Environment

San Gold Corporation

Request for Alteration to San Gold Corporation's Tailings Management Area

Prepared by:

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Project Number:

60116437 (4.2.1.1)

Date:

March, 2012

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by Consultant and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

Consultant accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of Consultant to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

March 22, 2012

Ms. Tracey Braun, M.Sc.
Director, Environmental Assessment and Licensing Branch
Manitoba Conservation
Suite 160 Union Station
123 Main Street
Winnipeg, Manitoba R3C 1A5

Dear Ms. Braun:

Project No: **60116437 (4.2.1.1)**

Regarding: **Request for Alteration to San Gold Corporation's Tailings Management Area**

Please find enclosed 7 hard copies and 22 electronic copies of the above noted Request for Alteration to San Gold Corporation's Tailings Management Area. Please note the required Environmental Act Proposal Form follows this letter of transmittal. The required application fee has been sent directly by San Gold Corporation. If you require any clarification or any additional information, please feel free to contact Scott Chapman at 477-5381.

Sincerely,
AECOM Canada Ltd.

Ron Typliski, P.Eng.
Vice-President, Manitoba District
Canada West Region

AZ:dh

cc: J. Hutchison, San Gold
E. Setchell, San Gold

Environment Act Proposal Form

Manitoba Conservation

Name of the development:	San Gold Corporation Tailings Management Expansion
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):	Class 2 Development
Legal name of the proponent of the development:	San Gold Corporation
Location (street address, city, town, municipality, legal description) of the development:	ML63 Antonio Road Bissett, MB R0E 0J0 Township 24, Range 13 East of the Prime Meridian
Name of proponent contact person for purposes of the environmental assessment:	John Hutchison - Mill Manager
Phone: 204-277-5411 xt 204 Fax: 204- 277-5552	Mailing address: San Gold Corporation P.O. Box 1000 Bissett, MB R0E 0J0
Email address:	
Webpage address:	
Date: March 20, 2012	Signature of proponent, or corporate principal of corporate proponent: Printed name: JOHN HUTCHISON

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$500
Class 2 Developments	$5,000
Class 3 Developments:	
Transportation and Transmission Lines	$5,000
Water Developments	$50,000
Energy and Mining	$100,000

Submit the complete EAP to:

Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-7100
Fax: (204) 945-5229
Toll Free: 1-800-282-8069, ext. 7100
http://www.gov.mb.ca/conservation/eal

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
7	22	Manitoba Conservation
1	2	San Gold Corporation

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	A.Zilinsky	August 18, 2011	Draft
2	A.Zilinsky	March 1, 2012	Final

AECOM Signatures

Report Prepared By:

Amber Zilinsky, P.Eng.
Environmental Engineer, Environment

Report Reviewed By:

Scott, Chapman, M.Sc., P.Eng.
Project Manager, Environment

Report Reviewed By:

Stephen Biswanger, P.Eng.
Manager, Remediation, Impact Analysis and Approvals, Environment

PROVINCE OF MANITOBA
S.J.E.
BISWANGER
Member
20755
3/2/2012
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
AECOM Canada Ltd. (MB)
No. 4671 Date: 2012/03/02

Executive Summary

San Gold Corporation (San Gold) retained AECOM to prepare a Request for Notice of Alteration (NOA) for the proposed tailings management area (TMA) expansion for their Rice Lake Gold Mine in Bissett, Manitoba. This NOA was conducted to meet the requirements of a major alteration to San Gold's existing Environment Act Licence No. 2628 R, and any pending revisions, under *The Environment Act*.

The project site is located approximately 2 km northeast of the Rice Lake Gold Mine Mill Complex and is located within San Gold's Mineral Lease #ML63. The proposed TMA expansion site is located immediately east of the existing TMA and is north of Provincial Road (PR) 304.

The proposed TMA expansion includes the construction of an additional main pond to hold tailings from the mill and an additional polishing pond to provide treatment of waste water from the new main pond, which will be pumped into the existing TMA polishing pond for discharge (via pumps) into No Name Creek on an annual basis during the open water discharge period (anticipated to occur from June 15 to freeze-up (November 30)). In order to access the proposed TMA expansion site, three new access roads will be constructed; two on the south side from PR 304 and one on the east side adjacent to the local landfill.

Based on an average milling rate of 2,500 short dry tons per day, the lifespan of the proposed TMA expansion is expected to be 10 years. Through additional dyke raising stages, there is a potential to increase the capacity of the proposed TMA expansion to extend its operational period.

An assessment of the potential environmental effects of the project during construction, operation and decommissioning was carried out. Potential environmental effects were identified by superimposing project elements onto existing environmental conditions, which were determined based on a review of publically available data, maps and reports and was supplemented where required with field-based programs.

Based on the assessment of available information and documented assumptions, potential negative residual effects were found to be negligible to minor in magnitude following the application of standard mitigation measures, and are not considered significant. The potentially minor residual effects relate to air quality as a result of dust and noise generation during construction and decommissioning as well as flora as a result of vegetation disturbance/loss during construction activities. Potential positive residual effects were found to be negligible in magnitude. A summary of potential effects and proposed mitigation measures is provided in Table E1. It is anticipated that surface water, groundwater, effluent and sediment quality as well as fish and fish habitat will continue to be monitored as required under the *Metal Mining Effluent Regulations* (MMER) (Environmental Effects Monitoring (EEM) program) and the prevailing Environment Act Licence. With the exception of monitoring re-vegetation efforts until the vegetation has been established, no additional monitoring or follow-up programs are recommended as part of this NOA.

As part of this assessment, public consultation was carried out in the form of a Town Council Meeting and an Open House event, both occurring on October 13, 2011. During these events, various items were raised, including concerns of a dyke breach, where required materials would be sourced from, visibility for vehicles leaving access roads and entering PR 304, safety around the proposed TMA expansion and surface water drainage. Once the raised items were discussed, both the Town Council and general public appeared to be interested in the project and were either neutral or positive towards it.

San Gold also offered to meet with the Hollow Water First Nation council; however they have not accepted this offer or expressed any concerns related to the proposed TMA expansion. If any questions or concerns are raised by the Hollow Water First Nation council, San Gold will work with the council to resolve any issues and forward the results to Manitoba Conservation if required.

In summary, the potential negative residual environmental effects are anticipated to be negligible to minor in magnitude with the implementation of the mitigation measures identified and continued monitoring requirements, with potential positive residual environmental effects anticipated to be negligible. It is our opinion that, based on the available information and documented assumptions, the proposed project is not likely to cause significant adverse environmental effects.

Table E1: Summary of Proposed Environmental Impacts

Classification of Potential Effect	Project Phase	Potential Effect	Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Mitigative Measures	Residual Effect	Degree of Reversibility	Significance
Topography	Construction	Change in Topography	Negligible to minor	Negative	Long Term	Rare	Project Site	Minimize the height of material stockpiles. Construction activities contained to the project site and/or approved areas.	Negligible	Reversible (project area) to Irreversible (TMA footprint)	Not significant
	Decommissioning	Change in Topography	Negligible	Positive	Long Term	Once	Project Site	Not applicable.	Negligible (Positive)	Not applicable	Not significant
Soils	Construction and Decommissioning	Erosion	Negligible	Negative	Short Term	Rare	Project Site	Minimize the height of material stockpiles and cover if required. Stockpiles to be placed away from drainage areas and other potential sources of water. Disturbed areas kept to a minimum and re-vegetated as practical where required.	Negligible	Reversible	Not significant
		Horizon Mixing	Negligible	Negative	Long Term	Rare	Project Site	Stockpile materials based on soil type/horizon.	Negligible	Not applicable	Not significant
		Waste Disposal	Negligible	Negative	Short to Moderate Term	Rare	Project Area	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site.	Negligible	Not applicable	Not significant
Geology	Construction	Bedrock Shaping/Stabilization	Negligible	Negative	Long Term	Once	Project Site	Only remove bedrock where absolutely necessary to secure the dyke structure. Use mechanical methods to remove bedrock where possible. If blasting is required, use smallest practical blasting charge to minimize fracture and overbreak.	Negligible	Irreversible	Not significant
Groundwater	Construction and Decommissioning	Groundwater Drawdown	Negligible	Negative	Short Term	Intermittent	Project Area	Complete dewatering activities only as required in areas of active construction. Groundwater drawdown will be limited to areas of active construction where activities cannot be appropriately completed if underwater. Where possible, backfill excavated areas with appropriate materials to maintain groundwater flow patterns.	Negligible	Reversible	Not significant
		Waste Disposal	Negligible	Negative	Short to Moderate Term	Rare	Project Area	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site.	Negligible	Not applicable	Not significant
	Operation	Groundwater Recharge	Negligible	Negative	Long Term	Continuous	Project Area	None applicable.	Negligible	Not applicable	Not significant
		Groundwater Quality	Negligible to minor	Negative	Short to Moderate Term	Rare	Project Area	The proposed TMA expansion will be geotechnically designed. Proposed TMA expansion lined with a clay layer compacted to a minimum of a1x10^{-7}cm/s. Clay core of dyke structures keyed into clay base and compacted as appropriate. Bedrock outcrops cleaned and reshaped to provide a secure bonding surface with the clay core of the dyke structures. If necessary, investigations will be completed to identify leaks/seepages, with repairs being made as required.	Negligible	Not applicable	Not significant
Air Quality	Construction and Decommissioning	Exhaust Emissions	Minor on-site and negligible off-site	Negative	Short Term	Continuous during working hours	Project Area	Vehicles/equipment will be well maintained. Vehicle idling kept to a minimum as per site specific orientation obligations.	Negligible	Reversible	Not significant
		Dust	Minor on-site and negligible off-site	Negative	Short Term	Intermittent	Project Area	Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, includes limiting traffic speeds, minimizing re-handling of materials, re-wetting of materials as needed, and completing activities during favourable weather conditions. Minimize height of stockpiles. Minimize the amount of disturbed area. Dust suppression to be used if required. Residents will be informed of construction schedule for blasting activities. Construction to occur in stages with re-vegetation where applicable. Where possible, re-vegetation will occur following decommissioning activities. Mechanical methods will be used to remove bedrock where possible. If blasting is required, the smallest practical blasting charge will be used. If necessary, blasting mats will be used during construction.	Negligible to minor on-site and negligible off-site	Not applicable	Not significant
		Noise	Minor on-site and negligible off-site, but major if blasting occurs.	Negative	Short Term	Intermittent during working hours, with blasting occurring rarely.	Project Area	Limit working hours to daylight hours as required. Vehicles/equipment to be well maintained. Residents will be informed of construction schedule for blasting activities. Hearing protection provided to human receptors as required. Bedrock should only be removed as necessary. Mechanical methods will be used to remove bedrock where possible. If blasting is required, the smallest practical blasting charge will be used. If necessary, blasting mats will be used during construction.	Minor on-site and negligible off-site	Reversible	Not significant

Table E1: Summary of Proposed Environmental Impacts (cont'd)

Classification of Potential Effect	Project Phase	Potential Effect	Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Mitigative Measures	Residual Effect	Degree of Reversibility	Significance
Flora	Construction	Vegetation Disturbance/Loss	Negligible to minor	Negative	Long Term	Once	Project Area	Construction vehicles and equipment will use designated pathways to access work areas. San Gold will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and re-vegetation if required. Temporarily disturbed areas will be kept to a minimum and re-vegetated as practical where required.	Negligible to minor	Reversible	Not significant
		Dust Deposition	Negligible	Negative	Short Term	Intermittent	Project Area	Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, includes limiting traffic speeds, minimizing re-handling of materials, re-wetting of materials as needed, and completing activities during favourable weather conditions. Minimize height of stockpiles. Minimize the amount of disturbed area. Dust suppression to be used if required.	Negligible	Not applicable	Not significant
		Waste Disposal	Negligible	Negative	Short to Moderate Term	Rare	Project Area	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site.	Negligible	Not applicable	Not significant
	Decommissioning	Re-vegetation	Negligible to minor	Positive	Long Term	Once	Project Area	Vegetation growth to be monitored. If required, subsequent re-vegetation efforts will be completed.	Negligible (Positive)	Not applicable	Not significant
Fauna and Species at Risk	Construction and Decommissioning	Habitat Disturbance/Loss	Negligible to minor	Negative	Long Term	Once	Project Site	Construction vehicles and equipment will use designated pathways to access work areas. Disturbed areas will be kept to a minimum and re-vegetated as practical where required and as part of decommissioning activities. Clearing activities restricted from April 15 to July 31, unless pre-construction monitoring is undertaken. Where possible, clearing activities will occur in the winter (November to April).	Negligible	Not applicable	Not significant
		Noise	Negligible, but minor if blasting occurs	Negative	Short Term	Intermittent during working hours, with blasting occurring rarely.	Project Area	Limit construction hours to daylight hours as required. Vehicles/equipment to be well maintained. Mechanical methods will be used to remove bedrock where possible. If blasting is required, the smallest practical blasting charge will be used. Blasting activities restricted from April 15 to July 31, unless pre-construction monitoring is undertaken. Where possible, blasting activities will occur in the winter (November to April).	Negligible	Not applicable	Not significant
	Operation	Noise	Negligible	Negative	Long Term	Intermittent to Continuous	Project Site	Pumps will be placed within a structure where possible. Pipelines will be placed to maximize tailings dispersion with the fewest pipeline movements. Pipelines will be moved with the smallest available equipment.	Negligible	Not applicable	Not significant
Transportation	Construction and Decommissioning	Congestion	Negligible	Negative	Short Term	Rare	Project Area	Material and equipment transportation to be scheduled around peak traffic hours if needed. Material transport trucks and equipment will access the site via appropriate access roads from the Rice Lake Gold Mine and Mill site and will not travel along PR 304 whenever possible.	Negligible	Not applicable	Not significant
		Traffic Delay	Negligible	Negative	Short Term	Rare	Project Area	If blasting is required, the smallest practical blasting charge will be used. Vehicle access will be permitted along PR 304 in the vicinity of the proposed TMA expansion once the area has been declared safe by a qualified supervisor following blasting activities. Detours around the blast area will be provided if necessary.	Negligible	Not applicable	Not significant
Heritage Resources	Construction	Destruction of Heritage Resources	Negligible to major	Negative	Long Term	Rare	Project Site	If an artifact is encountered during construction activities, work will stop and appropriate authorities will be contacted. Work will resume with appropriate approvals.	Negligible	Irreversible	Not significant
Aesthetics	Construction	Appearance	Negligible to minor	Negative	Short to Long Term	Once to Intermittent	Project Site	Construction waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site. Disturbed soils restored and re-vegetated following completion of construction activities as applicable. Project site will be set back from public areas, which will reduce visibility of site.	Negligible	Reversible to Irreversible (depending on vegetation re-growth rate)	Not significant
	Decommissioning	Appearance	Negligible	Positive (net)	Long Term	Once	Project Site	Vegetation growth to be monitored. If required, subsequent re-vegetation efforts will be completed.	Negligible (Positive)	Not applicable	Not significant
Land Use	Construction	Change in Land Use	Negligible	Neutral	Long Term	Once	Project Site	Not applicable.	Negligible	Not applicable	Not significant

Table E1: Summary of Proposed Environmental Impacts (cont'd)

Classification of Potential Effect	Project Phase	Potential Effect	Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Mitigative Measures	Residual Effect	Degree of Reversibility	Significance
Health and Safety	Construction and Decommissioning	Safety of the Workers and General Public	Negligible to major	Negative	Short to Long Term	Rare	Project Site	Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, includes limiting traffic speeds, minimizing re-handling of materials, re-wetting of materials as needed, and completing activities during favourable weather conditions. All work conducted in accordance with Manitoba's *Workplace Safety and Health Act*. Contractors to adhere to requirements of applicable health and safety legislation and site specific safety plan developed by prime contractor or others as appropriate. All workers will receive appropriate training as part of site specific orientation and in contract obligations with the prime contractor. Appropriate PPE will be worn at all times. If blasting is required, the smallest practical blasting charge will be used. Vehicle access will be permitted along PR 304 in the vicinity of the proposed TMA expansion once the area has been declared safe by a qualified supervisor following blasting activities. Vegetation at intersections between PR 304 and TMA access roads will be maintained to ensure appropriate lines of sight.	Negligible	Reversible to Irreversible (depending on incident type)	Not significant

Table of Contents

List of Tables

List of Figures

Appendices

Figures
Appendix A Notice of Alteration (Parks Environmental Inc.)
Appendix B Biological Inventory and Assessment of the Proposed Tailings Management Area Expansion at Bissett, Manitoba (Green Spaces Environmental Consulting)
Appendix C Archaeological Impact Assessment of the San Gold Resources Tailings Management Area Expansion (Quaternary Consultants Limited)
Appendix D Public Consultation

1. Introduction

This Request for Notice of Alteration (NOA) describes the proposed expansion of the tailings management area (TMA) associated with the Rice Lake Gold Mine. The subject NOA describes the potential environmental impacts related to the construction, operation and decommissioning activities associated with expanding the TMA east of its current location in order to provide additional tailings storage for the Rice Lake Gold Mine. This NOA has been prepared by AECOM Canada Ltd. (AECOM) on behalf of San Gold Corporation (San Gold).

1.1 Background

San Gold owns the Rice Lake Gold Mine located in Bissett, Manitoba which currently operates under Environment Act Licence 2628 R. Components of the Rice Lake Gold Mine include; two underground gold mines (Rice Lake Mine and Hinge Mine) and several exploration zones (007 Zone, Cartwright Zone, Cohiba Zone, L13 Zone and San Gold Minerals Zone (SG-1, SG-2 and SG-3)), a mill complex and an existing TMA.

In March of 2008, a NOA request was submitted to Manitoba Conservation by Wardrop Engineering Inc. on behalf of San Gold for the development and operation of the Cartwright Mine in Bissett, Manitoba. The March 2008 NOA for the Cartwright Mine was approved by Manitoba Conservation on April 23, 2008 as a minor alteration to the existing licensed development. A draft updated and revised Environment Act licence that would reflect the NOA was to be provided to San Gold by Manitoba Conservation for review and comment before it was formally issued. The draft licence was also to incorporate the SG-1 Mine (approved on September 29, 2006 by Manitoba Conservation as a minor alteration). To date, a draft Environment Act Licence has not been provided to San Gold for review regarding the two approved alterations.

In April of 2010, a NOA request was submitted to Manitoba Conservation by AECOM on behalf of San Gold for the revised operation of the Cartwright Mine, ramp development and mining of a bulk sample from the Hinge Zone and the infilling of an existing wet area for future development as a new baseball diamond. Formal approval regarding these proposed alterations was received from Manitoba Conservation (re: File #2435.3).

