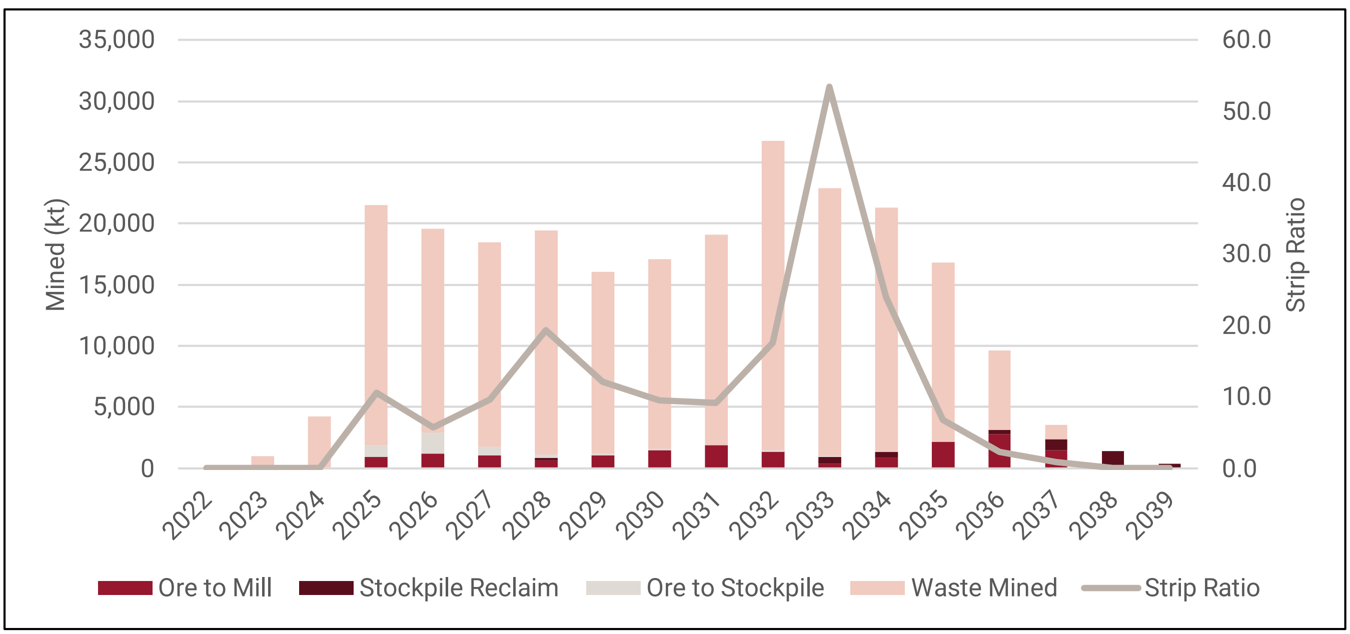
Source: MMTS, 2022.

**Figure 16-32: Marathon Production Schedule, Mill Feed Tonnes & Grade**



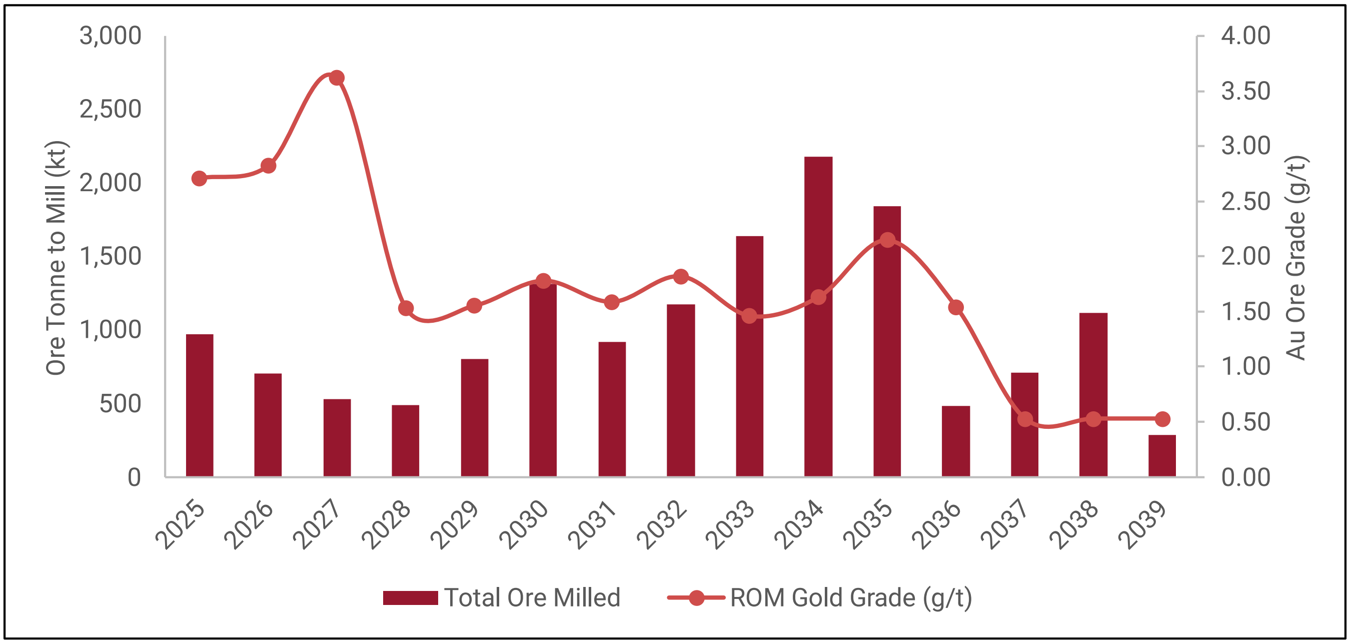

Source: MMTS, 2022.

**Figure 16-33: Marathon Mine Production Schedule, Material Mined & Strip Ratio**



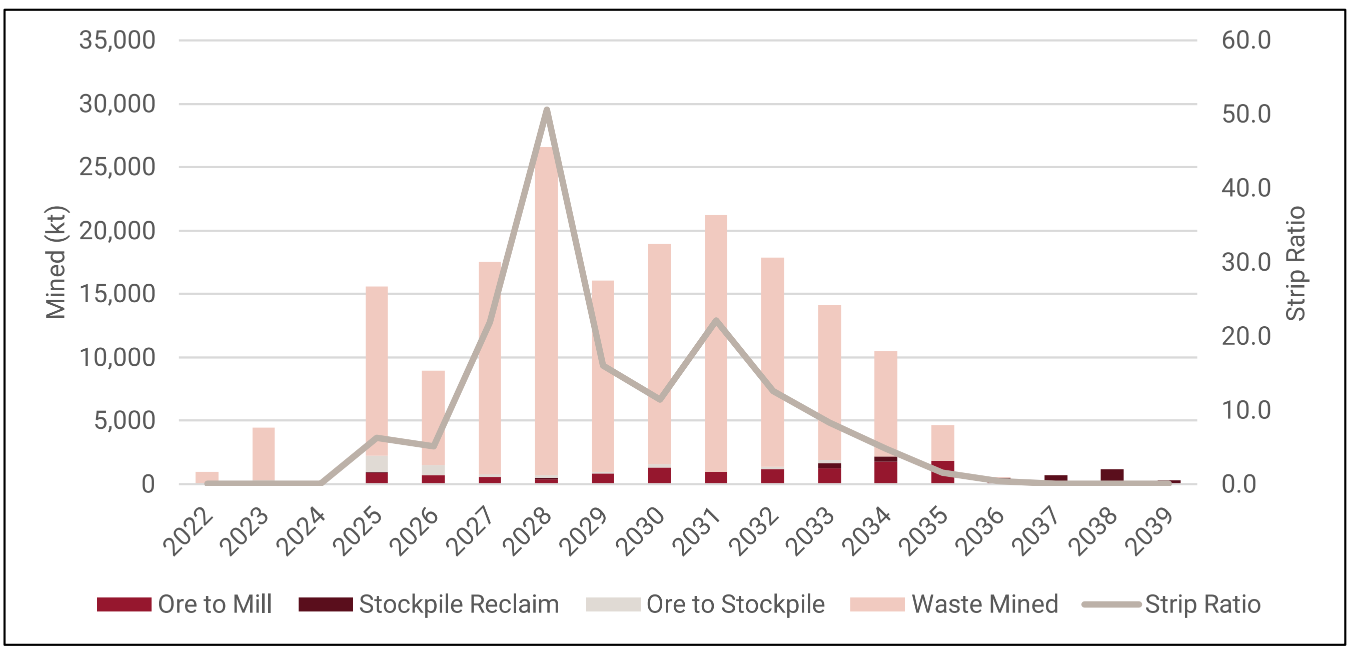

Source: MMTS, 2022.

**Figure 16-34: Leprechaun Production Schedule, Mill Feed Tonnes & Grade**



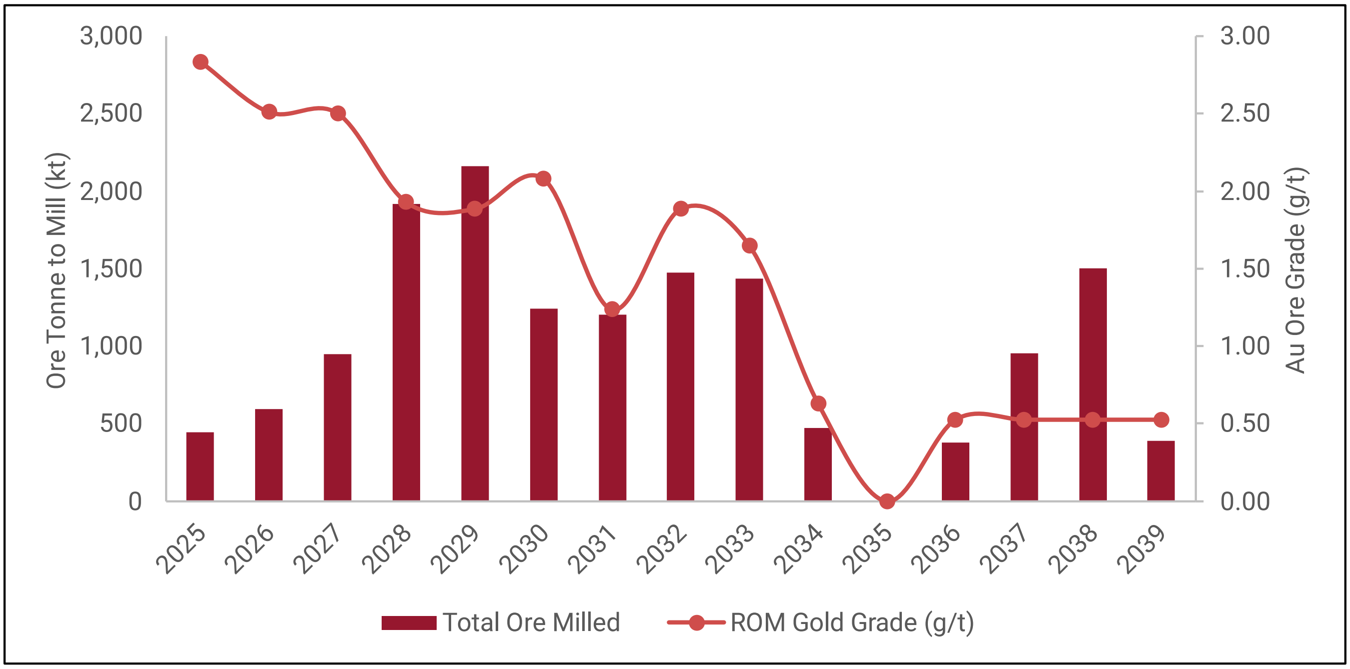

Source: MMTS, 2022.

**Figure 16-35: Leprechaun Mine Production Schedule, Material Mined & Strip Ratio**



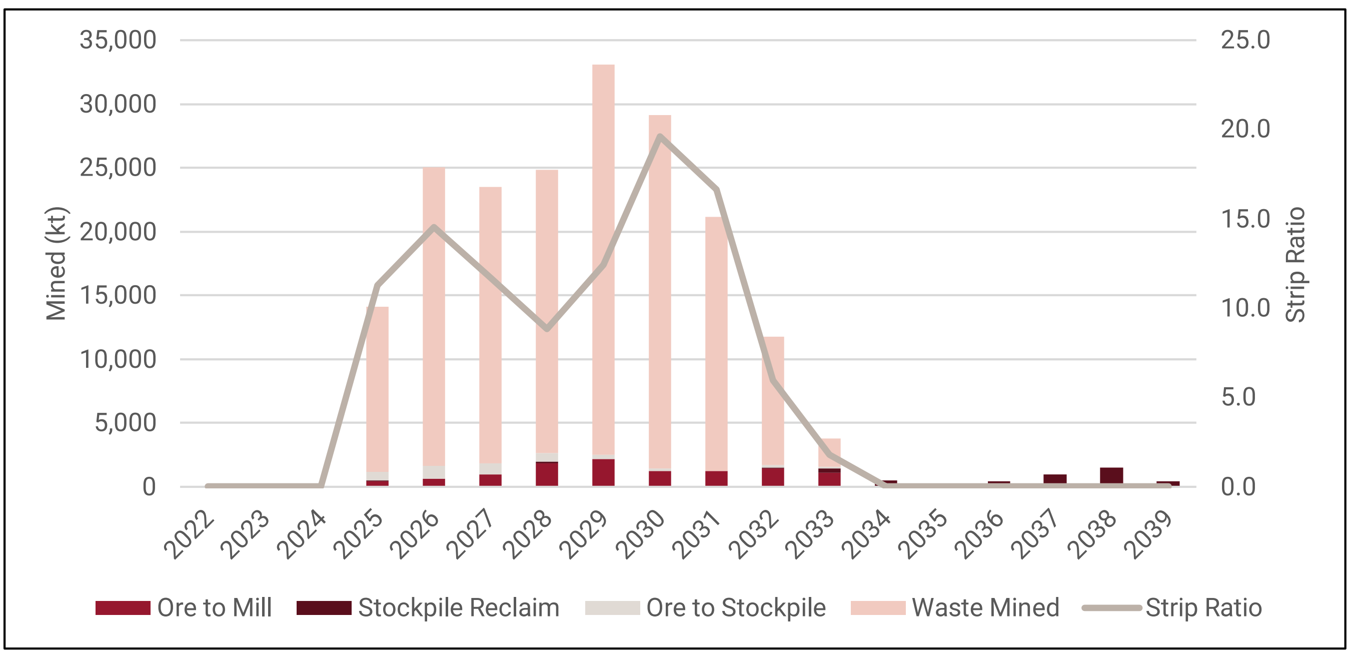

Source: MMTS, 2022.

**Figure 16-36: Berry Production Schedule, Mill Feed Tonnes & Grade**




Source: MMTS, 2022.

**Figure 16-37: Berry Mine Production Schedule, Material Mined & Strip Ratio**

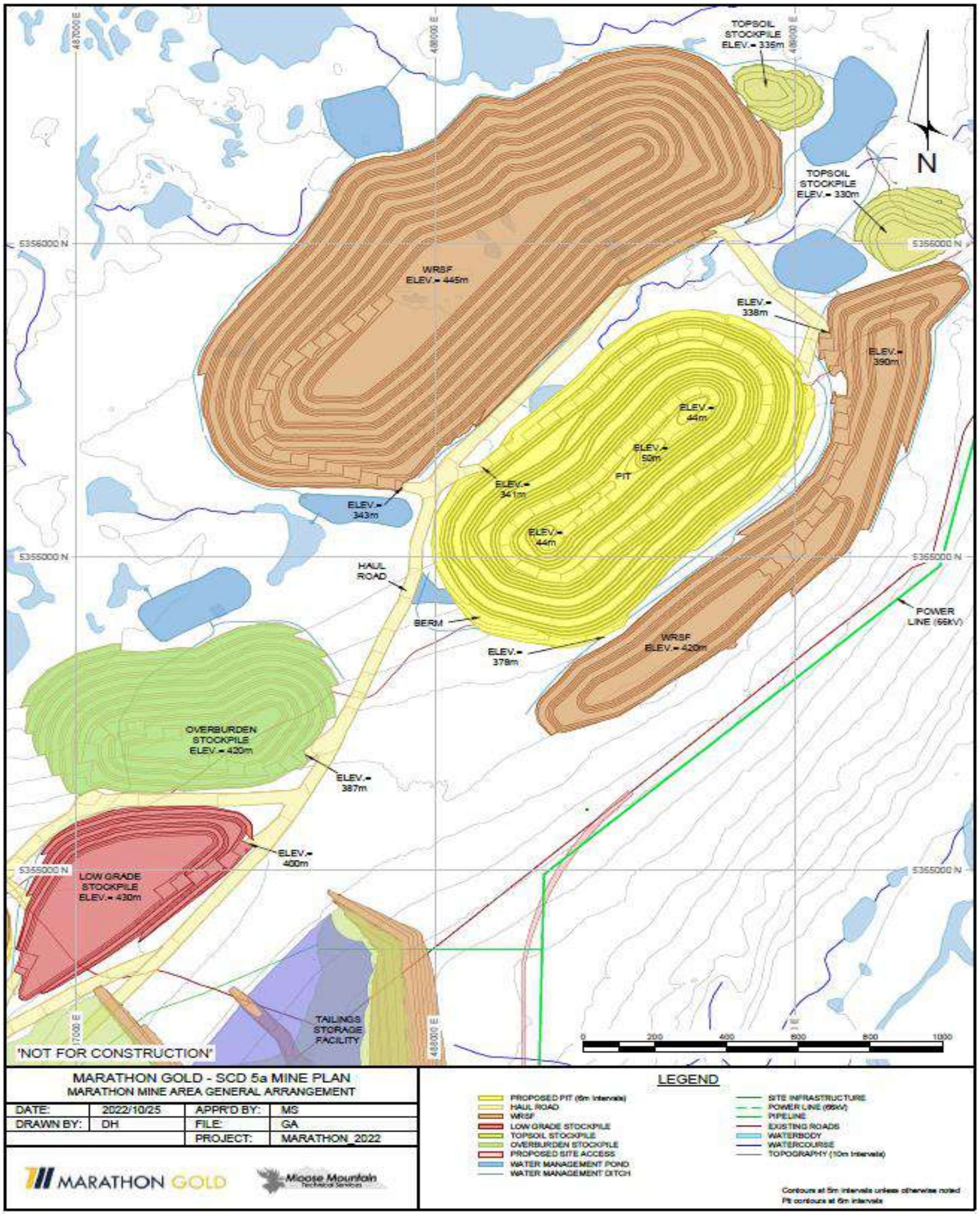



Source: MMTS, 2022.

**Table 16.7: Annual Mine Operations**

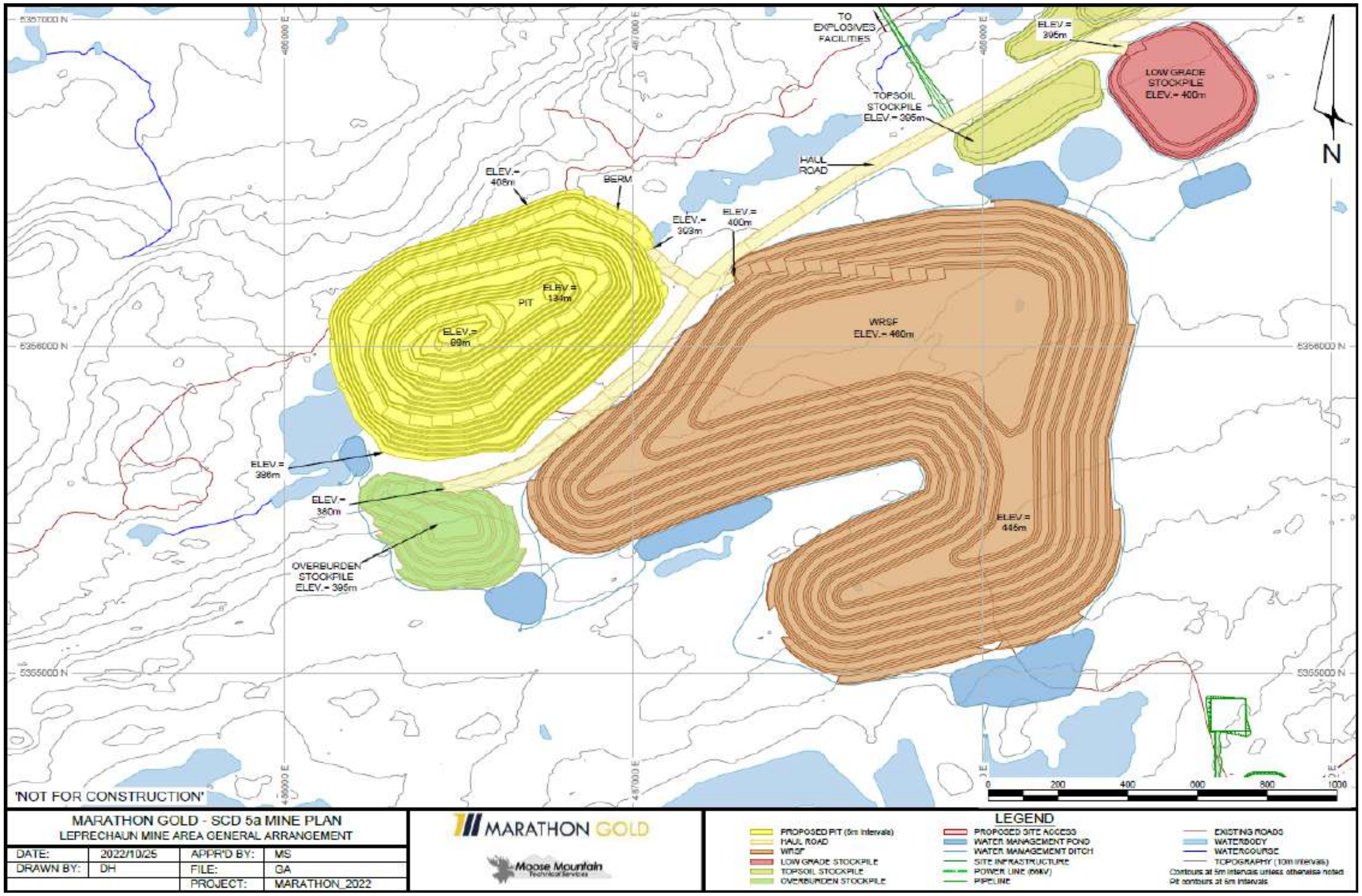
| Year | Activity |
|---|---|
| Construction (2022 to 2024) | Clearing and grubbing the phase 1 and phase 2 Marathon and Leprechaun pits.<br>Clearing and grubbing of ex-pit haul road, ore stockpile and overburden stockpile footprints.<br>Removal and stockpiling of topsoil from pit areas cleared and grubbed.<br>Removal and stockpiling of topsoil from the ore stockpile areas.<br>Removal and stockpiling of overburden from the pit areas cleared and grubbed.<br>Haul road construction from the pits to the stockpiles, crusher and tailings dam.<br>Initial grade control delineation drilling to the 314 bench of the Marathon phase 1 pit and the 344 bench of the Leprechaun phase 1 pit.<br>Mining of the Marathon phase 1 pit down to 344 bench.<br>Mining of the Leprechaun phase 1 pit down to the 374 bench.<br>Delivery of construction rock to the various infrastructure construction areas.<br>Delivery of construction rockfill to stage 1 and stage 2 of the tailings dam.<br>Stockpiling high-grade ore on the ROM pad and high-grade ore stockpile for use in mill commissioning. |
| 2025 | Clearing and grubbing of the east side of the Marathon waste rock stockpile footprint.<br>Clearing and grubbing of the south side of the Leprechaun waste rock stockpile footprint.<br>Clearing and grubbing of the phase 1 and 2 Berry pits and Berry ex-pit haul roads and north side of the Berry waste rock stockpile footprint.<br>Removal and stockpiling of topsoil from the pit areas cleared and waste rock stockpile footprints.<br>Haul road construction from the Berry pits to the stockpiles, crusher and tailings dam.<br>Marathon phase 1 pit mined down to 314 bench.<br>Leprechaun phase 1 pit mined down to 332 bench.<br>Berry phase 1 pit mined down to 402 bench.<br>Re-handle of stockpiled high-grade ore.<br>Delivery of construction rockfill to stage 3 of the tailings dam. |
| 2026 | Clearing and grubbing the remaining Marathon waste rock stockpile footprints.<br>Removal and stockpiling of topsoil from waste rock stockpile footprints.<br>Marathon phase 1 pit mined down to the 266 bench, phase 2 mined down to the 338 bench.<br>Leprechaun phase 1 pit mined down to the 290 bench, phase 2 mined down to the 386 bench.<br>Berry phase 1 pit mined down to the 378 bench, phase 2 mined down to the 402 bench.<br>Delivery of construction rockfill to stage 4 of the tailings dam. |
| 2027 | Clearing and grubbing phase 3 Marathon, Leprechaun, and Berry pits.<br>Clearing and grubbing the remaining Leprechaun and Berry waste rock stockpile footprints.<br>Removal and stockpiling of topsoil from cleared pit and waste rock stockpile footprints<br>Marathon phase 1 pit mined down to the 224 bench, phase 2 mined down to the 302 bench.<br>Leprechaun phase 1 pit mined down to 266 bench, phase 2 mined down to the 356 bench.<br>Berry phase 1 pit mined down to the 348 bench, phase 2 mined down to the 372 bench.<br>Delivery of construction rockfill to stage 4 of the tailings dam. |
| 2028 | Marathon phase 1 pit mined down to the pit bottom on the 206 bench.<br>Marathon phase 2 pit mined down to the 266 bench, phase 3 mined down to the 362 bench.<br>Leprechaun phase 1 pit mined down to the pit bottom on the 266 bench.<br>Leprechaun phase 2 pit mined down to 308 bench, phase 3 mined down to the 386 bench.<br>Berry phase 1 pit mined down to the 318 bench, phase 2 mined down to the 324 bench.<br>Re-handle of stockpiled high-grade ore.<br>Delivery of construction rockfill to stage 5 of the tailings dam. |
| 2029 | Marathon phase 2 pit mined down to the 230 bench, phase 3 mined down to the 350 bench.<br>Leprechaun phase 2 pit mined down to 272 bench, phase 3 mined down to the 380 bench.<br>Berry phase 1 pit mined down to the pit bottom on the 312 bench.<br>Berry phase 2 pit mined down to the 282 bench, phase 3 mined down to the 390 bench.<br>Delivery of construction rockfill to stage 5 of the tailings dam. |
| 2030-2033 | Marathon phase 2 pit mined down to the pit bottom on the 134 bench.<br>Marathon phase 3 pit mined down to the 212 m bench.<br>Leprechaun phase 2 pit mined down to the pit bottom on the 170 bench (2032).<br>Leprechaun phase 3 pit mined down to the 212 m bench.<br>Berry phase 2 pit mined down to the pit bottom on the 258 m bench (2030).<br>Berry phase 3 pit mined down to the pit bottom on the 198 m bench.<br>Start of deposition of Berry waste rock in mined out Phase 2 Berry open pit (2031).<br>Start of deposition of Marathon waste rock in mined out Phase 2&3 Berry open pit (2033).<br>Re-handle of stockpiled high-grade ore.<br>Delivery of construction rockfill to stage 6 of the tailings dam. |
| 2034 to 2037 | Marathon phase 3 pit mined down to the pit bottom on the 44 bench.<br>Leprechaun phase 3 pit mined down to the pit bottom on the 98 bench (2036).<br>Re-handle of remaining stockpiled high-grade ore (stockpile depleted 2034).<br>Re-handle of stockpiled low-grade ore. |
| 2038 to 2039 | Re-handle of remaining stockpiled low-grade ore (stockpiles depleted). |

**Figure 16-38: Marathon Layout Plan**



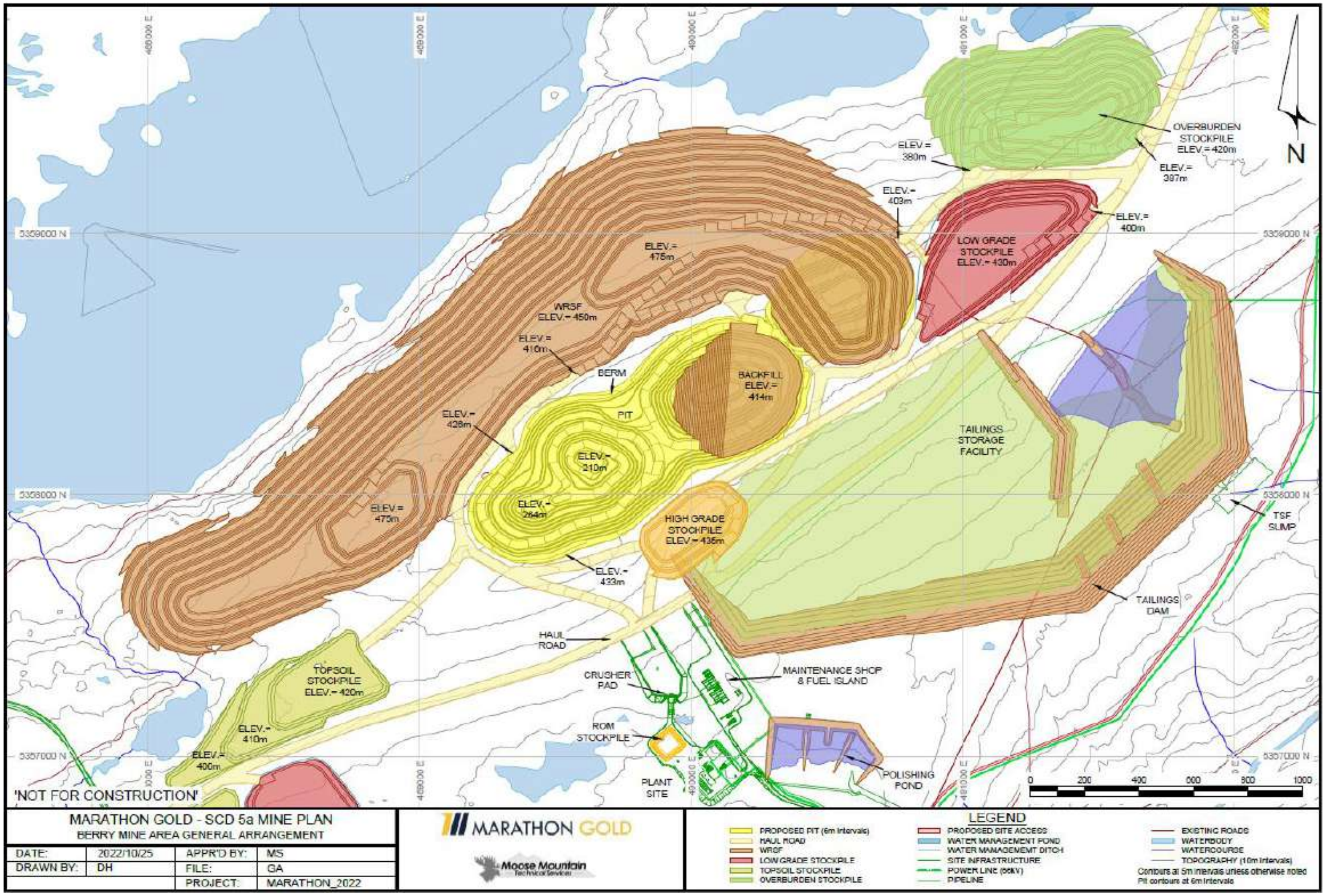

Source: MMTS 2022.

**Figure 16-39: Leprechaun Layout Plan**



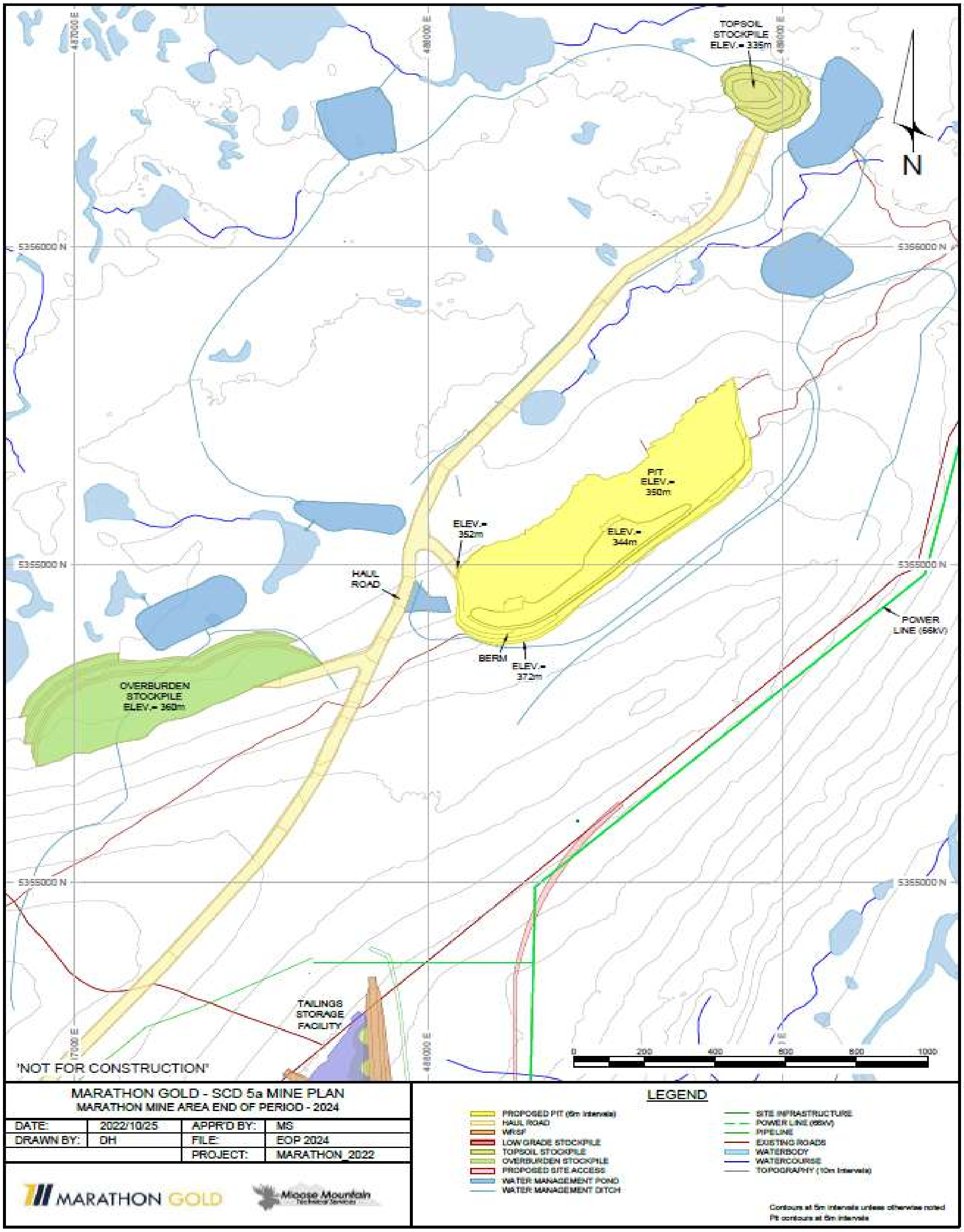

Source: MMTS 2022.

**Figure 16-40: Berry Layout Plan**



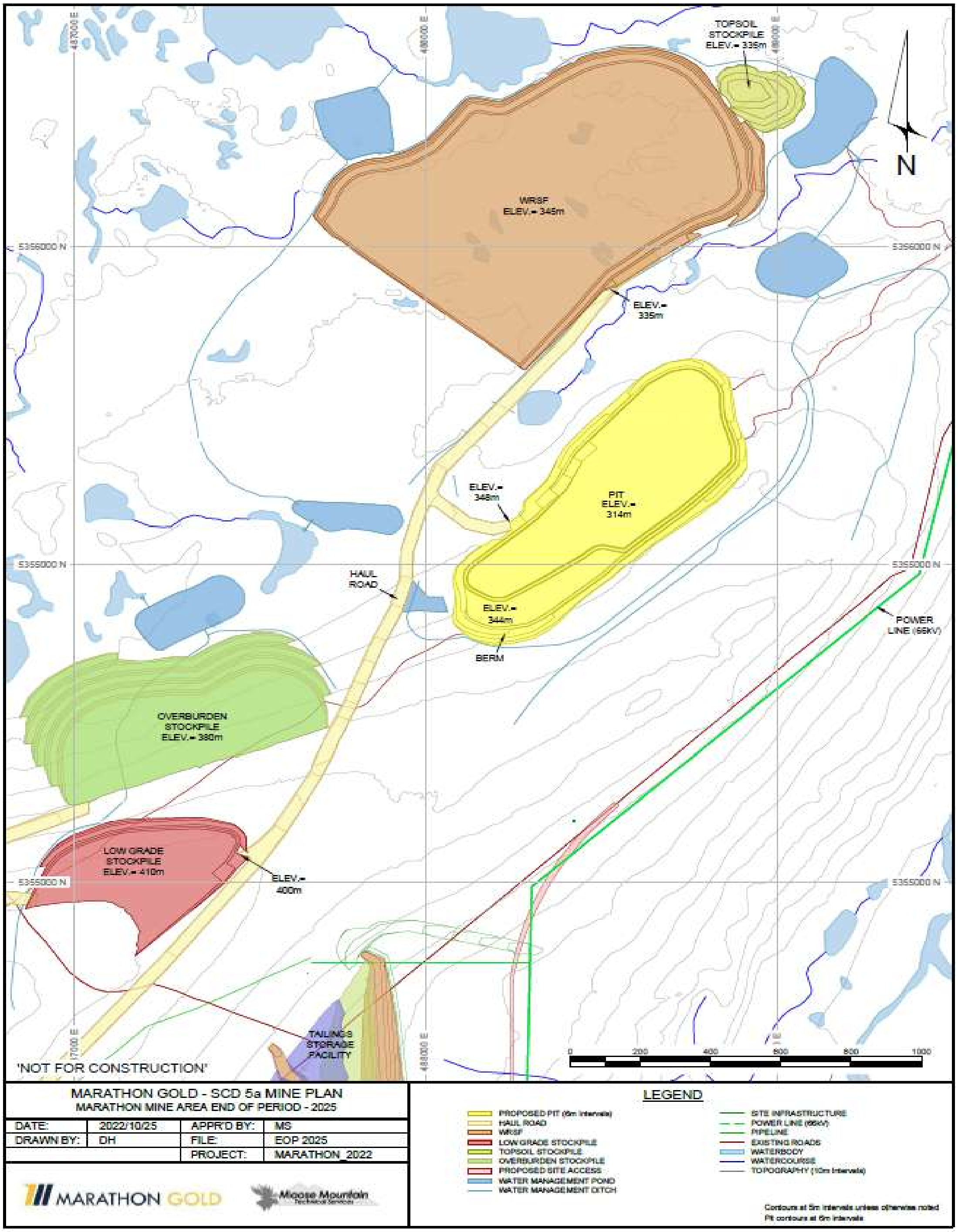

Source: MMTS, 2022.

**Figure 16-41: Marathon End of Period – 2024**



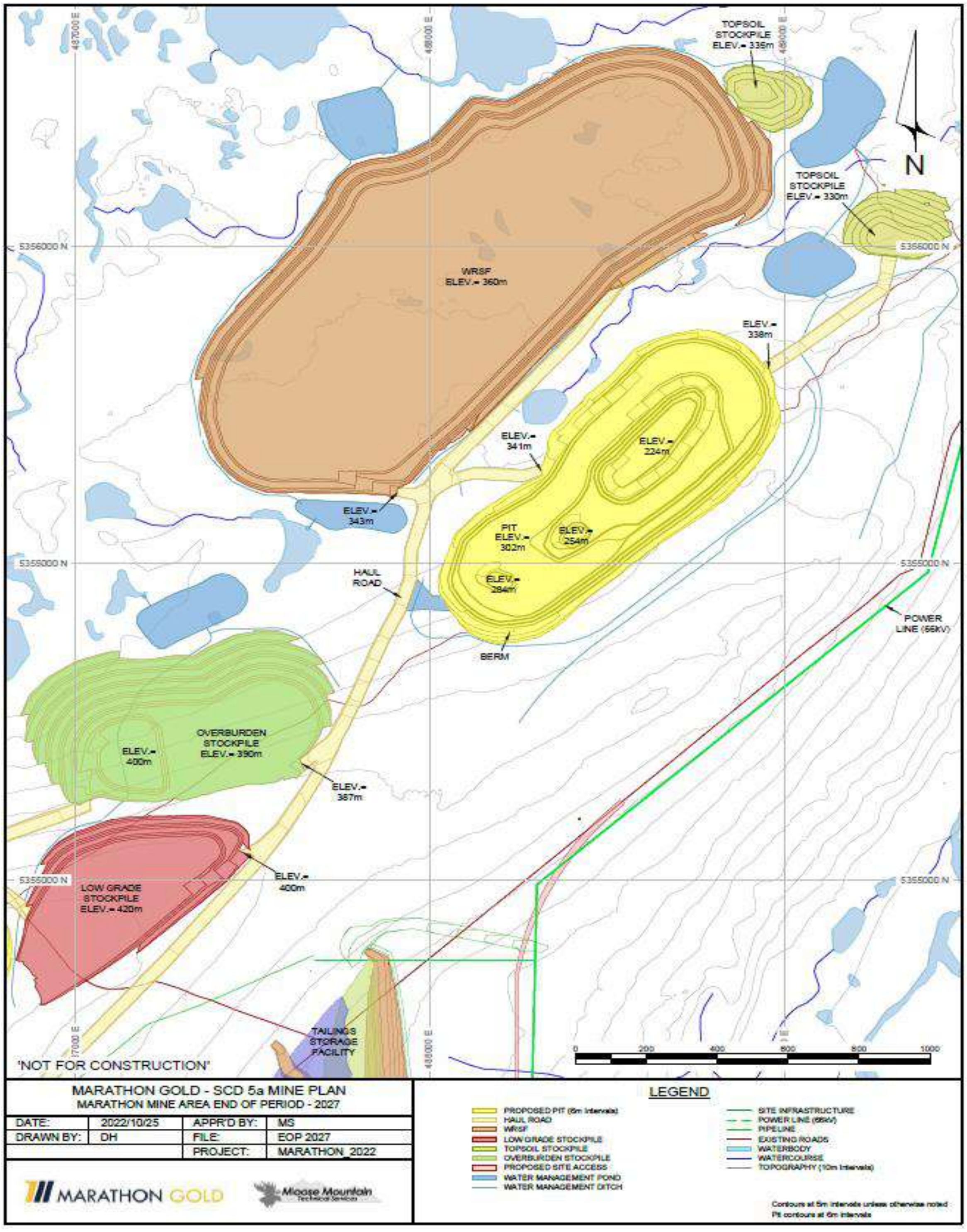

Source: MMTS 2022.

**Figure 16-42: Marathon End of Period – 2025**



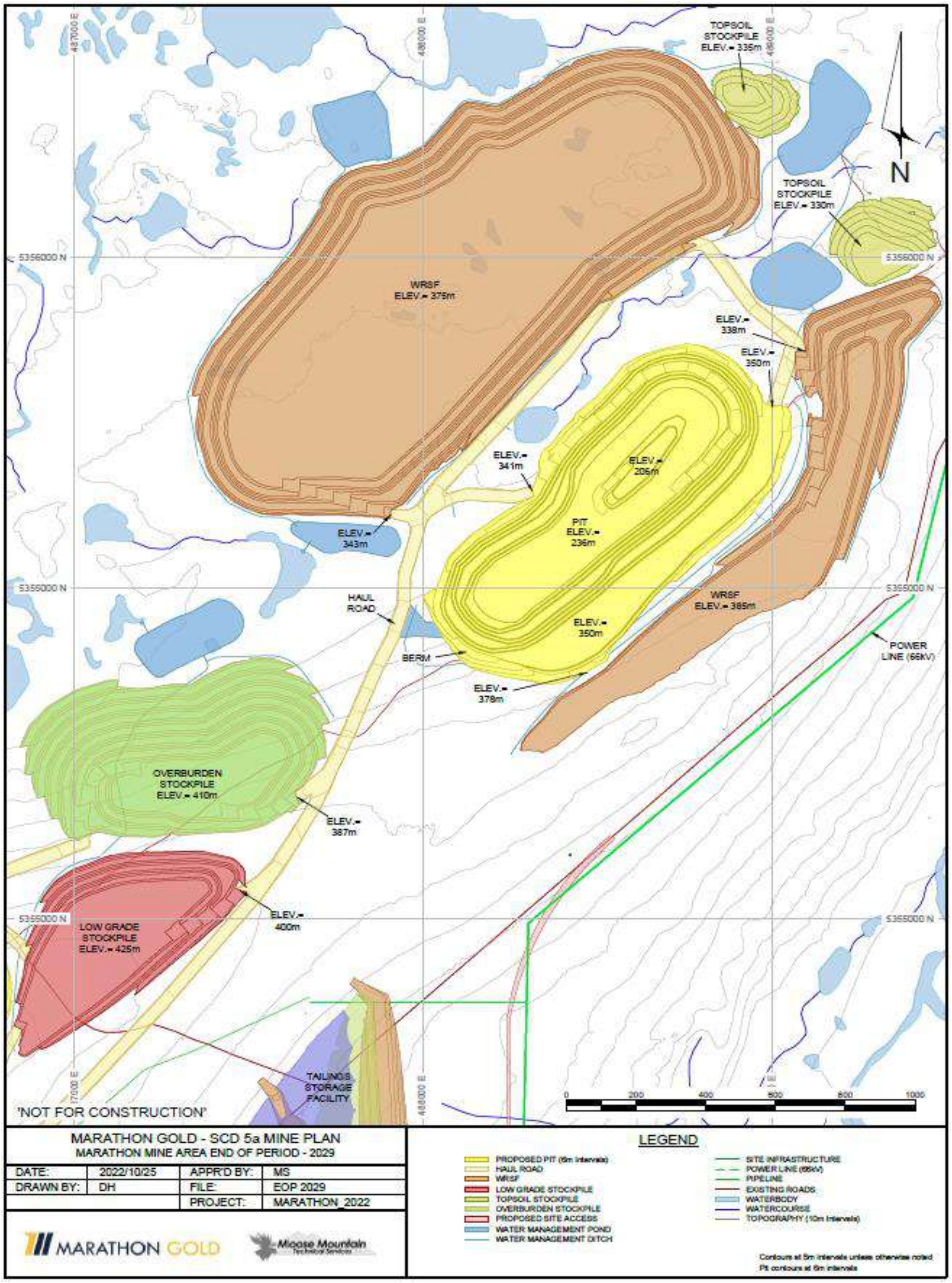

Source: MMTS 2022.

**Figure 16-43: Marathon End of Period – 2027**



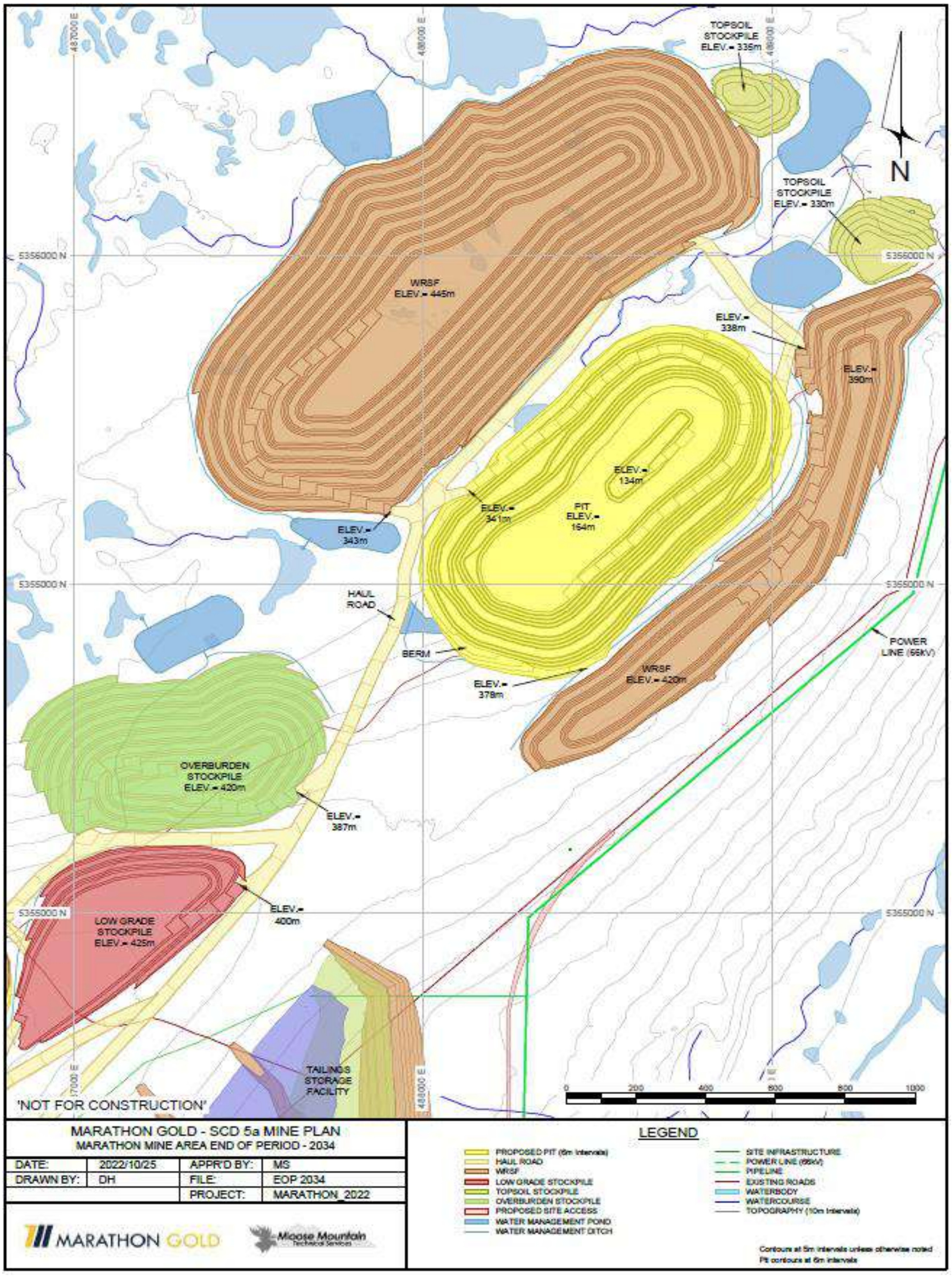

Source: MMTS 2022.

**Figure 16-44: Marathon End of Period – 2029**



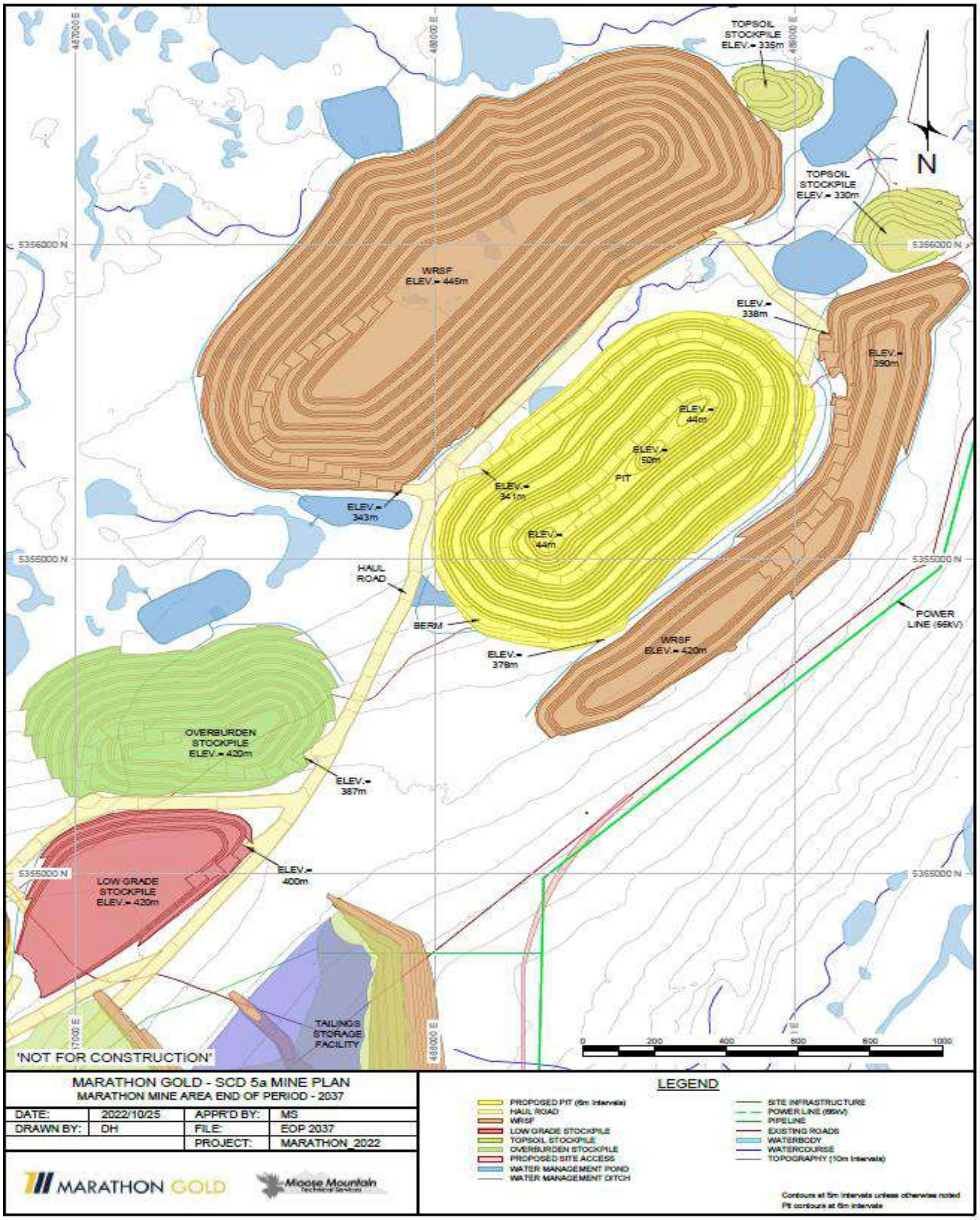

Source: MMTS 2022.

**Figure 16-45: Marathon End of Period – 2034**



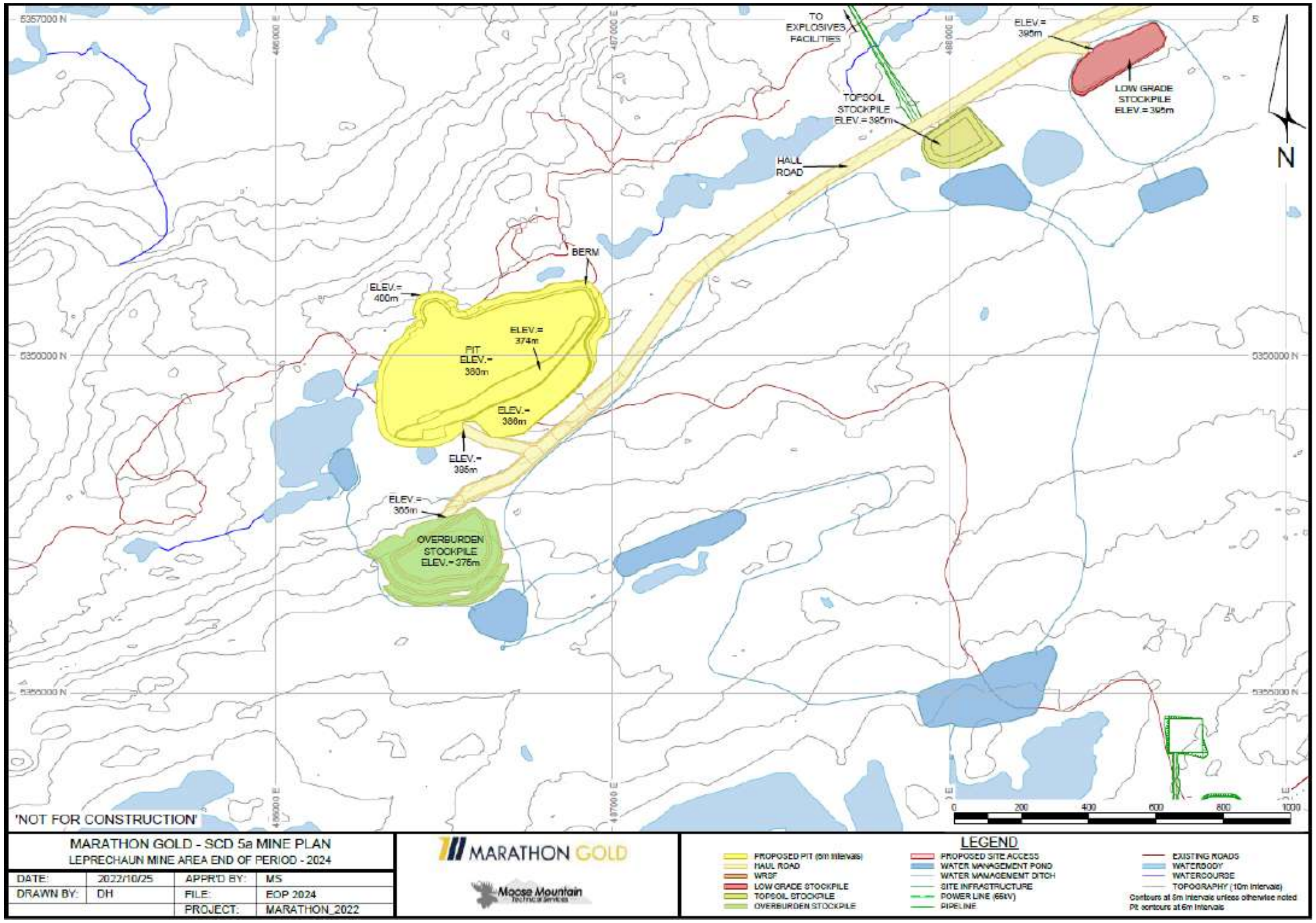

Source: MMTS 2022.

**Figure 16-46: Marathon End of Period – 2037**



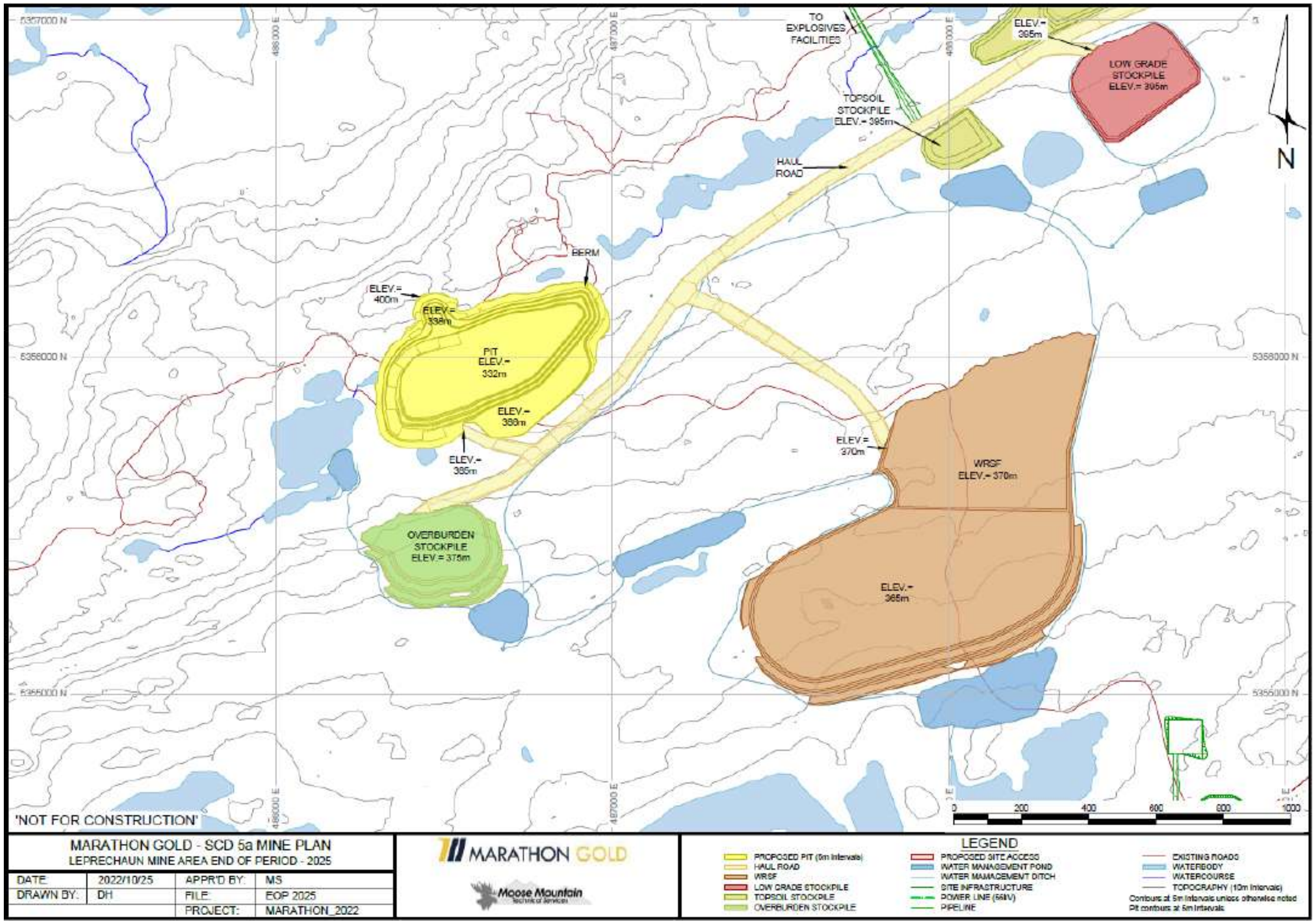

Source: MMTS 2022.

**Figure 16-47: Leprechaun End of Period – 2024**



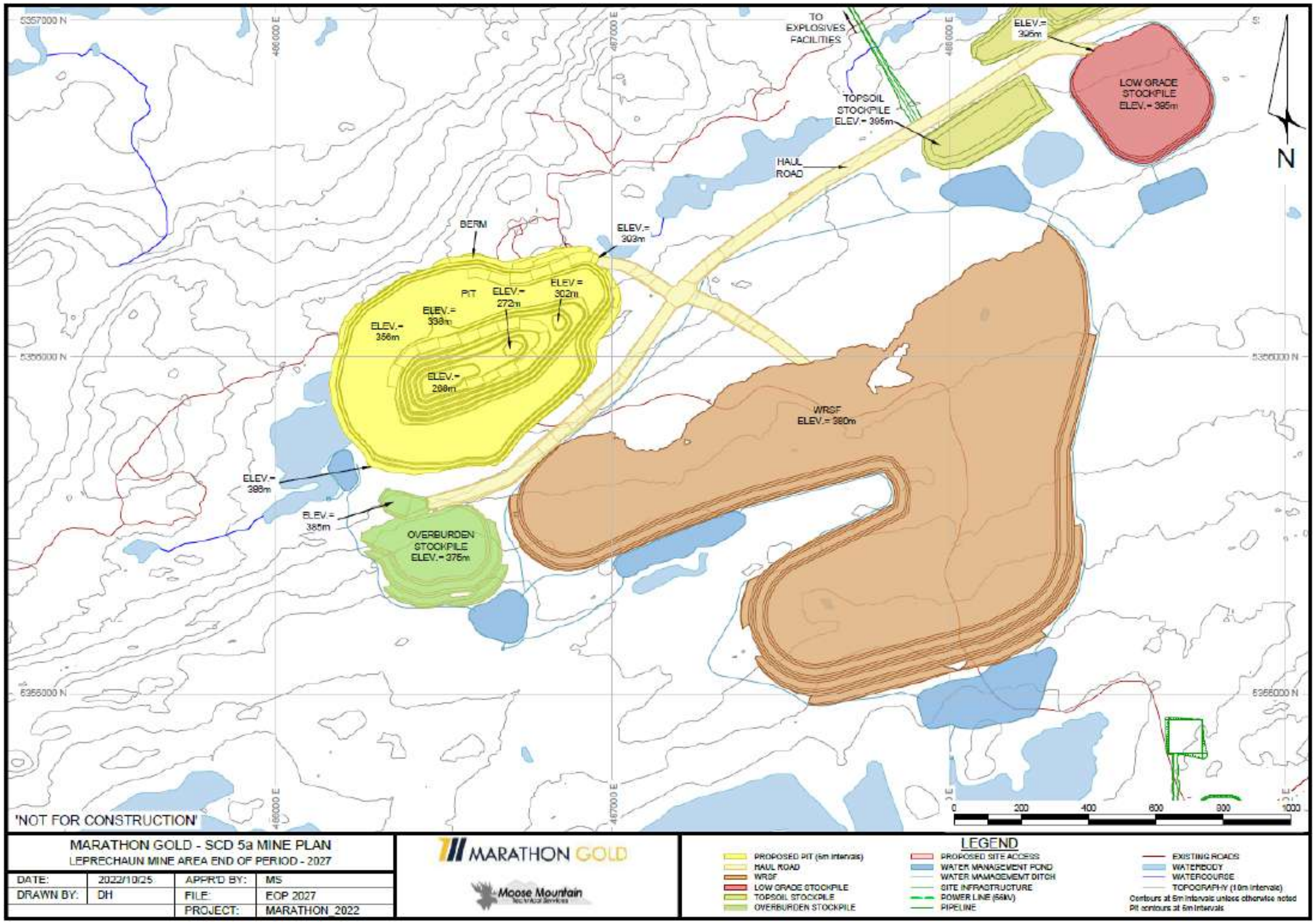

Source: MMTS, 2022

**Figure 16-48: Leprechaun End of Period – 2025**



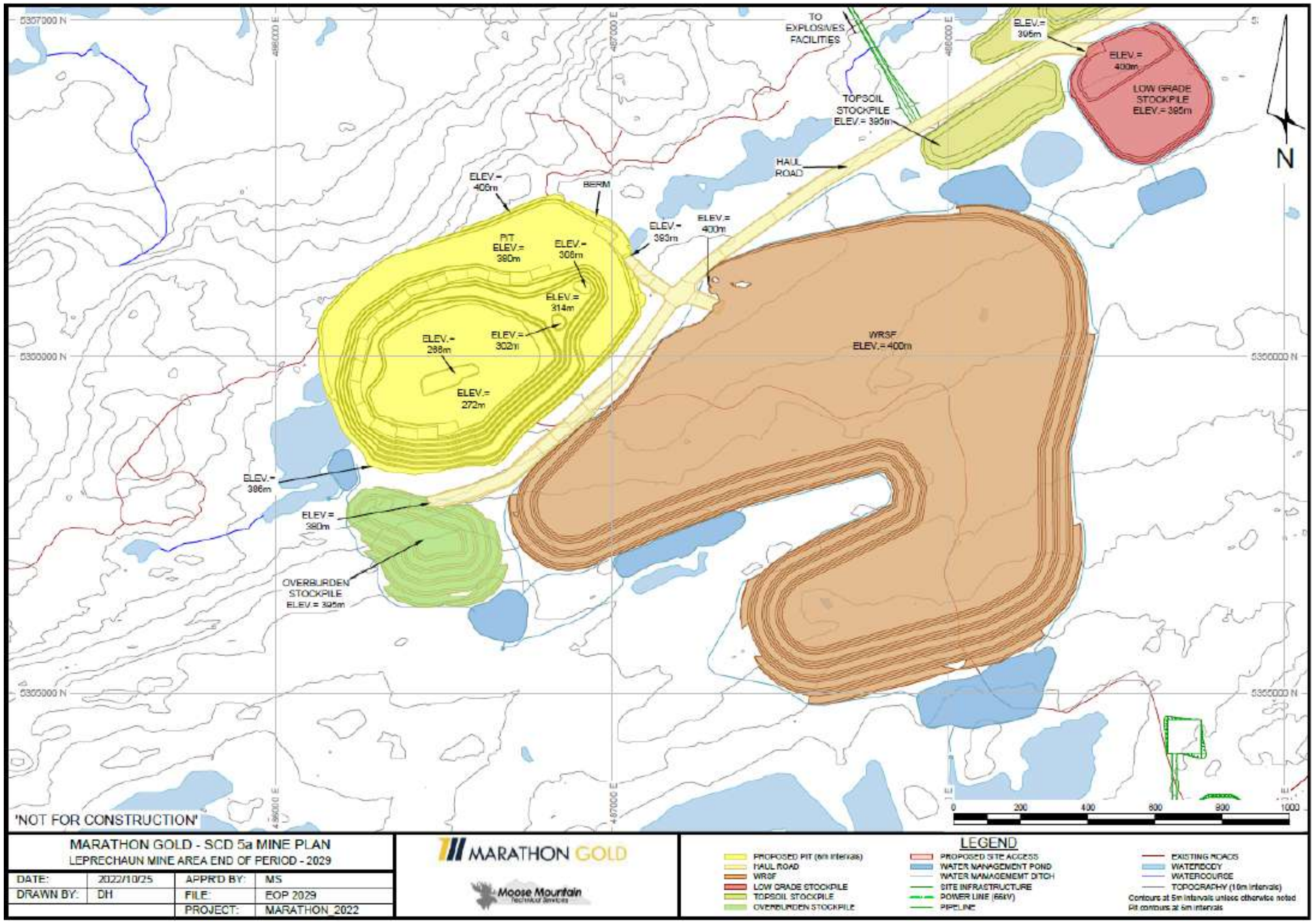

Source: MMTS, 2022.

**Figure 16-49: Leprechaun End of Period – 2027**



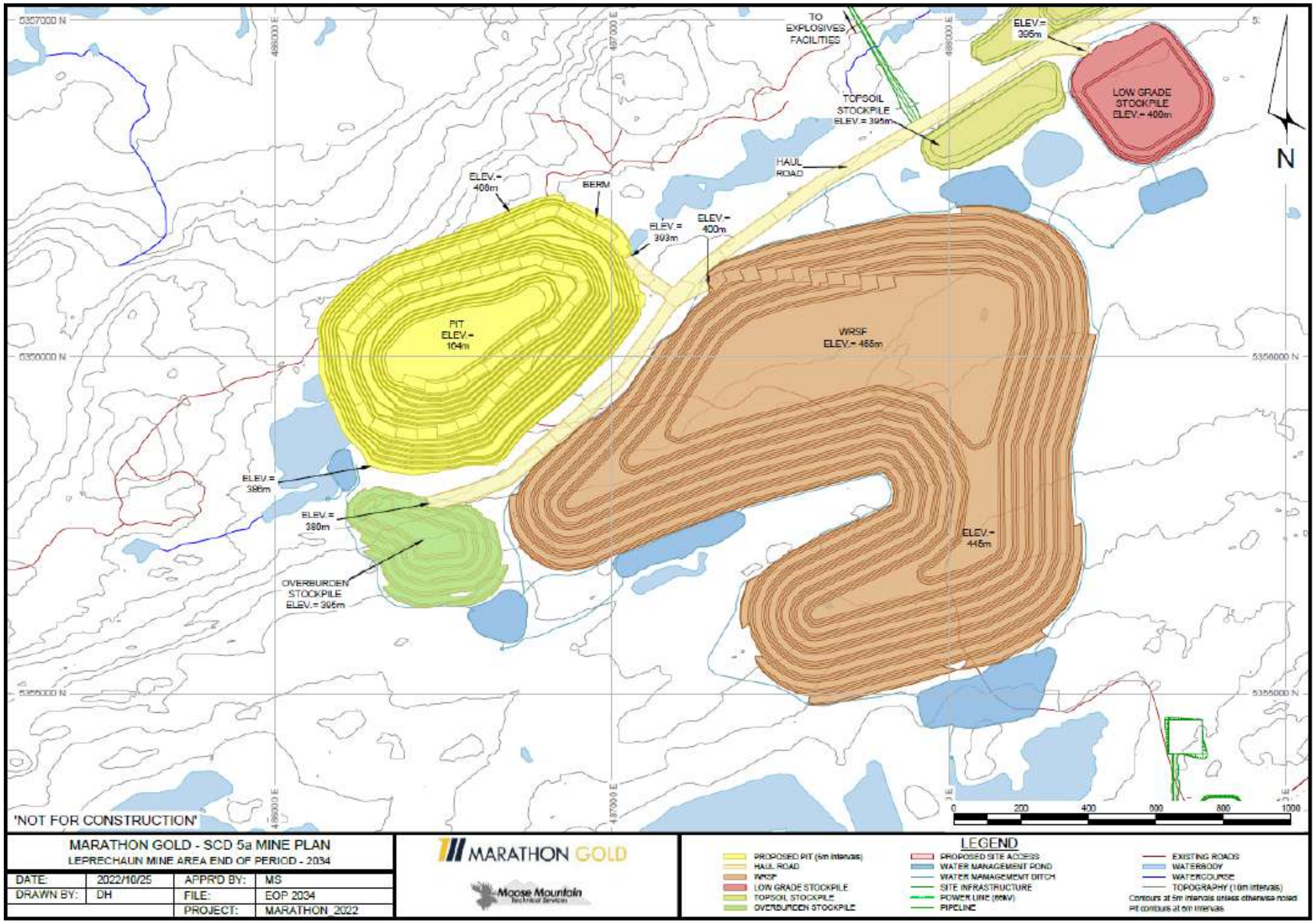

Source: MMTS, 2022.