In February of 2012, a NOA request was submitted to Manitoba Conservation by Parks Environmental Inc. on behalf of San Gold for several alterations to their existing Environment Act Licence (2628 R). Included within this NOA request was the expansion of the annual effluent discharge period to span from June 15 to November 30 (or the onset of freeze-up) for the existing TMA, an amendment to the existing surface water monitoring program with the removal of monitoring station NNC-GR, and the installation and operation of a portable crushing plant and associated incremental mill expansions. Additionally, this NOA confirmed the size of the culvert under Vanson Road (to accommodate an effluent discharge rate of 0.2 m^3/s), that Radium-226 will be monitored in surface water and effluent in accordance with the *Metal Mining Effluent Regulations* (MMER), and that the mill production rate listed in the Environment Act Licence is for an annual average for days the mill is in operation. A copy of this NOA is provided in **Appendix A** for reference. To date, approval has not been received from Manitoba Conservation regarding the latest proposed alteration to the mine activities; however it was assumed that approval for this February 2012 NOA will be granted prior to the approval of the subject NOA.

The following paragraphs provide a brief summary of the current activities at the Rice Lake Gold Mine.

San Gold holds titles to 40 mineral leases that stretch along the mine horizon for 12 km. San Gold also has title to over 3,600 ha contiguous to Mine Lease 63, which contains the Rice Lake Mine, and another 25 mineral claims that cover over 3,100 ha located in the Rice Lake Greenstone Belt. Through agreements and joint ventures, San Gold also has access to an additional 5,000 ha of land. (San Gold Corporation 2010)

Currently, San Gold extracts ore from the Rice Lake Mine, located adjacent to the mill, and the Hinge Mine, located 600 m east of the mill and 1,000 m east of the Rice Lake Mine. Ore produced from the mines is processed at the on-site mill. (San Gold Corporation 2010)

Several exploration zones, including Cohiba Zone and L13 Zone, are currently active; however resources have not been measured yet. Other exploration zones, such as San Gold Minerals Zone (SG-1, SG-2 and SG-3) and Cartwright Zone, have measured and indicated resources and inferred resources, however they are not currently active mines. (San Gold Corporation 2010)

Waste rock and waste ore are placed in stockpiles in designated areas at the Rice Lake Gold Mine (mill site). Runoff water from the stockpiles and tailing wastes from the mill are stored in the existing TMA. When water within the existing TMA meets applicable water quality standards, water is discharged (pumped) from the existing TMA into No Name Creek during the discharge period, which eventually flows into the Wanipigow River. Currently the discharge period occurs following Labour Day and continues as long as necessary until freeze-up at a maximum pump rate of 0.2 m^3/s. However, based on the February 2012 NOA completed by Parks Environmental Inc. (**Appendix A**), in the future, the discharge period is anticipated to occur from June 15) to freeze-up (approximately November 30) at a maximum rate of 0.2 m^3/s, provided the effluent quality meets applicable water quality standards, as per Environment Act Licence No. 2628 R, and any pending revisions.

1.2 Project Purpose

The existing TMA at the Rice Lake Gold Mine consists of a main pond and a polishing pond. Due to the difference between the TMA inputs (precipitation, watershed runoff, excess tailing wastewater, tailings solids and underground mine water inflow) and TMA outputs (evaporation, seepage, tailings voids, mill reclaim/recycling and controlled discharges into No Name Creek), the main pond is reaching its design capacity for storage of tailings solids. Based on the current milling rate (1,055 short dry tons per day (sdtpd)), the existing main pond is anticipated to reach the freeboard elevation in March 2017 and the top of the conceptual dyke in March 2021. With the proposed increase in the milling rate (described in the February 2012 NOA completed by Parks Environmental Inc. (**Appendix A**)), the remaining life of the existing TMA is reduced to approximately 1.5 years. In order to maintain the licenced, and proposed future, ore milling rates, an additional storage area for the TMA inputs needs to be created.

1.3 Regulatory Process

The environmental assessment and licensing of projects in Manitoba is legislated under *The Environment Act* (the Act) and its subsequent regulations and guidelines. The Act is administered by Manitoba Conservation. Under the Act, if alterations to a licensed development do not conform to the licence requirements or are likely to change the environmental impact, approval is required before the alteration can be implemented. For licensed developments, a Notice of Alteration (NOA) is submitted to Manitoba Conservation for consideration following this process.

Alterations to a licenced development can be either minor or major. An alteration is considered minor if the potential negative environmental impacts resulting from the alteration are insignificant and there is not an alteration to a licence condition amended by an appeal. If an alteration is not minor, the alteration is considered a major alteration and a Notice of Alteration request, meeting the requirements of a new proposal, is required for approval.

Early consultation with Manitoba Conservation indicated that a full environmental assessment would be required for the proposed TMA expansion. As there is no anticipated federal involvement with the proposed project (in terms of funding or approvals) and there are no alterations to the mill or ore production capacity, the proposed project is not subject to an environmental assessment under the *Canadian Environmental Assessment Act*.

1.4 NOA Document Structure

Section 2 of this document provides a description of the existing TMA and proposed TMA expansion, including: construction details, schedule, funding and project alternatives. **Section 3** of this document provides a description of existing environmental conditions of the proposed project site and surrounding area. **Section 4** includes a description of the scope of the assessment while **Section 5** describes resulting potential environmental effects and mitigation measures. Monitoring and follow-up programs are discussed in **Section 6**. **Section 7** summarizes public consultation completed as part of the proposed project with conclusions and recommendations provided in **Section 8**.

2. Project Description

2.1 Project Location

The Rice Lake Gold Mine is located in eastern Manitoba in the community of Bissett, Manitoba. The general location of the existing Rice Lake Gold Mine facilities including the Rice Lake Mine, SG-1 Mine, Cartwright Mine and Hinge Mine as well as the Cartwright, Hinge and 007 portal locations, the mill complex and the existing TMA are shown in **Figure 01**. The proposed TMA expansion, as indicated in **Figure 02**, is located immediately east of the existing TMA, with the west side of the proposed new polishing pond sharing the existing eastern dyke of the existing polishing pond.

2.1.1 Existing Land Use

The proposed site for the TMA expansion is located north of the community of Bissett, immediately east of the existing TMA. The land for the TMA expansion is located within San Gold's mineral lease #ML63.

2.2 Existing Tailings Management Area

The existing TMA is located approximately 1 km northeast of the mill complex and consists of a main pond and a polishing pond separated by a dyke, as illustrated in **Figure 02**.

The existing TMA was originally designed to be a zero-discharge system for the first six years of operation with an annual discharge for all following years. For the first six years, constructed dykes were to be raised annually until they reached the maximum design height. During this period, stored tailings solids and water wastes would be below the dyke level. Once the maximum design dyke height was reached, annual discharge would be required to release stored waste water to prevent overflowing the dykes.

In 1996, starter dykes were constructed to form a single tailings pond with a crest elevation of 274.0 m. When Harmony Gold took over the Rice Lake Gold Mine in 1998, the development and operation plan of the existing TMA was changed to follow the increase in tailings solids and not the combined increase in tailings solids, precipitation, watershed runoff and excess tailing wastewater, as what was originally planned. In order to follow only the increase in tailings solids, an internal divider was constructed in 1999 to separate the single tailings pond into a main pond and a polishing pond. The division of the single tailings pond allowed for tailings solids to be stored in the main pond with waste water treated in the polishing pond prior to discharge into No Name Creek.

As part of the construction of the internal divider, the starter dyes on the main pond and new dykes constructed on the west and south sides of the main pond were raised to a crest elevation of 276.0 m. In 2000, the dykes on the polishing pond were raised to a crest elevation of 275.0 m and in 2001 they were raised to a crest elevation of 276.0 m. In 2011/2012, a final raise of the existing dykes is planned to increase their height to 278.3 m, plus a 0.3 m traffic surface. At a dyke height of 278.3 m, the existing main pond has a maximum storage capacity of approximately 2,960,000 m^3 (2,722,000 m^3 plus a 0.5 m freeboard), while the existing polishing pond has a maximum storage capacity of approximately 797,500 m^3 (720,500 m^3 plus a 0.5 m freeboard).

Although inputs into the existing TMA include slurry from the mill, mine water, precipitation and surface runoff and outputs include water lost to tailings voids, reclaim water to the mill and mine, evaporation and discharge from the polishing pond, the overall operation of the existing TMA is dependent upon the influent slurry from the mill, the effluent reclaim water from the existing main pond and the polishing pond discharge.

Slurry from the mill, consisting of tailings and water, is conveyed via aboveground pipelines to the main pond of the existing TMA on a daily basis while the mill is in operation. The slurry is pumped to applicable areas within the existing main pond via aboveground pipelines. Waste water pumped from the mine is also sent to the existing main pond on a daily basis. Reclaim water from the existing main pond is pumped back to the mill and mine for applicable processes on a daily basis via pump stations located adjacent to the existing TMA. Pipelines for the mill slurry, mine water and reclaim water are generally located in trenches/ditches alongside access roads to the existing TMA site, with the pipelines running along the dyke structures in the vicinity of the existing TMA.

Generally, waste water is pumped from the existing main pond to the existing polishing pond in the spring following spring freshet and in the fall following discharge of the polishing pond. Historically, discharge from the existing polishing pond occurred once a year in the fall, following Labour Day, but before freeze-up, once the water quality met the required guideline concentrations as outlined in San Gold's Stage II Environment Act Licence (2628 R). Due to a culvert located under Vanson Road, located downstream of the discharge point on No Name Creek, the discharge rate from the existing polishing pond is restricted to a maximum pumping rate of 0.20 m^3/s. Based on the maximum pumping rate, approximately 46 days would be required to empty the existing polishing pond if it was storing its maximum volume of water of 797,500 m^3. In emergency situations where there has been a high volume of precipitation in the area, San Gold has historically obtained permission from Manitoba Conservation to discharge the polishing pond into No Name Creek during open water periods other than the fall, as long as the water quality has met applicable guideline concentrations.

Recently (February 2012, Parks Environmental Inc.), San Gold applied for an alteration to their existing Environment Act Licence to extend the polishing pond discharge period to span from June 15 to November 30 (or onset of freeze-up) in order to stop emergency discharges from the existing TMA as well as to provide more proportionate, and diluted, flows into No Name Creek. A copy of the February 2012 NOA completed by Parks Environmental Inc. supporting this proposed change is provided in **Appendix A**.

Based on a water balance model developed for the existing TMA (outlined in Section 2.3.1.1), at a current milling rate of 1,055 sdtpd, tailings in the existing main pond are anticipated to reach the freeboard elevation in March 2017 and the conceptual dyke top in March 2021. However, with the proposed increase in the milling rate (described in the February 2012 NOA completed by Parks Environmental Inc. (**Appendix A**)), the remaining life of the existing TMA is reduced to approximately 1.5 years. Due to the limited amount of remaining capacity within the existing main pond, a new area to hold tailings is required in the near future.

Existing Effluent Quality

As part of the environmental effects monitoring (EEM) program, effluent water samples were collected in November 2007, late September to early November 2008, mid-August to end of September 2009 as well as mid-August and September to early November 2010. Under Schedule 4 of the MMER, the only observed concentration to exceed applicable guideline concentrations was the mean monthly concentration of copper (0.373 mg/L; guideline of 0.3 mg/L) in November 2010; however this sample was a grab sample and did not exceed the maximum authorized concentration in a grab sample (0.6 mg/L). During 2010, aluminum was also found to exceed CCME guidelines in several samples; however the high concentrations were attributed to moving a pump used to convey effluent from the existing polishing pond to the discharge point. Total suspended solids (another parameter of concern) did not exceed applicable limits in the samples collected in 2010. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Acute toxicity tests completed from 2007 to 2010 indicated 0-10% mortality for rainbow trout and a 100% survival and mobility for *Daphnia magna*, with the exception of the October and November 2010 tests, which saw 70 and 90% mortality rates for *Daphnia magna*. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Seven sublethal toxicity tests were also completed from 2007 to 2010 for the Fathead Minnow (fish), *Ceriodaphnia dubiai (invertebrate)*, *Lemna minor* (plant) and *Pseudokirchneriella subcapitata* (algae). The majority of the toxicity tests indicated that there was no mine effluent dose response for the Fathead Minnow (six of the seven LC_{50} tests and seven of the seven IC_{25} tests) and the invertebrates (six of the seven LC_{50} tests and five of the seven IC_{25} tests). Results of IC_{25} tests for plant frond number, which represents plant growth, indicated that effluent had an effect on growth in five of the seven tests, however the IC_{25} test for plant dry weight indicated that there was no dose response. The IC_{25} tests for the algae indicated that there was no effluent dose response for the majority of the tests (five of the seven). (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

2.3 Proposed Project Description

The proposed project includes the construction of a TMA expansion, including the construction of an additional main pond and polishing pond immediately east of the existing TMA. The proposed TMA expansion is proposed to be constructed and operated in a similar fashion to that approved for the existing TMA. Access to the proposed TMA expansion will be provided through the construction of three new proposed access roads, two on the south side running north/south from the site to PR 304 and one on the east side running east/west to the site from PR 304, adjacent to the local landfill.

2.3.1 Design Parameters

2.3.1.1 Water Balance

To determine the remaining capacity of the existing TMA and the required size of the proposed TMA expansion, a water balance model was developed. Inputs into the TMA included discharged mill slurry (mixture of water and tailings), precipitation, watershed runoff and mine water, while outputs included evaporation, seepage, reclaim water for the mill and mine equipment and annual discharge.

Inputs

The mill discharge to the TMA is a slurry consisting of a mixture of water and mine tailings and is dependent on the operation and capacity of the mill. Based on a maximum predicted milling rate of 2,500 sdtpd, the monthly contribution of mine tailings to the proposed new main pond is approximately 47,200 m^3 and the net monthly contribution of water is approximately 222,600 m^3, which includes approximately 7,100 m^3 of trapped process water within the tailings voids.

Precipitation falling from November to March (winter months) was calculated as snow accumulation, while from April to October (summer months) precipitation was calculated as summer rainfall. Based on the available precipitation rates for Bissett (see Section 3.3.4), the annual precipitation rate is 557 mm. Although not part of the water balance, an extreme storm runoff value (or inflow design flood, IDF) was calculated to determine the amount of water an extreme individual storm would contribute to the proposed TMA expansion. Based on an extreme storm runoff value of 495 mm (calculated from a 1-in-1000 year extreme rainfall value of 132 mm and a probable maximum precipitation of 676 mm), an extreme individual storm would contribute approximately 581,000 m^3 of precipitation to the proposed new main pond and approximately 65,000 m^3 of precipitation to the proposed new polishing pond.

To determine the catchment areas for the proposed TMA expansion, a digital elevation model was created from contours obtained during a LiDAR survey completed in June 2008. The catchment area for the proposed TMA expansion is 1.59 km^2, as shown in **Figure 03**, compared to the catchment area for the existing TMA which was

0.95 km^2. Based on a calculated runoff coefficient of 0.57 for the project area, approximately 753,000 m^3 of runoff is anticipated to be collected annually in the proposed TMA expansion.

Based on the Environment Act Licence, approximately 550 m^3/month of mine water is anticipated to be contributed to the TMA.

Outputs

Evaporation rates for the Bissett area (obtained from the Stage II Environment Act Licence Application (Harmony Gold (Canada) Inc. *et al.* 2001) were compared to evaporation rates for Gimli and Indian Bay. As all the results were similar between the locations, as shown in the following table, and due to the availability of local Bissett data, an evaporation rate of 545 mm was adopted for the water balance model .

Table 2.1: Estimated Lake Evaporation Values for the Bissett area

Month	Lake Evaporation (mm)		
	Gimli[1]	Indian Bay[1]	Bissett[2]
May	76.7	96.8	75
June	124.6	114.3	125
July	132.6	125.9	140
August	112.3	101.2	110
September	69.6	61.8	70
October	27.2	26.1	25
Total	543	526.8	545

Source: Derived from [1] communication with Environment Canada.
[2] Harmony Gold (Canada) Inc. *et al.* 2001.

Seepage through the base and dyke structures has the potential to occur, however with proper design and construction, the seepage rates are anticipated to be low. Inspections of the existing dykes have found no evidence of seepage. Due to the low amount of seepage anticipated and no evidence of existing seepage, seepage losses were considered to be negligible for the water balance model.

Based on metering results for January 2011, approximately 2,216 m^3 of reclaim water is sent back to the mill on a daily basis. Although not metered, the amount of reclaim water that is sent to the mines for drilling equipment was assumed to be approximately 60 gal/min, which equates to approximately 327 m^3/d. In total, approximately 167,000 m^3 of water is removed from the existing TMA for the operation of the mill and mine equipment on a monthly basis, based on the maximum proposed milling rate of 2,500 sdtpd.

To maintain capacity within the existing and proposed new polishing pond(s), they will be emptied as required during the period between June 15 and freeze-up until they are considered to be dry. Based on an existing polishing pond volume of 797,500 m^3 (assuming a maximum (including freeboard) water elevation of 278.3 m) and a proposed new polishing pond volume of 1,158,000 m^3 (assuming a maximum (including freeboard) water elevation of 282.0 m), the maximum potential discharge volume is anticipated to be approximately 1,955,500 m^3, assuming both polishing ponds were completely full at the start of the discharge period. However, as the majority of the influent water will be sent to the proposed new polishing pond, the maximum discharge volume is only expected to occur in rare situations when San Gold is unable to fully discharge both polishing ponds during the previous year. Under typical operation of the proposed TMA expansion, the discharge is expected to release up to approximately 1,158,000 m^3 of water stored within the proposed new polishing pond.

Water Balance Summary

A summary of the inputs and outputs for the proposed TMA expansion are provided in the following table, based on a maximum predicted milling rate of 2,500 sdtpd. **Figure 04** provides an illustrative summary for the inputs and outputs for the proposed TMA expansion.

Table 2.2: Summary of Inputs and Outputs for the Proposed TMA Expansion

Component	Quantity
Input	
Mill Discharge	
Mine Tailings (m^3/month)	47,200
Water (m^3/month)	222,600
Precipitation (mm/yr)	557
Watershed Runoff (m^3/yr)	753,000
Mine Water (m^3/month)	550
Output	
Evaporation (mm/yr)	545
Seepage	-
Reclaim Water (m^3/month)	167,000
Annual Discharge (m^3/yr)	1,955,000

Notes: [1] Based on a maximum predicted milling rate of 2,500 sdtpd, and a 30 day operation/month.

[2] Annual discharge is a summation of both the existing and proposed new polishing ponds and does not have a licenced maximum number of pumping days. Discharge is controlled by a maximum pump rate into No Name Creek of 0.2 m^3/s (17,280 m^3/d).

2.3.1.2 Location

The location of the proposed TMA expansion was chosen based on local topography and proximity to the existing TMA in order to reduce the amount of infrastructure required to gain access to the proposed TMA expansion site and to maintain one discharge location to No Name Creek.

Based on local topography, the proposed TMA expansion will be located immediately east of the existing TMA with the existing and new polishing ponds sharing an existing dyke (Dyke 6). To maintain the required storage volumes in the proposed TMA expansion, dykes will be constructed along the southern edge of the proposed location. A dyke will also be constructed running north/south to separate the proposed TMA expansion into a proposed new main pond and a proposed new polishing pond. Where a dyke is not constructed, the existing elevated terrain will be used to contain the tailings and/or water. The approximate dyke configuration for the proposed TMA expansion is illustrated in **Figure 05**.

2.3.1.3 Geotechnical Design Conditions

As part of the geotechnical design, slope stability, seepage and settlement/consolidation of the clayey and sandy soils will be calculated. As part of the slope stability analysis, effective and total stress analyses will be performed, circular and block surfaces will be analysed and pore water pressure response to fill loading will be modeled to assess the stability at the end of construction. Additional analyses will be completed to estimate piezometric surfaces for rapid drawdown and steady state seepage conditions. As the 2005 National Building Code of Canada defines the area as "stable Canada", seismic loading will not be considered in the assessment.

The seepage analysis will be completed to estimate hydraulic gradients, determine critical hydraulic gradient for the dykes, assess seepage quantities and determine the blowout potential of the downstream side of the dykes. The seepage analysis will determine the amount of seepage that may occur through the clay base, at hydraulic connections between the bedrock and underlying layers of sand and silt till units and the dyke cores. The seepage rate is expected to be less than the rate through the underlying sand aquifer (approximately 0.1 L/s) and is considered to be a negligible factor in the proposed TMA expansion design.

As part of the geotechnical design, consolidation of the foundation clayey soils and elastic compression of the sandy soils will be monitored along with the settlement of fill materials to ensure the proposed TMA expansion is constructed appropriately.

2.3.2 Construction

2.3.2.1 Site Preparation

Prior to the construction of the proposed TMA expansion, and proposed access roads, vegetation (including trees, brushes and tall grasses) and surficial soils with high organic content (including peat and organic soils) will be removed from the footprint of the proposed project site in order to expose the upper layer of clay. Soils will be stockpiled in a suitable area for future reclamation activities or disposal. Removed vegetation will be separated and stockpiled based on usability. Any materials suitable for lumber or other applicable uses will be sold and/or reused, with remaining materials disposed of appropriately. As near surface soils tend to contain high silt content, these activities are recommended to be completed during the dry season and/or the winter season (November to April) to reduce earthwork costs and reduce disturbances to the underlying soils as well as the migration/breeding/denning of wildlife in the surrounding area.

In the dyke core foundation area, the natural clay layer will be over-excavated to key in the dyke foundation and provide a seepage cutoff. If the excavated clays are suitable, they will be placed within the clay core, otherwise they will be stockpiled for future reclamation or disposal, as appropriate.

The exposed soils within the proposed TMA expansion footprint, including the area of the dykes, will be thoroughly rolled and compacted to seal seepage paths potentially created during the stripping process. Any identified soft areas will be excavated to firm soil and replaced with compacted suitable soils as appropriate.

Where bedrock is encountered during the placement of the dykes, including when exposed due to stripping of overburden soils, the rock surface, including pockets and depressions, will be cleaned of soil and rock fragments prior to the placement of materials. Where required, bedrock will be shaped and stabilized and if necessary, cut back to maintain a smooth continuous profile. Any bedrock overhangs will be removed and treated with dental concrete (specific placement of concrete to fill voids and grooves) or slush grouting (placement of grout on rock surface that is brushed/broomed into voids and fissures). If possible, bedrock alterations will be completed using mechanical devices, however if blasting is required, care will be taken to minimize fracture and overbreak.

2.3.2.2 Dewatering

During construction, pumps and diversions may be required to prevent the occurrence of standing water on the proposed project site and within excavated areas. Any dewatering that is required will be monitored and checked to reduce the potential of drawing down the local water table as well as for sloughing/failure of any excavated areas. Any water removed during dewatering will be pumped into the existing TMA for eventual discharge into No Name Creek during typical operation. Any required piping will be placed over dyke structures so as to not potentially impair the integrity of the structure.

2.3.2.3 Dyke Construction

The proposed dykes will be constructed in a similar fashion to the existing dykes. The proposed dykes will consist of a clay core interior that will be surrounded by suitable granular fill on both the upstream and downstream slopes. A toe drain will be located at the toe of the downstream slope of the dyke structure. On the upstream slope of the dyke structure, an erosion protection filter and a layer of rip-rap will be placed to minimize erosion. The top surface of the dyke structure will consist of a layer of sand and gravel to provide vehicular access around the site. An illustration of the conceptual dyke cross section is provided in **Figure 06**.

Clay Core

Clay soils, either from within the proposed TMA expansion site or from approved borrow sources, will be used to construct the clay core of the dykes. As the clay materials are identified, samples will be obtained for Proctor testing and laboratory triaxial permeability testing to confirm that the required permeability (10^{-7} cm/s or lower) can be achieved. The clay soils used will be controlled during construction by visual inspection of the borrow materials and by hydrometer testing in the field.

Granular Fill

Granular fill on the upstream and downstream slopes will consist of sand or sand and gravel. Materials for the granular fill will be obtained from processed waste rock produced by mining activities.

Toe Drain

A toe drain consisting of sand and gravel will be placed at the toe of the downstream slope of the dyke structures. Materials for the toe drain will be obtained from processed waste rock produced by mining activities.

Erosion Protection

A rip-rap layer on the upstream side of the dyke slopes is proposed to protect against erosive actions from waves, winds and rainfall events. Waste rock from mining activities may be used as rip-rap as it is readily available and would not be readily degraded during freeze/thaw cycles and weathering.

To prevent soil movement through the rip-rap layer, a filter, consisting either of geotextile fabric, sand and gravel, or suitable equivalent, will be placed on the upstream slope of the dyke structure following the placement of the granular fill, but before the placement of the rip-rap layer. Where possible, materials obtained from the mining operations will be used.

Granular Traffic Surface

A granular traffic surface, consisting of well graded sand and gravel will be placed on top of the dyke structures to permit local vehicle access. Materials for the traffic surface will be obtained from waste rock produced from mining activities.

2.3.2.4 Dyke Staging

In order to maintain an appropriate factor of safety for the proposed dykes, they will be constructed in stages, similar to the existing dykes. The staged approach also allows for construction and operation flexibility as the actual storage requirements can be reviewed and the dyke design altered as required. If needed, there is also a potential to add additional tailings and/or water storage by increasing the heights of the dykes in the future.

To accommodate dyke construction around the proposed new main pond, it is anticipated that the dykes will be constructed in three stages. The first stage will occur at Year 0 and provide a capacity to store the anticipated Year 4 tailings storage requirement of 2,519,000 m^3. This storage requirement requires a minimum dyke height of approximately 278.5 m. Taking into account the provision of a 1 m freeboard, which would also accommodate a storm event and still provide a 0.5 m freeboard, the starter dyke will have a crest elevation of 279.5, plus a 0.3 m traffic surface. Although the first stage is designed to accommodate tailings to the end of Year 4, the second stage of construction is planned to start in Year 3 to provide sufficient time to raise the dykes. During the second stage, the dykes will be raised by 3.0 m to a crest elevation of 282.5 m, (including a 1 m freeboard) to accommodate a storage requirement of 4,215,000 m^3, which is the anticipated volume to the end of Year 7. A 0.3 m traffic surface will be placed on top of the dyke crest. Similar to the second stage, the third will be constructed one year in advance of its requirement to accommodate potential weather issues. During the third stage, the dykes will be raised to accommodate the maximum required storage volume, 5,904,000 m^3, which is obtained at an elevation of approximately 283.5 m, as well as accommodate for an extreme storm event occurring once the proposed new main pond is full. Based on an IDF of 495 mm, an extreme storm event would add 581,000 m^3 of precipitation and result in raising the water level of the proposed new main pond by 0.5 m. With the accommodation of the extreme storm event, a freeboard height of 0.5 m is expected to be sufficient to account for wave action across the pond. Taking into account a maximum water elevation of 284.0 m (283.5 m storage plus a 0.5 m storm event) and a 0.5 m freeboard, the ultimate dyke crest height for the proposed new main pond is 284.5 m, a dyke raise of 2.0 m over the second stage height. At the ultimate crest height of 284.5 m, the main pond will be able to store approximately 6,819,500 m^3 of tailings (6,485,000 m^3 at a height of 284.0 m to include a 0.5 m freeboard). A 0.3 m traffic surface will be applied on top of the final dyke elevation.

As the proposed new polishing pond will be pumped until practically dry on an annual basis, storage requirements for the proposed new polishing pond are lower compared to the proposed new main pond, and will vary on a yearly basis. Based on the water balance, the proposed new polishing pond must be able to store a minimum of 980,000 m^3 of water, which is the anticipated maximum volume of water waste to be produced over the proposed TMA expansion's 10 year life span. This maximum amount of storage is expected to occur in year 5 of operation, and will be accommodated by a dyke height of 281.0 m. In the event of an extreme storm event, which would add approximately 65,000 m^3 of precipitation, based on an IDF of 495 mm, and raise the water elevation by 0.5 m, the dyke for the proposed new polishing pond would require an elevation of 281.5 m. A 0.5 m freeboard above the maximum water level is expected to account for potential wave action across the pond. Taking into account a maximum water elevation of 281.5 m, a 0.5 m freeboard and a 0.3 m traffic surface, the ultimate dyke height is anticipated to be 282.3 m (ultimate dyke crest of 282.0 m). Although the maximum storage requirement within the proposed new polishing pond is anticipated to occur in year 5 of operation, year 4 of operation also required a dyke height of 281.0 m, plus storm event and freeboard. Due to the required storage volumes throughout operation, the construction of the dykes required for the proposed new polishing pond is expected to occur in one stage. If required, alterations to these dykes can be completed during the second and third construction stages required for the dykes on the proposed new main pond. At the ultimate crest height of 282.0 m, the proposed new polishing pond will be able to store approximately 1,158,000 m^3 of water (1,045,000 m^3 at a height of 281.5 m to include a 0.5 m freeboard).

As part of the proposed dyke raises, the traffic surface on the top of the dyke crest will have to be removed and the clay surface scarified to improve the bond between the existing and new fill layers. Along the downstream slopes of the dykes, the new fill will be keyed into the existing fill to provide a sufficient bond. Vegetation in the area of the new toe of slope as well as any new vegetation growth on the downstream slopes will be removed prior to the placement of new fill materials. Any unsuitable soils in the area of the toe of the slope will be removed and filled with crushed waste rock from mining activities. To prevent the penetration of waste rock into the natural soils and prevent the migration of fines, a geotextile separator will be placed between the waste rock and natural soils.

2.3.2.5 Borrow Sources

Low permeability materials required to construct the proposed TMA expansion will be obtained from borrow sources located within the proposed TMA expansion site or from approved locations in the vicinity of the proposed project site. These materials will be excavated from the borrow sources and stockpiled near the project site for appropriate sampling and testing prior to use within the proposed TMA expansion site. It is assumed that any borrow sources located outside of the proposed TMA expansion footprint will have been previously approved as a borrow source.

Prior to excavating the low permeability materials, any vegetated areas will be cleared and surficial organic soils removed. Where possible, the cleared vegetation will be sold, used or disposed of as appropriate, while the soils will be stockpiled near the borrow source or project site for future reclamation or will be disposed of at an appropriate landfill. Any soil layers encountered while excavating that are rejected for use at the proposed project site will be stockpiled near the borrow source and used to backfill excavated areas from the borrow source or for other reclamation activities as appropriate. Following construction activities, the borrow source, and any applicable stockpiles near the borrow source, will be graded to shed rain and/or overland drainage as appropriate.

Granular materials required for the dykes, including granular fill and rip-rap, will be sourced from stockpiled mine waste rock as it is readily available near the project site. Where required, mine waste rock will undergo further processing, such as crushing and screening, at the mill site to ensure appropriate sized materials are used during construction. Prior to placement within the dyke structure, granular materials will be stockpiled according to size and/or use at an appropriate location near the site.

2.3.2.6 Pipeline Installation

Existing aboveground pipelines used to convey discharged mill slurry and reclaim water to/from the existing TMA and the Rice Lake Gold Mine site are generally located adjacent to the existing TMA site access roads. To reduce costs associated with moving these pipelines, including the cost of shallow trenching and grubbing, these existing aboveground pipelines, in their existing locations, are anticipated to still be used with the proposed TMA expansion. Additional aboveground pipelines will be used to connect the existing aboveground pipelines to the proposed TMA expansion to continue conveying mill slurry and reclaim water to/from the proposed new main pond. Aboveground pipelines will also be placed across the dyke structures to convey discharge water from the proposed new main pond to the proposed new polishing pond and from the proposed new polishing pond to the existing polishing pond. If necessary, aboveground pipelines may also be placed alongside the proposed access roads being constructed to access the proposed TMA expansion site. As a result, no additional clearing activities should be required for the installation of pipelines.

As water in the proposed new polishing pond will be pumped into the existing polishing pond for discharge into No Name Creek, the existing discharge pipeline and discharge location will continue to be used. As a result, no construction activities will be required to occur around No Name Creek.

Pumps and pump houses required to convey water and slurry to/from the proposed TMA expansion are anticipated to be the same ones currently used for the existing TMA. The pumps and pump houses will be located in areas of existing and proposed road right-of ways, along the dyke structures and/or within the TMA ponds. When necessary, they will be moved around the site via light equipment. The pumps will continue to be powered via overhead electrical lines located in the TMA area. As a result, no additional clearing or special construction activities are required for their placement or use.

2.3.2.7 Proposed Access Roads

Access to the proposed TMA expansion site will be provided via granular traffic surfaces on the top surface of the existing and proposed dykes as well as from access roads constructed for the existing TMA site. Three additional access roads, two on the south side of the proposed TMA expansion (approximately 1/3 and 2/3 of the way across the south side going east) going south to PR 304 and one on the east side heading east towards PR 304, adjacent to the local landfill, as illustrated in **Figure 02**, are proposed to be constructed for additional access to the proposed TMA expansion site. Activities required to complete the proposed access roads will include vegetation and organic soil clearing, soil compaction and placement of waste rock (road surface). These activities will be completed in conjunction with construction activities associated with the proposed TMA expansion.

2.3.2.8 Re-vegetation

Following construction activities, areas cleared of vegetation will be re-vegetated with appropriate vegetative species, as applicable.

2.3.3 Operation

It is anticipated that once the proposed TMA expansion is ready for operation, pipelines directing the slurry and water to the existing main pond will be moved to direct the slurry and water to the proposed new main pond. In order to be able to maintain the supply of reclaim water to the mill and mine, it is expected that the reclaim water pipelines will remain within the existing main pond for several months until the proposed new main pond has a sufficient quantity of water to supply the mill and mine. At that time, the reclaim water pipelines will be moved to the proposed new main pond, essentially allowing for the future decommissioning of the existing main pond, as discussed in the Bissett Gold Mine Mine Closure Plan submitted September 1, 2001 (Harmony Gold (Canada) Inc. 2001). The decommissioning of the existing TMA is not considered part of this proposed project.

During operation of the proposed TMA expansion, slurry water from the mill and mine waste water will be pumped to the proposed new main pond and reclaim water from the proposed new main pond will be pumped back to the mill and mine on a daily basis. When required, anticipated in the late summer/fall before freeze-up (following the completion of the discharge period) and in the spring following freshet (before the start of the discharge period), water located within the proposed new main pond will be pumped into the proposed new polishing pond to start the natural degradation process so that the water quality will meet applicable guideline concentrations prior to discharge into No Name Creek during the discharge period (to occur between June 15 to November 30 (before freeze-up). It is anticipated that water stored in the proposed new polishing pond will be pumped into the existing polishing pond during the discharge period for discharge, via pumps, into No Name Creek. **Figure 07** illustrates the pumping regime of the proposed TMA expansion.

Based on a maximum dyke crest elevation of 284.5 m for the proposed new main pond and 282.0 m for the proposed new polishing pond, which includes 0.5 m of freeboard, the maximum volume of the proposed TMA expansion (including the storage of tailings and water within the freeboard) is anticipated to be 7,977,500 m^3, with 6,819,500 m^3 available in the proposed new main pond and 1,158,000 m^3 available in the proposed new polishing pond. As the freeboard is not meant to be used for storage, the usable volume of the TMA is 7,530,000 m^3, which includes 6,485,000 m^3 in the proposed new main pond at an elevation of 284.0 m and 1,045,000 m^3 in the proposed new polishing pond at an elevation of 281.5 m. These maximum volumes include provision for an extreme storm event occurring when the ponds are at their designed storage capacity (283.5 m for the proposed new main pond and 281.0 m for the proposed new polishing pond).

Existing contingency plans (listed in the Stage II Environment Act Licence Application (Harmony Gold (Canada) Inc. *et al.* 2001)) for dealing with spills from ruptured lines, tailings pipeline freezing, pump shut down events and unexpected seepage losses will be updated to include the proposed TMA expansion. These plans will be maintained and appropriately updated by San Gold as development of the Rice Lake Gold Mine continues.

2.3.3.1 Retention Time

During operation of the proposed TMA expansion, water from the proposed new main pond will be pumped into the proposed new polishing pond twice a year, once in the late summer/fall, but before freeze-up, following completion of the discharge period, as well as in the spring following spring freshet, but before the commencement of the discharge period. Once water within the proposed new polishing pond meets applicable guideline concentrations, it will be pumped into No Name Creek via the existing polishing pond. Based on the pumping regime, retention time may vary from a few weeks to several months; however, the water quality will meet applicable guideline concentrations before it is pumped into No Name Creek.

2.3.3.2 Discharge to No Name Creek

Once water stored in the existing polishing pond and proposed new polishing pond meets applicable quality criteria, the water will be pumped into No Name Creek from the existing polishing pond during the annual discharge period, with the proposed new polishing pond being concurrently pumped into the existing polishing pond during the discharge period. Discharge into No Name Creek will occur at a maximum pumping rate of 0.2 m^3/s until both polishing ponds are practically empty.

During operation of the proposed TMA expansion, the majority of water inputs and outputs will occur within the proposed TMA expansion as the existing TMA will be decommissioned. As a result, under normal operation of the proposed TMA expansion and a maximum milling rate of 2,500 sdtpd, the maximum amount of water to be discharged annually is approximately 1,158,000 m^3, which is the maximum storage volume within the proposed new polishing pond (includes a storm event and storage within the freeboard). If water is not stored within the freeboard, the maximum amount of water anticipated to be discharged is approximately 1,045,000 m^3. Some additional discharge water may result from the existing TMA, however as the only remaining source of water would be from precipitation, which is slightly higher than the evaporation rate (557 mm and 545 mm annually, respectively), the contribution from the existing TMA is expected to be negligible in comparison to the proposed new TMA. Based on a pump rate of 0.2 m^3/s, it is anticipated that the worst-case discharge period would require approximately 67 days (60 days if no water within the freeboard area), if pumping occurs at the maximum rate continuously throughout the discharge period.

In the event that discharge cannot occur, water will be stored within the existing polishing pond. In this instance, the following discharge period would need to pump water out of both the existing and proposed new polishing ponds. With a maximum total water volume of approximately 1,955,500 m^3 in both polishing ponds, it would take approximately 113 days to discharge at a pumping rate of 0.2 m^3/s. Based on the days available during the discharge period, 168 days, if the discharge period occurs from June 15 to November 30 (anticipated freeze-up), there is a sufficient time frame to empty both polishing ponds, including the potential to decrease the overall pumping rate into No Name Creek during the discharge period.