**Figure 16-50: Leprechaun End of Period – 2029**



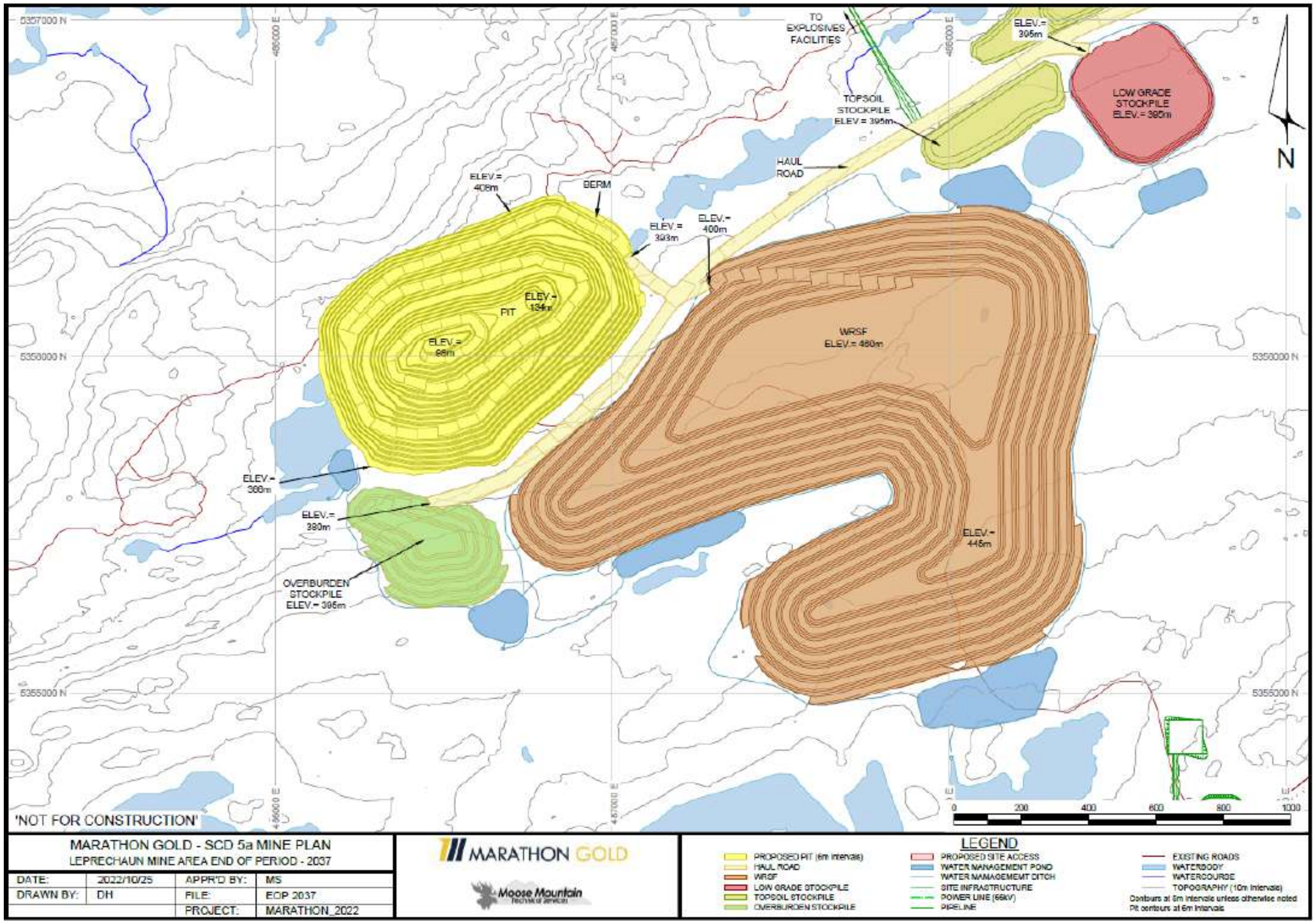

Source: MMTS, 2022.

**Figure 16-51: Leprechaun End of Period – 2034**



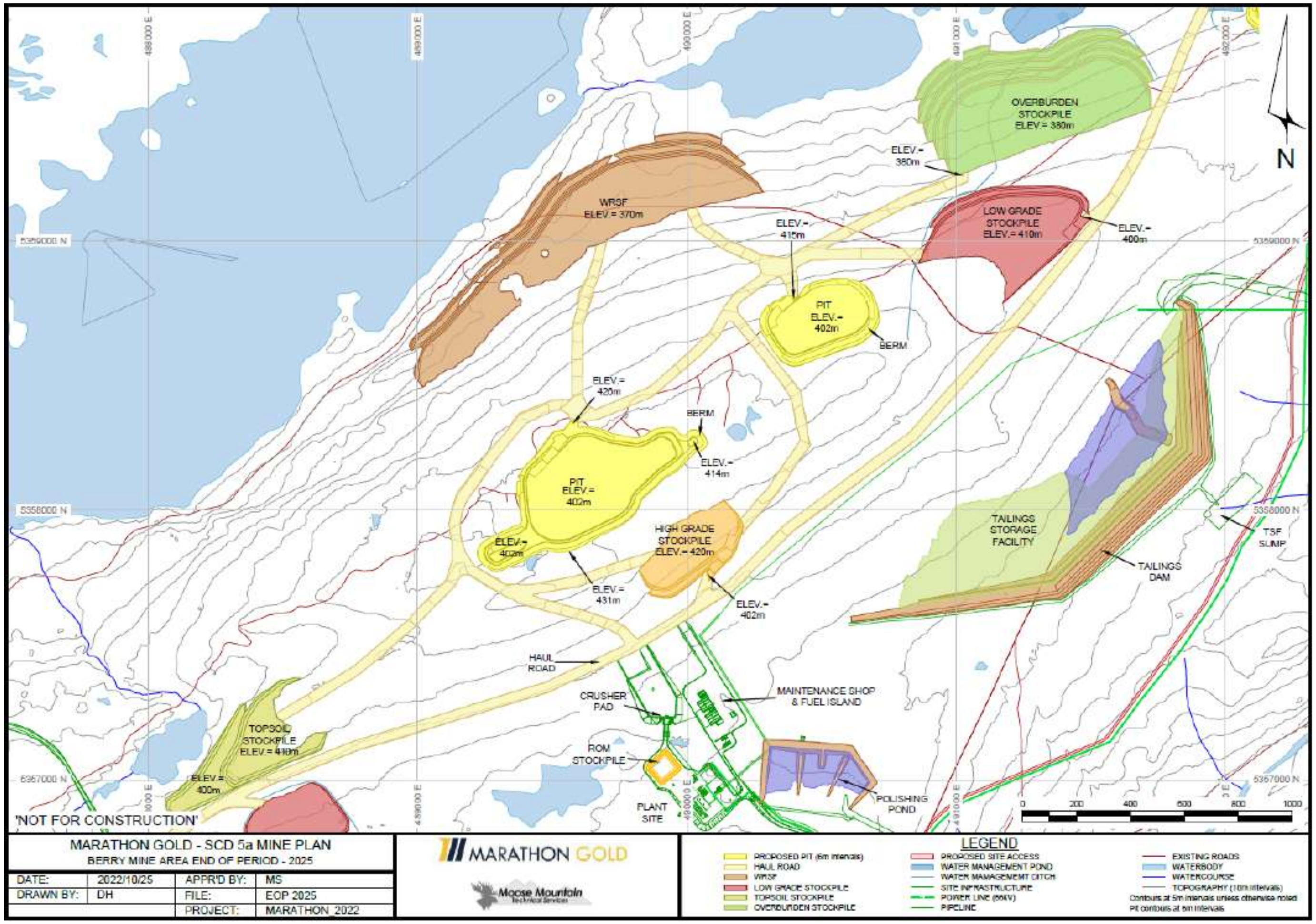

Source: MMTS, 2022.

**Figure 16-52: Leprechaun End of Period – 2037**



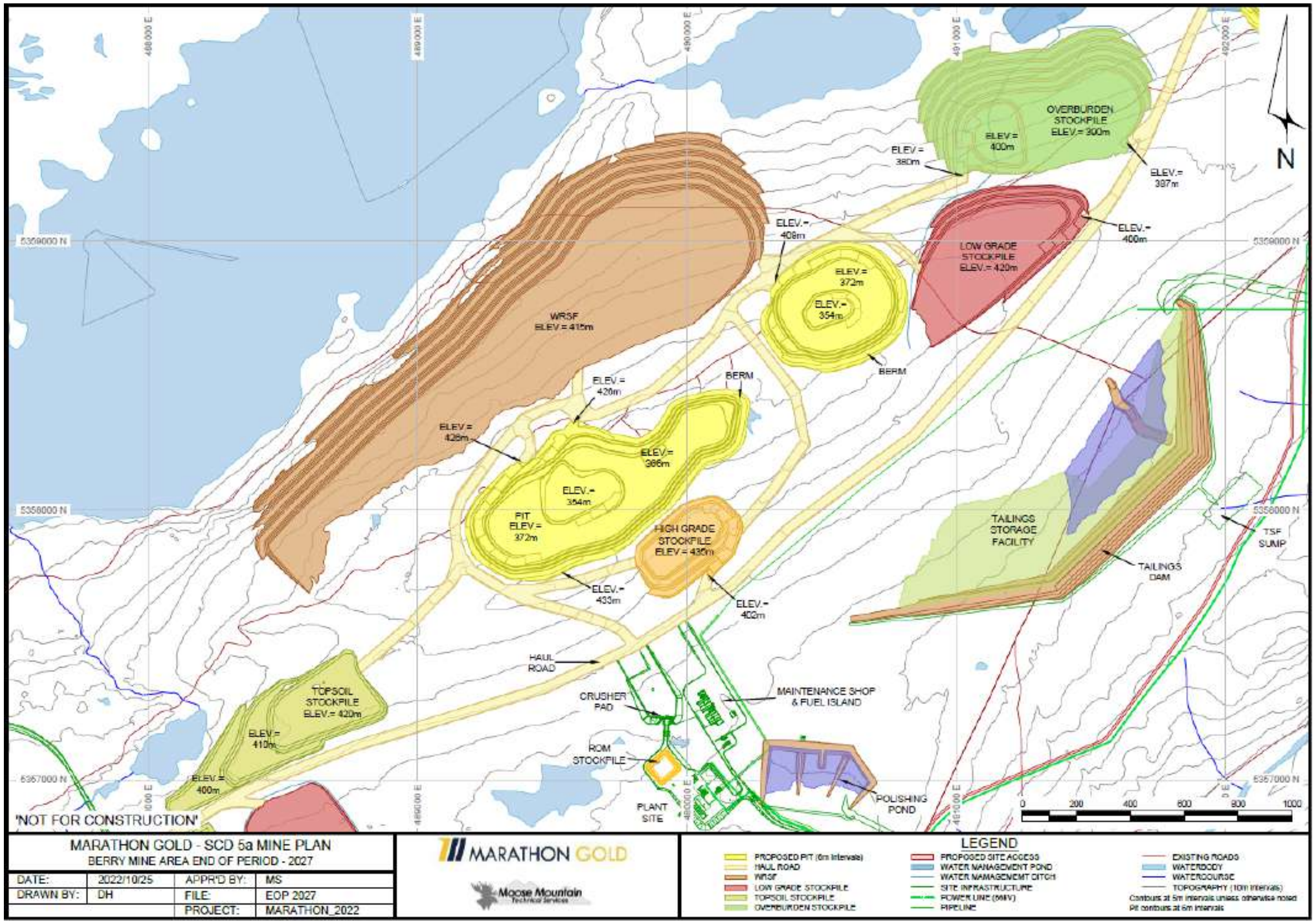

Source: MMTS, 2022.

**Figure 16-53: Berry End of Period – 2025**



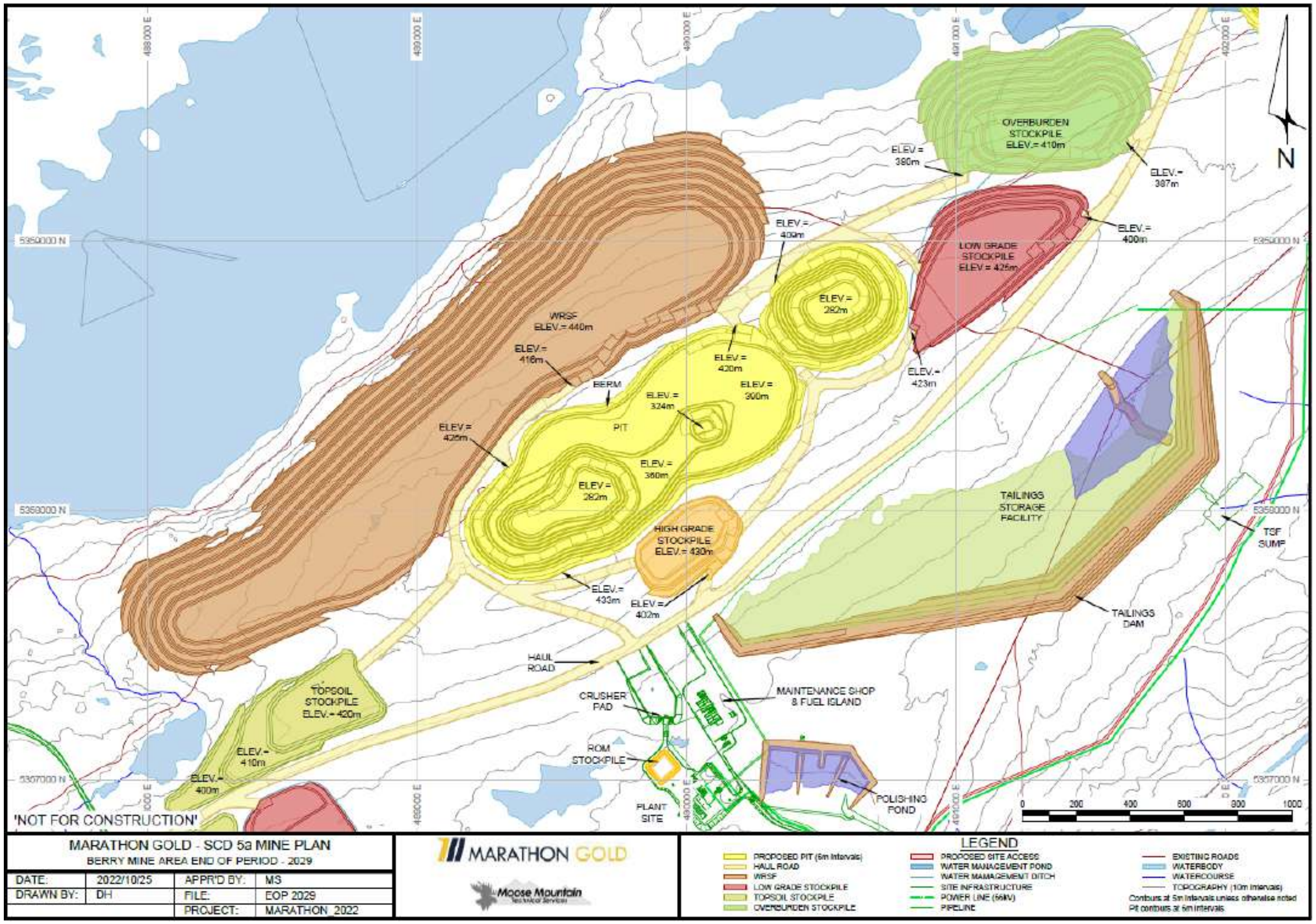

Source: MMTS, 2022.

**Figure 16-54: Berry End of Period – 2027**



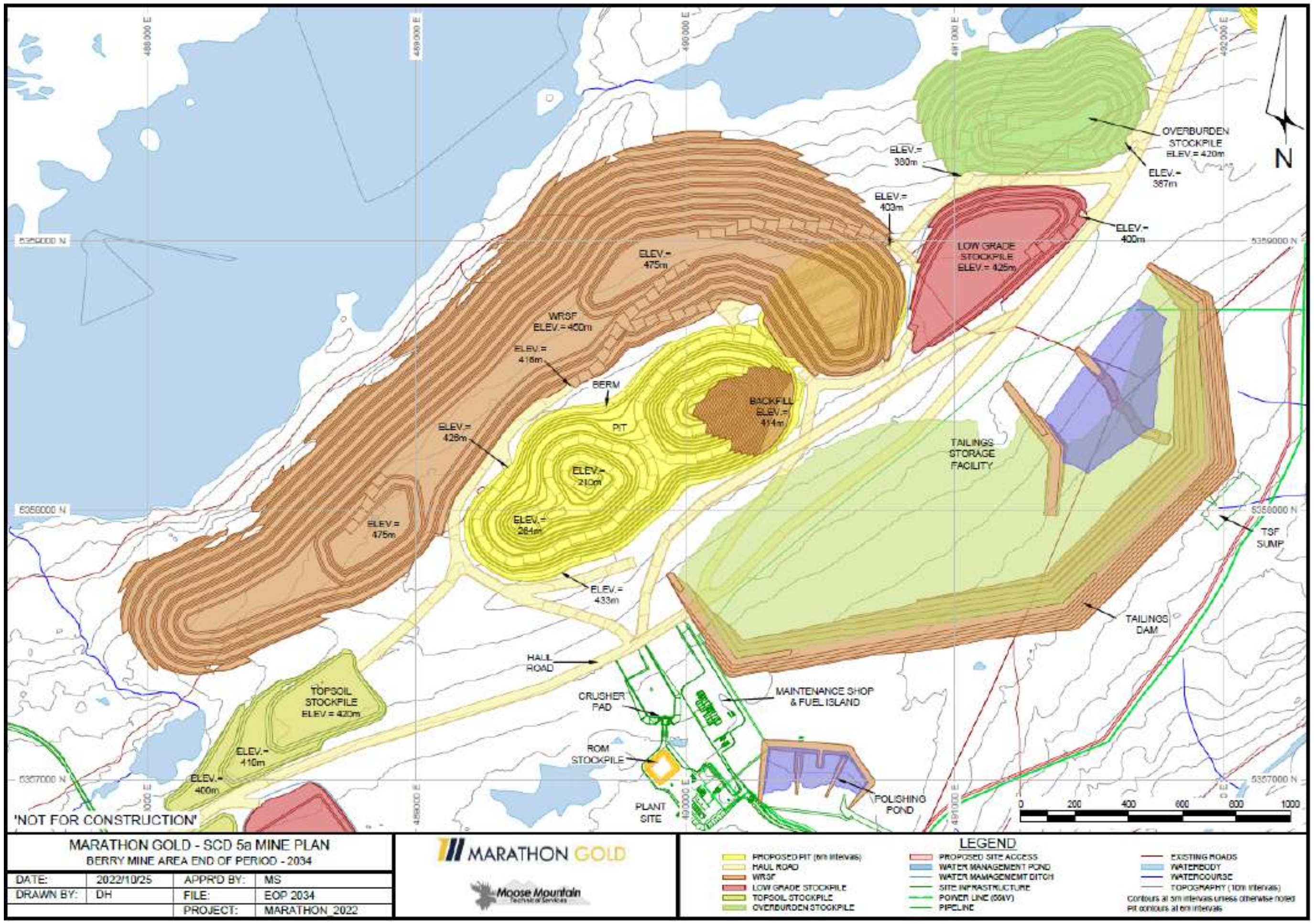

Source: MMTS, 2022.

**Figure 16-55: Berry End of Period – 2029**



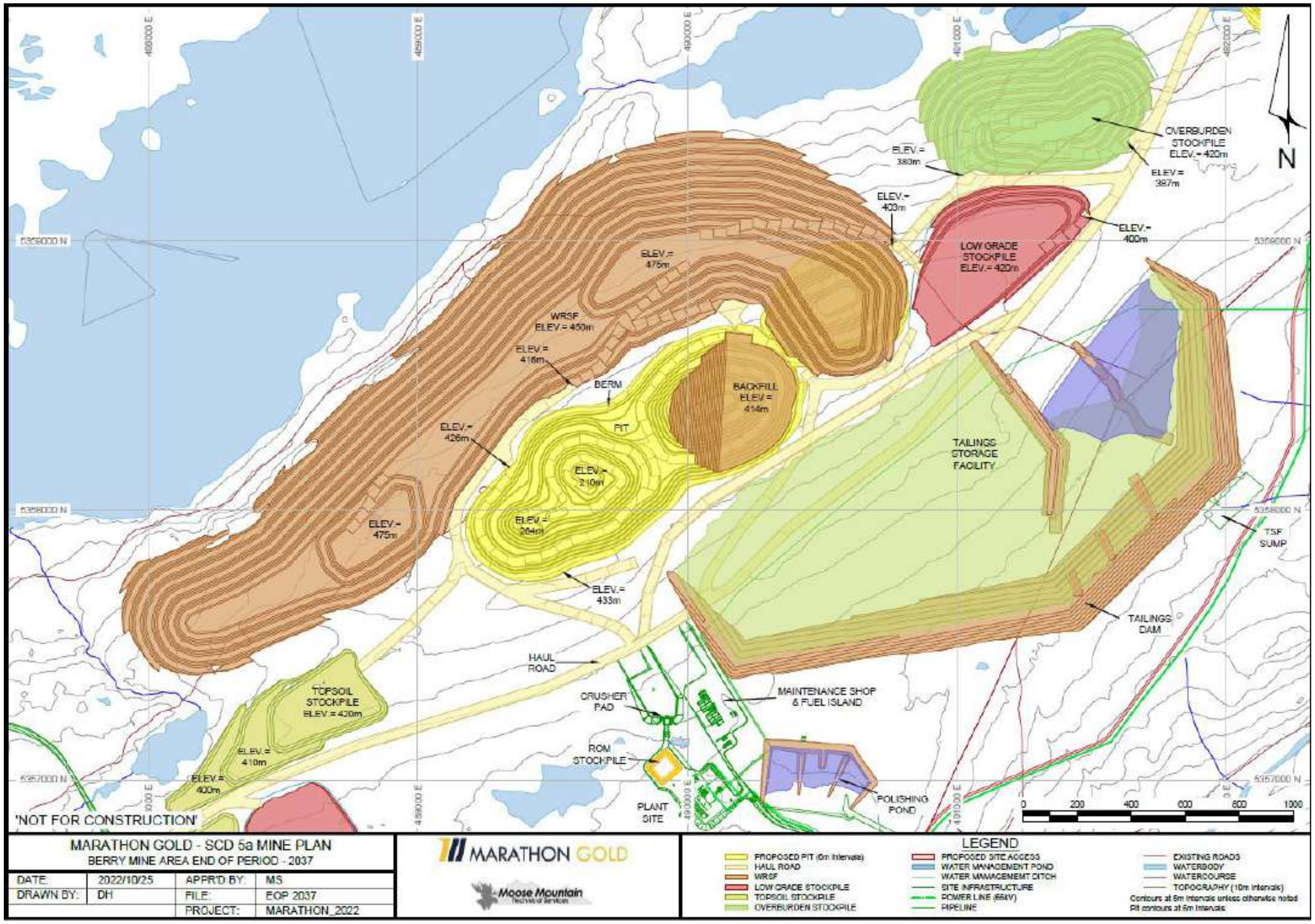

Source: MMTS, 2022.

**Figure 16-56: Berry End of Period – 2034**




Source: MMTS, 2022.

**Figure 16-57: Berry End of Period – 2037**




Source: MMTS, 2022.

## 16.8 Operations

Planned mining operations are typical of similar open pit precious metal operations in flat terrain.

Grade control drilling/sampling/assaying and blasthole sampling/assaying is carried out to better delineate the ore/waste contacts in upcoming benches. An ore control system is planned to provide field control for the loading equipment to selectively mine ore-grade material separately from the waste.

In-situ rock is drilled and blasted to create suitable fragmentation for efficient loading and hauling of both ore and waste rock. Drilling and blasting are planned on 6 m benches in selectively mined areas, and 12 m benches in bulk mined areas. Topsoil and overburden material will not require blasting. Powder factors of 0.29 kg/t in selectively mined areas and 0.25 kg/t in bulk mined areas are estimated. Emulsion and explosives are produced off site and trucked to storage facilities on site for distribution into the operations.

Loading in selective mined areas will be completed with hydraulic excavators on 6 m benches, on multiple flitches or sub-benches, and in bulk mining zones with hydraulic excavators and wheel loaders on 12 m benches. For selectively mined tonnages, 50% is planned to be directly loaded into haulers, while the other 50% is placed in piles on the bench and loaded into haulers via a wheel loader.

Ore and waste materials will be hauled out of the pit to scheduled destinations with off-highway rigid-frame haul trucks.

Mine pit services include the following:

- haul road maintenance
- pit floor and ramp maintenance
- stockpile maintenance
- ditching
- dewatering
- mobile fleet fuel and lube support
- topsoil excavation
- secondary blasting and rock breaking
- snow removal
- reclamation and environmental control
- lighting
- transporting personnel and operating supplies
- mine safety and rescue.

Direct mining operations, mine equipment fleet ownership, mine fleet maintenance, and technical services are all planned as Owner-managed functions.

Mining operations are based on 365 operating days per year with two 12-hour shifts per day. An allowance of 15 days of no production has been built into the mine schedule to allow for adverse weather conditions.

The number of hourly mine operations personnel, including maintenance staff, peaks at 365 persons. Due to the shift rotation, only one-quarter of full personnel will be on shift at a given time. Salaried personnel of approximately 50 persons will be required for mine operations, including the mine and maintenance supervision and mine technical services departments.

### 16.8.1 Open Pit Dewatering

Pits will be dewatered with conventional dewatering equipment (pit bottom submersible pumps). Daily pit inflow rates have been estimated based on direct precipitation over the pit areas and groundwater inflow rates via host rock hydraulic conductivity (Terrane, 2021 and Gemtec, 2022a, 2022b).

Field hydraulic testing included packer testing in deep geotechnical drillholes, installation of vibrating wire piezometers in geotechnical drillholes, hydraulic response (slug) testing in monitoring wells, short-term constant rate testing in exploration drillholes. Pumping test programs for Marathon and Leprechaun pits have also been run. Results of these programs defined a generally low permeability rock mass and a trend of decreasing hydraulic conductivity with depth.

Current estimates of pit hydrogeology suggest inflow from direct precipitation and groundwater to average 5,295 $m^3$/d for Marathon, 3,080 $m^3$/d for Leprechaun, and 5,185 $m^3$/d for Berry, based on hydraulic conductivity estimated from packer testing. Dewatering operations have been planned based on these amounts. Hydraulic conductivity values developed from more recent pumping tests, applied to the simplified hydrogeologic models for the Marathon and Leprechaun open pits, result in estimates of up to seven times the daily water inflow of the figures above. The pumping tests have suggested that there is a risk that the planned pit dewatering operations are not sufficient. Field operations through the construction period will allow future planning to better understand and mitigate this risk.

Maximum daily inflows associated with a 1:100-year design storm are estimated to be 119,158 $m^3$/d for Marathon, 102,545 $m^3$/d for Leprechaun, and 154,717 $m^3$/d for Berry, with direct precipitation making up the largest portion of overall inflow (greater than 80%) in all pits. Utilizing the hydraulic conductivity estimated from recent pumping tests would result in a slight increase to these maximum daily flow amounts.

It is possible that inflow rates higher than estimated may occur as the radius of influence reaches out to various surface water features within and surrounding the pit footprints and these water bodies become additional sources of recharge. In particular, the calculated radius of influence for the Leprechaun pit appears to extend out to Victoria Lake and Valentine Lake, the calculated radius of influence for the Berry pit appears to extend out to Valentine Lake, and the calculated radius of influence for the Marathon pit appears to extend out to Victoria River and Valentine Lake. Depending on the hydraulic connectively of these three pits with these surface water bodies through various structural features (i.e., faults, fractures, and shear zones), it is possible that these could provide significant sources of recharge and result in higher pit inflow rates than currently estimated.

Dewatering of the pits by way of natural seepage should have a direct effect on the bulk pore pressure regime developed behind the pit walls and allow pressures to dissipate passively. No additional active depressurization regimes have been planned.

Pit water will be pumped from in-pit sumps to collection ponds adjacent to the pits, where it will be managed as per the overall site water management plan (see Section 18.9 for details).

### 16.8.2 Planned Grade Control Measures

The aim of grade control is to accurately model ore/waste boundaries and the goal of selective mining along the ore/waste boundary is to minimize mining dilution.

For short-term mine planning on the scale of three months, a smaller and specific ore control model will be built using closer spaced reverse-circulation (RC) drilling, blasthole assays, and conditional simulation for gold grade interpolation. This model will be suitable for mining selectivity on 6 m widths and 6 m heights. The resource model will only be useful for medium- to long-term planning.

A conceptual ore control system (OCS) is planned to provide field control for the loading equipment to selectively mine ore grade material separately from the waste. The OCS will consist of the following:

- angled RC bench drilling on 30 m vertical intervals throughout all ore/waste boundary areas of the designed open pit on a 6 m x 6 m pattern
- sampling of RC drillholes for gold grades on 3.0 m intervals, 500 g charge
- blasthole sampling for all production holes drilled in mineralized areas
- assaying samples based on PAL (pulverize and leach) process at an on-site laboratory
- conditional simulation of gold grade assayed results into a 3 m x 3 m x 3 m block model
- generation of dig limits at a 0.38 g/t gold cut-off grade within block model
- loading dig limits into guidance systems on excavators
- additional field mark-up of dig limits by the technical services department
- sampling of mined gold grades at the crusher
- reconciliation of planned versus mined gold grade.

Blasts along the ore/waste boundary will use straight emulsion, rather than a blended emulsion or ammonium nitrate and fuel oil (ANFO) product, to reduce heave and minimize movement along the ore/waste boundary. This will minimize the dilution along the ore/waste contact or the dig limits for operations. However, the fragmentation that will result from using straight emulsion product is lower due to the reduced heave during blasting. This has an impact on the expected loader productivity in the selective mining zone (ore/waste boundary).

The combination of powder factor and blast designs (timing and sequencing) to minimize dilution will require field measurements and adjustments during operations. Post-blast material movement in operations is an area that has been studied and modelled, and attempts have been made to measure this movement (La Rosa, 2019; Thornton 2009).

Selective loading along the ore/waste boundary is described in Section 16.1.2, utilizing hydraulic excavators on 2 m flitches dynamically separating ore from waste along modelled boundaries and with additional direction of ore control geologists.

An automated hauler dispatch or fleet management system is planned for the loading and hauling tools to minimize the occurrence of misdirected loads. The mine plan direction for excavated materials can be uploaded to the loading tools, which can then dynamically impart this information onto the haulers as it is loading. The hauler operators are then informed of where to deliver the load and which loading tool to return to keep the operation running smoothly.

## 16.9 Mining Equipment

Grade control drilling will be carried out with 144 mm (5.5″) diesel hydraulic RC drills. Production drilling will be carried out with 200 mm (8") diesel rotary drills in bulk mining zones and 144 mm (5.5″) diesel down-the-hole (DTH) drills in selective mining zones.

Mining equipment commonly found in the open pit mining industry has been selected and sized for the loading and hauling fleet. A larger hydraulic excavator or possibly front shovel configuration (15.5 $m^3$ bucket) is proposed to handle large bulk waste headings planned over the mine life. Smaller hydraulic excavators (12.0 $m^3$ bucket) are proposed based on their ability to minimize losses and dilution for the ore control operations. Front-end wheel loaders (13.0 $m^3$ bucket) are proposed based on their ability to load the haulers in three to four passes, and their ability to load the crusher when required. Rigid-frame haulers (140-tonne and 90-tonne payload) are proposed for their flexibility in use on the smaller pit benches and in selective mining scenarios but they are not so small that the fleet size is excessive. Two articulated haulers (40-tonne payload) are proposed to supplement the fleet and provide additional flexibility for construction of the pits, haul roads, and tailings dam.

Graders will be used to maintain the haul routes for the haul trucks and other equipment within the pits and on all routes to the various waste storage locations and the crusher. Articulated trucks (40-tonne payload) that are outfitted with a water tank and gravel body are included for haul road maintenance. Track dozers (447 kW and 325 kW) are included to handle waste rock, ore, overburden, and topsoil at the various stockpile locations. A wheel dozer (370 kW) is included for shovel face, pit floor and haul road maintenance. Front-end wheel loaders (4.5 $m^3$ bucket) and hydraulic excavators (3.8 $m^3$ and 3.0 $m^3$ bucket) are included as pit support, loading tools for the articulated haulers, topsoil and gravel loading, and back-up loaders for the main fleet. The smaller excavators will also be useful for supporting ore control activities. Custom articulated fuel/lube trucks are included for mobile fuel/lube support. Various small mobile equipment pieces are proposed to handle all other pit service and mobile equipment maintenance functions.

Mine fleet maintenance activities are generally performed in the maintenance facilities located near the plant site.

Primary mining equipment estimates are shown in Table 16-8. A list of estimated support units is shown in Table 16-9.

**Table 16.8: Primary Mining Fleet Schedule**

| Unit | 2022 | 2023 | 2024 | 2025 | 2206 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038-2039 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drilling | | | | | | | | | | | | | | | | | |
| Diesel Rotary Tracked Drill – 200 mm (8") Holes | 0 | 0 | 0 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | 1 | 0 |
| Diesel DTH Tracked Drill – 165 mm (5.5") Holes | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 0 |
| Loading | | | | | | | | | | | | | | | | | |
| Hydraulic Excavator – 15.5 $m^3$ Bucket | 0 | 0 | 0 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 0 | 0 | 0 |
| Hydraulic Excavator – 12.0 $m^3$ Bucket | 1 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 1 | 0 |
| Wheel Loader – 13.0 $m^3$ Bucket | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Hauling | | | | | | | | | | | | | | | | | |
| Rigid-Frame Haul Truck – 140 t Payload | 0 | 0 | 0 | 12 | 13 | 16 | 22 | 22 | 22 | 22 | 22 | 22 | 18 | 18 | 6 | 0 | 0 |
| Rigid-Frame Haul Truck – 90 t Payload | 4 | 4 | 4 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 9 | 9 | 9 | 6 | 6 |

**Table 16.9: Support Units**

| Unit | Function | Maximum Number |
|---|---|---|
| Diesel RC Tracked Drill (144 mm) | Grade control drilling | 3 |
| Articulated Haul Truck (40 t Payload) | Haul support, topsoil hauling, construction support | 2 |
| Motor Grader (4.9 m Blade) | Haul road maintenance | 3 |
| Water/Gravel Truck | Haul road maintenance, gravel hauling | 3 |
| Track Dozer (447 kW) | Stockpile maintenance | 3 |
| Track Dozer (325 kW) | Pit support, construction, snow clearing | 2 |
| Track Dozer (160 kW) | Site preparation, snow clearing, construction | 1 |
| Wheel Dozer (350 kW) | Pit support, shovel support, snow clearing | 1 |
| Wheel Loader (4.5 $m^3$) | Pit support, gravel loading, and construction | 2 |
| Hydraulic Excavator (3.8 $m^3$) | Ore cleaning, preparation for ore loading, topsoil load | 3 |
| Hydraulic Excavator (3.0 $m^3$) | Pit support, ditching, construction activities | 2 |
| Hydraulic Excavator (1.8 $m^3$) | Pit support, ditching, construction activities | 1 |
| Fuel and Lube Truck | Mobile fuel/lube service | 3 |
| Shuttle Bus | Employee transportation | 6 |
| Pickup Trucks (1/4 ton) | Staff transportation | 10 |
| Light Plants (20 kW) | Pit lighting | 18 |
| Water Pumps (150 $m^3$/h) | Pit sump dewatering | 10 |
| On-Highway Dump Truck | Utility material movement | 2 |
| Flatbed Picker Truck | Material transport, pump crew support | 2 |
| Emergency Response Vehicle | First aid and mine rescue | 1 |
| Maintenance Trucks | Mobile maintenance crew and tool transport | 4 |
| Mobile Crane (36 t Capacity) | Mobile maintenance material handling | 1 |
| Float Trailer (150 ton Capacity) | Equipment and material transport | 1 |
| Shovel Float (300 ton Capacity) | Shovel transport | 1 |
| Forklift (3 t Capacity) | Shop material and tire handling | 2 |
| Mobile Steam Cleaner | Mobile maintenance equipment cleaning | 2 |
| Scissor Lift / Mobile Personnel Lift | Mobile maintenance support | 2 |

# 17 RECOVERY METHODS

## 17.1 Overall Process Design

The provided testwork was analyzed and several process route options were addressed in the initial stages of the feasibility study. Based on the analysis, a process route was chosen as the best suited for the testwork results and subsequent economic analysis for the material. The unit operations selected are typical for this industry.

Per the mining production schedule, as the high-grade ore is fed to the mill in the first three years, the project will utilize a more capital cost-effective mill design, including a primary grind size $P_{80}$ of 75 µm, gravity recovery of gold and gravity tails cyanidation.

As the mill feed grade decreases, and plant capacity is required to increase to maintain gold production, the project will use the existing grinding mills, and coarsen the primary grind size $P_{80}$ to 150 µm. Flotation equipment will then be employed to recover most of the gold to a low mass concentrate stream, at 5% mass pull (of mill feed), and ultra-fine grinding and cyanidation will be applied. Using this approach, initial capital costs will be reduced where possible, and when the mill is required to expand to maintain a steady gold production profile, the flowsheet will be modified to again reduce the expansion capital costs and the operating costs.

In essence, the project will be constructed in two distinct phases, as follows:

- Phase 1 (2.5 Mt/a) – Comprises a semi-autogenous grinding (SAG) mill, ball mill, gravity concentration, and gravity tails leaching with pre-aeration, carbon elution, and gold recovery. Leach-adsorption tails will be treated for cyanide destruction, thickened, and deposited in the tailings management facility (TMF).
- Phase 2 (expansion to 4.0 Mt/a) – Includes Phase 1 equipment with the addition of pebble crushing, gravity tails flotation, flotation concentrate regrinding, flotation concentrate leaching, and thickening of both the flotation concentrate and flotation tailings streams

Key process design criteria are listed below:

- Phase 1 nominal throughput of 6,850 t/d or 2.5 Mt/a
- Phase 2 nominal throughput of 10,960 t/d or 4.0 Mt/a
- crushing plant availability of 75%
- plant availability of 92% for grinding, gravity concentration, flotation, leach plant and gold recovery operations.

## 17.2 Phase 1 – Mill Process Plant Description

The Phase 1 process design is comprised of the following circuits:

- primary crushing of run-of-mine (ROM) material

- a covered stockpile of crushed material to provide buffer capacity ahead of the grinding circuit
- SAG mill with trommel screen followed by a ball mill with cyclone classification
- gravity recovery of the cyclone feed slurry by one semi-batch centrifugal gravity concentrator, followed by intensive cyanidation of the gravity concentrate and electrowinning of the pregnant leach solution in a dedicated cell located in the gold room
- trash screening
- pre-aeration (PA), leach + carbon-in-leach adsorption (L/CIL hybrid)
- acid washing of loaded carbon and pressure Zadra-type elution followed by electrowinning and smelting to produce doré
- carbon regeneration by rotary kiln
- cyanide destruction of tailings using $O_2/SO_2$
- carbon screening, tailings thickening and tailings management facility
- effluent water treatment followed by a polishing pond before discharging into Victoria Lake.

### 17.2.1 Plant Design Criteria

Key process design criteria for the mill during Phase 1 are listed in Table 17-1.

**Table 17.1: Key Milling Plant Process Design Criteria for Phase 1**

| Design Parameter | Units | Value |
|---|---|---|
| Plant Throughput | t/d | 6,850 |
| Gold Head Grade – Design | g/t Au | 2.76 |
| Crushing Plant Availability | % | 75 |
| Mill Availability | % | 92 |
| Bond Crusher Work Index (CWi) | kWh/t | 16.5 |
| Bond Rod Mill Work Index (BWi) | kWh/t | 13.9 |
| Bond Ball Mill Work Index (BWi) | kWh/t | 17.0 |
| JK Axb Parameter – (75th percentile) | Axb | 41.5 |
| Bond Abrasion Index (Ai) | g | 0.41 |
| Primary Crusher | | C130 or Equivalent |
| Material Specific Gravity | $t/m^3$ | 2.68 |
| Angle of Repose | degrees | 37 |
| Moisture Content | % | 3.0 |
| Pebble Lime Addition | kg/t material | 3.8 |
| SAG Mill Dimensions | | 7.93 m dia. X 4.3 m EGL |
| SAG Mill Installed Power | MW | 4.8, with VFD |
| SAG Mill Discharge Density | % w/w | 70 |
| SAG Mill Ball Charge | % v/v | 9 |
| Ball Mill Dimensions | | 5.5 m dia. X 8.5 m EGL |
| Ball Mill Installed Power | MW | 4.6, with VFD |
| Ball Mill Discharge Density | % w/w | 72 |
| Ball Mill Ball Charge | % v/v | 28 |
| Primary Grind size ($P_{80}$) | µm | 75 |
| Gravity Circuit Feed Source | | Cyclone feed slurry |
| Gravity Circuit Feed Rate | % cyclone recirculation | 21.8 |
| Gravity Circuit Recovery | %Au | 45 |
| L-CIL Residence Time, including Pre-aeration | h | 36 |
| L-CIL Extraction | %Au | 93 |
| L-CIL Operating Density | % w/w | 42.5 |
| L-CIL DO Target | ppm | 20 |
| L-CIL pH Target | | 12 |
| L-CIL Carbon Concentration | g/L | 12 |
| Loaded Carbon, Average | g Au/t C | 2,280 |
| L-CIL Sodium Cyanide Addition | kg/t material | 1.5 |
| L-CIL Hydrated Lime Addition | kg $Ca(OH)_2$/t material | 1.0 |
| Pre-aeration, Leach & CIL Tanks | # | 1 + 2 + 6 |
| Tonnes of Carbon per Column | t | 7.0 |
| Detox Residence Time | min | 60 |
| Detox Oxygen Addition Rate | g $O_2$/g $SO_2$ | 3.0 |
| Detox WAD Cyanide Feed to Circuit | mg/L $CN_{WAD}$ | 200 |
| Detox WAD Cyanide Discharge Target | mg/L $CN_{WAD}$ | <2.0 |
| Detox Copper Sulphate Addition | ppm $Cu^{+2}$ | 25 |
| Detox SMBS Addition | g $SO_2$/g $CN_{WAD}$ | 5.0 |
| Detox Hydrated Lime Addition | g CaO/g $SO_2$ | 0.75 |
| Final Tails Thickener Underflow Density | % w/w | 65 |
| Flocculant – Final Tails Thickener | g/t material | 30 |

### 17.2.2 Primary Crushing and Stockpiling

The crushing circuit is designed for an annual operating time of 6,570 h/a or 75% availability at the Phase 2 capacity of 10,960 t/d from the outset.

Material is hauled from the mine or stockpiles and direct tipped into to the ROM hopper. Provision for dumping on the ROM pad for blending and re-handling into the ROM hopper is provided. Material from the ROM hopper is crushed by a primary jaw crusher. ROM hopper material is reclaimed by a vibrating grizzly at 381 t/h to feed the jaw crusher.

A fixed rock breaker is utilized to break oversize rocks at the feed to the jaw crusher. The crushed material is conveyed to a covered stockpile that provides approximately 19 hours of live storage at the Phase 1 nominal processing rate. Given the milling operation is designed for an annual operating time of 8,059 h/a or 92% availability, this will result in excess crushed material production when the crusher is operational. The excess crushed material will allow routine crusher maintenance to be carried out without interrupting feed to the mill.

The mill feed stockpile is equipped with apron feeders to regulate feed into the SAG mill. Crushed material is drawn from the stockpile by two apron feeders and feeds the grinding circuit via the SAG mill feed conveyor. Pebble lime is added to the SAG mill feed conveyor for pH control in leaching as required. SAG mill pebble production is recycled via a series of conveyors back to the SAG mill feed conveyor.

The material handling and crushing circuit includes the following key equipment:

- ROM hopper
- vibrating grizzly
- fixed rock breaker
- primary jaw crusher
- mill feed apron feeders (equipped with VFDs)
- material handling equipment.

### 17.2.3 Grinding Circuit

The grinding circuit consists of a SAG mill followed by a ball mill in closed circuit with hydrocyclones. The circuit is sized based on a SAG $F_{80}$ of 120 mm and a ball mill product $P_{80}$ of 75 µm. The SAG mill slurry discharges through a trommel where the pebbles are screened and recycled to the SAG mill via conveyors. Trommel undersize discharges into the cyclone feed pumpbox.

The ball mill is fed by cyclone underflow and gravity circuit tails. The ball mill discharges through a trommel and the oversize is screened out and discharged to a scats bunker. Trommel undersize discharges into the cyclone feed pumpbox.

Water is added to the cyclone feed pumpbox to obtain the appropriate density prior to pumping to the cyclones. This hopper also has a dedicated pump to feed the gravity circuit scalping screen. Cyclone overflow gravitates to the leach-adsorption circuit via a trash screen.

The grinding circuit includes the following key equipment:

- 4,800 kW SAG mill (shared VFD with ball mill)
- 4,800 kW ball mill
- cyclone feed pumpbox
- classification cyclones.

### 17.2.4 Gravity Concentrate Recovery Circuit

The gravity circuit comprises one centrifugal concentrator complete with a feed scalping screen. Feed to the circuit is directed from the cyclone feed pumpbox via a dedicated pump to the scalping screen. Gravity scalping screen oversize at +2 mm reports to the gravity tails pumpbox, from where the gravity tails pump directs the material back to feed the ball mill.

Scalping screen undersize is fed to the centrifugal concentrator. The gravity concentrator is semi-batch operation, and the gravity concentrate is collected in the concentrate storage cone and subsequently leached by the intensive cyanidation reactor circuit. The tails from the intensive leach reactor circuit report to the gravity tails pumpbox and from there are returned to the grinding circuit.

The gravity recovery circuit includes the following key equipment:

- gravity feed scalping screen
- gravity concentrator
- gravity tails pumpbox.

### 17.2.5 Intensive Leach Reactor

Concentrate from the gravity circuit reports to the intensive leach reactor (ILR) to extract the contained gold by intensive cyanidation. The concentrate from the gravity concentrator is directed to the ILR gravity concentrate storage cone and de-slimed before transfer to the ILR.

ILR leach solution (mixture of NaCN, NaOH and LeachAid® - an oxidant) is made up within the heated ILR reactor vessel feed tank. From the feed tank, the leach solution is circulated though the reaction vessel, then drained back into the feed tank. The leached residue within the reaction vessel is washed, with wash water recovered to the reaction vessel feed tank, and then the solid gravity leach tailings are pumped to the ball mill discharge pumpbox.

The ILR pregnant leach solution is pumped from the reaction vessel feed tank to the ILR pregnant solution tank located in the gold room.

ILR pregnant solution is treated in the gold room for gold recovery as gold sludge using a dedicated electrowinning cell. The sludge is combined with the sludge from the carbon elution electrowinning cells and smelted. It can also be smelted separately for metallurgical accounting purposes.

The ILR circuit includes the following key equipment:

- gravity concentrate storage cone
- intensive cyanidation reactor
- ILR pregnant solution tank
- ILR electrowinning cell.

### 17.2.6 Pre-Aeration, Leach and Adsorption Circuit

The pre-aeration, leach and adsorption circuit consists of one per-aeration tank, and two agitated leach tanks followed by six agitated CIL tanks in series, located outdoors in dedicated bunded areas serviced by sump pumps. Each tank is equipped with a dual, rubber-lined, impeller mechanical agitator to ensure uniform mixing of slurry, and carbon for the gold adsorption in the CIL tanks. The pre-aeration, and leach tanks are larger than the CIL tanks and provide a total circuit residence time of 36 hours at 42.5% w/w pulp density at the nominal slurry flowrate during the Phase 1 of the project.

The pre-aeration tank is sparged with air via a hollow shaft agitator to control the iron in the process and ultimately optimize the cyanide consumption in the L/CIL circuit. The operational level in the pre-aeration tank is higher than in the first leach tank to allow the slurry to gravity flow in a sloped launder. In addition, provision is made to inject air in the last three CIL tanks.

Oxygen is sparged to each leach tank to maintain adequate dissolved oxygen levels for leaching at 20 ppm. Hydrated lime is added to further refine the operating pH to the desired set point of 12. Cyanide solution is added to the first leach tank. Fresh/regenerated carbon from the carbon regeneration circuit is returned to the last tank of the CIL circuit and is advanced counter-currently to the slurry flow by pumping slurry and carbon. Slurry from the last CIL tank gravitates to the cyanide detoxification tanks.

The inter-tank screen in each CIL tank retains the carbon whilst allowing the slurry to flow by gravity to the downstream tank. This counter-current process is repeated until the loaded carbon reaches the first CIL tank. Recessed impeller pumps are used to transfer slurry between the CIL tanks and from the lead tank to the loaded carbon screen mounted above the acid wash column in the elution circuit.

The pre-aeration, leach and carbon adsorption circuit includes the following key equipment:

- trash screen
- pre-aeration tank and agitator
- leach/CIL tanks and agitators
- air blowers for pre-aeration
- loaded carbon screen
- intertank carbon screens
- carbon sizing screen.

### 17.2.7 Cyanide Destruction

Leach-adsorption tails at 41.5% w/w solids flow by gravity to the cyanide destruction tank. The water used for acid rinse and carbon transfer is also included in the feed to detoxification circuit. As a result, the percentage solids in the feed to the detoxification circuit is estimated to be closer to 40% w/w solids.

The tank operates with a total residence time of approximately 60 mins to reduce weak acid dissociable cyanide ($CN_{WAD}$) concentration from 200 ppm to less than 2.0 ppm.

Cyanide destruction is undertaken using the $SO_2/O_2$ method. The reagents required are oxygen, lime, copper sulphate, and sodium metabisulphite (SMBS). Oxygen for the cyanide destruction reaction is added to the cyanide detox tank via the hollow-shaft agitator. This agitator ensures that the oxygen and reagents are thoroughly mixed with the tailings slurry.

From the detoxification tank, the tailings report to the carbon safety screen. Screen undersize feeds the tailings thickener, whilst screen oversize (recovered carbon) is collected in fine carbon bulk bags for potential return to the CIL circuit.

The main equipment in this area includes the following:

- cyanide destruction tank and agitator
- oxygen supply system
- carbon safety screen.

### 17.2.8 Tailings Thickening

Detoxified tailings are thickened before discharge to the TMF. The overflow of the thickener is reused as process water in the plant. Flocculant is combined with the feed to the thickener to improve the settling rate of the material. The underflow is pumped to the TMF for final deposition with decant water from the TMF returned for use as process water.

The main equipment in this area includes the following:

- high-rate thickener
- overflow tank for process water storage
- underflow / final tailings pumps (two-stage).

### 17.2.9 Carbon Acid Wash, Elution and Regeneration Circuit

#### 17.2.9.1 Carbon Acid Wash

Prior to gold stripping stage, loaded carbon is treated with a weak hydrochloric acid solution to remove calcium, magnesium, and other salt deposits that could render the elution less efficient or become baked on in subsequent steps and ultimately foul the carbon.

Loaded carbon from the loaded carbon recovery screen flows by gravity to the acid wash column. Entrained water is drained from the column and the column is refilled from the bottom up with the hydrochloric acid solution. Once the column is filled with acid, it is left to soak, after which the spent acid is rinsed from the carbon and discarded to the cyanide destruction tank.

The acid-washed carbon is then hydraulically transferred to the elution column for gold stripping.

The main equipment in this area includes:

- acid wash carbon column with 7-tonne capacity
- hydrochloric acid feed pump
- spent solution discharge sump pump.

#### 17.2.9.2 Gold Stripping (Elution)

The gold stripping (elution) circuit uses the pressure Zadra process.

The elution sequence commences with the injection of a set volume of water into the bottom of the elution column, along with the simultaneous injection of cyanide and sodium hydroxide solution to achieve a weak NaOH (2.0% w/w) and weak NaCN (0.2% w/w) solution. Once the prescribed volume has been added, the pre-soak period commences. During the pre-soak, the caustic/cyanide solution is circulated through the column and the elution heater until a temperature of 95°C is achieved.

Upon completion of the pre-soak period, additional water is pumped through the trim heat exchanger and elution heater, then through the elution column to the pregnant eluate tank at a rate of 2.0 bed volumes (BV)/h. At this stage, the temperature of the strip solution passing through the column is increased to 140/150°C at a pressure of 350/500 kPag and the gold is stripped off the loaded carbon.

Strip solution flows up and out of the top of the column, passing through the heat exchanger via the elution discharge strainers and to the pregnant solution tank.

Upon completion of the cool down sequence, the carbon is hydraulically transferred to the carbon regeneration kiln feed hopper via a dewatering screen.

The stripping circuit includes the following key equipment:

- elution carbon column with 7-tonne capacity
- strip solution heater (electric) with heat exchangers
- strip eluate, and pregnant solution tanks.

#### 17.2.9.3 Carbon Reactivation

Carbon is reactivated in an electric rotary kiln. Dewatered barren carbon from the stripping circuit is held in a 7-tonne kiln feed hopper. A screw feeder meters the carbon into the reactivation kiln, where it is heated to 750°C in an atmosphere of superheated steam to restore the activity of the carbon.

Carbon discharging from the kiln is quenched in water and screened on a carbon sizing screen located on top of the CIL tanks to remove undersized carbon fragments. The undersize fine carbon gravitates to the carbon safety screen, whilst carbon screen oversize is directed to the CIL circuit.

As carbon is lost by attrition, new carbon is added to the circuit using the carbon quench tank. The new carbon is then transferred along with the regenerated carbon to feed the carbon sizing screen.

The carbon reactivation circuit includes the following key equipment:

- carbon dewatering screen
- regeneration kiln (electric) including feed hopper and screw feeder
- carbon quench tank.

### 17.2.10 Electrowinning and Gold Room

Gold is recovered from the pregnant solution by electrowinning and smelted to produce doré bars. The pregnant solution is pumped through one electrowinning cell with stainless steel mesh cathodes. Gold is deposited on the cathodes and the resulting barren solution is pumped to the leach circuit. One additional electrowinning cell is dedicated to process ICR pregnant solution.

The gold-rich sludge is washed off the steel cathodes in the electrowinning cells using high-pressure spray water and gravitates to the sludge hopper. The sludge is filtered, dried, mixed with fluxes, and smelted in an electrical induction furnace to produce gold doré. The electrowinning and smelting process takes place within a secure and supervised gold room equipped with access control, intruder detection, and closed-circuit television equipment.

The electrowinning circuit and gold room include the following key equipment:

- electrowinning cells with rectifiers
- sludge pressure filter
- drying oven
- flux mixer
- induction smelting furnace with bullion moulds and slag handling system
- bullion vault and safe
- dust and fume collection system
- gold room security system.

### 17.2.11 Effluent Treatment Plant

Excess water from the TMF is fed to an effluent water treatment plant followed by a polishing pond before discharging into Victoria Lake. Excess water in the TMF will be treated according to the Metal and Diamond Mining Effluent

Regulations (MDMER) 2021 discharge regulations. The effluent treatment plant (ETP) will be operated year-round, with water only being released during non-winter months, seven months of the year.

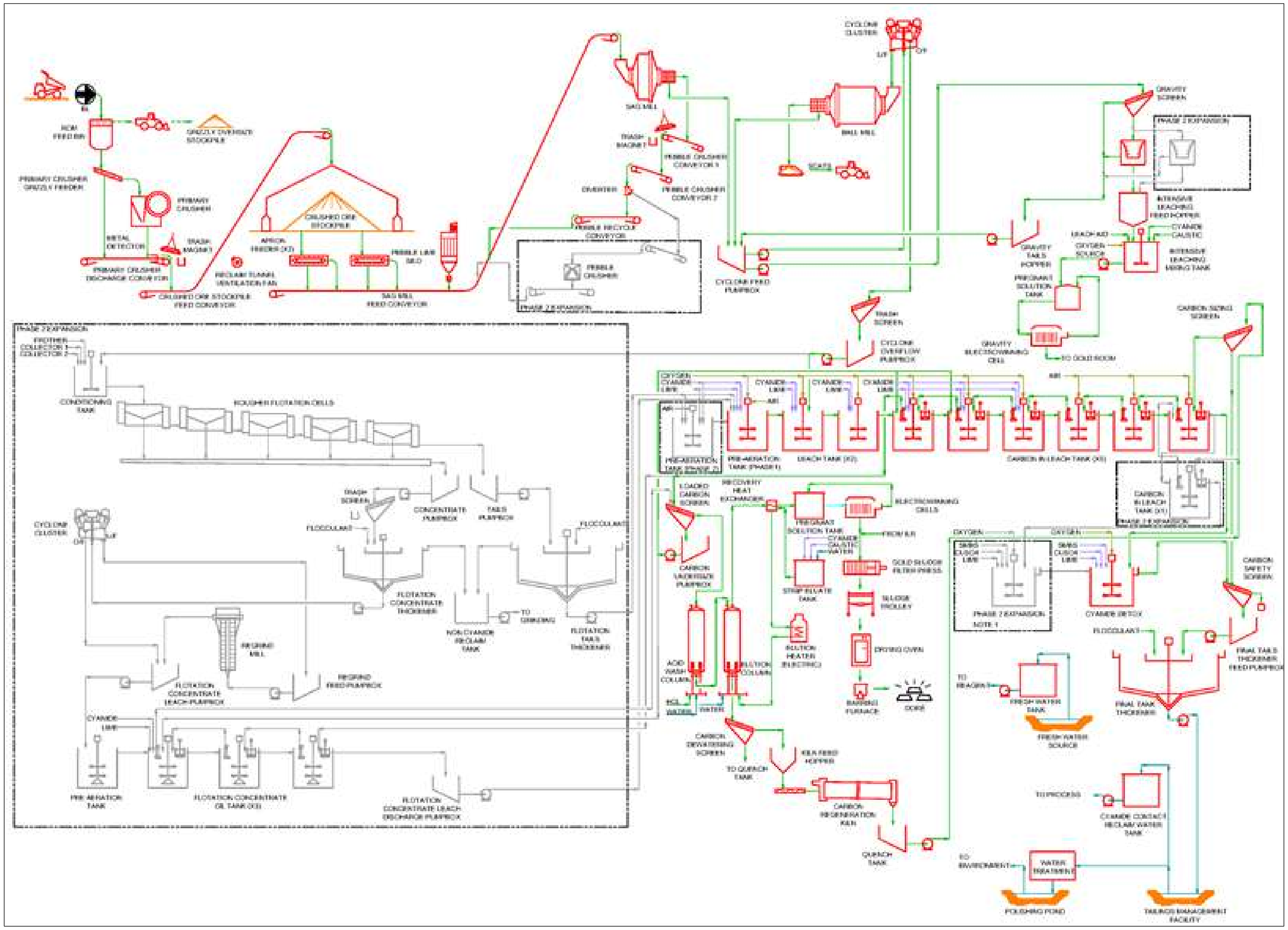
Heavy metals removal by precipitation in detoxification will reduce contained copper in solution. The precipitate sludge will report to the TMF. A biological treatment method using submerged attached growth reactor (SAGR) will subsequently reduce ammonia and cyanide contained in the TMF. SAGR is a porous graded rock bed with nitrifying bacteria. Blowers provide the required aeration to complete the nitrification process. Residual cyanide and ammonia will meet MDMER 2021 guidelines for discharged water into the environment.

### 17.2.12 Flowsheet and Layout Drawings

An overall process flow diagram showing the unit operations in the selected process flowsheet is presented in Figure 17-1. Plans and sections of the proposed plant are provided in Figures 17-2 to 17-5.

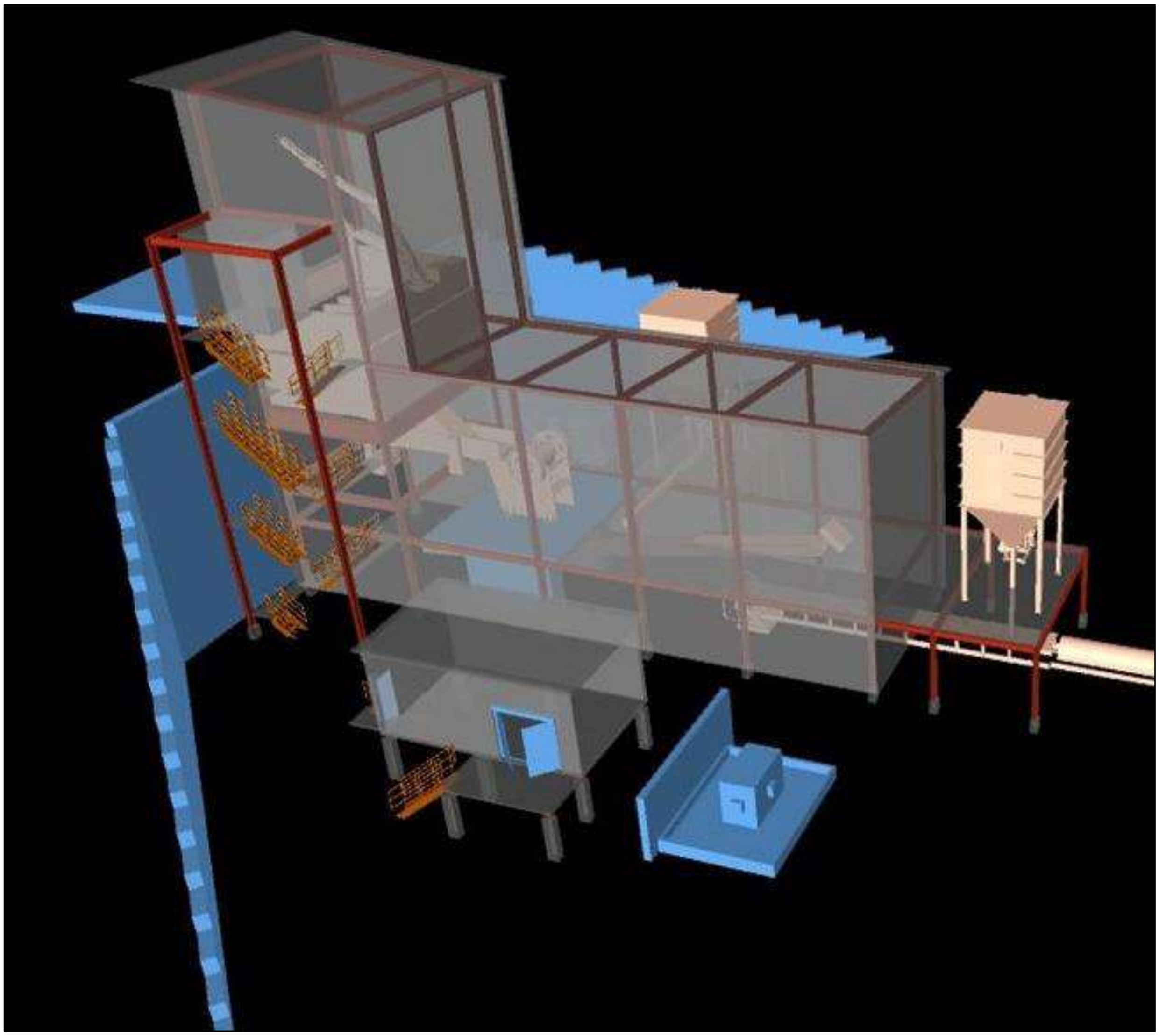
In the process plant general arrangement drawing (Figure 17-1), the process areas shaded in grey (such as flotation, thickeners, and concentrate leach tanks) represent the equipment that is required for Phase 2, and thus will be constructed in parallel to the Phase 1 operation during production Year 3.

**Figure 17-1: Overall Process Flow Diagram**



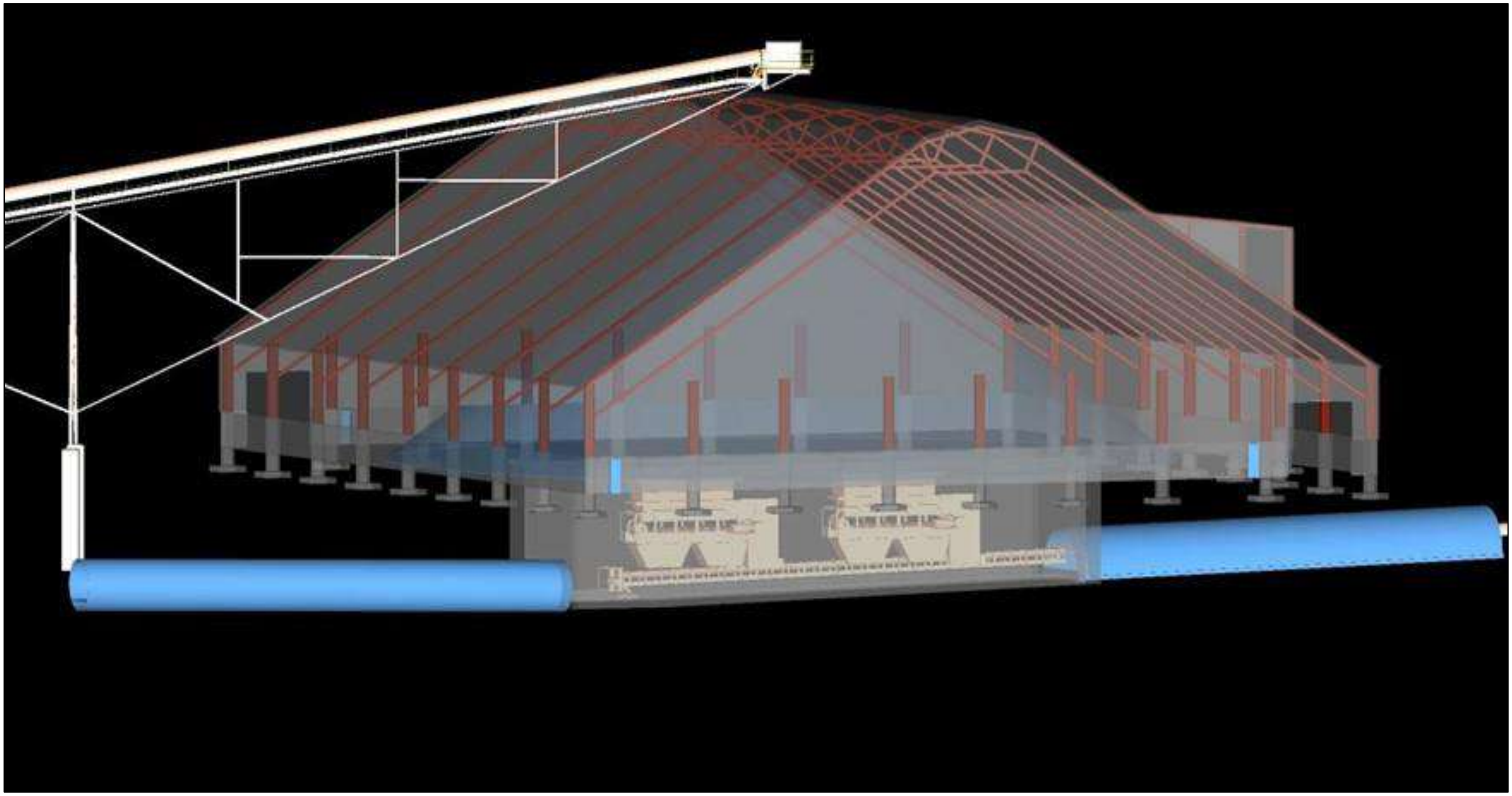

Source: SNC-Lavalin 2022.

**Figure 17-2: Crushing Area Section**



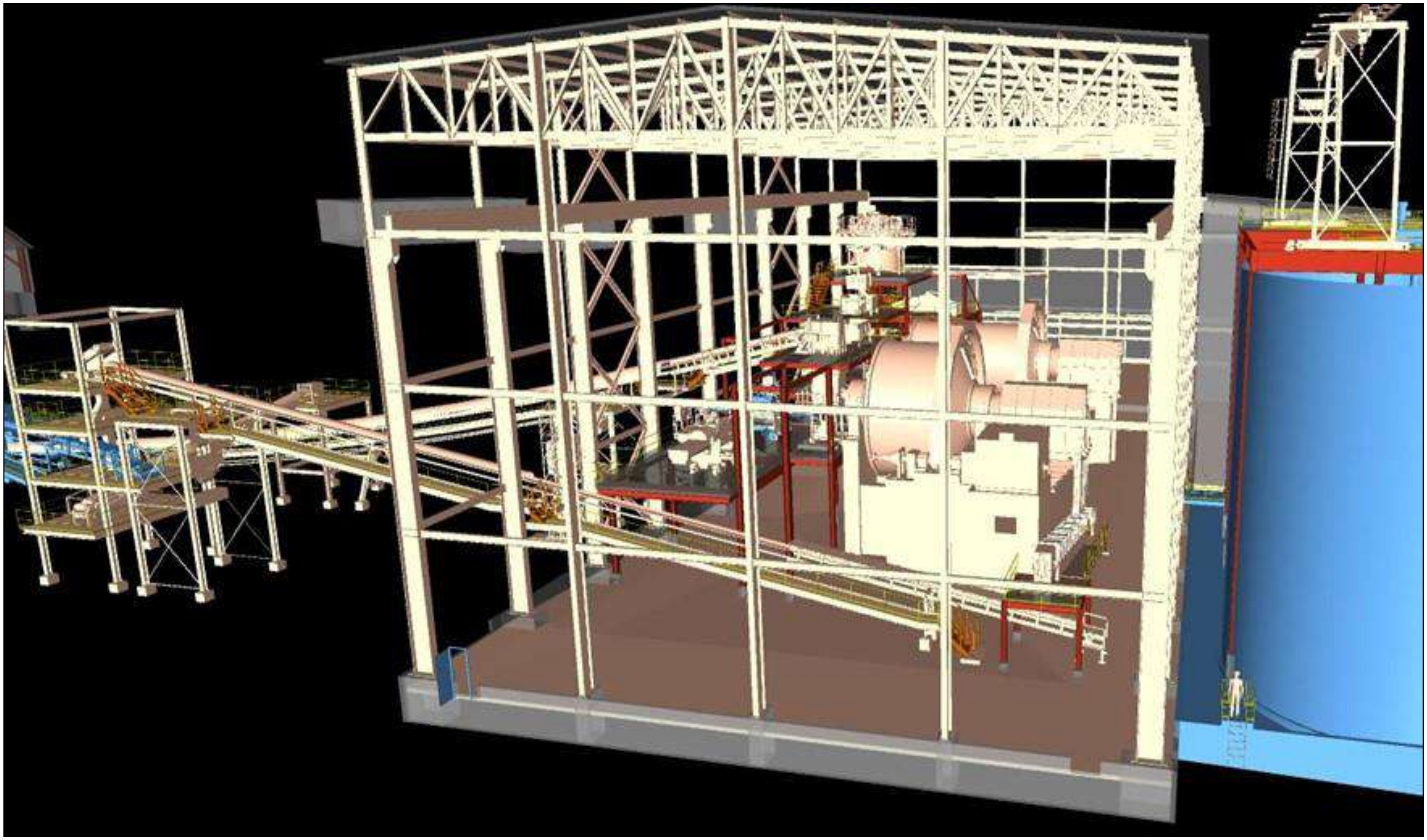
Source: SNC-Lavalin, 2022.

**Figure 17-3: Stockpile Area Section**



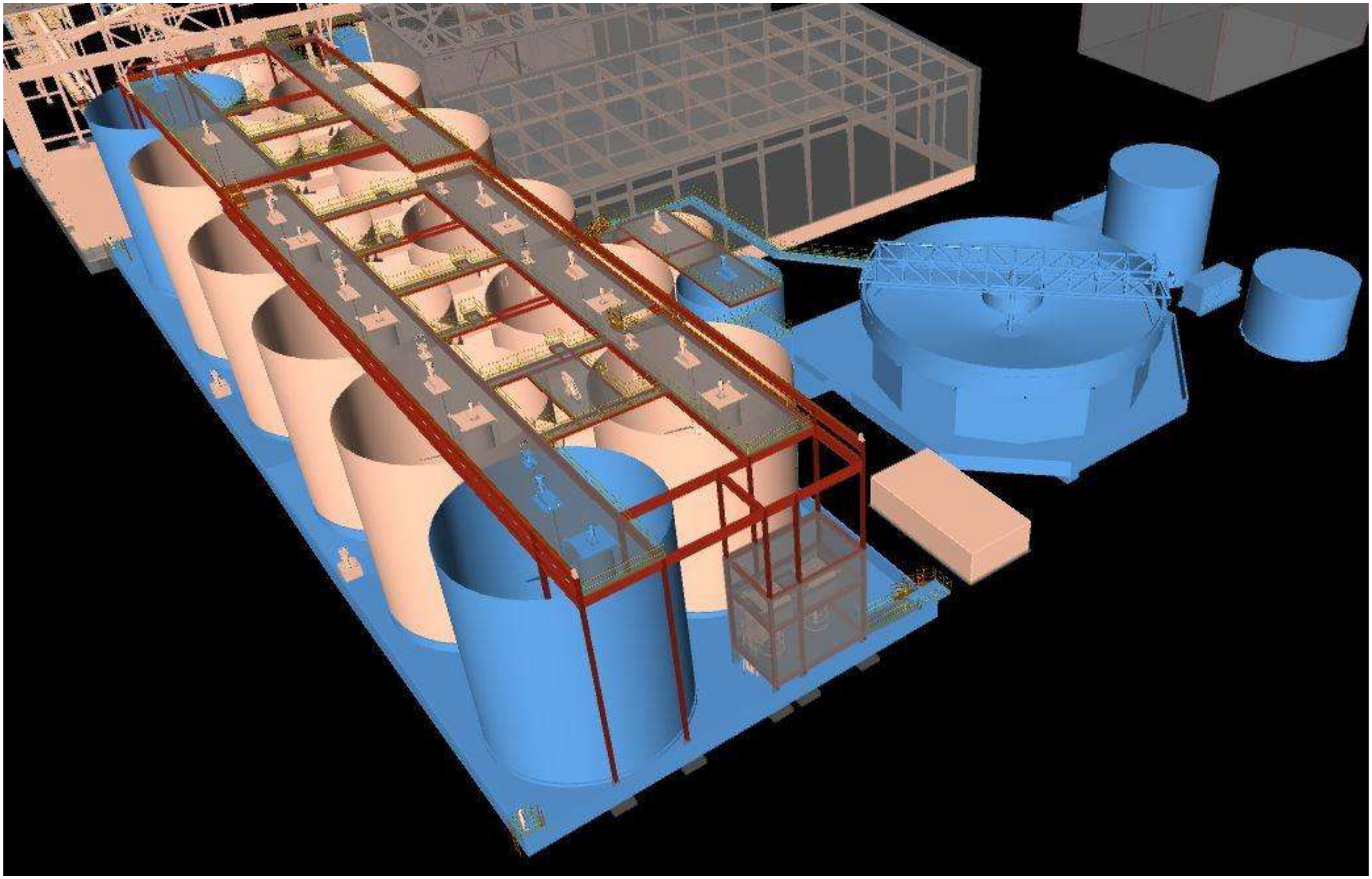
Source: SNC-Lavalin, 2022.