2.3.4 Decommissioning

2.3.4.1 Existing TMA

Decommissioning of the existing TMA main pond will be carried out as outlined in the Bissett Gold Mine Mine Closure Plan (Harmony Gold (Canada) Inc. 2001) and the Gold Project Tailings Impoundment Design Report (AGRA Earth & Environmental Limited 1996).

2.3.4.2 Proposed TMA Expansion

Decommissioning of the proposed new main pond will not occur for at least 10 years following the start of its operation, once it has reached its designed storage capacity. It is anticipated that decommissioning activities for the proposed new main pond will be similar to the decommissioning activities of the existing TMA main pond, and will only occur with approval from Manitoba Conservation and other applicable regulators. The following provides some general information regarding the decommissioning of the proposed TMA expansion.

To prevent impounding water against the dyke structures following decommissioning, the general filling strategy of the proposed new main pond will be to create tailings beaches along the upstream side of the dykes with an overall general slope towards the proposed new polishing pond to the west. Once the proposed new main pond has reached its tailings capacity, all available water will be pumped into the proposed new polishing pond for treatment and eventual discharge to the existing polishing pond and No Name Creek. Once water levels in the proposed new main pond and polishing pond have been drawn down, the dyke separating the two proposed new ponds will be lowered to act as a closure discharge weir, which will control sediment and maintain a minimum level of water in the proposed new main pond. To provide for long term erosion control, the top of the dyke separating the ponds will be reconstructed as a rip-rap spillway to allow surficial water to flow from the proposed new main pond to the proposed new polishing pond.

To allow water to flow from the proposed new polishing pond to the existing polishing pond, the separating dyke structure (Dyke 6) will be lowered and reconstructed as a rip-rap spillway. Following decommissioning, surficial water will be able to flow from the proposed new main pond to the proposed new polishing pond and into the existing polishing pond for discharge to No Name Creek via the existing discharge pipeline. To discharge between the existing polishing pond and No Name Creek, pumps will continue to be used. Potentially in the future, a weir system may be designed and constructed to allow the existing TMA and proposed TMA expansion to drain naturally into No Name Creek; however the potential weir system is considered outside the scope of this project.

As part of the reclamation process, the downstream slopes of the dykes will be re-vegetated. Re-vegetation will be started following the last dyke raise stage and will continue as appropriate following decommissioning. Vegetation species will be selected based on their ability to provide a stable, self-sustaining cover. Following decommissioning, the surface of the proposed new main pond will be re-vegetated with appropriate vegetation species. Stockpiled organic materials remaining from construction activities will be placed where required to allow for successful re-vegetation. If required, dead vegetation within the proposed new main pond and along the dyke structures will be removed prior to re-vegetation.

Any pipelines, pump stations and electrical power lines to the proposed TMA expansion will be removed during decommissioning. Depending on the circumstances, the pipelines, pump stations and electrical power lines may be re-directed and re-used for other mining applications. Pipelines that cannot be re-used will be thoroughly cleaned and cut into manageable pieces and likely sold as scrap. Any pump stations and electrical lines that cannot be reused will likely be sold.

Any tailings pipeline trenches remaining will be backfilled with waste rock from the mining activities and re-vegetated as appropriate. If required, topsoil or stockpiled organic materials will be placed over the waste rock to provide a suitable growing medium for the vegetation.

Monitoring of surface water and groundwater quality, re-vegetation growth and erosion will continue following decommissioning until it is deemed no longer required by Manitoba Conservation, and/or other applicable regulators.

2.3.4.3 Proposed Access Roads

The two proposed access roads on the south side of the proposed TMA expansion will be decommissioned during the decommissioning of the proposed TMA expansion. The layer of placed waste rock, the upper soil layers and any culverts will be removed and disposed of as appropriate, likely in an applicable waste disposal (landfill) site. The remaining materials will be contoured to match the surrounding area and re-vegetated as appropriate. The proposed access road on the east side of the proposed TMA expansion will likely remain open until all decommissioning activities, as well as any required post-decommissioning monitoring has been completed. Once activities are no longer required at the proposed TMA expansion site, the proposed access road on the east side will be removed, contoured and re-vegetated in a similar fashion to the two southern proposed access roads.

An update to the existing Mine Closure Plan to include the decommissioning, and associated costs, of the proposed TMA expansion will be submitted for approval to the Director of Mines and other applicable regulators.

2.4 Project Alternatives

No alternative locations were examined in the placement of the proposed TMA expansion due to the space requirements of a new TMA and the costs and potential effects associated with the construction of new access roads and pipeline placement through native forested areas and surface waters.

Although a "do nothing" alternative could be considered and compared against the construction of a new TMA, the "do nothing" alternative is not a realistic option as the remaining capacity of the existing TMA is limited and well short of the life expectancy of the Rice Lake Gold Mine.

2.5 Project Schedule

Construction is anticipated to begin in spring/summer of 2012. Site preparation may be started in 2012, pending the issue of an Environment Act Licence, and/or other applicable approvals. With the exception of subsequent dyke raises, construction of the proposed TMA expansion is anticipated to be completed by the summer of 2013, with its operation commencing shortly thereafter. Construction required to complete the dyke raises is currently anticipated to occur three years and six years following the start of operations (anticipated to occur in 2016 and 2019). Although not part of this project, decommissioning of the existing main pond will start once the proposed TMA expansion becomes operational. Decommissioning of the proposed new main pond will not take place for approximately 10 years following the start of its operation, based on a maximum milling rate of 2,500 sdtpd.

2.6 Project Funding

The project will be funded by San Gold. No government funding is anticipated to be required.

3. Existing Environment

3.1 Scope of Description

The environment described in the following sections includes a description of the general area around the proposed TMA expansion site. Where detailed information is available, the description is limited to the proposed TMA project site.

3.2 Project Setting

The Rice Lake Gold Mine is located in Bissett, Manitoba, approximately 166 km northeast of the City of Winnipeg. The Rice Lake Gold Mine is situated on the northwest shore of Rice Lake and consists of the Rice Lake Mine, SG-1 Mine (currently in care and maintenance), the Cartwright Mine, the Hinge Mine, the Cartwright, Hinge and 007 portal locations, the Rice Lake Mill and the existing TMA, as shown in **Figure 01**. The current TMA is located approximately 1 km northeast of the Rice Lake Mill. The proposed TMA expansion lies to the east of the current TMA and occupies approximately 98 ha as shown in **Figure 02**. The site of the proposed TMA expansion is currently owned by San Gold Corporation, and falls within Township 24, Ranges 13 and 14, EPM.

The proposed TMA expansion site is located approximately 412 km east of the Manitoba-Saskatchewan border, approximately 33 km west of the Manitoba-Ontario border, approximately 226 km north of the Canada-United States of America border, and approximately 54 km east of Lake Winnipeg. (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed))

The nearest populated areas along with their approximate distance from the community of Bissett include the communities of Manigotagan (43 km west), Aghaming (46 km northwest), Hollow Water (47 km northwest) and Seymourville (48 km northwest). (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed))

The closest First Nation communities from the proposed TMA expansion site include Hollow Water First Nation (approximately 48 km northwest) and Little Black River First Nation (approximately 51 km southwest). (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed))

The closest flowing surface water bodies to the proposed TMA expansion site include No Name Creek (approximately 1.3 km northwest), Bog Creek (approximately 1.6 km west), Wanipigow River (approximately 1.1 km north), Round Lake (approximately 3.4 km northwest) and Horseshoe Creek (approximately 4.1 km northwest), as well as Normandy Creek (approximately 0.40 km south) and Rice Lake (approximately 1.2 km southeast), both south of Provincial Road (PR) 304, as shown in **Figure 01**. (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed))

3.3 Physical Environment

The proposed TMA expansion site and general surrounding area is located within the Lac Seul Upland Ecoregion of the Boreal Shield Ecozone. The Lac Seul Upland Ecoregion is subdivided into three Ecodistricts (Berens River 370, Wrong Lake 371 and Nopiming 373). The project site is predominantly contained within the Wrong Lake Ecodistrict, however the eastern extent of the project area may potentially extend into the Nopiming Ecodistrict. (Bulloch *et al.* 2002)

3.3.1 Land

3.3.1.1 Topography

The topography of the proposed TMA expansion area generally consists of significant outcroppings of bare Precambrian Shield rock on the north and northeast sides and low-lying areas characterized by small creeks and bogs (Green Spaces Environmental Consulting 2008).

The proposed TMA expansion site is located in a low-lying area. Elevations of the proposed site vary with minimum elevations of approximately 265.5 m above sea level (asl) within the proposed new polishing pond area and approximately 270 masl within the proposed new main pond area, and maximum elevations of approximately 280 masl within both the proposed new polishing pond and main pond areas, as illustrated in **Figure 02**. Elevations of at least 290 masl were located both north and south of the proposed site.

3.3.1.2 Soils

General Soils of the Project Area

According to the biophysical land classification study undertaken by Woo *et al.* (1977) the landforms within the general project area are predominantly basic bedrock ridges overlain by a blanket of clayey glaciolacustrine soils. Soils of the general project area consist of a complex of the Indian Bay Complex, Lettonia and Baynham soil associations.

Baynham Soil Association

The Baynham soil association is predominantly composed of typic mesisol, but also includes sphagnic phase typic mesisol and typic humisol. All of the soil subgroups are classified as poorly drained. The parent material of the Baynham soil association consists of deposits of mesic to humic forest peat or very thin discontinuous fibric sphagnum peat overlying forest peat. These parent materials are underlain by undifferentiated mineral materials. The soils are generally found on gently sloping to level bogs in areas of lower slopes and depressions (Woo *et al.* 1977).

Indian Bay Complex Soil Association

In the area of the project site, the Indian Bay Complex soil association is composed of moderately well drained to well drained lithic phase solonetzic gray luvisol, and imperfectly drained lithic phase gleyed solonetzic gray luvisol. These soils dominantly developed from Precambrian bedrock with minor veneers and pockets of calcareous lacustrine clay. Layers of non-calcareous till and/or fibric forest peat may also be present in the parent materials. The soils generally occur on moderately rolling to ridged topographies. (Woo *et al.* 1977)

Lettonia Soil Association

Although there are two variations of the Lettonia soil association, only one is located in the general project area. This variation consists of moderately well to well drained solonetzic gray luvisol, with imperfectly drained gleyed solonetzic gray luvisol and moderately well to well drained orthic gray luvisol. These soils were formed from moderately to strongly calcareous clay textures lacustrine sediments and are generally found on the crest, upper and mid slopes of gently sloping to moderately rolling topographies. (Woo *et al.* 1977)

Soils Encountered at the Project Site

During the geotechnical drilling investigation completed by AECOM in March 2011, a total of 17 test holes were completed along the proposed TMA expansion dyke locations, as shown in **Figure 05**.

In seven of the test holes, mostly along the proposed TMA expansion east and west dykes, the soils generally consisted of a layer of topsoil and/or a layer of peat up to a depth of 2 m below ground surface. With the exception of two test holes, this layer was underlain by a layer of clay ranging from 0.8 m to 2.6 m in depth. Clayey and/or sandy silt layers were found under the clay layer to depths ranging between 6.1 m and 11.7 m below ground surface. In two of the test holes, a 1 m layer of sand was encountered within the silt layers. Following the silt layers, a clay layer, approximately 1.2 to 5.2 m in thickness, was encountered in four of the test holes. A layer of sand, varying in thickness from 1 m to 9 m, was found under the clay and/or silt layer. In two of these test holes, the base sand layer was classified as being till.

In seven of the remaining test holes, the soils generally consisted of a layer of topsoil or peat up to a depth of 0.6 m below ground surface. This layer was underlain by a layer of silt ranging from 1.3 m to 5.6 m in depth, which was then underlain by a layer of sand ranging from 0.2 m to 5 m in depth. In one of these test holes, the sand layer was classified as being till. A 1 m layer of clay was found under the sand layer for one of these seven test holes.

The remaining three test holes varied in their stratigraphy. One of the test holes consisted of alternating layers of silt and clay to a bottom depth of 7.2 m below ground surface. A second one consisted of a 0.5 m layer of peat underlain by a 4.1 m layer of silt followed by a 2.1 m layer of clay. The third test hole consisted of a 0.3 m layer of peat underlain by alternating layers of clay and silty clay to a depth of 11.7 m below ground surface followed by a layer of sand, classified as till, to a depth of 14 m below ground surface.

During the investigation, test holes were drilled until auger refusal, on assumed bedrock. Based on the 17 test holes completed in the area of the proposed dykes, the bedrock potentially varies from approximately 2.7 m to 20.7 m below ground surface.

Soil Capability for Agriculture

Although the Canada Land Inventory (CLI) has assessed and mapped the land capability for agriculture for much of rural Canada, no data was available for the project area (Canada Land Inventory 2000).

3.3.1.3 Geology

Bedrock Geology

The Rice Lake area is situated in the central portion of the Archaen Rice Lake greenstone belt of the western Superior Structural Province of the Precambrian Shield (AGRA Earth & Environmental Limited 1996, Wardrop 2008). The Rice Lake greenstone belt is surrounded by the Wanipigow Fault to the north, the Normandy Creek Shear zone to the east, the Manigotagan Gneissic complex to the south and an unnamed fault to the west. The Rice Lake greenstone belt is composed of volcanic and sedimentary rocks of the Rice Lake Group and overlying sedimentary rocks of the San Antonio formation. The Rice Lake Group is intruded by mafic dykes and sills, and quartz diorite-granodiorite batholiths (AGRA Earth & Environmental Limited 1996, MacBride 2006, Wardrop 2008).

The Rice Lake Group is composed of the Bidou Lake Subgroup and the Gem Lake Subgroup, overlain by the Edmunds Lake Formation. The Bidou Lake subgroup is characterized by a bimodal volcanic sequence (basalt-dacite) and derived sedimentary rocks while the Gem Lake Subgroup is characterized by a complete volcanic differentiation cycle and interlayered sedimentary rocks (Harmony Gold (Canada) Inc 2001).

3.3.2 Water

3.3.2.1 Surface Water

The nearest bodies of water to the proposed project site include No Name Creek, Horseshoe Creek, Wanipigow River, Bog Creek, Rice Lake and Normandy Creek. The existing TMA is located near the headwaters of Bog Creek, however discharges from the existing TMA are sent into No Name Creek. No Name Creek is situated on the northwest side of the existing TMA and flows west and north where it merges with the Horseshoe Creek and flows into the Wanipigow River as shown in **Figure 01**. The Wanipigow River flows westerly into Lake Winnipeg just north of the community of Manigotagan through the Hollow Water First Nation.

Although there are no current flow statistics for the No Name Creek, Horseshoe Creek or the Wanipigow River, estimates were made by scaling the flow statistics calculated for other similar gauged reference watersheds based on the ratios of the drainage areas. Records from the reference watersheds were used to determine long term mean, maximum and minimum flows. The Thomann and Mueller method was used to estimate $_7Q_{10}$ flows from the reference watershed records as well (Harmony Gold (Canada) Inc. *et al.* 2001).

The estimated flow statistics for No Name Creek, Horseshoe Creek and Wanipigow River are summarized in Table 3.1, Table 3.2 and Table 3.3. Both No Name Creek and Horseshoe Creek were estimated to have no flow during the estimated minimum flow condition and No Name Creek is expected to have a negligible flow in all months under the $_7Q_{10}$ condition (Harmony Gold (Canada) Inc. *et al.* 2001).

Table 3.1: Estimated Flow Statistics for No Name Creek

Month	Mean (m^3/s)		Maximum (m^3/s)		Minimum (m^3/s)		$_7Q_{10}$ (m^3/s)	
	NNC-VR[a]	NNC-HC[b]	NNC-VR[a]	NNC-HC[b]	NNC-VR[a]	NNC-HC[b]	NNC-VR[a]	NNC-HC[b]
January	0.003	0.004	0.026	0.045	0	0	0.001	0.001
February	0.002	0.004	0.027	0.047	0	0	0.001	0.001
March	0.003	0.005	0.077	0.136	0	0	0.001	0.001
April	0.039	0.068	0.357	0.627	0	0	0.001	0.001
May	0.017	0.030	0.223	0.392	0	0	0.001	0.001
June	0.013	0.023	0.207	0.364	0	0	0.001	0.001
July	0.011	0.020	0.177	0.311	0	0	0.001	0.001
August	0.006	0.010	0.199	0.349	0	0	0.001	0.001
September	0.011	0.020	0.624	1.10	0	0	0.001	0.001
October	0.011	0.020	0.124	0.218	0	0	0.001	0.001
November	0.009	0.015	0.081	0.142	0	0	0.001	0.001
December	0.005	0.008	0.040	0.070	0	0	0.001	0.001

Source: Harmony Gold (Canada) Inc. *et al*. 2001

Notes: [a] NNC-VR – No Name Creek at Vanson Road.

[b] NNC-HC – No Name Creek above the confluence with Horseshoe Creek.

Table 3.2: Estimated Flow Statistics for Horseshoe Creek

Month	Mean (m^3/s)		Maximum (m^3/s)		Minimum (m^3/s)		$_7Q_{10}$ (m^3/s)	
	HC-NNC[a]	HC-WR[b]	HC-NNC[a]	HC-WR[b]	HC-NNC[a]	HC-WR[b]	HC-NNC[a]	HC-WR[b]
January	0.012	0.016	0.034	0.079	0	0	0.002	0.003
February	0.009	0.013	0.024	0.071	0	0	0.002	0.003
March	0.010	0.015	0.133	0.269	0	0	0.001	0.002
April	0.088	0.156	0.600	1.22	0	0	<0.001	0.001
May	0.099	0.129	0.448	0.840	0	0	0.008	0.009
June	0.054	0.077	0.293	0.660	0	0	0.005	0.006
July	0.049	0.069	0.312	0.620	0	0	0.001	0.002
August	0.023	0.033	0.220	0.570	0	0	<0.001	0.001
September	0.032	0.052	0.450	1.54	0	0	0.001	0.002
October	0.040	0.060	0.280	0.498	0	0	0.001	0.010
November	0.030	0.045	0.206	0.348	0	0	0.001	0.002
December	0.020	0.028	0.075	0.145	0	0	0.004	0.005

Source: Harmony Gold (Canada) Inc. *et al*. 2001

Notes: [a] HC-NNC – Horseshoe Creek above the confluence with No Name Creek.

[b] HC-WR – Horseshoe Creek at the Wanipigow River.

Table 3.3: Estimated Flow Statistics for Wanipigow River

Month	Mean (m^3/s)		Maximum (m^3/s)		Minimum (m^3/s)		$_7Q_{10}$ (m^3/s)	
	WR-HC[a]	WR-LW[b]	WR-HC[a]	WR-LW[b]	WR-HC[a]	WR-LW[b]	WR-HC[a]	WR-LW[b]
January	1.24	3.64	3.38	9.95	0.03	0.10	0.42	1.23
February	1.05	3.09	2.61	7.68	0.04	0.11	0.46	1.35
March	1.01	2.98	4.18	12.3	0.06	0.18	0.43	1.26
April	3.41	10.0	24.7	72.7	0.38	1.12	0.55	1.62
May	8.04	23.6	35.6	105	0.48	1.40	1.15	3.38
June	6.47	19.0	22.9	67.3	0.50	1.46	1.11	3.26
July	4.23	12.4	11.4	33.6	0.55	1.62	0.95	2.79
August	2.78	8.2	23.8	69.9	0.16	0.46	0.60	1.77
September	2.40	7.07	19.2	56.4	0.08	0.24	0.56	1.65
October	2.16	6.35	9.60	28.2	0.04	0.11	0.57	1.68
November	2.11	6.21	7.84	23.1	0.02	0.07	0.50	1.46
December	1.63	4.80	4.90	14.4	0.03	0.09	0.45	1.32

Source: Harmony Gold (Canada) Inc. *et al*. 2001

Notes: [a] WR-HC – Wanipigow River below Horseshoe Creek.

[b] WR-LW – Wanipigow River at the entrance to Lake Winnipeg.

Flood Risk

Based on information provided by Manitoba Water Stewardship, minimal mapping has been completed for Bissett or the surrounding area, and no flood risk map is available. In lieu of a flood risk map, Manitoba Water Stewardship recommends that any development be at least 1.5 m above and 30 m from the ordinary high water mark of any water bodies where the hazard has not been defined and that development be set back at least 10 times the height

of the bank or 60 m from any waterways where the hazard has not been defined. It was also recommended to avoid the marshy areas in the vicinity of Bissett. (Bryer, pers. comm. 2009)

In the area around Bissett, Manitoba Water Stewardship could only provide the 100 year flood level for Rice Lake (252.7 m G.S.C. Datum), as no flood levels had been established for Round Lake, Horseshoe Lake, or any of the other water bodies in the area. (Bryer, pers. comm. 2009)

Surface Water Quality

Historically, surface water samples were collected in several locations within No Name Creek (including upstream of the existing TMA end of pipe location, at Vanson Road and at the Gun Range) and Wanipigow River (including upstream and downstream of the confluence with Horseshoe Creek and at the confluence with Wanipigow Lake) in May 1996, November 1999, October 2000, April 2001 and August 2002. (Harmony Gold (Canada) Inc. *et al.* 2001, Manitoba Water Stewardship, Water Quality Management Section 2009, Green 2003)

The samples collected in 1996, 1999 and 2000 were analyzed for total and dissolved metals, cyanide and routine water chemistry. A summary of these water quality results is provided in the Stage II Environment Act Licence Application. (Harmony Gold (Canada) Inc. *et al.* 2001)

The samples collected in 2001 and 2002 exceeded applicable guideline concentrations for the protection of aquatic life for total iron. With the exception of the sample collected from No Name Creek (Vanson Road), these samples also exceeded the applicable guideline concentration for total aluminum. Additional parameters that exceeded applicable guideline concentrations for some of the samples included ammonia nitrogen and dissolved lead (upstream on Wanipigow River) and dissolved oxygen (No Name Creek at Vanson Road). (Canadian Council of Ministers of the Environment 1999; Green 2003; Manitoba Water Stewardship, Water Quality Management Section 2009; Williamson 2002)

Water samples were also collected from the Wanipigow River (upstream and downstream of the confluence with Horseshoe Creek) as part of the EEM program in December 2007, September to November 2008, August to October 2009 and August to November 2010. Concentrations of copper, aluminum and iron in some of the samples, both upstream and downstream, were found to exceed applicable guideline concentrations. Concentrations of total suspended solids in the downstream samples collected in August of 2009 and 2010 were found to exceed applicable guideline concentrations; however these concentrations appeared to correspond to local flood events as elevated total suspended solids concentrations were found in the upstream samples. Periodically, total suspended solids concentrations in samples from the downstream location have shown at least a "factor of 2" difference compared to the upstream samples. This difference was considered to be a result of the local geology and precipitation patterns. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Sediment Quality and Turbidity

Historically, sediment samples have been collected in May 1996 and November 1999. In 1996, a sample was collected from No Name Creek upstream of the existing TMA end of pipe location, while in 1999, samples were collected at two locations along No Name Creek (at Vanson Road and at the Gun Range) and at two locations along Wanipigow River (upstream and downstream of the confluence with No Name Creek), with three samples collected at each location in 1999. The samples were generally analyzed for total metals, total mercury, total organic carbon and moisture content. A summary of the sediment analysis is provided in the Stage II Environment Act Licence Application. (Harmony Gold (Canada) Inc. *et al.* 2001)

Background turbidity and total suspended solids values for Wanipigow River and No Name Creek are presented in Table 3.4, along with background levels for dissolved solids for reference. Based on the historic values, suspended

sediment values are typically below 25 mg/L and turbidity values are typically below 8 NTUs in the water samples. As a result, the maximum increase allowed for these parameters are 5 mg/L and 2 NTUs for long-term exposures and 25 mg/L and 8 NTUs for short-term exposures (Canadian Council of Ministers of the Environment 1999; Williamson 2002).

Table 3.4: Background TDS, TSS and Turbidity Results for Closest Stations Sampled in 2002

Station No.	Total Dissolved Solids (mg/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)	
	2001	2002	2001	2002	2001	2002
MB05RA S119[1]	67	54	5	3	3.5	2.6
WR-DS[2]	-	91	-	8	-	6.2
WR-US[2]	-	54	-	3	-	2.6
NNC-VR[2]	-	266	-	3	-	1.6

Source: Compiled from: [1] Manitoba Water Stewardship, Water Quality Management Section 2009
[2] Manitoba Water Stewardship (Green 2003)

Notes: MB05RA S119 – Location on Wanipigow River approximately 3 km upstream of the confluence with Horseshoe Creek.
WR-DS – Wanipigow River downstream of the confluence with No Name Creek.
WR-US – Wanipigow River upstream of the confluence with No Name Creek.
NNC-VR – No Name Creek at Vanson Road.

Sediment samples were collected September 23 and 24, 2010 in five locations downstream of the discharge pipeline location on No Name Creek as well as five locations on Bog Creek as a reference. Samples were analyzed for particle size, fractional organic carbon and total organic carbon. Total organic carbon within the samples collected from No Name Creek ranged from 0.67 to 26.5%. The highest value was found closest to the discharge pipeline location in an area of peat, while the lowest value was found near Vanson Road in coarse grained sediments (gravel and sand). The remaining three samples were obtained from fine grained sediments (silt and clay) and had total organic carbon values ranging from 1.53 to 4.26%. The samples obtained from Bog Creek were all obtained from fine grained sediments (silt and clay) and had total organic carbon values ranging from 1.08 to 4.97%. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

3.3.2.2 Groundwater

Hydrostratigraphic Units

Although groundwater has not been studied specifically in the proposed TMA expansion site, it was studied in the general area during the initial design stages of the existing TMA. Within the general area, four hydrostratigraphic units were identified: Precambrian bedrock, silty sand and till, lacustrine clay, and various surficial organic deposits (including peat) (AGRA Earth & Environmental 1996).

The Precambrian bedrock in the general area consists of Rice Lake Series breccias and andesite, which are anticipated to have similar hydraulic characteristics. As bedrock generally has low porosity, and low hydraulic conductivity, the hydraulic flows within the bedrock would be dominated by fracture patterns, including joints, shears and faults. Although groundwater was not observed during investigations for the existing TMA, seepage water within the local mines indicates that there is a water table within the bedrock. The water table within the bedrock is likely to be a general reflection of the topography, with recharge occurring along rock ridges and discharge occurring within topographic depressions. (AGRA Earth & Environmental 1996)

During the 1996 existing TMA investigation, as well as in a few test holes completed during the geotechnical drilling in March 2011, a sand till unit was found above the bedrock, and generally below a layer of clay. Based on the earlier investigation, the thickness of the till increased to several meters thick towards the centre of the depression (which became the existing TMA) from having no till along the rock ridges. A hydraulic conductivity test completed on one of the groundwater monitoring wells installed during the 1996 investigation indicated that the hydraulic conductivity of the till was in the order of 10^{-4} cm/s, which is in the same order of hydraulic conductivity estimated for the tailings. (AGRA Earth & Environmental 1996)

Aquifers

Based on the Bedrock Aquifers map produced by the Water Resources Branch, bedrock aquifers in the project area are composed of igneous and metamorphic Precambrian rocks. Although water may be found within fractures or fracture zones in the bedrock, water bearing fractures are generally scarce and vary significantly between areas. The bedrock aquifers generally have well yields between 0.01 L/s to 0.5 L/s, but yields may exceed 5 L/s. (Rutulis 1986a)

Based on the Sand and Gravel Aquifer map produced by the Water Resources Branch, the project area falls within the Canadian Shield, which is generally characterized by outcrops and areas of thin glacial drift. In the Canadian Shield, sand and gravel aquifers can be found within the glacial drift between outcrops. These aquifers vary in size, and may have yields ranging from less than 0.1 L/s to more than 10 L/s. (Rutulis 1986b)

Groundwater Quality

Bedrock aquifers in the project area have varying water quality, ranging from excellent to salty, with total dissolved solids concentrations typically less than 2,500 mg/L in potable waters (Rutulis 1986a). The total dissolved solids concentrations of the sand and gravel aquifers in the project area are typically less than 2,500 mg/L as well (Rutulis 1986b).

Accessible groundwater wells installed as part of the 1996 investigation of the existing TMA were monitored in 1999 and 2000. During the 1999 investigation, groundwater was found ranging from 0.6 m to 1.6 m below the top of the well casing; while in 2000, groundwater was found approximately 0.8 m below the top of the well casing. These water levels indicated artesian conditions in the sand (till) aquifer, which were present during the groundwater well installation in 1996. These artesian conditions were reported to reduce the migration of tailings water into the local groundwater system. (Harmony Gold (Canada) Inc. *et al.* 2001)

Groundwater samples collected in 1999 and 2000 were analyzed for routine water quality parameters, total and dissolved cyanide, nutrients and dissolved metals. At the time of the investigation, increases in dissolved aluminum and copper were noted in Bog Creek and west of the existing TMA, compared to baseline conditions. However as the dissolved copper in one monitoring well upstream of a second monitoring well along Bog Creek did not have an increase in dissolved copper, it was reported that the elevated dissolved copper concentrations were not likely a result of subsurface migration, although further investigations would be needed to confirm. During the 1999 sampling event, high total suspended solids concentrations were found in two of the monitoring wells compared to baseline conditions, however the increase was attributed to the bentonite seal of the wells as bentonite appeared to be observed within the purge water removed from the two monitoring wells. During both the 1999 and 2000 sampling events, no significant changes in groundwater quality were observed east of the existing TMA. (Harmony Gold (Canada) Inc. *et al.* 2001)

Additional information regarding the 1999 and 2000 sampling events, including laboratory results are available in the Stage II Environment Act Licence Application, prepared August 23, 2001.

Extent of Groundwater Use

Based on a review of Manitoba Water Stewardship's Groundwater Management Section 2009 well records, an estimated 87 registered wells exist within a 30 km radius of the proposed TMA expansion site, including five registered wells with unknown sections. According to the well records, of the 87 registered wells, 22 are registered as production wells and 65 are registered as test wells. Within a 10 km radius of the proposed TMA expansion site, there are nine registered wells, three registered as production wells and six registered as test wells. Within a 1 km radius of the proposed TMA expansion site, there are potentially two registered wells, both registered as test wells; however as these wells were reported to be near the Wanipigow River, they are likely not within 1 km of the proposed TMA expansion site. (Manitoba Water Stewardship, Groundwater Management Section 2009)

A summary of the water use of the production wells within a 30 km, 10 km and 1 km radius of the proposed TMA expansion site is indicated in Table 3.5).

Table 3.5: Number of Registered Production Wells by Water Use Within 30 km, 10 km and 1 km of the Proposed TMA Expansion Site[1]

Distance from Proposed TMA Expansion	Domestic	Domestic & Other	Total
30 km [a]	21	1	22
10 km [b]	2	1	3
1 km	0	0	0

Source: [1.] Manitoba Water Stewardship, Groundwater Management Section (2009).

Notes: [a.] Includes wells within 10 km and 1 km of the proposed TMA expansion site.
[b.] Includes wells within 1 km of the proposed TMA expansion site.

As indicated in Table 3.5, all of the reported production wells in the regional study area (within 30 km) are intended for domestic or domestic and other water use. It is also noted that no production wells were reported to occur within 1 km of the proposed TMA expansion site.

The indicated depth from the ground surface to the perforated well section in which groundwater can enter the production wells within 10 km of the proposed TMA expansion site ranges from 5.8 m to 24.7 m below the ground surface. The shallowest production well within the 10 km radius reported a bottom depth of 7.6 m below the ground surface (Manitoba Water Stewardship, Groundwater Management Section 2009).

Based on the review of Manitoba Water Stewardship's Water Branch 2009 well records, the closest wells to the proposed TMA expansion site are located in 10-24-13-EPM and 15-24-13-EPM. There are six registered wells in 10-24-13-EPM, of which two are production wells for domestic water use, and one registered well in 15-24-13-EPM, which is registered as a production well for domestic and other use. One production well and one test well within 10-24-13-EPM are owned by J. Stevenson, while the remaining production and test wells are owned by Parks Branch/Renewable Resources. Two additional wells, located in 24-13-EPM and 24-14-EPM, are registered as test wells and are owned by Parks Branch. According to groundwater information presented in two of the well logs, groundwater was reported at depths of 1.5 and 4.9 m below the ground surface. Soils similar to those encountered during the March 2011 geotechnical investigation, presented in Section 3.3.1.2, were described in the available well logs. (Manitoba Water Stewardship, Groundwater Management Section 2009)

It is not the intention of the San Gold Corporation to construct supply wells on the proposed TMA expansion site or for the proposed operation of the TMA expansion to withdraw or utilize any encountered groundwater from the area.

Groundwater Level

During the geotechnical investigation of the proposed project site in March 2011, groundwater levels were recorded for the completed test holes. Piezometers were installed in four of the test holes to potentially monitor groundwater levels in the future. At the time of the March investigation, groundwater levels were reported to range between 0.3 m and 6.1 m below the ground surface.

During the investigation, groundwater seepage was noticed in several of the test holes. The depth below the ground surface to the top of the observed groundwater seepage was measured upon completion of the test hole(s). During the investigation, groundwater seepage was observed between 0.05 m and 1.83 m below the ground surface.

3.3.3 Air Quality

There is no ambient air quality data available for the project area as there is no continuous air quality monitoring station in the project area. However, Manitoba Conservation and Environment Canada have several air quality monitoring stations in areas surrounding the project in Manitoba and northwestern Ontario. Manitoba Conservation's air quality monitoring stations are located in the City of Winnipeg, the City of Brandon, the City of Flin Flon and the City of Thompson. The nearest Environment Canada air quality monitoring stations in northwestern Ontario are located in Pickle Lake, the Experimental Lakes Area and Fort Frances.

Based on the general undeveloped nature of the proposed TMA expansion site and the distance to the existing mining portals and the community of Bissett, the City of Winnipeg residential station as well as the Pickle Lake and the Experimental Lakes Area stations would provide the most representative data set applicable to the project area.

The location of the three nearest air quality monitoring stations, in relation to the project area, are shown in **Figure 08** and the estimated ambient air quality data is provided in Table 3.6.

Table 3.6: Estimated Ambient Air Quality for the Project Area

Name of Pollutant	Data Source	Units of Measurement	Averaging Period	Average Annual Concentration
CO^{1}	Winnipeg (Residential) NAPS Site	ppm	1995 – 2008	0.34
$NO_2^{1,a}$	Winnipeg (Residential) NAPS Site	ppb	1995 – 2008	10.4
$NO^{1,a}$	Winnipeg (Residential) NAPS Site	ppb	1995 – 2008	5.3
$NO_X^{1,a}$	Winnipeg (Residential) NAPS Site	ppb	1995 – 2008	15.1
$PM_{2.5}^{1}$	Winnipeg (Residential) NAPS Site	$\mu g/m^3$	1997 – 2008	5.24
$O_3^{1,a}$	Winnipeg (Residential) NAPS Site	ppb	1995 – 2008	21.1
$O_3^{2,b}$	Experimental Lakes Area NAPS Site	ppb	1997-2006	32.1
$O_3^{2,c}$	Pickle Lake NAPS Site	ppb	2006	33.1

Sources: [1.] Manitoba Conservation, Air Quality Section (Manitoba Conservation. Pollution Prevention Branch, Air Quality Section 2010).

[2.] Environment Canada, NAPS Network Reports (Environment Canada 2009).

Notes: [a.] Parameter was converted to a concentration in ppb from a provided concentration in pphm.

[b.] Data for the Experimental Lakes Area NAPS Site was also available for 1996 and 1995, however as they were not complete, they were not included in the table.

[c.] The 2006 data for the Pickle Lake NAPS Site was missing values for January and February, therefore the average annual concentration is based on a 10-month period.

3.3.4 Climate

As a part of the Lac Seul Upland Ecoregion, the general project area is located in the cooler and most humid subdivision of the Mid-Boreal Ecoclimatic Region in Manitoba and is characterized by short, warm summers and long, cold winters (Smith *et al.* 1998). Bissett typically receives an average of 557.2 mm of precipitation per year, with 134 cm as snow (Environment Canada 2010a). The closest meteorological station that measures temperature and precipitation is the Bissett station, while the closest meteorological station that measures wind speed and direction is the Red Lake station in Ontario. The locations of the Bissett and Red Lake meteorological stations are indicated on **Figure 08**.

Table 3.7 shows the monthly temperature and precipitation for the Bissett station and the monthly wind speed and direction for the Red Lake station over the normal year. Table 3.8 shows other relevant weather parameters for the Bissett area.

Table 3.7: Climatic Data for the Community of Bissett (1971-2000) and the Town of Red Lake (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Yr
Daily Average Temperature (^{o}C)[a]	-19	-15.2	-7.1	2.6	10.9	15.8	18.3	17.1	10.8	4.3	-5.9	-16.3	1.4
Precipitation (mm)[a]	21.5	17.5	26.9	31.9	50.9	89.3	73.0	79.5	67.9	48.0	30.1	20.6	557.2
Average Wind Speed (kph)[b]	9.4	9.7	11	11.5	11.7	11.5	10.7	10.5	11.9	12.8	12	9.9	11.1
Most Frequent Wind Direction[b]	NW	NW	SE	SE	SE	SE	NW	SW	NW	NW	NW	SE	NW

Source: Environment Canada 2010a, 2010b

Notes: [a.] Information from Bissett meteorological station.

[b.] Information from Red Lake meteorological station.