**Figure 17-4: Grinding & Tank Area Section**



Source: SNC-Lavalin, 2022.

**Figure 17-5: Pre-Aeration, Leach, CIL Tanks, Tailings Detoxification and Thickening Area Section**



Source: SNC-Lavalin, 2022.

## 17.3 Phase 2 – Mill Process Plant Description

The proposed process design is comprised of the following circuits:

- primary crushing of ROM material
- covered crushed material stockpile to provide buffer capacity ahead of the grinding circuit
- grinding circuit: SAG mill with trommel screen followed by a ball mill with cyclone classification
- pebble crushing
- gravity gold recovery from the cyclone feed slurry by two semi-batch centrifugal gravity concentrators (one original, one added for Phase 2), followed by intensive cyanidation of the gravity concentrate and electrowinning of the pregnant leach solution in a dedicated cell located in the gold room as for Phase 1
- trash screening
- rougher flotation
- flotation concentrate thickening
- flotation concentrate regrind
- flotation concentrate pre-aeration and leach + adsorption (L/CIL hybrid)
- flotation tails thickening
- flotation tails leach + adsorption (L/CIL hybrid)
- acid washing of loaded carbon and Zadra-type elution followed by electrowinning and smelting to produce doré
- carbon regeneration by rotary kiln
- cyanide destruction of tailings using $O_2$/$SO_2$ process
- carbon screening, tailings thickening and tailings management facility
- effluent water treatment followed by a polishing pond before discharging into Victoria Lake.

### 17.3.1 Plant Design Criteria

The key process design criteria for the mill during Phase 2 are listed in Table 17-2. Any repeated comminution characteristics identical to Phase 1 have been omitted.

**Table 17.2: Key Milling Plant Process Design Criteria for Phase 2**

| Design Parameter | Units | Value |
|---|---|---|
| Plant Throughput | t/d | 10,960 |
| Gold Head Grade – Design | g/t Au | 1.81 |
| Availability & Comminution Characteristics | | See Phase 1 |
| Pebble Lime Addition | kg/t | 0.8 |
| SAG Mill Dimensions | | 7.93 m dia. x 4.3 m EGL |
| SAG Mill Installed Power | MW | 4.8 (with VFD) |
| SAG Mill Discharge Density | % w/w | 70 |
| SAG Mill Ball Charge | % v/v | 16 |
| Ball Mill Dimensions | | 5.5 m dia. x 8.5 m EGL |
| Ball Mill Installed Power | MW | 4.8 (with VFD) |
| Ball Mill Discharge Density | % w/w | 72 |
| Ball Mill Ball Charge | % v/v | 30 |
| Primary Grind size ($P_{80}$) | µm | 150 |
| Gravity Circuit Feed Source | | cyclone feed slurry |
| Gravity Circuit Feed Rate | % cyclone recirculation | 27.5 |
| Gravity Circuit Recovery | %Au | 45 |
| Flotation Conditioning Tank Residence Time | min | 10 |
| Flotation Concentrate Mass Pull | % | 5.0 |
| Flotation Residence Time | min | 30 |
| Flotation Circuit Recovery | %Au | 90 |
| Regrind Product size ($P_{80}$) | µm | 15 |
| Flotation Concentrate Thickener Underflow Density | % w/w | 60 |
| Flotation Tails Thickener Underflow Density | % w/w | 65 |
| Flotation Concentrate Pre-aeration Residence Time | h | 6.0 |
| Flotation Concentrate CIL Residence Time | h | 48 |
| Flotation Concentrate CIL Extraction | %Au | 95 |
| Flotation Concentrate CIL Operating Density | % w/w | 42 |
| Flotation Concentrate CIL DO Target | ppm | 20 |
| Flotation Concentrate CIL pH Target | | 11 |
| Flotation Concentrate CIL Carbon Concentration | g/L | 18 |
| Flotation Concentrate CIL Sodium Cyanide Addition | kg/t | 1.0 |
| Flotation Concentrate CIL Hydrated Lime Addition | kg $Ca(OH)_2$/t | 1.0 |
| Flotation Concentrate Pre-aeration & CIL Tanks | # | 1+3 |
| Flotation Tails Pre-aeration & Leach Residence Time | h | 8 |
| Flotation Tails CIL Residence Time | h | 18 |
| Flotation Tails CIL Extraction | %Au | 91 |
| Flotation Tails CIL Operating Density | % w/w | 50 |
| Flotation Tails CIL DO Target | ppm | 20 |
| Flotation Tails CIL pH Target | | 11 |
| Flotation Tails CIL Carbon Concentration | g/L | 12 |
| Flotation Tails CIL Sodium Cyanide Addition | kg/t | 1.0 |
| Flotation Tails CIL Hydrated Lime Addition | kg $Ca(OH)_2$/t | 0.5 |
| Flotation Tails Pre-aeration, Leach & CIL Tanks | # | 1 + 3 + 7 |
| Tonnes of Carbon per Column | t | 7.0 |
| Detox Characteristics | | See Phase 1 |

### 17.3.2 Primary Crushing and Stockpiling

This area is identical to the equivalent area in Phase 1 (see Section 17.2.2), except for the addition of a pebble crusher in the pebble recycle circuit. As in Phase 1, The SAG mill slurry discharges through a trommel where the pebbles are screened and recycled to the SAG mill via conveyors, but in this phase, the addition of a pebble crusher in the recycle circuit will avoid build-up in the SAG mill. The conveyor recycle circuit has an installed tramp magnet and the following conveyor has a metal detector installed, to protect the pebble crusher from ball parts or other metal scraps that may cause it damage. The pebble crusher may be bypassed for maintenance using a diverter chute.

### 17.3.3 Grinding Circuit

This area is identical to the equivalent area in Phase 1 (see Section 17.2.3), except for an increase in the primary grind $P_{80}$ to 150 µm.

### 17.3.4 Gravity Concentrate Recovery Circuit

This area is identical to the equivalent area in Phase 1 (see Section 17.2.4), with the addition of one gravity concentrator.

### 17.3.5 Intensive Leach Reactor

This area is identical to the equivalent area in Phase 1 (see Section 17.2.5).

### 17.3.6 Flotation, Thickening and Concentrate Regrind Circuit

Cyclone overflow gravitates over a trash screen to remove foreign material prior to flotation. Trash reports to the trash bin, which is periodically removed for emptying. Screen undersize gravitates to the rougher conditioner tank. Reagents are dosed into the rougher conditioner tank and mixed thoroughly.

The rougher flotation circuit consists of five 130 $m^3$ forced-air tank cells in series. Rougher concentrate is pumped into the flotation concentrate thickener. The rougher tailings are pumped to flotation tailings thickener. Flocculant is combined with the feed to the thickener to improve the settling rate of the material. Flotation tails thickener underflow reports to the pre-aeration-leach-CIL tanks. The overflow from both thickeners is recovered in a process water tank and re-used specifically in the grinding circuit to ensure the non-cyanide contact water is used pre-flotation.

Flotation concentrate thickener underflow reports to the concentrate regrind mill. The target product size from the regrind mill is $P_{80}$ of 15 µm. Fine grinding is achieved via attrition and abrasion of the particles in a horizontal fine grinding mill containing small ceramic beads as the grinding medium in an open-circuit configuration with a hydrocyclone.

Cyclone overflow feeds the flotation concentrate leach circuit pre-aeration tank, which overflows to the three flotation concentrate CIL tanks. Loaded carbon from the flotation tailings CIL circuit is returned to the last tank of the flotation concentrate CIL circuit. As for the leach and adsorption circuit described in Section 17.2.6, the carbon is advanced counter-currently to the slurry flow by pumping slurry and carbon. Slurry from the last flotation concentrate CIL tank is pumped to the flotation tails L/CIL circuit.

The intertank screen in each flotation concentrate CIL tank retains the carbon whilst allowing the slurry to flow by gravity to the downstream tank. This counter-current process is repeated until the loaded carbon reaches the first flotation concentrate CIL tank. Recessed impeller pumps are used to transfer slurry between the flotation concentrate CIL tanks and from the lead tank to the loaded carbon screen mounted above the acid wash column in the elution circuit.

The flotation, thickening, concentrate regrinding and leaching circuit includes the following key equipment:

- trash screening
- rougher flotation feed conditioning tank and agitator
- rougher flotation tank cells
- flotation concentrate thickener
- regrind mill and cyclone
- flotation concentrate leach tanks and agitators
- flotation tails thickener
- flotation tails.

### 17.3.7 Flotation Tailings Pre-Aeration, Leach and Adsorption Circuit

This area is identical to the equivalent area in Phase 1 (see Section 17.2.6), with the addition of one more leach tank in series and operating at 50% w/w solids concentration, receiving the underflow from the flotation tails thickener and the discharge from the flotation concentrate CIL circuit. At the head CIL tank, instead of the carbon advance slurry reporting to the loaded carbon screen, the carbon advances to the flotation concentrate CIL circuit for further loading.

### 17.3.8 Cyanide Destruction

This area is identical to the equivalent area in Phase 1 (see Section 17.2.7), with the addition of one more cyanide destruction tank, one more carbon safety screen, and operating at 48.7% w/w solids concentration.

### 17.3.9 Tailings Thickening

This area is identical to the equivalent area in Phase 1 (see Section 17.2.8).

### 17.3.10 Carbon Acid Wash, Elution and Regeneration Circuit

This area is identical to the equivalent area in Phase 1 (see Section 17.2.9).

### 17.3.11 Electrowinning and Gold Room

This area is identical to the equivalent area in Phase 1 (see Section 17.2.10).

## 17.4 Reagent Handling and Storage

Each set of compatible reagent mixing and storage systems are located within curbed containment areas to prevent incompatible reagents from mixing. Storage tanks are equipped with level indicators, instrumentation, and alarms to ensure spills do not occur during normal operation. Appropriate ventilation, fire and safety protection, eyewash stations, and Material Safety Data Sheet (MSDS) stations are located throughout the facilities. Sumps and sump pumps are provided for spillage control.

The following reagent systems are required for the process:

- pebble lime
- hydrated lime
- sodium cyanide
- hydrochloric acid
- copper sulphate pentahydrate
- sodium metabisulphite
- sodium hydroxide
- flocculant
- activated carbon
- anti-scalant
- smelting fluxes
- frother, collector 1 and collector 2 for Phase 2
- liquid oxygen
- sulphamic acid.

### 17.4.1 Pebble Lime

Pebble lime is delivered in bulk and is pneumatically conveyed from the tanker to the pebble lime silo located in the crushing circuit adjacent to the crusher ore stockpile. Pebble lime is extracted from the lime silo and fed onto the SAG mill feed conveyor in a solid form for pH control in leaching as required. The pebble lime silo is designed to provide a minimum of a four-day supply of pebble lime at average usage.

### 17.4.2 Hydrated Lime

Hydrated lime is delivered in bulk bags, which are lifted using a frame and hoist into the hydrated lime bag breaker on top of the mixing/storage tank. The solid reagent discharges into the tank and is slurried in process water to achieve the required dosing concentration. The slurried hydrated lime is pumped through a ring main with distribution points in leaching/CIL and cyanide destruction. An extraction fan is provided over the lime bag breaker/mixing tank to remove reagent dust that may be generated during reagent addition/mixing.

### 17.4.3 Sodium Cyanide (NaCN)

Sodium cyanide is delivered to site in secured boxes containing the reagent bulk bags. Bags are lifted using a frame and hoist into the sodium cyanide bag breaker on top of the tank. The solid reagent discharges into the tank and is dissolved in water to achieve the required dosing concentration. A sodium cyanide dust collector is located at the top of the mixing tank to collect reagent dust and return it to the mixing tank. The sodium cyanide dust collector is assisted by the sodium cyanide dust fan. After the mixing period is complete, cyanide solution is transferred to the cyanide storage tank using a transfer pump. Sodium cyanide is delivered to the flotation concentrate leach circuit, flotation tailings leach circuit, intensive leach reactor and elution circuit with dedicated dosing pumps. An extraction fan is provided over the sodium cyanide bag breaker/mixing tank to remove reagent dust that may be generated during reagent addition/mixing.

### 17.4.4 Copper Sulphate

Copper sulphate pentahydrate is delivered in solid crystal form in small bags and stored in the warehouse. Process water is added to the agitated copper sulphate mixing tank. A pallet of bags is lifted using a frame and hoist, and periodically a single bag is placed on the copper sulphate bag breaker on top of the tank. The solid reagent falls into the tank and is dissolved in water to achieve the required dosing concentration. A copper sulphate dust collector is located at the top of the mixing/storage tank to remove reagent dust and return it to the mixing tank. The copper sulphate dust collector is assisted by the copper sulphate exhaust fan. Copper sulphate solution is transferred by gravity to the copper sulphate storage tank, which has a stacked arrangement with the mixing tank. Copper sulphate is delivered to cyanide destruction circuits using the copper sulphate dosing pump. An extraction fan is provided over the copper sulphate bag breaker/mixing tank to remove reagent dust that may be generated during reagent addition/mixing.

### 17.4.5 Sodium Metabisulphite (SMBS)

SMBS is delivered in the form of solid flakes in bulk bags and stored in the warehouse. Process water is added to the agitated SMBS mixing tank. Bags are lifted using a frame and hoist into the SMBS bag breaker on top of the tank. The solid reagent falls into the tank and is dissolved in water to achieve the required concentration. An SMBS dust collector is located at the top of the mixing tank to capture reagent dust and return it to the mixing tank. The SMBS dust collector is assisted by the SMBS exhaust fan.

After the mixing period is complete, SMBS solution is transferred to the SMBS storage tank using the SMBS transfer pump. SMBS is delivered to the cyanide destruction circuit using the SMBS dosing pump. An extraction fan is provided over the SMBS mixing tank to remove $SO_2$ gas that may be generated during mixing. The SMBS mixing area is ventilated using the SMBS area roof fan.

### 17.4.6 Sodium Hydroxide (NaOH)

Sodium hydroxide (caustic soda) is delivered in totes as a 50% w/w solution and stored adjacent to the elution circuit until required. During winter months, the reagent concentration may be adjusted (to 20% w/w) to prevent it from freezing in the totes. Dosing pumps automatically deliver the reagent to the required locations—gravity concentrate leach circuit (ILR), elution circuit, electrowinning and cyanide solution mixing—to ensure the dosing requirements are met.

### 17.4.7 Hydrochloric Acid (HCl)

Hydrochloric acid is delivered in totes as a solution and stored adjacent to the elution circuit until required. Hydrochloric acid with 32% strength is mixed with raw water (inline) to achieve the required 3% w/v concentration. Hydrochloric acid is delivered to the acid wash circuit using the hydrochloric acid dosing pump.

### 17.4.8 Flocculant

Powdered flocculant is delivered to site in bulk bags and stored in the warehouse. A self-contained mixing and dosing system is installed, including a flocculant storage hopper, a flocculant blower, flocculant wet jet mixer, flocculant mixing tank (agitated), and flocculant dosing pump. Powdered flocculant is loaded into the flocculant storage hopper using the flocculant hoist. The dry flocculant powder transferred to the flocculant hopper and from the hopper the powder is pneumatically transferred into the wet jet mixer where it is contacted with fresh water.

Flocculant solution, at 0.50% w/v, is agitated in the flocculant mixing tank for a pre-set period. After a pre-set time, the flocculant is transferred to the flocculant storage tank using the flocculant transfer pump. Flocculant is dosed to the various high-rate thickeners using variable speed helical rotor style pumps. Flocculant is further diluted just prior to the addition point.

### 17.4.9 Frother (MIBC)

MIBC is delivered as a liquid in IBCs and stored in the warehouse until required. A permanent bulk box is installed to provide storage capacity local to the flotation area. MIBC is used as received and without dilution. Diaphragm-style dosing pumps deliver the reagent to the required locations within the flotation circuit. A top-up of the permanent bulk boxes is carried out manually as required.

### 17.4.10 Collector 1 (PAX)

PAX is delivered in granular powder form in bags and stored in the warehouse. Raw water is added to the agitated PAX mixing tank. Bags are lifted using a frame and hoist into the PAX bag breaker on top of the tank. The solid reagent falls into the tank and is dissolved in water to achieve the required dosing concentration. PAX solution is transferred by gravity to the PAX storage tank, which has a stacked arrangement with the mixing tank.

The mixing tank is ventilated using the PAX tank fan to remove any carbon disulphide gas. PAX is delivered to the flotation circuit using the PAX dosing pump. Actuated control valves provide the required PAX flowrates at a number of locations around the flotation circuit.

### 17.4.11 Collector 2 (R208)

R208 is delivered as a liquid in IBCs and stored in the warehouse. It is used as received and without dilution. Diaphragm-style dosing pumps deliver the reagent to the required locations within the flotation circuit. A top-up of the permanent bulk boxes is carried out manually as required.

### 17.4.12 Activated Carbon

Activated carbon is delivered in solid granular form in bulk bags. When required, the fresh carbon is introduced to the carbon quench tank, or directly to the final CIL tank.

### 17.4.13 Anti-Scalant

Anti-scalant is delivered as a solution in 1-$m^3$ totes and stored in the warehouse until required. Anti-scalant is dosed neat, without dilution. Positive displacement-style dosing pumps deliver the anti-scalant to the strip solution tank as needed.

### 17.4.14 Oxygen and Process Air

Oxygen is injected into the Phase 1 leach tanks to achieve a dissolved oxygen level of >20 ppm. For this purpose, oxygen is produced in a vacuum swing adsorption (VSA) plant at site to meet requirements of both Phase 1 and Phase 2 consumptions.

Low-pressure air blowers will be used to supply the required air to the pre-aeration tank and the last three flotation tailings CIL tanks.

### 17.4.15 Sulphamic Acid

Sulphamic acid is delivered in 25 kg poly bags. The solution is prepared and dosed at a concentration of 10% w/w using a peristaltic pump. Sulphamic acid is used to descale calcium carbonate precipitates that form in the heating and heat recovery system that is part of the elution system.

### 17.4.16 Gold Room Smelting Fluxes

Borax, silica sand, sodium nitrate, and soda ash are delivered as solid crystals/pellets in bags or plastic containers and stored in the warehouse until required.

## 17.5 Services and Utilities

### 17.5.1 Process / Instrument Air

High-pressure air at 750 kPag is produced by compressors to meet plant requirements. The high-pressure air supply is dried and used to satisfy both plant air and instrument air demand. Dried air is distributed via the air receivers located throughout the plant.

### 17.5.2 Low-Pressure Air

Compressed air is injected into the Phase 2 flotation concentrate and flotation concentrate leach tanks to achieve a dissolved oxygen of >8 ppm. Low-pressure air for flotation is supplied by air blowers.

## 17.6 Water Supply

Details of the water supply into the system are described in Section 18.9.

### 17.6.1 Fresh Water Supply System

Fresh water is supplied from Victoria Lake to the fresh/firewater tank. Fresh water is used for all purposes requiring clean water with low dissolved solids and low salt content, primarily as follows:

- intensive leaching (1.1 $m^3$/h)
- reagent make-up – flocculant and sodium cyanide (3.9 $m^3$/h)

- elution circuit make-up (10.6 $m^3$/h).

Fresh water is stored in the fresh/firewater tank for use in process applications and as fire water for use in the sprinkler and hydrant system, and cooling water for mill motors and mill lubrication systems (closed loop).

### 17.6.2 Process Water Supply System

Overflow from the final tailings thickener and TMF decant water meet the main process water requirements for Phase 1. Fresh water provides any additional make-up water requirements. Total reclaim water from the TMF is 154.1 $m^3$/h, and the total amount of water being recycled from the final tailings thickener to the reclaim water tank is 351.2 $m^3$/h. Reclaim water usage breakdown is primarily as follows:

- reagent usage at 2.03 $m^3$/h (SMBS, copper sulphate, lime preparation)
- gland Water usage is 33.3 $m^3$/h
- loaded Carbon Screen at 2.72 $m^3$/h
- ball Mill Area at 137.4 $m^3$/h
- SAG Mill area at 300.8 $m^3$/h
- carbon Safety Screen at 27.2 $m^3$/h.

For Phase 2, flotation concentrate, and flotation tails thickener overflow, feed a non-cyanide contact process water tank that is recycled to the grinding circuit to ensure the flotation performance is not impacted by recycling cyanide.

### 17.6.3 Gland Water

One dedicated gland water pump is fed from the cyanide contact reclaim water tank to supply gland water to all slurry pump applications in the plant. Gland water requirement is approximately 33.3 $m^3$/h).

### 17.6.4 Plant Site Power Demand

Process plant loads defined by area are listed in Table 17-3.

**Table 17.3: Process Plant Loads by area.**

| Areas | Phase 1 – Load (kW) | Phase 2 – Load kW |
|---|---|---|
| Crushing/Storage/Reclaim | 500 | 700 |
| Grinding | 8700 | 10,100 |
| Flotation/CIL/Tailings | 2900 | 3800 |
| Reagents/Oxygen/Compressed Air | 1000 | 1200 |
| Elution/Carbon Regen/Refinery | 1400 | 1600 |
| Fresh Water/Reclaim/ Water Treatment | 500 | 600 |
| Site Services | 1000 | 1000 |
| Camp | 1000 | 1000 |
| **Total kW** | **17,000** | **20,000** |

## 17.7 Reagent and Consumable Requirements

Reagent consumptions are based on testwork results or standard industry practices. A summary of the estimated reagent and consumable rates is shown in Table 17-4.

**Table 17.4: Estimated Reagent Consumptions**

| Reagent | Form | Unit | Phase 1 Consumption | Phase 2 Consumption |
|---|---|---|---|---|
| Activated Carbon | Coconut shell, grade 6 x 12 mesh | g/t feed | 40 | 25 |
| Collector 1 (PAX) | Pellets, 90% minimum purity | kg/t feed | NR | 0.04 |
| Collector 2 (R208) | Liquid, 97.5% minimum purity | kg/t feed | NR | 0.02 |
| Copper Sulphate | Blue crystal, pentahydrate, 99.5% minimum purity | kg/t feed | 0.14 | 0.10 |
| Flocculant | Powder, 97.5% minimum purity | kg/t feed | 0.03 | 0.05 |
| Frother | Liquid, 97.5% minimum purity | kg/t feed | NR | 0.038 |
| Hydrochloric Acid | Liquid, 33% w/w | $m^3$/strip | 1.2 | 1.2 |
| Pebble Lime | Granules, 90% minimum available CaO | kg/t feed | 3.8 | 0.8 |
| Hydrated Lime | Powder, 90% minimum available CaO | kg/t feed | 1.12 | 0.82 |
| Sodium Cyanide | Powder, 98% minimum purity | kg/t feed | 0.63 | 0.78 |
| Sodium Hydroxide | Liquid, 50% w/w | kg/t feed | 0.15 | 0.09 |
| SMBS | Powder, 97.5% minimum purity | kg/t feed | 1.03 | 0.95 |
| Oxygen | Produced in situ | kg/t feed | 0.87 | 0.86 |
| Anti-scalant | Liquid | kg/t feed | 0.015 | 0.011 |
| Sulphamic Acid | Powder | g/t feed | 5.0 | 3.1 |
| Borax | Powder | kg/100 kg concentrate | 60 | 60 |
| Silica | Powder | kg/100 kg concentrate | 30 | 30 |
| Sodium Nitrate | Powder | kg/100 kg concentrate | 5 | 5 |
| Sodium Carbonate | Powder | kg/100 kg concentrate | 5 | 5 |
| SAG Mill Media | 125 mm balls | kg/t feed | 0.74 | 0.58 |
| Ball Mill Media | 50-75 mm balls | kg/t feed | 0.87 | 0.57 |
| Regrind Media | 6 mm beads | kg/t feed | NR | 0.01 |

Reagents will require storage capacity on site for sufficient inventory to be held to mitigate the risk of process disruptions. In Table 17-5, the projected lead time of reagents and consumables has been listed upon receiving feedback from key suppliers during the feasibility study phase.

**Table 17.5: Reagent Order Expected Lead Time**

| Reagent | Maximum Expected Lead Time (weeks) |
|---|---|
| Activated Carbon | 14 |
| Anti-scalant | 2 |
| Ball Mill Media (2-3 inches) | 2 |
| Borax | 3 |
| Collector 1 (PAX) | 14 |
| Collector 2 (R208) | 5 |
| Copper Sulphate | 10 |
| Flocculant | 2 |
| Frother | 5 |
| HCl | 3 |
| Hydrated Lime | 3 |
| NaCN | 3 |
| NaOH | 3 |
| Nitre | 3 |
| Pebble Lime | 2 |
| Regrind Mill Media (6 mm) | 14 |
| SAG Mill Media (5 inches) | 2 |
| Silica | 2 |
| SMBS | 10 |
| Sodium Carbonate | 3 |
| Sulphamic Acid | 3 |

Recommended operational inventory and facility sizing guidelines were calculated per the lead time projections and mill consumption (see Table 17-6). Area requirements include space for movement of personnel and equipment.

Operational requirements necessitate a storage warehouse of approximately 28.7 m x 28.7 m of climate-controlled space, and 4.8 m x 4.8 m of non-climate-controlled space. Bulk bags and totes will be stacked two units high; small bags will be stacked four units high. Frother and collector 1 (PAX) will have separate dedicated storage space.

**Table 17.6: Reagent Operational Inventory Recommendations**

| Reagent | Bulk Unit Type / Stacking Configuration | Recommended Inventory (t) | Bulk Units | Area Required ($m^2$) |
|---|---|---|---|---|
| **Indoor (Climate Controlled)** | | | | |
| NaCN | 1 tonne bag / 2 unit stacking | 492 | 492 | 367 |
| Hydrated Lime | 1 tonne bag / 2 unit stacking | 131 | 131 | 98 |
| Copper Sulphate | 25 kg bag / 4 unit stacking | 275 | 275 | 103 |
| SMBS | 1 tonne bag / 2 unit stacking | 264 | 264 | 197 |
| Flocculant | 1 $m^3$ / 2 unit stacking | 8 | 8 | 6.0 |
| NaOH | 1 $m^3$ / 2 unit stacking | 24 | 24 | 18 |
| Collector 2 (R208) | 1 $m^3$ / 2 unit stacking | 11 | 11 | 8.2 |
| Anti-scalant | 1 $m^3$ / 2 unit stacking | 2 | 2 | 1.0 |
| Borax | 25 kg bag / 4 unit stacking | 1 | 40 | 5.0 |
| Nitre | 25 kg bag / 4 unit stacking | 1 | 40 | 5.0 |
| Sodium Carbonate | 25 kg bag / 4 unit stacking | 1 | 40 | 5.0 |
| Silica | 25 kg bag / 4 unit stacking | 1 | 40 | 5.0 |
| Sulphamic Acid | 25 kg bag / 4 unit stacking | 1 | 40 | 5.0 |
| **Total Area** | | | **823 (28.7m x 28.7m)** | |
| **Indoor (Non-Climate Controlled)** | | | | |
| HCl | 1 $m^3$ IBC / 2 unit stacking | 16 | 16 | 12 |
| Activated Carbon | 500kg bag / 2 unit stacking | 2 | 4 | 3.0 |
| **Total Area** | | | **25 (4.8m x 4.8m)** | |
| **Outdoor** | | | | |
| SAG Mill Media (5 inch) | Truck | 30 | - | 5.2 |
| Ball Mill Media (2-3 inch) | Truck | 50 | - | 7.3 |
| Regrind Mill Media (6 mm) | Truck | 23 | | 4.3 |
| **Total Area** | | | | **16.8** |
| **Dedicated Frother Storage (Phase 2 only, Climate Controlled)** | | | | |
| Frother | 1 $m^3$ IBC / 2 unit stacking | 22 | 22 | 11 |
| **Dedicated Collector 1 (PAX) Storage (Phase 2 only, Climate Controlled)** | | | | |
| Collector 1 (PAX) | 1 tonne bag / 2 unit stacking | 24 | 24 | 18 |

# 18 PROJECT INFRASTRUCTURE

## 18.1 Overall Site

The overall site plan (see Figure 18-1) shows the major project facilities, including the open pit mines, tailings management facility (TMF), waste rock facilities, polishing pond, mine services, access road, accommodations camp, and effluent treatment plant. Access to the facility is from the northeast side of the property from the existing public access road. Process plant access will be via the security gate at the public road intersection.

The site will not be fenced due to local legislation, which requires open access to all waterbodies in the area. However, there will be gatehouses to clearly delineate the mining and processing areas to deter access by unauthorized people. The process plant is located south of Valentine Lake, between the Marathon and Leprechaun deposits, largely dictated by the location of the TMF, in a position that avoids the impact to the natural waterbodies.

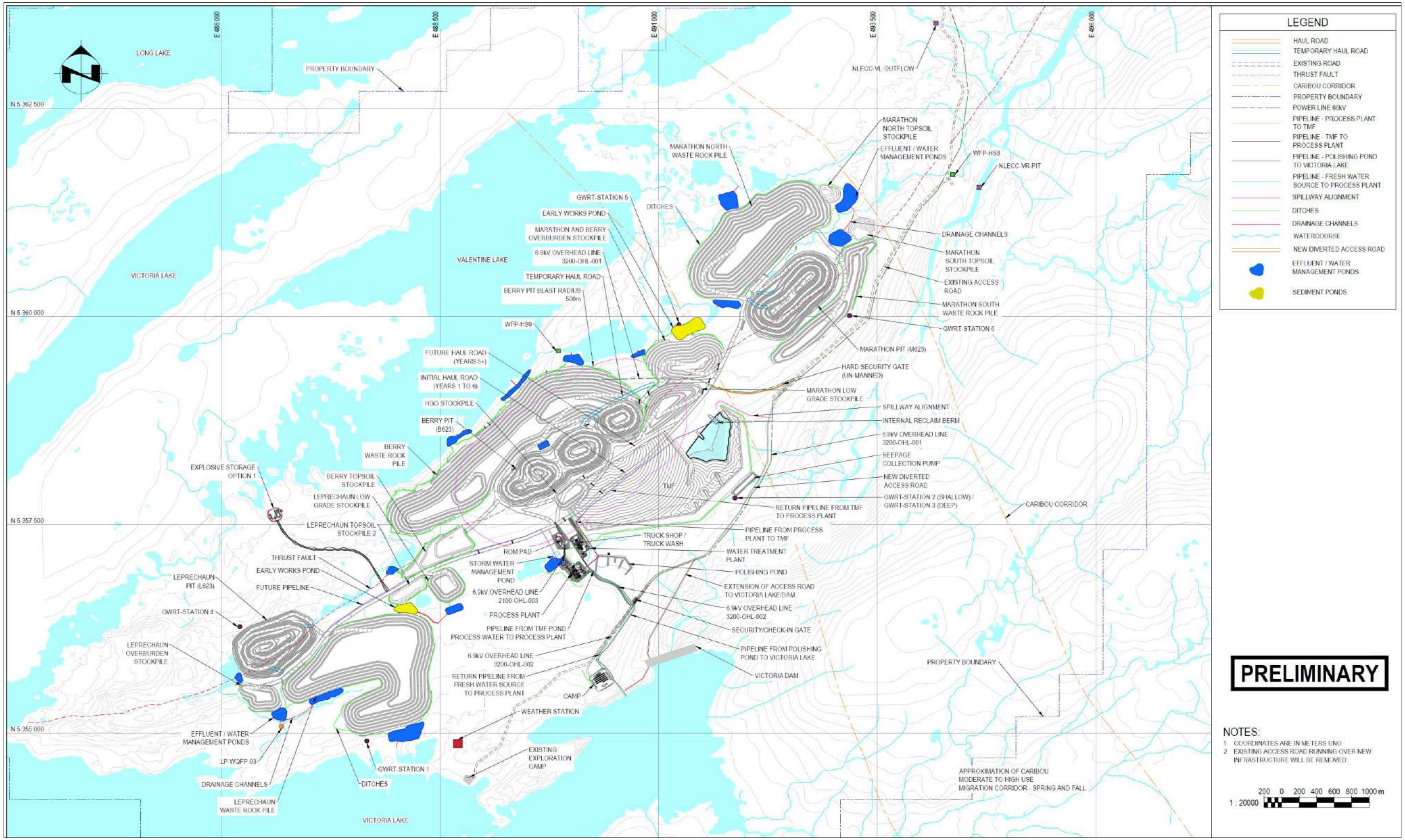
Site selection and location took into consideration the following factors:

- locate the ROM pad between the two furthest open pits, to minimize haul distance
- ensure the location of the process plant and mining truck area are outside the flyrock exclusion zone from the Berry Zone resource
- utilize the natural high ground for the ROM pad as much as possible
- separate heavy mine vehicle traffic from non-mining, light-vehicle traffic
- locate the process plant near an existing access road
- locate the process plant in an area safe from flooding
- locate the heavy equipment foundation on competent bedrock and utilize the possibility of rock anchors for foundations design
- place mining, administration and processing plant staff offices close together to limit walking distances between them
- locate the ready line close to the mining admin/office area and changehouse
- avoid known fish habitation areas.

## 18.2 Process Plant Pad and Stormwater Management

The design approach for process plant site selection and stormwater management is aimed at intercepting and diverting non-contact water outside of the process plant area to reduce the amount of contact water to be managed at the process plant site. The process plant site pad will be graded to allow surface runoff water to drain naturally to the internal network of collection swales and ditches that are sized to handle peak flow resulting from the 1:25-year rainfall storm event.

**Figure 18-1: Overall Site Plan**




Source: MMTS, 2022.

The storm pond is sized based on 1:100-year storm event and overflow spillway designed for a 1:200-year storm event. The pond design considered minimum wet pond depth for operational purposes, maximum pond depth based on maximum operating volume, maximum storage required in combination with a pumping rate, and detention time to promote settling of solids. The water in the storm management pond water will be released to the environment by gravity via a primary low flow reversed slope submerged outlet pipe, secondary outlet and emergency spillway. Water quality design used the same criteria as other site sedimentation ponds using the 1:10 year event as the water quality design flow.

## 18.3 Roads

### 18.3.1 Access to Site

The access to the process plant site, camp site and explosive storage area are through new 0.86 km, 0.21 km, and 0.30 km gravel roads, respectively. The access roads connect these facilities to an existing 63 km public gravel road which will be upgraded. The road upgrade includes re-surfacing gravel pavement, improving surface drainage, and installing new culverts at stream crossings.

Granular fill material for road base and sub-base construction and upgrade will be sourced from permitted borrow pits along the route and established quarries. The public road upgrade will also include replacing existing wooden bridges and rehabilitating/repairing the existing steel bridges. The construction of the new TMF dam will overprint approximately 2.2 km of existing road on the site property. A new 3.1 km detour road will be constructed to replace that section of road.

### 18.3.2 Plant Site Roads

The roads within the process plant area will be generally 6 m wide, integrated with process plant pad earthworks, and designed with adequate drainage. The roads will allow access between the administration building, warehouses, mill building, crushing buildings, stockpile, mining truck shop, and top of ROM Pad.

## 18.4 Power Supply

### 18.4.1 Electrical Power Source

Newfoundland-Labrador Hydro (NL Hydro) will supply power to the Valentine Gold Project as per conditions outlined in a Power Supply Agreement with Marathon Gold. The system supply point will be the Star Lake Terminal Station which is located approximately 20 km (in a straight line) to the northwest of the Valentine Gold Project.

To facilitate the connection, the following infrastructure will be required:

- Upgrade of the existing Star Lake Terminal Station to support the addition of electrical, protection and control, and communications equipment required to provide power to the Valentine Terminal Station; communications equipment will also be installed at NL Hydro's Buchans Terminal Station and at Valentine Terminal Station for remote monitoring and protection.

- Construction of a 40 km 66 kV wood pole transmission line (TL 271) from Star Lake Terminal Station to Valentine Terminal Station.

The Valentine Gold Project has the following load (maximum demand) requirements:

- Phase 1: Initial start-up requirement between 2023 and 2027 – 17 MW
- Phase 2: Full load requirement in 2028 to end of life – 20 MW.

As agreed-upon with Marathon Gold, NL Hydro will develop, own, and operate the Star Lake Terminal Station extension and TL 271. Marathon Gold will develop, own, and operate the Valentine Terminal Station with consideration for NL Hydro standards and operating procedures to ensure safety and reliability. Expected completion is tentatively planned for November 2023 with first power available to meet Marathon's requirement in December 2023.

### 18.4.2 Electrical Distribution

The plant electrical system is based on 6.6 kV distribution. The 66 kV feed from NL Hydro will be stepped down to 6.6 kV at the Valentine Lake Terminal Substation and will supply the plant main 6.6 kV switchgear housed in the main process plant electrical room.

The larger variable frequency drives (VFDs) will have 6.6 kV input, fed by plant main 6.6 kV switchgear. Separate 6.6 kV / 600 V distribution transformers at the various electrical rooms will be fed from the plant main 6.6 kV switchgear. Electrical rooms will be provided at the following locations:

- process plant main
- primary crusher area
- substation
- stockpile and reclaim
- grinding areas
- gold room / leaching / reagents
- flotation areas.

The main process plant electrical room will house the 6.6 kV switchgear. The other electrical rooms will consist of 6.6 kV / 600 V transformers (in Phase 2) close coupled to the 600 V motor control centers (MCCs), LV VFDs, LV soft starters, plant control system cabinets, lighting and services transformers, distribution boards, and uninterrupted power supply (UPS) power distribution.

To reduce installation time, the electrical rooms were considered prefabricated modular buildings, installed on structural framework 2 m above ground level for bottom entry of cables. The electrical rooms will be installed with HVAC units and suitably sealed to prevent ingress of dust. They will be in the process plant area and as close as possible to the main load points to minimize costs.

### 18.4.3 Power Reticulation

Overhead power lines of 6.6 kV will provide power to various remote facilities. Pole-mounted or pad-mounted transformers will step down the voltage at each location and supply the low voltage distribution system to respective facilities.

### 18.4.4 Star Lake Substation

The tie-in of 66 KV overhead line to NL Hydro's equipment at Star Lake Terminal Station will be required to be carried out.

### 18.4.5 66 kV Overhead Line

A 66 KV overhead line using monopole structures is proposed to be installed between NL Hydro's Star Lake Terminal Station up to Marathon Gold's Valentine Lake Terminal Station.

### 18.4.6 Valentine Substation

The main terminal substation (Valentine Lake) is located near the process plant. This terminal substation will be with 100% redundancy in transformer capacity. Two 20/26.7 MVA oil-filled with forced air-cooled type substation transformers are proposed to be installed to carry the maximum power required by the site.

This includes future growth and redundancy in the event a single transformer is temporarily out of service. This terminal substation will also include fibre optic for the power line communication between Star Lake and Valentine Lake substations.

### 18.4.7 Standby / Emergency Power Supply

Three 1500 kW diesel generators in weatherproof enclosures will be provided to supply the power to camp during the construction phase. Permanent power to camp will be supplied via 6.6 kV overhead pole lines after the site's main substation is energized. The same 6.6 kV pole lines will supply critical process loads and life safety systems to the process plant by diesel generators (on standby) located at the camp site. The generators have been sized to simultaneously provide adequate emergency power to critical process systems and the camp. The most critical power required at the process plant is for the tank agitators and rougher flotation cells. To prevent overloading the standby diesel generators, the agitators may be toggled (i.e., keep two running for 10 minutes and cycle through each).

### 18.4.8 SAG and Ball Mill Drives

The SAG and ball mills are the largest electrical loads in the plant (4.8 MW LSSM motors). Both motors are synchronous, with single VFD and bypass switchgear arrangements to minimize voltage drop impact on the utility supply system during motor start-up. The VFD will be used to start the ball mill, and once the ball mill is running on fixed speed, the same VFD will be used to run the SAG mill at variable speed. The ball mill synchronous motor will be run at its leading power factor to eliminate the need for power factor correction capacitors.

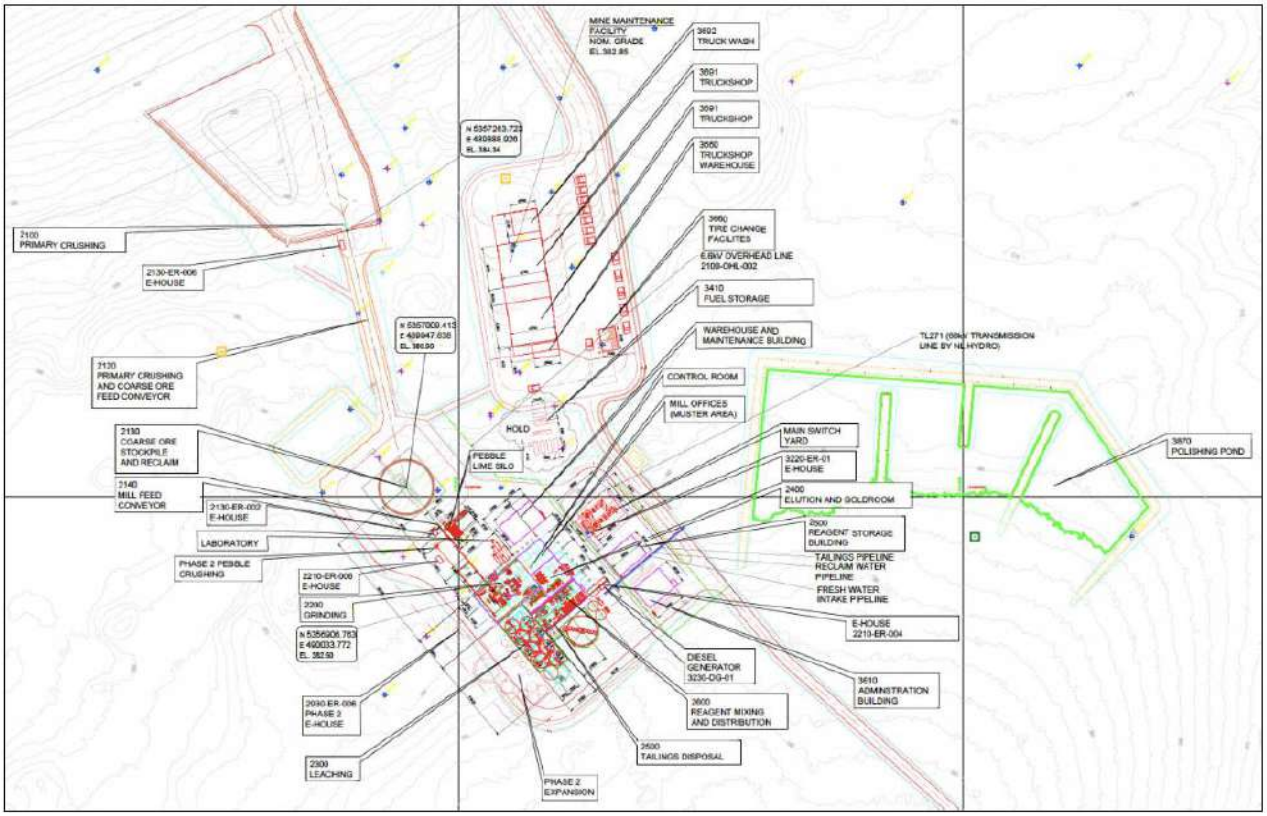
### 18.4.9 Construction Power

Initial power for construction will be provided by diesel generators, as is the current approach for the exploration camp at the Valentine site.

## 18.5 Support Buildings

Figure 18-2 shows the process plant infrastructure during Phase 1.

**Figure 18-2: Process Plant & Process Infrastructure – Phase 1**




Source: SNC-Lavalin, 2022.

### 18.5.1 Process Plant Building

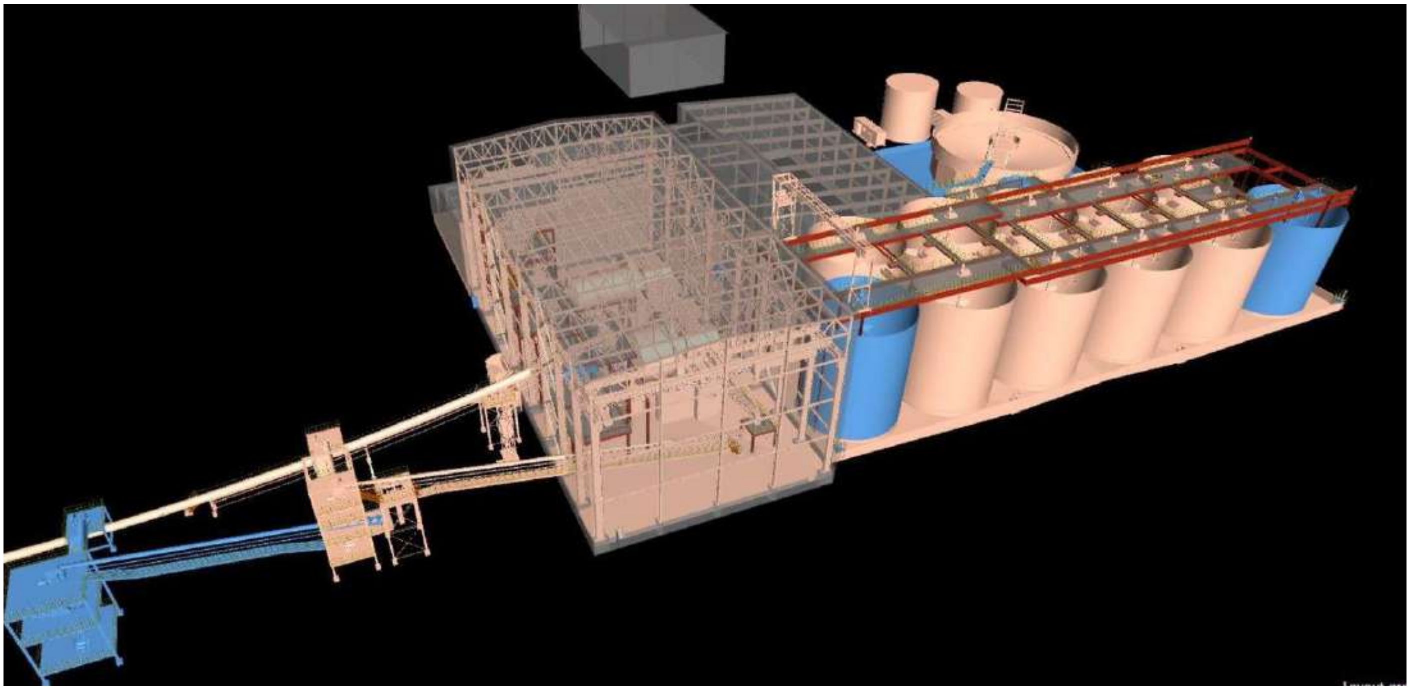
The process plant (Figure 18-3) consists of three main process buildings located southeast of the primary crusher building and east of the coarse ore storage stockpile/reclaim: the mill building (grinding, ADR/gold room, reagent mixing buildings) and a leaching and tailings processing area located outside the buildings. All buildings will be supported on reinforced concrete footings with concrete slabs and pedestals. The grinding building will be a 62 m (long) x 32 m (wide) pre-engineered steel building with a ground floor and multiple equipment access platforms. The building will house the SAG mill, ball mill, cyclone feed hopper/pumps, cyclones, trash screen, and liner handler. The process equipment will be serviced by a 30-tonne overhead crane.

The gold room and ADR buildings are located adjacent to the grinding building and will have dedicated areas for the gravity circuit, acid wash column, elution column and regeneration equipment. The elution area will be separated from the gold room in a 24m (long) x 12 m (wide) pre-engineered building. The gold room will be a lean-to building 30 m (long) by 29 m (wide) attached to the mill building separated by a partition wall for security. The gold room will house the gravity circuit, electrowinning cells, sludge hopper/filter, drying oven, furnace, vault and security room, complete with a monorail.

The reagent mixing building will be a 54 m (long) x 23 m (wide) fabric building, complete with a five-tonne bridge crane, that will house the reagent mixing tanks, reagents totes including cyanide, activated carbon, copper sulphate, flocculants, anti-scalant, and SMBS, in addition to the tailings pumping hopper and pumps. Outdoor storage adjacent to the reagent storage area is reserved for additional storage as required.

All pre-engineered and fabric buildings will be fully enclosed with metal cladding and fabric cover respectively, complete with fiberglass blanket insulation.

**Figure 18-3: Process Plant Building**



Source: SNC-Lavalin, 2022.

### 18.5.2 External Process Areas

The design includes some process areas that will not be inside building infrastructures.

The primary crushing area will be located northwest of the process plant. The equipment in this area includes the vibrating grizzly feeder, primary jaw crusher, chutes and platework. It will compose a modular structure crushing system package along with the stockpile and mill feed conveyors.

The primary crusher module will be located on the ground complete with equipment platforms. The process equipment will be serviced by mobile cranes as required. The primary crusher will be supported on reinforced concrete raft slab. The stockpile will be covered by a fabric building.

In Phase 2, the flotation/regrind area will be added, with a 57 m (long) x 22 m (wide) area, complete with a 10-tonne bridge crane, and will house five 130 m³ flotation tank cells, including tank platforms and flotation reagents. This area will also house the regrind mill, and its associated cyclone cluster and pumps. The concentrate and tailings thickeners will be located outside, adjacent to the building.

### 18.5.3 Truck Shop / Truck Wash / Storage

The truck shop building at the site will be a 44 m (wide) x 40 m (long) fabric building located north of the ROM pad. The building each equipped with four bays, will be used to maintain haul trucks and highway trucks, and for spare parts storage. The haul truck maintenance bays will be serviced mobile crane. The building will be supported on a reinforced Seacan containers. This structure will be completed in year 2 of operations. A temporary truck shop/ truckwash will be erected on site, which will consist of a smaller fabric building and a turnkey portable wash pad.

The truck shop offices, lunchroom and washrooms will be inside one prefabricated, modular building located immediately east of the truck shop. Additional storage will be available inside shipping containers placed adjacent to the truck shop.

The truck wash building at the site will be a 25 m (wide) x 18 m (long) fabric building also located north of the ROM pad, and east of the truck shop. The building will be used for washing haul trucks and will be supported on a concrete foundation. This structure will be competed in Year 1 of operations.

The truck shop storage warehouse will be an 18 m wide x 24 m long fabric building with a gravel floor supported on concrete foundations.

### 18.5.4 Plant Maintenance Shops and Storage Buildings

The reagent storage area will be a fabric building adjacent to the administration building located just north of the process building.

### 18.5.5 Explosives Storage and Handling

A 6 m wide access road and 100 m x 135 m pad will be constructed to deliver and store explosives required for mine operations. A design buffer of 1.1 km to all other site facilities and operations is assumed. The pad area will be gated and contain bulk storage facilities, a garage for mobile equipment, and trailers for personnel. A separate 30 m x 20 m pad will be constructed along the access road to store the explosive magazine. Explosives and accessories will be prepared and transported to the mine pits as needed.

### 18.5.6 Fuel Station

The fuel station will consist of a 50 m (long) x 70 m (wide) open-air area including truck manoeuvring space. There will be a central area, with reinforced concrete containment. The fuel station will be located adjacent to the truck shop. The fuel station will service the on-site mine equipment and mobile fleet.

Diesel fuel storage and supply will be provided by a fuel supplier and will include fuel storage, offloading pumps, dispensing pumps, associated piping and electronic fuel control/tracking.

### 18.5.7 Plant Administration Building / Mill Muster Building

The main administration office building will be a 25 m (wide) x 32 m (long), single-storey building located northeast of the process plant. The building will include offices, meeting rooms, a lunchroom, and washrooms. The buildings will be of prefabricated modular construction placed on precast concrete block footings.

The mill muster offices will cover a 16 m (wide) x 27 m (long) area in a double-storey arrangement in the northwest corner of the process plant building. The clean and dirty dry, workshop and tool crib room will be on the lower level, while the control room and offices will be on the upper level.

#### 18.5.8 Laboratory

The laboratory will be an assortment of prefabricated, single-storey, modular buildings on precast concrete blocks, totalling 260 $m^2$ of area, and housing the equipment for typical mine and plant assays.

#### 18.5.9 Security Gate

The security gatehouse will have one boom gate for vehicle access and another for personnel. There will be a shack where the gate security personnel will be allocated, with a section where induction training can be performed for visitors and new employees, as well as first aid, which will also be the parking location for the ambulance.

### 18.6 Site-Wide Investigations

#### 18.6.1 Overview

Marathon Gold retained GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) to conduct site-wide geotechnical and hydrogeological field investigations from 2019 to 2022 in support of engineering design of various mine infrastructure. GEMTEC carried out the field program for the original feasibility study level from September 4 to October 30, 2020 (GEMTEC, 2021). This was followed up by a site-wide detailed design- and construction-level geotechnical and hydrogeological field investigation from August 5, 2021 to June 27, 2022 that focused on additional characterization of sub-surface conditions primarily in the areas of the TMF and plant, and borrow source studies of new areas for project development (GEMTEC, 2022b). GEMTEC's field investigation for the current update to the original feasibility study was carried out between June 8 and June 29, 2022 and was completed to characterize geotechnical and hydrogeological conditions in the areas of the waste rock pile and other material stockpiles associated with development of the Berry deposit (GEMTEC, 2022d).

GEMTEC's site-wide investigations included the excavation of test pits, drilling of geotechnical boreholes, geotechnical logging, soil and bedrock geotechnical testing/analysis, installation of monitoring wells, in-situ hydraulic conductivity testing of soil and bedrock (packer testing and slug testing), groundwater quality sampling, and outcrop mapping in the following mine site infrastructure areas (site areas):

- Marathon deposit Area – including the waste rock pile, overburden stockpile, topsoil stockpile, and shallow subsurface conditions in the open pit footprint
- Leprechaun deposit area – including the waste rock pile, the overburden stockpile, the topsoil stockpiles the low-grade ore stockpile, and shallow subsurface conditions in the open pit footprint.
- Berry deposit Area – including the waste rock pile, overburden stockpile, topsoil stockpile, and shallow subsurface conditions in the open pit footprint
- Marathon/Berry low-grade ore stockpile
- TMF area – including the embankment, basin, and polishing pond
- high-grade ore stockpile

- plant site
- camp pad
- explosives pad
- haul roads, site access roads, sedimentation ponds and ditches.

The following sections summaries the key findings and recommendations from GEMTEC's original feasibility-level 2020 site-wide investigation, in addition to the subsequent 2021-2022 detained design and the most recent 2022 feasibility study update site-wide geotechnical and hydrogeological investigation reports.

### 18.6.2 Geotechnical

Based on the subsurface investigations carried out across the project area since 2019, the various site areas were found to be underlain by a surficial layer of organic material (rootmat, topsoil, and/or varying thicknesses of peat), overlying till, overlying bedrock.

The characteristics of the bedrock encountered in each site development area are summarized as follows:

- Marathon Deposit Areas – Typically of fair quality and mainly consisted of mafic intrusives of variable strength (weak to very strong), strong felsic-intermediate intrusives, with occasional medium strong Conglomerate (found locally in 20BH-20 and 20BH-23).
- TMF Areas – The most prevalent materials were medium-strong foliated laminated fine-grained sediments (FLFGS), strong sandstones, and mudstones of variable strength (weak to strong), accounting for 75% of the drilled rock core. The bedrock was typically of fair to good quality; however, the FLFGS and sandstone materials were occasionally poor quality.
- High-Grade Ore Stockpile Area – Weak conglomerate of poor to fair quality.
- Plant Site Area – The most prevalent materials were mudstones of variable strength (weak to very strong), accounting for 66% of the drilled rock core. The other bedrock observed in the area were medium strong FLFGS, strong mafic intrusives, medium strong sandstones, and medium strong siltstones. The bedrock was typically of fair quality, however the FLFGS and mudstone materials were occasionally of poor quality.
- Leprechaun Deposit Areas – The most prevalent material was strong conglomerate, accounting for 67% of the drilled rock core. The other bedrock observed in the area were strong mafic intrusives, and strong mudstones. The bedrock was typically of fair quality.
- Polishing Pond Areas – The materials encountered were FLFGS of variable strength (weak to strong) and strong mudstones. The bedrock was typically of fair to good quality, however the FLFGS were occasionally poor quality and in one case (21BH-GLDR-13) 9 m of core was returned as completely disintegrated rock gravel (very poor quality).
- Berry Deposit Areas – The materials encountered were fair quality, strong mafic intrusives (gabbro), fair quality, strong to very strong felsic intermediate intrusives (granite, felsic porphyry and tondhjemite) and fair quality, strong conglomerates.

In addition to the rock types described above, the northeast trending VLTF is present in the Marathon, Leprechaun and Berry proposed pit areas and adjacent material stockpiles but was not encountered in the relatively shallow, vertical boreholes completed in these areas as part of GEMTEC's (2021, 2022b and 2022d) site wide programs. No other faults or significant fracture zones were encountered in the shallow boreholes completed in the various project site areas as part of GEMTEC's (2021, 2022a and 2022b) programs.

The mean freezing index for Buchans, NL, about 80 km north of the site, according to published Canadian Climate Normal values, is 890°C-days, recorded from 1981 to 2010. The estimated frost penetration depth for the site is 1.8 m below finished ground surface elevations using a design freezing index of 1,250°C-days.

According to the National Building Code of Canada (NBCC, 2020) Site Class C can be used for an average Standard Penetration Resistance value of N60 >50 within the upper 30 m provided that there is no more than 3 m of overburden soil between the underside of the footings and the bedrock. In cases where there will be more than 3 m of overburden soil between the underside of the footings and the bedrock, Site Class D should be used.

### 18.6.3 Hydrogeology

The findings of the hydrogeological field components of GEMTEC's site-wide programs for each site area are detailed in GEMTEC (2021, 2022b, and 2022d). Overall, groundwater levels measured in the site areas were shallow, ranging from 6.29 meters below ground surface (mbgs) to -0.57 mbgs (artesian). In most areas of the project, shallow groundwater flow was determined to follow topography and the direction of surface runoff at horizontal hydraulic gradients of up to 7% (0.07 m/m), measured in the area of the Marathon overburden stockpile and low-grade ore stockpile. A steeper horizontal hydraulic gradient of 17% (0.17 m/m) was determined for the Berry waste rock pile area. Estimated vertical hydraulic gradients determined using paired well systems in the TMF, plant site, and Marathon and Leprechaun waste rock pile areas indicate slight vertical gradients ranging from less than 1% (< 0.01 m/m) in the Marathon waste rock pile and TMF areas to 3% (0.03 m/m) in the plant site and Leprechaun waste rock pile areas; both downwards and upwards components of flow are identified. Two paired well systems in the Berry waste rock pile area indicate steeper downwards vertical hydraulic gradients ranging from 8% (0.08 m/m) to 26% (0.26 m/m)

Estimates of hydraulic conductivity for the soil (till) range from 1.88E-07 m/s in the Berry waste rock pile area to 2.97E-04 m/s in the plant site, with an overall geometric mean of 5.49E-06 m/s for the project. The hydraulic conductivity of shallow bedrock (down to the tested depth of about 30 m) ranged from 6.20E-08 m/s in the Berry to 4.44E-04 m/s in the TMF, with an overall geometric mean of 2.95E-06 m/s for the project. These estimates of soil and bedrock hydraulic conductivity are within the typical range of literature values for similar soil and bedrock types. The results of the hydrogeological investigations completed to date indicate soil and bedrock down to a tested depth of approximately 30 m have a moderately low permeability and show no significant trends in hydraulic conductivity based on lithology or depth.

The groundwater table is generally shallow at the project, and some dewatering will be required for service trenches and excavations. The anticipated rate of groundwater inflow into excavations is expected to be moderate and should be able to be handled by typical sump pump systems and drainage ditches, depending on the actual depth and location of the excavation work. Groundwater is classified as either calcium-bicarbonate or sodium bicarbonate water, with a principally meteoric signature and no significant inorganic water quality environmental issues.

The groundwater collected from 21 monitoring wells in the various project site areas were analyzed for subsurface corrosion potential to support concrete mix design requirements. The results of the analysis are presented in Table 18-1. Based on the conductivity, pH, and the measured chloride concentration of the groundwater samples tested, the groundwater in the work area can be classified as light to moderately corrosive (Rodriguez, 2018). The manufacturer of any buried steel elements that will be in contact with the soil or groundwater should be consulted to ensure that the durability of the intended product is appropriate. It is noted that the corrosivity of the soil/groundwater could vary throughout the year due to the application of sodium chloride for de-icing.

**Table 18.1: Laboratory Analysis Results – Corrosion Potential**

| Site Area | Test Hole ID | pH | Chloride mg/L | Sulphate mg/L | Resistivity (Ohm-cm) |
|---|---|---|---|---|---|
| Marathon WRP | 20BH-15B | 6.96 | 2 | <2 | 3,290 |
| | 20BH-16 | 7.86 | 3 | 8 | 3,720 |
| Marathon Pit | 20BH-20 | 7.72 | 2 | 3 | 5,380 |
| TMF | 20BH-26B | 7.82 | 3 | 3 | 3,290 |
| | 20BH-28 | 7.86 | 2 | 3 | 3,890 |
| | 21BH-GLDR-06 | 7.86 | 3 | 9 | 2,270 |
| | 21BH-GLDR-11 | 7.70 | 8 | 45 | 4,180 |
| Plant Site | 20BH-01 | 7.06 | 2 | <2 | 5,680 |
| | 20BH-05B | 7.37 | 2 | 3 | 6,250 |
| | 20BH-09 | 6.96 | 2 | 4 | 12,700 |
| | 21BH-01 | 7.35 | 3 | 3 | 15,400 |
| | 21BH-05 | 7.36 | 2 | <2 | 3,050 |
| Leprechaun WRP | 20BH-35B | 7.37 | 2 | <2 | 4,180 |
| | 20BH-36 | 7.39 | 2 | 12 | 6,540 |
| Berry WRP | 22BH-02 | 7.73 | 5 | 11 | 3,460 |
| | 22BH-03A | 6.75 | 2 | <2 | 8,470 |
| | 22BH-03B | 7.84 | 3 | 3 | 8,470 |
| | 22BH-04A | 7.00 | 4 | 11 | 1,380 |
| | 22BH-04B | 10.11 | 14 | 29 | 2,400 |
| | 22BH-07 | 7.76 | 6 | 16 | 3,060 |
| | 22BH-SD | 7.73 | 6 | 16 | 3,070 |

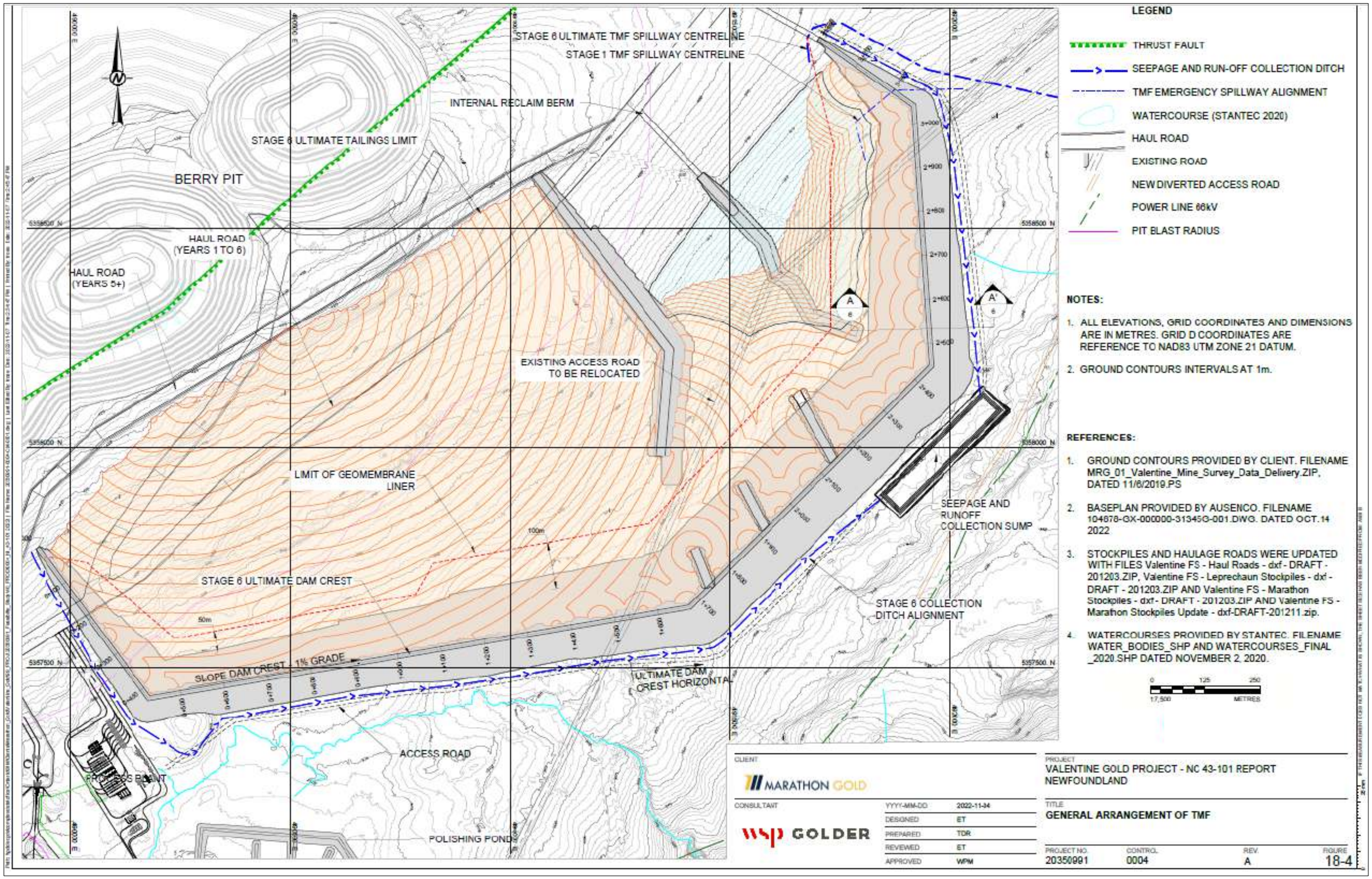
Source: GEMTEC, 2021, 2022b and 2022d.

## 18.7 Tailings Management Facility

### 18.7.1 Background

The feasibility-level design of the TMF is built upon the same location selected as part of a site selection options analysis study carried out during the pre-feasibility study. The site was selected based on consideration for a balance of environmental, social, economic and operational parameters. In the trade-off study, thickened tailings were adopted for the TMF. The TMF alignment was optimized from the pre-feasibility study with the dam alignment adjusted to improve storage efficiency and avoiding known fish habitat in the small streams at the downstream toe of the dam. The general arrangement of the TMF, as represented in its ultimate configuration, is shown on Figure 18-4.

**Figure 18-4: Tailings Management Facility – General Arrangement**




Source: Golder, 2022.

The TMF is formed by constructing perimeter zoned rockfill embankment dams, which are raised in stages. The waste rockfill is sourced from Leprechaun, Marathon, and Berry open pits. The upstream face of the dam is lined with geomembrane which is anchored into relatively low permeability foundation soils. As an added level of robustness in the design, the geomembrane liner also extends upstream of the dam toe to protect the dam against piping of fine foundation soils into the rockfill due to seepage forces.

Thickened tailings slurry has been adopted for the project. This dewatering technology provides opportunity for a denser, more stable, non-segregated mass when deposited. The selection of thickened tailings is premised on taking advantage of the topography at the TMF location, with deposition from the natural hillside upstream of the dams and providing a steeper beach slope over conventional slurry deposition.

### 18.7.2 Design Criteria

The TMF has a feasibility design to accommodate 31.6 Mt (approximately 22.22 $Mm^3$) of tailings material that will be produced over the initial 10 years of the mine life. Tailings will subsequently be deposited in the mined-out Berry open pit beginning in Year 10 and for the remainder of the mine life (approximately 20.0 Mt of tailings stored in the pit). The design is based on the annual mill throughput which ramps up from 2.295 Mt/a in Year 1 to 4.0 Mt/a in Year 5.

The overall design objective of the TMF is to safely contain tailings while protecting groundwater and surface water resources during both operations and long-term (post-closure). The design of the TMF has taken into account the criteria in Table 18-2, as well as the following:

- reducing the impact and risks on the surrounding environment
- safe, long-term containment of all solid mine waste materials
- collection and management of water released from the tailings during operations for reuse as process water in the mill, to the extent practical
- avoid development of mine waste infrastructure on fish habitat
- staged development of the TMF over the life of the project to defer capital cost and allow for efficient use of waste materials from pit stripping as construction materials.

**Table 18.2: TMF Design Criteria**

| Parameter | Value |
|---|---|
| Material Specific Gravity | 2.73 |
| Thickened Tailings Discharge Solids Content | 65% (by mass) |
| Assumed Void Ratio of the Deposited Tailings | 0.92 |
| Calculated Average Dry Density of the Deposited Tailings | 1.42 $t/m^3$ |
| Calculated Maximum Volume of Tailings for Storage at the TMF | 22.22 $Mm^3$ |
| Assumed Tailings Beach Slope | 3% |

The TMF will safely store the environmental design flood (EDF), resulting from a 1:100-year, 30-day rain on snowmelt event or 1:100-year, 7-day rain event on the highest normal operating pond, with no discharge through the spillway.

A spillway designed to safely pass the inflow design flood (IDF), resulting from the probable maximum flood (PMF) event.

The dam safety program established in NL requires that dams must be designed, operated and maintained to meet the requirements of Canadian Dam Association (CDA) Dam Safety Guidelines. In accordance with the dam classification methodology presented in the CDA Dam Safety Guidelines, the proposed TMF dams have been classified as a “Very High” consequence of failure, based on the potential environmental impact and population at risk. Golder carried out a dam breach assessment and assimilative capacity study in 2021 to inform the consequence classification. The results of the assessment confirmed that the consequence classification is appropriate. The design of the TMF was carried out to meet minimum allowable factors of safety under static and pseudo-static loading conditions recommended in the current CDA Dam Safety Guidelines.

### 18.7.3 Tailings and Waste Rock Characteristics

Under the direction of Paolo Toscano (Marathon Gold), BaseMet carried out metallurgical testing for the VGP for the feasibility study and generated representative blended tailings samples of the combined Leprechaun and Marathon ore / tailings streams for Phase 1 (nominal grind size of $P_{80}$ = 75 µm) and Phase 2 (nominal grind size of $P_{80}$ = 150 µm) mill circuits. A series of geotechnical tests were completed on two representative tailings samples (one sample each of the Phase 1 and Phase 2 materials) in Golder’s laboratory in Burnaby, BC. The tailings samples comprised 20 kg of equivalent dry solids in thickened slurry form prepared to the design slurry density of 65% solids by mass. A summary of the laboratory testing is provided in Table 18-3.

**Table 18.3: Summary of Tailings Laboratory Testing**

| Geotechnical Laboratory Test | | Results | |
|---|---|---|---|
| | | Sample 1: 75 µm | Sample 2: 150 µm |
| Sieve and Hydrometer (ASTM D7928) | | $P_{80}$ = 83 um,<br>Sandy SILT | $P_{80}$ = 175 um,<br>SAND and SILT |
| Atterberg Limits (ASTM D4318) | | Non-Plastic | Non-Plastic |
| Undrained Settling Test | Initial dry density, $\rho_{dry}$ | 1.10 g/cm$^3$ | 1.11 g/cm$^3$ |
| | Final dry density, $\rho_{dry}$ | 1.32 g/cm$^3$ | 1.41 g/cm$^3$ |
| Drained Settling Test | Initial dry density, $\rho_{dry}$ | 1.11 g/cm$^3$ | 1.10 g/cm$^3$ |
| | Final dry density, $\rho_{dry}$ | 1.40 g/cm$^3$ | 1.49 g/cm$^3$ |
| Standard Proctor (ASTM D698) | Optimum moisture content, w | 16.0% | 13.8% |
| | Maximum dry density, $\rho_{dry}$ | 1,710 kg/m$^3$ | 1,739 kg/m$^3$ |
| Specific Gravity (ASTM D854) | | 2.75 | 2.73 |
| Maximum and Minimum Density (ASTM D4253 & D4254) | Maximum index density, $\rho_{dry}$ | 1,735 kg/m$^3$ | 1,814 kg/m$^3$ |
| | Minimum index density, $\rho_{dry}$ | 1,195 kg/m$^3$ | 1,307 kg/m$^3$ |
| Air Drying | Initial moisture content, w | 54.1% | 51.7% |
| | Final moisture content, w | 19.9% | 6.51% |
| | Elapsed time | 12.78 days | 17.92 days |
| Slurry Consolidation Test | Coefficient of consolidation, cv (mean over the full loading stress range) | 2.40 x10$^{-1}$ cm$^2$/s | 2.87 x10$^{-1}$ cm$^2$/s |
| | Permeability, k (mean over the full loading stress range) | 6.87 x10$^{-8}$ m/s | 3.48 x10$^{-8}$ m/s |
| Permeability Test (ASTM D5084-10) | Permeability, k (avg.) | 1.81 x10$^{-6}$ m/s | 1.18 x10$^{-6}$ m/s |
| Consolidated Drained Direct Shear (ASTM D3080) | Angle of friction - peak strength,’ | 33.6˚ | 36.3˚ |

Note: Samples for permeability and consolidated drained direct shear testing were prepared to a dry density of 1.40 g/cm$^3$ prior to testing.

Tailings will be produced from ore originating from the Leprechaun, Marathon, and Berry open pits. Geochemical characterization of tailings and construction rock was completed by Stantec and is discussed in Section 20.7. This section also summarizes approaches to mitigate potential risks of acid rock drainage and metal leaching from these materials.

Blast fragmentation modelling carried out by MMTS has predicted that the particle size distribution for the Marathon and Leprechaun waste rock will comprise primarily 1000 mm minus material and be suitable rockfill for construction of the TMF dam. Selective sorting of oversized boulders at the source is expected.

### 18.7.4 Geotechnical Subsurface Conditions

Geotechnical and hydrogeological site investigations at the proposed TMF were carried out by GEMTEC in the summer/fall 2021. During this time, 31 test pits were excavated, and 14 boreholes were advanced (GEMTEC, 2022b). Previously, in 2020, 32 test pits had been excavated and 11 boreholes had been advanced for earlier studies (GEMTEC, 2021).

In general, the subsurface conditions encountered at the investigation locations comprised a surficial layer of organics up to approximately 3.3 m thick underlain by a non-cohesive glacial till deposit. The till extended to the bedrock surface and ranged in thickness from 0.0 m to 9.1 m. Based on standard penetration testing, the till was found to be in a ‘compact’ to ‘very dense’ state. The bedrock surface was encountered at an average depth of 3.1 m below ground surface (bgs) at the investigation locations. Bedrock lithology was described as mudstone, sandstone, siltstone and mafic intrusive.

Groundwater levels measured in monitoring wells installed in the boreholes indicate water levels are shallow, ranging from -0.52 m bgs to 1.10 m bgs, and averaging 0.13 m bgs.

Overburden in-situ hydraulic conductivity values were estimated using rising and falling head hydraulic response (slug) testing methods in 14 monitoring wells—seven during the 2020 investigation and seven during the 2021 investigation—that were installed within boreholes across the TMF footprint. The computed geometric mean hydraulic conductivity of the till was approximately $6.0 \times 10^{-6}$ m/s. Bedrock hydraulic conductivity was estimated using Lugeon packer testing methods during drilling and slug testing in monitoring wells with screened intervals in bedrock. A total of 93 tests (24 and 69 during the 2020 and 2021 investigations, respectively) were completed in bedrock boreholes across the TMF footprint. The computed geometric mean hydraulic conductivity for the bedrock was $5.0 \times 10^{-6}$ m/s.

### 18.7.5 Dam Design

Figures 18-5 and 18-6 show the dam typical cross-section and pertinent construction details. The TMF design concept comprises rockfill embankments raised in a downstream direction, developed over six stages. The upstream slopes of the TMF embankments include a geomembrane liner to act as a low-permeable barrier as no viable fine-grained material borrow sources have been identified. The TMF perimeter dams form a horseshoe-shaped side-hill facility, which is contained by natural ground on the northwest side. All zoned materials within the embankments will be produced from crushing and screening waste rock.

The embankments have 2H:1V downstream slope, interim upstream slope of 3H:1V and an ultimate overall upstream slope of 4H:1V. The liner on the embankment slope is underlain by a non-woven geotextile, a sand filter / bedding layer, sand and gravel transition layer, and a select rockfill layer designed for filter compatibility to prevent internal erosion / piping failure. A 40 m wide filter zone wraps beneath the upstream dam toe to protect against potential higher vertical gradients at the upstream toe and reduces the risks associated with internal erosion and piping.

**Figure 18-5: Tailings Management Facility – Typical Dam Section**

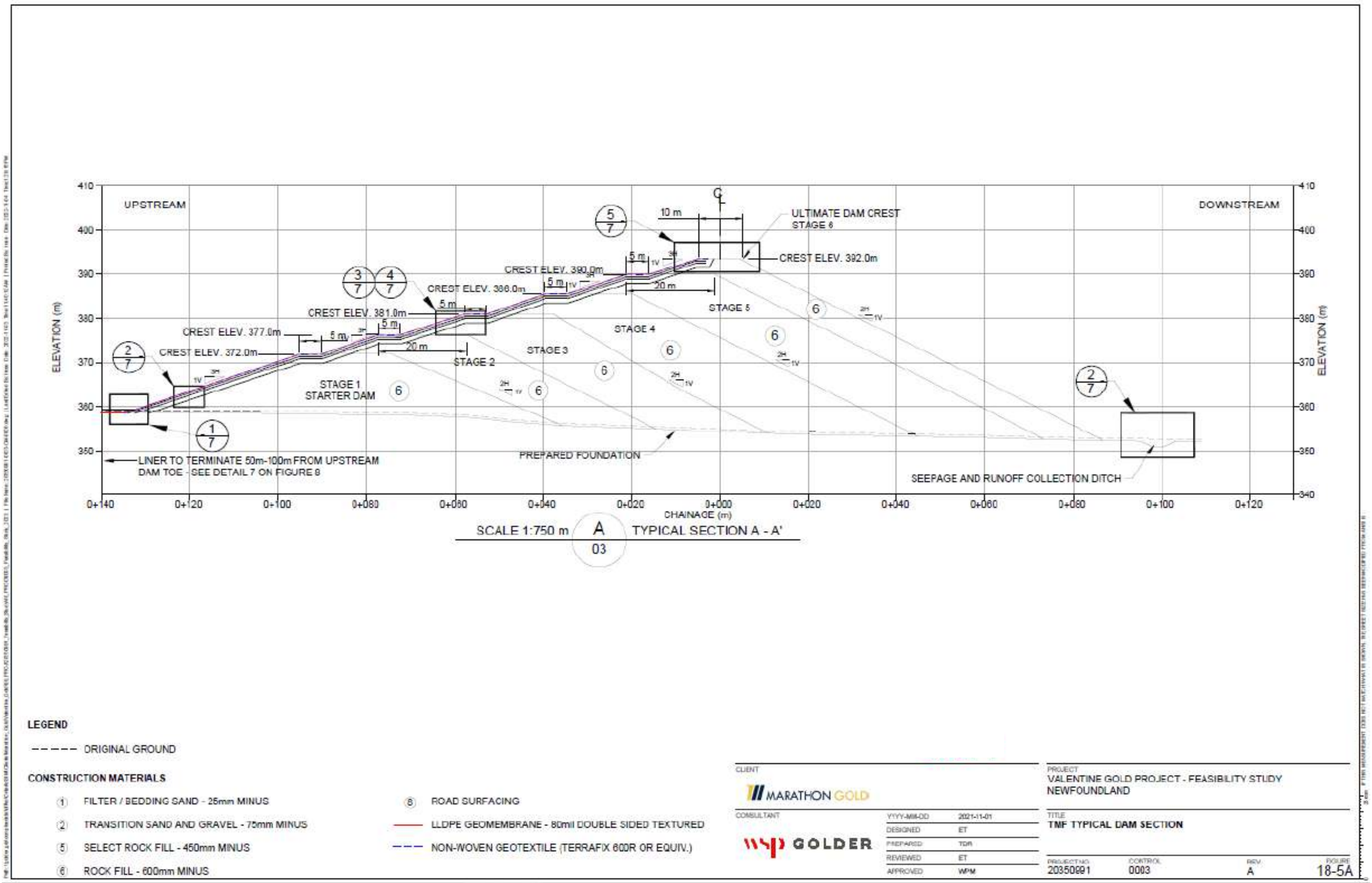
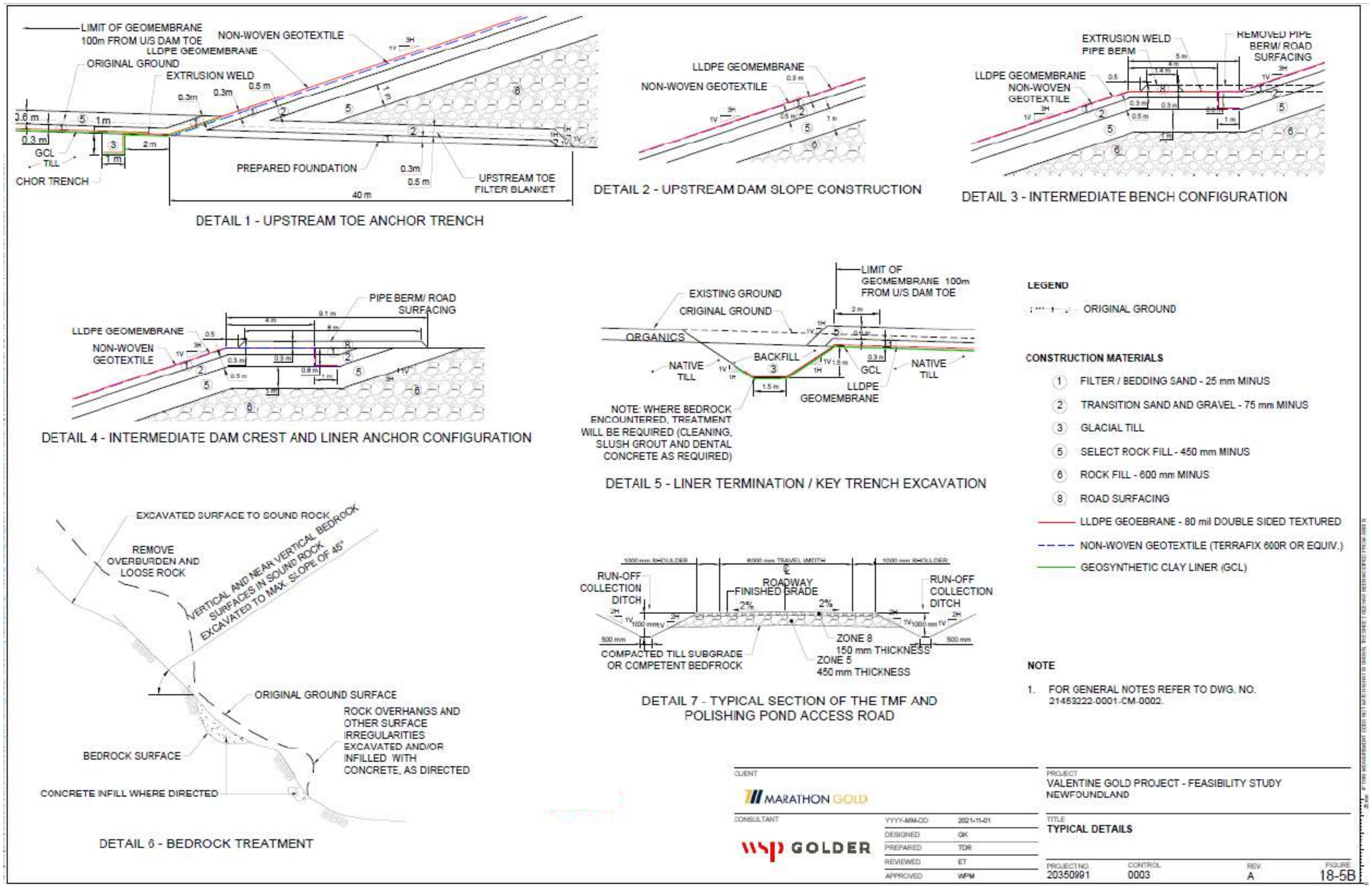


**Figure 18-6: Tailings Management Facility – Typical Details**




Source: WSP Golder, 2022.

The geomembrane liner extends 100 m upstream of the dam toe to reduce the foundation seepage rate, reduce the critical hydraulic gradient at the upstream toe of the dam and cut-off any potential permeable zones of bedrock outcrops and/or sandier overburden materials which may be present. A geosynthetic clay liner (GCL) will be installed under the upstream geomembrane liner to protect it from punctures and damage.

The non-PAG waste rock fill will be placed in lifts and compacted by the mine fleet, while the foundation preparation, sand and transition zones, and liner installation will be carried out by a civil contractor. The sand and transition materials are required to be produced from crushing and screening waste rock, as no viable local borrow sources have been identified to date.

Settlement plates, inclinometers and vibrating wire piezometers will be installed in the dam at various stages of construction to provide information to support long-term performance monitoring.

### 18.7.6 Tailings Deposition Plan

The tailings deposition plan for the TMF involves subaerial spigotting of thickened tailings both from the crest of the perimeter of the embankment dams at approximately 100 m spacing and the natural high ground on the northwest side of the basin. Initial spigotting from the perimeter dam following starter dam construction and each subsequent stage raise will promote the development of a beach over the liner. The tailings beach will enhance dam safety, protect the liner from ice damage, and reduce seepage potential through the liner. During winter months, deposition will occur by end-pipe discharge to prevent freezing of lines, with the tailings lines and discharge points being actively managed to ensure optimal filling of the basin.

The combination of discharging from the dam and the natural ground will allow the TMF decant pond to form at the east side of the basin. A portion of the decant pond will be against natural ground where the emergency and closure spillways will be located. An internal reclaim berm constructed of waste rock will extend into the decant pond such that a barge may be accessed and floated or fixed at a location with suitable pond depth.

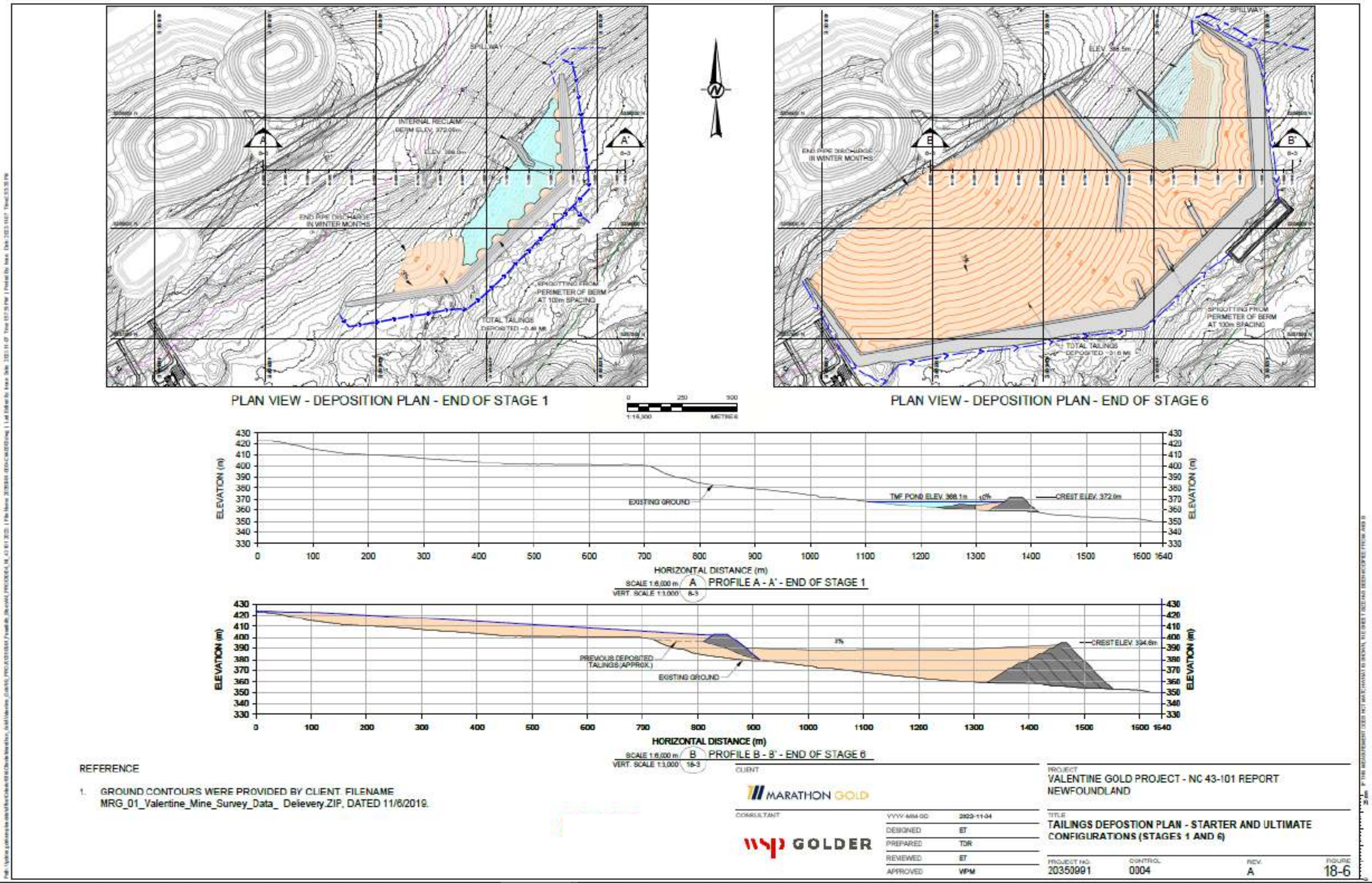
The TMF dams are designed to be raised based on storage requirements. Table 18-4 summarizes the dam stage sequencing and storage availability. Stages 1 and 2 will be built first, with Stage 1 having a lower interim crest elevation to facilitate wet commissioning of the mill and the capture of freshwater for start-up in January 2025. Stage 2 will be completed later in 2023 before the onset of winter and will provide storage until the end of 2024.

**Table 18.4: TMF Staged Raising Details**

| TMF Stage | Year of Construction | Tailings Storage Availability (Mt) | Operational Period | Dam Crest Elevation | |
|---|---|---|---|---|---|
| | | | | Maximum (masl) | Minimum (masl) |
| 1 | 2023 & 2024 | 2.295 | Oct 2024 (Wet Commissioning) – Jan. 2026 | 372.0 | 372.0 |
| 2 | 2024 | | | 377.0 | 377.0 |
| 3 | 2025 | 8.051 | Jan. 2026 – Mar. 2028 | 394.6 | 381.0 |
| 4 | 2027 | 15.699 | Mar. 2028 – April 2030 | 403.2 | 386.0 |
| 5 | 2029 | 23.573 | April 2030 – April 2032 | 409.3 | 390.0 |
| 6 | 2031 | 31.558 | April 2032 – April 2034 | 411.5 | 392.0 |

The tailings deposition plan configurations at the end of Stage 1 and Stage 6 are illustrated in Figure 18-7.

**Figure 18-7: Tailings Deposition Plan – Starter & Ultimate Configurations (Stage 1 & 6)**



Except for Stage 1 and Stage 2, the crest of the dam will slope down from the west abutment at a 1% grade for about half the alignment length and then run horizontal up to the east abutment. This sloping crest, in conjunction with the strategy of deposition from the natural ground towards the dam, will reduce the dam fill requirements while maintaining suitable pond storage on the east side of the TMF.

The TMF will be monitored to demonstrate that performance goals have been achieved and design criteria and assumptions have been met. The perimeter embankment will be raised in stages to provide the necessary storage during the first 10 years of operation.

Tailings will subsequently be deposited subaqueously in the mined-out Berry open pit (the southwest pit) starting in spring 2034 (Year 10) and for the remainder of the mine life.

Site investigation at the Berry pit location was carried out by Terrane (2022b). GEMTEC interpreted the in-situ testing results from 69 packer tests across a variety of depths in bedrock and concluded that the permeability of the rock is low (geometric mean of 4.55 $x10^{-8}$ m/s). There is a weakly-defined decrease in hydraulic conductivity with depth. There are no substantial hydraulic conductivity variations in rock mass, and the fault zones tested (including the VLTF) did not have substantially higher mean values than the surrounding rock mass. It is not anticipated that faults intersecting or near the Berry pits will be preferred pathways for groundwater flow (GEMTEC, 2022d).

Water quality modelling in the Berry open pit was carried out by Stantec and is discussed in Section 20.7.5. Based on these findings, lining of the pit prior to deposition is not included in the design. Refinement of the groundwater modelling to evaluate the impacts of the flooded open pit on the local environment may be required. A specific model should also address the impacts of in-pit disposal of tailings in the mined-out Berry pit. Golder understands Stantec is evaluating the site-wide hydrogeology and contaminant transport in consideration of the TMF and open pit.

### 18.7.7 TMF Water Management

The site-wide water balance was completed by Stantec, while Golder completed the TMF water balance. The TMF water balance considered average monthly flows as well as 25-year wet and dry annual precipitation scenarios. The water balance model was run from start-up (Year -1) to the end of operations (Year 15).

The TMF receives runoff from hydrological conditions and process water discharged with the tailings stream. Excess water from the overall mine site (e.g., from open pit dewatering and waste rock stockpile runoff) is managed separately and does not report to the TMF. The water balance concludes that the TMF has a positive water balance.

Excess water within the TMF will be collected and recycled to the process plant to the maximum practical extent. A water treatment plant and polishing pond allow for the treatment and discharge of surplus TMF water to Victoria Lake. Treatment and discharge are assumed to occur for seven to eight months per year during the ice-free period. For each dam stage, the TMF pond spillway invert has been sized to temporarily store the critical EDF above the maximum operating water level (MOWL). For Stage 1 only, the TMF pond was sized to store both the EDF volume and PMF volume because it does not have an operational spillway during the three-month period. Reclaim water is pumped to the process plant from a barge in the TMF, which is located at the end of the internal reclaim berm extending into the pond. Assuming no inflow to the pond in winter months (i.e., runoff and process water remain frozen on the tailings beach), a pre-winter minimum pond volume is required to ensure a mill reclaim inventory during the freeze up period, which ranges from approximately 0.4 $Mm^3$ to 1.0 $Mm^3$, depending on the year of operation.

An emergency spillway and discharge channel are included in the design on the east abutment of the TMF dam for Stages 2 through 6 to provide safe passage of the IDF. Riprap-lined runoff and seepage collection ditches are provided along the toe of the dam and report to a single downstream collection sump. Seepage and runoff gathered in the collection sump is recycled back to the TMF during the operating period via a pumping system.

### 18.7.8 Closure Considerations

The tailings are considered non-PAG and therefore require no special measures for long-term chemical stability (e.g., permanent water or geomembrane liner cover). Closure of the TMF will include lowering the spillway to allow for passive drainage and eliminating the supernatant pond water, regrading of tailings to ensure positive drainage to the lowered spillway and establishing a vegetated overburden cover over the exposed tailings beaches for physical stability and reduced infiltration. The polishing pond dams and seepage runoff collection sump perimeter berms will be breached and regraded. The Berry pit will be flooded and provided with a permanent passive discharge channel.

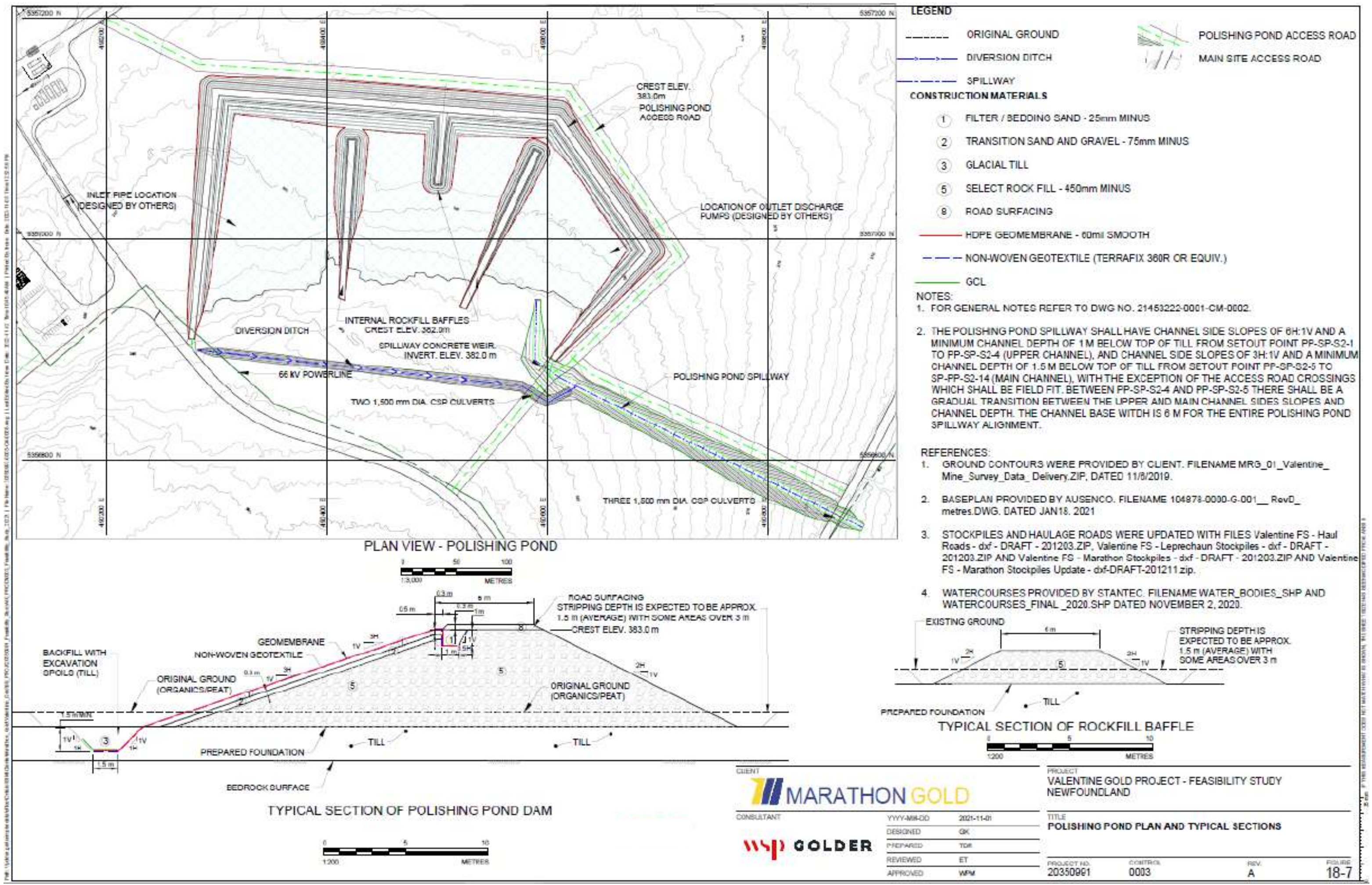
## 18.8 Polishing Pond

The polishing pond is located east of the process plant site and has a footprint area of 8 ha. The general arrangement of the polishing pond is shown on Figure 18-8. The pond will be constructed with an operational capacity of about 57,700 $m^3$ based on a maximum flow through rate which is sufficient to treat runoff, precipitation, and process flows for up to a 25-year wet precipitation year.

Containment for the pond will be provided by perimeter dams lined with a geomembrane similar to the upstream slope of the TMF dam. The pond is designed to provide sufficient residence time for the settlement of solids. To promote settling and flow distribution, the pond includes internal rockfill baffles designed to reduce short-circuiting. The pond considers the same hydraulic design criteria as the TMF pond (i.e., EDF and IDF). The design also allows for a dead storage depth of up to 1.5 m for solids accumulation.

An emergency spillway and discharge channel will be constructed in natural ground for the polishing pond to safely pass the IDF.

**Figure 18-8: Polishing Pond – General Arrangement Plan and Typical Sections**



## 18.9 Water Systems

### 18.9.1 Site Water Balance

A site-wide water balance was completed to estimate the quantity of mine site contact water expected to be managed during the operational phase of the project to support the Environmental Impact Statement and feasibility design.

The mine site is divided into four complexes. From north to south, they are the Marathon Complex, the Berry Complex, the Process Plant Complex, and the Leprechaun Complex. Water management functions independently with decentralized treatment and control in each complex.

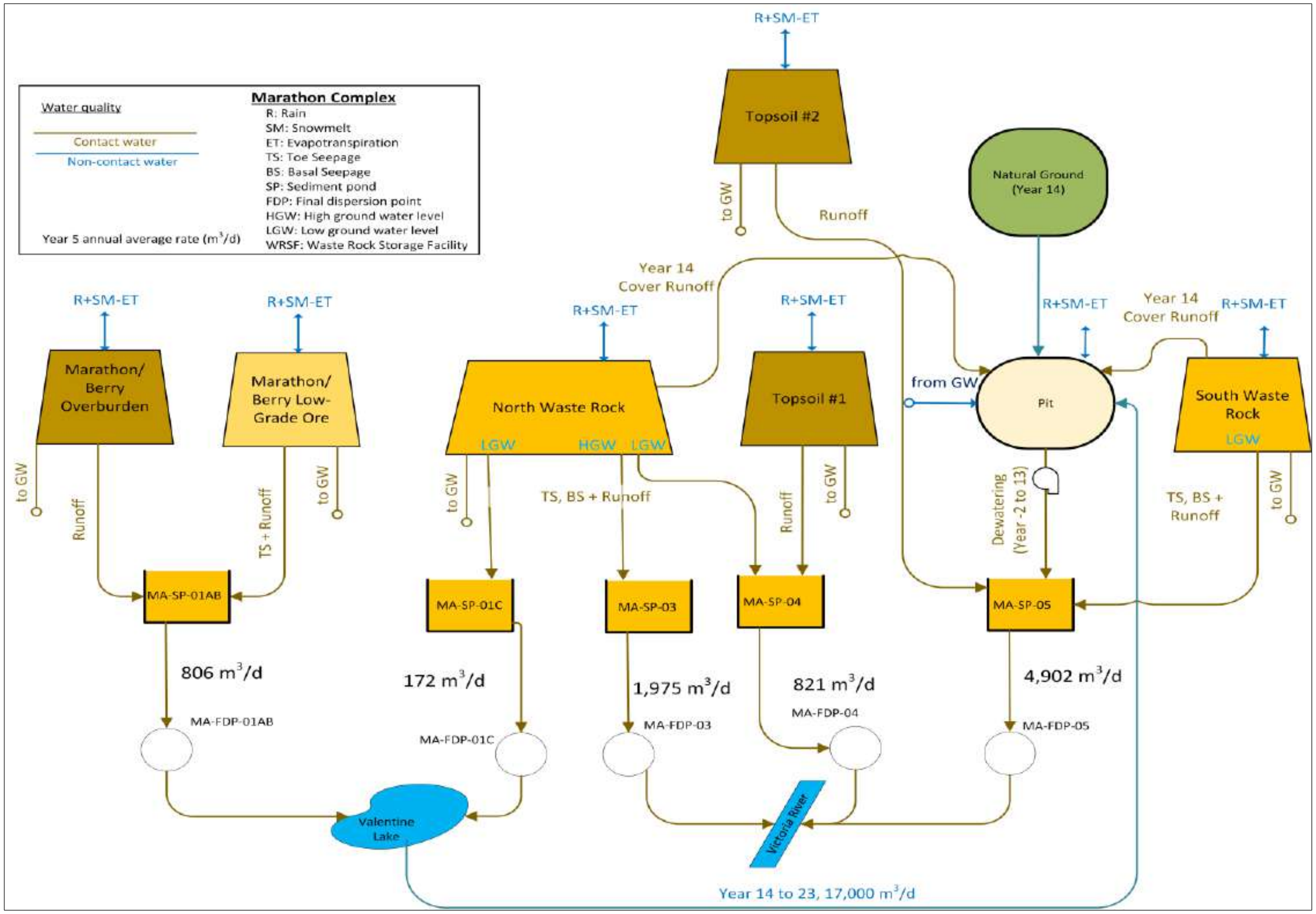
To reduce the mine water inventory, non-contact runoff is proposed to be diverted using perimeter berms to allow runoff to naturally flow off site. Commencing in Year 9 of operations, tailings are proposed to be deposited in the Berry pit for six years. During this time, the TMF will continue to be used as the primary source of reclaim water; the deficit will be made up with water from Victoria Lake and the water cover over the tailings deposited in the Berry pit.

As shown in Figure 18-9, the Marathon Complex drains and discharges ultimately to Valentine Lake or Valentine River. As shown in Figure 18-10, the Berry Complex drains and discharges ultimately to Valentine Lake. The Leprechaun Complex drains and discharges ultimately to Victoria Lake Reservoir through direct lake tributaries (Figure 18-11). During operation Years 1 to 9, the process plant area and TMF will drain and discharge to the Victoria Lake Reservoir as well; however, during Years 10 to 15, excess TMF water will be reclaimed to the process plant with no discharge to the reservoir. During Years 10 to 15, tailings will be deposited in the southwest pit of the Berry Complex.

Accelerated filling of the Leprechaun pit from waste rock pile water management pond excess, natural ground runoff, and the Victoria Lake Reservoir will commence in Year 13 as part of progressive reclamation. Similarly, filling of the Marathon pit will commence in Year 14 with water from Valentine Lake and waste rock pile water management pond excess.

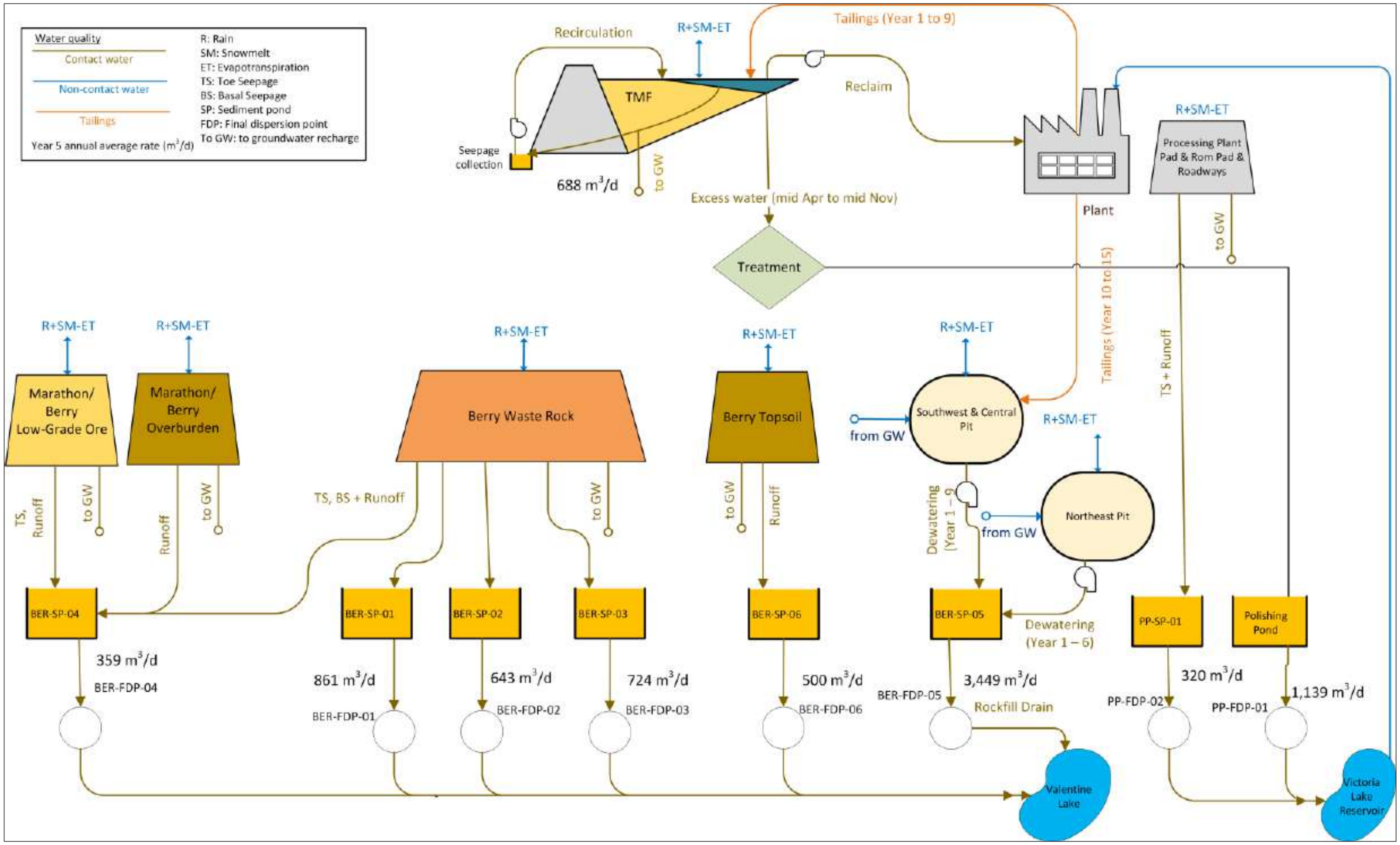
Accelerated pit filling is not anticipated for the Berry pits, as tailings will be discharged into the southwest pit, and the other pits (central and northeast) will be filled with waste rock. The flow arrows in Figures 18-9, 18-10 and 18-11 show the direction of flow (to or from the project facility) accounted for in the water quantity model. Key updates to water management infrastructure since the pre-feasibility study design are presented in Section 18.9.6.

**Figure 18-9: Marathon Operational Water Balance – Climate Normal Condition**



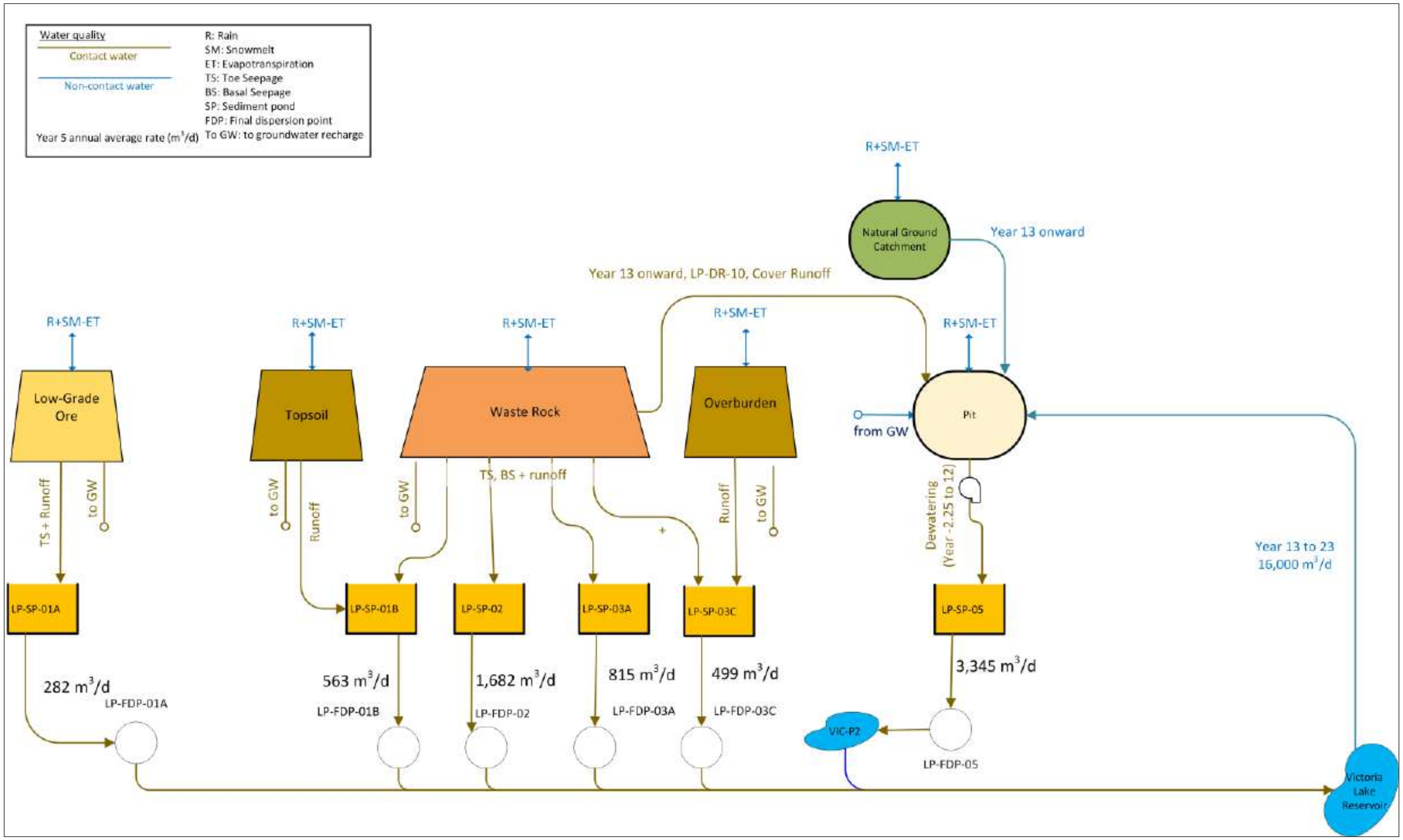

Source: Stantec, 2020.

**Figure 18-10: Berry Operational Water Balance – Climate Normal Condition**




Source: Stantec, 2022.

**Figure 18-11: Leprechaun Operational Water Balance – Climate Normal Condition**




Source: Stantec, 2022 (showing feasibility study updates).

#### 18.9.1.1 Water Balance Methods

The water balance accounts for precipitation, groundwater, toe seepage captured from beneath the piles, evaporation, transpiration, and infiltration losses of each identified mine site component. The water balance represents the mine site components at full development during operation. The proportion of infiltration that becomes part of deeper regional groundwater flow and that does not report to seepage collection ditches was not included in the model. Average precipitation at the mine site was represented by the Climate Normals precipitation (1981-2010) for the Environment and Climate Change Canada (ECCC) climate station Buchans (Station ID 8400698). Building from this base case, a probabilistic Monte Carlo analysis was conducted to extend the analysis to include extreme wet and dry climatic conditions. This allows for the prediction of runoff, seepage, and water quality behaviour and characteristics over this range of climatic conditions.

A proportion of precipitation in the cold months of December through March was assumed to be stored as snow with melt occurring in the months of March through June. Groundwater and surface water inflows to the pits were based on a hydrogeological model developed by Stantec and field hydrogeological work by others (Terrane, 2019 & 2020). Evaporation from ponds at the site was represented by the average evaporation rate (millimeters per month) reported at the Stephenville and Gander ECCC climate stations (Station IDs 8401700 and 8403800). Actual evapotranspiration (AET) at the site was based on a USGS Thornthwaite model (Thornthwaite, 1948). Inputs to the USGS Thornthwaite model included average climate precipitation and temperature data at Buchans, local soil conditions, and recommended values provided by the USGS (McCabe and Markstrom, 2007). The amount of AET was adjusted in the model based on project facility and project phase. These adjustments were applied to account for the characteristics of stockpile slope, soil storage, and infiltration of each project facility.

The percentage of precipitation that results in runoff from the pile areas was accounted for in the water quantity model by a water balance approach. The accounting was the balance of rainfall plus snowmelt runoff less evapotranspiration and net infiltration that falls on the catchment. Net infiltration is the sum of groundwater infiltration and toe seepage less any soil losses. The proportion of net infiltration that reports as seepage to perimeter ditching and is collected in the seepage collection system is carried through the model to the water management ponds. Different from the waste rock and LGO piles, the topsoil and overburden stockpiles are fine-grained, which limits infiltration into the pile and increases runoff. As a result of the soil material combined with the steep pile slopes, the net infiltration through the piles was assumed to be negligible.

Runoff from the tailings and polishing pond was estimated in the model based on the proportion of total precipitation (rainfall plus snowmelt runoff) on the catchment multiplied by a seasonally adjusted runoff coefficient. Seepage was modelled as shallow seepage that is collected and recirculated to the TMF and deep basal seepage lost to the system.

The modelled project facilities, including the processing plant, TMF, open pit and stockpiles, will have drainage and diversion controls that prevent external natural drainage from coming into contact with project facilities and becoming contact water.

#### 18.9.1.2 Water Balance Results

Figures 18-8, 18-9 and 18-10 show the water balance gains and losses for each mine component identified in the four complexes, in cubic meters per hour, under normal climate conditions. Actual instantaneous flows will vary significantly by month and by varying annual climate conditions.

The Marathon Complex consists of the Marathon pit, Marathon northwest waste rock pile, Marathon topsoil stockpile, partial drainage from the Marathon and Berry overburden stockpile, and partial drainage from the Marathon and Berry low-grade ore stockpile. The Berry Complex consists of the Berry southwest, central and northeast pits, Berry waste rock pile, Berry topsoil stockpile, partial drainage from the Marathon and Berry overburden stockpile, and partial drainage from the Marathon and Berry low-grade ore stockpile. The Leprechaun Complex consists of a waste rock pile, Leprechaun topsoil pile, Leprechaun overburden and low-grade ore stockpiles, and stormwater ponds. Runoff from these project components will be collected in drainage ditches and directed to sedimentation ponds. Pond discharges will be directed locally to unnamed tributary streams to Victoria River (70%), and directly to Valentine Lake (30%) for Marathon and Berry.

Drainage from the Berry and Marathon Complexes reporting to Valentine Lake ultimately discharges to Victoria River, which flows north to Red Indian Lake and the Exploits River system. The Leprechaun Complex will discharge locally to unnamed tributary streams to Victoria Lake, as well as directly to Victoria Lake. Victoria Lake was diverted during the Bay d'Espoir hydroelectric project to the east; the lake now drains via the Victoria Canal, Granite Canal, and Meelpaeg Reservoir to the Bay d'Espoir Generating Facility on the south coast of the Island.

The water management ponds are influenced by climate inputs. They collect runoff, toe seepage, and shallow groundwater flow from the waste rock pile and low-grade ore, overburden, and topsoil stockpiles through seepage collection ditches around these facilities. The water quantity model simulated the function of the water management ponds. The water management ponds will discharge to the final dispersion points when the pond water level rises above the low-level outlet.

The Processing Plant Complex consists of the TMF, polishing pond, water treatment plant, process plant, truck shop wash-ROM pad, and high-grade ore stockpile. The processing plant and TMF will operate as a circuit with tailings being deposited in the TMF as a thickened slurry (60% to 65%) and process water being reclaimed via a pump and pipeline from a point downstream of the polishing pond back to the process plant. Generally, the simulation flow results on the water management ponds and the final dispersion points, from 5$^{th}$ to 95$^{th}$ percentile results, range from approximately -25% to +25% of the mean results within each mine phase. This is consistent with the range of precipitation and approximately represents the 1:25 return period wet year to the 1:5 dry year.

Fresh water for elution, reagents and potable water requirements will be pumped from Victoria Lake to the process plant at a rate of 19 $m^3$/h Surplus water from the TMF will be discharged to a treatment plant, from where treated water will be sent to a polishing pond prior to discharge via pipeline to Victoria Lake. Ore rock will be stored on the run-of-mine stockpile and in the high-grade ore stockpile prior to processing.

The primary source of water to meet the plant water demand is the reclaim from the TMF tailings pond. The secondary source is fresh water from Victoria Lake Reservoir to balance plant water demand deficit (i.e., difference between the demand and the reclaim). A deficit of reclaim water to meet process plant demand is predicted to occur during the first year of operation for a few months and typically during the spring of the year prior to ice melt, and for longer durations beginning in Year 11 when tailings begin being deposited in the southwest Berry pit and the main source of inflows to the TMF is precipitation and pumped seepage collection.

The water balance model was run iteratively to analyze the volume of excess water from the TMF requiring treatment prior to discharge to the environment. In the model, TMF runoff was pumped to the treatment plant at different monthly rates when the tailings pond level reached different percentage of its storage volume capacity. The capacity of the water treatment plant will not be exceeded for the 95$^{th}$ percentile corresponding to a 1:25 return period wet year. Results from the probabilistic analysis indicate no release of untreated water from the tailings pond during operation (before Year 13) for the 95$^{th}$ percentile when the process plant stops reclaim. This condition could change depending on future operation management philosophy between the tailings pond and the water treatment plant.

### 18.9.2 Fresh Water Supply System

The design took into consideration that fresh water will be captured from Lake Victoria. It will be directed to the fresh/firewater tank, from where it will be distributed to required points in the plant, and it will feed the potable water treatment system, elution circuit and reagent systems. During the first year of operation, fresh water will be required to supplement process water demand, typically recovered from the TMF. The bottom section of the fresh/firewater tank will be dedicated to the firewater system.

### 18.9.3 Potable Water Supply

The quality requirement for the potable water treatment plant will match local drinking water guidelines. Fresh water will be sourced from the freshwater intake pump (at Lake Victoria) and processed through the potable water treatment skid before being stored in the potable water tank.

Prior to further use, potable water will be heated by the tepid water heating skids before being distributed to safety showers and other points in the plant facilities. The distribution piping will either be buried below the frost line or heat-traced and insulated wherever it is not inside a heated building. Where necessary, manual drain points will be included.

### 18.9.4 Fire Suppression System

All facilities will have a fire suppression system in accordance with the structure's function. For the most part, fire water will be used with an underground ring main network around the facilities. All buildings will have hose cabinets and handheld fire extinguishers. Electrical and control rooms will be equipped with dry-type fire extinguishers. Ancillary buildings will be provided with automatic sprinkler systems. For the reagents, appropriate fire suppression systems will be included according to their material safety datasheets.

### 18.9.5 Sewage Collection

A sewage treatment plant package will be supplied at both the plant/truck maintenance area and camp area to treat all sewage collected within the site. The collection network will be underground. Office and domestic waste will be collected and disposed of off-site in accordance with applicable regulations.

### 18.9.6 Surface Water Management

The water management infrastructure was progressed from a pre-feasibility to a feasibility study design with some early works water management infrastructure having advanced to IFC. New or revised water management infrastructure associated with the Berry Complex, a new sedimentation pond at the Leprechaun complex, and an expanded sedimentation pond at the Marathon Complex form the basis of updated feasibility design. The previously completed early works IFC (Stantec, 2022) and feasibility study design (Stantec, 2021) remaining unchanged are documented in those respective reports. Key changes since the 2021 feasibility study design include the following:

- The number of water management ponds was increased from 12 to 19 in the feasibility study design.
- Reductions in pond excavation were realized in the feasibility study design by reducing the overall combined pond footprints and by relocating some ponds to low-lying areas from the confirmation that the existing ponds/watercourses in these areas were not fish habitat.
- Water management infrastructure design was adjusted in the feasibility study design to limit bedrock excavation, as this detail was not available in the pre-feasibility study design. In some cases, pond bottoms were raised or perimeter ditches circumvented bedrock outcrops, designed to be piped for a segment below the Leprechaun waste rock pile or French drains designed to convey excess flow from the Berry pit and dewatering pond below the Berry waste rock stockpile.

- The dam embankment design was changed from a till core with rockfill in the pre-feasibility study to a feasibility-level HDPE-lined embankment as a result of the required 1.8 m frost cover and seepage/slope stability analysis. This change in dam design results in additional rockfill material required, an excess quantity of excavated till/overburden material, and an HDPE and geotextile liner. However, the new dam design results in an overall lower dam embankment height than the till core design.

#### 18.9.6.1 Design Objectives

The primary objectives of the water management design for the Valentine Gold Project were maintained from the pre-feasibility study design to reduce operational risks and environmental impacts. These objectives include the following:

- reduce water inventory through perimeter berms, separate groundwater and surface water flows, and promote overland flow of non-contact runoff
- effectively control flooding and provide water management design that produces effluent achieving regulatory effluent criteria
- reduce final points of discharge through grading of ditches and construction of diversion channels to combine spill points to collective effluent discharge points and or sedimentation ponds
- maintain flow to fish-bearing streams and bogs by maintaining pre-development catchments
- reduce water management costs during operation through gravity drainage, where possible, thus reducing pump requirements.

#### 18.9.6.2 Design Criteria

In Newfoundland and Labrador, both water quantity and quality criteria are drawn from provincial and federal regulations and regulatory guidance, and in the case of the Valentine Gold Project, further project-specific Environmental Impact Screening (EIS) guidance (CEAA, 2019; NLDMA, 2020). Additional design criteria are sourced from industry best practices and Marathon Gold corporate direction. The design criteria that were incorporated into the water management design are described below.

The Valentine Gold Project will be registered under the Metal and Diamond Mining Effluent Regulations (MDMER). The MDMER sets a daily flow volume monitoring requirement at each final discharge point. Effluent from the Valentine Gold Project will be subject to MDMER discharge limits which set maximum allowable limits for specific deleterious substances (e.g., metals and total suspended solids (TSS)) for new mines). Specifically, as a new mine, the Valentine Gold Project will be subject to effluent limits from Table 1 of Schedule 4 of MDMER.

A 15 m setback from field-identified potentially fish-bearing streams and bogs/ponds was applied in design. This design criterion is in line with the Newfoundland and Labrador Policy on Flood Plain Management (DOEC, 2004). EIS guidance (NLDMA, 2020) requires that climate change be considered in design. This results in higher precipitation events and associated design flow.

As part of the EIS, an environmental flow to fish-bearing streams is required to reduce environmental effects to fish and fish habitat. Therefore, flow to fish-bearing streams and bogs was predominately maintained in design by draining mine site components to pre-development catchment areas, where reasonable.

Water management sedimentation ponds were designed with multiple stage outlets to incorporate system flexibility to manage water under variable climatic conditions. Sedimentation ponds were designed to store runoff from the project component areas for storm events up to 1:100 annual exceedance probability (AEP) with spring snowmelt and emergency spillways to accommodate the 1:200 AEP flow. The sedimentation pond effluent is slowly released to enhance baseflow augmentation to provide flood attenuation and reduce downstream scour and erosion. Ponds were excavated beneath the ground surface to decrease the height of the dam and enhance dam safety.

The water management design of contact water treatment focused on sedimentation, as sedimentation will reduce TSS concentrations and the particulate fraction of metals. Ponds were designed primarily to meet the minimum residence time required for sediment to settle 1 m, reaching a trapping efficiency of 80%. Runoff from the water quality design storm event will be detained in the sedimentation pond for a minimum of 24 hours. A primarily subsurface, reversed slope, low-level outlet will act as a containment feature for hydrocarbon and light non-aqueous phase liquids (LNAPL) and will also reduce thermal discharge effects. A secondary outlet will be installed to relieve flood flows over a shorter period to maintain storage in the pond. Finally, an emergency spillway will relieve flood flows commencing at the 1:100 AEP water level and greater.

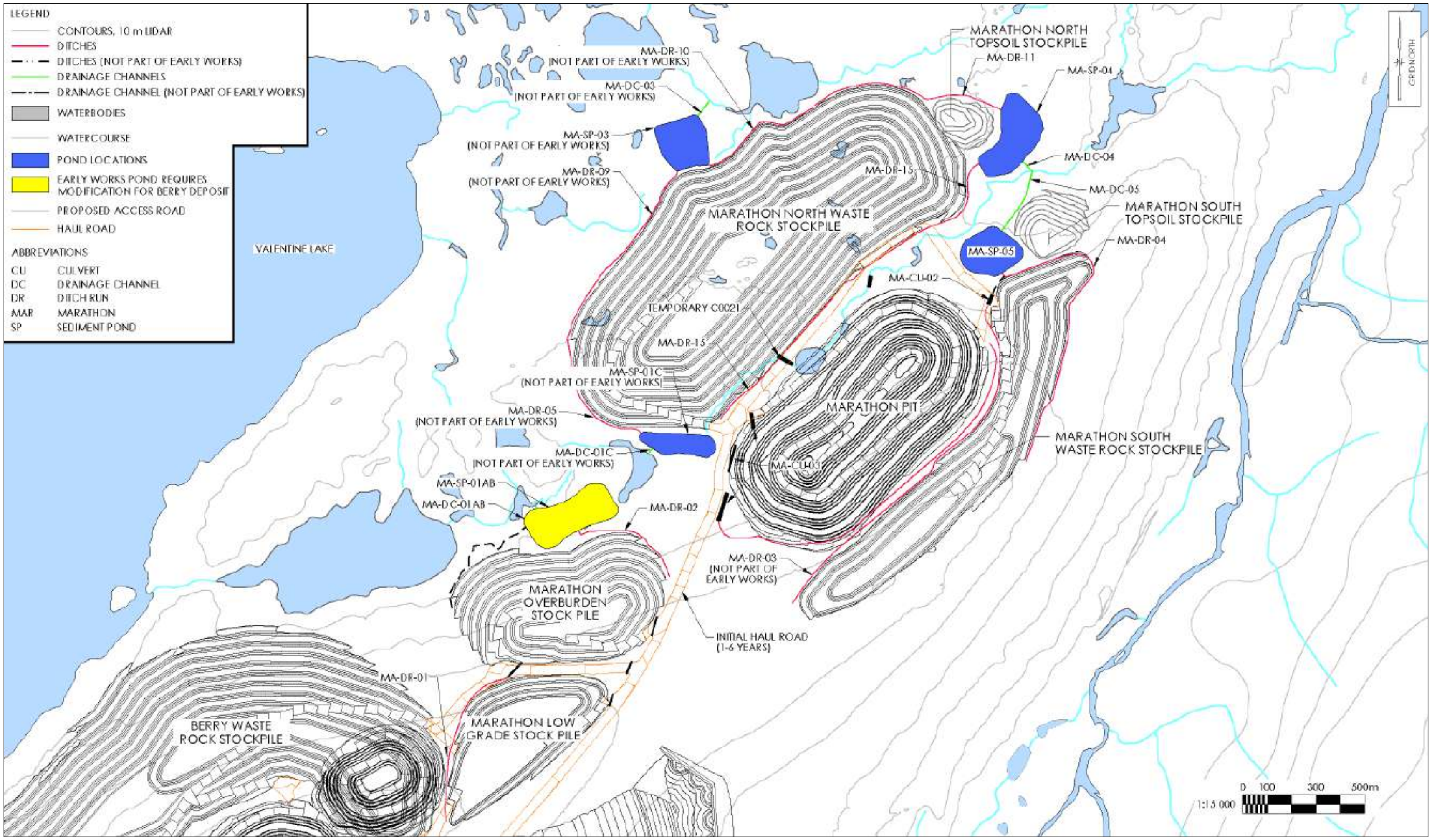
Ditches will be constructed along the perimeter of piles to convey the 1:100 AEP surface runoff and toe drainage to sedimentation ponds for water quality and quantity control. Ditch runs have been designed to convey flow through gravity to reduce operational costs of pumping. Ditch excavation materials will be sidecast and used to create adjacent diversion berms following a standard trapezoidal geometry to reduce construction costs.

#### 18.9.6.3 Water Management Infrastructure

The mine site is subdivided into four complexes. From north to south, these are the Marathon Complex, the Berry Complex, the Process Plant and TMF Complex, and the Leprechaun Complex. Water management in these complexes functions independently with decentralized water treatment and management in each. Water management components consist of sedimentation ponds, dams, drainage ditches, and pumps to collect and contain surface water runoff from waste rock, low-grade stockpiles, overburden stockpiles, topsoil stockpiles, and pits. Water management components are identified in Figures 18-15, 18-16 and 18-17 for the Marathon, Berry and Leprechaun complexes, respectively. The water management plan for the process plant was described in Section 18.9.6.1. The design of the TMF accounts for a positive water balance, which includes rainfall and snowmelt and the management of the effluent, which is described in Section 18.9.1.

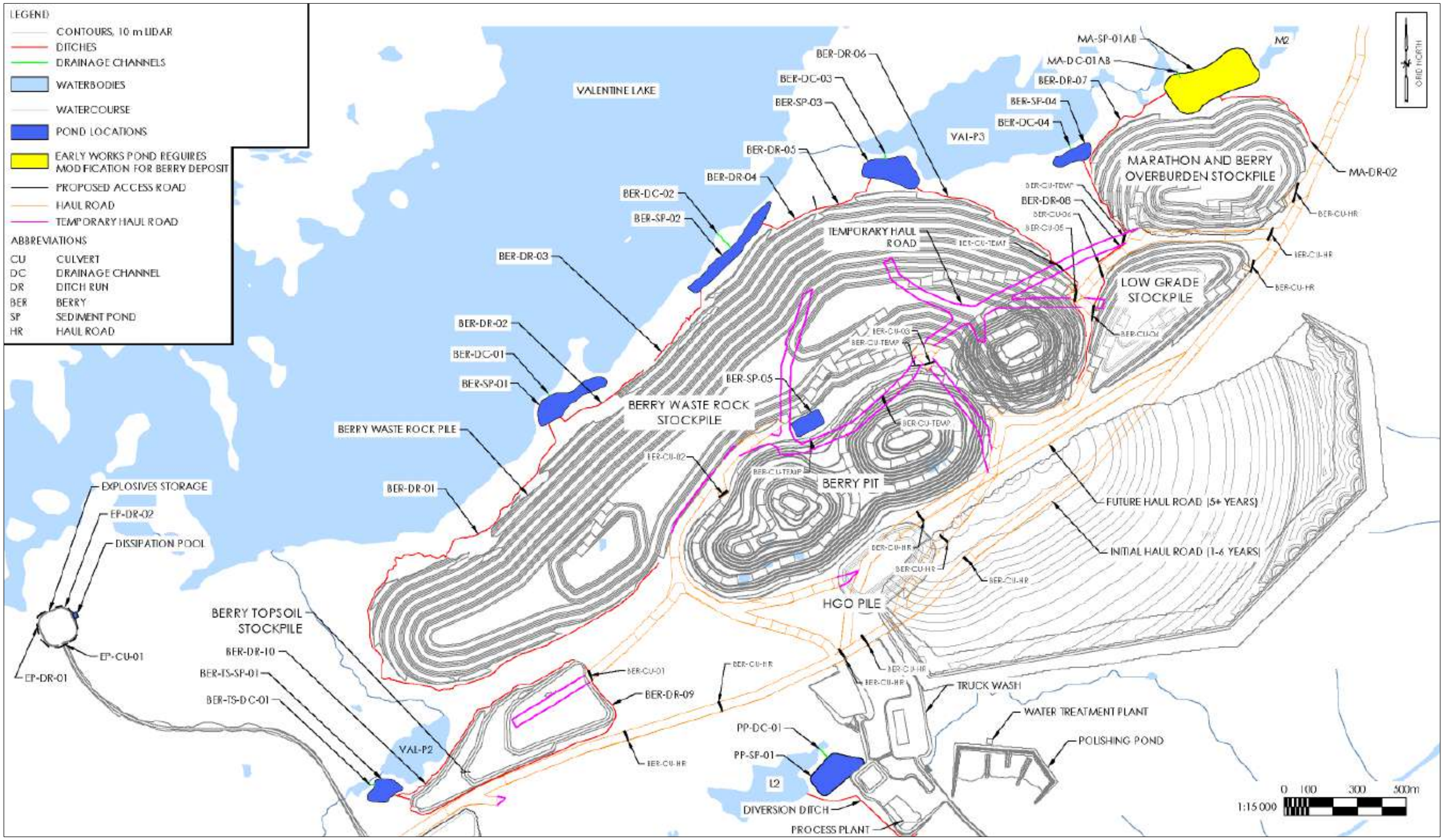
The Leprechaun Complex will be served by a series of ditches and sedimentation ponds that will discharge to Victoria Lake or one of its tributaries. The Berry Complex ditches and ponds will discharge to Valentine Lake, and the Marathon Complex ditches and ponds will discharge to tributaries of Valentine Lake or Victoria River. Excess runoff from the TMF not reused in processing will be routed through a polishing pond and water treatment plant prior to discharge to Victoria Lake. Runoff from the process plant yard and associated stockpiles will be collected in a sedimentation pond and discharged to Victoria Lake.

**Figure 18-12: Marathon Water Management Components**



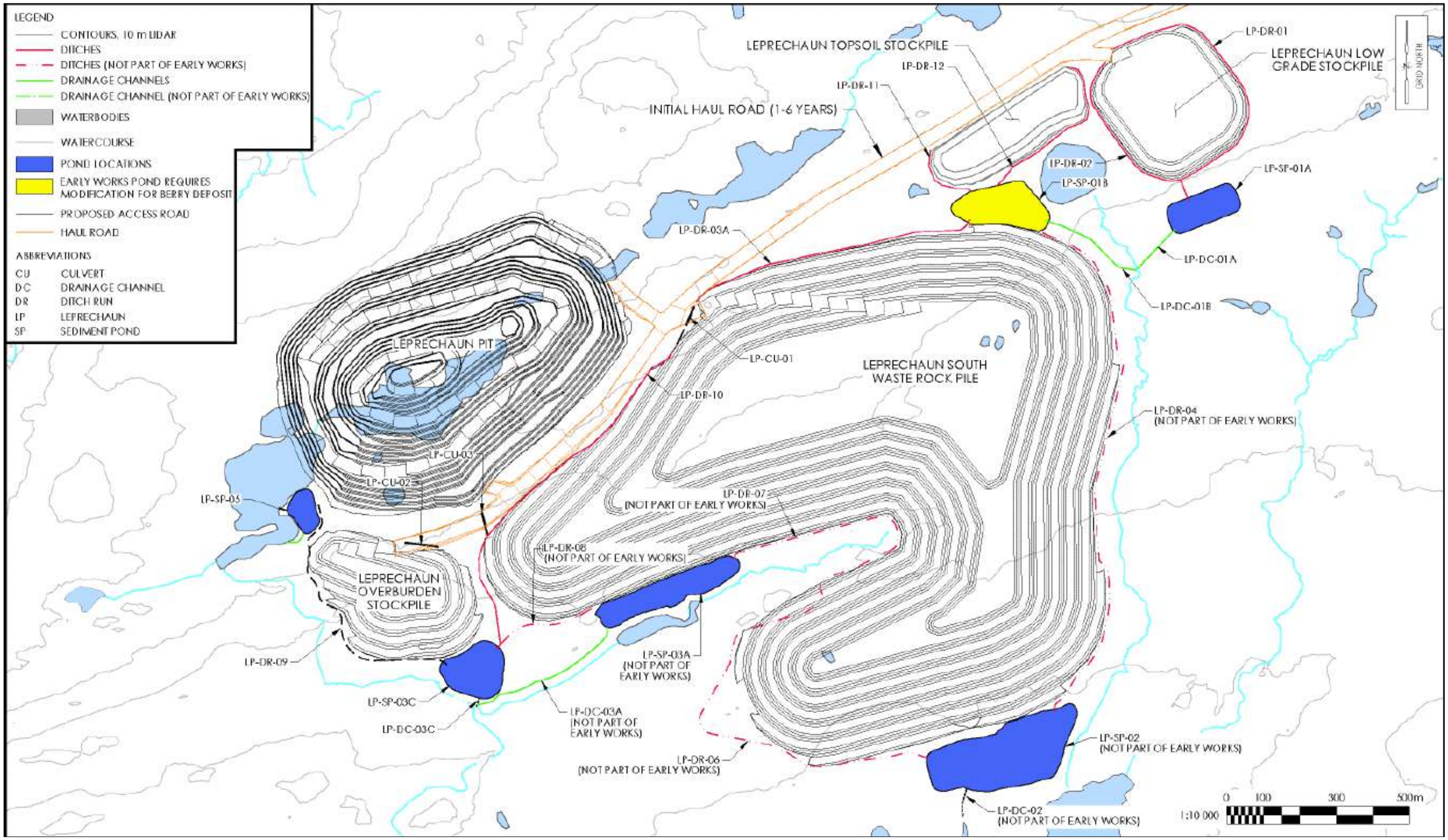

Source: Stantec, 2022.

**Figure 18-13: Berry Water Management Components**




Source: Stantec, 2022.

**Figure 18-14: Leprechaun Water Management Components**




Source: Stantec, 2020.

Water management features for the Marathon, Berry and Leprechaun complexes were designed under a decentralized water treatment framework, operating under gravity drainage to reduce pumping needs. The design of the water management utilized cuts and fills to reduce initial trucking costs and make use of local materials. Measures to control erosion and prevent sedimentation into a fish-bearing watercourse or waterbody was accomplished in design using ditch and berm lining for erosion protection and energy dissipation measures, such as sediment traps and energy dissipation pools. Pumps will be required to dewater the Marathon, Berry and Leprechaun pits. A pit dewatering pond was designed at a low-lying location adjacent to each pit.

Water management pond normal water levels will account for a permanent pool (i.e., inactive storage at the ponds low operating water level) to promote settling and storage of sediment, and with consideration of ice thickness during the cold season of 50 cm. All permanent pools will be excavated below grade. In areas with higher relief, the active storage in the ponds will also be excavated below grade (i.e., inactive storage volume), thus reducing the total dam height and improving dam safety. Ponds will include multi-stage outlet control through a low-level submerged outlet, mid-level outlet, and spillway.

The water management pond dams will be constructed of a blasted rockfill, anticipated to be poorly graded 250 mm minus (10” minus) rock. A layer of screened sand and gravel will be placed on the upstream slope of the dam as bedding material for the HDPE geosynthetic liner (the liner).

The inlet to the pond will include a riprap ditch for energy dissipation to reduce the velocity of the flow into the pond, thus limiting short circuiting. The dam crest will be 4 m wide and 3H:1V embankment slopes to allow for light vehicle access on top of the berm to facilitate maintenance and monitoring activities.

Ditches will follow a standard trapezoidal geometry with a maximum 2H:1V side slope tied into existing grade to reduce cost of construction and maintaining a minimum of 20 cm freeboard. Ditch excavation materials will be sidecast and used to create adjacent diversion berms to reduce cost of construction. Sidecast berms will be constructed on the outside bank of the ditches. No berms will be constructed between the ditch and its source stockpile. Ditches will be lined with riprap for erosion protection where hydraulic shear stresses warrant and vegetated in other locations.

Effluent from the sedimentation ponds was designed to meet MDMER limits prior to release to the receiving environment. To meet the required storage many of the pond embankment dam heights exceed the CDA safety guidelines trigger of 2.5 m from the toe of the downstream slope to the dam crest and 30,000 $m^3$ of liquid storage. In order to reduce effects to the environment, the footprint of the water management infrastructure avoids fish-bearing watercourses or waterbodies and therefore associated discharge of a deleterious substances.

Based on the feasibility level and IFC design completed by Stantec to date, a number of water management pond embankments trigger Canadian Dam association (CDA) dam criteria of greater than 2.5 m high and > 30,000 $m^3$ liquid storage. An incremental consequence assessment was conducted as part of the feasibility-level design to determine the dam classifications of the structures considered a dam under CDA. The consequence assessment considered loss of life, environmental and cultural losses, and infrastructure and economic losses.

The largest incremental consequences due to a dam breach are predicted under the fair-weather conditions within the small headwater watercourses/waterbodies downstream of the breach. The effects of a dam breach are fully attenuated by the receivers of Valentine Lake, Victoria Lake or Victoria River, in addition to downstream ponds along the release paths. The potential environmental and cultural losses as a result of a dam breach were assessed based on the ecological impact, intrinsic hazard of contents and the duration of impact for the species at risk (Brook Trout). The loss of habitat in the downgradient watercourses, lakes, or wetlands is considered a “low” environmental loss. Based on the CDA, a low classification corresponds to an inflow design flood of 1:100 years.

#### 18.9.6.4 Pit Dewatering

Pumps will be required to dewater the Marathon, Berry and Leprechaun pits. A pit dewatering pond was designed at a low-lying location adjacent to each pit. A total pond volume of 10,000 m³ for both Marathon and Leprechaun was proposed as adequate to contain pit dewatering based on the rates reported by Terrane (2019; 2022). Pit dewatering ponds accounted for constant groundwater inflows to the pit as well as the 100-year design storm dewatered over an extended period. Pit dewatering discharge directed to the pit dewatering ponds at the surface will be subsequently drained to pre-development catchments. In cases where higher producing fractures or fracture/fault zones are encountered, it is typical to attempt to reduce elevated groundwater inflows by use of slurry walls or injection grouting as this will reduce dewatering pump capacity and ongoing energy demands. Further, it is common under large storm conditions for open pits mines to temporarily redeploy pumping capacity from other areas of the mine to the open pit and/or to obtain secured rental access to additional dewatering pumping capacity on a demand basis.

## 18.10 Accommodations Camp

An accommodations camp is included in the design for the mining pre-production, construction and operations phases. The camp will be tied into the plant power grid and will accommodate a maximum of 430 people. The average peak workforce during construction will be 380; however, the additional number of rooms will accommodate individuals working on capital projects, such as the TMF, phase 2 expansion, and water management infrastructure.

The number of camp beds takes into consideration all personnel. The total labour force, as well as full-time equivalents (FTEs), expected on site at a given time (accounting for FIFO rotations) is summarized below:

- an average of 260 direct construction workers with a peak of 375
- an average of 20 construction management staff with a peak of 40
- an average of 12 Marathon Gold office and site team staff with a peak of 15
- an average of 20 accommodation camp staff with a peak of 25
- operations peak – approximately 350 FTEs in the camp.

The complex will consist of dorm facilities and a core building. A temporary camp has been mobilized for 135 persons until the permanent accommodations is constructed and is operational. The accommodations complex is made up of eight single-storey dorm units, one two-storey dorm unit, and a core building containing the kitchen facilities.

# 19 MARKET STUDIES AND CONTRACTS

Marathon Gold has not completed any formal marketing studies on gold production that will result from the mining and processing of gold ore from the Valentine Gold Mine into doré bars. Gold production is expected to be sold on the spot market. Terms and conditions included as part of the sales contracts are expected to be typical of similar contracts for the sale of doré throughout the world. Gold is bought and sold on many world markets, and it is not difficult to obtain a market price at any time. The gold market is very liquid, with numerous active buyers and sellers.