Table 3.8: Other Weather Parameters for Bissett, Manitoba

Weather Parameter	Value
Last Spring Frost (0^{o}C)[1]	May 15 – June 1
First Fall Frost (0^{o}C)[1]	Sept 15 – Oct. 1
Frost Free Period (> 0^{o}C)[1]	120 – 140 days
Extreme Maximum Temperature (^{o}C)[2]	37.5 (June 1995)
Extreme Minimum Temperature (^{o}C)[2]	-46.1 (Jan. 1974)
Extreme Daily Rainfall (mm)[2]	81 (Sept. 1980)
Maximum Hourly Wind (km/h)[2]	59 (Oct. 1984)
Maximum Gust (kph)[2]	81 (June 1984)

Sources: [1.] Energy. Mines and Resources Canada 1981a, 1981b, 1981c.

[2.] Data obtained from the Bissett meteorological station (Environment Canada 2010a).

3.4 Biological Environment

3.4.1 Flora

Vegetation in the Wrong Lake Ecodistrict is characterized by Jack Pine and Trembling Aspen in the upland regions and Black Spruce in the areas of imperfectly drained uplands and bog peatlands. Areas with good drainage may also host mixed stands of White Spruce, Balsam Fir, Trembling Aspen and Balsam Poplar. The project area is also located within the southeast vegetation district, which is characterized by Jack Pine forest mixed with Black Spruce muskeg and Jack Pine treed rock. (Bulloch *et al.* 2002)

According to Rowe (1972), the project area is located within the Lower English River forest section of the Boreal Forest Region. This area is characterized by mixed stands of Trembling Aspen, Balsam Poplar and White Spruce on well-drained soils, with shallow bogs consisting of Black Spruce and Tamarack. Other species common to the Lower English River area of the Boreal Forest include Balsam Fir, White Birch and Jack Pine.

According to Harmony Gold (Canada) Inc. (2001), lands in the general region have been classified by the CLI as ranging from Class 3, lands having slight limitations to commercial forestry, to Class 7, lands having severe limitations which preclude commercial forestry.

A biological inventory and assessment of the project area, as illustrated in **Figure 09**, was completed by Green Spaces Environmental Consulting (2008) between May 28 and September 17, 2008. A copy of their report is provided in **Appendix B**. The following paragraphs summarize the findings of this work.

The study team responsible for the biological inventory and assessment systematically walked north-south and east-west transects, where possible, across the project area in an effort to identify and determine the status of as many plant and wildlife species as possible. The topography in the project area ranged from significant outcroppings of bare Precambrian Shield rock, on the north and northeast sides, to low-lying areas characterized by small creeks and bogs, which resulted in a wide diversity of vegetative communities. There was a waste disposal site towards the eastern portion of the investigated area which was noted as being heavily impacted by human activity. Several sand and/or gravel borrow pits were also noted to the southeast portion of the investigated area.

A total of 251 plant species were identified within the project area, with the most prominent communities including Balsam Fir, Black Spruce, Tamarack, Jack Pine, mixed woods (deciduous and coniferous), Balsam Poplar, Aspen Poplar and Sedge-Willow. It was also noted that several species were at the edge of their documented range in Manitoba; however no observed vegetative species were listed under the *Manitoba Endangered Species Act* (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed)) or the Federal Species at Risk Public Registry (Government of Canada 2011). A complete list of the plant species observed in the project area is provided in **Appendix B**.

The biological assessment recommended that if portions of the project area were to be utilized as a new TMA, the low-lying areas should be developed first in an effort to protect the orchid species that were typically found at higher elevations around rock outcroppings. Although the observed orchid species had conservation rankings, none of the observed species are listed as provincially or federally protected.

3.4.2 Fauna

The Lac Seul Upland Ecoregion typically includes wildlife such as Moose, Black Bear, Wolf and Woodland Caribou. Other species of wildlife found in the area include Lynx, Ermine, Fisher, Mink, Red Squirrel, Beaver, Muskrat and

Snowshoe Hare. Bird Species of the Ecoregion include Bald Eagle, Great Horned Owl, Red-Tailed Hawk, Spruce Grouse, Herring Gull, Double Crested Cormorant, Turkey Vulture and various waterfowl. (Smith *et al.* 1998)

Although the CLI has assessed and mapped the land capability for ungulates and waterfowl for much of rural Canada, no data was available for the project area (Canada Land Inventory 2000).

In conjunction with the vegetative assessment, a wildlife assessment was carried out between May 28 and September 17, 2008. The following sections summarize the findings of the site survey. A copy of the biological inventory and assessment report completed by Green Spaces Environmental Consulting (2008) is provided in **Appendix B**.

3.4.2.1 Mammals

The diverse plant community in the project area supports a diverse population of wildlife. Eighteen mammalian species were noted in the project area; however small animal trapping was not undertaken. Within the investigated area, observed small mammal species included Red Squirrels, Eastern Chipmunks, Little Brown Myotis (Bats) and Big Brown Bats, while observed large species included Moose, White-tailed Deer and Black Bear. It was noted that the Grey Wolf may also be present in the area; however none were observed during the study. In addition to the species observed, tracks of several additional species, such as Mink, were found. Where the tracks were identifiable, they were included as being species observed in the area.

None of the species observed were listed under the *Manitoba Endangered Species Act* (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed)) or the Federal Species at Risk Public Registry (Government of Canada 2011). A complete list of the mammal species observed in the project area is provided in **Appendix B**.

3.4.2.2 Birds

The biological inventory recorded a total of 130 bird species within the project area. Some of the bird species used the project area for breeding and nesting, while others appeared to be transient in the area or were migratory and only occupied the area during the spring or fall. Given this variety in use, it is unlikely that the 130 recorded bird species represent all of the bird species that occupy the area on a multi-year basis.

During the 2008 investigation, a Red-tailed Hawk was seen and/or heard on a regular basis and a pair of Broad-winged Hawks was observed to use the project area on a regular basis. Although these two species breed in the Bissett area, no evidence of their breeding for 2008 was found in the project area, and they were classified as only potentially breeding in the area. Some species, including Wood Ducks, American Wigeon, Blue-winged Teal and Black-billed Cuckoo, were ranked as transient species as they were observed within or over the investigated area, but no breeding evidence was found. The Whip-poor-will, Baltimore Oriole and Great Gray Owl were identified as breeding in the Bissett area and were seen within or over the investigated area. However, no evidence was found to prove that they bred in the area in 2008. Based on nests found, parents seen feeding their young and/or being recorded on territory, five species, including Canada Geese, Common Nighthawks, Magnolia Warblers, Ruffed Grouse and Northern Saw-whet Owls, were identified as breeding in the area in 2008.

With the exceptions of the Common Nighthawk, Olive-sided Flycatcher, Rusty Blackbird and Whip-poor-will, which are listed on the Federal Species at Risk Public Registry, and discussed in a later section, none of the observed birds were listed under the *Manitoba Endangered Species Act* (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed)) or the Federal Species at Risk Public Registry (Government of Canada 2011). A complete list of the bird species recorded in the project area is provided in **Appendix B**.

3.4.2.3 Amphibians

Seven species of amphibians were recorded in the project area, including the Blue-spotted Salamander and a number of species of frogs, including Gray Tree Frog, Northern Spring Peeper, Boreal Chorus Frog, Northern Leopard Frog, Mink Frog and Wood Frog. It was noted that the Blue-Spotted Salamander is likely at the northern edge of its known range in Manitoba, and that the Mink Frog was definitely at the northern extremity of its known range in Manitoba. The Northern Leopard Frog was also found in the project area in wet areas and often along the highway traversing the southern edge of the project area.

With the exception of the Northern Leopard Frog which is listed on the Federal Species at Risk Public Registry, and discussed in a later section, none of the observed amphibians were listed under the *Manitoba Endangered Species Act* (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed)) or the Federal Species at Risk Public Registry (Government of Canada 2011. A list of the amphibian species recorded in the project area is provided in **Appendix B**.

3.4.2.4 Reptiles

Only two species of reptiles were recorded in the project area; the Red-sided Garter Snake and the Western Painted Turtle. Neither of the observed reptiles were listed under the *Manitoba Endangered Species Act* (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed)) or the Federal Species at Risk Public Registry (Government of Canada 2011. A list of the reptile species recorded in the project area is provided in **Appendix B**.

3.4.3 Aquatic Resources

The project region is characterized by the presence of many bodies of water including lakes, streams and rivers. The existing TMA was originally designed as a zero-discharge facility; however a one-time discharge to Bog Creek was permitted in 1998 with Harmony Gold's purchase of the property. Following an application for a Stage II Environment Act Licence for the existing TMA, periodic autumn discharges into No Name Creek were permitted. The current operation of the existing TMA allows for discharges to be diverted to No Name Creek, which subsequently drains into the Wanipigow River via Horseshoe Creek.

3.4.3.1 Benthic Invertebrates

No Name Creek

In November of 1999, three benthic invertebrate samples were obtained from one location along No Name Creek near the gun range upstream of the confluence of No Name Creek and Horseshoe Creek. From the samples, 15 taxa, representing eight invertebrate orders, were identified, with Diptera being the most numerous invertebrate found, accounting for 66% of the invertebrates. Chironomidae represented the majority of the Dipteran within the samples. Approximately 28% of the total invertebrate abundance was represented by gastropods, mostly from the Planorbidae. (Harmony Gold (Canada) Inc. *et al.* 2001)

As part of the EEM program, three benthic invertebrate samples were collected in late September 2010 at each of five locations within No Name Creek. Sediments collected from No Name Creek appeared to be high in fine organic content and emergent macrophyte roots, which resulted in high numbers of smaller species. Within the samples, 32 taxa groups (35 taxa using the chrironomid sub-families) were found, with Oligochaetes (worms) and Chironomidae (non-biting midges) being the most abundant. The average invertebrate density for the samples was approximately 34,877 individuals/m^3, with the samples having an average of 14.2 different taxa. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Bog Creek

As part of the EEM program, three benthic invertebrate samples were collected in late September 2010 from each of five locations within Bog Creek as a reference to No Name Creek. Sediments appeared to be high in clay content, reducing the number numbers of smaller species present. Within the samples, 32 taxa groups (35 taxa using the chrironomid sub-families) were found, with Amphipods and Chironomidae (non-biting midges) being the most abundant. Average invertebrate density was 6,356 individuals/m^3, with samples having an average of 14.1 different taxa. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Based on statistical analysis, there was no significant statistical difference in the invertebrate density between No Name Creek and Bog Creek, but there was variability between replicate samples. In terms of taxa richness, the number of taxa was similar in the samples between the two creeks, and there was no significant statistical difference. A calculation of the Simpson's Diversity Index, which is a measure of diversity taking into account the number of species present and their abundance, produced mean values of 0.661 for No Name Creek and 0.750 for Bog Creek. The results of a Simpson's Evenness calculation, which is a measure of species abundance, produced mean values of 0.064 for No Name Creek and 0.059 for Bog Creek. The results of the Simpson's Diversity Index and Simpson's Evenness indicated that the two creeks were not statistically different. The Bray-Curtis Index calculation, which is an indication of dissimilarity between two sites, produced significantly statistically different results, which likely reflects differences in composition between No Name Creek and Bog Creek. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Wanipigow River

In November of 1999, three benthic invertebrate samples were obtained from each of two locations along Wanipigow River (upstream and downstream of the confluence of Horseshoe Creek and Wanipigow River). The samples obtained from Wanipigow River varied in invertebrate abundance and diversity with the upstream location having 22 taxa representing nine orders and the downstream location having three taxa representing three orders. Diptera, mostly Chironomidae, was most the abundant invertebrate order in both locations representing 83% of the upstream samples and 53% of the downstream samples. Mostly due to the low number of Dipterans present at the downstream location, the overall invertebrate density of the downstream location (246 individuals/m^3) was significantly less than the upstream location (6,913 individuals/m^3). (Harmony Gold (Canada) Inc. *et al.* 2001)

The total invertebrate density of the upstream Wanipigow River samples (6,913 individuals/m^3) was higher compared to the No Name Creek samples (4,594 individuals/m^3), however both sample locations had similar diversity based on the number of taxa identified (10.7 average) at each location. Although the two locations had a similar diversity, different invertebrate were present at the two locations, including Sphaerid clams and gastropods consisting primarily of Viviparidae at the upstream Wanipigow River location and *Isotoma*, *Neoplea*, *Haemopsis* and *Helobdella* and gastropods consisting primarily of Physidae and Planorbidae at the No Name Creek location. (Harmony Gold (Canada) Inc. *et al.* 2001)

Additional information regarding the 1999 sampling event, including laboratory results, is available in the Stage II Environment Act Licence Application, prepared August 23, 2001, while additional information regarding the 2010 sampling event is available in the Cycle 1 EEM Interpretative Report for the Rice Lake Gold Mine, prepared March 21, 2011.

3.4.3.2 Fish and Fish Habitat

No Name Creek

The riverbed within No Name Creek is mostly composed of clay with some silt. Active and historic beaver ponds are present in several areas along the creek. In 2010, the average channel width was 0.6 m and the average channel depth was 0.5 m between the beaver ponds. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

In November 1999, a baseline fisheries study was completed for No Name Creek to determine fish presence, community composition, relative abundance, biological characteristics and tissue metal concentrations. Fish were collected near the gun range (upstream of the confluence of No Name Creek and Horseshoe Creek), and at Vanson Road (approximately half way between the gun range and the existing TMA). Species caught at both locations during the study included Brook Stickleback, Central Mudminnow and Finescale Dace. Fathead Minnows were also caught at the gun range location. Overall, the most abundant species at both locations was Brook Stickleback, however the most common species found at the gun range site included Brook Stickleback and Finescale Dace, while Central Mudminnow was more common at the Vanson Road site. (Harmony Gold (Canada) Inc. *et al.* 2001)

As part of the EEM program, a small bodied fish survey was completed in the fall of 2010 at five locations along No Name Creek within the effluent exposure area. The effluent exposure area was defined from immediately downstream of the discharge outlet to approximately 1.4 km downstream, with expected effluent concentrations ranging between 66 and 72% based on measured conductivity in the creek. The most abundant species captured included Finescale Dace, followed by Fathead Minnow, Central Mudminnow and Brook Stickleback. Generally, more fish were obtained further downstream near the confluence with Horseshoe Creek compared to the sampling locations near Vanson Road, where no fish were caught. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Based on species availability, 50 Finescale Dace were caught for analysis of total length, body weight, age, gonad weight and liver weight. Out of the 50 fish caught, 38 were male, five were female and seven were indeterminate. Based on the fish caught, the average male length was 61.45 mm, with a weight of 2.23 g and an age of 3.6 years, while the average female length was 84.60 mm, with a weight of 6.04 g and an age of 7 years. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

No Name Creek likely provides year round habitat for forage fish species in areas that do not freeze to the bottom, such as beaver ponds. Although four species of minnows were present within No Name Creek, No Name Creek would not directly support or potentially sustain a fishery due to the numerous beaver dams that prevent access from downstream fish. Although the hydrologic regime, nutrient flow and water quality of No Name Creek would need to be maintained as it may indirectly support fish stocks that may sustain fishing activities downstream, it has a low productive capacity and only indirectly contributes to a fishery in a non-critical way. As a result, the 1999 baseline fisheries study suggested that No Name Creek would fall into Class 3 Habitat under the Department of Fisheries and Oceans, and would require a minimum level of protection. (Harmony Gold (Canada) Inc. *et al.* 2001)

Bog Creek

The riverbed within Bog Creek is mostly composed of clay with some silt present. Active and historic beaver ponds are present in various areas along the creek. In 2010, the average channel width was 1.5 m and the average channel depth was 0.8 m between the beaver ponds. A culvert under PR 304 prevents movement of fish upstream of PR 304. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

As part of an environmental baseline study completed for the Bissett Gold Mine in 1995 and 1996, a fish study was completed for Bog Creek. Species caught as part of this study included Brook Stickleback, Central Mudminnow,

Finescale Dace and Fathead Minnow. Spottail Shiner was also caught during the 1995 sampling, but not the 1996 sampling. During the study, Brook Stickleback was the most abundant species caught. (Harmony Gold (Canada) Inc. *et al.* 2001)

As part of the EEM program, a small bodied fish survey was completed in the fall of 2010 at six locations along Bog Creek to provide a reference to No Name Creek. The reference area along Bog Creek started approximately 2 km east of the existing TMA. The most abundant species captured included Finescale Dace, followed by Brook Stickleback and Central Mudminnow. No Fathead Minnow were captured during the sampling event. Generally, more fish were obtained from the three sampling locations near the headwaters of Bog Creek, immediately south of the existing TMA, compared to the three sampling locations further downstream between Vanson Road and PR 304. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Based on species availability, 50 Finescale Dace were caught for analysis of total length, body weight, age, gonad weight and liver weight. Out of the 50 fish caught, 25 were male, 10 were female and 15 were indeterminate. Based on the fish caught, the average male length was 67.08 mm, with a weight of 3.09 g and an age of 4.56 years, while the average female length was 83.40 mm, with a weight of 6.05 g and an age of 7.4 years. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Comparing the results of the EEM fish survey, with the exception of condition factor in the female fish, all other tests for required fish endpoints indicated no statistical difference between fish obtained from Bog Creek and No Name Creek. The condition factor in female Finescale Dace was higher for the fish obtained from No Name Creek compared to Bog Creek, however it is uncertain whether this is an effect of effluent-related effects. Based on the limited data collected for required and supportive end points, differences between fish obtained from the two creeks are most likely due to differences in habitat and not effluent-related effects. (Parks Environmental Inc. and Kilgour & Associates Ltd. 2011)

Wanipigow River

A baseline fisheries study was completed for the Wanipigow River in November 1999. Samples were collected both upstream and downstream of the confluence of Horseshoe Creek and Wanipigow River. Species caught at both locations during the study included Brook Stickleback, Finescale Dace and young-of-the-year Common White Sucker. Central Mudminnow and Troutperch were also caught at the upstream location. (Harmony Gold (Canada) Inc. *et al.* 2001)

The portion of Wanipigow River that receives drainage from No Name Creek and Horseshoe Creek is relatively isolated in terms of fish habitat. Upstream of Wanipigow Lake (downstream of the confluence with Horseshoe Creek), fish passage is prevented by the falls above Curry Landing (downstream of the downstream sampling location). Fish passage into Wallace Lake (upstream of the confluence with Horseshoe Creek) is prevented by Birch Falls approximately 10 km upstream of the confluence with Horseshoe Creek and No Name Creek. Isolation of this area was reflected in low number of juvenile and adult species caught during the 1999 study. (Harmony Gold (Canada) Inc. *et al.* 2001)

Additional information regarding the 1999 sampling event, including laboratory results, is available in the Stage II Environment Act Licence Application, prepared August 23, 2001, while additional information regarding the 2010 sampling event is available in the Cycle 1 EEM Interpretative Report for the Rice Lake Gold Mine, prepared March 21, 2011.

3.4.3.3 Stocked Fish Species

Fish stocking records for the Lac Seul Upland Ecoregion indicate that 53 water bodies have previously been stocked with fish. The majority of these water bodies are found within or near the Nopiming Provincial Park, the Atikaki Provincial Wilderness Park and the Powerview area and will not be affected by the proposed TMA expansion (Bulloch *et al.* 2002).