Asahi Refining provided a quotation for transportation and refining costs that were used in the study. Marathon Gold plans to contract out the transportation, security, insurance, and refining of doré gold bars. Marathon Gold may enter into contracts for forward sales of gold or other similar contracts under terms and conditions that would be typical of, and consistent with, normal practices within the industry in Canada and in countries throughout the world.

# 20 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

Information presented in this section is based on publicly available information, including the Environmental Impact Statement (EIS) (Marathon Gold, 2020), associated baseline study appendices and further studies undertaken subsequent to submission of the EIS for the Valentine Gold Project. The appendices are comprised of the environmental baseline studies conducted in the project area and surrounding vicinity. The project area as defined for the purposes of the 2020 EIS is shown in Figure 20-1. Information included herein may require review and reassessment should changes to the scope, area, or design of the project occur as project planning and design progress. The EIS (Marathon Gold, 2020) covered the entire Valentine Project except the Berry pit complex and associated changes to the approved designated project. The Berry pit complex is included in this feasibility study update and will be the central focus of future environmental assessment processes. To distinguish the EIS completed for the Valentine project without the Berry pit expansion, the EIS will be referred to as the 2020 EIS.

## 20.1 Environmental Setting

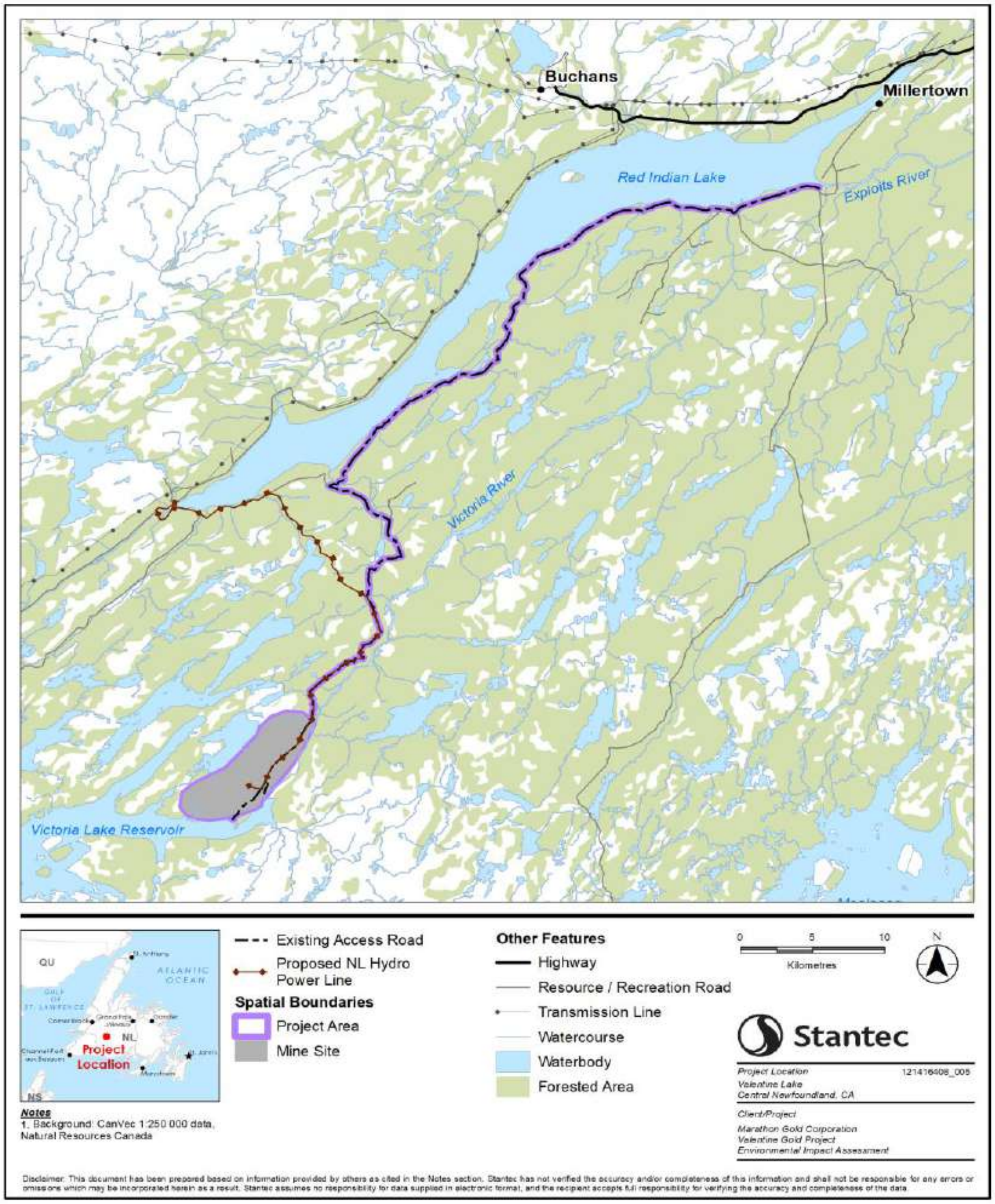
The project is located in the Central Region of the island of Newfoundland, in a rural area with a history of exploration and mining activities. Other land and resource use in the region includes commercial forestry, multiple hydroelectric developments, mineral exploration, outfitting, cabins, harvesting (e.g., trapping, hunting and fishing), and recreational land use (e.g., hiking, boating, snowmobiling and all-terrain vehicle (ATV) use). Although there are currently no active mines in the area, mineral exploration activity takes place throughout the region. The closest communities are, the Town of Buchans (55 km straight line distance to the mine site), the Local Service District of Buchans Junction (69 km straight line distance to the mine site) and the Town of Millertown (63 km straight line distance to the mine site).

The following sections summarize the terrestrial and aquatic ecosystems present in the vicinity of the project and are based on literature reviews and baseline surveys conducted between 2011 and 2022. The social, cultural, and economic environment of the region is also discussed.

### 20.1.1 Terrestrial Ecology

The project is located within the Red Indian Lake Subregion of the Central Newfoundland Forest (CNF) Ecoregion (Newfoundland and Labrador Department of Fisheries and Land Resources [NLDFLR], 2019a). This ecoregion typically consists of rolling hills, dense forest, and organic deposits occurring in valleys and basins (Protected Areas Association (PAA), 2008). The CNF Ecoregion has the warmest summers and coldest winters on the island of Newfoundland, with potential for night frost year-round (NLDFLR, 2019a). Annual precipitation in the Ecoregion averages around 1,200 mm. The average annual temperature is approximately 3.8˚C, ranging from -8.4˚C in February to 16.3˚C in July. Mean annual runoff in the project boundaries ranges between 51% to 86% of climate normal precipitation (Stantec, 2020). Terrain (i.e., topography and landforms) varies and includes boggy areas, thin to thick glacial till layers, and bedrock outcrops. Scattered wetlands, specifically patterned fens and bogs are common in the project area and vicinity. Balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*) and black spruce (*Picea mariana*) are dominant tree species in the region.

**Figure 20-1: Project Area**




Source: Stantec, 2021.

The region includes a variety of wildlife mammal species commonly found in the boreal forest on the island of Newfoundland. Mammal species confirmed in the project area (Marathon Gold, 2020) include woodland caribou (*Rangifer tarandus caribou*), moose (*Alces alces*), black bear (*Ursus americanus*), Canada lynx (*Lynx canadensis*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), marten (*Martes*), muskrat (*Ondatra zibethicus*), river otter (*Lontra canadensis*), southern red-backed vole (*Myodes gapperi*), meadow vole (*Microtus pennsylvanicus*), snowshoe hare (*Lepus americanus*), and

American red squirrel (*Tamiasciurus hudsonicus*). Mink (*Neovison vison*), ermine (*Mustela erminea*), northern long-eared bat (*Myotis septentrionalis*), and little brown bat (*Myotis lucifugus*) are also expected to occur in the vicinity of the project.

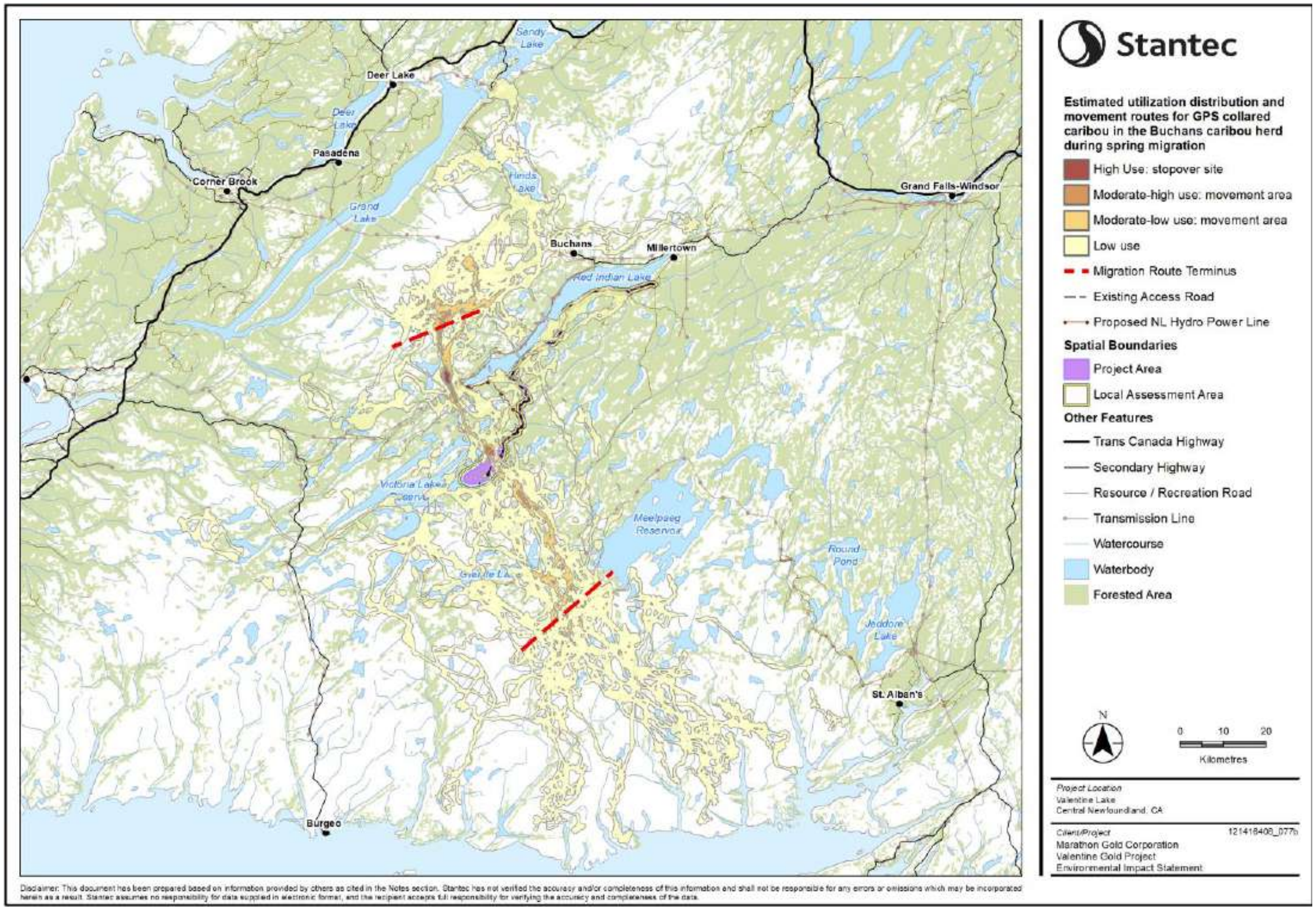
Broadly, the avifauna groups present in this area include passerines, waterfowl, upland gamebirds, and raptors. Based on the available information, which included literature, project-specific field studies, and federal and provincial databases, a total of 98 species of birds were identified as having the potential to occur in or near the project. The most commonly recorded passerine species included white-throated sparrow (*Zonotrichia albicollis*), ruby-crowned kinglet (*Regulus satrapa*), Swainson’s thrush (*Catharus ustulatus*), boreal chickadee (*Poecile hudsonicus*), black-capped chickadees (*Poecile atricapillus*), Canada jay (*Perisoreus canadensis*), black-and-white warbler (*Niotilta varia*), yellow-bellied flycatcher (*Empidonax flaviventris*), and common loon (*Gavia immer*) (a waterbird). The raptors observed in the vicinity of the project area were boreal forest-dwelling species that rely on the habitat for nesting, hunting, and breeding. In general, waterfowl were common in wetland and open water habitats in the vicinity of the project during spring breeding and fall staging periods. A Sensitive Wildlife Area along the Victoria River was identified as containing important waterfowl habitat (NL-EHJV, 2008). While this area overlaps with the project area, the waterfowl habitat that was likely the focus of this designation are “steadies” on the Victoria River system located north of the mine site, before the river drains into Red Indian Lake (B. Adams, pers. comm, 2020).

Habitats in the area also support designated species at risk (SAR) and species of conservation concern (SOCC). In Canada and in Newfoundland and Labrador, SAR include species listed as Extirpated, Endangered, Threatened, Vulnerable, or of Special Concern under the Newfoundland and Labrador *Endangered Species Act* (NL ESA), the federal *Species at Risk Act* (SARA), or by the Status of Endangered Wildlife Species in Canada (COSEWIC) (COSEWIC, 2017). SOCC include those species recommended for listing by the Species Status Advisory Committee (SSAC) as Endangered, Threatened, Vulnerable, of Special Concern, or are considered provincially rare by the Atlantic Canada Conservation Data Centre (AC CDC) (Stantec, 2020).

Most of the project area is not considered to have high potential for rare vascular plant species due to habitat type, tree species composition, stand age, and/or microclimatic conditions (Stantec, 2019a). While no plant SAR or SOCC was identified in the project area during 2019 vegetation surveys (Stantec, 2019a), three plant SOCC were identified during 2017 field surveys of the project area. These were nodding water nymph (*Najas flexilis*), identified at a single location within the footprint of the proposed Marathon pit; short-scaled sedge (*Carex deweyana*); and perennial bentgrass (*Agrostis perennans*) (Stantec, 2017d). The provincial status rank (S-rank) for these three species is S2 (imperilled). Four graminoid (grass) species of SOCC were identified during regional surveys conducted in 2014 in support of the project’s ELC.

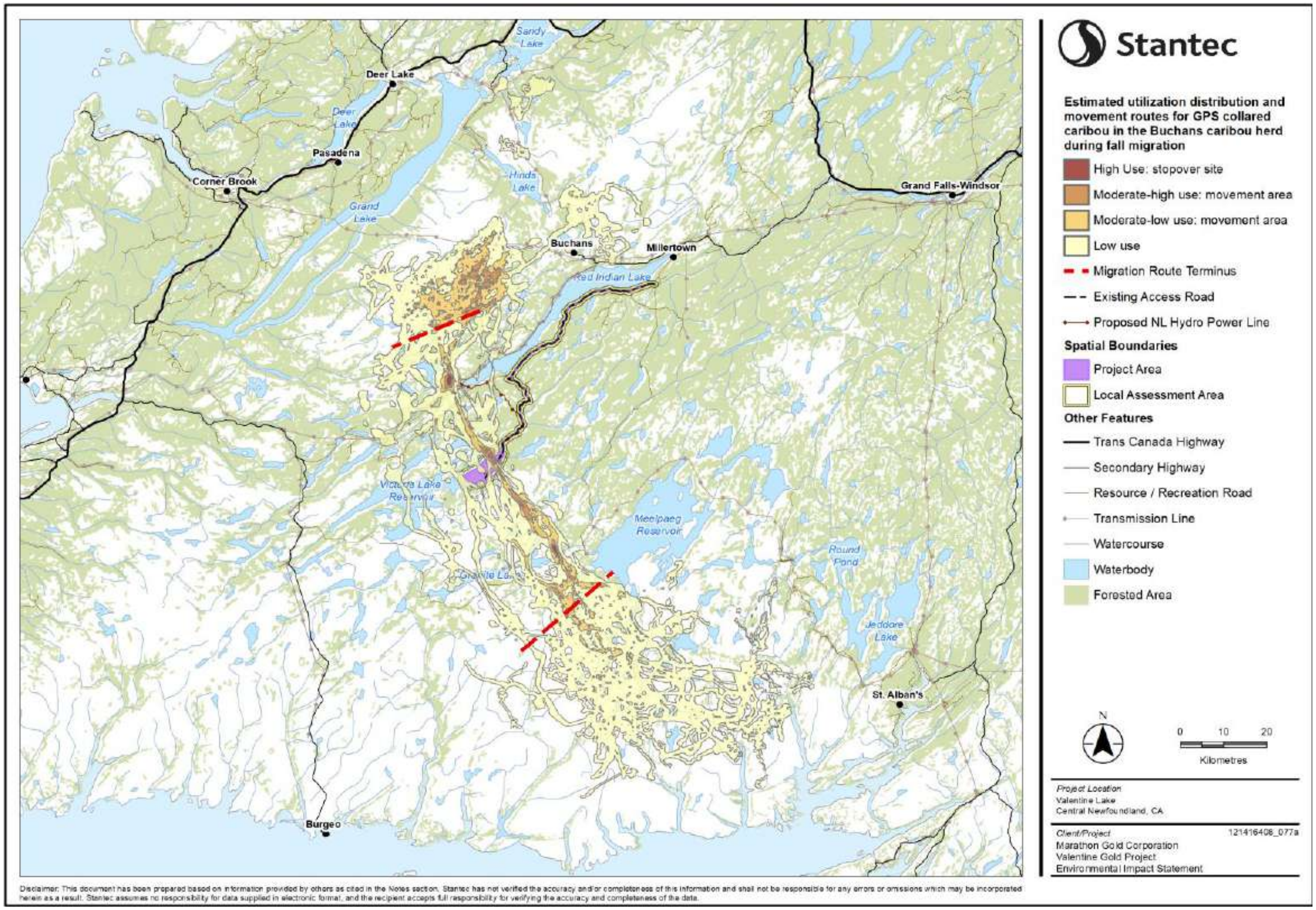
Caribou on the island of Newfoundland have been assessed as special concern by COSEWIC (COSEWIC, 2014). The project area overlaps or is in proximity to the ranges of caribou herds including the Buchans, Grey River, Gaff Topsails, and La Poile herds. Collectively, these herds represent approximately 36% of the caribou population on the island of Newfoundland (Government of NL, 2019a). The caribou population on the island of Newfoundland has recently declined, most likely due to a combination of food limitation with predation by coyotes. Recent population estimates indicate that the Grey River, Gaff Topsails and La Poile herds have decreased by 60-80% compared to population peaks recorded from the late 1980s. Recent surveys indicate that population trends for the caribou herds noted above may be stabilizing (Government of NL, 2019a). The project area overlaps with the Grey River Caribou Management Area. Animals from the Buchans herd migrate through the mine site semi-annually (Figures 20-2 and 20-3), while resident caribou from the Grey River herd, can occur year-round within the project area. The La Poile herd has no overlap with the project area, and only a small portion of the winter range of the Gaff Topsails herd overlaps with the project area.

**Figure 20-2: Estimated Utilization Distribution & Migration Corridors for GPS Collared Caribou in the Buchans Herd During Spring Migration**




Source: Stantec, 2021.

**Figure 20-3: Estimated Utilization Distribution & Migration Corridors for GPS Collared Caribou in the Buchans Herd During Fall Migration**




Source: Stantec, 2021.

American marten (Newfoundland population) has been observed within the project area (incidental sightings, and marten hair snag traps). The Newfoundland population of marten is listed as Threatened and is protected under SARA (COSEWIC 2007) and the NL ESA. A small portion (6.3 $km^2$) of proposed critical habitat for American marten (Newfoundland population) overlaps the project area.

With respect to avifauna, three SAR (olive-sided flycatcher *(Contopus cooperi*), common nighthawk (*Chordeiles minor)*, and rusty blackbird (*Euphagus carolinus*)) and three SOCC (Caspian tern (*Hydroprogne caspia*), bay-breasted warbler (*Setophaga castanea*) and Nashville warbler (*Leiothlypis ruficapilla*)) were observed in the in the vicinity of the project area during field studies. Six olive-sided flycatchers were recorded in the project area in 2019. The rusty blackbird is listed as Special Concern under federal legislation and as Vulnerable under provincial legislation. After the 2020 EIS, Marathon continued baseline avifauna monitoring, and have implemented the Avifauna Management Plan subsequent to the commencement of early works construction.

Additional SAR and SOCC have the potential to occur in the project area based on available habitats. Field studies conducted since the EIS submission have confirmed the presence of resident northern long-eared bat (*Myotis septentrionalis)* and little brown bat (*Myotis lucifugus)* within the project area. The nearest confirmed bat hibernation site is over 12 km from the project area. Gray-cheeked thrush (*Catharus minimus*), red crossbill (*Loxia curvirostra*), and bank swallow (*Riparia riparia*) may also occur in the project area (Stantec, 2014a).

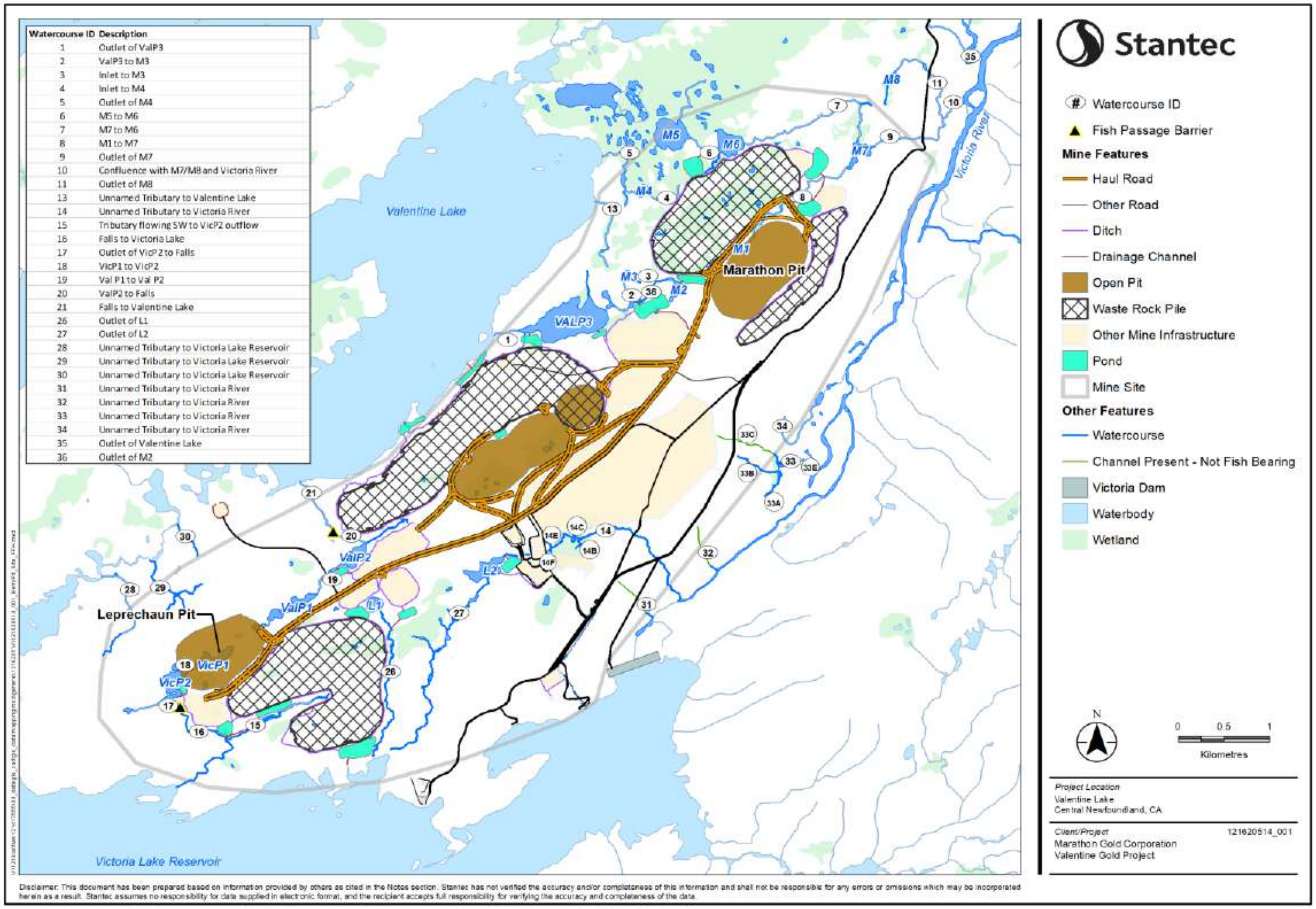
### 20.1.2 Aquatic Ecosystem

The project is situated along a boundary between the Exploits River Watershed and the Bay D'Espoir Watershed (also referred to as the White Bear Watershed). The Victoria Lake Reservoir, to the south of the project area, was created in 1967 with the construction of the Victoria Lake Reservoir dam and spillway at the outflow of Victoria Lake, which originally flowed via the Victoria River to Red Indian Lake and ultimately to the Exploits River. With the construction of the dam, flow from Victoria Lake was diverted in a generally southeast direction to Bay D'Espoir and the Victoria Lake Reservoir is now part of the White Bear Watershed. The dam and spillway are located close to the project and remain operational. There are multiple hydroelectric projects downstream, between Victoria Lake Reservoir and Bay D'Espoir. The head of the Victoria River (altered by hydro development) to the east of the project area, and Valentine Lake to the northwest, feed into the Exploits River, one of the most important Atlantic salmon rivers on the Island for numbers of salmon returning.

Within the region, sea-run and landlocked (ouananiche) Atlantic salmon (*Salmo salar*), brook trout (*Salvelinus fontinalis*), Arctic char (*Salvelinus alpinus*), American eel (*Anguilla rostrata*), and threespine stickleback (*Gasterosteus aculeatus*) are known to occur (Cunjak and Newbury 2005; Porter et al. 1974). Migratory habitat of sea-run Atlantic salmon and American eel is interrupted by several hydroelectric dams which provide upstream passage but may not facilitate optimal downstream migratory passage. The sea-run Atlantic salmon are part of the Northeast Newfoundland Atlantic Salmon population and are designated as Not at Risk by COSEWIC (COSEWIC 2010). Victoria Lake Reservoir and Valentine Lake are not accessible to sea-run Atlantic salmon. American eel is designated as Threatened by COSEWIC (COSEWIC 2012). American eel is known to occur along the access road on the south side of Red Indian Lake; however, it is not known to occur in Victoria Lake Reservoir or Valentine Lake.

Aquatic baseline studies were completed in the project area in 2011, and 2018 to 2022. Fish habitat at the mine site was characterized in ponds, bog holes, lakes, and streams (Figure 20-4). Ponds surveyed were estimated to have a maximum depth of 2 m and contain a high proportion of fines and low amounts of aquatic vegetation, with surface areas ranging from 0.5 to 26 ha. Habitat was shallow and generally poor for spawning, young of the year (YOY), juvenile, and adult life stages of brook trout and Atlantic salmon (ouananiche). However, habitat was more suitable for threespine stickleback. No fish SAR were captured in ponds, lakes, or streams in the Aquatic Survey Area.

**Figure 20-4: Aquatic Survey Area**




Source: Stantec, 2022.

Several bog holes surveyed within the proposed footprint of project infrastructure were frozen to the bottom during winter and were therefore assumed to not be fish habitat. Fishing effort at these bog holes resulted in no fish catches, demonstrating that the bog holes within the project footprint do not support fish.

For Victoria Lake Reservoir, water depths in the reservoir are likely 35 m greater than pre-dam depths. Shorelines drop steeply in the lake, limiting the littoral zone, with shorelines consisting of rock and sand. The lake is naturally devoid of aquatic vegetation; however, the lake was found to contain generally suitable habitat for spawning, YOY, juvenile and adult life stages of brook trout, Atlantic salmon (ouananiche) and Arctic char. For Valentine Lake, with a maximum water depth of 25.4 m, suitable habitat was determined to be present based on the depth preferences of brook trout, threespine stickleback and Atlantic salmon (ouananiche).

The streams that were surveyed within the Aquatic Survey Area (which included the mine site and areas immediately adjacent), were generally small (<5 m width), shallow (<0.5 m), and slow flowing (<0.2 m/s). First order, low gradient streams that flowed through bog or wetland habitats were generally characterized by shallow flats with slow / negligible velocities, and fine grain substrates.

The lower reaches of streams were generally more riffle / run habitat, associated with increased gradient and velocities, coarser substrates, well-defined channels, and generally permanent flow characteristics. Habitat quality in streams was highly variable. First order streams that drained wetlands were generally poor for spawning, YOY, juvenile and adult life stages of brook trout and Atlantic salmon (ouananiche) due to the large quantity of fine grain substrates, while providing more suitable habitat for threespine stickleback. Rocky reaches of streams provided suitable habitat for spawning and rearing habitat for YOY, juvenile and adult life stages of brook trout. Higher order streams with gravel and cobble substrates provided spawning habitat and rearing habitat for YOY and juvenile Atlantic salmon (ouananiche). Suitable fish habitat was also found at several proposed stream crossing locations.

In general, the surface water quantity and quality in the project area and vicinity is within the acceptable ranges for supporting cold water fish communities, with mean discharges ranging from 0.004 $m^3$/s to 0.352 $m^3$/s throughout the year. Mean monthly flows were found to be highest in June and July, with the lowest flows occurring in October and November, with some streams becoming intermittent, due to low flows. In pond, lake, and stream sediments, there were no exceedances of the Canadian Sediment Quality Guideline Probable Effects Limits except for arsenic which was above the guidelines. In NL, naturally high arsenic levels are not uncommon and are influenced by bedrock geology, surficial and chemical processes, and proximity to areas of mineralization (particularly copper and gold) (Serpa et al. 2009).

The lakes and ponds in the Aquatic Study Area were characterized by generally low primary productivity (i.e., the production of chemical energy into organic compounds by living organisms), while streams were characterized as having low to moderate primary productivity. Secondary productivity, characterized by benthic invertebrate community descriptors, showed that density (number of individuals per $m^2$) was variable in ponds, lakes, and streams, even within similar habitat types. Species evenness (a measure of the diversity of a benthic community) was low in ponds and moderate in lakes, while benthic invertebrate community diversity was moderate in both ponds and lakes. Overall, the benthic invertebrate communities were representative of undisturbed aquatic habitat.

### 20.1.3 Social, Cultural and Economic Environment

The project is in a rural region and not within the boundaries of a municipality. The closest communities are the Town of Millertown, the Town of Buchans and the Local Service District of Buchans Junction. These nearby communities, along with Badger, Grand Falls-Windsor, and Bishop’s Falls, have been shaped primarily by natural resource-based industries, including mining, forestry, and hydroelectric developments.

Exploration in the Buchans area began in the early part of the 20th century, and production of base metals (e.g., copper, zinc, and lead) began in 1926. A base metal mine established near Buchans contributed substantially to the provincial economy until closure in 1984 (Wardle, 2004). The region saw an economic resurgence with continued exploration and the discovery of the Duck Pond base metal deposit in 1987. Duck Pond Operations began commercial production in 2007, employing more than 270 people in the local Buchans-Millertown region (Canadian Mining Journal Editor, 2013). Duck Pond, the only recently active mine in the area, ceased operation in July 2015 (Teck, 2016). Some limited employment and procurement opportunities associated with the Duck Pond operation remain through the three-phase decommissioning process. There are currently no operating mines in the region, although mineral exploration has continued and there are many mineral licenses surrounding the project area.

Forestry and logging were important economic drivers in central Newfoundland from the early 20th century until the early 21st century. The industry was primarily in support of the pulp and paper industry, which was greatly reduced following the closure of Abitibi-Consolidated Inc.'s mill in Grand Falls-Windsor in 2009.

In 2016, the main industries providing employment to residents of the region were health care and social assistance, retail trade, and construction (Statistics Canada, 2017).

The region is also used for recreational activities, including hunting, fishing, hiking, backcountry camping, snowmobiling, ATV use and boating. Numerous gravel roads, formerly Abitibi forestry access roads that are now maintained by the provincial government, provide access to the area for recreational and other users. There are private cabins in the region, primarily around ponds, lakes, and rivers. There are also 21 outfitters registered with the Land Division within a 35 km radius of the project area, nine of which are active (according to Tourism NL). The project area occurs within several provincial hunting and trapping areas for big game (e.g., moose, caribou, black bear) and small game (e.g., coyote, hare, furbearers).

Angling occurs on several waterbodies in the region. There is an active recreational salmon fishery on the Exploits River, which flows northeast from Red Indian Lake. The Exploits River (including tributaries) is a scheduled salmon river, regulated by Fisheries and Oceans Canada (DFO) under the *Fisheries Act* and the *Canada Wildlife Act*. Based on 2016 population surveys, the returns of Atlantic salmon to the Exploits River system have declined compared to previous five-year means (2011 to 2015), and the egg density was 37% of the conservation requirement (Veinott et al. 2018). According to the 2022-2023 DFO Anglers Guide retention of Atlantic salmon in rivers in insular Newfoundland is permitted subject to regulations (https://www.nfl.dfo-mpo.gc.ca/en/NL/AG/GeneralRegulations).

Currently, most salmon anglers fishing on the Exploits River use the lower river and tributaries from Grand Falls down to the river mouth. The middle section of the river is used less often, and there is little access and angler activity at the upper river above Beothuk Lake (formerly Red Indian Lake) Dam (SCNL, pers. comm. 2020). Brook trout, arctic char, and land-locked Atlantic salmon (ouananiche) are also commonly fished in the region. Outfitters in the region reported salmon angling occurring at the Exploits River near Grand Falls-Windsor and Bishop Falls, occasionally at the mouth of Victoria River near Red Indian Lake (Snow Shoe Lake Hunting and Fishing, pers. comm. 2020) and the head of the Exploits River (near Exploits dam). One outfitter also identified areas for ouananiche and brook trout angling along the route between Victoria Lake Reservoir and Bay d'Espoir, including Victoria River, Granite Lake, Meelpaeg Lake, Cowy Lake, Snowshoe Pond, Hospital Pond, Blizzard Pond, and Wilding Lake (Snow Shoe Lake Hunting and Fishing, pers. comm. 2020).

The province manages 55 protected areas, including 31 provincial parks, 16 ecological reserves, three wildlife reserves, two wilderness reserves, and three other protected areas (NLDFLR 2019b). There are three provincial protected areas in the area, including Little Grand Lake Ecological Reserve (~27 km from the mine site and ~23 km from the project area), Little Grand Lake Wildlife Reserve (~28 km from the mine site and ~23 km from the project area), and T'Railway Provincial Park (~76 km from the mine site and ~26 km from the project area).

A Historic Resources Overview Assessment for the project was completed in 2017 and updated in 2020. Field work was carried out in the fall of 2021 to further support historic resource work. Within the project area, ethnohistoric evidence indicates that important caribou migration corridors approach and traverse the project area, and that there is theoretical potential for precontact sites of all periods, particularly for sites of Maritime Archaic and late precontact Amerindian peoples, and, to a lesser extent, potential for Paleo-Eskimo sites. With respect to historic resources, there is potential for Beothuk sites as the project area lies within the territory of the Beothuk prior to the second quarter of the nineteenth century, and potential for historic Mi'kmaq sites dating to the second half of the nineteenth century into the twentieth century. After the 2020 EIS and in cooperation with Indigenous groups, Marathon has completed historic resources surveys that have indicated no historic resource potential.

The Federal Guidelines to the 2020 EIS identify Qalipu Mi'kmaq First Nation (Qalipu) and Miawpukek First Nation (Miawpukek) as Indigenous groups that may be affected by the project. The Miawpukek Reserve is located at the mouth of the Conne River on the south coast of the island of Newfoundland, approximately 113 km from the project area. The area of the reserve is approximately 620 ha. The total registered membership of Miawpukek is 3,063, of which approximately 33% live on reserve. Qalipu was registered as a band under the *Indian Act* in 2011. Although a registered band, Qalipu does not manage any reserve lands. Its members reside within 67 communities across the Island, with the nearest community to the project being Buchans located 55 km to the mine site, and the nearest community by road being Millertown. Qalipu maintains satellite administrative offices in Glenwood, Grand Falls-Windsor, Stephenville, and St. George's, with a head office in Corner Brook. Qalipu currently has approximately 22,000 members.

Since the 2020 EIS, Marathon has continued to engage and consult with Indigenous groups and local communities and has reached multiple agreements respecting their interests with respect to the project. The project has expanded its local workforce since 2020 and with commencement of early works construction in October 2022 has mobilized local construction workers and equipment to site.

## 20.2 Jurisdiction, Applicable Laws and Regulations

### 20.2.1 Canadian Environmental Assessment Act (2012) and the Newfoundland and Labrador Environmental Protection Act

The proposed project components and ancillary infrastructure are exclusively located within the province of Newfoundland and Labrador. The Valentine Gold Project was therefore subject to the environmental assessment (EA) provisions of Part X of the Newfoundland and Labrador *Environmental Protection Act* (NL EPA), and the Environmental Assessment Regulations (Section 33 (2)). As the proposed production rate for the Valentine Gold Project was greater than 600 t/d, the project was subject to the *Canadian Environmental Assessment Act 2012* (CEAA 2012) (Section 16 (c) of the Regulations Designating Physical Activities).

In August 2019, a new *Impact Assessment Act* (IAA) came into force, replacing CEAA 2012. The Valentine Gold Project was assessed under CEAA 2012 because, at the time, any project for which IAAC had already posted a Notice of Commencement continued under CEAA 2012 by default. Within 60 days, however, proponents could request that an EA be continued instead as an impact assessment under the IAA. Due primarily to the potential impacts on schedule associated with transferring the project assessment regime, Marathon Gold elected to continue under CEAA 2012.

Although there was no formal harmonization agreement between Newfoundland and Labrador and the federal government with regards to the assessment of the Valentine Gold Project, Marathon Gold was permitted to prepare a single set of EA documents that addresses the requirements of both levels of government. Marathon Gold submitted an EA Registration/Project Description for the Valentine Gold Project in April 2019 to the Canadian Environmental Assessment Agency (CEA Agency, now IAAC) and to the EA Division of the provincial Department of Environment, Climate Change and Municipalities (NLDECCM) to initiate the regulatory assessment process. A summary of the Project Description Report is available online at https://ceaa-acee.gc.ca/050/documents/p80169/129223E.pdf. Following a period of public consultation and review of the document by federal and provincial regulators, Marathon Gold was advised on June 21, 2019 that it would be required to prepare an EIS, as was anticipated by Marathon. IAAC published finalized guidelines for the EIS in July 2019, while NLDECCM published finalized guidelines in February 2020.

A single EIS was prepared by Marathon Gold and its primary EA consultant, Stantec Consulting Ltd., to meet the requirements of CEAA 2012, the NL EPA and the project-specific guidelines issued by the federal government and the provincial government. The EIS was submitted to IAAC and NLDECCM on September 29, 2020 and is available online at https://iaac-aeic.gc.ca/050/evaluations/document/136521. On November 3, 2020, the EIS was determined by IAAC to be conforming with the federal guidelines, and the federal and provincial technical review processes began, overseen by IAAC and a provincial Environmental Assessment Committee (EAC) established under the auspices of NLDECCM. A 50-day public review period occurred concurrently with the regulatory technical review.

As part of the standard EA regulatory process, following the technical reviews IAAC issued information requirements (IR) to Marathon Gold, and NLDECCM specified additional information required in order for ministerial determination to be made on the project. Marathon Gold developed responses to these requests, submitted to the regulators through 2021 and early 2022.

The Valentine Gold Project was released from the provincial EA process on March 17, 2022, and from the federal EA process on August 23, 2022. It is anticipated that the Berry pit complex will be subject to provincial EA registration requirements, proposed for submission in 2023, and the changes will be sent via similar submission to IAAC as a change to the previously assessed Designated Project (i.e., ‘the Valentine Gold Project’).

Permitting for site-specific activities related to the Valentine Gold Project’s construction and operation commenced following successful release from the EA processes. Early works construction permitting related to the Valentine Gold Project, excluding elements associated with the Berry pit complex, were in place by October 2022. Early works construction commenced in October 2022. A list of key permits that may apply to the Valentine Gold Project, and that may need to be amended and/or issued by regulators to authorize the Berry pit complex, is provided in Section 20.4 of this report.

### 20.2.2 Species at Risk Act (SARA) and NL Endangered Species Act

Both federal and provincial governments regulate species at risk and their protection through specific legislation. SARA is intended to protect species at risk in Canada and their “critical habitat” (as defined by SARA). Under SARA, proponents are required to demonstrate that no harm will occur to listed species, their residences or critical habitat, or identify adverse effects on specific listed wildlife species and their critical habitat, followed by the identification of mitigation measures to avoid or reduce effects. Activities must comply with SARA, with prohibitions against (1) the killing, harming, or harassing of endangered or threatened SAR (Sections 32 and 36); and (2) the destruction of critical habitat of and endangered or threatened SAR (Sections 58, 60 and 61). The NL ESA also provides special protection for native plant and animal species considered to be endangered, threatened or vulnerable in NL.

### 20.2.3 Fisheries Act

Amendments to the *Fisheries Act* came into force in 2019, reintroducing provisions for the protection of fish and fish habitats, notably the prohibition against harmful alteration, disruption or destruction (HADD) of fish habitat. The Act also prohibits activities that cause the “death of fish” (other than permitted fishing activities), considers the cumulative effects of development activities, and provides additional protection for highly productive, sensitive, rare or unique fish and/or fish habitats. If death of fish or the HADD of fish habitat will likely result from a project, proponents are required to apply for an authorization from the Minister of Fisheries, Oceans and the Canadian Coast Guard as per Paragraph 34.4(2)(b) or 35(2)(b) of the Fisheries Act Regulations. The application must include an offsetting plan to counterbalance the HADD, along with a financial guarantee as an assurance mechanism if the offsetting plan is not completed. A *Fisheries Act* authorization includes terms and conditions the proponent must follow to avoid, mitigate, offset and monitor impacts to fish and fish habitat resulting from a project. Other key amendments to the Act include strengthening the role of Indigenous peoples in application reviews and introducing a new permitting framework and codes of practice, and new decision-making criteria.

### 20.2.4 Metal and Diamond Mining Effluent Regulations (MDMER)

The Metal and Diamond Mining Effluent Regulations (MDMER), pursuant to the *Fisheries Act*, replace the former Metal Mining Effluent Regulations (MMER), with provisions that have come into effect gradually between June 1, 2018 and June 1, 2021.The MDMER strengthens effluent quality standards and improves the efficiency of environmental effects monitoring (EEM).

The MDMER adds requirements for a fish tissue study for selenium (under specified monitoring results), and additional substances to be monitored (i.e., chloride, chromium, cobalt, sulphate, thallium, uranium, phosphorus and manganese) as part of effluent characterization and water quality monitoring studies. Sub-lethal toxicity testing focuses on the most sensitive test species, and biological monitoring studies focus on aquatic communities facing situations of higher risk for environmental effects. Exemptions may be allowed from some biological monitoring requirements for mines with effluent presenting lower risks of affecting fish and fish habitat.

Effective June 1, 2021, the authorized discharge limits for some deleterious substances (arsenic, copper, cyanide, lead, nickel and zinc) were reduced for existing mines (i.e., mines that become subject to the regulations within three years of promulgation of the Amendments), and reduced even further for new mines (i.e., mines that become subject to the regulations more than three years after promulgation of the Amendments). Effective June 1, 2021, un-ionized ammonia was also be added as a deleterious substance as well as a new requirement that effluent to freshwater not be acutely lethal to *Daphnia magna*.

### 20.2.5 Carbon Emissions Pricing

In 2016, the federal government announced the Pan-Canadian Approach to Pricing Carbon Pollution, providing flexibility to provinces and territories to develop carbon pollution pricing systems of their own and outlining the required criteria for these systems (ECCC, 2019). Provinces and territories could implement one of two system types, either a direct price on carbon pollution or a cap-and-trade system (ECCC, 2016a). To support this initiative and to facilitate achieving federal emissions reduction targets, the federal government, in consultation with the provinces and territories, developed the Pan-Canadian Framework on Clean Growth and Climate Change, to which Newfoundland and Labrador signed on in December 2016 (ECCC, 2016b). Provinces and territories without jurisdictional carbon pollution pricing systems (meeting the federal benchmark requirements) are required to comply with the federal carbon pollution pricing system.

The Made-in-Newfoundland-and-Labrador Carbon Pricing Plan was approved by the federal government to meet the requirements of the Pan-Canadian Approach to Pricing Carbon Pollution in October 2018 (NLMAE, 2018). The plan consists of a hybrid system containing performance standards for large emitting facilities and large-scale electricity generation, and a carbon tax on fuel combustion. Marathon continues to engage with regulators regarding carbon emissions reduction and pricing as regulatory plans and requirements evolve federally and provincially.

### 20.2.6 Canadian Navigable Waters Act

The *Canadian Navigable Waters Act* (CNWA), which came into force in August 2019 and replaced the former *Navigation Protection Act*, applies to anyone planning activities that will affect navigation in navigable waters. The CNWA regulates major works and obstructions on navigable waters, even those not listed on the schedule of navigation, and creates a new category for “major works”. Major works are those likely to substantially interfere with navigation, and always require approval from Transport Canada. Transport Canada administers the CNWA through the Navigation Protection Program. No component of the Marathon Gold Valentine project triggered CNWA requirements nor do any envisioned components of the Berry pit complex expansion.

#### 20.2.7 Water Resources Act (2002)

The *Water Resources Act* gives the Water Resource Management Division of the NL Department of Environment, Climate Change and Municipalities (NLDECCM) the responsibility and legislative power for the management of water resources in the province. The Environmental Control Water and Sewer Regulations, under the *Water Resources Act*, which incorporate the limits imposed by the MDMER, will also apply to discharge of water and effluent from the project. Water supply well construction for various infrastructure (e.g., accommodations camp) is regulated under the Well Drilling Regulations (2003), NLR 63/03 under the *Water Resources Act*. The Newfoundland and Labrador Policy for Development in Wetlands (NLMAE 2001) describes developments that are not permitted within wetlands and defines activities that require permitting under Section 48 of the *Water Resources Act*.

Dam improvements and new construction in NL are regulated via the *Water Resources Act*, and a permit to construct a dam is required under Act. The Act does not contain any specific dam safety regulations and the province looks to the Canadian Dam Association (CDA) for guidance on dam safety and references the CDA Dam Safety Guidelines (CDA, 2013) and associated bulletins specifically for any proponent / project contemplating developing or operating a dam for any purpose.

#### 20.2.8 NL Mining Act

The *Mining Act* requires the submission and approval of a Development Plan, Rehabilitation and Closure Plan, and financial assurance, all of which are prerequisites to obtain the project's Mill License.

#### 20.2.9 Historic Resources Act (1985) (HRA)

The *Historic Resources Act* is administered by the Provincial Archaeology Office (PAO) of the Department of Tourism, Culture, Industry and Innovation, and, in the case of architectural resources, by the Heritage Foundation of NL. Historic resources are typically broken down into four broad categories: archaeological sites and materials (e.g., remains of campsites and/or stone tools pre-dating 1960); cultural / spiritual sites (e.g., Indigenous and non-Indigenous burial sites and other sacred places); paleontological sites and materials (fossils); and architectural resources (e.g., historical buildings and properties).

### 20.3 Environmental Studies

#### 20.3.1 Baseline Studies

Table 20-1 lists the environmental baseline studies completed in support of the Valentine Gold Project between 2011 and the spring of 2020.

**Table 20.1: Environmental Studies Included as Baseline Study Appendices to the EIS (Marathon Gold, 2020)**

| Number | Baseline Study Appendix | Attachment Number | Attachment Name |
|---|---|---|---|
| BSA.1 | Dam Safety | 1-A | Dam Breach Assessment and Inundation Study – Valentine Gold Tailings Management Facility (2020) (Golder) |
| | | 1-B | Dam Breach Assimilative Capacity Study for the Valentine Gold Tailings Management Facility (2020) (Golder) |
| | | 1-C | Valentine Gold Project Blast Impact Assessment (2020) (Golder) |
| BSA.2 | Woodland Caribou | 2-A | Fall 2019 Caribou Survey – Remote Cameras (2019) |
| | | 2-B | Spring 2020 Caribou Survey – Remote Cameras (2020) |
| | | 2-C | 2020 Post-Calving Aerial Survey (2020) |
| BSA.3 | Water Resources | 3-A | Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment (2017) |
| | | 3-B | Valentine Lake Project: Preliminary Hydrogeology Assessment, Water Level Data (2019) |
| | | 3-C | Valentine Gold Project Hydrology and Water Quality Monitoring Baseline Report (2020) |
| | | 3-D | Hydrogeology Baseline Report (2020) (GEMTEC) |
| BSA.4 | Fish, Fish Habitat and Fisheries | 4-A | Fish and Fish Habitat Data Report (2012) |
| | | 4-B | Valentine Gold Project: 2018 Fish and Fish Habitat |
| | | 4-C | Aquatic Survey (2019) |
| | | 4-D | Ice Thickness Survey (2020) |
| | | 4-E | Fisheries Baseline Report |
| | | 4-E | 2020 Fish and Fish Habitat Data Report |
| ABSA.5 | Acid Rock Drainage / Metal Leaching (ARD/ML) | 5-B | Phase II ARD/ML Assessment (2020) |
| BSA.6 | Atmospheric Environment | Not Applicable | Air, Noise and Light Baseline Field Study (2020) |
| BSA.7 | Avifauna, Other Wildlife and Their Habitats | 7-A | Winter Wildlife (2013) |
| | | 7-B | 2011 Forest Songbird Surveys (2014) |
| | | 7-C | 2011 Baseline Waterfowl and Waterfowl Habitat Study (2014) |
| | | 7-D | Ecological Land Classification (2015) |
| | | 7-E | Waterfowl (2017) |
| | | 7-F | Vegetation Baseline Study, Rare Plants Survey (2017) |
| | | 7-G | Newfoundland Marten (2018) |
| | | 7-H | Forest Songbird Survey (2019) |
| | | 7-I | Vegetation Baseline Study (2019) |
| BSA.8 | Species at Risk / Species of Conservation Concern | -- | Not Applicable |
| BSA.9 | Community Health, Services and Infrastructure / Employment and Economy | 9-A | An Analysis of the Economic Impacts Associated with Marathon Gold's Valentine Gold Project (2020) |
| | | 9-B | Estimate of Quarterly Direct Employment by Project Phase and National Occupational Classification (NOC) |
| | | 9-C | Educational Requirements by National Occupational Classification (NOC) and Availability of Training Programs within NL |
| BSA.10 | Historic Resources | 10-A | Valentine Lake Project: Historic Resources Baseline Study (2017) |
| | | 10-B | Valentine Gold Project: Historic Resources Baseline Study 2020 Update (2020) |

These environmental studies were attached to the EIS as Baseline Study Appendices and can be accessed at https://iaac-aeic.gc.ca/050/evaluations/document/136521. Baseline studies listed in Table 20-1 were conducted by Stantec except where noted. Subsequent to 2020, further baseline work has been undertaken related to water resources, aquatic and terrestrial communities for the Valentine Gold Project with some specific studies in the area of the Berry pit complex. None of the on-going or completed studies change the conclusions of the previously approved 2020 EIS for the project, without the Berry pit expansion.

### 20.3.2 Environmental Impact Statement

As indicated in Section 20.2.1, Marathon Gold prepared and submitted an EIS to meet the requirements of CEAA 2012, the NL EPA and the project-specific guidelines issued by the federal government and the provincial government for the Valentine Gold Project. The full EIS can be accessed at https://iaac-aeic.gc.ca/050/evaluations/document/136521. A summary of the EIS can be accessed at https://iaac-aeic.gc.ca/050/evaluations/document/136514. As indicated in Section 1.16, the EIS was submitted in 2020, without the Berry pit expansion, and received provincial and federal approval in 2022.

#### 20.3.2.1 Scope and Methods

The scope of the Valentine Gold Project for the purposes of the 2020 EIS included the components and activities required to construct and operate the project facilities, as well as to ultimately decommission, rehabilitate and close the facilities at the end of the project life. Project components and activities associated with the primary mining at the Marathon and Leprechaun pits, milling and processing activities include site and haul road construction and maintenance, waste rock management, electrical power supply and distribution, process and potable water supply and distribution, site wide stormwater and effluent management including monitoring, treatment and discharge; fuel storage and fuelling stations; mine and plant workshops and services; administrative office; personnel accommodations and lunchrooms; and security. A power line connected from nearby NL Hydro's Star Lake Generating Station to the mine site will be required to supply power to the project and will be constructed and operated by NL Hydro. The power line was subject to separate environmental approvals with NL Hydro as the proponent, so was not included within the scope of the project; however, it was considered within the EIS as a contributor to potential cumulative effects.

The assessment of environment effects focused on valued components (VCs), which are the elements of the environment that could be affected by a project and are of importance or interest to regulators, Indigenous groups and stakeholders. Fifteen VCs were identified as relevant and important to the Valentine Gold Project environmental assessment based on regulatory requirements and engagement with Indigenous groups and stakeholders. These were: Atmospheric Environment; Groundwater Resources; Surface Water Resources; Fish and Fish Habitat; Vegetation, Wetlands, Terrain and Soils; Avifauna; Caribou; Other Wildlife; Community Services and Infrastructure; Community Health; Employment and Economy; Land and Resource Use; Indigenous Groups; Historic Resources; and Dam Infrastructure. For each VC, a local assessment area (LAA) and regional assessment area (RAA) were identified to provide spatial boundaries for the assessment.

Scoping establishes the parameters of the EA and focuses the assessment on relevant issues and concerns. The factors considered for the EA for the project included the following:

- purpose of and need for the project
- alternatives to the project and alternative means of carrying out the project
- public and stakeholder comments and Indigenous group input

- local knowledge
- environmental effects of the project, including effects due to accidents and malfunctions, as well as consideration of cumulative effects of the project in combination with other projects and activities
- technically and economically feasible mitigation measures to avoid or reduce adverse effects or enhance or prolong beneficial environmental effects
- residual (post-mitigation) environmental effects that are beneficial or harmful that are likely to be caused by the undertaking regardless of the mitigation measures applied
- significance of the identified environmental effects
- requirements for follow-up programs
- changes to the project that may be caused by the environment
- the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future
- the future predicted condition of the environment without the project.

The EIS included a characterization of the existing conditions within the spatial boundaries of each VC, including a discussion of the influences of past and present physical activities on the VC leading to the current conditions. The assessment followed standard EA methods for describing project interactions with each VC and for determining potential environmental effects associated with the project during construction, operation, and decommissioning, rehabilitation and closure phases.

The EA process served as a mechanism to consider results of engagement in early project planning, and Marathon's previously approved 2020 EIS incorporated outcomes of engagement to avoid and reduce adverse environmental effects. Several important aspects of the project concept and engineering design have been modified, refined and adapted to reduce potential adverse effects. These changes were made during the project pre-feasibility and previous feasibility studies, detailed engineering design and in consideration of discussions with regulators, stakeholders and Indigenous groups, and in response to input received during public, Indigenous and regulatory review of the Registration / Project Description and EIS submitted to the federal and provincial governments in 2019 and 2020.

#### 20.3.2.2 Results of the EIS

The environmental assessment predicted that routine project activities associated with the Valentine Gold Project will not cause significant adverse environmental effects on any of the VCs, with the exception of caribou. Similar results were determined for cumulative effects, where project effects are considered in combination with the effects of other projects (past, present, and reasonably foreseeable future projects).

The general results of the assessment of the Valentine Gold Project that relate to the key issues raised by regulators, Indigenous groups, and stakeholders, are summarized below. The EIS should be consulted for a full description of predicted residual effects of the project (Marathon Gold, 2020) (https://iaac-aeic.gc.ca/050/evaluations/document/136521):

- Employment and Economic Benefits: There are substantial employment and economic benefits to flow from the project to the benefit of local communities, the Central Region of NL, and the province. The development of an on-site accommodations camp for all workers, on-site medical and emergency response resources will reduce potential adverse effects on local community infrastructure and services. Local hiring and contracting policies for direct employment and contracts, and induced employment and business in the region will result in substantial benefits to the local, regional and provincial economy over a 17-year period (including construction, operation and decommissioning, rehabilitation and closure).

- Water Resources: The environmental assessment predicted no significant adverse residual effects on groundwater or surface water resources resulting from routine project activities, or from the cumulative effects of the project in combination with other past, present, or reasonably foreseeable future projects. In the event of an accidental event such as a large spill of hazardous materials or effluent release, the risk of effects occurring is reduced based on contingency and emergency response plans. For a dam breach of the full-height TMF, there will be surface water effects in the Victoria River and a relatively small portion of Red Indian Lake only, and the effects are substantially reduced 2 km downstream from the TMF, in the Victoria River.

- Fish and Fish Habitat: The environmental assessment predicted no significant effects on fish and fish habitat resulting from routine project activities or from the cumulative effects of the project in combination with other past, present, or reasonably foreseeable future projects. Some small streams and ponds on site will be affected by project development and operation, most of which is habitat for threespine stickleback only. Marathon Gold has developed, submitted and will implement a Fish Habitat Offsetting Plan in consultation and with approval of Fisheries and Oceans Canada (DFO) that will counterbalance harmful alteration disruption and destruction (HADD) of fish habitat. For accidental events, a potential TMF dam breach carries the most substantial risk. The assessment has determined that for the worst-case TMF dam breach, effects will be limited to the Victoria River and a relatively small area of Red Indian Lake, and therefore will not affect Atlantic salmon resources in the Exploits River.

- Caribou: Potential project residual effects of change in habitat and mortality risk are predicted to be low magnitude for all four herds. The magnitude for change in movement for the Gaff Topsails, Grey River and La Poile herds is also predicted to be low. However, the residual effect for change in movement for the Buchans herd is predicted to be high due to the amount of overlap of the project with an existing migration corridor, and the proportion of collared caribou that use the path overlapping the project. The Buchans herd, which is part of South Coast sub-population, represents 13.7% of the total caribou population on the Island. The prediction of a significant effect is established on a conservative basis and reflects both the uncertainty in how project activities may affect the migratory movement of the Buchans herd and what the long-term effects on the herd may be, and the uncertainty of success of the proposed mitigation measures. During the EA Information Requirements (IR) process Marathon proposed to modify the waste rock storage area (WRSA) at the Marathon pit complex to further mitigate caribou passage effects. In essence this design change for caribou mitigation modified the Marathon pit WRSA from a large single cell design west of the pit to a two-cell design reducing the west cell footprint and creating a second cell immediately east of the pit. The reduction in the original cell size will open up more caribou passage opportunity and the second cell to the east will divert caribou passage around the open pit ultimately making the site more permeable for migrating caribou. Marathon Gold is committed to working with regulators, Indigenous groups and stakeholders to develop comprehensive programs to monitor migration patterns and populations of the caribou herds in the area, and in particular the Buchans herd. Marathon Gold has worked with provincial regulators to conduct ongoing baseline monitoring programs subsequent to the 2020 EIS, has developed a Caribou Protection and Environmental Effects Monitoring Plan which it has implemented since the start of early works construction and will continue to adapt these monitoring programs over the life of the project.

- Victoria Lake Reservoir and Victoria Dam: The environmental assessment predicted no significant effects on Victoria Lake Reservoir or Victoria Dam resulting from routine project activities, or from the cumulative effects of the project in combination with other past, present, or reasonably foreseeable future projects. Due to Marathon's re-location of the TMF downstream of the Victoria Dam, a worst-case TMF dam breach is also not expected to impact the Victoria Dam.

With respect to cumulative effects, residual adverse effects from project activities may combine with other mining projects; exploration activities; forestry; hunting, outfitting, trapping, and/or fishing; off-road vehicles; hydroelectric development; and linear features (e.g., power lines) to result in cumulative environmental effects. Except for caribou, the VCs are not anticipated to experience adverse effects that would contribute cumulatively to significant residual effects. The project is conservatively predicted to result in significant adverse effects on caribou, specifically related to change in movement for the Buchans herd. Future activities associated with other projects are expected to combine with potential project effects contributing to the predicted high magnitude effect on movement of the Buchans herd and may measurably affect the abundance and/or sustainability of the Buchans herd in the RAA.

With respect to accidental events, the following potential accidents or malfunction scenarios were identified as having the potential to occur during the project: TMF malfunction; open pit slope failure; low-grade ore and high-grade ore stockpiles and waste rock piles slope failure; fuel and hazardous materials spill; unplanned release of contact water; sewage treatment plant failure; over blasting; fire / explosion; vehicle accident; and watercourse crossing failure. In the unlikely event of a worst-case industrial accident or malfunction which results in a large-scale release into the environment (i.e., worst-case TMF malfunction or fire / explosion), there is a potential for significant residual adverse effects to VCs. However, the risk of a significant effect associated with an accident or malfunction is low, given the project design, maintenance and monitoring measures that will be in place to reduce the risk of such an occurrence. Emergency response plans and contingency measures will be in place to limit the extent and nature of potential environmental effects in the event of an accident or malfunction. For minor incidents with a higher likelihood of occurrence (e.g., small hydrocarbon spills from equipment), the residual effects are not likely to be significant, as these will be contained within the mine site and readily cleaned up.

#### 20.3.2.3 Provincial EA Release and Conditions

The Valentine Gold Project was released from the provincial EA process on March 17, 2022. The Minister of Environment and Climate Change informed Marathon Gold Corporation that, under the authority of Section 67(3) (a) of the *Environmental Protection Act*, the Lieutenant-Governor in Council has released the Valentine Gold Project from further environmental assessment (https://www.gov.nl.ca/releases/2022/ecc/0317n03/), subject to the following terms and conditions:

- The proponent shall adhere to all mitigation, monitoring and commitments stated in the Environmental Impact Statement (EIS) submitted on November 3, 2020, and in the amended EIS submitted August 6, 2021 and in the second amendment to the EIS submitted on January 7, 2022.

- The proponent shall submit an Environmental Protection Plan (EPP) for all applicable mining construction activities, for the Minister's approval, prior to the start of mining construction. The EPP shall describe the environmental protection and mitigation measures that will be applied throughout the life of this component of the Project to avoid or minimize potential negative effects on the environment associated with the Project and will be updated by Marathon Gold Corporation as needed.

- The proponent shall submit an EPP for all applicable mining operations activities, for the Minister's approval, prior to the start of mining operations. This EPP will describe the environmental protection and mitigation measures that will be applied throughout the life of this component of the project to avoid or minimize potential negative effects on the environment associated with the project and will be updated by the proponent as needed.

- The proponent shall implement, review, and update the Caribou Protection and Environmental Effects Monitoring Plan in collaboration with the Department of Fisheries, Forestry and Agriculture (FFA) – Wildlife Division. This review should occur twice per year, every year of project operation and prior to each caribou migration, and should include sharing and reviewing of all data collected during the most recent migration, including the operational response of the mine site.

- The proponent shall fund the hiring of one full-time environmental ecologist position and one full-time environmental effects monitor position to report to FFA for all phases of the project, and shall provide financial support to offset additional survey activities required by FFA (i.e., winter surveys, fall classifications and surveys specific to monitoring caribou response to the project).

- The proponent shall provide annual funding to support three graduate students, over all phases of the project, to study specific and cumulative project effects.

- The proponent shall submit a Fish Data Collection Plan for the approval of the FFA – Wildlife Division by May 1, 2022.

- The proponent shall, in consultation and partnership with the Water Resources Management Division (WRMD) of the Department of Environment and Climate Change, establish a real-time water resource monitoring network that shall be comprised of water quantity, quality, climate and groundwater monitoring stations. The proponent is to bear all costs associated with the monitoring network and must install the required stations to collect baseline data prior to project commencement, and throughout the life of the project.

- The proponent shall submit a plan, developed in consultation with WRMD, to address remediation of the Victoria River valley in the case of a tailings dam breach that blocks the flow of water in the Victoria River and results in water backing up towards the Victoria Dam prior to commencement of project construction.

- The proponent shall meet with NL Hydro at least quarterly, commencing with project construction, to discuss issues of mutual concern including but not limited to dam safety, blasting, site access, and further studies, and shall undertake and cover the cost associated with the following work, in consultation with NL Hydro:

    - Modelling of the tailings dam breach that incorporates outflows from the Victoria Reservoir and development of dam breach inundation maps. This shall include assessment of a range of annual exceedance probability floods where incremental differences may be of more impact, and further refinements to improve the accuracy of the model used in the analysis including survey work to establish accurate elevations. The modelling shall be submitted to the WRMD for review prior to the commencement of project construction;

    - Monitoring and review of ground acceleration and blasting impacts on the Victoria Dam by a qualified geotechnical engineer to ensure impacts are maintained within acceptable limits. NL Hydro shall be consulted on the review prior to the undertaking of any blasting operations that have the potential to impact existing NL Hydro assets, including the Victoria Dam; and

    - Notification of NL Hydro of changes to the project design, site access, the commencement of major works that may result in increased vehicle traffic on the access road, blasting operations, and any other activities, which may affect the operations of NL Hydro or the safety of its' assets, including the Victoria Dam.

- The proponent shall undertake further investigation to confirm the hydraulic conductivity of the Valentine Lake thrust fault. Marathon Gold Corporation shall also undertake further characterization of the Victoria Lake Group rock units. Full characterization of these units must be undertaken prior to the start of mine development. The data shall be used to update the groundwater model and the new modelling results shall be submitted and found by the WRMD to be sufficient, prior to the start of mine development.

- The Department of Industry, Energy and Technology requires the development of a Benefits Agreement that meets the approval of the Minister of Industry, Energy and Technology. The Benefits Agreement must also include a Gender Equity, Diversity and Inclusion Plan that meets the requirements of the Minister responsible for Women and Gender Equality. Marathon Gold Corporation is required to finalize the Benefits Agreement and Gender Equity, Diversity and Inclusion Plan and obtain Ministerial approval prior to the commencement of site activities.

- The proponent is required to submit an Outfitter Environmental Effects Monitoring Plan (OEEMP) in partnership with the Newfoundland and Labrador Outfitters Association (NLOA) that aligns with the Memorandum of Understanding that Marathon Gold Corporation and the NLOA signed on October 4, 2021. The OEEMP must be submitted to the Department of Tourism, Culture, Arts and Recreation for review in consultation with the NLOA and must be approved by the Department of Tourism, Culture, Arts and Recreation prior to construction activities.

- The proponent is required to construct its facility and operate it in a manner consistent with the Management of Greenhouse Gas best available control technology requirements prescribed in the Management of Greenhouse Gas Regulations.

On October 6, 2022, the provincial Minister of Environment and Climate Change issued a letter to Marathon Gold indicating that the EA conditions required pre-construction had been met.

#### 20.3.2.4 Federal EA Release and Conditions

The Valentine Gold Project was released from the federal EA process on August 23, 2022. The Decision Statement (144901E.pdf (iaac-aeic.gc.ca) from the federal Minister of the Environment stated:

> "In accordance with paragraph 52(1)(b) of the Canadian Environmental Assessment Act, 2012, after considering the report of the Agency on the Designated Project and the implementation of mitigation measures that I consider appropriate, I have determined that the Designated Project is not likely to cause significant adverse environmental effects referred to in subsection 5(2) of the Canadian Environmental Assessment Act, 2012.
>
> In accordance with subsection 53(2) of the Canadian Environmental Assessment Act, 2012, I have established the conditions below in relation to the environmental effects referred to in subsection 5(2) of the Canadian Environmental Assessment Act, 2012, with which the Proponent must comply."

The federal decision statement set out a series of conditions of EA release on which Marathon Gold is actively working to fulfill. The conditions are grouped by theme as follows:

- general conditions including continued consultation, development of follow-up programs, annual reporting and information sharing requirements, and conditions related to changes in proponent and/or changes to the Designated Project

- fish and fish habitat

- migratory birds

- greenhouse gas emissions
- health and socio-economic conditions of Indigenous peoples
- current use of lands and resources for traditional purposes
- physical and cultural heritage and structures, sites or things of historical, archaeological,
- paleontological or architectural significance
- species at risk
- accidents and malfunctions
- conditions and activity schedules
- record-keeping.

#### 20.3.2.5 Future Environmental Assessment for Berry Pit Complex

The Berry pit complex was not included in the description of project components and activities or the Project Area (PA) of the Valentine Gold Project Environmental Assessment, although many of the baseline studies undertaken in support of the Valentine Gold Project EA included the area of the Berry pit complex in their respective Local Assessment Area (LAA). As such, the provincial and federal EA releases do not include the proposed Berry pit expansion.

From the Provincial Environmental Assessment perspective, the inclusion of the Berry pit expansion would be considered a new undertaking, whereas federally the Berry pit expansion would be considered a change to the Designated Project. The federal designated project list (Physical Activities Regulations- SOR 2019-285) sets out specific triggers related to project changes such as mine expansions and refers to metal mine expansion of mining area and/or mill capacity after expansion. The proposed Berry pit complex does not meet the thresholds identified in the Regulations such that a federal EA would be triggered under the *Impact Assessment Act*.

Marathon Gold will confirm EA requirements for the Berry pit expansion with provincial and federal regulators.

### 20.3.3 Environmental Management and Monitoring Plans

The 2020 EIS included commitments to implement mitigation and conduct follow-up monitoring for VCs throughout project construction, operation and decommissioning, rehabilitation and closure (Marathon Gold, 2020). Many of these commitments will be operationalized through the implementation of environmental management and monitoring plans. The EIS contains commitments to prepare the following:

- Environmental Protection Plan including an Air Emissions Management Plan, Avifauna Management Plan, and Wildlife Management Plan
- Chemical and Hazardous Materials Storage and Handling Plan
- Waste Management Plan
- Contingency Plan including contingency plans for Fuel and Hazardous Material Spills, Extreme Weather, Failure of Erosion and Sedimentation Control Measures and / or Dams; Forest Fires; Wildlife Encounters and Discovery of Historic Resources

- Explosives and Blasting Management Plan
- Fish Habitat Offsetting Plan
- Water Management Plan
- Gender Equity and Diversity Plan
- Benefits Agreement
- Community Cooperation Agreements
- TMF Operations, Maintenance and Surveillance Manual
- Public (Stakeholder) Safety Plan (dams)
- Effluent Monitoring Plan
- Tailings / Effluent Release Emergency Response Plan
- Emergency Response and Spill Contingency Plans
- Follow-up and Monitoring Plan(s) for Outfitters, Groundwater, Greenhouse Gas Emissions, Avifauna, Other Wildlife, Country Foods, Ambient Air Quality, Fish and Fish Habitat, Surface Water and Noise
- Caribou Protection and Environmental Effect Monitoring Plan
- Rehabilitation and Closure Plan
- Acid Rock Drainage and Metal Leaching Management Plan
- Traffic Management Plan.

## 20.4 Environmental Permitting

Upon release from the provincial and federal EA processes in 2022, numerous approvals, authorizations, and permits are required prior to initiating project construction. Each of these permits or authorizations is applied for separately with relevant information included in the applications. Where an EA is required, regulators can only issue permits following release of the project from the EA process (which has occurred for the Valentine Gold Project, and not the Berry pit expansion area). However, to reduce potential schedule delays, some long-lead items can be initiated and discussed with regulators, and some applications can be filed prior to release from the EA processes. Compliance with terms and conditions of approvals, standards contained in federal and provincial legislation and regulations, and commitments made during the EA processes (including application of mitigation measures and monitoring and follow-up requirements), need to be assured throughout all project phases.

Table 20-2 provides a general, overarching list of approvals, authorizations, and permits that may be required from provincial and federal agencies and departments for a mine in Newfoundland and Labrador. Note that, as the project is not located within a municipality, municipal approvals, authorizations, and permits are not required. Marathon Gold currently has mineral licenses and permits in place for the existing exploration activities, accommodations camp and early works activities for the Valentine Gold Project, as identified in Table 20-3, Marathon Gold will continue to engage with regulatory authorities throughout project planning to confirm regulatory permitting and compliance requirements.

**Table 20.2: General Environmental Approvals, Authorizations & Permits Potentially Required for a Mine in NL**

| Environmental Permit, Approval or Authorization Activity | Issuing/Approval Agency |
|---|---|
| **Provincial** | |
| Release from EA Process | NLDECCM– Minister |
| Approval of Environmental Protection Plan | |
| Monitoring Plan for Certificate of Approval | NLDECCM– Pollution Prevention Division |
| Certificate of Approval for Construction and Operation (Industrial Processing Works) | |
| Certificate of Approval for Generators | |
| Approval of Environmental Contingency Plan/Emergency Spill Response | |
| Permit to construct a Non-Domestic Well | NLDECCM– Water Resources Management Division |
| Certificate of Environmental Approval to Alter a Body of Water | |
| Culvert Installation | |
| Fording/Bridge | |
| Pipe Crossing/Water Intake | |
| Stream Modification or Diversion | |
| Other Works Within 15 m of a Body of Water | |
| Water Use License | |
| Permit to Construct a Potable Water System | |
| Permit to Occupy Crown Land | Department of Fisheries and Land Resources (NLDFFA) – Crown Lands Division |
| Permit to Control Nuisance Animals | NLDFFA– Wildlife Division |
| Operating Permit to Carry out an Industrial Operation During Forest Fire Season on Crown Land | NLDFFA– Forestry and Agrifoods Agency |
| Permit to Cut Crown Timber | |
| Permit to Burn | |
| Surface and Mining Leases | NL Department of Industry, Energy and Technology – Mineral Development and Mineral Lands Division |
| Development Plan | |
| Rehabilitation and Closure Plan | |
| Financial Assurance | |
| Mill License | |
| Quarry Development Permit | |
| Blasters Safety Certificate | Department of Digital Government and Service NL – Government Service Centre |
| Approval for Storage and Handling of Gasoline and Associated Products | |
| Fuel Tank Registration | |
| Approval for Used Oil Storage Tank System (Oil/Water Separator) | |
| Certificate of Approval for a Waste Management System | |
| Certificate of Approval for a Sewage/Septic System | |
| National Building Code – Fire, Life Safety, and Building Safety | |
| Buildings Accessibility Registration and Permit | |
| Food Establishment License | |
| Application to Develop Land for Septic | |
| **Federal** | |
| Release from EA Process | Impact Assessment Agency |
| *Fisheries Act* Authorization and Request for Review | Fisheries and Oceans Canada (DFO) |
| Tailings Impoundment Area Designation | Environment and Climate Change Canada |
| Metal and Diamond Mining Effluent Regulations (MDMER) process with ECCC including notification, identification of final discharge point, effluent monitoring, and environmental effects monitoring (EEM) | |
| Approval of MDMER Emergency Response Plan | |
| Approval to Interfere with Navigation | Transport Canada |
| License to Store, Manufacture, or Handle Explosives (Magazine License) | Natural Resources Canada |

**Table 20.3: Environmental Approvals, Authorizations & Permits in Place (or Applied for) for Exploration & the Valentine Gold Project**

| Environmental Permit, Approval or Authorization Activity | Issuing/Approval Agency |
|---|---|
| **Provincial** | |
| Release from EA Process | NLDECCM – Minister |
| Approval of Environmental Protection Plan | |
| Certificate of Approval for Construction and Operation (Industrial Processing Works) - Early Works | NLDECCM – Pollution Prevention Division |
| Certificate of Approval for Generators (awaiting approval) | |
| Approval of Environmental Contingency Plan/Emergency Spill Response (in EPP) | |
| Permit to construct a Non-Domestic Well – Temporary Camp | |
| Culvert Installation | |
| Fording/Bridge | NLDECCM – Water Resources Management Division |
| Pipe Crossing/Water Intake (Awaiting Approval) | |
| Water Use License | |
| Permit to Construct a Potable Water System (Awaiting Approval) | |
| Permit to Cut Crown Timber | NLDFFA – Forestry and Agrifoods Agency |
| Surface and Mining Leases | NL Department of Industry, Energy and Technology – Mineral Development and Mineral Lands Division |
| Development Plan (Awaiting Approval) | |
| Rehabilitation and Closure Plan (Awaiting Approval) | |
| Financial Assurance – Early Works | |
| Quarry Development Permit (Awaiting Approval) | |
| Blasters Safety Certificate | Department of Digital Government and Service NL – Government Service Centre |
| Approval for Storage and Handling of Gasoline and Associated Products | |
| Fuel Tank Registration | |
| Certificate of Approval for a Waste Management System (in CoA) | |
| Certificate of Approval for a Sewage/Septic System (awaiting approval) | |
| National Building Code – Fire, Life Safety, and Building Safety – Temporary Camp (Permanent Camp Awaiting Approval) | |
| Buildings Accessibility Registration and Permit – Temporary Camp (Permanent Camp Awaiting Approval) | |
| Food Establishment License – Temporary Camp | |
| Application to Develop Land for Septic | |
| **Federal** | |
| Release from EA Process | Impact Assessment Agency |
| *Fisheries Act* Authorization | Fisheries and Oceans Canada |
| License to Store, Manufacture, or Handle Explosives (Magazine License) | Natural Resources Canada |

## 20.5 Baseline Hydrology

Baseline hydrology studies for the project site were completed by Stantec from 2012 to 2022. The following summarizes key baseline hydrology observations and findings.

The Valentine Gold Project area sits at the drainage divide between Victoria Lake Reservoir draining to the southeast and the Victoria River draining to the north. Valentine Lake and the Victoria Steadies drain to the Exploits River via the Victoria River and Red Indian Lake. Victoria Lake, which formerly drained to the Victoria River, now because of hydroelectric development, drains from the southeast end of the reservoir through the Bay D'Espoir watershed. The

Exploits and Bay D'Espoir watersheds are two of the largest watersheds in the island portion of the province and are significantly altered and controlled by hydroelectric developments.

The Valentine Gold Project is primarily focused on four feature complexes, the Leprechaun, Berry and Marathon deposit complexes and the processing area and adjacent TMF. The Leprechaun complex area is comprised of two watersheds, one flowing north to Valentine Lake and the other flowing south to Victoria Lake Reservoir. The Leprechaun open pit area consists of three ponds (Middle, East and West ponds), small creeks, and wetlands. The East Pond drains to Valentine Lake and the Middle and West Ponds drain to Victoria Lake. All other areas of the Leprechaun complex drain via a series of small tributaries to Victoria Lake. The Berry complex is comprised of three watersheds all draining to Valentine Lake. One watershed is associated with ValP1 and ValP2 ponds originating in the Leprechaun complex and flowing to Valentine Lake through the Berry complex. A second watershed originates in the Marathon complex and drains though a portion of the Berry complex via ValP3 pond to Valentine Lake. The third watershed is a drainage area directly adjacent to Valentine Lake. The Marathon open pit area contains a single pond and small stream which drains east to tributaries of Victoria Steadies and then to the Victoria River. Other areas of the Marathon complex will also drain to the Victoria Steadies and west to Valentine Lake, which drains to the Victoria River. The processing plant area drains to a tributary of Victoria Lake and the TMF area drains via a series of small tributaries to the Victoria River. Project infrastructure was mapped into 22 small sub-watershed areas ranging in size from 0.1 to 2.3 $km^2$.

Climate affects the runoff characteristics and stream flows that define hydrologic conditions in the project area. The project area lies within the Western Mountains and Central Uplands climate zone of NL and is generally characterized by cloudy conditions, strong winds and heavy snowfall in winter. The climate normal annual precipitation amount is 1,236 mm at the Buchans climate station. The highest mean monthly precipitation occurs in December (123.1 mm) and the lowest mean monthly precipitation occurs in April (85.7 mm). The snowfall climate normal statistics show that average annual snowfall recorded at Buchans is 359.3 cm, with month-end snow depths typically highest in February (refer to Section 5.4 of this report).

Based on a review of soils, surficial geological maps and aerial photographs, the overburden material in the project area generally consists of a discontinuous layer of till of variable thickness over exposed bedrock. The Water Resources Atlas of Newfoundland classifies the surficial geology as a veneer of glacial till (less than 1.5 m) over bedrock (NLDOEC 1992). The project area is considered part of the Mountain pedoclimatic zone, which is characterized by stony, shallow, coarse textured soils (Agriculture Canada 1988). These soils are further described as imperfectly drained, commonly very shallow and associated with large areas of rock outcrops. Coarse textured soils are considered to correspond with sands and loamy sands.

The topography of the site is hilly with elevations in the local sub-watersheds ranging from 273 to 437 meters above sea level (masl). A local ridge runs through the project area in a NE to SW direction, with water draining east and south to the Victoria River and Victoria Lake Reservoir or north and west to Valentine Lake.

A regional hydrological assessment was conducted using the Water Survey of Canada hydrometric monitoring stations flow data from the region. The mean annual stream flow ranges from 51% to 86% of climate normal total precipitation. The remaining 14% to 49% of total precipitation is evapotranspiration. A streamflow coefficient for the project area was calculated to be 62.5% and was determined using the climate normal precipitation data from Buchans and the evapotranspiration rate 463 mm from the Water Resources Atlas of Newfoundland (NLDOEC 1992. The mean annual flow per unit area was 0.034 $m^3/s/km^2$ and ranged from 0.020 $m^3/s/km^2$ to 0.037 $m^3/s/km^2$. Stream flow tends to peak twice a year in April to May due to spring freshet, and in November due to autumn rainfall. Minimum flows are observed during winter months from January to February and late summer in August. Regional relationships were developed for annual flows, low flows, and peak flows.

Local hydrologic conditions were assessed using the continuous water level data collected at nine hydrometric monitoring stations and manual water discharge measurements at three hydrometric stations. Initial monitoring installations occurred

October 2012 and stations added as the project plans developed in subsequent years. Local hydrometric stations have been sited to monitor flows in watercourses or water levels in ponds that would either be future receiving waters or may be affected by future project activities, and the distribution of the hydrometric network provides a highly correlated representation to local hydrometric conditions in the project area.

The mean annual flows ranged from 0.017 to 0.040 $m^3/s/km^2$ and correlates with regional estimates. The low flows ranged from 0.0 to 0.001 $m^3/s/km^2$ and the peak flows ranged from 0.259 to 2.12 $m^3/s/km^2$. Monthly baseflows contributions to totals were estimated to range from 23% (April) to 43% (March) with an annual average baseflow contribution estimated at 35%. Baseflows vary with depth to water Table and areas with higher rock permeability.

## 20.6 Hydrogeology

Several hydrogeological programs have been completed since 2017, including project-wide baseline hydrogeology programs by Stantec Consulting Ltd. (Stantec 2017, 2019) and GEMTEC Consulting Engineers and Scientists Ltd. (GEMTEC 2020). The results of the hydrogeological baseline programs were used to support early mine planning and engineering, and environmental permitting requirements. Additional hydrogeological investigations have been conducted as part of geotechnical programs by Terrane Geosciences Incorporated (Terrane) (2020, 2021, 2022a and 2022b) and GEMTEC Consulting Engineers and Scientist Limited (GEMTEC) (2021, 2022a, 2022b, 2022c) to support this updated feasibility study, including the installation of 19 boreholes completed as monitoring wells in the vicinity of the proposed waste rock piles (nine of these completed within the footprint of the proposed Berry waste rock pile), and 22 within the proposed footprint of the tailings management facility.

Based on a review of geological maps and aerial photographs, the overburden material in the vicinity of the project primarily consists of a discontinuous layer of till of variable thickness. Along with glacial deposits, areas of organic and peaty soils are present overlying either till or bedrock in areas of poor drainage. Areas of high ground in the Leprechaun and Marathon deposit areas are characterized by bedrock outcrop exposed within the till veneer and various other surficial deposits. The Leprechaun deposit lies along the boundary of the Neoproterozoic Valentine Lake intrusive complex and the Silurian Rogerson Lake Formation of the Exploits Subzone. The Berry deposit lies along the boundary of Valentine Lake Quartz Monzonite and the Spruce Book Formation. The Marathon deposit is located within the Valentine Lake Intrusive Complex (Van Staal et al., 2005). A well-defined northeast-trending regional fault (Valentine Lake Shear Zone) occurs immediately to the south of the Leprechaun deposit.

The prominent topographic ridge that underlies the project is inferred to act as a regional flow divide for both surface water drainage and groundwater flow and defines an area of groundwater recharge. Overall, the direction of shallow groundwater flow is assumed to follow topography and surface runoff, and discharge into the low-lying surface waterbodies that border the property. Locally, groundwater flow from the Marathon deposit is expected to travel southeast towards Victoria River and northwest towards Valentine Lake, which flows into Victoria River northeast of the project, and ultimately discharges into the Exploits River approximately 100 km to the north. Groundwater from the Berry deposit is expected to flow either directly west into Valentine Lake or toward the small tributaries associated with ValP2 and ValP3 which also drain to Valentine Lake. Groundwater from the Leprechaun deposit is expected to primarily flow south-southeast towards Victoria Lake Reservoir, with a lesser component flowing north towards Valentine Lake.

Hydraulic testing completed to date includes packer testing of geotechnical boreholes, slug testing of monitoring wells, and short-term constant rate testing of historical exploration boreholes. Results of these programs indicate a trend in decreasing hydraulic conductivity with depth with a geometric mean of $7 \times 10^{-6}$ m/s determined for the overburden till material, decreasing two orders of magnitude to geometric means of $6 \times 10^{-8}$ m/s, $3 \times 10^{-8}$ m/s, and $5 \times 10^{-8}$ m/s respectively, for deep bedrock associated with the Marathon, Leprechaun, and Berry deposits. This decreasing trend in hydraulic conductivity with depth is attributed to decreasing bedrock weathering and fracturing with depth and is observed in the geotechnical RQD dataset. No correlation between hydraulic conductivity and lithological unit has been identified to date, supporting the assumption that permeability is likely controlled by fractures and joints. There is currently no indication of significantly increased hydraulic conductivity in areas tested along the thrust fault separating the Valentine Lake Intrusive Complex and the Rogerson Lake Conglomerate. Baseline water quality testing to date indicates a calcium-sodium-bicarbonate-chloride-sulphate type groundwater that is characterized as clear, slightly hard to very hard, and predominantly slightly alkaline with moderate acid buffering potential and low conductivity, indicating fresh conditions. Langelier Saturation Index values for groundwater samples indicate groundwater is neither strongly corrosive nor scale-forming with respect to solid $CaCO_3$, with generally low dissolved metals content.

Groundwater modelling was conducted to support the EIS. Groundwater inflow rates to the open pits required for dewatering were estimated to be up to 1,350 $m^3$/d at the Leprechaun pit, 900 $m^3$/d at the Berry pit complex and 1,846 $m^3$/d at the Marathon pit, based on the full development of the pits. The groundwater flow model is being updated to account for recent packer and pump testing results as well as feasibility level edits to the Berry pit complex.

## 20.7 Acid Rock Drainage/Metal Leaching

The methods for the ARD/ML assessment followed the Mine Environment Neutral Drainage (MEND) publication entitled “Prediction Manual for Characterizing Drainage Chemistry from Sulphidic Geologic Materials” (Price 2009). The geochemistry testing program included:

- static testing of approximately 2,800 samples of waste rock, ore, overburden, and tailings
- characterization of composite samples using the static tests and mineralogical methods
- kinetic testing of composite samples including 29 humidity cells, nine field leach bins (FLBs), three ageing tests, and two sub-aqueous columns tests.

Acid rock drainage potential classification is based on calculation of the neutralization potential ratio (NPR=NP/AP) of samples compared to thresholds proposed by Price (2009). A sample is conservatively classified as potentially acid generating (PAG) if the NPR is below 2; otherwise, the sample is classified as non-PAG. The fraction of PAG samples for a given lithology was multiplied by the total tonnage of each lithology to estimate the mass of PAG materials in each pit (referred below as a sample count method). In addition, an ARD block model was developed for the Marathon pit to provide more accurate percentages and distributions of PAG materials.

Metal leaching potentials were evaluated by comparing the concentrations of trace elements in the leachates from kinetic tests with the effluent quality limits prescribed in the Metal and Diamond Mining Effluent Regulations (MDMER). Concentrations exceeding MDMER limits indicate parameters with high leaching potential.

The key findings of the ARD/ML assessment and modelling of contact water quality are summarized in the subsections below.

### 20.7.1 Overburden Stockpiles

Up to 3.4% of overburden from the Leprechaun pit and up to 10% of overburden from the Marathon pit could be PAG (NPR<2). All samples of overburden from the Berry pits are non-PAG. If PAG overburden is identified by testing during operations and prior to use, the material will be segregated and placed in the waste rock pile in accordance with the management protocols for PAG waste rock to limit potential for development of ARD. Kinetic testing and modelling show that management of ML from overburden is not required. All stockpiled non-PAG overburden will be consumed during closure rehabilitation.

### 20.7.2 Waste Rock Piles

Up to 1.0% and up to 13% of waste rock from Leprechaun and Berry deposits, respectively, are classified as PAG. Marathon pit will generate between 1.5% and 3.7% PAG classified rock based on evaluation using ARD block model and sample count methods, respectively. Stantec Consulting Ltd. (Stantec) recommends blending PAG and non-PAG rock and encapsulation of the blended rock with non-PAG rock to reduce risk from development of localized ARD. This management strategy is proposed for all lithologies containing PAG rock, except for PAG gabbro from the Marathon deposit, which also indicated metal leaching above MDMER limits soon after exposure. Potentially acid-generating gabbro will be segregated during excavation and transported to the footprint of the LGO stockpile allowing for an active treatment should ARD/ML drainage develop. This material will be relocated to one of the Berry pits when mining of this pit is complete. Leachates from other lithologies of waste rock are not expected to exceed MDMER limits based on available kinetic testing and water quality modelling predictions (Stantec 2020a, b and c). Therefore, no mitigation of ML is currently expected to be required for waste rock except for PAG gabbro, which will be handled as described previously. The waste rock piles will be covered with overburden and revegetated during rehabilitation further reducing the risk of ARD/ML.

### 20.7.3 Low-Grade Ore Stockpiles

Approximately 3.6% and 43% of LGO from Leprechaun and Berry deposits, respectively, are estimated to be PAG. Marathon pit will generate between 14% and 49% of LGO which is classified as PAG based on assessment using the ARD block model and sample count method, respectively. Stockpiles of LGO will be processed before the estimated time of ARD onset for PAG LGO based on kinetic testing. There are no exceedances of the MDMER limits observed in leachates from kinetic tests under neutral pH conditions. In the case that additional information indicates the need for water treatment, the current mine plan segregates effluent from the Marathon-Berry LGO stockpile from other mine water streams to facilitate collection and water treatment. To further reduce ARD/ML risks, non-PAG LGO will be stockpiled preferentially with PAG LGO routed to the mill feed as soon as practicable, provided the grade requirement for the mill feed is met.

### 20.7.4 Ore and Tailings

High-grade ore (HGO) from all three deposits will be stockpiled together. Approximately 3.7% and 59% of Leprechaun and Berry HGO classify as PAG, respectively. Between 15% (estimated from ARD block model) and 51% (from sample count) of Marathon HGO is conservatively classified as PAG. In composite samples, the mixture of the ores is non-PAG and the HGO stockpile is not expected to generate ARD. In addition, estimated ARD onset time for PAG ore is longer than the expected life of the HGO stockpile. No exceedances of the MDMER limits were observed in leachates from high grade ores under neutral pH conditions. If acidic conditions develop, MDMER effluent limits could be exceeded for copper (Cu) in pockets of PAG ore from Marathon. Drainage from the HGO stockpile flows to the TMF and any potential acidity would be neutralized in the tailings pond or in the mill during processing. To limit exposure of PAG HGO within the stockpile, this ore could be preferentially directed to the mill feed, while non-PAG HGO could be allocated to the stockpile, provided the grade requirement for the mill feed is met.

Composite samples of tailings classify as non-PAG and are not expected to generate ARD. The tailings pond and pore water in tailings will likely exceed the MDMER limits for total cyanide CN(T), un-ionized ammonia (N-NH3,UN), and Cu. Water treatment is currently included in the project design to mitigate these exceedances. Tailings beaches in the TMF will be rehabilitated prior to closure when tailings deposition transitions to the Berry pits. The approach of preferentially stockpiling non-PAG LGO will create a non-PAG layer of tailings on the surface of the TMF. This non-PAG layer is expected to consume oxygen, thereby reducing oxygen diffusion into tailings deposited earlier in the mine operation. Tailings will be covered with soil and revegetated during the rehabilitation period. Tailings deposited in the Berry pits will be flooded as quickly as practicable, limiting further oxidation and production of ARD/ML. By post closure, TMF overflow quality is expected to improve because there will be no further tailings production, the final layer of tailing should be non-

PAG, and as a result of cover placement. However, CNT, Cu, and N-NH3,UN are predicted to exceed the MDMER limit in toe seepage from the tailings dam in post closure. Therefore, passive treatment of the seepage is currently considered.

### 20.7.5 Open Pits

Mine water and discharges from Marathon and Leprechaun pit lakes are not expected to become acidic or exceed MDMER effluent limits post-closure. Operational sampling of pit walls, monitoring of mine water, and pit lake monitoring will verify these predictions. Water quality in the Berry pits that contain tailings will be managed through permanent stratification of pit lakes and/or in pit (passive) treatment to produce pit outflow water quality that complies with discharge limits.

## 20.8 Rehabilitation and Closure Planning

Rehabilitation is defined as measures taken to restore a property as close to its former use or condition as practicable, or to an alternate use or condition that is deemed appropriate and acceptable by NL Department of Industry, Energy and Technology (DIET), NLDECCM, and NLDFFA-WD. For mining projects, a Rehabilitation and Closure Plan is a requirement under the *Newfoundland and Labrador Mining Act* (Chapter M-15.1 Sections 8, 9 and 10). There are three key stages of rehabilitation activities that occur over the life span of a mine, which include:

- progressive rehabilitation
- closure rehabilitation
- post-closure monitoring and treatment.

Progressive rehabilitation involves rehabilitation that is completed throughout the mine operation prior to closure wherever practicable to do so. This includes activities that contribute to the overall rehabilitation effort and would otherwise be carried out as part of the closure rehabilitation at the end of mining life.

Closure rehabilitation involves activities that are completed after mining operation ceases, to restore and/or reclaim the project to as close to its pre-mining condition as practicable. Such activities include demolition and removal of site infrastructure, re-vegetation of disturbed areas, and other activities to achieve the requirements and goals as detailed in the project’s Rehabilitation and Closure Plan.

Once closure rehabilitation activities have been completed, a period of post-closure monitoring is required to show that the rehabilitation has been successful. The post closure monitoring will continue until it has been demonstrated that the rehabilitation of the site has been successful. The site can then be closed out or released by NLDIET and an application to relinquish the property back to the Crown. The process of attaining Recognized Closed Mine status under federal MDMER is similar to that prescribed by NLDIET.

A Rehabilitation and Closure Plan has been submitted and approved for early works construction. A complete Rehabilitation and Closure Plan for life of mine has been developed for the project and submitted to NLDIET for approval. The following sections outline the rehabilitation and closure philosophies and concepts used in the development of the project’s Rehabilitation and Closure Plan. The Berry pit expansion will require an amendment to the project’s Rehabilitation and Closure Plan.

In addition to compliance with the approved Rehabilitation and Closure Plan, Marathon Gold will be required to register closure of the mine as an undertaking subject to assessment under the NL Environmental Protection Act. It is anticipated that such assessment will engage the closure requirements of the Rehabilitation and Closure Plan.

### 20.8.1 Approach to Rehabilitation and Closure

As the planning and design stages of the project continue, consideration for the future closure issues and requirements will continue to be incorporated into project design. In efforts to be proactive with rehabilitation activities, the following steps will be implemented:

- disturbances of terrain, soil, and vegetation will be limited to the areas necessary to complete the required work as defined by the project.
- organic soils, mineral soils, glacial till, and excavated rock will be stockpiled separately, where practicable, and protected for future use.
- stabilization of disturbances will be completed to reduce erosion and promote natural revegetation.
- natural revegetation will be encouraged throughout the project area.

Organic material, and overburden will be removed from various development areas and stockpiled for progressive and final rehabilitation activities. Some overburden (suitable glacial till) may be used as a low-permeability fill material for dams, ditching, and as a base for stockpile pads to assist in drainage control. As the project design process moves forward, the volume of soils required for all rehabilitation activities will be assessed, to ensure that sufficient soils are available for rehabilitation, while avoiding excavating and stockpiling soils in greater quantities than those required, thereby resulting in increased project footprint and soils excavation, management and closure impacts.

ARD/ML test results are presented in detail in the Phase III ARD/ML Assessment Report and summarized in Section 20.7 of this report. Overall, the soils and rock materials at the site have a low risk of being acid generating, with some ore materials having an increased risk and are currently classified as PAG. However, with appropriate mitigation (mixing and blending of PAG and non-PAG materials and encapsulation), none of the permanent site waste rock stockpiles are expected to generate acidic drainage. As such, the site design and development, as well as the plans for rehabilitation and closure (soil cover), include measures to address ARD/ML issues. In the unlikely event that further testing determines that ARD/ML may present a risk post-closure, the project design, as well as the rehabilitation and closure plans will be adapted. Tailings toe seepage is predicted to have MDMER exceedances of $CN_T$, Cu, and $N\text{-}NH_3$ UN. During operations, a treatment plant and polishing pond are proposed to treat TMF effluent quality. During closure and post closure passive treatment approaches such as constructed/engineered wetlands, permeable reactive barriers will be considered to address water quality exceedances.

### 20.8.2 Progressive Rehabilitation

As the mine advances from development to operational stages and throughout the operational phase of the project, opportunities for progressive rehabilitation are possible. Opportunities include, but are not limited to, the following:

- demolishing and rehabilitation of construction or exploration related infrastructure (e.g., buildings, roads, and laydown areas)
- grading and revegetating completed tailings areas, where practicable

- stabilizing and temporarily seeding longer-term topsoil and overburden stockpiles to reduce erosion
- installing rock barricades and signage along the highwalls of the open pits
- progressively rehabilitating waste rock piles as benches and/or sections are completed (ongoing over life of project) – waste rock piles will be constructed from the ground up using slopes and benches of 10 m height; when a bench is finished in one area, the slope surfaces will be covered with overburden / organics (anticipated 0.3 m each in thickness) and revegetated, with the surfaces of the horizontal benches scarified and covered with an anticipated 0.3 m thickness of organics and also revegetated.
- completing revegetation studies and trials
- decommissioning and rehabilitating the TMF while project operation continues, once tailings deposition moves from the TMF to the Berry open pit in Year 9 of the operation phase (noting that decant water from the TMF will continue to be recycled for process water)
- directing tailings, waste rock and contact water to the Berry pit, and contact water to the Leprechaun and Marathon pits, as each of the pits is exhausted and while milling operation continues; based on the hydrogeological assessment, it has been determined that the pits could require up to 42 years to fully flood without supplementing inflow (alternatively, the EIS considered an accelerated pit filling scenario where water would be pumped from Valentine Lake and Victoria Lake Reservoir to the Marathon and Leprechaun pits, respectively, to further reduce the time to flood the pits from 42 years to a total of 8 years). The Berry pit will be backfilled with waste rock in its northern and central basins and tailings in the southern basin. Based on projected final tailings and water surface elevations the southern Berry pit may not require augmented or accelerated filling.

### 20.8.3 Closure Rehabilitation

Closure rehabilitation activities will be carried out at the mine site once it is no longer economical to mine, or once resources have been exhausted. In general, the closure activities that will be completed for the site include, though are not limited to, the following, and will be conducted in accordance with regulations at the time of closure:

- removing hazardous chemicals, reagents and similar materials for re-sale or disposal at an approved facility as per provincial and federal regulations
- disconnecting, draining, cleaning, disassembling and, where feasible, selling equipment for re-use to a licensed scrap dealer; if this is not achievable, equipment will be removed from site for disposal
- dismantling and removing site buildings and surface infrastructure for re-use, disposal, or recycling at approved facilities
- demolishing concrete foundations to a minimum of 0.3 m below the surface grade and covering areas with natural overburden materials to promote re-vegetation; demolished concrete will be used as fill material for re-grading or removed from site for disposal in an appropriate facility
- removing and rehabilitating fuel and explosive storage and dispensing facilities; this will include Environmental Site Assessments, if required

- breaching water management ponds to allow drainage to the surrounding areas for natural filtration – prior to release to the environment, water quality testing will be completed on the pond waters; these features will subsequently be graded and contoured to re-establish drainage patterns and revegetated as required
- decommissioning any wells on site (including groundwater monitoring wells and potable drinking water wells), in compliance with the Guidelines for Sealing Groundwater Wells (Government of NL 1997)
- re-establishing pre-mining site drainage patterns to the extent feasible
- grading and/or scarifying disturbed areas, covering these with overburden and organic materials, where required, and seeding to promote natural re-vegetation.

#### 20.8.3.1 Open Pits

Upon closure, equipment and dewatering infrastructure will be removed, and the open pit(s) will be allowed to fill with surface water runoff, precipitation, and groundwater seepage. Natural filling of the pits is forecast to require from 34 to 38 (Marathon pit) and 37 to 42 (Leprechaun pit) years without supplementing inflow. While the site is still in operation, and potentially for some time following operation and prior to final closure, excess site contact water will be directed to the open pits, as practicable, to accelerate filling. It is also proposed to pump water from Valentine Lake and Victoria Lake Reservoir to further expedite filling of the Marathon pit and Leprechaun pit, respectively, reducing the flooding times to within the closure and anticipated post-closure monitoring periods. Water would be withdrawn from Victoria Lake Reservoir (0.178 $m^3/s$) and Valentine Lake (0.145 $m^3/s$) over an eight-year period. Further details and assessment of potential effects of the proposed approach are provided in Chapter 7 of the EIS. The Berry pit complex incorporates three pit basins, the northern basin will be backfilled with waste rock as will a portion of the central basin while the southern basin will be backfilled with tailings slurry commencing after year 9 of operations. Berry pit complex filling with water after deposition ceases will be shortened due to the volume of waste rock, tailings and tailings water deposited such that accelerated filling of the Berry pit may not be required.

Once filled to the spill elevation, the water will be permitted to overflow the pits. A detailed assessment of the pit geometry and spill elevation in relation to the surrounding terrain will be required during operation to determine where the water will ultimately flow from the pit post-closure, and a channel may be required to reconnect this drainage to the natural, adjacent waterbodies. Monitoring of water quality within the open pit during filling will be completed to assess the potential discharge water quality and to determine if any water treatment could be required until water quality meets the appropriate criteria.

Rock or soil barricades and signage will be constructed along the crest of the open pit(s), as well as across any access roads or ramps, barricading access to the open pit(s). Warning signs will be erected at regular intervals along the berm, notifying the public of the open pit. Areas of sloped access, above and below the final high-water mark, will be constructed to permit ingress and egress for people or animals.

#### 20.8.3.2 Waste Rock Piles

Four waste rock piles adjacent to each of the open pits, will be created throughout the operational life of the project. These piles will be sloped and benched in accordance with the closure design as they are developed, creating overall safe slopes for final closure of three horizontal to one vertical (3H:1V), incorporating interim benching. The waste rock piles will also be progressively rehabilitated via placement of overburden / organic materials on benches and slopes and subsequent revegetation. At final closure, only the remaining areas of the waste rock piles that could not be progressively rehabilitated will require rehabilitation. The ditching and sedimentation ponds constructed to manage the runoff from these piles will be left in place and retrofitted to provide passive water quality treatment until the runoff and seepage water quality is suitable for direct release, at which point the ditching and pond infrastructure can be removed and regraded to return drainage patterns to as close to natural as possible.

#### 20.8.3.3 Tailings Management Facility

The tailings that are produced from the milling process will be deposited in the TMF for the first nine years of the project operation phase using a thickened tailings process as described in Section 17. Once the Berry open pit is exhausted in Year 9, the tailings will be pumped to and deposited in this open pit.

The TMF is being designed for closure in accordance with the guidance provided by the CDA, such that the geometry of the dams will not require modification during the mine closure phase to provide long-term stability of the facility. When the tailings deposition is moved to the Berry open pit in Year 9, the process of closure and rehabilitation of the TMF will commence. It is expected that the water treatment plant and polishing pond components of the TMF will operate for some time, and that water collecting within the TMF (seepage drainage from the tailings, as well as runoff) will continue to be pumped to the mill as reclaim water. Exposed tailings will be covered with overburden, organic soil materials and revegetated, and as water quality and flows reach equilibrium within the facility, a larger, closure spillway will be constructed to lower the water level within the tailings impoundment. At this time, the water treatment plant and polishing pond will be removed and water flowing from the tailings impoundment will be channelled to release to the environment.

After closure, covered tailings beaches are not expected to produce acidic runoff and/or have high or moderate leaching except for P. The seepage from the TMF is predicted to exceed MDMER limits for $CN_T$, un-ionized $NH_3$, and Cu in post-closure. Runoff over the covered tailings surface will be considered non-contact water and will drain overland via the post-closure spillway. Passive treatment systems for TMF toe seepage are considered as a mitigation option.

As the project progresses, Marathon Gold will evaluate the tailings impoundment and consider options to further dewater the stored tailings working towards classifying the TMF as a landform (under the CDA closure guidelines) and therefore alleviating the requirements for maintaining and inspecting the dams post-closure. Conservatively, Marathon Gold will work with NLDIET and NLDECCM, Water Resources Division, and use the guidance established by the CDA and MAC, and Global Industry Standards on Tailings Management, to establish a plan for long-term inspection and maintenance of the dams.

The regulatory landscape regarding tailings management has been changing because of significant dam failures in recent years, and it is anticipated that regulation and guidance will continue to change with respect to tailings management, closure of tailings facilities, and needed alignment with climate change. Marathon Gold is committed to working with provincial regulators and following CDA guidelines so that the TMF is designed, constructed, operated, and ultimately rehabilitated, in a safe and responsible manner that will protect the environment in the long term.

### 20.8.4 Post-Closure and Long-Term Monitoring

The post-closure monitoring program will continue after final closure activities are completed for an estimated 6 to 10 years noting that final closure for some key components will be closed and rehabilitated prior to the end of the operation phase of the project. The monitoring period could also be shortened based on the satisfaction of regulators that physical and chemical characteristics of the site are acceptable and stable. When the project is deemed physically and chemically stable, it is currently anticipated that the site will be relinquished to the Crown, noting the requirements for relinquishment in 2044 may be different from current requirements.

The post-closure and long-term monitoring plans are not yet developed. These programs will be developed based on the experience gained through monitoring plans during construction and operation and it is anticipated that the closure monitoring plans will mirror the operational monitoring program to provide continuity of data and a historical baseline. It is also anticipated that, as the post-closure monitoring program moves forward, the monitoring requirements will decrease until ultimately, they will no longer be required.

#### 20.8.5 Cost Estimate for Closure

The estimated cost to complete the closure activities for the Valentine Gold Project included in the financial analysis sections of this feasibility study report are based on Marathon Gold completing the closure activities described above. These costs are based on the current level of detail for the project and is equivalent to a Class 4 Estimate (±25%). Refer to Section 21 for further closure cost details.

#### 20.8.6 Financial Assurance

As defined in the *Mining Act*, a lessee shall provide financial assurance as part of a Rehabilitation and Closure Plan prior to site development. The financial assurance amount is based on the cost estimate for the closure activities as presented in the Rehabilitation and Closure Plan. The complete Rehabilitation and Closure Plan for the Valentine Gold Project has been developed and submitted to NLDIET for approval. Refer to Section 21 of this report for further closure cost details.

### 20.9 Community Relations and Consultation

Marathon Gold is committed to operating the project within a sustainable development framework which reduces harm to the environment, contributes to local communities, respects human and Indigenous rights, and adheres to openness and transparency in operations. One of the key principles of sustainable development is meaningful engagement with the individuals, communities, groups, and organizations interested in or potentially affected by the project to build and maintain positive, long-term and mutually beneficial relationships. Marathon Gold has engaged and continues to engage with relevant government departments and agencies, Indigenous groups, and stakeholder organizations, including communities, business and industry organizations, fish and wildlife organizations, environmental non-governmental organizations and individuals.

The objectives of Marathon's engagement and consultation efforts are to:

- provide project information and updates on a timely and continuing basis in a manner which is inclusive, culturally sensitive and appropriate to the circumstances of Indigenous groups and stakeholders
- engage Indigenous groups and stakeholders in respectful and meaningful dialogue throughout the environmental assessment process and over the life of the project
- identify, document, and respond to issues or concerns by Indigenous groups and stakeholders throughout the environmental assessment process and over the life of the project
- integrate feedback from Indigenous groups, communities and stakeholders into project planning and execution, the assessment of effects and the implementation of mitigation
- demonstrate how issues and concerns raised during engagement have been addressed.

### 20.10 Regulatory Engagement

Marathon Gold met with representatives from individual provincial and federal departments and agencies throughout the preparation of the Valentine Gold Project 2020 EIS, particularly to seek clarification on interpretation and application of the EIS Guidelines requirements and will continue to meet as needed throughout the EA Conditions fulfillment, permitting and Berry complex EA and permitting processes. Marathon Gold has also met with the municipal governments of the communities located closest to the project. Outcomes of regulatory consultation and regulatory review processes (of the Project Description and EIS guidelines) were incorporated as applicable throughout the 2020 EIS, including in VC selection, approach to baseline studies, modelling methodology, proposed mitigation measures, and depth and focus of the various VC assessments.

Engagement with stakeholders and Indigenous groups, initiated prior to and during the EA process, has continued following EA release. The public and Indigenous groups will also be consulted regarding the Berry pit expansion and associated project changes, prior to and during regulatory consultation.

The regulatory authorities that have an interest in the project are identified in Table 20-4.

**Table 20.4: Relevant Regulatory Authorities & Jurisdictions**

| Federal Government | Provincial Government | Municipal Government |
|---|---|---|
| • Impact Assessment Agency of Canada (formerly Canadian Environmental Assessment Agency)<br>• Environment and Climate Change Canada<br>• Fisheries and Oceans Canada<br>• Health Canada<br>• Natural Resources Canada<br>• Indigenous Services Canada | • Department of Industry, Energy and Technology<br>• Department of Fisheries, Forestry and Agriculture<br>• Department of Environment, Climate Change and Municipalities<br>• Department of Tourism, Culture, Arts and Recreation<br>• Department of Health and Community Services<br>• Office for the Status of Women | • Town of Buchans<br>• Town of Millertown<br>• Local Service District (LSD) of Buchans Junction<br>• Town of Badger<br>• Town of Bishop's Falls<br>• Town of Grand Falls-Windsor |

#### 20.10.1 Stakeholder Engagement

Public engagement and public participation activities undertaken by Marathon Gold have involved a wide range of stakeholders, including communities, fish and wildlife organizations, environmental non-governmental organizations, trade and industry groups, cabin owners, individuals and members of the public. Key community and stakeholder engagement activities have included:

- information sharing through Marathon's website, social media, quarterly newsletters and direct mailouts
- meetings in person, by conference and video calls, and virtual meetings to provide corporate and project updates and information on the environmental assessment process; this has included in person and virtual public meetings (the latter format was adopted to adhere to provincial COVID-19 restrictions)
- exit surveys and questionnaires to enable community residents and members of organizations to provide input and feedback.

Many questions and comments raised during the engagement activities for the project focused on the following topics:

- capitalizing on employment, training, and procurement opportunities from the project
- equitable representation of local residents and businesses in employment and contracting
- tailings pond design and potential impacts on water quality
- impacts to fish and fish habitat, should a dam breach occur
- compensation for impacts to fish habitat
- emergency response should a dam breach occur
- design alternatives to the TMF
- management of waste rock and acid rock drainage / heavy metals concerns
- air quality concerns related to emissions, greenhouse gases (GHGs), tailings and dust
- use of cyanide
- impacts to wildlife (caribou, moose) and associated outfitting operations
- socio-economic effects (salaries, accommodations, health services and working conditions)
- life of the mine and rehabilitation of the mine site.

Further details on Marathon's response to the questions and concerns raised can be found in Section 3 of the Valentine Gold Project EIS (Marathon Gold, 2020).

### 20.10.2 Indigenous Engagement

The Federal EIS Guidelines (Part 2, Section 5) identify Miawpukek and Qalipu as Indigenous groups that may be affected by the project. No other Indigenous groups have come forward or have been identified by either level of government or by Marathon Gold as having an interest in, or being potentially affected by, the project. Marathon Gold has provided each Indigenous group with opportunities to learn about the project, including its location, design, potential effects and proposed mitigation measures, to provide input respecting the potential effects of the project upon Indigenous interests and activities, and to discuss potential mitigation, avoidance and monitoring measures. More specifically, Marathon's engagement activities with each group have included the following during and post-EA:

- Information Sharing Initiatives: Transmission of, and opportunities to review, project-related documentation including EIS baseline information, newsletters, notices and other materials (e.g., press releases), related to the project, Marathon's corporate operations, and employment and business opportunities.

- Meetings: Meetings and offers to meet with Indigenous leadership, community members and other groups in person (by video, conference calls, or webcast) to discuss the project and associated regulatory processes, issues and concerns and potential mitigation, and holding a project review workshop to provide information related to the project's proposed layout and design.

- Land and Resource Use Studies: Offers of funding to conduct land and resource use studies and to collect Indigenous knowledge to enhance Marathon's understanding of the potential project effects on Indigenous interests and activities, and to incorporate into the EIS and/or post-EA planning and design.

- Avoidance, Mitigation and Monitoring Initiatives: Discussion with representatives of each Indigenous group of potential mitigation, monitoring and avoidance measures to address potential effects. Marathon has been actively reviewing and engaging with Indigenous groups in the development of follow-up programs.

Throughout engagement, Indigenous groups have been given opportunities to provide Marathon Gold with their views on:

- Indigenous activities or interests in or near the project area or elsewhere that might be relevant to the assessment of the project and its potential effects

- the effects of changes to the environment on their health and socio-economic conditions, physical and cultural heritage and current use of lands and resources for traditional purposes pursuant to paragraph 5(1)(c) of CEAA 2012

- the fish habitat offsetting plan and baseline aquatic environmental effects monitoring study design.

Marathon's engagement process has been based upon consistent and regular contact and information exchange designed to enable each group or representative organization to understand the project and identify potential effects on their communities, activities, and asserted or established Indigenous rights.

Questions and concerns on a variety of issues were raised by Indigenous groups including:

- need to balance economic benefits against potential adverse environmental effects
- education, training, and employment opportunities, specifically employment for women
- need for ongoing engagement and engagement with youth
- involvement in environmental monitoring
- tailings management
- impacts to wildlife, including caribou, moose and pine marten
- impacts on fish and fish habitat, with particular reference to salmon and trout
- water quality and water treatment
- impacts to Victoria Dam
- impacts to air quality
- rehabilitation and closure

- impacts to plants
- limitation of access to, and impacts upon, current use of lands and resources for traditional purposes
- impacts to heritage resources.

Further details on Marathon's response to the questions and concerns raised can be found in the Chapter 3 of the EIS (Marathon Gold, 2020).

# 21 CAPITAL AND OPERATING COSTS

Unless stated otherwise, all costs presented in this section are in Canadian dollars (CAD or C$).

## 21.1 Capital Costs

The estimate conforms to Class 3 guidelines for a feasibility study level estimate with a ±15% accuracy according to the Association for the Advancement of Cost Engineering International (AACE International).The base date for the capital cost estimate is Q3 2022.

Table 21-1 on the following page provides a summary of the estimate for overall initial capital cost. The estimate includes costs for mining, site preparation, process plant, tailings facility, power infrastructure, camp, owners' costs, spares, first fills, buildings, roadworks, and off-site infrastructure.

The estimate is based on an EP+CM execution approach for the process/infrastructure areas, and Owner-managed execution for the site-wide civil earthworks camp and power infrastructure packages, as outlined in Section 24. The 2021 FS capital cost was based on an engineer, procure, and construct (EPC) basis for process and related infrastructure. Marathon Gold has advanced the project under an engineering procurement and construction management (EPCM) execution model where SNC-Lavalin (SLI) was awarded the EP Services (EP) and Progesys HQ (Progesys) was selected as the construction management services (CM) provider.

The following parameters and qualifications were considered:

- No allowance has been made for exchange rate fluctuations.
- There is no escalation added to the estimate.
- A growth allowance was included.
- Data for the estimates have been obtained from numerous sources, including:
    - mine schedules
    - feasibility-level and detailed engineering design
    - topographical information obtained from the site survey
    - geotechnical investigations
    - budgetary equipment quotes from Canadian and International suppliers
    - purchased equipment including permanent camp, mining mobile equipment, drills, SAG mill and drive, ball mill and drive, jaw crusher, cyclones, ADR circuit, pumps, thickener, and screens
    - budgetary unit costs from numerous local NL contractors for civil, concrete, steel, electrical, piping and mechanical works
    - awarded contracts for camp catering, civil earthworks, explosives, fuel and equipment grease and lubricants
    - data from similar recently completed studies and projects.

Major cost categories (permanent equipment, material purchase, installation, subcontracts, indirect costs, and Owner's costs) were identified and analysed. Percentage of contingency was allocated to each of these categories on a line-item basis based on the accuracy of the data. An overall contingency amount was derived in this fashion.

As outlined in Table 21.1 the overall initial capital cost of the project in Phase 1 will be approximately C$534 million, including all capitalized sunk costs between 2021 and October 31, 2022.

**Table 21.1: Summary of Capital Costs (C$M)**

| WBS | Description | Initial Cost (C$M) | Expansion Cost (C$M) | Sustaining Costs (C$M) |
|---|---|---|---|---|
| 1100 | Mine Infrastructure and Services | 28 | 0 | 10 |
| 1200 | Mine Fixed Equipment | 11 | 0 | 0 |
| 1300 | Mine Mobile Equipment | 28 | 0 | 253 |
| 2000 | Process Plant - Site Wide | 124 | 0 | 0 |
| 2100 | Primary Crushing | 3 | 0 | 0 |
| 2200 | Grinding | 22 | 0 | 0 |
| 2300 | Leaching | 1 | 2 | 0 |
| 2400 | Elution & Gold Room | 7 | 0 | 0 |
| 2500 | Tailings Disposal | 3 | 0 | 1 |
| 2600 | Reagents | 2 | 0 | 0 |
| 2700 | Air & Water Services | 1 | 5 | 0 |
| 2800 | Process Buildings | 0 | 0 | 0 |
| 2900 | Phase 2 - Flotation / Concentrate Leach / Pebble Crushing | 0 | 34 | 0 |
| 3100 | Bulk Earthworks | 18 | 0 | 8 |
| 3200 | High-Voltage Power Switchyard & Power Distribution | 26 | 0 | 0 |
| 3300 | Communications | 3 | 0 | 0 |
| 3400 | Fuel Storage | 0 | 0 | 0 |
| 3500 | Sewage | 1 | 0 | 0 |
| 3600 | Infrastructure Buildings | 11 | 0 | 4 |
| 3700 | Water Supply | 0 | 0 | 35 |
| 3800 | Tailings Management Facility | 33 | 0 | 55 |
| 3900 | Permanent Camp | 28 | 2 | 0 |
| 4100 | Main Access Road | 6 | 0 | 0 |
| 4200 | High-Voltage Power Supply | 16 | 0 | 0 |
| 5100 | Temporary Construction Facilities & Services | 30 | 7 | 0 |
| 5200 | Commissioning Representatives & Assistance | 2 | 0 | 0 |
| 5300 | Spares | 1 | 0 | 2 |
| 5400 | First Fills & Initial Charges | 1 | 0 | 0 |
| 6300 | Phase 1 - Engineering Subconsultants & QA/QC | 21 | 0 | 0 |
| 6500 | Phase 2 - EPCM Scope Delivery | 0 | 8 | 0 |
| 7100 | Project Staffing & Expenses | 7 | 0 | 0 |
| 7400 | Home Office Financial, Legal, Insurance | 4 | 0 | 0 |
| 7500 | Owner's Cost | 59 | 0 | 0 |
| - | Closure Costs | - | - | 72 |
| - | Salvage Value | 0 | 0 | (30) |
| | **Subtotal** | **496** | **60** | **410** |
| 8100 | Project Contingency | 39 | 6 | 17 |
| | **Total Project Costs** | **534** | **66** | **427** |

## 21.2 Basis of Capital Cost Estimate – Initial and Expansion

### 21.2.1 Exchange Rates

Vendors and contractors were requested to price in native currency. The estimate is prepared in the base currency of Canadian dollars (CAD or C$). Pricing has been converted to Canadian dollars using the exchange rates in Table 21-2.

**Table 21.2: Estimate Exchange Rates**

| Code | Currency | Exchange Rate |
|---|---|---|
| CAD | Canadian | 1.00 |
| EUR | Euro | 1.53 |
| USD | United States Dollar | 1.33 |

### 21.2.2 Area 1000 – Mining

Mine capital costs have been derived from vendor quotations and operational data collected by other Canadian open pit mining operations.

Pre-production mine operating costs (i.e., all mine operating costs incurred before mill start-up) are capitalized and included in the capital cost estimate. Pre-production pit operating costs include grade control, drill and blast, load and haul, support, and GME costs. All mine operations site development costs—such as clearing and grubbing, topsoil stripping, standing water removal, haul road construction and explosive pad preparation—are capitalized.

The initial primary mine equipment fleet purchases are planned as financing or lease agreements with the vendors. This covers the purchases for drills, excavators, wheel loaders, haul trucks, graders, water trucks, dozers and fuel/lube trucks made between 2022 and 2025. Down payments and monthly lease payments are capitalized through the initial and sustaining periods of the project. All ancillary fleet and all expansion and sustaining replacement fleet purchases after 2025 are treated as a traditional capital purchase arrangement in the period the equipment is required.

Purchases for the primary mine equipment fleet have been made in advance of the project construction in late 2022, and a vendor holding fee has been allocated to these equipment purchases and has been capitalized. Estimated fleet spare parts not covered under consignment arrangements with the vendors have also been capitalized.

The following items are capitalized through the initial and sustaining periods:

- explosives storage area site prep and initial blasting supplies
- communication radios
- mine survey gear and supplies
- geology, grade control, and mine planning software licenses
- maintenance tooling and supplies
- mine rescue gear
- piping for pit dewatering.

### 21.2.3 Area 2000 – Process Plant and 3000 – On-Site Infrastructure

Pricing in the estimate is categorized as shown in Table 21-3.

**Table 21.3: Pricing Status Definitions**

| Pricing Code | Price Description | Definition |
|---|---|---|
| A | Actual | Expenditure of item is complete |
| P | Purchase Order | Official document issued by a buyer committing to pay the seller for the sale of specific products or services to be delivered in the future |
| F | Firm Bid | Firm pricing from current award / committed purchase orders, (sub) contracts or from a firm quotation (within the quote validity period) |
| B | Budgetary Quote | Price based on budget quotes solicited by Procurement department specifically for the project (data sheets available) |
| H | Historical | Pricing for similar items from completed projects or historical reports. Historical pricing will typically require escalation to the base date and/or size/capacity factoring |
| E | In-house | Pricing estimated using in-house information |
| S | Sunk | Expenditure of item was completed either during or prior to the current Project and the supply cost for item is shown as zero |

All major processing equipment for both Phase 1 and Phase 2 was sized based upon the process design criteria, as outlined in Chapter 17. Once the mechanical equipment list was outlined, the mechanical scopes of work were derived and sent for pricing by Canadian and International equipment suppliers (see Table 21-4). Once the quotations were reviewed and integrated, in total 67% of the value of mechanical and electrical equipment was sourced from vendor pricing, with the remainder of equipment pricing based on escalated pricing from the previous capital cost estimate or in house pricing. Expansion (Phase 2) capital costs were escalated from the 2021 cost estimate.

**Table 21.4: Equipment Pricing Basis by Packages**

| Package No. | Package Name | Pricing Basis |
|---|---|---|
| PM2005 | Platework | BQ/IH |
| PM2104 | Jaw Crusher Package | LOA |
| PM2201 | Mills (Ball & SAG) | LOA |
| PM2001 | Agitators | IH |
| PM2501 | Thickeners & Floc System | LOA/IH |
| PM2203 | Cyclones | LOA |
| PM2007 | Horizontal Centrifugal Pumps | LOA/IH |
| PM2008 | Sump Pumps | LOA |
| PM2006 | Vertical Cantilever Slurry Pumps | LOA |
| PM2009 | Positive Displacement Pumps | IH |
| PM2701 | Plant Compressors & Air Package | IH |
| PM2102 | Conveyors (Belt & Feeders) | BQ/IH |
| PM2206 | Cranes & Hoists | IH |
| PM2101 | Apron Feeder | LOA |
| PM2302 | Specialty Screens / CIL Screens | IH |
| PM2202 | Vibrating Screens | LOA |
| PM3702 | Fresh Water Barge & Pipeline | IH |
| PM2605 | Sterilization Skid | IH |
| PM2604 | Reagents Package | IH |
| PM2204 | Gravity Concentrator & ILR | LOA |
| PM2401 | Acid Wash, Elution, ADR & Gold Equip. | LOA |
| PM2602 | Pebble Lime System | IH |
| PM3501 | Sewage Treatment Plant | IH |
| PM2703 | Fire Water Pumps | IH |
| PM2003 | Samplers | LOA |
| PJ2001 | Cyanide Analyzer and Detectors | IH |

For all electrical tagged equipment, no updated packages were received, all tagged equipment from the EPC estimate was escalated based on the SLI escalation indices at 14%.

To support the major mechanical and electrical equipment packages, the process plant and infrastructure engineering design was completed to a feasibility study and detailed engineering level of definition, allowing for the bulk material quantities (steel, concrete, earthworks, piping, cables, instruments, etc.) to be derived for the major commodities, as outlined in Table 21-5. Commodity resource codes were realigned from the 2021 FS capital cost estimate.

**Table 21.5: Material Commodity Codes**

| Commodity Resource Code | Commodity Description |
|---|---|
| 1000 | Excavation |
| 2000 | Fill & Backfill |
| 3000 | Concrete |
| 4000 | Structural Steel |
| 5000 | Exterior Wall |
| 6000 | Roofing |
| 7000 | Piping - buried |

In August 2022, Marathon engaged contractors that provided pricing for the EPC estimate to refresh their original pricing submissions to reflect current market pricing. Refresh bids were provided and updated where applicable for the current estimate. The returned price schedules included all direct and indirect costs to perform the works (Table 21-6). Contract and package numbers were updated to align with the Marathon's codes.

Most of the labour and bulks, including civil, concrete, structural steel and architectural, were based on the refreshed contractor pricing obtained by MOZ. In the absence of refreshed pricing, SLI used in-house material escalation benchmarks to bring forward EPC pricing to the base date.

**Table 21.6: Construction Contracts**

| Package No. | Package Name |
|---|---|
| CB2001 | Concrete |
| CA2001 | Mill Pre-Engineered and Plant Building |
| CG2002 | Steel, mechanical and piping (SMP) |
| CM2001 | Field Erected Tanks |
| CE3201 | Overhead Power Line (OHL) |
| CE2001 | Electrical / Instrumentation Installation |

### 21.2.4 Area 3000 – Tailings Management Facility

Golder was retained by Marathon Gold to carry out a feasibility-level design of the TMF. As part of this study, Golder has completed construction material take-off's (MTO) for each stage of the TMF and for closure considerations. The TMF will be constructed in six stages.

Most of the MTOs are related to earthworks type construction and are based on the stratigraphic boundaries shown on the borehole and test pit records which are inferred from non-continuous sampling, observations of drilling and excavation progress and the results of standard penetration tests. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Variation in the stratigraphic boundaries and foundation conditions, and hence the quantities derived from this information, between and beyond investigation locations will exist and is to be expected.

#### 21.2.4.1 Sources of Data

Topographic mapping used for the MTOs was obtained from Marathon in 2019 and comprised 5 m contour interval data over the broader project area and 1 m contour interval data from aerial survey in the area roughly bounded by Victoria River, Victoria Lake and Valentine Lake. Site investigation data from 2019 through 2021 within the foundations of the TMF and associated infrastructure was provided by GEMTEC.

To support the pre-feasibility and feasibility level design of the TMF and associated infrastructure, geotechnical and hydrogeological site investigations at the proposed TMF were carried out by GEMTEC in the summer/fall of 2021. This work included 31 test pits excavated and 14 boreholes advanced (GEMTEC, 2022) in addition to the 34 test pits excavated and 11 boreholes advanced in 2020 (GEMTEC, 2021) and 7 test pits excavated and 1 monitoring well advanced in in 2019 (GEMTEC, 2020). Survey of the investigation locations was completed by Marathon and provided by GEMTEC. Investigation spacings are approximately 50 m to 250 m along the dam alignment, which is reasonable for the level of study. Investigation data is documented in GEMTEC's investigation reports.

#### 21.2.4.2 Methodology

Quantity estimate calculations were carried out using commercially available CAD software (Civil3D and/or Muk3D) to make direct measurements from constructed 3-dimensional models and surfaces or derived from Microsoft excel spreadsheet equations and formulas using inputs from measurements made in CAD as required (e.g., ditch alignment lengths, 2-D footprint areas, etc.). Volume measurements resulting from CAD software models were verified with excel spreadsheets to validate the quantities.

The MTOs were based upon the design typical sections and details, plans, cross-sections, and profiles illustrated on the figures included within Golder's Feasibility Study TMF design report. All quantities are based on the neat design lines illustrated on the figures. Quantities for all zoned fill materials are based upon compacted, in-place volumes and an appropriate bulking factor will need to be applied for determining volumes required from the supplier/source. Quantities for channels and ditches are based on the typical sections and not on actual design grading profiles, which will be defined at the next stage of design. No contingency was applied to any of the quantities estimated.

### 21.2.5 Area 4000 – Off-Site Infrastructure

#### 21.2.5.1 P0518 – High-Voltage Power Supply

The estimate allows for development of a high-voltage powerline connecting the site to the provincial electricity supply.

#### 21.2.5.2 P0519 – Main (Site) Access Road

The estimate allows for upgrades to the site access road connecting Millertown and the site, including rehabilitation of bridges, re-surfacing of the roadway, and ditching and culverts for water management. Roadwork quantities and bridge rehabilitation requirements were scoped by the civil/structural department, with support of road survey works by others.

Roadworks were quoted as part of the site access road package by providing contractors with a bill of quantities for completion of unit rates for each designated task. The returned price schedules included the direct and indirect costs to perform the works. The returned rates were compared and evaluated, and the selected contractor rates have been carried in the estimate.

### 21.2.6 Area 5000 – Project Indirects

#### 21.2.6.1 Area 5100 – Contractor Indirects

Contractor indirect costs are related to the contractor's direct costs, but cannot easily be allocated to any part of them, including:

- mobilization and demobilization
- site offices and utilities
- construction equipment including mobile equipment, scaffolding, and safety supplies
- head office costs/contribution
- financing charges
- insurances
- profit.

Contractors provided indirect costs as part of their pricing schedules. Consideration was also given to the indirect costs, to ensure that appropriate COVID-19 management and site testing was performed at site, for any persons mobilizing to site.

#### 21.2.6.2 Area 5200 – Vendor Representatives

Vendor representative costs during commissioning and construction includes vendor representative support during the installation of the purchased equipment.

Vendor representative costs have been based on the engineer's evaluation of recommendations and prices provided by equipment vendors during the pricing enquiry process.

#### 21.2.6.3 Area 5300 – Spares Parts

Capital spares were based a $1M allowance by Marathon. Commissioning spares were based on 0.5% of equipment supply costs in the estimate.

#### 21.2.6.4 Area 5400 – First Fills

Process first fill quantities (e.g., mill media and reagents) and first fill lubricants (e.g., greases, oils, and hydraulic fluids). An allowance of $700,000 is included for first fills.

#### 21.2.6.5 Fuel

The estimate considers fuel supply by the Owner. Contractors provided fuel usage requirements, to which a rate inclusive of storage and supply was applied.

#### 21.2.6.6 Area 5500 – Freight Costs

Freight costs were based on vendor input when available otherwise calculated based on in-house information and in all cases included within the material or equipment costs. In the absence of vendor freight pricing, the following was used for determining freight costs:

- 13% was applied to tagged equipment supply costs
- 5% on bulk materials.

No duty costs were included in the estimate as it not expected that any equipment will be procured offshore.

### 21.2.7 Area 6000 – Project Delivery Costs

#### 21.2.7.1 Engineering and Procurement Services

A detailed engineering, project management and procurement services cost of $14.1M was based on the engineering and procurement consultant's commercial proposal and includes current pending and approved DCN's. The following project-based services and expenses were included:

- project management
- project administration
- engineering management
- detailed engineering
- document control
- procurement
- quality management
- vendor inspection and expediting (SLI and/or agencies)
- project controls: estimating, planning and cost control
- information technology services.

#### 21.2.7.2 Construction Management

Construction management (CM) costs of $15.4 M were based on the following site-based services as required:

- construction management
- site construction superintendents
- contract administration
- site health and safety
- project controls, accounting, planning, cost control, document control
- site quality assurance.

#### 21.2.7.3 Other Service Providers

Listed below are other project service providers and estimated costs:

- Golder – TMF Construction Support ($1.1 million)
- Stantec – Water Management construction support ($0.3 million)
- All Rock – Material Testing ($1.4 million)
- Landmark Surveying & Engineering – Quantity Surveying ($0.3 million).

### 21.2.8 Area 7000 – Owner's Costs

#### 21.2.8.1 General Owner's Costs

Owner's costs include the following:

- Owner's team (including construction, start-up, and commissioning)
- pre-production process and administrative costs
- land
- First Nations
- environmental
- freight and logistics support
- recruiting, training and site visits
- IT and communications
- insurance, finance, legal, and offices
- closure costs for the process plant and tailings management facility
- operational readiness.

### 21.2.9 Area 8000 – Estimate Contingency

Contingency is an integral part of the estimate. It can best be described as an allowance for undefined items or cost elements incurred within the defined project scope, but that cannot be explicitly foreseen due to a lack of detailed or accurate information.

It should not be considered compensation for estimating inaccuracy, nor is it intended to cover any costs due to potential scope changes, "Acts of God", labour strikes, labour disruptions outside the control of the project manager, fluctuations in currency or cost escalation beyond the predicted rates.

A deterministic approach was adopted by MOZ for calculating contingency, as per Table 21-7.

**Table 21.7: Deterministic Contingency Criteria**

| Item | Contingency Estimation Criteria – Deterministic Approach | Low | High | Deterministic |
|---|---|---|---|---|
| 1 | Package closed/firm price/awarded | -5% | 5% | 0% |
| 2 | PO issued | 0% | 7% | 3% |
| 3 | Budgetary quotation (±5%) with full technical and commercial evaluation | 0% | 10% | 5% |
| 4 | Budgetary quotation (±7%) | 0% | 13% | 7% |
| 5 | Mix of detailed estimate and budget quotations or awarded POs and contracts | 0% | 17% | 8% |
| 6 | SLI indicative estimate (weighted average contingency based on adjusted deterministic criteria | 0% | 19% | 10% |
| 7 | Mix of preliminary engineering and budgetary quotations escalated | 0% | 20% | 10% |
| 8 | Major earthworks – initial MTO's including 2% growth | 0% | 24% | 12% |
| 9 | Informal quotation – engineering data sheet and quick technical analysis | 0% | 30% | 15% |

Note: SLI contingency was determined by Marathon Gold at 9.5% on all costs at $17.2 M. Project contingency was calculated at $39 M or 8% of costs evaluated.

### 21.2.10 Growth Allowance

Each line item of the estimate is developed initially at base cost only. A growth allowance is then allocated to each element of those line item costs to reflect the level of definition of design and pricing strategy.

Estimate growth is:

- is intended to account for items that cannot be quantified based on current engineering status, but which are empirically known to appear
- accuracy of quantity take-offs and engineering lists based on the level of engineering and design undertaken at a feasibility study level
- pricing growth for the likely increase in cost due to development and refinement of specifications as well as re-pricing after initial budget quotations and after finalization of commercial terms and conditions to be used on the project.

Marathon has set a design growth of 5% applied to all packaged equipment.

### 21.2.11 Exclusions

The following costs and scope will be excluded from the capital cost estimate:

- senior finance charges
- residual value of temporary equipment and facilities
- environmental approvals

- remediation costs for non-hazardous and hazardous materials if encountered including associated schedule delay
- changes in Canadian Law and regulations (i.e.: tariffs)
- this study or any further project studies
- force majeure issues
- future scope changes
- special incentives (schedule, safety, or others)
- no allowance has been made for loss of productivity and/or disruption due to COVID-19, religious, union, social and/or cultural activities
- management reserve
- Owner's escalation costs
- Owner's foreign exchange exposure
- operating costs
- working capital
- land acquisition
- project-specific risk reserve has not been evaluated.

## 21.3 Basis of Capital Cost Estimate – Sustaining

### 21.3.1 Area 1000 – Mining

Lease payments for the initial mine equipment fleet are capitalised through the sustaining periods of the project. Down payments, lease payments and capital purchases for expansions and replacements to the mine equipment fleet are capitalised through the life of mine of the project.

Expansions to the capitalised spare components and radio communications systems are included in the sustaining period as the additional mobile fleet is commissioned. The piping system for pit dewatering is also expanded during the sustaining capital period. Fleet management and dispatch systems are added to mine operations in the sustaining period.

High precision GPS (global positioning system), machine guidance systems, fleet management systems, and dispatch systems are added to mine operations and capitalised in the sustaining period.

### 21.3.2 Area 3000 – Water Management Facilities

As outlined in Section 18, an overall surface water management strategy was developed that includes several ponds and ditches around the site, typically adjacent to the stockpiles. The quantities for these civil works were estimated by Stantec and assigned to a specific period, such as pre-production or Years 1 to 3. The remaining quantities produced in sustaining from 2025 through 2028 were then combined with rates received from the heavy civil contract from local contractors, and costs estimated as shown in Table 21-8.

**Table 21.8: Water Management Facility Costs**

| Phase | Completion | Costs (C$M) |
|---|---|---|
| 2 | July 2025 | 7.4 |
| 3 | July 2026 | 7.4 |
| 4 | July 2027 | 4.4 |
| 5 | July 2028 | 4.4 |
| Total | | 23.7 |

### 21.3.3 Area 3000 – Infrastructure Buildings

Quotations for infrastructure buildings were acquired from Canadian and Newfoundland-based contractors. All buildings for the project, including pre-engineered steel buildings, fabric buildings and modular buildings, have been purchased in the initial capital phase. The only building that will be purchased under sustaining capital is the truck shop building.

Each of the fabric buildings are listed in Table 21-9; however, the modular building rental cost have been considered as operating costs under G&A. The breakdown of the repayment plan per building is shown in Table 21-9.

**Table 21.9: Infrastructure Buildings Costs**

| Building | Repayment Terms | Amount (C$M) |
|---|---|---|
| Truck Shop | Purchase | 3.8 |
| Total | | 3.8 |

### 21.3.4 Area 3000 – Tailings Management Facility

#### 21.3.4.1 Effluent Treatment Plant

The effluent treatment plant is broken up into Phases 1 and 2. Phase 1 will commence with the installation of a metal precipitation system as well as one stage of submerged attached grown reactor (SAGR), to be commissioned in April 2025, six months after the target first gold date. Phase 2 will add two more SAGR stages, to be commissioned in September 2025. The total cost includes the costs for the first and second phase, as well as the related labour costs based on unit rates provided by the installation contractors as part of their pricing schedules and are shown in Table 21-10.

**Table 21.10: Water Treatment Plant Costs**

| Phase | Completion | Costs (C$M) |
|---|---|---|
| 1 | April 2025 | 5.5 |
| 2 | September 2025 | 5.5 |
| Total | | 11.0 |

#### 21.3.4.2 Tailings Management Facility

Following construction of the start-up configuration, the tailings dam will be raised in five stages over the mine life, as outlined in Section 18. The quantities for these civil works were estimated by Golder and assigned to a specific period. The quantities produced by Golder were then combined with rates received from the heavy civil contract from local contractors, and costs estimated as shown in Table 21-11.

**Table 21.11: Tailing Management Facility Costs**

| Stage | Completion | Costs (C$M) |
|---|---|---|
| 1 and 2 | December 2024 | 10.9 |
| 3 | December 2025 | 10.9 |
| 4 | December 2027 | 10.9 |
| 5 | December 2029 | 10.9 |
| 6 | December 2031 | 10.9 |
| Total | | 54.5 |

#### 21.3.4.3 Tailings Slurry Pipeline

The costs for the tailing piping (C$0.9 million) to the Leprechaun pit were calculated based on estimated quantities applied to the unit rates provided by the installation contractors in their pricing schedules.

### 21.3.5 Area 4000 – Access Road Upgrades

The estimate allows for upgrades to the site access road connecting Millertown and the site, including rehabilitation of bridges, re-surfacing of the roadway, and ditching and culverts for water management. Roadwork quantities and bridge rehabilitation requirements were scoped by the civil/structural department, with support of road survey works by others.

Roadworks were quoted as part of the site access road package by providing contractors with a bill of quantities for completion of unit rates for each designated task. The returned price schedules included the direct and indirect costs to perform the works. The returned rates were compared and evaluated, and the selected contractor rates have been carried in the estimate.

Initial works will be completed to allow for construction access and two more programs will take place in 2025 and 2026 for a total of $8.0 million.

### 21.3.6 Area 5300 – Capital Spares

Capital spares were based on a $2 million allowance by Marathon Gold which will be utilized in April 2025.

### 21.3.7 Area 7000 – Owner's Cost – Closure Costs

Within the heavy earthworks contract, the bulk material take-off for all necessary demolition, rehabilitation, revegetation, earth grading/contouring, scrap metal disposal/tipping fees, as well as post-closure monitoring were estimated and provided by third party consultants. The total closure cost was calculated to be C$71.7 million based on the unit rates provided by the installation contractors as part of their pricing schedules.

#### 21.3.7.1 Process Plant

Site closure for the process plant area capture the cost associated with the demolition of equipment, process plant, and mining building infrastructure and remediation works of the site. The closure costs were derived from unit rate costs provided by the installation contractors as part of their pricing schedules.

#### 21.3.7.2 Tailings Management Facility

Site closure costs for the non-process plant footprint include works to soil cover, revegetate/hydroseed the stockpiles and TMF, and construct a closure spillway. The closure costs for the TMF and remaining stockpiled were provided by the responsible party as per the WBS and included in the cost estimate provided to Marathon Gold.

#### 21.3.7.3 Salvaging

Salvaging costs have been projected by assuming that all mechanical, electrical, and mobile equipment will carry a 10% resale value at the end of the mine life, and that all spares remaining in the warehousing can be returned to the stock provider, projected at 5% of the mechanical cost value of the project. Total salvaging value was estimated at $30 million.

### 21.3.8 Area 8000 – Contingency

The same contingency method as described in Section 21.2.9 has been used for sustaining costs.

### 21.3.9 Growth Allowance

The same growth method as described in Section 21.2.10 has been used for sustaining costs.

## 21.4 Operating Costs

The operating cost estimate is presented in Q3 2022 Canadian dollars (CAD for currency reference and C$ as symbol). The estimate was developed to have an accuracy of ±15%. The estimate includes mining, processing, general and administration (G&A), and accommodations costs.

Process and G&A operating costs were established in the 2021 Feasibility Study and updated by Marathon Gold for the current study. Ausenco peer-reviewed the updated costs for inclusion in this study report.

The operating cost estimates for the life of mine are provided in Table 21-12. The overall life-of-mine operating cost is $2,996 million over 15 years, or $58/t of ore milled, with 3.25 years of operation for Phase 1 and 11 years of operation for Phase 2. Mine costs are shown separately in detail, as the yearly average values are variable.

**Table 21.12: Average Annual Plant and G&A Operating Cost Summary**

| | Phase 1 – 2.5 Mt/a | | Phase 2 – 4.0 Mt/a | |
|---|---|---|---|---|
| **Cost Center** | **C$M** | **C$/t** | **C$M** | **C$/t** |
| **Processing & Tailings** | | | | |
| Consumables | 25.7 | 10.53 | 37.3 | 9.40 |
| Plant Maintenance | 2.2 | 0.91 | 2.7 | 0.68 |
| Power | 7.0 | 2.86 | 8.8 | 2.22 |
| Laboratory | 0.2 | 0.07 | 0.2 | 0.05 |
| Labour (O&M) | 12.2 | 5.02 | 11.9 | 2.99 |
| Processing Mobile Equipment | 0.2 | 0.1 | 0.3 | 0.07 |
| **Subtotal** | **47.5** | **19.5** | **61.1** | **15.4** |
| **Effluent Treatment** | | | | |
| **Subtotal** | **2.5** | **1.0** | **2.1** | **0.52** |
| **Subtotal Plant Operating Cost** | **50.0** | **20.5** | **63.1** | **15.9** |
| **General & Administration** | | | | |
| Labour (G&A) | 6.8 | 2.79 | 7.4 | 1.87 |
| G&A Expenses | 12.1 | 4.95 | 11.6 | 2.77 |
| Site Maintenance | 3.5 | 0.94 | 3.4 | 0.58 |
| Camp & Bussing | 2.9 | 1.73 | 2.9 | 0.99 |
| **Subtotal** | **25.3** | **10.4** | **25.3** | **6.2** |
| **Total** | **75.3** | **30.9** | **88.4** | **22.1** |

### 21.4.1 Basis of Operating Cost

#### 21.4.1.1 Assumptions

Common to all operating cost estimates are the following assumptions:

- Cost estimates are based on Q3 2022 pricing without allowances for inflation.
- For material sourced in US dollars, an exchange rate of 1.31 Canadian dollar per US dollar was assumed.
- Fuel costs and associated taxes were established using the forward-looking contract pricing as of 2025 and onwards. Estimated costs are C$1.3858/L for diesel and C$1.45/L for gasoline.
    - Rates are decreased during the construction period of the project as the Newfoundland and Labrador Provincial Road Tax is assumed not to apply due to the provincial discounts allowed for during construction.
    - Diesel rates applied are $1.3858/L. This excludes HST but includes all other charges.
- The annual power costs were calculated using an energy price of C$0.044/kWh and a demand price of C$10.73/kW. The prices were based on Newfoundland Industrial Firm Rates located in the "Schedule of Rates, Rules and Regulations" – July 1, 2022.
- Labour is assumed to come mostly from Newfoundland, and locally from places such as Buchans, Millertown, Badger, Grand Falls-Windsor, and Bishop's Falls.

#### 21.4.1.2 Basis of Process Operating Cost

The following was used to determine the project's LOM process operating costs in agreement with the cost definition and estimate methodologies outlined below. This basis considers the development of a facility capable of processing 6,850 t/d of ore in Phase 1 and 10,960 t/d in Phase 2.

Assumptions made in developing the process operating cost estimate are listed below:

- Mill production is set at an average of 2.5 Mt/a for Phase 1 and 4.0 Mt/a for Phase 2.
- Process plant operating costs are calculated based on labour, power consumption, and process and maintenance consumables.
- Off-site gold refining, insurance, and transportation costs are excluded, as they are included elsewhere.
- Oxygen is assumed to be delivered to site as liquid oxygen.
- Operating costs incurred during the pre-production period have been capitalized within Marathon Gold.
- Labour rates were provided by Marathon Gold, following multiple industrial market surveys completed in 2020, 2021 and 2022 that specifically reviewed mining and technical engineering roles within the Province of Newfoundland and Labrador.
- General and administration (G&A) costs were baselined against previous project experience, defined along with specific inputs from Marathon Gold as well as market surveys and the use of actual employee salaries where applicable.
- Consumables costs are based on data from quotes from similar projects in Eastern Canada and are based on quotes as of Q2 2022.
- No factor for spare parts has been applied to adjust for consumption of less spare parts in early years of operation.
- Grinding media consumption rates have been estimated based on the ore characteristics.
- Reagent consumption rates have been estimated based on the metallurgical testwork results at a nominal basis.
- Mobile equipment cost provides for fuel and maintenance, not for purchase or vehicle lease.