Stocked water bodies that have the potential to be affected by the proposed TMA expansion include Rice Lake, approximately 1.2 km south of the proposed TMA expansion site, Round Lake, approximately 3.3 km west of the proposed TMA expansion site, Wanipigow River, approximately 1.1 km north of the proposed TMA expansion site and is connected to No Name Creek via Horseshoe Creek, and Wallace Lake, approximately 16 km east of the proposed TMA expansion site and upstream along Wanipigow River from the confluence of Horseshoe Creek and No Name Creek. Stocked fish species include Kokanee (Wanipigow River in 1969), Rainbow Trout (Round Lake in 1981), Smallmouth Bass (Rice Lake in 1991) and Walleye (Rice Lake in 2002-2004 and Wallace Lake in 1997 and 2003). (Bulloch *et al.* 2002, Manitoba Water Stewardship 2010)

3.4.4 Protected Species

To determine the potential species at risk that may be in the project area, the Manitoba Conservation Data Centre, Occurrence of Species by Ecoregion for the Lac Seul Upland Ecoregion was examined (Manitoba Conservation, Manitoba Conservation Data Centre 2011 (accessed)). The species listed for the Ecoregion were then cross referenced with the Manitoba *Endangered Species Act* (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed)) and Schedule 1 of the Federal *Species at Risk Act* (Government of Canada 2011) to determine the listed rare or sensitive species that may occur in the project area. Species distribution maps available from the Manitoba Conservation Wildlife and Ecosystem Protection Branch (2011) and the Species at Risk Public Registry (Government of Canada 2011) were also used, where possible, to determine listed species that may occur in the project area. The search results found that there is a potential for three listed species to occur in the general project area as shown in Table 3.9.

Table 3.9: Federally and Provincially Listed Species that May Occur in the Project Area

Species	Federal SARA Species Schedule 1 Status[1]	Manitoba Conservation Endangered Species Act Status[2]	Environmental Considerations
Eastern Wolf ***Canis lupus lycaon***	Special Concern	Not Listed	• Within the southern portion of its range it inhabits deciduous and mixed forests, while in the northern portion of its range it inhabits mixed and coniferous forests.[1] • Mainly found in Great Lakes and St. .Lawrence regions of Quebec and Ontario, but can also be found in southern Manitoba.[1]
Woodland Caribou (Boreal Population) ***Rangifer tarandus caribou***	Threatened	Threatened	• Winter habitat includes mature and old-growth coniferous forests containing large quantities of terrestrial and tree-inhabiting lichens, while summer habitat includes young stands following a fire or logging activities.[1] • Generally show preference for peatland habitats, especially areas with Black Spruce, White Spruce and Tamarack.[1] • Generally avoid areas of clear cuts, shrub-rich habitat and aspen-poplar dominated sites.[1] • Rutting/mating period typically occurs in late September/early October with calving occurring in mid May to mid June.[1]
Yellow Rail ***Cotumicops noveboracensis***	Special Concern	Not Listed	• Nesting habitats include marshes dominated by sedges, true grasses and rushes, where there is little to no standing water and where the substrate remains saturated throughout the summer.[1] • Habitats can also include damp fields and meadows, on floodplains of rivers and streams, in bogs and the upper levels of estuarine and salt marshes.[1] • Eggs are typically laid in late May to early June.[3]

Sources: [1.] Species at Risk Public Registry (Government of Canada 2011)
[2.] Species Listed Under the Manitoba Endangered Species Act (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed))
[3.] NatureServe Explorer 2010

The Department of Fisheries and Oceans provides regional-scale distribution mapping for aquatic species at risk. Based on available distribution maps, Lake Sturgeon (Red-Assiniboine River, Lake Winnipeg subspecies) and Shortjaw Cisco were the only species to potentially be located in the project area. These species are listed as Endangered and Threatened, respectively, by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), but neither is currently listed under the Federal *Species at Risk Act* or the Manitoba *Endangered Species Act*, and are not necessarily legally protected. (Fisheries and Oceans Canada 2010, Manitoba Water Stewardship 2010, Government of Canada 2011 and Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed))

Although the desktop study revealed a potential for three species at risk to be in the area, the desktop study was based on approximate breeding ranges. To determine the known species in the project site and immediately surrounding area, the list of observed species produced during the biological inventory and assessment, carried out between May 28 and September 17, 2008, was compared to Schedule 1 of the Federal *Species at Risk Act* as well as the *Manitoba Endangered Species Act*. The search results indicated that five species at risk were observed in the general project area during the 2008 site survey. The observed species at risk are listed in Table 3.10.

Table 3.10: Federally and Provincially Listed Species Found in the Project Region

Species	Federal SARA Species Schedule 1 Status[1]	Manitoba Conservation Endangered Species Act Status[2]	Environmental Considerations
Whip-poor-will ***Caprimulgus vociferous***	Threatened	Not Listed	• Nests in semi-open or patchy forests.[1] • Ground-level vegetation and woodland size may affect breeding.[1] • Nesting areas are often near shrubby pastures or wetlands with perches.[1] • Prefers breeding habitats with pine and oak.[1] • Nesting generally occurs between late May and early July, with eggs layed on the ground.[1]
Common Nighthawk ***Chordeiles minor***	Threatened	Not Listed	• Nests in open, vegetation-free habitats, including dunes, beaches, recently harvested forests, burnt-over areas, logged area, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores and river banks.[1] • May also inhabit mixed and coniferous forests.[1] • Birds arrive from early May to mid June, with eggs laid on the ground until mid August. Migration south occurs between mid August and mid September.[1]
Rusty Blackbird ***Euphagus carolinus***	Special Concern	Not Listed	• Nests in the boreal forest and favours shores of wetlands including slow moving streams, peat bogs, marshes, swamps, beaver ponds and pasture edges.[1] • During winter prefers damps forests and to a less extents cultivated fields.[1] • Reach breeding grounds (margins of wetlands) between April and May, with nestlings leaving the nest after 11 to 13 days.[1] • Migration runs from late August to early October.[1]
Olive-sided Flycatcher ***Contopus cooperi***	Threatened	Not Listed	• Associated with open areas containing tall live trees or snags for perching.[1] • Open areas may include forest clearings, forest edges located near natural openings (rivers or swamps) or human-made openings (logged areas).[1] • Birds return between April and June, predominantly in mid to late May, and leave starting from late July to early September.[1]
Northern Leopard Frog (Prairie Population) ***Lithobates pipiens***	Special Concern	Not Listed	• Overwintering sites are well-oxygenated water bodies such as streams or large pond that do not freeze solid.[1] • Breeding sites are temporary ponds that often dry up in late summer and have no fish.[1] • Summer habitats include moist upland meadows and native prairie,[1] • Prefer areas near water and where vegetation is less than 30 cm in height.[1] • Breeding runs from mid April to late June.[1]

Sources: [1.] Species at Risk Public Registry (Government of Canada 2011)
[2.] Species Listed Under the Manitoba Endangered Species Act (Manitoba Conservation, Wildlife and Ecosystem Protection Branch 2011 (accessed))

According to the biological inventory and assessment report (Green Spaces Environmental Consulting 2008), a wide array of plant, mammal, bird, amphibian and reptile species are present in the project area, however this is also true for a much larger area bordering PR 304 and stretching from the Winnipeg River at Powerview to the west and Wallace Lake to the east. The project area consists of a small segment of the overall diversified land in the area. The report also stated that although federally protected species were found in the area, none of the species identified are classified as "rare" provincially.

3.5 Transportation

The community of Bissett is accessible by PR 304, which is a two lane, undivided, all-season, gravel highway. PR 304 is the only access road into Bissett, and is located immediately north of the community. Gravel roads within Bissett provide local travel around the community. Charter air service is provided by two local companies, with the one local company able to provide float and ski-plane service (Manitoba Aboriginal and Northern Affairs 2003). No airplane runways or railway lines are located in the vicinity of Bissett.

Based on available traffic data, the annual average daily traffic rate along PR 304 near Bissett is 190 vehicles per day. (University of Manitoba Transport Information Group and Manitoba Highway Traffic Information System 2010)

3.6 Heritage Resources

Within the regional study area, the only provincially designated heritage site is the Wanipigow Lake Archaeological Site, located on the southeastern shore of Wanipigow Lake, approximately 18.5 km northeast of the proposed TMA expansion site. (Canada's Historic Places 2011 (accessed))

Within the local study area, there are a number of heritage resources including a number of archaeological sites on the northern side of the Wanipigow River, the shores of Rice Lake and near Quesnel Lake. Various artefacts have been found at the archaeological sites along the Wanipigow River, including ceramics, projectile points, scrapers, hammerstones and a number of other cutting and scraping tools. The majority of the archaeological sites are listed in disturbed and/or destroyed conditions due mainly to flooding and erosion. (Dickson 2009)

In addition to the archaeological sites, the Bissett United Church, listed as an inventoried building (INV1024), and two plaques, one commemorating Gold Mill – Independence Lake (PLAQ452) and one commemorating San Antonio Mineral Claim (PLAQ2359), were found within the community of Bissett. (Dickson 2009)

To determine heritage resources in the proposed TMA expansion site, a Heritage Resource Impact Assessment (HRIA) was conducted by Quaternary Consultants Ltd. (2009) in 2009. A copy of the HRIA is provided in **Appendix C**. The investigation consisted of foot traverses (walking the study area) to visually examine the ground surface within the area of interest, as illustrated in **Figure 09**. If, and where, necessary, shovel test pitting was used to augment identified archaeological locations. The following paragraphs summarize the findings of the HRIA.

During the heritage resources assessment, it was noted that the low-lying areas within the area of interest, including the proposed TMA expansion site, were covered in a thick layer of sphagnum that would cover archaeological resources older than 20 years. Although the low-lying areas may have been accessed by hunting and gathering parties, there was no resource utilization strategy that would have resulted in campsites for any duration, and would have a very low potential for archaeological resources. As a result, the investigation concentrated on the higher bedrock outcrops along the northern portion of the area of interest as well as near the SG1 and SG2 mines along the southern portion of the area of interest.

Two rock features were identified near the northwest section of the bedrock outcrop along the north perimeter of the investigated area of interest. These two rock features consisted of apparently arranged rock piles, with one consisting of a row of rocks piled on larger rocks, and the other consisting of one rock piled on a second. Although the rock features were identified as potential heritage resources due to thick lichen growth, no function could be attributed to either feature, and they were considered of minor importance.

Based on the results of the archaeological survey, it was recommended that no additional archaeological investigations were required for the proposed TMA expansion.

3.7 Socio-Economic Environment

3.7.1 Settlement and Population

3.7.1.1 Community of Bissett

The community of Bissett was first recognized under the *Northern Affairs Act* in October 1972, operating under the governance of a mayor and council. Historically, Bissett principally provided services to the gold mine and those that the mine employed. Between 1943 and the gold mine closure in 1968, the San Antonio Gold Mine employed approximately 200 employees and produced 38,272,130 grams of gold and 6,108,620 grams of silver. The mine has also operated during various intervals from 1980 to the present (Manitoba Aboriginal and Northern Affairs 2003).

As of 2006, the community of Bissett had a census population of 120, having decreased by 50.6% from a population of 243 reported in the 2001 Canadian census (Statistics Canada 2010d). Although it was reported that the community had 130 housing units (Manitoba Aboriginal and Northern Affairs 2003), approximately 107 were private dwellings, of which 51 were occupied by residents at the time of the 2006 census (Statistics Canada 2010d).

Community of Bissett Services

Emergency fire services provided in the community of Bissett include a pumper truck and equipment from the community fire hall. Portable forestry equipment and a ½ ton truck with potable water supply are also available for grass and brush fires. The emergency medical services in Bissett are provided by a community operated ambulance under contract to the North Eastman Health Association Inc. The nearest hospital to the project area is located in Pine Falls, Manitoba. Police services for the community of Bissett are provided from the Royal Canadian Mounted Police (RCMP) Powerview detachment, in Powerview, Manitoba. The RCMP also maintains a trailer facility in Bissett for overnight accommodation (Manitoba Aboriginal and Northern Affairs 2003).

Electrical service is provided by Manitoba Hydro via land lines. Manitoba Telecom Services (MTS) provides individual land line service and digital switching telephone service. Water is sourced from Rice Lake and treated through nanofiltration and chlorination before being distributed via water lines to the community. Sewage services are provided to the community via low pressure collection system or haul truck, which transports the waste to a lagoon. A solid waste disposal site is located approximately 3 km northeast of the community. One school, from nursery to grade 9, is located within the community, San Antonio School, and is operated by the Frontier School Division. Recreation facilities in the community include a baseball diamond, beach area, campground, curling rink and hall, handicraft building and an outdoor rink with a change house (Manitoba Aboriginal and Northern Affairs 2003).

3.7.1.2 Division No. 19, Unorganized

Division No. 19, Unorganized covers an area of approximately 60,410 km^2 and includes the majority of eastern Manitoba and the Interlake region. As of 2006, Division No. 19, Unorganized had an estimated population of 3,315 (Statistics Canada 2010a), having increased by 3.0% from the 3,217 reported in 2001 Census data. Between 2001 and 2006, the relative population increase in Division No. 19 was greater than that of the Province as a whole, which experienced a 2.6% increase during this period (Statistics Canada 2010c).

Within the Division No. 19, Unorganized area, there are 89 localities, including the community of Bissett. (Statistics Canada 2010e)

Division No. 19, Unorganized Services

Services for Division No. 19, Unorganized vary across the region. In the vicinity of the project area, services would be provided by the community of Bissett, as outlined in Section 3.7.1.1.

3.7.1.3 Hollow Water First Nation Community

The closest First Nation Community to the study area is the Hollow Water First Nation, on Hollow Water Reserve No. 10. The community is located approximately 148 km northeast of Winnipeg and 48 km northwest of the proposed TMA expansion site (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed)). Access to the Hollow Water First Nation community is provided by an all-weather road via PR 304. The nearest air service is available in Bissett, Manitoba and the nearest coach service is provided daily by Grey Goose Bus Lines in Pine Falls (Southeast Community Futures Development Corporation 2009b).

As of 2006, the Hollow Water 10 Indian Reserve had a population of 619 residents, having decreased by 0.5% from the 2001 Census population of 622. This decrease in population is in contrast to the trend in the province as a whole, which experienced a 2.6% increase during this period (Statistics Canada 2010b, Statistics Canada 2010c). The reserve occupies 16.38 km^2. The reserve contains 181 private dwellings, of which 154 were occupied by residents. The community has an experienced labour force of 175 people (Statistics Canada 2010b). Table 3.11 indicates the total population, both on and off the reserve, of the Hollow Water First Nation as of 2009.

Table 3.11: Total Registered Population of the Hollow Water First Nation

Hollow Water First Nation	Population
On-Reserve[a]	1,019
Off-Reserve[b]	601
Total	1,620

Source: Southeast Community Futures Development Corporation 2009b.

Notes: [a.] On-Reserve - includes registered males and females on own reserve.
[b.] Off-Reserve - includes registered males and females on other reserves and off reserves.

Hollow Water First Nation Community Services

A health office provides basic health care services on-reserve, with the nearest hospital located in Pine Falls, Manitoba. Transportation and a community health nurse van are provided to take people to the hospital. Fire protection services are provided by a volunteer fire department equipped with a pumper truck and ancillary equipment. Police services are provided by the RCMP detachment located in Powerview, Manitoba. School services are provided by the Wanipigow School which offers levels kindergarten to grade 12. (Indian and Northern Affairs Canada 2004)

Electricity is provided to the community via land lines. Community water is sourced from the Wanipigow River and is treated before it is distributed through the community via a piped distribution system. Some residences also receive water through a truck delivery service. Sewage is collected via a piped collection system and treated in a two-cell lagoon before being discharged into an effluent ditch that flows into the Wanipigow River. A few residences still utilize pit privies for sewage disposal. One landfill site is maintained by the community to handle solid waste. Additional community services include a First Nation government office, community hall, ice rink and gymnasium. (Indian and Northern Affairs Canada 2004)

The base of the local economy consists of fishing, hunting, trapping and wild rice harvesting. Businesses and commercial services in the community include the Hollow Water Development Corporation, Wanipigow Producer Co-op, Raven's Creek Chipstand, William's Esso Service, Grandpa George's Gas/Diesel Bar and the Wy-Ky-Kan Housing Authority. (Indian and Northern Affairs Canada 2004)

3.7.1.4 Little Black River First Nation Community

The second closest First Nation Community to the study area is the Little Black River First Nation, on Black River Reserve No. 9. The community is located on the banks of the O'Hanly and Black Rivers, approximately 110 km northeast of Winnipeg and 51 km southwest of the proposed TMA expansion site (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed)). The community is accessible by an all-weather road via PR 304 and 4 km of municipal road (Southeast Community Futures Development Corporation 2009a).

The Little Black River Reserve No. 9 was home to 460 residents in 2006, having increased by 18.3% from the 2001 Census population of 389. This relative increase in population is much greater than that of the province as a whole, which experienced a 2.6% increase during this period (Statistics Canada 2010b, Statistics Canada 2010c). The reserve occupies 9.23 km^2. The reserve contained 135 private dwellings, of which 122 were occupied by residents. The community has an experienced labour force of 105 people (Statistics Canada 2010b). Table 3.12 indicates the total population, both on and off the reserve, of the Black River First Nation as of 2009.

Table 3.12: Total Registered Population of the Little Black River First Nation

Black River First Nation	Population
On-Reserve[a]	750
Off-Reserve[b]	281
Total	1,031

Source: Southeast Community Futures Development Corporation 2009a.

Notes: [a.] On-Reserve - includes registered males and females on own reserve.
[b.] Off-Reserve - includes registered males and females on other reserves and off reserves.

Little Black River First Nation Community Services

A health office provides basic health care services on-reserve, with the nearest hospital located in Pine Falls, Manitoba. Fire protection services for the community are provided by the volunteer fire department equipped with a pumper truck and ancillary equipment. Police services are provided by the RCMP detachment located in Powerview, Manitoba. School services for the community are provided by the Little Black River School which offers levels kindergarten to grade 8. (Indian and Northern Affairs Canada 2004)

Electricity is provided to the community via land lines. Water is sourced from the Little Black River and is treated prior to distribution to the community via a piped system. Sewage is collected via a piped collection system and treated in a two-cell lagoon before being discharged into Wendigo Creek. One landfill site is maintained by the community to handle solid waste. Additional community services include an administration office and a multi-purpose building. (Indian and Northern Affairs Canada 2004)

The base of the local economy consists of trapping, agricultural development, wild rice harvesting, hunting and commercial fishing. Businesses and commercial services in the community include the school bus service, Ernest's Gas Station and Grocery Store, O'Hanley Enterprises and a pool hall. (Indian and Northern Affairs Canada 2004)

3.7.1.5 Age Characteristics of Area Population

Table 3.13 presents the age structure of Division No. 19, Unorganized, including the community of Bissett, and the nearest First Nations Communities to the study area. Detailed age characteristics for the community of Bissett were not available. In general, the age structures of the First Nations Communities are much more heavily weighted to the 0-19 years age group than the Province as a whole. Both of the First Nation Communities have at least half of their population under the age of 20 and less than 5% of their population above the age of 65 while the Province of Manitoba had just over a quarter of its population under 20 and almost 15% above the age of 65. The Division No. 19, Unorganized population fell between the First Nation Communities and the Province in each of the three age groupings (0-19 years, 20-64 years and 65 years or over).