### 21.4.2 Mining Operating Costs

Estimated annual and life-of-mine unit mining costs are shown Table 21-13.

Mine operating costs are built up from first principles. Inputs are derived from vendor quotations and historical data collected by MMTS. This includes quoted cost and consumption rates for such inputs as fuel, lubes, explosives, tires, undercarriage, GET, drill bits/rods/strings, machine parts, machine major components, and operating and maintenance labour ratios. Labour rates for planned hourly and salaried personnel have been supplied by Marathon Gold.

**Table 21.13: Unit Mine Operating Costs, $/t mined**

| | LOM | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grade Control | $0.04 | $0.07 | $0.07 | $0.03 | $0.03 | $0.03 | $0.03 | $0.03 | $0.03 | $0.03 | $0.04 | $0.06 | $0.10 | $0.13 |
| Production Drilling | $0.31 | $0.29 | $0.32 | $0.30 | $0.31 | $0.29 | $0.32 | $0.29 | $0.31 | $0.28 | $0.29 | $0.40 | $0.38 | $0.37 |
| Blasting | $0.40 | $0.37 | $0.37 | $0.40 | $0.39 | $0.38 | $0.39 | $0.40 | $0.40 | $0.42 | $0.44 | $0.48 | $0.46 | $0.66 |
| Loading | $0.38 | $0.37 | $0.37 | $0.38 | $0.40 | $0.36 | $0.37 | $0.37 | $0.37 | $0.37 | $0.38 | $0.42 | $0.45 | $0.82 |
| Hauling | $1.19 | $0.82 | $0.87 | $0.92 | $1.21 | $0.98 | $1.11 | $1.11 | $1.41 | $1.39 | $1.81 | $2.04 | $2.39 | $3.07 |
| Support | $0.41 | $0.38 | $0.37 | $0.39 | $0.40 | $0.39 | $0.36 | $0.36 | $0.38 | $0.44 | $0.46 | $0.56 | $0.67 | $1.06 |
| Site | $0.03 | $0.06 | $0.04 | $0.04 | $0.03 | $0.02 | $0.02 | $0.02 | $0.02 | $0.03 | $0.03 | $0.04 | $0.08 | $0.13 |
| Unallocated Labour | $0.05 | $0.04 | $0.04 | $0.03 | $0.03 | $0.02 | $0.03 | $0.03 | $0.03 | $0.04 | $0.05 | $0.10 | $0.23 | $0.73 |
| **Direct Costs – Subtotal** | **$2.81** | **$2.41** | **$2.45** | **$2.49** | **$2.80** | **$2.48** | **$2.63** | **$2.61** | **$2.94** | **$3.01** | **$3.50** | **$4.09** | **$4.77** | **$6.97** |
| Mine Operations GME | $0.09 | $0.09 | $0.08 | $0.07 | $0.06 | $0.06 | $0.06 | $0.07 | $0.08 | $0.10 | $0.13 | $0.17 | $0.38 | $0.56 |
| Mine Maintenance GME | $0.05 | $0.04 | $0.04 | $0.04 | $0.03 | $0.04 | $0.04 | $0.04 | $0.04 | $0.06 | $0.07 | $0.11 | $0.19 | $0.33 |
| Technical Services GME | $0.09 | $0.08 | $0.08 | $0.07 | $0.06 | $0.07 | $0.07 | $0.07 | $0.08 | $0.11 | $0.14 | $0.20 | $0.41 | $0.49 |
| **Total GME Costs – Subtotal** | **$0.23** | **$0.21** | **$0.20** | **$0.18** | **$0.15** | **$0.17** | **$0.17** | **$0.18** | **$0.19** | **$0.27** | **$0.34** | **$0.47** | **$0.98** | **$1.39** |
| **Total Mine Operating Cost** | **$3.03** | **$2.62** | **$2.65** | **$2.68** | **$2.95** | **$2.65** | **$2.79** | **$2.79** | **$3.13** | **$3.28** | **$3.84** | **$4.57** | **$5.75** | **$8.36** |

Note: LOM costs include rehandling of ore from stockpiles in 2038 and 2039.

#### 21.4.2.1 Mine Operations

The mine will operate 365 days per year, 24 hours per day with two 12-hour shifts per day. Four shifts are specified, all based on a rotation of one week on and one week off: one crew on dayshift, one crew on night shift, and two crews off, drive-in and drive-out. An allowance of 15 days of no production has been built into the mine schedule to allow for adverse weather conditions.

#### 21.4.2.2 Mine Production Schedule

Annual ore production tonnes, waste tonnes, and stockpiled management tonnes are taken from the feasibility study mine production schedule summarized in Table 16-6. Drilling, loading, and hauling equipment hours are estimated based on the capacities and parameters of the equipment fleet applied to this production schedule. These tonnes and hours also provide the basis for blasting consumables, and support fleet usage estimates.

#### 21.4.2.3 Grade Control Inputs

Grade control drilling is applied to all scheduled mineralised material (ore and waste) to “look ahead” at upcoming benches and better define mineralisation boundaries for controlled blasting and loading operations. A requirement for reverse circulation (RC) grade control drilling hours is calculated with inputs from hole size, pattern dimensions, bench height, material density, and penetration rate of the drill.

Additional costs are added to the grade control estimate for sampling and assaying on 3 m intervals through the planned RC drilled hole.

Sampling and gold assaying costs have also been included for each blasthole drilled in planned selective mining areas to the end of 2027. It is assumed that after 2027 either RC drilling or blasthole sampling will be selected as the preferred grade control technique, so from 2028 to the end of mine life, the ratio of RC and blasthole samples per selectively mined tonne is reduced by half.

Sampling and ARD assaying costs have also been included based on a sample ratio per tonne of overburden and rock waste mined. Costs for assay laboratory technicians are not included in the mining areas, but elsewhere in the project.

#### 21.4.2.4 Production Drilling Inputs

Based on the tonnes scheduled, a requirement for production drilling hours is calculated with inputs from hole size, pattern dimensions, bench height, material density, and penetration rate of the drill.

Drilled patterns and depths are applied in identified selective mining zones, and alternative patterns and depths in bulk mining zones. Trim blasting is planned to be drilled on an alternative pattern and depth and applied to estimated distances of open pit highwall established in each year of the mine plan.

No drilling is assumed in topsoil and overburden materials.

#### 21.4.2.5 Blasting Inputs

Variable powder factors in selective and bulk mining areas are estimated, 0.29 to 0.25 kg/t respectively. Powder factor estimates are based on a fragmentation study conducted on the various rock properties encountered in the Marathon and

Leprechaun open pits. For each targeted powder factor, the pattern area, explosive density, and quantity of explosives is calculated and costed. In addition, an estimate for initiation systems and blasting accessories is provided on a per hole basis, which includes detonation cord, boosters, and electric detonators. As an emulsion product is assumed, no liners are included in the per hole pricing.

Additional costs are estimated for blasting labour, rentals of blasting trucks, supplier operations management fees, as well as coverage for lease costs for supplier storage facilities, magazine, garage, trailers, and fencing.

#### 21.4.2.6 Loading and Hauling Inputs

Fleet requirements for loading and hauling are calculated on loader and hauler productivities applied to the mine production schedule. Loader productivities are applied to the scheduled material movement to calculate required equipment operating hours. For selectively mined zones of the deposit (Section 16.1.2 for description) the 12.0 m3 bucket hydraulic excavator is applied to the scheduled tonnes, with 50% direct loaded into haulers and the other 50% placed in piles on the bench and rehandled with the wheel loader.

Planned average annual loader productivities for the 15.5 m3 bucket hydraulic excavator are 2,250 t/h, and for the 12.0 m3 bucket hydraulic excavators range from 1,273 t/h to 1,546 t/h, depending on material loaded (ore, waste, till) and selective or bulk mining conditions. Planned average annual loader productivities for the 13.5 m3 wheel loader are 1,580 t/h in rehandle piles and 1,492 t/h while production loading. The wheel loader is also planned to load the primary crusher for 25% of the mill feed tonnages, at a planned productivity of 792 t/h.

Haulage profiles are estimated from pit centroids at each bench to designated dumping points for each scheduled period. These haul profiles are inputs to a haul cycle simulation program and the resulting cycle times are used to estimate required hauler operating hours and fuel burn in each scheduled period. Annual average hauler productivities for the 91-tonne payload haulers range from 140 t/h to 390 t/h depending on the haul distances and elevation changes incurred in the year. Annual average hauler productivities for the 140-tonne payload haulers range from 190 t/h to 610 t/h. Stockpile reclaim productivities are assumed to be 390 t/h. LOM average haul speeds are 17 kph over the entire haul cycles, and 22 kph on the hauls themselves. Articulated haulers are assigned to topsoil stripping activities as well as operating hours initially assigned to the 91-tonne payload hauler fleet at a ratio of 36.9/84.9. All productivities listed above are on a NOH (net operating hour) basis.

#### 21.4.2.7 Pit Support Inputs

Pit services include the following:

- haul road development and maintenance
- shovel floor clean-up and support
- pit floor and ramp maintenance
- stockpile maintenance
- ditching
- dewatering
- mobile fleet fuel and lube support
- topsoil excavation
- secondary blasting and rock breaking
- snow removal
- reclamation and environmental control
- lighting
- transporting personnel and operating supplies
- mine safety and rescue.

A fleet of mobile equipment is specified to handle these pit support activities. Annual utilisation of this support equipment is driven by the utilisation of the primary equipment in the fleet.

#### 21.4.2.8 Equipment Operating Cost

All equipment is costed using quoted or estimated fuel consumption rates, consumables costs, GET estimates, labour ratios and general parts and preventative maintenance costs, on a per hour basis. The hourly rates are then multiplied by the operating hours of the machine to find a constant distributed operating cost per operating or working hour.

The costs for major components of the larger equipment types are calculated separately from the distributed hourly cost. Major repairs are clocked with the usage of the piece of equipment so that major repairs costs are forecast in the year it occurs, rather than averaging this cost over many years. Equipment replacement is clocked in the same manner, so that individual equipment units cumulative operating hours are tracked up to a set limit, and then a replacement is introduced, and sustaining capital costs incurred in that year.

Running hours (service metre unit) on each piece of equipment are estimated based on operating capacities and requirements of the mine production schedule. These service metre unit hours are multiplied by the hourly consumables rates and unit operating costs to calculate the total equipment operating costs for each year of operation.

A variable diesel price is used by schedule period, based on a forecast provided by Marathon Gold, ranging from $1.545/L down to $1.386/L. The applied diesel price is reduced by $0.145/L during the pre-production period due to the removal of the provincial road tax before operational start-up, and addition of supplier costs to cover on site fuel distribution systems.

#### 21.4.2.9 Hourly Labour

Labour workhour ratios are categorised for the different labour types (e.g., operators, mechanics, electricians, etc.) and assigned to each piece of equipment, and then multiplied by the operating hours. The total hours required for each category are added together and rounded off to assign a full person to each crew; any additional hours remaining, after rounding, are grouped together into an unallocated labour pool. Table 21-14 shows a summary of mine hourly labour counts.

#### 21.4.2.10 Mine GME

General mine expense (GME) is a category for mine operation, mine maintenance and technical service department overheads. It consists of labour costs for all salaried staff, department overheads such as consumables, rentals, travel, and training, outside services and consultants, software, and fleet management and engineering systems’ licensing and maintenance. This category is a fixed cost, and does not vary by production or fleet size, except for ramp-ups to full staffing and ramp-downs at the end of the mine life. Table 21-15 shows a summary of estimated salaried staff and technical personnel.

**Table 21.14: Mine Hourly Labour Summary**

| Position | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mine Operations** | | | | | | | | | | | | | | | | | | |
| Drill Operator | 4 | 4 | 4 | 20 | 20 | 24 | 24 | 24 | 24 | 24 | 20 | 16 | 12 | 12 | 8 | 4 | 0 | 0 |
| Blasters/Helpers | 6 | 6 | 6 | 18 | 18 | 24 | 24 | 24 | 24 | 24 | 18 | 18 | 18 | 18 | 6 | 6 | 0 | 0 |
| Excavator Operator | 4 | 4 | 4 | 16 | 18 | 18 | 20 | 20 | 20 | 20 | 14 | 14 | 10 | 10 | 6 | 2 | 0 | 0 |
| Loader Operator | 0 | 0 | 0 | 6 | 6 | 6 | 6 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Haul Truck Driver | 12 | 16 | 16 | 76 | 84 | 90 | 108 | 108 | 108 | 100 | 100 | 88 | 84 | 68 | 40 | 20 | 6 | 6 |
| Grader Operator | 2 | 2 | 2 | 8 | 8 | 8 | 12 | 12 | 12 | 12 | 12 | 8 | 8 | 8 | 4 | 4 | 2 | 2 |
| Support Operator | 8 | 8 | 8 | 32 | 32 | 34 | 36 | 36 | 36 | 32 | 28 | 24 | 20 | 12 | 8 | 4 | 4 | 2 |
| Water Truck Operator | 1 | 2 | 2 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 5 | 3 | 1 | 1 |
| Fuel Truck Operator | 1 | 2 | 2 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 4 | 4 | 4 | 3 | 1 | 1 | 1 |
| **Mine Maintenance** | | | | | | | | | | | | | | | | | | |
| Electrician | 2 | 2 | 2 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 6 | 6 | 4 | 2 | 2 | 2 | 2 |
| HD Mechanic | 6 | 6 | 6 | 35 | 35 | 38 | 44 | 44 | 44 | 40 | 40 | 32 | 29 | 23 | 13 | 7 | 3 | 3 |
| LD Mechanic | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
| Machinist | 2 | 2 | 2 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 5 | 4 | 4 | 3 | 2 | 1 | 1 | 1 |
| Welder | 2 | 2 | 2 | 8 | 9 | 9 | 10 | 10 | 10 | 10 | 9 | 8 | 6 | 5 | 4 | 1 | 1 | 1 |
| Labourer | 2 | 2 | 2 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 8 | 8 | 6 | 4 | 2 | 2 | 2 |
| | | | | | | | | | | | | | | | | | | |
| **Total Hourly Labour** | **54** | **60** | **60** | **260** | **272** | **294** | **328** | **326** | **326** | **310** | **286** | **244** | **222** | **186** | **110** | **60** | **26** | **24** |

**Table 21.15: Mine Salaried Staff Summary**

| Position | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mine Operations** | | | | | | | | | | | | | | | | | | |
| Mine Manager | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Mine Operations Superintendent | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mine Clerks | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Mine Operations Supervisor | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 0 |
| Pit Supervisors | 0 | 0 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 0 | 0 |
| Safety/Training Officer | 1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 0 |
| Pit Labourer/Field Sampler | 2 | 8 | 8 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 8 | 8 | 4 | 0 | 0 |
| Dispatch Controllers | 0 | 0 | 0 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 0 | 0 | 0 |
| Contracts Supervisor | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| **Mine Maintenance** | | | | | | | | | | | | | | | | | | |
| Maintenance Superintendent | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Maintenance Supervisor | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 0 |
| Maintenance Clerk | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Maintenance Planner | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 |
| Reliability Engineer | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Welding Supervisor | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 |
| **Technical Services** | | | | | | | | | | | | | | | | | | |
| Geology Manager | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Senior Geologist | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 0 | 0 | 0 |
| Mine Geologist | 0 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 0 |
| Ore Grade Technicians | 0 | 2 | 2 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 2 | 1 | 0 |
| Chief Mining Engineer | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Senior Mining Engineer | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| Planning Engineer | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 |
| Drill and Blast Engineer | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 0 | 0 |
| Geotechnical Engineer | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Dispatch Engineer | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 |
| Surveyor / Technician | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 0 | 0 |
| **Total Staff** | **10** | **27** | **31** | **64** | **65** | **64** | **64** | **64** | **64** | **64** | **64** | **62** | **62** | **58** | **53** | **21** | **8** | **1** |

#### 21.4.2.11 Mine Operations Site Development Costs

Mine operations site development costs are described below:

- Clearing & Grubbing – The costs for clearing and grubbing are estimated for the pits, haul road, and stockpile areas. The costs are incurred prior to those areas being required for mine operations. It is assumed that 60% of all open pit areas and 15% of haul road and stockpile areas are already cleared via existing on-site activities. Unit costs for clearing and grubbing have been supplied by Marathon Gold based on contractor quotations.

- Wetland Till Removal – For the Marathon, Leprechaun and Berry deposits, the costs for removal of wetland areas in the pit limits are estimated at a premium of $2/t over the normal till removal costs. Quantities are estimated based on the measured wetland areas, an excavation depth of 2 m, and a density of 2.0 t/m3.

- Topsoil Excavation – Topsoil quantities for pit stripping are included in the mine production schedule, with loading and hauling hours accounted for in the mine fleet. Additional topsoil stripping quantities for the haul roads and stockpile footprints are also estimated. Topsoil hauling productivities of 104 m3/h are based on 1.5 km hauling distances for the articulated haulers. Hydraulic excavator topsoil excavation productivity is estimated to be two times the hauler productivity.

- Crusher Rock Production – An estimate to produce crush rock for mine operations is included. Crush rock will be used for haul road construction and maintenance, as well as for stemming materials in blasting. Haul roads are planned with a 0.5 m crush rock topping when constructed and 0.1 m resurfaced per year. Stemming quantities are estimated based on blastholes planned per year and stemming length in each blasthole.

### 21.4.3 Process Operating Costs

The LOM process operating cost is $857 million over 15 years. A breakdown of this value and its unit costs is presented in Table 21-16.

**Table 21.16: Average Annual Process Operating Cost**

| | Phase 1 | | Phase 2 | |
|---|---|---|---|---|
| **Cost Center** | **C$M** | **C$/t** | **C$M** | **C$/t** |
| Consumables | 25.7 | 10.53 | 37.3 | 9.40 |
| Plant Maintenance | 2.2 | 0.91 | 2.7 | 0.68 |
| Power | 7.0 | 2.86 | 8.8 | 2.22 |
| Laboratory | 0.2 | 0.07 | 0.2 | 0.05 |
| Labour (O&M) | 12.2 | 5.02 | 11.9 | 2.99 |
| Processing Mobile Equipment | 0.2 | 0.10 | 0.3 | 0.07 |
| Water Treatment | 2.5 | 1.03 | 2.1 | 0.52 |
| **Total** | **50.0** | **20.5** | **63.1** | **15.9** |

#### 21.4.3.1 Consumables

Individual reagent consumption rates were estimated based on the metallurgical testwork results, Marathon's project operating cost files, industry practice, and peer-reviewed literature. A detailed description of the reagents required for the process is provided in Section 17.

Other consumables (e.g., liners for the primary crusher, SAG mill, ball mill, and ball media for the mills) were estimated using:

- metallurgical testing results (abrasion)
- previously completed calculation methods, including simulations
- forecast nominal power consumption.

Reagents and consumables represent approximately 51% to 59% of the total process operating cost at C$10.53/t milled for Phase 1 and $9.40/t milled for Phase 2.

#### 21.4.3.2 Maintenance

Annual maintenance consumable costs were calculated based on a total installed mechanical capital cost by area using a weighted average factor from 1% to 5%. The factor was applied to mechanical equipment, platework, and piping. The total maintenance consumables operating cost is C$0.91 to 0.68/t milled, or approximately 4% of the direct mechanical capital cost, which is equivalent to approximately 4.4% of the total process operating cost.

#### 21.4.3.3 Power

The processing power draw was based on the average power utilization of each motor on the electrical load list for the process plant and services. Power will be supplied by the NL Hydro grid to service the facilities at the site.

#### 21.4.3.4 Laboratory and Assays

Operating costs associated with laboratory and assay activities were estimated according to the anticipated number of assays per day and per year. Assay costs include environmental sampling and assaying. Assay costs associated with processing mine grade control samples or exploration samples are included in the mine operating costs. The laboratory and assays comprise approximately 0.5% of the total process operating cost, and the forecasted annual requirement for internal assays will be around 15,000 for Phase 1 and 21,000 for Phase 2 for the processing plant. Approximately 1,700 samples per year are required for the environmental sampling schedule.

#### 21.4.3.5 Mobile Equipment

Vehicle costs are based on a scheduled number of light vehicles and mobile equipment, including fuel, maintenance, spares and tires, and annual registration and insurance fees.

#### 21.4.3.6 Labour

Staffing was estimated by benchmarking against similar projects. The labour costs incorporate requirements for plant operation, such as management, metallurgy, operations, maintenance, site services, assay lab, and contractor allowance. The total operational labour averages 90 employees for Phase 1 and 94 employees for Phase 2.

Individual personnel were divided into their respective positions and classified as either 8-hour or 12-hour shift employees. Salaries were provided by Marathon Gold, who performed a local survey for the salaries of each expected role. Marathon Gold also confirmed the specific benefits and bonuses to be allocated. Thus, the rates were estimated as overall rates, including all burden costs, but do not include camp costs (included separately under “Camp Costs” in the G&A cost center).

An organizational staffing plan outlining the labour requirement for the process plant is shown in Table 21-17. The G&A staffing plan is summarized in Table 21-18.

**Table 21.17: O&M Staffing Plan**

| Labour Summary | # Shift | # People | Quantity |
|---|---|---|---|
| Process Plant Upper Management | | | |
| Manager Process Plant | 1 | 1 | 1 |
| Process and Site Maintenance Superintendent | 1 | 1 | 1 |
| Process Plant Superintendent | 1 | 1 | 1 |
| Maintenance Planner | 1 | 1 | 1 |
| Electrical Planner | 1 | 1 | 1 |
| Chief Metallurgist | 1 | 1 | 1 |
| Chief Assayer | 1 | 1 | 1 |
| Process Plant Trainer | 1 | 2 | 2 |
| Process Plant Administrative Assistant | 1 | 2 | 2 |
| Process Plant Technical Services | | | |
| Metallurgical Technician | 1 | 2 | 2 |
| Metallurgical Technician | 1 | 2 | 2 |
| Senior Chemist | 1 | 1 | 1 |
| Assay Lab Technician | 4 | 2 | 8 |
| Process Plant Maintenance | | | |
| Maintenance Supervisor | 1 | 2 | 2 |
| Electrical Supervisor | 1 | 2 | 2 |
| Millwright (JP) | 5 | 2 | 10 |
| Maintenance Apprentice | 1 | 2 | 2 |
| Instrument Technician (JP) | 2 | 2 | 4 |
| Electrician (JP) | 3 | 2 | 6 |
| Electrical Apprentice | 2 | 2 | 4 |
| Carpenter (JP) | 2 | 2 | 4 |
| Process Plant Labourer | 2 | 2 | 4 |
| Mill Operations | | | |
| Process Plant Supervisor | 2 | 2 | 4 |
| Control Room Operator | 2 | 2 | 4 |
| Tailings & Reagent Operator | 2 | 2 | 4 |
| Leach and Elution/Flotation Operator | 2 | 2 | 4 |
| Grinding Operator | 2 | 2 | 4 |
| Crusher Operator | 2 | 2 | 4 |
| Crusher Loader Operator | 2 | 2 | 4 |
| Gold Room Operator | 2 | 2 | 4 |
| **Total** | **51** | **52** | **94** |

**Table 21.18: G&A Staffing Plan**

| Labour Summary | # Shift | # People | Quantity |
|---|---|---|---|
| General Manager | 1 | 1 | 1 |
| GM Administrative Assistant | 1 | 1 | 1 |
| Stakeholder Indigenous & Relations Coordinator | 1 | 1 | 1 |
| Camp Accommodations Superintendent | 1 | 1 | 1 |
| Accommodation Administrative Assistant | 1 | 1 | 1 |
| Contracts | | | |
| Contracts Manager | 1 | 1 | 1 |
| Contracts Administrator | 1 | 1 | 1 |
| HSE | | | |
| Health Safety & Environmental Manager | 1 | 1 | 1 |
| Health Safety & Emergency Response Coordinator | 2 | 2 | 4 |
| Occupational Nurse/Hygiene Coordinator | 1 | 2 | 2 |
| Senior Environmental Coordinator | 1 | 1 | 1 |
| Environmental Coordinator/Technician | 2 | 3 | 6 |
| HSE Management Systems Analyst | 1 | 1 | 1 |
| Environmental Scientist/Engineer | 1 | 1 | 1 |
| Human Resources | | | |
| Manager Human Resources | 1 | 1 | 1 |
| Training Superintendent | 1 | 1 | 1 |
| Training Administrator | 1 | 1 | 1 |
| Human Resources Business Partner | 1 | 3 | 3 |
| HR Administrative Coordinator | 1 | 1 | 1 |
| Human Resources Business Partner (Project) | 1 | 1 | 1 |
| Labour Relations Specialist | 1 | 1 | 1 |
| Receptionist | 1 | 1 | 1 |
| Program Development Strategist | 1 | 1 | 1 |
| Program Specialist | 1 | 1 | 1 |
| IT | | | |
| IT Manager | 1 | 1 | 1 |
| IT Technician | 2 | 2 | 4 |
| System Analyst | 1 | 1 | 1 |
| Finance | | | |
| Finance Manager | 1 | 1 | 1 |
| Senior Accountant | 1 | 1 | 1 |
| Payroll Clerk | 1 | 2 | 2 |
| Accounts Payable Clerk | 1 | 2 | 2 |
| Procurement Superintendent | 1 | 1 | 1 |
| Purchasing Agent | 1 | 1 | 1 |
| Logistics Coordinator | 1 | 1 | 1 |
| Warehouse Supervisor | 1 | 2 | 2 |
| Warehouse Technicians | 4 | 2 | 8 |
| Project Owner’s Team – Construction Only | | | |
| Construction Manager | 1 | 1 | 1 |
| Civil Construction Superintendent | 1 | 1 | 1 |
| Civil Construction Coordinator | 1 | 3 | 3 |
| Site Services Labourers | 2 | 2 | 4 |
| **Total** | **48** | **53** | **69** |

#### 21.4.3.7 Water Treatment

The water treatment costs were developed from first principles and checked alongside effluent treatment plant vendors, regarding required power for operation and consumables. A summary of effluent treatment operating costs is shown in Table 21-16. The treatment for ammonia is still pending and not included in these costs.

### 21.4.4 Tailings Management Facility Operating Cost

Operating costs for the TMF include personnel for operating, maintenance, environmental monitoring, safety-related dam surveillance, and a light vehicle. These costs are included with the process operating costs. Supporting engineering studies, investigations, design, construction supervision, safety-related dam inspections, and general consulting costs are included with the engineering costs provided to Marathon Gold.

### 21.4.5 General and Administrative Operating Costs

General and administrative (G&A) costs are expenses not directly related to the production of gold and include expenses not included in mining, processing, external refining, and transportation costs. These costs were developed with input from Marathon Gold.

A bottom-up approach was used to develop estimates for G&A costs over the life of mine. The G&A costs were determined for a 15-year mine life with an average cost of $10.40/t milled for Phase 1 and $6.20/t milled for Phase 2. These costs were assembled according to the following departmental cost reporting structure:

- G&A maintenance (includes snow-clearing, surface grading, and watering during the summer)
- G&A personnel
- camp (including camps for mine labour)
- bussing (personnel transport to site)
- modular building rentals
- human resources (including recruiting, training, and community relations)
- infrastructure power (including power, fuel, and heat)
- site administration, maintenance and security (including subscriptions, professional memberships and dues, external training, advertising and promotional material, first aid, office supplies and equipment, sewage and garbage disposal, bank and payroll fees)
- assets operation (including non-operation-related vehicles)
- health and safety (including personal protective equipment and hospital service costs)
- environmental (including sampling and TMF operation)
- IT and telecommunications (including hardware and satellite link)
- contract services (including insurance, consulting, sanitation, auditing, licenses, freight, and legal fees)
- cyanide code fees.

The G&A labour costs were estimated by developing a headcount profile for each department which was then forecast over the life of mine. Labour rates provided by Marathon Gold were applied to develop the total G&A labour cost.

G&A labour resources include 69 employees (includes at personnel stationed at site and at the Grand Falls Windsor office).

Health and safety equipment, supplies, training, and environmental costs were provided by Marathon Gold, as were the IT and telecommunications costs for telecommunication, networking, Internet, computers, radio system, and repairs.

A breakdown summary of LOM G&A costs is shown in Tables 21-19 and 21-21.

**Table 21.19: Annual Average G&A Operating Cost Summary**

| | Phase 1 | | Phase 2 | |
|---|---|---|---|---|
| **Cost Center** | **C$M** | **C$/t** | **C$M** | **C$/t** |
| Labour (G&A) | 6.8 | 2.79 | 7.4 | 1.87 |
| G&A Expenses | 12.1 | 4.95 | 11.6 | 2.77 |
| General Maintenance | 2.3 | 0.94 | 2.3 | 0.58 |
| Camp | 3.5 | 1.46 | 3.4 | 0.83 |
| Bussing Cost | 0.6 | 0.27 | 0.6 | 0.16 |
| **Total** | **25.3** | 10.4 | **25.3** | 6.2 |

**Table 21.20: Process Operating and G&A Cost Averages by Phase and LOM**

| | Phase 1 | | Phase 2 | | LOM | |
|---|---|---|---|---|---|---|
| **Cost Center** | **C$M** | **C$/t** | **C$M** | **C$/t** | **C$M** | **C$/t** |
| Plant Milling + Water Treatment | 162.4 | 20.5 | 694.6 | 15.9 | 857.0 | 16.6 |
| G&A - Expenses | 82.4 | 10.4 | 278.3 | 6.2 | 360.6 | 6.99 |
| Total | **244.8** | 30.9 | **972.9** | 22.1 | **1217.7** | 23.6 |

### 21.4.6 Exclusions

The following costs and scope will be excluded from the operating cost estimate:

- An additional operating cost of C$3.93/oz (C$0.19/t) of sold gold is considered in the financial model for refining and transportation charges, based on a recent quote received from Asahi.

In addition, a credit for contained silver within the final doré was declared as a refining credit within the financial model, which totalled C$9.32/oz, weighted over life-of-mine. The contained silver credit in the sold gold was determined in the core head assay, by ICP, and applying a 50% recovery of head to sold gold.

# 22 ECONOMIC ANALYSIS

## 22.1 Cautionary Statement

The results of the economic analyses discussed in this section represent forward-looking information as defined under Canadian securities law. The results depend on inputs that are subject to several known and unknown risks, uncertainties, and other factors that may cause actual results to differ materially from those presented herein. Forward-looking information includes the following:

- mineral reserve estimates
- assumed commodity prices and exchange rates
- proposed mine production plan
- projected mining and process recovery rates
- assumptions about mining dilution
- sustaining costs and proposed operating costs
- interpretations and assumptions regarding joint venture and agreement terms
- assumptions as to closure costs and closure requirements
- assumptions about environmental, permitting, and social risks.

Additional risks to the forward-looking information include the following:

- changes to costs of production from what is assumed
- changes in the estimated timing and quantity of production
- unrecognized environmental risks
- unanticipated reclamation expenses
- unexpected variations in quantity of mineralized material, grade or recovery rates
- geotechnical or hydrogeological considerations during mining being different from what was assumed
- failure of mining methods to operate as anticipated
- failure of plant, equipment or processes to operate as anticipated

- changes to assumptions as to the availability of electrical power, and the power rates used in the operating cost estimates and financial analysis
- ability to maintain the social license to operate
- accidents, labour disputes and other risks of the mining industry
- changes to interest rates
- changes to tax rates
- changes in government regulation of mining operations
- potential delays in the issuance of permits and any conditions imposed with the permits that are granted.

The mine plan is based on the estimated mineral reserves for the project. No inferred mineral resources were included in the material scheduled for processing.

## 22.2 Methodology Used

An engineering economic model was developed to estimate annual pre-tax and post-tax cash flows and sensitivities of the project based on a 5% discount rate. It must be noted that tax calculations involve complex variables that can only be accurately determined during operations and, as such, the actual after-tax results may differ from those estimated. A sensitivity analysis was performed to assess the impact of variations in metal prices, foreign exchange rates, operating costs and initial capital costs.

The capital and operating cost estimates developed specifically for this project are presented in Section 21 of this report in 2022 Canadian dollars. The economic analysis has been run on a constant dollar basis with no inflation.

## 22.3 Financial Model Parameters

A base case gold price of US$1,700/oz is based on two- and three-year trailing averages of the LBMA Gold Bullion price and is meant to reflect the average metal price expectation over the life of the project. No price inflation or escalation factors were taken into account. Commodity prices can be volatile, and there is the potential for deviation from the forecast.

The economic analysis was performed using the following assumptions:

- Project construction starting October 5, 2022
- commercial production starting on January 1, 2025
- mine life of 14.3 years
- exchange rate of 0.75 (USD:CAD)
- cost estimates in constant 2022 Canadian dollars with no inflation or escalation

- 100% ownership with 1.5% NSR (assumes buy back of 0.5% NSR)
- capital costs funded with 100% equity (no financing costs assumed)
- all cash flows discounted to December 31, 2022 using mid period discounting convention
- working capital based on accounts payable of 30 days, accounts receivable of 15 days, and inventory of 15 days
- gold is assumed to be sold in the same year its produced
- no contractual arrangements for refining currently exist.

## 22.4 Taxes

The project has been evaluated on an after-tax basis to provide an approximate value of the potential economics. The tax model was compiled with assistance from third-party taxation professionals. The calculations are based on the tax regime as of the date of the feasibility study update. At the effective date of the cashflow, the project was assumed to be subject to the following tax regime:

- The Canadian corporate income tax system consists of 15% federal income tax and 15% provincial income tax.
- The mining tax rate in Newfoundland and Labrador is 15%.

At the base case gold price assumption, total tax payments are estimated to be C$598 million over the life of mine.

## 22.5 Refining and Transport Cost and Silver Credit

Mine revenue is derived from the sale of gold doré into the international marketplace. No contractual arrangements for refining currently exist. However, the parameters used in the economic analysis are consistent with current industry rates. A refining and transport charge of C$3.93/oz was assumed with 99.95% gold payability resulting in a C$10 million cost over the life of mine. Silver credits were estimated based on a price of US$22/oz with a 50% recovery and 99.5% payability resulting in a C$25 million credit over the life of mine.

## 22.6 Royalty

A 1.5% royalty has been assumed for the project, resulting in approximately C$87 million in royalty payments over life of mine. It has been assumed that the company has bought back 0.5% of a previously outstanding 2% NSR for approximately C$9 million prior to December 31, 2022, resulting in the financial model carrying only a 1.5% NSR. As the financial model is based on an asset level, the C$9 million outflow has not been incorporated in the financial model.

## 22.7 Economic Analysis

The economic analysis was performed assuming a 5% discount rate, with all cashflows being discounted to December 31st, 2022. All cashflows in 2022 occur prior to this date and have not been included in calculations for net present value (NPV), internal rate of return (IRR), cumulative cash flow, and payback period. The pre-tax NPV discounted at 5% is

C$1,000 million; the internal rate of return IRR is 26.7%; and payback period is 2.7 years. On an after-tax basis, the NPV discounted at 5% is C$648 million; the IRR is 22.4%; and the payback period is 2.8 years. A summary of project economics is shown graphically in Figure 22-1 and listed in Table 22-1. The economic analysis was done on monthly, quarterly and annual cashflow basis, but the cashflow output is shown on an annualized basis in Table 22-2.

**Figure 22-1: Project Economics**

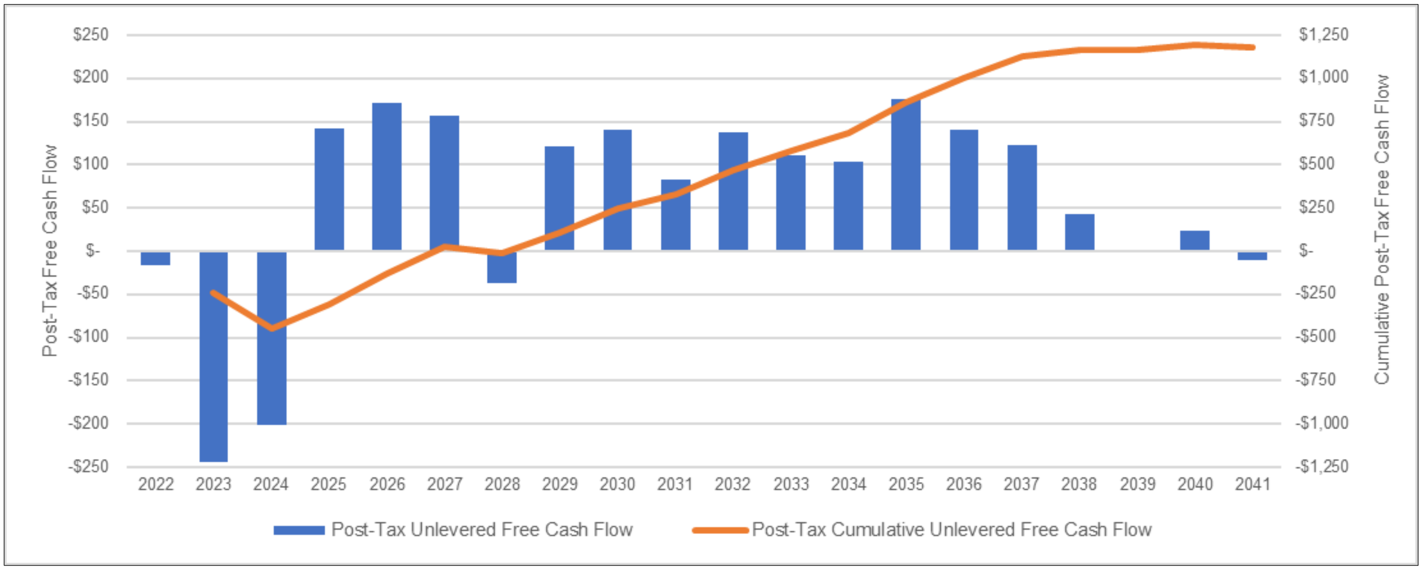


**Table 22.1: Summary of Project Economics**

| General | | LOM Total / Avg. |
|---|---|---|
| Gold Price (US$/oz) | | $1,700 |
| Mine Life (years) | | 14.3 |
| Total Waste Tonnes Mined (kt) | | 545,424 |
| Total Mill Feed Tonnes (kt) | | 51,580 |
| Strip Ratio | | 10.57x |
| **Production** | | **LOM Total / Avg.** |
| Mill Head Grade (g/t) | | 1.62 |
| Mill Recovery Rate (%) | | 95% |
| Total Mill Ounces Recovered (koz) | | 2,553 |
| Total Average Annual Production (koz) | | 179 |
| **Operating Costs** | | **LOM Total / Avg.** |
| Mining Cost (C$/t Mined) | | $3.03 |
| Processing Cost (C$/t Milled) | | $16.62 |
| G&A Cost (C$/t Milled) | | $6.99 |
| Refining & Transport Cost (C$/oz) | | $3.93 |
| Silver Credit (C$/oz) | | ($9.61) |
| Total Operating Costs (C$/t Milled) | | $58.09 |
| Cash Costs (US$/oz AuEq) | | $902 |
| AISC (US$/oz AuEq) | | $1,046 |
| **Capital Costs** | | **LOM Total / Avg.** |
| Sunk Capital (C$M) | | $71 |
| Remaining Initial Capital (C$M) | | $463 |
| Expansion Capital (C$M) | | $66 |
| Sustaining Capital (C$M) | | $377 |
| Closure Costs (C$M) | | $79 |
| Salvage Costs (C$M) | | ($30) |
| Sustaining Capital incl. Salvage and Closure Costs (C$M) | | $426 |
| **Financials** | **Pre-Tax** | **Post-Tax** |
| NPV (5%) C($M) | $1,000 | $648 |
| IRR (%) | 26.7% | 22.4% |
| Payback (years) | 2.7 | 2.8 |

Notes: **1.** Cash costs consist of mining costs, processing costs, mine-level G&A, refining charges (including silver credit) and royalties. **2.** AISC includes cash costs plus expansion capital, sustaining capital, salvage value and closure costs. **3.** Calculations for pre-tax and post-tax financials exclude cashflows occurring in 2022. **4.** Sunk Capital includes actual expenditures from January 2021 up to and including October 2022. Remaining Initial Capital includes forecasted expenditures from November 2022 up to and including December 2024.

## 22.8 Sensitivity Analysis

A sensitivity analysis was conducted on the base case pre-tax and after-tax NPV and IRR of the project, using the following variables: gold price, foreign exchange rate, operating costs, and initial capital costs. Pre-tax sensitivity results are shown in Table 22-3 and Figure 22-2; Table 22-4 and Figure 22-3 show post-tax sensitivity results. The analysis revealed that the project is most sensitive to changes in foreign exchange rate and gold price, and less sensitive to operating costs and initial capital costs.

**Table 22.2: Project Cash Flow on an Annualised Basis**

| Cash Flows Discounted to December 31, 2022 | Units | Sum/Avg | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Macro Assumptions** | | | | | | | | | | | | | | | | | | | | | | |
| Gold Price - Flat | US$/oz | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 | $1,700 |
| Foreign Exchange | C$:US$ | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 | $0.75 |
| **Free Cash Flow Valuation** | | | | | | | | | | | | | | | | | | | | | | |
| **Revenue** | **C$mm** | **$5,785** | **--** | **--** | **--** | **$441** | **$456** | **$464** | **$400** | **$471** | **$518** | **$387** | **$497** | **$408** | **$381** | **$492** | **$376** | **$309** | **$148** | **$38** | **--** | **--** |
| Operating Cost | C$mm | ($2,996) | – | – | – | ($206) | ($218) | ($236) | ($291) | ($265) | ($274) | ($264) | ($268) | ($222) | ($207) | ($186) | ($143) | ($101) | ($80) | ($34) | – | – |
| Refining Charges (incl. Silver Credit) | C$mm | $14 | – | – | – | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $0 | – | – |
| Royalties | C$mm | ($87) | – | – | – | ($7) | ($7) | ($7) | ($6) | ($7) | ($8) | ($6) | ($7) | ($6) | ($6) | ($7) | ($6) | ($5) | ($2) | ($1) | – | – |
| **EBITDA** | **C$mm** | **$2,716** | **--** | **--** | **--** | **$229** | **$232** | **$222** | **$103** | **$200** | **$237** | **$118** | **$222** | **$181** | **$169** | **$300** | **$228** | **$204** | **$66** | **$4** | **--** | **--** |
| Sunk Capital | C$mm | ($71) | ($71) | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Remaining Initial Capital | C$mm | ($463) | ($17) | ($244) | ($202) | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Expansionary Capital Cost | C$mm | ($66) | – | – | – | – | – | – | ($66) | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Sustaining Capital Cost | C$mm | ($377) | – | – | – | ($85) | ($53) | ($59) | ($72) | ($30) | ($25) | ($12) | ($7) | ($12) | ($9) | ($5) | ($5) | ($4) | – | – | – | – |
| Closure Capital Cost | C$mm | ($79) | – | – | – | – | – | – | – | – | ($6) | ($6) | ($6) | ($6) | ($6) | ($6) | ($6) | ($6) | ($7) | ($7) | ($7) | ($10) |
| Salvage Value | C$mm | $30 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | $30 | – |
| Changes in Working Capital | C$mm | – | – | – | – | ($1) | ($2) | $1 | $0 | ($7) | ($2) | $5 | ($4) | $2 | $0 | ($5) | $3 | $1 | $6 | $3 | – | – |
| **Pre-Tax Unlevered Free Cash Flow** | **C$mm** | **$1,690** | **($88)** | **($244)** | **($202)** | **$143** | **$177** | **$164** | **($34)** | **$164** | **$204** | **$105** | **$205** | **$165** | **$154** | **$283** | **$221** | **$194** | **$65** | **$0** | **$23** | **($10)** |
| Pre-Tax Cumulative Unlevered Free Cash Flow | C$mm | $1,778 | | ($244) | ($446) | ($303) | ($126) | $38 | $4 | $167 | $372 | $477 | $682 | $847 | $1,001 | $1,284 | $1,505 | $1,699 | $1,765 | $1,765 | $1,788 | $1,778 |
| **Newfoundland-Labrador Mining Tax** | C$mm | ($157) | – | – | – | ($1) | ($6) | ($7) | – | ($5) | ($14) | – | ($17) | ($12) | ($11) | ($34) | ($24) | ($23) | ($2) | – | – | – |
| **Income Tax Payable** | C$mm | ($441) | – | – | – | – | – | – | ($3) | ($37) | ($49) | ($23) | ($51) | ($42) | ($39) | ($72) | ($56) | ($49) | ($20) | – | – | – |
| **Post-Tax Unlevered Free Cash Flow** | **C$mm** | **$1,092** | **($88)** | **($244)** | **($202)** | **$142** | **$171** | **$157** | **($37)** | **$121** | **$141** | **$83** | **$137** | **$111** | **$104** | **$176** | **$141** | **$123** | **$43** | **$0** | **$23** | **($10)** |
| Post-Tax Cumulative Unlevered Free Cash Flow | C$mm | $1,181 | | ($244) | ($446) | ($304) | ($133) | $24 | ($13) | $108 | $249 | $331 | $469 | $580 | $684 | $860 | $1,001 | $1,124 | $1,167 | $1,167 | $1,190 | $1,181 |
| **Production Profile** | | | | | | | | | | | | | | | | | | | | | | |
| Total Resource Mined | kt | 51,580 | – | 243 | 55 | 5,164 | 5,993 | 4,345 | 3,968 | 4,627 | 4,564 | 4,000 | 4,435 | 3,117 | 2,613 | 4,000 | 3,000 | 1,455 | – | – | – | – |
| Total Waste Mined | kt | 545,424 | 975 | 5,182 | 4,190 | 45,858 | 47,518 | 55,120 | 66,403 | 60,539 | 60,555 | 57,427 | 51,772 | 36,339 | 28,284 | 17,479 | 6,550 | 1,234 | – | – | – | – |
| Total Material Mined | kt | 597,003 | 975 | 5,425 | 4,245 | 51,022 | 53,511 | 59,465 | 70,371 | 65,166 | 65,119 | 61,427 | 56,207 | 39,456 | 30,897 | 21,479 | 9,550 | 2,689 | – | – | – | – |
| Strip Ratio | w:o | 10.57 | – | 21.35 | 76.01 | 8.88 | 7.93 | 12.69 | 16.73 | 13.08 | 13.27 | 14.36 | 11.67 | 11.66 | 10.82 | 4.37 | 2.18 | 0.85 | – | – | – | – |
| Percent of Resource Depleted (excl. Pre-Strip) | % | 100.0% | – | – | – | 10.1% | 11.7% | 8.5% | 7.7% | 9.0% | 8.9% | 7.8% | 8.6% | 6.1% | 5.1% | 7.8% | 5.9% | 2.8% | – | – | – | – |
| Mill Feed | kt | 51,580 | – | – | – | 2,295 | 2,500 | 2,500 | 3,250 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,002 | 4,000 | 4,000 | 4,000 | 4,000 | 1,031 | – | – |
| Mill Head Grade (Au) | g/t | 1.62 | – | – | – | 2.83 | 2.69 | 2.73 | 1.78 | 1.69 | 1.86 | 1.39 | 1.78 | 1.46 | 1.37 | 1.77 | 1.35 | 1.11 | 0.53 | 0.53 | – | – |
| Contained (Au) | koz | 2,689 | – | – | – | 209 | 216 | 220 | 186 | 217 | 239 | 179 | 229 | 188 | 176 | 227 | 174 | 143 | 69 | 18 | – | – |
| Mill Recovery (Au) | % | 95.0% | – | – | – | 93.2% | 93.2% | 93.2% | 95.0% | 95.7% | 95.7% | 95.5% | 95.7% | 95.6% | 95.5% | 95.7% | 95.5% | 95.4% | 95.1% | 95.1% | – | – |
| Recovered Gold | koz | 2,553 | – | – | – | 195 | 201 | 205 | 176 | 208 | 229 | 171 | 219 | 180 | 168 | 217 | 166 | 136 | 65 | 17 | – | – |
| Gold % Payable | % | 99.95% | – | – | – | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | 99.95% | – | – |
| **Payable Gold** | **koz** | **2,552** | **--** | **--** | **--** | **195** | **201** | **205** | **176** | **208** | **228** | **171** | **219** | **180** | **168** | **217** | **166** | **136** | **65** | **17** | **--** | **--** |
| **Revenue** | **C$mm** | **$5,785** | **--** | **--** | **--** | **$441** | **$456** | **$464** | **$400** | **$471** | **$518** | **$387** | **$497** | **$408** | **$381** | **$492** | **$376** | **$309** | **$148** | **$38** | **--** | **--** |
| **Operating Costs** | | | | | | | | | | | | | | | | | | | | | | |
| **Total Operating Costs** | **C$mm** | **$2,996** | **--** | **--** | **--** | **$206** | **$218** | **$236** | **$291** | **$265** | **$274** | **$264** | **$268** | **$222** | **$207** | **$186** | **$143** | **$101** | **$80** | **$34** | **--** | **--** |
| Mine Operating Costs | C$mm | $1,779 | – | – | – | $134 | $142 | $159 | $208 | $173 | $182 | $171 | $176 | $129 | $119 | $98 | $55 | $22 | $9 | $2 | – | – |
| Mill Processing incl. Water Treatment Costs | C$mm | $857 | – | – | – | $47 | $51 | $51 | $57 | $66 | $66 | $66 | $66 | $66 | $62 | $62 | $62 | $59 | $58 | $19 | – | – |
| G&A Costs | C$mm | $361 | – | – | – | $25 | $25 | $26 | $26 | $26 | $26 | $26 | $26 | $26 | $26 | $26 | $26 | $20 | $14 | $12 | – | – |
| Operating Costs per tonne Processed | C$/t Processed | $58 | – | – | – | $90 | $87 | $94 | $90 | $66 | $69 | $66 | $67 | $55 | $52 | $47 | $36 | $25 | $20 | $33 | – | – |
| **Refining & Transport Costs & Royalties** | | | | | | | | | | | | | | | | | | | | | | |
| Refining & Transport Cost C$3.93/oz Au | C$mm | $10 | – | – | – | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $1 | $0 | $0 | – | – |
| Silver Credit | C$mm | ($25) | – | – | – | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($2) | ($1) | ($1) | ($0) | – | – |
| **Total Off-Site Operating Costs** | **C$mm** | **($14)** | **--** | **--** | **--** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($1)** | **($0)** | **--** | **--** |
| **NSR Royalty** | | | | | | | | | | | | | | | | | | | | | | |
| Total Revenue | C$mm | $5,785 | – | – | – | $441 | $456 | $464 | $400 | $471 | $518 | $387 | $497 | $408 | $381 | $492 | $376 | $309 | $148 | $38 | – | – |
| Refining & Transport Costs | C$mm | ($10) | – | – | – | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($1) | ($0) | ($0) | – | – |
| Silver Credit | C$mm | $25 | – | – | – | $2 | $2 | $2 | $2 | $2 | $2 | $2 | $2 | $2 | $2 | $2 | $2 | $1 | $1 | $0 | – | – |
| Total Net Revenue | C$mm | $5,800 | – | – | – | $442 | $457 | $465 | $401 | $472 | $519 | $388 | $498 | $409 | $382 | $494 | $377 | $310 | $149 | $38 | – | – |
| **Royalties (1.5% NSR)** | **C$mm** | **$87** | **--** | **--** | **--** | **$7** | **$7** | **$7** | **$6** | **$7** | **$8** | **$6** | **$7** | **$6** | **$6** | **$7** | **$6** | **$5** | **$2** | **$1** | **--** | **--** |
| **Cash Costs** | | | | | | | | | | | | | | | | | | | | | | |
| Cash Cost | US$/oz Au | $902 | – | – | – | $600 | $578 | $748 | $1,100 | $897 | $854 | $1,180 | $879 | $978 | $1,092 | $665 | $784 | $939 | $2,119 | $2,692 | – | – |
| All-in Sustaining Cost (AISC) | US$/oz Au | $1,046 | – | – | – | $930 | $776 | $964 | $1,684 | $1,004 | $956 | $1,258 | $922 | $1,054 | $1,160 | $704 | $832 | $996 | $2,198 | $2,995 | – | – |

| Capital Expenditures | Units | Sum/Avg | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sunk Capital** | **C$mm** | **$71** | **$71** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Remaining Initial Capital** | **C$mm** | **$463** | **$17** | **$244** | **$202** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Mining Capital Cost | C$mm | $67 | $7 | $32 | $28 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Process Plant Capital Cost | C$mm | $162 | $9 | $74 | $79 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Infrastructure Capital Cost | C$mm | $120 | $25 | $63 | $32 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Off-site Infrastructure | C$mm | $22 | $17 | $5 | $0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Contractor Indirects | C$mm | $34 | $7 | $15 | $12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Project Delivery | C$mm | $21 | $10 | $9 | $1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Owners Cost | C$mm | $71 | $13 | $28 | $30 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Contingency | C$mm | $39 | $1 | $17 | $20 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Expansion Capital** | **C$mm** | **$66** | -- | -- | -- | -- | -- | -- | **$66** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Sustaining Capital** | **C$mm** | **$377** | -- | -- | -- | **$85** | **$53** | **$59** | **$72** | **$30** | **$25** | **$12** | **$7** | **$12** | **$9** | **$5** | **$5** | **$4** | -- | -- | -- | -- |
| Sustaining Infrastructure Capital | C$mm | $115 | -- | -- | -- | $35 | $17 | $11 | $13 | $4 | $4 | $4 | $4 | $4 | $4 | $4 | $4 | $4 | -- | -- | -- | -- |
| Sustaining Mining Capital | C$mm | $263 | -- | -- | -- | $50 | $36 | $48 | $58 | $26 | $21 | $8 | $2 | $8 | $5 | $1 | $0 | -- | -- | -- | -- | -- |
| **Closure Cost** | **C$mm** | **$79** | -- | -- | -- | -- | -- | -- | -- | -- | **$6** | **$6** | **$6** | **$6** | **$6** | **$6** | **$6** | **$6** | **$7** | **$7** | **$7** | **$10** |
| **Salvage Value** | **C$mm** | **($30)** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | **($30)** | -- |
| **Total Sustaining Capital incl. Closure Cost & Salvage Value** | **C$mm** | **$426** | -- | -- | -- | **$85** | **$53** | **$59** | **$72** | **$30** | **$31** | **$18** | **$13** | **$18** | **$15** | **$11** | **$11** | **$10** | **$7** | **$7** | **($23)** | **$10** |
| **Total Capital Expenditures incl. Salvage Value** | **C$mm** | **$1,026** | **$88** | **$244** | **$202** | **$85** | **$53** | **$59** | **$137** | **$30** | **$31** | **$18** | **$13** | **$18** | **$15** | **$11** | **$11** | **$10** | **$7** | **$7** | **($23)** | **$10** |

Notes: **1.** Cash costs consist of mining costs, processing costs, mine-level G&A, refining charges (including silver credit) and royalties. **2.** AISC includes cash costs plus expansion capital, sustaining capital, salvage value and closure costs. **3.** Calculations for pre-tax and post-tax economics, including cumulative unlevered free cash flow exclude cashflows occurring in 2022. **4.** Sunk capital includes actual expenditures from January 2021 up to and including October 2022. Remaining Initial Capital includes forecasted expenditures from November 2022 up to and including December 2024.

**Table 22.3: Pre-Tax Sensitivity**

**Pre-Tax NPV Sensitivity to Discount Rate**

| Discount Rate | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| 0.0% | $1,108 | $1,443 | $1,778 | $2,113 | $2,448 | $2,784 |
| 3.0% | $734 | $996 | $1,258 | $1,520 | $1,782 | $2,044 |
| 5.0% | $550 | $775 | $1,000 | $1,224 | $1,449 | $1,674 |
| 8.0% | $344 | $525 | $707 | $888 | $1,069 | $1,250 |
| 10.0% | $241 | $399 | $558 | $716 | $874 | $1,033 |

**Pre-Tax IRR Sensitivity to Discount Rate**

| Discount Rate | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| 0.0% | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 3.0% | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 5.0% | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 8.0% | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 10.0% | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |

**Pre-Tax NPV Sensitivity to Foreign Exchange**

| FX | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| 0.65 | $1,071 | $1,330 | $1,590 | $1,849 | $2,108 | $2,368 |
| 0.70 | $792 | $1,033 | $1,274 | $1,514 | $1,755 | $1,996 |
| 0.75 | $550 | $775 | $1,000 | $1,224 | $1,449 | $1,674 |
| 0.80 | $339 | $549 | $760 | $971 | $1,181 | $1,392 |
| 0.85 | $152 | $350 | $548 | $747 | $945 | $1,143 |

**Pre-Tax IRR Sensitivity to Foreign Exchange**

| FX | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| 0.65 | 28.1% | 33.0% | 37.7% | 42.3% | 46.7% | 50.9% |
| 0.70 | 22.6% | 27.4% | 32.0% | 36.4% | 40.6% | 44.8% |
| 0.75 | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 0.80 | 13.0% | 17.6% | 21.9% | 26.2% | 30.2% | 34.1% |
| 0.85 | 8.7% | 13.2% | 17.5% | 21.7% | 25.7% | 29.5% |

**Pre-Tax NPV Sensitivity to Operating Costs**

| Opex | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| (20.0%) | $956 | $1,181 | $1,406 | $1,630 | $1,855 | $2,080 |
| (10.0%) | $753 | $978 | $1,203 | $1,427 | $1,652 | $1,877 |
| -- | $550 | $775 | $1,000 | $1,224 | $1,449 | $1,674 |
| 10.0% | $347 | $572 | $797 | $1,021 | $1,246 | $1,471 |
| 20.0% | $144 | $369 | $594 | $818 | $1,043 | $1,268 |

**Pre-Tax IRR Sensitivity to Operating Costs**

| Opex | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| (20.0%) | 26.0% | 30.3% | 34.4% | 38.5% | 42.4% | 46.1% |
| (10.0%) | 21.9% | 26.3% | 30.6% | 34.8% | 38.8% | 42.7% |
| -- | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 10.0% | 13.1% | 18.0% | 22.6% | 27.1% | 31.4% | 35.6% |
| 20.0% | 8.4% | 13.6% | 18.4% | 23.0% | 27.5% | 31.8% |

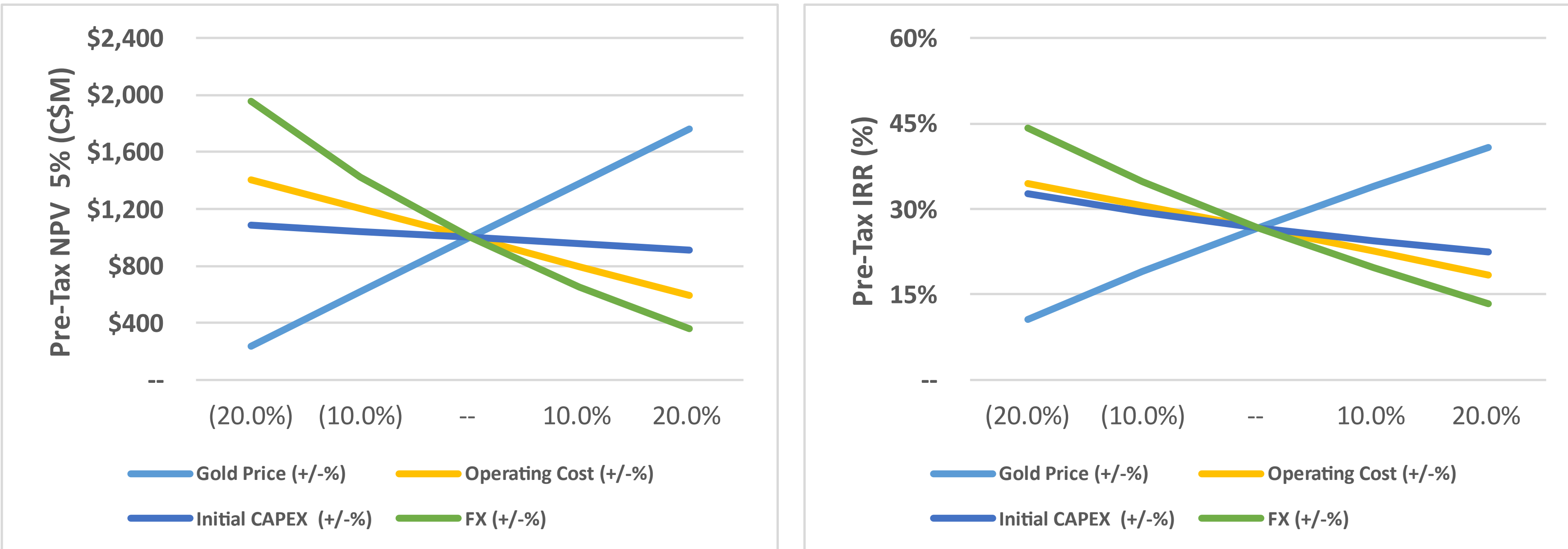
**Pre-Tax NPV Sensitivity to Initial Capital Costs**

| Initial Capex | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| (20.0%) | $636 | $860 | $1,085 | $1,310 | $1,534 | $1,759 |
| (10.0%) | $593 | $818 | $1,042 | $1,267 | $1,492 | $1,716 |
| -- | $550 | $775 | $1,000 | $1,224 | $1,449 | $1,674 |
| 10.0% | $508 | $732 | $957 | $1,182 | $1,406 | $1,631 |
| 20.0% | $465 | $690 | $914 | $1,139 | $1,364 | $1,588 |

**Pre-Tax IRR Sensitivity to Initial Capital Costs**

| Initial Capex | Gold Price (US$/oz) | | | | | |
|---|---|---|---|---|---|---|
| | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
| (20.0%) | 21.9% | 27.4% | 32.6% | 37.7% | 42.6% | 47.3% |
| (10.0%) | 19.6% | 24.6% | 29.4% | 34.0% | 38.5% | 42.9% |
| -- | 17.6% | 22.2% | 26.7% | 31.0% | 35.2% | 39.2% |
| 10.0% | 15.9% | 20.3% | 24.4% | 28.5% | 32.4% | 36.1% |
| 20.0% | 14.4% | 18.5% | 22.5% | 26.3% | 29.9% | 33.5% |

**Figure 22-2: Pre-Tax NPV & IRR Sensitivity Results**




Source: Ausenco, 2022.

The current "run rate" for the production profile has been split into three phases of the Valentine life of mine: three years at 2.5 Mt/a, nine years at 4 Mt/a, and the final stockpile processing period (see Table 22-4).

**Table 22.4: Mining Phases and Production Schedule "Run Rate"**

| Annual Averages[1,2] | Phase 1 | Phase 2 | Phase 1 & 2 | Phase 3 | LOM |
|---|---|---|---|---|---|
| | First 3 Years 2025-27 | Mid 9 Years 2028-36 | First 12 Years 2025-36 | Stockpile Last 3 Years 2037-39 | 14.3 Year Mine Life 2025-39 |
| Recovered Gold (koz Au) | 200 | 193 | 195 | 97 | 179 |
| Head Grade (g/t Au) | 2.75 | 1.60 | 1.80 | 0.79 | 1.62 |
| Processing Rate (Mtpa) | 2.5 | 4.0 | 2.5 to 4.0 | 4.00 | 2.5 to 4.0 |
| AISC[3] (US$/oz) | $890 | $1,048 | $1,007 | $1,510 | $1,046 |
| FCF (C$M) | $157 | $109 | $121 | $74 | $113 |

Notes: **1.** Denotes a specified a financial measure within the meaning of NI 52-112. See note on "Non-IFRS Financial Measures'. **2.** Represents full calendar years. **3.** AISC includes Royalties, Total Cash Cost and Sustaining Capital, including expansion and closure cost. Excludes corporate G&A.

**Table 22.5: Post-Tax Sensitivity**

**Post-Tax NPV Sensitivity to Discount Rate** — Gold Price (US$/oz)

| Discount Rate | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.0% | $764 | $976 | $1,181 | $1,382 | $1,583 | $1,784 |
| 3.0% | $494 | $663 | $825 | $983 | $1,140 | $1,298 |
| 5.0% | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 8.0% | $209 | $330 | $445 | $555 | $664 | $774 |
| 10.0% | $133 | $240 | $341 | $437 | $533 | $629 |

**Post-Tax IRR Sensitivity to Discount Rate** — Gold Price (US$/oz)

| Discount Rate | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 3.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 5.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 8.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 10.0% | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |

**Post-Tax NPV Sensitivity to Foreign Exchange** — Gold Price (US$/oz)

| FX | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.65 | $691 | $847 | $1,003 | $1,158 | $1,311 | $1,464 |
| 0.70 | $518 | $668 | $813 | $958 | $1,102 | $1,244 |
| 0.75 | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 0.80 | $217 | $360 | $498 | $630 | $757 | $884 |
| 0.85 | $81 | $225 | $360 | $489 | $614 | $734 |

**Post-Tax IRR Sensitivity to Foreign Exchange** — Gold Price (US$/oz)

| FX | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| 0.65 | 23.4% | 27.0% | 30.5% | 33.8% | 36.9% | 40.0% |
| 0.70 | 19.1% | 22.9% | 26.2% | 29.5% | 32.7% | 35.6% |
| 0.75 | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 0.80 | 10.9% | 14.9% | 18.6% | 21.9% | 25.0% | 27.9% |
| 0.85 | 7.2% | 11.2% | 14.9% | 18.3% | 21.5% | 24.4% |

**Post-Tax NPV Sensitivity to Operating Costs** — Gold Price (US$/oz)

| Opex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | $622 | $759 | $894 | $1,029 | $1,162 | $1,294 |
| (10.0%) | $495 | $635 | $771 | $906 | $1,041 | $1,174 |
| -- | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 10.0% | $222 | $374 | $520 | $660 | $795 | $931 |
| 20.0% | $72 | $236 | $388 | $533 | $672 | $807 |

**Post-Tax IRR Sensitivity to Operating Costs** — Gold Price (US$/oz)

| Opex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | 21.8% | 25.0% | 28.1% | 31.1% | 33.9% | 36.6% |
| (10.0%) | 18.5% | 22.1% | 25.3% | 28.4% | 31.4% | 34.2% |
| -- | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 10.0% | 11.0% | 15.3% | 19.1% | 22.7% | 25.8% | 28.9% |
| 20.0% | 6.9% | 11.4% | 15.6% | 19.4% | 22.9% | 26.1% |

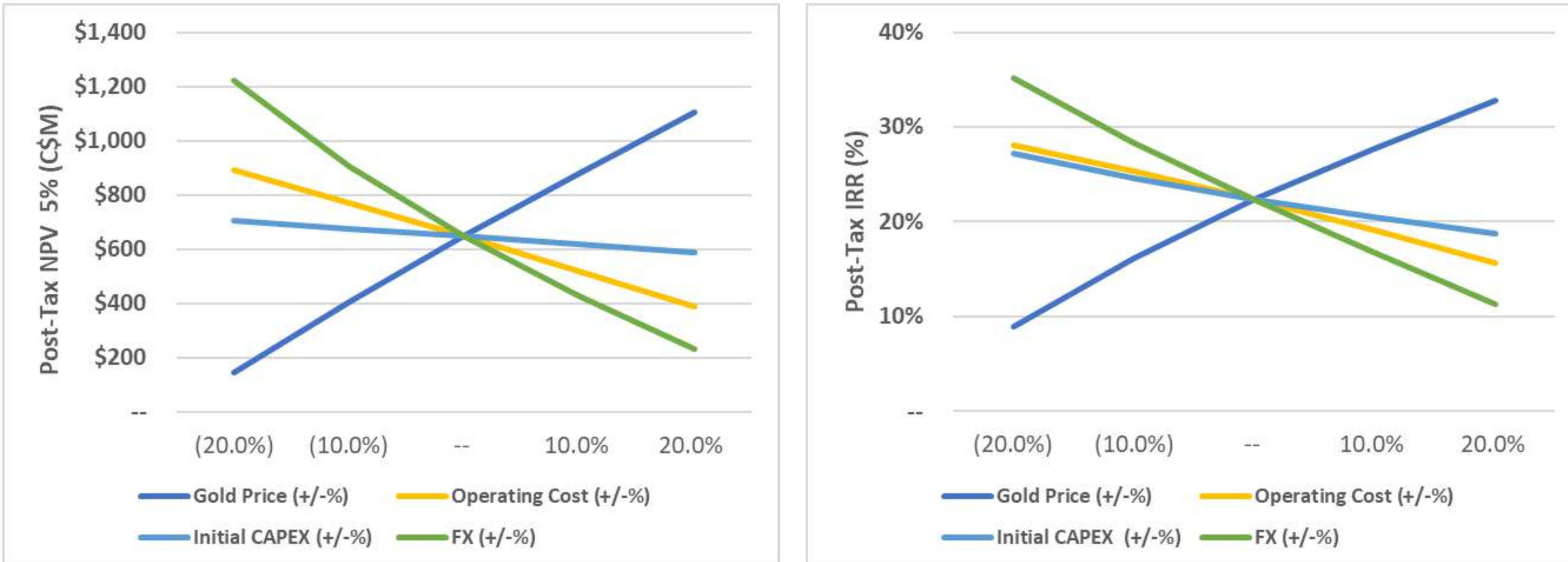
**Post-Tax NPV Sensitivity to Initial Capital Costs** — Gold Price (US$/oz)

| Initial Capex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | $425 | $568 | $704 | $840 | $975 | $1,109 |
| (10.0%) | $393 | $538 | $676 | $812 | $947 | $1,081 |
| -- | $361 | $507 | $648 | $783 | $919 | $1,054 |
| 10.0% | $328 | $477 | $618 | $755 | $890 | $1,026 |
| 20.0% | $295 | $445 | $588 | $727 | $862 | $997 |

**Post-Tax IRR Sensitivity to Initial Capital Costs** — Gold Price (US$/oz)

| Initial Capex | $1,500 | $1,600 | $1,700 | $1,800 | $1,900 | $2,000 |
|---|---|---|---|---|---|---|
| (20.0%) | 18.8% | 23.3% | 27.2% | 30.9% | 34.5% | 37.9% |
| (10.0%) | 16.7% | 20.8% | 24.6% | 28.0% | 31.3% | 34.5% |
| -- | 14.9% | 18.8% | 22.4% | 25.6% | 28.6% | 31.6% |
| 10.0% | 13.4% | 17.1% | 20.4% | 23.5% | 26.4% | 29.2% |
| 20.0% | 12.0% | 15.5% | 18.8% | 21.7% | 24.5% | 27.1% |

**Figure 22-3: Post-Tax NPV & IRR Sensitivity Results**



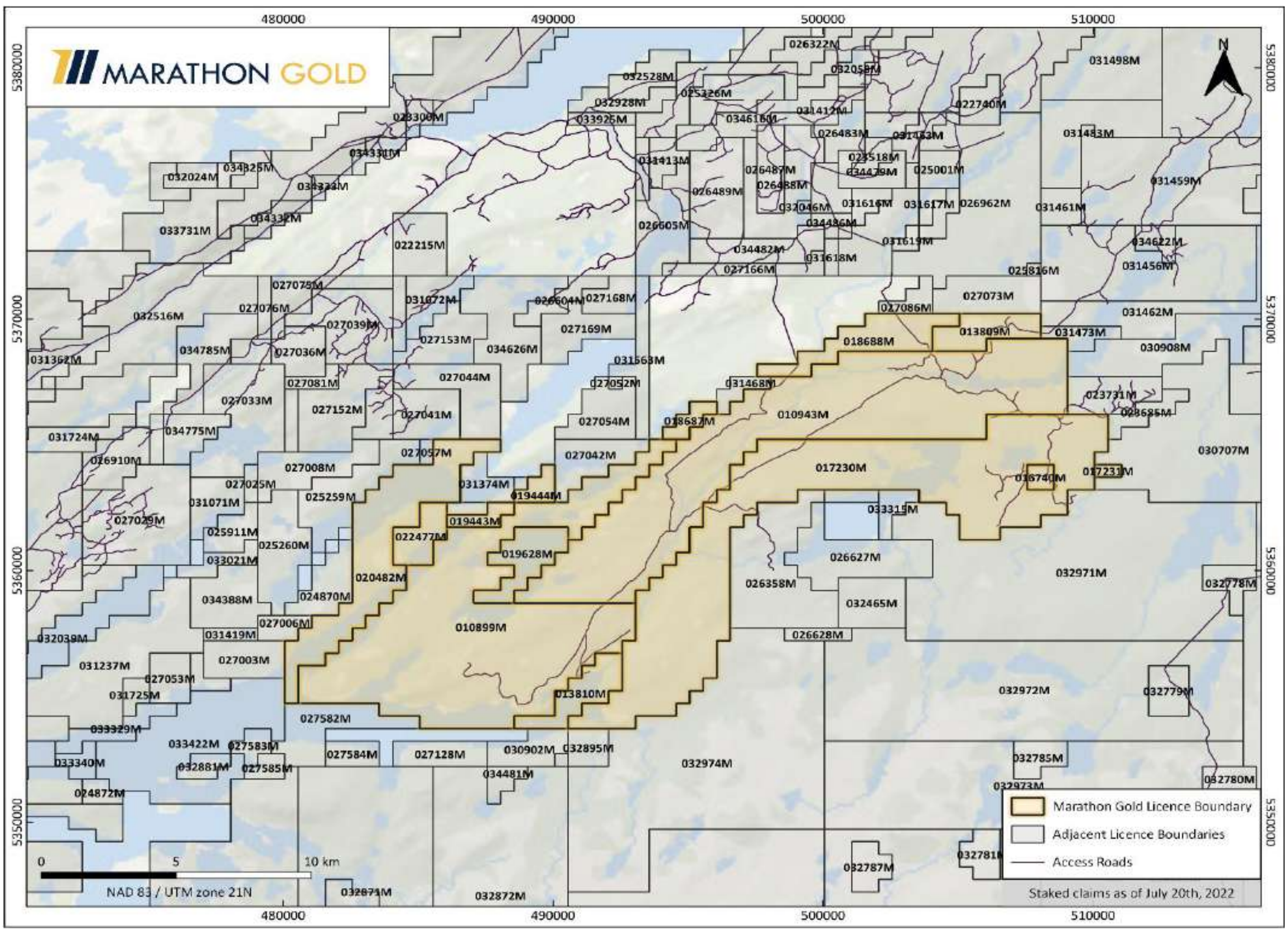

Source: Ausenco, 2022.

# 23 ADJACENT PROPERTIES

The Valentine Gold Project is almost surrounded by other mineral claims belonging to various mineral exploration companies (Figure 23-1), not all of which have gold as the primary metal of interest. To the best of the QPs knowledge, there are no other advanced projects in the area adjacent to the Valentine Gold Project; this statement is supported by the Government of Newfoundland and Labrador (2022) Mining Development Review map of developing properties.

The tenure and claims presented in Figure 23-1 are based on data from the Newfoundland and Labrador Government website, which is updated daily. The QP has not verified the information or the styles of mineralization on the properties held by other companies. The mineralization on other properties is not necessarily indicative of the mineralization at the Valentine Gold Project.

**Figure 23-1: Valentine Lake Property Tenure Map & Adjacent Claims**




Source: Marathon Gold, 2022.

# 24 OTHER RELEVANT DATA AND INFORMATION

## 24.1 Project Execution & Organization

The Project Execution Plan (PEP) is a governing document that establishes the means to execute, monitor, and control the execution phase of the Valentine Gold project. The plan will serve as the main communication tool to ensure the project team is aware and knowledgeable of project objectives and how they will be accomplished.

The following subsections summarize the contents of the Valentine Gold Project PEP.

### 24.1.1 Summary

The PEP includes, but is not limited to, the following:

- an overview of the project
- the scope of work and services
- execution strategy
- the project schedule with key activities and target dates identified
- an organizational chart.

The Valentine Gold Project is intended to be constructed in two distinct phases, an initial installation (Phase 1) and an expansion (Phase 2).

The PEP will be supported by various sub-plans including, but not limited to, the following:

- Health, Safety and Environment Management Plan
- Engineering Execution Plan
- Procurement Strategy and Management Plan
- Contracting Strategy and Management Execution Plan
- Construction Execution Plan
- Commissioning Execution Plan
- Project Controls Plan
- Project Quality Plan

- Risk Management Plan
- Logistics and Materials Management Plan
- Site Requirements for Construction
- Commercial Management Plan.

#### 24.1.2 Objectives

Marathon Gold aims to bring the Valentine Gold Project into operation while satisfying the following objectives:

- zero harm to personnel involved with construction, operation, and maintenance of the facilities, and zero unintended environmental impact or incidents
- preserve or improve the project value through effective control of project costs and completion of construction and commissioning on or ahead of schedule
- satisfy quality and performance targets
- comply with company policies and legislative requirements, negotiated benefits agreements
- maintain positive community relations.

#### 24.1.3 Execution Strategy

Three contract strategies will be employed to deliver detailed engineering and execution of the project through the following:

1. An EP contract that generally encompasses the process plant and select on-site infrastructure.
2. A CM contract that manages the construction activities of the process plant and select on-site infrastructure. The CM team is built from Marathon Gold resources and the selected contractor’s resources forming an integrated team.
3. EPCM scope, led by several engineering consultants nominated by Marathon Gold, that generally encompasses site bulk earthworks, TMF and water management.
4. EPCM scope, led by Marathon Gold, that generally encompasses the development of the mining pits, earthworks, select on-site infrastructure, off-site infrastructure, and a permanent camp.

These are described in more detail in the following subsections.

#### 24.1.3.1 EP Contract

Under this agreement, the contractor will deliver the engineering and procurement of the process plant (and select on-site infrastructure).

The delivery strategy is summarized as follows:

- Engineering and design for construction will be completed by the contractor. Detailed design started in April 2022 and will be completed in October 2023.
- Procurement of equipment and materials, including expediting and shipment will be completed by the contractor (purchase orders by Marathon Gold). Procurement tasks will be prioritized by equipment delivery time and to support engineering progress. Purchase orders for non-critical equipment and materials supplied from Canada, USA, or Europe will include transport to site. Transport of critical goods will be managed by a freight forwarder.

#### 24.1.3.2 CM Contract

Under this agreement, the contractor will deliver the construction phase of the process plant (and select on-site infrastructure) based on a unit rate contract.

- The contractor will finalize the contracting strategy for construction of the process plant during detailed engineering following a process of contractor evaluations and pricing reviews. Contracts will be managed by the construction team on site.
- The contractor's site team will report to Marathon Gold's VP of Projects, Engineering & Construction. The contractor will provide safety and field supervision who will manage interfaces between the various construction contractors working on site and monitor quality and progress. The construction management team will be based on site.
- The CM team will advise Marathon Gold on contractor selection through production of specification and contractor packages and performing technical and commercial bid evaluations.

#### 24.1.3.3 EPCM Scope Led by Engineering Consultant

This delivery strategy can be summarized as follows:

- Engineering and design for construction will be completed by the engineering consultant. Detailed design started in April 2022 and will be completed in October 2023.
- Procurement of equipment and services, contract management will be performed by Marathon Gold. The engineering consultant will advise Marathon Gold on vendor and contractor selection through production of specification and contractor packages and performing technical and commercial bid evaluations.
- Marathon Gold will continue to perform commercial management of contractors during construction. The engineering consultant will provide technical supervision and support on-site as required. The engineering consultant's site team will report to Marathon Gold's VP of Projects, Engineering & Construction

#### 24.1.3.4 EPCM Scope Led by Marathon Gold

Marathon Gold will manage select scope areas and engage delivery contractors as required to execute fixed scopes. Notable scope inclusions are as follows:

- mobile mining equipment selection and procurement
- mining pit detailed design and development
- permanent camp design and procurement
- access road upgrades scoping and development
- high-voltage powerline to site permitting, engineering and development
- high-voltage substation supply
- general earthworks, including TMF construction and water management.

### 24.1.4 Project Organization

#### 24.1.4.1 Organization & Resourcing

The project team is organized based on an integrated team approach, minimizing the duplication of roles and activities between the Owner's Team and their major delivery partners. A project organization chart is shown in Figure 24-1.

Marathon Gold will be performing or managing a considerable portion of the project scope, including the mine design, power transmission line, pit pre-stripping and delivery of certain construction materials to designated work sites. Key persons will be established on both teams at site to ensure efficient coordination.

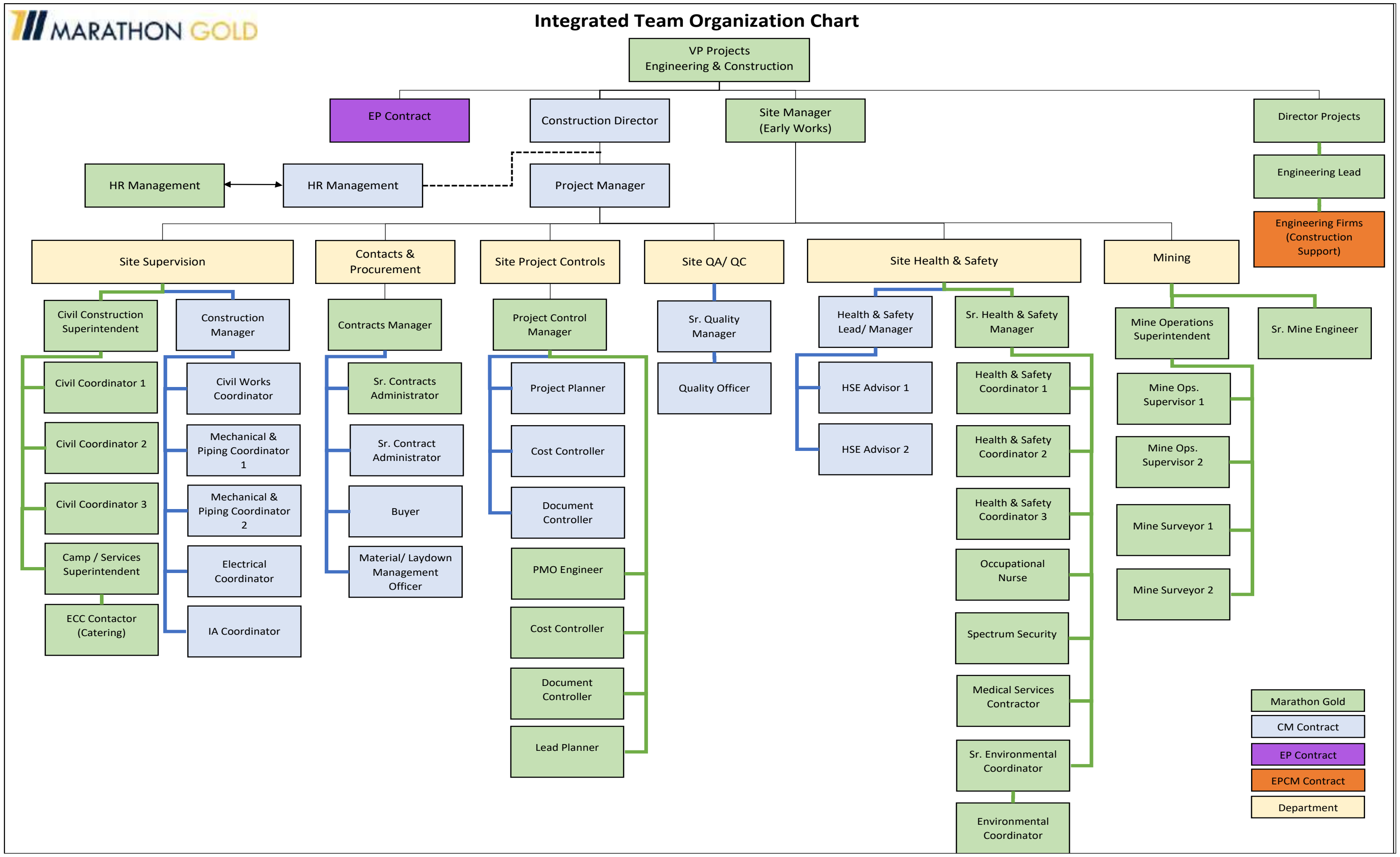
#### 24.1.4.2 Alignment Strategy

The project alignment strategy aims to create shared understanding of the project vision and strategy to enable Marathon Gold and its internal and external stakeholders to achieve the project objectives. The project delivery team will operate as one team with defined responsibilities, accountabilities, and authorities. The team will be established and supported to deliver "Best for Project" outcomes in line with Marathon Gold's expectations and critical success factors.

Establishment of the delivery team working relationships and agreeing acceptable desired outcomes will be done in facilitated alignment sessions.

The alignment effort will be concentrated at the front-end of the project, although ongoing activities will be planned throughout to increase overall effectiveness, commitment, and cohesiveness of project team members.

## Figure 24-1: Project Organization




Source: Marathon Gold, 2022.

#### 24.1.4.3 Sponsor Group

A Sponsor Group/ Steering Committee will be formed to reinforce corporate commitment to the project as it passes through its various phases. Key activities include the following:

- directing the business objectives for the participants to achieve 'best for project' outcomes
- providing corporate commitment to achieving the desired outcomes for the project
- reinforcing common purpose in achieving the project goals
- managing third party events outside of the control of the project team
- providing corporate recognition and reward for performance
- supporting the project in resolution of issues.

The Sponsor Group will comprise senior executives from the EP contractor, CM contractor and Marathon Gold. The Sponsor Group will stay abreast of events and issues on and around the project. The principal responsibility of each member in their role on the Sponsor Group is directed at ensuring that the project is guided, supported, and encouraged to achieve the project objectives. Each member's association with their own organization is secondary to their responsibility to support the project.

### 24.1.5 Construction Execution Strategy

#### 24.1.5.1 Construction Sequencing

An overall master execution schedule is included in Section 24.2; however, this section will outline the high-level execution sequencing constraints that were evaluated to determine the execution schedule baseline.

There will be a period of early works that will need to be completed prior to the first mobilization to site. These early works include the following main tasks:

- environmental and construction permitting activities
- detailed engineering
- issue the purchase order for the long-lead items (mining fleet, ball/SAG mills, LSS motors, ADR circuit)
- initial pit development for waste rock
- keypad construction for early works construction including camp and process plant
- award of key construction contracts (camp construction, site civil works, concrete batch plant, pre-engineered buildings).

The completion of these early works activities was targeted prior to first mobilization to site in October 2022. This date was predicated on Marathon Gold receiving their EIS permit approval in September 2022 and filing and receiving the appropriate environmental/construction permits to allow ground-breaking to occur.

It was critical that no site works that move the project forward occurred until these permits were in hand. This included early mobilization and staging equipment on site, early site preparations, or stockpiling of construction materials.

Once the permits were obtained, the first contractors to mobilize were the camp construction contractors and early civil works contractors responsible for clearing and grubbing specific site works boundaries. It is critical that the clearing and grubbing contractors drop the trees in the specific site boundaries in the winter before the migratory bird nesting window opens in April 2023.

As the clearing and grubbing activities continue, the heavy civil work will follow to strip topsoil and organics and stockpile them in designated areas for future remediation works. Temporary water management catchments and ditches will also be developed as the civil works continue in the Marathon and Leprechaun pits, the tailings management dam footprint, as well as the process plant pad development.

After the early civil works are completed, there will be three main work-fronts on the project property. The mining works will continue the pit development of both the Marathon and Leprechaun pit locations, generating and stockpiling waste rock material that will be crushed/screened via a contract crushing/screening plant and used for construction materials. The TMF works will be placing and compacting hauled waste rock to raise the dam wall and finishing with crushed/screened material and installing the geomembrane liner. The process plant works will begin with the concrete batch plant set up in late Q1 2023, followed by the start of the detailed earthworks and concrete works in early Q2 2023 for buildings and major equipment foundations. Construction will be continuous until commissioning activities begin in Q3 2024 with “first gold” in January 2025.

#### 24.1.5.2 Winter Construction

The concrete works for the process plant are scheduled to be carried out between April and September 2023. The construction sequence for the process plant is such that the process plant and reagent pre-engineered buildings will be fully constructed and cladded prior to the winter. This will allow installation works to continue within the buildings, sheltered from any inclement weather.

The TMF geomembrane liner installation works consists of laying both coarse and fine bedding material on the dam wall and then rolling out and keying in large areas of geomembrane liner. This work is especially dependent on weather, as large precipitation events can wash out the bedding material and the high winds associated with this region can hamper liner installation productivity. The decision was made as a project team to complete the dam construction and key in the liner to a reasonable point prior to the 2023/2024 winter and then stop that activity. The remainder of the liner will be installed in the spring of 2024 when the weather is more favourable. The hauling, placement, and compaction of waste rock material to continue dam wall construction can continue through the winter period.

#### 24.1.5.3 Site Laydown Requirements

Any goods or equipment that can be stored outdoors may be placed in an on-site, outdoor laydown area that is ideally located near the process plant. The outdoor laydown area will have to be on level ground, with all snow removed prior to the arrival of goods and equipment.

Indoor storage will be required for all materials requiring protection from the nature elements. An industrial building that is constructed early and is not immediately required for other purposes (e.g., reagents building) may be used as a storage warehouse.

Both the site laydown and indoor storage facilities will need to obtain the necessary authorizations to store any hazardous materials. The required security, protective and handling equipment should be on hand to allow hazardous materials to be temporarily stored as necessary.

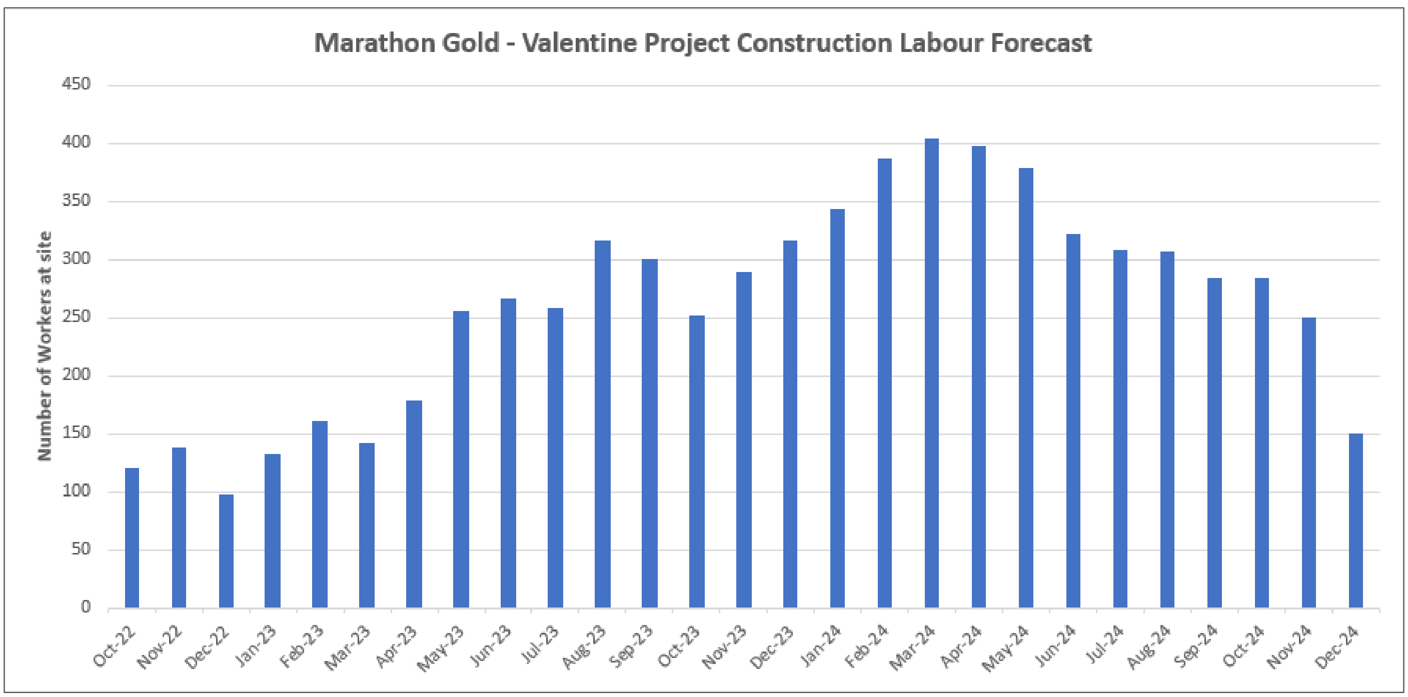
#### 24.1.5.4 Camp Requirements

A temporary camp is set to be utilized during the early works Q4 2022 to early Q2 2023, until the permanent camp is up and running. The permanent camp will be built and utilized for both the construction phase and the operations phase of the project. As accommodation will be required for the construction workforce, the camp has been purchased and will be installed in the early works phase of the project. A temporary camp has been installed and will be utilized for six to eight months to allow for the permanent camp construction to be completed.

#### 24.1.5.5 Construction Staffing

A labour loading forecast was developed for the construction phase (see Figure 24-2). The forecast was developed utilizing labour hours received from contractors who provided budgetary pricing for the feasibility study, as well as from organization charts for the construction management teams from the owner, the engineering firms, and the CM Contractor.

**Figure 24-2: Camp Requirements During Construction Period**




Source: Marathon Gold, 2022.

#### 24.1.5.6 Shared Site Services

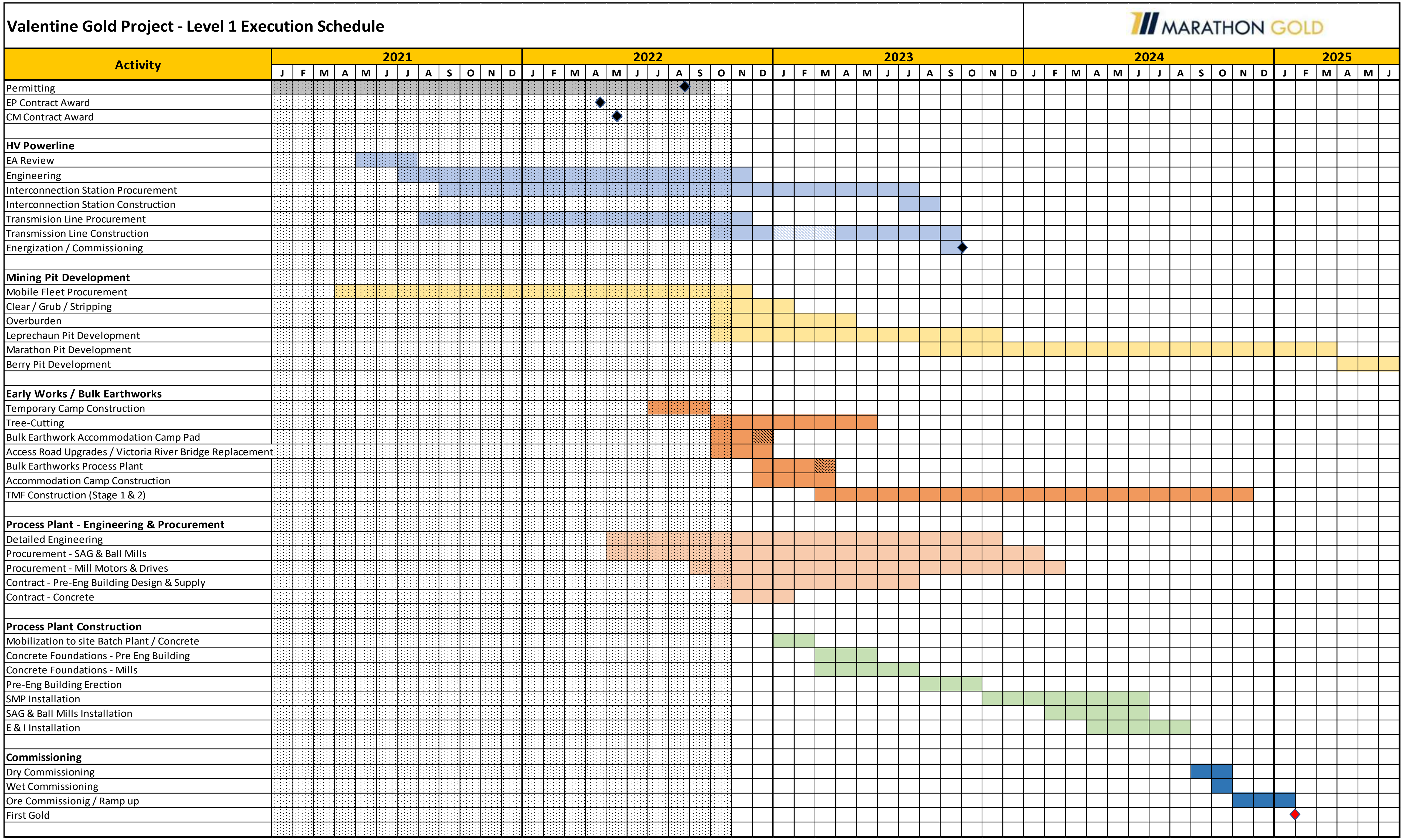
Several services were identified as common across the work fronts during construction. It may be advantageous to offer these common services to the contractors both from a cost perspective, as well as to allow site service contracts to local businesses. These services include:

- diesel fuel supply
- road maintenance/snow clearing
- garbage removal
- bussing workforce to/from the camp each day (Marathon Gold Integrated Team's Personnel)
- upfront purchase or lease of mobile equipment that will be required by operations that can be free issued to the construction contractors for use during construction.

## 24.2 Project Execution Schedule

The preliminary project execution schedule is shown in Figure 24-3.

**Figure 24-3: Marathon Gold Project Execution Schedule**



## 24.3 Risk

Risk identification and mitigation was ongoing throughout the feasibility study, and will continue through value/detailed engineering, construction, operations and closure. Risks were identified and qualitatively ranked in the Valentine Gold Project Risk Register. As the project moves from the feasibility study phase into the execution phase, it will be necessary to update the Project Risk Register. The evaluations were based on the following categories/areas:

01 - Health & Safety
02 - Environmental
03 - Stakeholder Relations
04 - Schedule
05 - Technical / Engineering
06 - Procurement
07 - Construction
08 - Operations
09 - Commissioning
10 - Human Resources / Staffing
11 - Cost
12 - Security

### 24.3.1 Risk Analysis Workshop Process

The objective of this process was to a undertake a risk analysis in a workshop environment utilizing expert input from consultants, engineering firms and Marathon Gold representatives. The purpose was to capture the results in a Risk Register that can be utilized for ongoing project risk management.

The methodology adopted for this risk analysis was in accordance with the best practices of risk management standards. Risk identification is the most important part of the process by which risks are identified based heavily on "expert judgement”. Quantified evaluations of likelihood and consequences are captured in the workshop environment under the guidance of the risk facilitator.

The risk levels used were based on the categories listed in Table 24-1 and the criteria in Table 24-2.

**Table 24.1: Risk Categories**

| Risk Level | Definition |
|---|---|
| **5 - Catastrophic** | Unacceptable Risk - Mitigation and risk reduction measures must be implemented as soon as possible. |
| **4 - Major** | Unwanted Risk - Implementation of preventive control measures and risk reduction measures, as well as re-evaluation of risks at regular intervals. |
| **3 - Serious** | Acceptable risk with control – Risks must be reduced to the lowest possible level. |
| **2 - Medium** | Acceptable Risk |
| **1 - Minor** | Negligible risk |

Source: Marathon Gold, 2022.

**Table 24.2: Risk Criteria**

| Risk Type (Project) | 1 - Minor | 2 - Medium | 3 - Serious | 4 - Major | 5 - Catastrophic |
|---|---|---|---|---|---|
| **Capital Costs (Baseline - 500 m)** | **200 k to 1.5 M** | **1.5 M to 5 M** | **6 M to 10 M** | **11 M to 25 M** | **More than 25 M** |
| **Project Schedule** | -Less than 2 weeks delay of project schedule.<br><br>- Minor impact on project financial returns (IRR). | - Between 2 weeks and 1 month delay of project schedule.<br><br>- Impact on financial returns of the project. | - Between 1 month and 2 months delay of project schedule.<br><br>- Impact on financial returns of the project. | - Project schedule end date delayed between 2 months and 4 months.<br><br>- Notable/Important impact on financial returns of the project. | - Project scheduled delayed by more than 4 months.<br><br>- Major impact on financial returns of the project. |
| **Disturbance of Production** | Little effect on production. | Production is affected, with loss of non-critical sector(s). | Production is affected, with temporary loss of one critical sector. | Production is affected, there is loss of more than one critical sector. Example: loss of operations of a critical sector, crushing, tailings. | Required to use contingency plans and/or provisional operation plans. |
| | No need for overtime to compensate for effects on production. | Obligation to compensate with occasional overtime. | Obligation to compensate with frequent overtime. | Obligation to compensate through regular (daily) use of overtime. | Overtime cannot fully compensate for production loss. |
| | Event has little impact on the project. | Project is affected. | Production can be delayed with some loss of production. | Production often delayed; important loss of production. | Production loss. |
| **Acceptance of the Project by the Users** | Resistance to change with little impact on integration of the project in production. | Resistance to change preventing project acceptance. | - Resistance to change preventing project acceptance.<br><br>- Minor modifications to obtain acceptance of deliverables by employees and integration of project. | - Resistance to change preventing project acceptance.<br><br>- Additional employee training, equipment modification, technical modification etc, required to obtain acceptance. | - Plant employees refuse the deliverables of the project.<br><br>- Major difficulties prevent project acceptance; project rejected; extraordinary effort required to save the situation. |
| **Commissioning and Ramp-up of the Project** | Minor problems while the operations team takes ownership of the project. | Problems while the operations team takes ownership of the project operation and ramp-up (temporary lack of availability of labour compensated for by overtime). | Problems while the operations team takes ownership of the project operation and ramp-up (change management problems: hiring, training, scheduling, availability of labour, etc.). | Major problems while the operations team takes ownership of the project operation and ramp-up. (change management problems, lack of spare parts, poor pre-operational verifications (POV), difficulties in meeting production objectives, equipment deficiencies, hiring, training, availability of labour, etc.). | Major problems with operation and ramp-up (major change management problems, unable to meet production targets, hiring, training, availability of manpower, critical equipment deficiencies, unavailability of spare parts, etc.). |
| **Engineering/Technology/ Constructability** | Minor technical and/or process problems with negligeable impact on attaining production objectives. | Problems of a technical nature and/or process nature making it difficult to reach production objectives. | - Technical and/or process with important and/or permanent negative impact on attaining production objectives and maintaining equipment.<br><br>- Possible to attain only 95% of production objectives. | Major technical and/or process problems making it impossible to attain more than 85% of production objectives. | Major technical and/or process problems making it impossible to attain 75% of production objectives. |
| **Social Acceptance of the Project by the Community & Social Acceptability** | Few complaints or no significant impact on the community. | Complaints and some impact on the immediate community. | Important impact on the community requiring modifications to scope. | Important impact on the community requiring major modifications to scope (<25%). | Important impact on the community requiring major modifications to scope (25%) or project cancellation. |
| **Human Resources/Work Relations** | Little reaction by workers. | Union Reaction. | Serious work slowdown; refusal to work overtime. | Construction end dates questioned and/or sporadic stoppage of work.<br><br>Labour walk-out. | Work stoppage generating important losses.<br><br>Necessitating force majeure. |

| Risk Type (Project) | 1 - Minor | 2 - Medium | 3 - Serious | 4 - Major | 5 - Catastrophic |
|---|---|---|---|---|---|
| **Environmental Impact (EIA & Permitting)** | **Project site** (process plant, facilities, WTP, mining area, TMF)<br>- Near-source confined and promptly reversible impact.<br><br>- Normally reversible within one shift. | **On site**<br>- Near-source confined and short-term reversible impact.<br><br>- Normally reversible within one week. | **On site**<br>- Near-source confined and medium-term recovery impact.<br><br>- Normally reversible within one month. | **On site**<br>- Unconfined impact requiring long-term recovery, with residual damage.<br><br>- Unconfined incident/release resulting in significant but limited in area.<br><br>- Normally reversible within one year. | **On site**<br>- Impact that is widespread-unconfined and requiring long-term recovery, with major residual damage.<br><br>- Normally reversible within more than one year. |
| | **Off site**: NA | **Off site**<br>- Near-source confined and promptly reversible impact.<br>- Normally reversible within one shift.<br>- Very minor perturbation of wildlife or floristic. | **Off site**<br>- Near-source confined and short-term reversible impact.<br>- Normally reversible within one week.<br>- Minor perturbation of wildlife or floristic. | **Off site**<br>- Near-source confined and medium-term recovery impact.<br>- Normally reversible within one month.<br>- Important perturbation of wildlife or floristic. | **Off site**<br>- Off-site or unconfined incident/release resulting in extensive or long-lasting damage to habitat, resources, wildlife or neighbouring communities.<br>- Normally reversible within one year. |
| **Community Impact** | **Socio-economic**<br>Minor level community dissatisfaction. | **Socio-economic**<br>Low level community dissatisfaction/support. | **Socio-economic**<br>Censure/endorsement in local media. | **Socio-economic**<br>Significant harm/sustainable benefit with wide group implications. | **Socio-economic**<br>Permanent or irreversible harm/sustainable benefit. |
| | **Cultural heritage**<br>Community complaint solved via existing site procedures. | **Cultural heritage**<br>Non-compliance with Corporate standards. | **Cultural heritage**<br>Repairable damage to site or item of cultural significance. | **Cultural heritage**<br>- Irreparable damage to site or item of international cultural significance<br>- Breach of license or non-compliance with community agreement. | **Cultural heritage**<br>Irreparable damage to site or item of international cultural significance. |
| | **Outrage**<br>Isolated incident. | **Outrage**<br>Low level community dissatisfaction. | **Outrage**<br>Repeated community complaints requiring site management or business unit response. | **Outrage**<br>Severe, prolonged local community resistance greater than one year of public exposure in national media. | **Outrage**<br>Severe, prolonged complaints, greater than three years of public exposure in international media. |
| **Personnel Safety** | Discomfort or minor injury<br>(minor cuts, bruises, abrasions). | Reversible injury requiring medical treatment with return to normal duties (no restrictions). | Reversible injury, moderate irreversible damage or impairment to one person. | Serious injury, severe irreversible damage or severe impairment to one person. | One or more fatalities or permanent damage of several individuals. |
| | No medical treatment required<br>Near miss. | First aid medical treatment. | Lost time injury. | Permanent injury. | One fatality or more. |
| **Health Impact** | Reversible health effect or little concern, requiring first aid treatment at most. | Reversible health effects normally requiring medical treatment. | Severe, reversible health effects normally with lost time incident. | Single fatality or irreversible damage to health or disabling illness. | Multiple fatalities, irreversible health damage, or serious disablement of more than one person. |
| | Minor irritations of eyes, throat, nose, skin or muscular discomfort. | Could include heat stress, dehydration. | Could include acute short-term effects such as extreme heat stress, muscular skeletal, vibration, nervous system, certain infectious disease. | Could include progressive chronic conditions and/or acute/short-term high-risk effects. | Could include effects of carcinogens, mutagens, teratogens and/or agents toxic to reproductive system (known or suspected), sensitization of respiratory tracts. |
| **Compliance Impact** | Non-compliance with internal operational procedure with low potential for impact. | Non-compliance with external standard or operating procedure with low to medium potential for impact. | Non-compliance with moderate potential for impacts (e.g., intermittent compliance of work permit or licence). | Breach of licence, legislation, or regulation or repeated non-compliance. | Partial or total business unit closure or license suspension |
| | No impact. | Minor fines. | Moderate fines. | High potential for prosecution and severe fines. | Regulator imposed suspension or severe reduction of operations. |
| | No impact on clients or investors. | Minor impact on clients or investors. | Some client loss, no impact on investors. | Public exposure in national media major effort must be invested to recuperate lost clients and investors. | Important and irreversible loss of a majority of clients and investors. |

Source: Marathon Gold, 2022.

Risk probabilities used to assess the chances of that risk occurring were based on the criteria summarized in Table 24-3.

**Table 24.3: Risk Probability Criteria**

| Level | Definition | Descriptive | Probability | Frequency Interval (Multiple Events) |
|---|---|---|---|---|
| A | **Almost Certain** | Recurring event during the lifetime of a project/operation. Very high probability that the event will happen during the first year of operation, even at many occasions, will certainly happen. | > 90% | More than twice a year |
| B | **Likely** | Event that may occur frequently during the lifetime of a project/operation. Will probably happen in the first year of operation. | 50% - 90% | once per year |
| C | **Possible** | Event that may occur during the lifetime of a project/operation. Could probably happen. | 20% - 49% | 1 once in 2 years |
| D | **Unlikely** | Low probability of occurrence during the lifetime of a project/operation. | 5% - 19% | 1 once in 1 to 5 years |
| E | **Very Unlikely (Rare)** | Event that is probable, but very unlikely to occur during the lifetime of a project/operation. | < 5% | More than 20 years |

By taking the information listed in Tables 24-1 to 24-3 and combining it and providing weightings, a risk prioritization table was created, such as the one shown in Table 24-4.

### 24.3.2 Risk Analysis

The process of risk analysis begins by selecting an area/category of interest. The area is analysed with various risks proposed by the team. The proposed risk is quantified for likelihood and impact based on the tables in Section 24.3.1. The standard method of assessing and displaying overall risk for each activity is graphically in the risk prioritization matrix.

The results of the Valentine Gold Project risk analysis are summarized in the prioritization matrix shown in Table 24-5.

The results show that 65 risks that were notable enough to record. Within the summary, three risks were noted in the red danger zone. Those risks were mostly related to plant operational dangers. A detailed review of the risks with the purpose of determining practical risk mitigation procedures was conducted. The post-mitigation risk prioritization is in progress and is updated monthly.

**Table 24.4: Risk Prioritization Table**

| | | Weights | 2 | 3 | 5 | 9 | 13 |
|---|---|---|---|---|---|---|---|
| Consequences | Weights | | E - Very Unlikely (Rare) | D - Unlikely | C - Possible | B - Likely | A - Almost Certain |
| | 32 | 5 - Catastrophic | 64 | 96 | 160 | 288 | 416 |
| | 16 | 4 - Major | 32 | 48 | 80 | 144 | 208 |
| | 8 | 3 - Serious | 16 | 24 | 40 | 72 | 104 |
| | 4 | 2 - Medium | 8 | 12 | 20 | 36 | 52 |
| | 2 | 1 - Minor | 4 | 6 | 10 | 18 | 26 |

**Table 24.5: Pre-Mitigation Risk Prioritization Matrix**

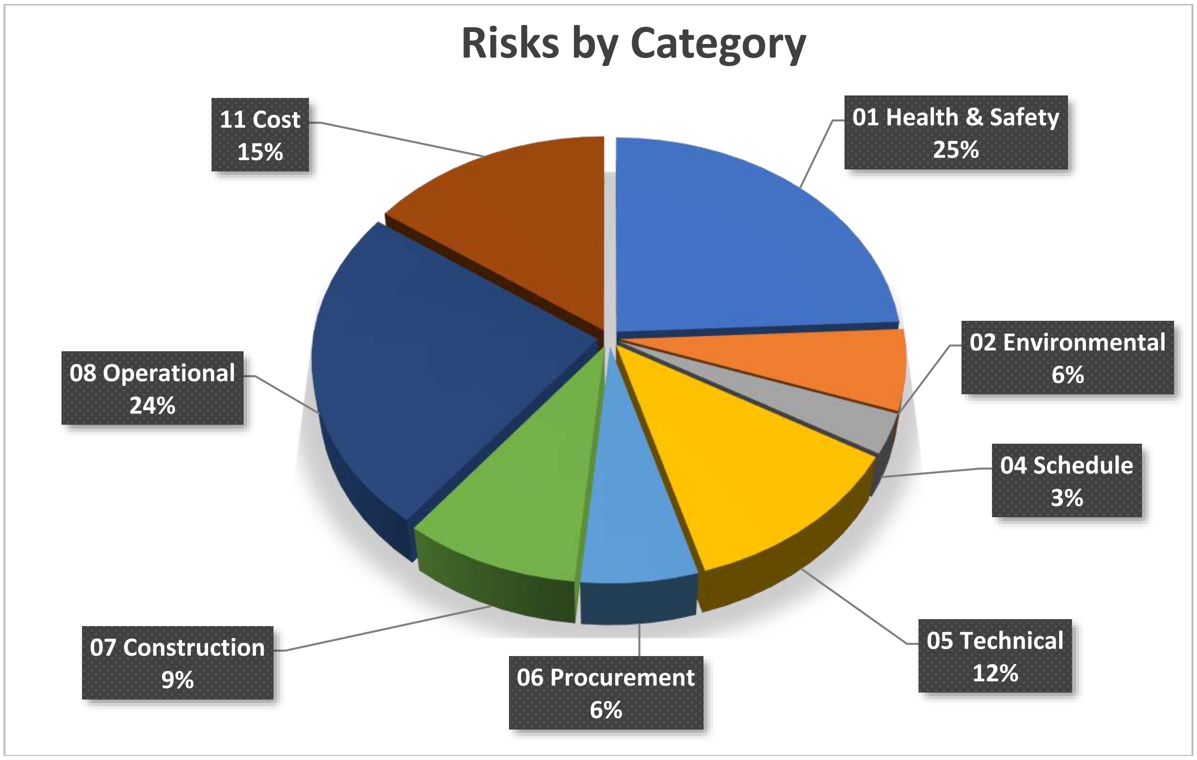
| | | Weights | 2 | 3 | 5 | 9 | 13 |
|---|---|---|---|---|---|---|---|
| Consequences | Weights | | E - Very Unlikely (Rare) | D - Unlikely | C - Possible | B - Likely | A - Almost Certain |
| | 32 | 5 - Catastrophic | 8 | | | | |
| | 16 | 4 - Major | 3 | 3 | | | |
| | 8 | 3 - Serious | 2 | 40 | 7 | 4 | |
| | 4 | 2 - Medium | 0 | 13 | 42 | 4 | 1 |
| | 2 | 1 - Minor | 2 | 7 | 3 | 5 | 1 |

**Legend for Tables 24-4 to 24-5**

| Risk Level |
|---|
| Very High (>160) |
| High (80 to 144) |
| Medium (26 to 72) |
| Low (10 to 24) |
| Very Low (4 to 8) |

The pie chart in Figure 24-4 summarizes the percentage of the total risks per area. A discussion of the most notable risks is provided in Section 24.3.3.

**Figure 24-4: Valentine Gold Project Risk Categories**




Source: Marathon Gold, 2022.

### 24.3.3 Summary of Notable Project Risks

#### 24.3.3.1 Procurement and Logistics

A list of the major procurement and logistics risks is noted below. The risks have been assessed with mitigation to minimize their impact to the project and mainly fall under the high- to medium-risk range.

- The high cost of materials (supply chain issues, lack of inventory) and labour (limited pool of resources in province) are still both concerns that requires further planning, scheduling and recruiting to lower this particular issue.
- Freight costs are not yet stabilized and manufacturing of key equipment in China are a risk due to lock downs in country including the closing of ports. These will be managed as delivery timelines approach and the freight forwarder is able to work with the manufacturer on the best options at that time.

#### 24.3.3.2 Mining

A list of the major mining risks is noted below. The risks have been assessed with mitigation to minimize their impact to the project and mainly fall under the low- to medium-risk range.

- The start-up schedule and start-up equipment and personnel deployment are some of the main areas of risk and opportunity that will benefit by further studies and schedule definition and detailing.

#### 24.3.3.3 Tailings Management Facility

The following list provides some of the main risks associated with the TMF during construction and operations. The risks fall mostly in the low- to medium-risk range.

1. Inadequate characterization of the TMF foundation conditions could lead to increased construction material requirements and costs.
2. Water management issues associated with both the quantity and quality of the inflows to the TMF could result in excess water stored in the TMF that would require additional treatment and discharge to the environment to maintain dam containment.
3. Damage to the dam liner due to improper construction or installation could result in excess seepage. This may overwhelm the downstream sumps and cause uncontrolled discharge to the environment thus incurring additional costs for environmental rehabilitation and the implementation of additional controls.
4. A failure of the tailings dam would result in the uncontrolled release of water and/or tailings into the environment, resulting in operations shutdown and significant costs for environmental clean-up and rehabilitation and dam reconstruction.

The above risks have been currently classified as low, as it is recognized that contingency planning, engineering, quality controls during design, construction, and operation will be implemented to mitigate these risks.

#### 24.3.3.4 Health and Safety

The list of health and safety risks relates to both internal and external areas. The risks associated with personnel safety in the process plant were some of the most serious risks noted in the assessment as many chemicals, products, and pieces of equipment in the process plant if not properly used could result in serious harm or death. After mitigation procedures and proper training were taken into consideration, the risks were reassessed as being in the low to medium range.

The main items captured in the risk register include the following:

- flooding of downstream areas that could damage a key bridge on the access road
- release of water from the dam to the Victoria River
- insufficient training of personnel in the use and exposure to various chemicals in the plant (i.e., cyanide, and NaOH)
- failure of monitoring equipment such as cyanide gas detectors.

The above risks have been currently classified as medium, but planning and ongoing implementation of proper training protocols through operational readiness and experienced training personnel as well as proper upfront engineering will mitigate these risks.

#### 24.3.3.5 Construction

A key risk identified for construction activities relates to excavation activities, which are underway. This risk falls in the medium- to high- risk range and is discussed below.

- The overburden depth that was calculated during basic engineering was found to be inadequate. Current on-site mitigation measures are managing the increased excavation and backfill requirements to maintain the schedule and limit the cost impact.

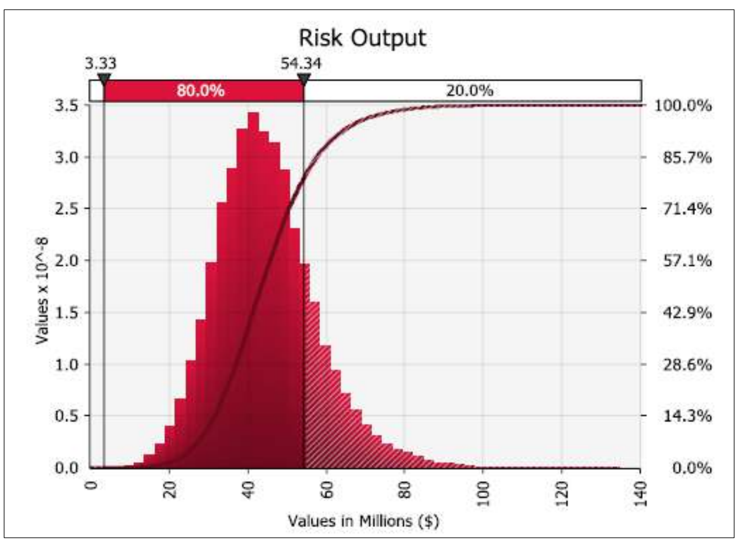
## 24.4 Monte Carlo

A Monte Carlo simulation was generated to produce a likely range of values for each input in the risk register. This was carried out using a defined logic network based on a probabilistic cost from the bell-curve distribution established by the optimistic, most likely, and pessimistic inputs for both cost and schedule. The simulation ran several iterations of the complete logic network, selecting a new value for each input in every simulation. The software collected the data and produced histograms that provide a range of data for different probabilities of occurrence based on the identified parameters.

Based on one-hundred-thousand iterations, the risk budget required to address and mitigate specific risk events is shown within the indicative S-Curve in Figure 24-5. This figure shows that based on the risk rankings, there should be a minimum risk reserve of $3,330,000 or a maximum of $54,340,000 contingency allocated for these risks based on the $P_{80}$ probabilistic distribution. This is due to a few of these risks having very high likelihoods.

Note that the risk reserve percentage was based on a $495,552,704 capital cost baseline, excluding contingency.

**Figure 24-5: $P_{80}$ Monte Carlo Output Graph**



# 25 INTERPRETATION AND CONCLUSIONS

## 25.1 Property Description and Location

Mineral rights to the property are 100% controlled by Marathon Gold. The 14 contiguous mineral licenses (24,000 hectares) are in good standing as of the effective date of this report and are fully permitted for work expenditures associated with annual assessment work requirements. In addition to mineral exploration licenses for the property, Marathon also holds the mining leases to the Leprechaun and Marathon deposits.

The Valentine Gold Project is subject to regulation under the environmental protection regimes of the *Canadian Environmental Assessment Act* and the Newfoundland and Labrador (NL) *Environmental Protection Act*. To APEX's knowledge, there are no other significant factors or risks that may affect access, title, or the right or ability to perform work on the property.

## 25.2 Exploration

Marathon Gold has conducted numerous ground exploration surveys since 2010. This work includes geological mapping, lithogeochemical grab and channel sampling, ground geophysical surveying (induced polarisation, magnetic, and seismic), diamond drilling, RC drilling, metallurgical processing, and environmental baseline studies. The results of this work have significantly improved the understanding of exploration potential at the project through a systematic and detailed geological approach.

The work collectively expedited the discovery, confidence level, and advancement of five main gold deposits at the project: Leprechaun, Sprite, Berry, Marathon and Victory deposits. Several other exploration targets have been identified by Marathon Gold across the property, namely the Frank, Rainbow, Steve, Scott, Triangle, Victoria Bridge, Narrows, Victory SW, Victory NE, Eastern Arm, and Western Peninsula.

In addition, the exploration results have been used by BOYD and APEX to develop robust 3D geological models and mineral resource estimations. The geological evidence of which, in the case of indicated and measured resources, is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation (Table 25-1).

## 25.3 Drilling

Between 2010 and the end of 2021, Marathon Gold had drilled 1,782 diamond drillholes totalling 413,236 m. In 2021, Marathon Gold completed the company's largest drill program in the history of the Valentine Lake property which focussed on infill drilling of the Berry deposit. A summary of the drillholes and gold assays used to update the Leprechaun, Berry and Marathon resource estimations is provided in Table 25-1.

APEX and BOYD consider the drilling procedures have been conducted to a high standard, and that there are no drilling, sampling, or recovery factors that could materially impact the accuracy and reliability of results.

**Table 25.1: Exploration Results that form the Marathon, Leprechaun & Berry Geological Databases**

| Exploration Activity | Marathon (to 14 May 2022) | Leprechaun (to 14 April 2022) | Berry (to 12 June 2022) |
|---|---|---|---|
| Drillholes | 713 drillholes totalling 151,663 m in total length drilled | 483 drillholes totalling 99,976 m in total length drilled | 421 drillholes totalling 99,845 m in total length drilled |
| Gold Assays | 109,456 assays totalling 159,104 m of total assayed length (96.4% of the total length drilled) | 70,912 assays totalling 96,749 m of total assayed length (96.8% of the total length drilled) | 72,474 assays totalling 95,829 m of total assayed length (96.0% of the total length drilled) |
| Geological Records | 16,838 geological records | 8,617 geological records | 8,736 geological records |
| Survey Records | 25,218 survey records | 24,709 survey records | 22,290 survey records |
| Visible Gold Records | 1,444 visible gold records | 1,252 visible gold records | 537 visible gold records |
| QTPV Records | 3,907 QTPV records | 2,892 QTPV records | 4,919 QTPV records |

Notes: QTPV = quartz-tourmaline-pyrite zones. Dates listed reflect assay data cut-off. All drillholes summarized were drilled prior to 2022.

## 25.4 Sample Preparation, Analyses and Security

APEX reviewed and compared hardcopy laboratory certificates and drill logs against the electronic spreadsheets provided by Marathon Gold and found no issues. APEX considers that the sample preparation, analytical procedures, and security were of a good standard and that the results are adequate for use in mineral resource estimation.

A weak, but consistent, negative bias was observed in the results of certified reference material (CRM) assays dating back to 2010, which may indicate that some FA results are weakly underestimated. Marathon Gold does not routinely analyse duplicate pulp samples. Limited data on duplicate pulp samples can exhibit a nugget effect at relatively low gold grades (less than 6 g/t). The use of metallic sieve analyses on any sample that assays greater than 100 ppb Au (and 300 ppb Au as a threshold since 2019) was used to increase the accuracy of gold analytical results.

Marathon Gold has bolstered its QA/QC protocol during 2022 which has elevated the confidence level of the Valentine Gold Project's geology and mineralization.

## 25.5 Data Verification

The qualified person considers that the data collected, prepared and analyzed by Marathon Gold is adequate for the estimation of mineral resources in accordance with CIM definitions and guidelines (2014, 2019) and the disclosure rule NI 43-101.

The April 2022 site inspection allowed APEX to confirm the geological interpretations made in support of mineral resource estimations. The verification of the drill databases conducted by BOYD in preparation of the mineral resource estimates presented in Section 14 have shown the data to be reliable and accurate. Further, results of the independent analytical test work conducted by APEX demonstrate that the Marathon Gold assay dataset is valid and appropriate to be used in resource estimations.

## 25.6 Mineral Resource Estimations

The mineral resource estimates were completed by BOYD under the supervision of Mr. Eccles, who reviewed and accepts responsibility of the mineral resources. The mineral resources, reported below in Table 25-2, include five identified gold deposits—Leprechaun, Sprite, Berry, Marathon, and Victory—that comprise the Valentine Gold Project. Mineral resources are not mineral reserves and do not have demonstrated economic viability. The estimate is of mineral resources only and because these do not constitute mineral reserves, they do not have demonstrated economic viability.

**Table 25-2: Consolidated Valentine Gold Project Mineral Resources**

| Material/ Category | Open Pit | | | Underground | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tonnes (t) | Grade (g/t) | Gold (oz) | Tonnes (t) | Grade (g/t) | Gold (oz) | Tonnes (t) | Grade (g/t) | Gold (oz) |
| **Leprechaun Deposit** | | | | | | | | | |
| Measured | 7,315,000 | 2.56 | 601,400 | 57,000 | 3.38 | 6,200 | 7,372,000 | 2.56 | 607,600 |
| Indicated | 8,023,000 | 1.75 | 451,000 | 194,000 | 3.18 | 19,800 | 8,217,000 | 1.78 | 470,800 |
| **M+I** | **15,338,000** | **2.13** | **1,052,400** | **251,000** | **3.22** | **26,000** | **15,589,000** | **2.15** | **1,078,400** |
| Inferred | 4,131,000 | 1.28 | 169,500 | 725,000 | 3.28 | 76,500 | 4,856,000 | 1.58 | 246,000 |
| **Sprite Deposit** | | | | | | | | | |
| Measured | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 |
| Indicated | 695,000 | 1.74 | 38,800 | 6,000 | 2.20 | 400 | 701,000 | 1.74 | 39,200 |
| **M+I** | **695,000** | **1.74** | **38,800** | **6,000** | **2.20** | **400** | **701,000** | **1.74** | **39,200** |
| Inferred | 1,189,000 | 1.20 | 45,900 | 61,000 | 2.47 | 4,800 | 1,250,000 | 1.26 | 50,700 |
| **Berry Deposit** | | | | | | | | | |
| Measured | 6,678,000 | 2.41 | 517,600 | 73,000 | 3.72 | 8,700 | 6,751,000 | 2.43 | 526,300 |
| Indicated | 10,178,000 | 1.66 | 542,700 | 230,000 | 2.32 | 17,100 | 10,408,000 | 1.67 | 559,800 |
| **M+I** | **16,856,000** | **1.96** | **1,060,300** | **303,000** | **2.66** | **25,800** | **17,159,000** | **1.97** | **1,086,100** |
| Inferred | 4,740,000 | 1.31 | 200,300 | 592,000 | 2.87 | 54,600 | 5,332,000 | 1.49 | 254,900 |
| **Marathon Deposit** | | | | | | | | | |
| Measured | 14,851,000 | 1.86 | 889,600 | 252,000 | 4.32 | 35,000 | 15,103,000 | 1.90 | 924,600 |
| Indicated | 14,092,000 | 1.49 | 673,700 | 895,000 | 3.55 | 102,200 | 14,987,000 | 1.61 | 775,900 |
| **M+I** | **28,943,000** | **1.680** | **1,563,300** | **1,147,000** | **3.72** | **137,200** | **30,090,000** | **1.76** | **1,700,500** |
| Inferred | 5,285,000 | 1.50 | 254,300 | 1,699,000 | 3.66 | 200,000 | 6,984,000 | 2.02 | 454,300 |
| **Victory Deposit** | | | | | | | | | |
| Measured | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 |
| Indicated | 1,084,000 | 1.46 | 50,800 | 1,000 | 1.80 | 100 | 1,085,000 | 1.46 | 50,900 |
| **M+I** | **1,084,000** | **1.46** | **50,800** | **1,000** | **1.80** | **100** | **1,085,000** | **1.46** | **50,900** |
| Inferred | 2,200,000 | 1.16 | 81,800 | 130,000 | 3.05 | 12,700 | 2,330,000 | 1.26 | 94,500 |
| **All Deposits** | | | | | | | | | |
| Measured | 28,844,000 | 2.17 | 2,008,600 | 382,000 | 4.06 | 49,900 | 29,226,000 | 2.19 | 2,058,500 |
| Indicated | 34,072,000 | 1.60 | 1,757,000 | 1,326,000 | 3.28 | 139,600 | 35,398,000 | 1.67 | 1,896,600 |
| **M+I** | **62,916,000** | **1.86** | **3,765,600** | **1,708,000** | **3.45** | **189,500** | **64,624,000** | **1.90** | **3,955,100** |
| Inferred | 17,545,000 | 1.33 | 751,800 | 3,207,000 | 3.38 | 348,600 | 20,752,000 | 1.65 | 1,100,400 |

Notes: **1.** CIM (2014) definitions were followed for mineral resources. **2.** The effective date for the Leprechaun, Berry, and Marathon deposits MRE is June 15, 2022. The effective date for the Sprite and Victory deposits MRE is November 20, 2020. The independent Qualified Person, as defined by NI 43-101, is Mr. Roy Eccles, P.Geo. (PEGNL) of APEX Geoscience Ltd. **3.** Open pit mineral resources are reported within a preliminary pit shell at a cut-off grade of 0.3 g/t Au. Underground mineral resources are reported outside the pit shell at a cut-off grade of 1.36 g/t Au. Mineral resources are reported inclusive of mineral reserves**. 4.** Mineral resources are estimated using a long-term gold price of US$1,800 per ounce, and an exchange rate of 0.76 USD/CAD. **5.** Mineral resources reported demonstrate reasonable prospect of eventual economic extraction, as required under the CIM 2014 standards as MRMR. **6.** The mineral resources would not be materially affected by environmental, permitting, legal, marketing, and other relevant issues based on information currently available.**7.** Numbers may not add or multiply correctly due to rounding.

## 25.7 Mining

### 25.7.1 Mineral Reserve Estimates

Proven and probable mineral reserves have been modified from measured and indicated mineral resources at Marathon and Leprechaun. Inferred mineral resources have been set to waste. The mineral reserves are supported by the 2021 Valentine Gold Updated Feasibility Study.

Factors that may affect the mineral reserve estimates include metal prices, changes in interpretations of mineralization geometry and continuity of mineralization zones, geotechnical and hydrogeological assumptions, ability of the mining operation to meet the annual production rate, operating cost assumptions, process plant and mining recoveries, the ability to meet and maintain permitting and environmental license conditions, and the ability to maintain the social license to operate.

### 25.7.2 Mine Plan

Reasonable open pit mine plans, mine production schedules, and mine capital and operating costs have been developed for the mineral reserves estimates at Marathon and Leprechaun.

Pit layouts and mine operations are typical of other open pit gold operations in Canada, and the unit operations within the developed mine operating plan are proven to be effective for these other operations.

The mine plan supports the cash flow model and financials developed for the feasibility study.

## 25.8 Metallurgical Testwork and Processing

Metallurgical testwork was conducted on samples from the Berry deposit to determine its amenability to processing in the process plant of the 2021 Feasibility Study that was designed to handle Marathon and Leprechaun material. It was found that the comminution, gravity separation, flotation, slurry thickening, leach characteristics of gravity concentrate, gravity tailings, flotation concentrate and flotation tailings, and cyanide detoxification properties of Berry material were very similar to that of Marathon and Leprechaun feed material.

Testwork on low grade samples from the Marathon and Leprechaun deposits extended knowledge of the grade versus recovery relationship for such material. New grade-recovery equations were developed for feed from each of the three deposits and for a mixture of feeds. These equations were applied to the mine productions schedules to determine the gold recovery values and for the cash flow model.

## 25.9 Site Infrastructure

The infrastructure for this project consists of open pit mines, tailings management facility (TMF), waste rock facilities, polishing pond, mine services, access road, accommodations camp, and effluent treatment plant. Access to the facility is from the northeast side of the property from the existing public access road. Process plant access will be via the security gate at the public road intersection.

## 25.10 Impact on Third-Party Assets

Moving the TMF downstream of the Victoria Dam and reservoir has significantly reduced the potential impact of an assumed TMF failure. Further engineering work was carried out to fully assess the potential for Marathon Gold's proposed project to impact NL Hydro's Victoria Lake Reservoir Assets, and summarized as follows:

- A dam breach assessment was carried out for the TMF following the PFS (Golder, 2021). An update to the study was subsequently carried out to include design updates adopted during the FS (Golder 2022). Based on preliminary modelling results, approximately 1.2 m of water may pond at the toe of the Victoria Dam for approximately an hour before flowing downstream during the probable maximum precipitation event. Flooding at the toe of the Victoria Dam during this event is a result of the local flooding from the storm with no incremental flooding as a result of the hypothetical dam breach scenarios that were analysed.

- A vibration analysis determined that vibrational energy from blasting in the open pits transferred to the Victoria Dam foundation and/or dam will be below the threshold peak particle velocity of 50 mm/s (Golder, 2020b).

## 25.11 Capital and Operating Costs

AACE Class 3 costs have been developed for this feasibility study with an accuracy of ±15%. The cost estimates were derived from first principles bulk material take-offs and equipment sizing calculations, with supporting quotations for major equipment, and contractor supply/installation rates to the value of 88% of the cost estimate, with the remaining cost items benchmarked against recent Canadian mining projects.

## 25.12 Economic Analysis

The economic analysis was performed assuming a 5% discount rate. The pre-tax NPV discounted at 5% is C$1000 million; the internal rate of return IRR is 27%; and payback period is 2.7 years. On an after-tax basis, the NPV discounted at 5% is C$648 million; the IRR is 22.4%; and the payback period is 2.8 years. The sensitivity analysis revealed that the project is most sensitive to changes in foreign exchange rate and gold price, and less sensitive to operating costs and initial capital costs.

## 25.13 Risks and Uncertainties

Risk identification and mitigation was ongoing throughout the feasibility study, and will continue through value/detailed engineering, construction, operations and closure. Risks were identified and qualitatively ranked in the Valentine Gold Project Risk Register. As the project moves from feasibility into the execution phase, it will be necessary to update the project risk register.

There is a degree of uncertainty attributable to the estimation of mineral resources and mineral reserves and corresponding grades dedicated to future production. Any material changes in the quantity of mineral resources or mineral reserves or grade may affect the economic viability of Marathon's properties. The existence of mineral resources or mineral reserves should not be interpreted as an assurance of mine life or of the profitability of current or future operations. For example, future fluctuations in gold prices may materially affect the Company's ability to advance the Valentine Gold Project. Thus, until mineralization is mined and processed, the quantity of mineral resources and mineral reserves and grades must be considered as estimates only.

# 26 RECOMMENDATIONS

## 26.1 Overall

Based on the financial analysis, the Valentine Gold Project has robust economics and merits further exploration and development.

## 26.2 Exploration and Mineral Resources

Marathon Gold should continue with the company's infill and exploratory drill program strategies.

- Further drilling on the Valentine Gold Project should focus on decreasing strip ratios of the three main deposits (Leprechaun, Berry, Marathon) as well as greenfields exploration in previously underexplored areas proximal to the VLSZ.

- Exploratory drilling targets should be developed through prospecting and trenching of areas will little previous exploration work.

- A reverse circulation drill program should be continued with a focus on advanced grade control in the Leprechaun and Marathon deposits.

Further prospecting should be conducted on the recently (2022) defined Eastern Arm and Western Peninsula occurrences. Prospecting, soil and till sampling should be used to define targets for potential follow-up work including trenching, and possibly drill testing. Trenching should be conducted in previously underexplored areas of the VLSZ between the currently defined deposits to define any potential zones of economic mineralization and drill targets.

Additional QA/QC strategies were put in place during the 2022 exploration program; the protocols have elevated the confidence level of the Valentine Gold Project's geology and mineralization. Marathon should continue to follow these protocols rigorously. Umpire and duplicate sampling programs should be undertaken at the end of the 2022 exploration program.

Further refine the constraining mineralized domains within the geological models. This would involve improving the mafic dike solids as well as the QTPV domain. Results will be used for drillhole targeting, short term block models, and future mineral resources updates.

## 26.3 Mineral Reserves and Mining Methods

The following recommendations are made as the project advances through construction. Costs for these programs have been estimated and included in the mining area operating costs for the project:

- Geotechnical monitoring and field data collection of the open pit walls is recommended throughout the life of the open pits. These programs should begin at the on-set of mining to allow for confirmation of design assumption herein.

- Geotechnical mapping and regular inspection of benches. This should include tension crack mapping along the crest of benches.
- Geological and major structure mapping informing an up to date lithological and structural geologic model.
- Develop a program to monitor any potential large-scale movements on the open pit slopes (surface prisms or radar).
- Yearly to bi-annual third-party inspections and slope stability audits.
- Implement a geomechanical testing program to confirm all pit slope design values. Comparison and adjustment of recommended slope designs based on performance monitoring of the slopes.
- Additional piezometer installation to allow for on-going assessment of water levels relative to slope depressurization targets and slope design phreatic surface modelling.

- Mid-range monthly mine planning through the construction period and first year of mill operations. Develop physical cut plans for each month, as well as associated stockpile advancements and primary fleet equipment hour estimates.
- Further engagement with equipment vendors to secure build spots for long lead time items should be carried out.
- Blasting to both minimise dilution while improving mine-to-mill performance can be optimised in future studies. This will require field measurements and adjustments during operations.
- Opportunities should be explored to increase project value via alternative deposit development strategies. The inclusion of the Sprite, and Victory resource deposits into the overall project should be examined.

The following geotechnical recommendations apply to developing the Berry deposit. Costs for these programs are estimated to be $0.5 million and are additional to the mine area capital and operating costs.

- Berry specific geotechnical investigations to bring the models to a construction level of confidence, to be completed in advance of Berry pit mining in 2025.
  - Drilling of three or four additional geotechnical holes to evaluate the potential effect of major structures on the Berry footwall.
  - Targeted pumping tests for Berry should be completed to provide another measure of bulk hydraulic conductivity of the rock mass at the pit-scale and to provide data on anisotropy (both horizontal and vertical) in the hydraulic response to refine predictions of pit inflows and dewatering requirements.
- Complete an evaluation of earlier pit phases versus the geotechnical data to evaluate if interim pit phases require design adjustments.

The following hydrogeological investigations and modelling are recommended to understand the hydrogeological conditions as they relate to slope stability management and estimate the expected inflow of water in the pit from the groundwater.

- Drilling approximately 4 to 6 HQ-3, oriented drillholes (~1,200 to 1,500 m). Geotechnical logging will be completed on these holes. Areas of the Berry pit that require more data will be targeted to model major geological structures.
- Packer testing of these additional drillholes within the three pits, with a focused objective to better characterize K of major faults.

- Targeted pumping test within the pits is proposed to provide another measure of bulk hydraulic conductivity of the rock mass at the pit-scale and to characterize anisotropy (both horizontal and vertical) that may exist in the hydraulic response around the pits. It is anticipated that these results can be used to assess potential anisotropic and flow boundary conditions which may influence pit dewatering/ depressurization requirements. Pumping test results can also be used to corroborate rock mass geometric mean K values, which to date have been solely based on Packer testing.
- Install additional multi-level VWPs.
- Update the hydrogeological numerical model with the Berry pit complex 3D geometry.
- Include all new information from the packer tests and pumping tests such as aquifer transmissivity, storativity, specific capacity and hydraulic conductivity at discrete zones and elevations from packer testing data and holistically for bulk estimates from the pump tests.

The transient model builds off the steady-state model but provides a more continuous integration of climate, surface water, seepage collection and recharge. It will use site records of monitoring well data and surface water flows over a calibration period to calibrate the model. Once calibrated, the transient model can be used to extract pit inflows at any point of interest along the modelled period.

## 26.4 Metallurgical Testwork

The following activities are recommended to support the detailed design of processing facility beyond the feasibility study:

- Further optimize flotation concentrate leach conditions, including confirmation and definition of the beneficial effect of adding cyanide to the ultra-fine grinding mill, confirmation of the usefulness of a pre-aeration step, and optimization of the leach/Cil residence time. Consider reducing leach/CIL time from 48 hours to 36 hours or less, prior to transfer of the residue to flotation tailings leach where it sees an additional 22 hour of leach/CIL treatment.
- Further optimize gravity-leach flowsheet cyanide detoxification reagent demand required to obtain suitable detoxification conditions.
- Confirm the suitability of recirculating detoxified barren solution and tailings solution supernate to the grinding circuit as a source of process water.

## 26.5 Recovery Methods

The following activities are recommended to support the design of the processing plant beyond the feasibility study:

- Additional geotechnical site investigations (both test pit and borehole methods) should be carried out at the preferred process plant site locations to validate the existing information that has been gathered on the foundation conditions associated with the proposed buildings.
- Complete water treatment test work to support ammonia treatment.
- Finalization of all testwork reports for delivery into detailed engineering.

## 26.6 Site Infrastructure

The following activities are recommended to support the detailed design of site infrastructure beyond the feasibility study:

- GEMTEC carried out the field program for the original feasibility study level from September 4 to October 30, 2020 (GEMTEC, 2021). This was followed up by a site-wide detailed design- and construction-level geotechnical and hydrogeological field investigation from August 5, 2021 to June 27, 2022 that focused on additional characterization of sub-surface conditions primarily in the areas of the TMF and plant, and borrow source studies of new areas for project development (GEMTEC, 2022a). GEMTEC's field investigation for the current update to the original feasibility study was carried out between June 8 and June 29, 2022 and was completed to characterize geotechnical and hydrogeological conditions in the areas of the waste rock pile and other material stockpiles associated with development of the Berry deposit (GEMTEC, 2022b).

## 26.7 Water Management

The mine site is divided into four complexes. From north to south, they are the (1) Marathon Complex, (2) Berry Complex, (3) Process Plant and TMF Complex, and (4) Leprechaun Complex. Water management in these complexes functions independently with decentralized treatment and control in each complex.

- Water management components for the Marathon, Berry and Leprechaun complexes consist of water management (i.e., flood attenuation and sedimentation) ponds, dams, berms, drainage ditches, and pumps to collect and contain surface water runoff from waste rock, low-grade stockpiles, overburden stockpiles, topsoil stockpiles, and pits.

- The process plant pad and truck shop area will be served by a series of collection ditches and a sedimentation pond. Water management in the TMF consists of the tailings pond, effluent treatment plant, polishing pond, seepage collection ditches, pumps, and a discharge pipeline to Victoria Lake.

Water management infrastructure design for early works construction has advanced to the "Issued for Construction" level. Water management infrastructure for operations and the Berry pit expansion has been developed to the feasibility (preliminary) level and will continue to detailed design after the issue of the feasibility study.

The following activities are recommended to support the design of the water management systems beyond the feasibility study and into detailed design:

- Integrate the results of recent groundwater water level monitoring, packer, and pumping test data into the calibrated groundwater flow model constructed for the project to further increase confidence in groundwater inflow predictions to the open pits as well as seepage capture performance in perimeter ditching.

- Progress the design of de-centralized water management in around the Berry pit and integrate with the overall complex (i.e., sedimentation ponds, berms, drainage ditches and outlet channels).

- Maintain adequate component waterbody setbacks to account for regulatory buffers and water management infrastructure around the Berry pits and waste piles.

- Identify opportunities to enhance sedimentation pond volumes at select locations.

- Continue geochemical testing and assessment of ARD/ML to further refine parameters of potential concern around the Berry pit.

- Refine assimilative capacity study of effluent meeting MDMER criteria in keeping with water management infrastructure updates.
- Further optimize cut and fill of water management components and/or use of surplus material.
- Conduct a geotechnical program at the locations of proposed water management features prior to detailed design to refine the assumptions associated with overburden, bedrock, and required grubbing.

## 26.8 Tailings Management Facility

The following activities are recommended to support the design of the TMF in the next phase of study:

- Supplemental geotechnical and hydrogeological site investigations are recommended for further definition of the subsurface conditions and to support construction material quantity estimation for later stages of dam raising.
- Geotechnical investigations should be carried out within the property boundary to identify potential borrow sources and requirements for development of the borrow areas.
- Optimization of deposition planning (including in-pit disposal at Berry Pit), and construction staging should be carried out based on the findings of the geotechnical site investigations and other project developments.
- Optimize the design of the water treatment plant and polishing pond.
- Develop construction drawings and technical specifications for the first stage of construction.
- Verify the geochemistry results of tailings generated from the Berry Pit does not impact closure cover design.
- Further characterize the hydrogeological conditions of the Berry open pit and groundwater modelling following in-pit tailings disposal.
- Advance closure design planning in early years of operation and implement progressive closure once tailings deposition in the TMF has ceased.

## 26.9 Environment, Permitting, and Community Relations

As indicated in Section 20.2.1, Marathon Gold prepared and submitted an EIS for the Valentine Gold Project to meet the requirements of CEAA 2012, the NL EPA and the project-specific guidelines issued by the federal government and the provincial government. Upon release from the provincial and federal EA processes in 2022, numerous approvals, authorisations, and permits have, are, and will be prepared and submitted for approval as required for project construction.

A detailed list of obtained, ongoing, and anticipated permitting requirements is provided in Chapter 20. Compliance with terms and conditions of approvals, standards contained in federal and provincial legislation and regulations, and commitments made during the EA processes (including application of mitigation measures and monitoring and follow-up requirements), are being addressed throughout project planning, construction, operation, and decommissioning. Approvals, authorisations, and permits required prior to initiating project construction have been obtained and construction has commenced.

Marathon Gold has engaged and developed agreements with indigenous groups as well as entered into cooperation agreements with six central Newfoundland communities located in proximity to the Valentine Gold Project. The agreements provide a framework for a long-term, positive working relationship between Marathon Gold and local stakeholders and identify the interests of each community in employment, business opportunities, community investment, and environmental protection.

Since EIS/EA submission, Marathon Gold has continued baseline studies in several disciplines including aquatic and terrestrial communities, surface and groundwater resources. Marathon Gold has undertaken a gap assessment of baseline environmental studies needed to support the Berry complex EA and anticipates that continued and proposed baseline monitoring has and will fill gaps. Marathon Gold has initiated early works permitting and has permitting in hand to support the start of construction. Early works permitting as well as discussions with community stakeholders is ongoing. Recommendations for this section include:

- continue baseline and effects monitoring in support of the project
- notify IAAC of a change to the previously designated project
- undertake an environmental assessment as required based on regulatory guidance for the Berry pit expansion
- continue early works and undertake subsequent permitting for the operational phase and Berry pit project expansion
- continue engagement and consultation with community, indigenous and other stakeholders.

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### 27.1.2 Personal Communication

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