Table 3.13: Age Characteristics of Division No. 19, Unorganized and First Nation Communities near the Study Area, Compared to Manitoba

Location	Age		
	0-19 years	20-64 years	65 years or over
Division No. 19, Unorganized	37.9%	52.1%	9.8%
Black River 9, Indian Reserve	54.3%	45.7%	3.3%
Hollow Water 10, Indian Reserve	50.0%	45.2%	2.4%
Manitoba	**26.9%**	**59.0%**	**14.1%**

Source: Derived from Statistics Canada (2010b, 2010c).

Note: Percentages are approximate only.

3.7.2 Local Economy

Based on the total experienced labour force, the largest industries in Division No. 19, Unorganized (including the community of Bissett and surrounding area) are agriculture and resource-based industries (29.9%), other services (23.5%), business services (13.7%), educational services (10.8%) and health care and social services (10.3%), as of 2006 (Statistics Canada 2010c).

Within the community of Bissett, forestry, trapping, mining and wild rice are major contributors to the economy (Manitoba Aboriginal and Northern Affairs 2003). Historically, the Bissett Gold Mine has been the largest employer in Bissett. Manitoba Conservation was reported to be the second largest employer, as it operates a helitac base located in the community (Community of Bissett 2009 (accessed)).

3.7.2.1 Forestry

There is substantial harvesting of the forested areas surrounding Bissett. Bissett and the surrounding forestry areas fall within Forest Management License Area No. 1 and Forestry Management Unit #31 (Manitoba Conservation, Forestry Branch 2010b).

Lands in the general region have been classified by the CLI as ranging from Class 3, lands having slight limitations to commercial forestry, to Class 7, lands having severe limitations which preclude commercial forestry. Such limitations may include moisture deficiency, shallow soil depth, excessive stoniness, high levels of carbohydrates, exposure to extremes in climate and elements and low soil fertility. Common forest tree species for the Bissett

region include Black Spruce, Jack Pine, Trembling Aspen, White Spruce and Balsam Fir (Harmony Gold (Canada) Inc. 2001).

3.7.2.2 Trapping and Hunting

The majority of trapping in the Bissett area occurs along registered traplines in the Hole River and Lac du Bonnet Registered Trap Line Zones, which Bissett shares with other nearby communities (Manitoba Aboriginal and Northern Affairs 2003). The hunting of black bear is a prominent part of the local outfitting business as the Bissett region experiences long spring and fall bear hunting seasons. Other common game animals include moose, deer and upland game birds (Harmony Gold (Canada) Inc. 2001).

3.7.2.3 Mining

Since mining activities began in Bissett in 1932, mining has played a significant role in the local economy. Currently, San Gold Corporation mines ore from the Rice Lake Mine and the Hinge Mine, with near future plans to mine from the 007 Zone, where bulk sampling has already commenced, and Cartwright Mine. Additionally, future mines may also be possible in several exploration zones, including the Cohiba Zone, L13 Zone and San Gold Minerals Zone (SG-1, SG-2 and SG-3). To maintain production, San Gold Corporation employs approximately 425 people. Due to periodic mine inactivity over the years, the local economy has diversified so as not to be solely dependent on the mine, and maintain the economic community of Bissett. (Community of Bissett 2009 (accessed), San Gold Corporation 2010).

3.7.2.4 Other

Other sources of income for the community also include tourism and the provision of local services. Local services offered include lodging, groceries, food services, gas, fly out services, camp areas, trophy fishing, beach area, equipment contractors and lumber sales. To help encourage economic development in the area, the community of Bissett formed the Bissett Development Corporation (Manitoba Aboriginal and Northern Affairs 2003, Community of Bissett 2009 (accessed)).

Table 3.14 highlights the labour force participation rate and unemployment rate for incorporated municipalities and First Nation communities nearest the study area, as compared to the Province as a whole, based on 2006 Statistics Canada Census data.

Table 3.14: Unemployment Rate and Labour Force Participation Rate

Community	Unemployment Rate [1]	Labour Force Participation Rate [1]
Division No. 19, Unorganized	16.7%	47.2%
Black River Indian Reserve No. 9	24.0%	47.2%
Hollow Water Indian Reserve No. 10	25.0%	53.3%
Manitoba	**5.5%**	**67.3%**

Source: [1.] Derived from Statistics Canada Census Data, (Statistics Canada 2010b, 2010c).

3.8 Land Use

3.8.1 Protected Areas

The closest protected areas to the project area are the Nopiming Provincial Park (approximately 5 km south of Bissett), Manigotagan River Provincial Park (approximately 9 km southwest of Bissett), Atikaki Provincial Wilderness Park (approximately 14 km northeast of Bissett) and the proposed UNESCO World Heritage Site, Atikaki/Woodland Caribou/Accord First Nations or Pimachiowin Aki site, (approximately 14 km northeast of Bissett) (Manitoba Agriculture, Food and Rural Initiatives 2010 (accessed)).

3.8.2 Land Use Designations

As the regional and local study areas are located within an unorganized territory (Division No. 19, Unorganized), a zoning by-law or development plan is not available for the region. However, land use designations and management are provided for the community of Bissett, as well as protected areas, including Manigotagan River Provincial Park, Nopiming Provincial Park and Atikaki Provincial Wilderness Park. Of the areas with land use designations and management, only the eastern portion of Bissett is potentially located within 1 km of the proposed TMA expansion site. Land use designations within Bissett include residential, commercial, highway commercial, community services, industrial, parks and recreation, open space, natural resource and hazard lands, and shorelands protection area (Government of Manitoba 1988). Although not within 1 km of the project site, three provincial parks are located within approximately 15 km, with two of the parks located less than 10 km away. Land use designations in these provincial parks include recreational development, backcountry, resource management, wilderness, access and/or access-wilderness (Manitoba Land Initiative 2010 (accessed)).

As previously mentioned, the forested areas of the study area fall within Forest Management License Area No. 1 and Forestry Management Unit #31. The Forest Management License sets out the land from which trees may be cut, the volume of timber that may be harvested and other related terms and conditions. (Manitoba Conservation, Forestry Branch 2009a).

4. Scope of the Assessment

4.1 Temporal Boundaries

The temporal boundaries of the assessment were divided into the following phases:

- Construction Phase – pending Environment Act Licence issue with clearing occurring in 2012 and dyke construction occurring in 2012 and 2013. Additional construction activities are anticipated to occur in years 3 and 6 of operation as a result of required dyke raises.
- Operation Phase – anticipated to occur for a period of 10 years following the completion of construction activities in 2013.
- Decommissioning Phase – anticipated to occur at least 10 years into the future.

4.2 Geographic Boundaries

The following are the spatial boundaries defined for this report. However, where specifically noted, these boundaries may be adjusted to suit the valued ecosystem component considered.

- The **project site** includes any land owned by San Gold that will be disturbed by project activities.
- The **project area** generally includes any area, up to 1,000 m beyond the project site, which could be disturbed by project effects. This includes effects during construction, such as noise, vehicle emissions, traffic, etc.
- The **project regional boundary** includes any area beyond the project area that may be affected by the construction or operation activities of the project. Effects that may be seen outside of the project area may include items such as climate change effects.

4.3 Environmental and Social Components

This environmental assessment considers changes to the environment caused by the project, as well as any resultant effects on the socio-economic environment by scoping for appropriate Valued Ecosystem Components (VECs) and Valued Social Components (VSCs). For this project, VECs were selected based on ecological importance and/or value to the existing environment, the relative sensitivity of environmental components to project influences and their relative social, cultural, or economic importance. VSCs include components of the socio-economic environment that may be affected by a change in the environment as a result of the project.

The interaction between project components and VECs and VSCs are identified in Table 4.1. Interactions are based on judgement of the assessor combined with assumed implementation of standard environmentally responsible construction techniques and operating procedures in the course of the project construction, operation and decommissioning. Section 5 discusses the potential effects of the project and VEC/VSC interactions identified in Table 4.1 and identifies required mitigation measures, residual effects and significance.

Table 4.1. Identification of VEC/VSC Interactions with Project

	Valued Ecosystem Components																				Valued Social Components[2]					
	Topography		Soils (erosion, compaction, settling, stability, quality)		Geology		Surface Water (quality, quantity, flow, flood, current, tides, wave action, shoreline/bottom alteration, drought, littoral process)		Groundwater (quantity, quality, flow, water table)		Air Quality (dust, emissions, noise)		Climate (wind, precipitation, inversion, fog)		Flora (abundance)		Fauna (population change, productive capacity, habitat modification)		Aquatic Resources (population change, productive capacity, habitat modification)		Protected Species		Transportation	Heritage Resources	Aesthetics	Land Use (protected areas, zoning, official plan)	Recreation Tourism	Human Health and Safety
	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VEC	VEC on Project	Project on VSC	Project on VSC	Project on VSC	Project on VSC	Project on VSC	Project on VSC
Construction Phase																												
Site Preparation	x		x		x		x		x		x			x	x		x				x		x	x	x	x		x
Dewatering							x		x					x					x									x
Dyke Construction	x		x				x				x			x	x		x				x		x		x	x		x
Dyke Staging	x		x				x				x			x	x		x				x		x					x
Pipeline Installation											x				x		x				x							x
Proposed Access Road Construction			x				x				x			x	x		x				x		x					x
Re-vegetation														x	x		x				x				x			x
Operation Phase																												
Proposed TMA Expansion											x			x			x				x		x					x
Discharge to No Name Creek							x				x			x			x		x		x						x	x
Proposed Access Roads											x												x					x
Decommissioning Phase																												
Decommision Proposed TMA Expansion			x				x				x			x	x		x				x		x		x			x
Remove Unnecessary Tailings Pipeline Trenches	x		x				x				x			x	x		x				x		x		x			x
Remove Proposed Access Roads	x		x				x				x			x	x		x				x		x		x			x
Clean, Cut and/or Remove Pipelines, Pump Stations and Electrical Power Lines											x																	x

Notes
1. x = identified interaction
2. only indirect interactions with VSCs as a result of an direct project/VEC interactions were considered

5. Discussion of Environmental Effects, Significance and Mitigation

5.1 Effects Assessment Methodology

The potential for project interactions with VECs and subsequent interactions with VSCs was analyzed by superimposing project elements onto existing natural conditions and applying standard mitigation measures. An underlying assumption of this method is that the project will be constructed with due care for safety and environmental matters, using current and reasonable construction practices.

Various terms have been used to identify and describe the potential effects and are described in the following table.

Table 5.1: Explanation of Terms Used in Effects Assessment

Project Phase:	Refers to the phase of the project as construction, operation or decommissioning of the proposed TMA expansion.
Potential Effect:	Classification of the type of effects anticipated during a specific project phase.
Magnitude of Effect:	Refers to the estimated percentage of population or resource that may be affected by activities associated with the construction, operation and decommissioning of the proposed TMA expansion. Where possible and practical, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Magnitude of effect has been classified as either less than (<) 1%, 1 to 10%, or greater than (>) 10% of the population, or resource base. Where the magnitude of an effect has been defined as virtually immeasurable and represents a non-significant change from background in the population or resource, the effect is considered negligible. An exception to this is in terms of potential human health effects where, for example deaths due to waterborne disease amounting to 1% of the population would still be considered major.
Direction of Effect:	Refers to whether an effect on a population or a resource is considered to have a positive, negative or neutral effect.
Duration of Effect:	Refers to the time it takes a population or resource to recover from the effect. If quantitative information was lacking, duration was identified as short-term (<1 year), moderate term (1 to 10 years) and long term (>10 years).
Frequency of Effect:	Refers to the number of times an activity occurs over the project phase, and is identified as once, rare, intermittent, or continuous.
Scope of Effect:	Refers to the geographical area potentially affected by the effect and was rated as project site, project area or project regional boundary as defined in Section 4. Where possible, quantitative estimates of the resource affected by the effect were provided.
Degree of Reversibility:	Refers to the extent an adverse effect is reversible or irreversible over a 10-year period.
Residual Effect:	A subjective estimate of the residual effect remaining after employing mitigation measures in reducing the magnitude and/or the duration of the identified effect on the environment.

Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Degree of Reversibility of Effect
Negligible (immeasurable)	Positive	Short term (< 1 year)	Once	Project Site	Reversible
Minor (<1%)	Negative	Moderate (1 to 10 years)	Rare	Project Area	Irreversible
Moderate (1 to 10%)	Neutral	Long term (>10 years)	Intermittent	Project Regional Boundary	
Major (>10%)			Continuous		

The following sections address the various components of the environment and social environment, which are anticipated to be affected by the proposed construction, operation and decommissioning activities. The potential effects on specific environmental parameters are described in terms of relative or absolute significance, where possible. Effects are defined as negligible, minor, moderate or major according to terms in Table 5.1. Effects that are negligible in magnitude are considered sufficiently mitigated and no further mitigation measures are proposed. The significance of any adverse residual effect with magnitudes ranging from minor to major was ascertained based on an evaluation of the effect's magnitude, geographic extent, duration/frequency, reversibility and ecological context. Where residual effects were found to be negligible in magnitude, the effects were not considered significant. A summary table of the potential effects, mitigation measures and significance of residual effects is included in Table 5.2.

5.2 Topography

5.2.1 Construction

During construction of the proposed TMA expansion, the topography is anticipated to change by activities associated with site preparation and dyke construction, including excavating, stockpiling, material placement and rock shaping/stabilization. Topography in the project area varies with low elevations of approximately 265.5 and 270 m and high elevations of approximately 280 m within the project site and elevations of at least 290 m north and south of the project site. With the construction of the dykes, the elevation of the project footprint is anticipated to increase to 282.3 m within the proposed new polishing pond and 284.8 m within the proposed new main pond. The change in topography is anticipated to range in magnitude from negligible in areas where the change will not be noticeable, such along the north side of the proposed TMA expansion and adjacent to some rock outcrops along the southern portion of the proposed TMA expansion, to minor in areas where the change will be noticeable, such as where the dykes are constructed along the southern portion of the proposed TMA expansion. These topography changes are only anticipated to occur within the project site. Overall, the change in topography is expected to be a negative effect and may have subsequent effects on vegetation (loss), soils (erosion) and surface water (drainage flow pattern). With the construction of the dykes, the potential effect is essentially considered to occur over the long term, however the effect on topography will only occur rarely; once during initial construction and again during the dyke raises.

To minimize topography effects, the following mitigation measures will be applied as appropriate:

- Material stockpile heights will be limited.
- Construction activities will be contained to the project site and/or approved areas.

Although the project may have a minor change in the topography as a result of the construction of the dykes, the change in topography will be contained to the project site and is unlikely to be noticeable from areas other than the project site due to the surrounding higher elevations adjacent to the project site. As long as construction activities are contained to the project site, the residual effect is considered to be negligible. As the purpose of the project is to provide an area to store tailings, the potential residual effect of the change in topography is considered to be irreversible, however the potential residual effect can also be considered to be reversible in areas such as the stockpiles as the existing topography would be restored with the use of the stockpiled material. As the change in topography is expected to be limited to the project site, the overall potential residual effect is considered not significant.

5.2.2 Operation

Although the proposed TMA expansion will be filled during operation, potential effects related to a change in topography would have occurred during the construction of the dykes. As a result, no changes in topography are anticipated to occur during operation of the proposed TMA expansion.

5.2.3 Decommissioning

During decommissioning, the topography in the vicinity of the project site will change with the decommissioning of tailings pipeline trenches and proposed access roads. As part of decommissioning, the pipeline trenches will be backfilled to match the existing terrain elevations and the proposed access roads will be contoured to match the surrounding area. The changes in elevation are anticipated to be negligible, but positive as the decommissioning would likely be restoring topography conditions back to its original condition prior to the original construction of the trenches and proposed access roads. This positive change would only occur once during decommissioning and would be long term. In terms of the change in topography, only the project site is anticipated to be affected. As the potential effect is expected to be positive, no mitigation measures are recommended. The potential positive residual effect is expected to be negligible and not significant.

5.3 Soils

5.3.1 Construction and Decommissioning

5.3.1.1 Erosion

During construction and decommissioning, there exists potential for effects to soils (soil loss) due to erosion from wind and precipitation. Conditions favourable for erosion have the potential to occur during site preparation, including vegetation clearing and material excavating and stockpiling, as well as during dyke construction and from the movement of equipment during both construction and decommissioning. The construction process will require the disturbance of approximately 98 ha of land for the proposed TMA expansion as well as a potential additional 1 ha for incidental activities including proposed access roads and vehicle movement/storage. Erosion of soil and material stockpiles due to wind has the potential to cause subsequent effects on air quality, while erosion due to precipitation has the potential to cause subsequent effects on surface water quality. As the project site is located within a low area, any erosion effects due to precipitation are anticipated to remain within the project site. As soils found and/or used at the project site are predominantly clay, silt and waste rock, which are generally heavier materials, and the site is surrounded by vegetated areas, potential erosion effects due to wind are anticipated to remain in the immediate vicinity of the project site. Based on the materials present at the project site and the natural containment of the project site, erosion effects are anticipated to be negligible and occur rarely (likely only during severe weather events). The potential negative effect of erosion is anticipated to occur over the short term of the construction and decommissioning phases.

To minimize erosion, the following measures are proposed:

- Material stockpile heights will be limited, and covered or re-wetted if required.
- Material stockpiles will be located away from drainage areas and other potential sources of water.
- Disturbed surfaces will be kept to a minimum with re-vegetation occurring as soon as practical where required.

With the implementation of applicable mitigation measures, the potential residual effect of soil erosion is anticipated to be negligible, with potential residual effects only occurring within the project site, and only during severe weather events. As the effects of erosion can be reversible within a short timeframe through soil replacement, the potential residual effect is considered not significant.

5.3.1.2 Horizon Mixing

Excavating and backfilling activities, as well as the stockpiling of materials, have the potential to mix soil horizons, which may change the quality of the soil. As the surrounding land use is predominantly underground mining, changes in soil quality are not anticipated to have a noticeable effect on land use. Depending on the materials that are mixed, there is a potential that they may not be separable. As a result, the potential effect of soil mixing may be long term. However, the mixing of inseparable soils is anticipated to be minimized and occur rarely as most materials used will be placed in appropriate stockpiles and there should be noticeable difference between the materials used at the site. Since soil horizon mixing would be contained within the project site and small changes in the soil quality are not likely to affect local land use, the potential negative effect is considered negligible.

To reduce the potential for soil horizon mixing, stockpiled materials will be separated based on soil type/horizon and used as appropriate.

As a change in soil quality due to a change in soil horizons is not anticipated to have a noticeable effect on land and land use in the surrounding area, the potential residual effect is considered negligible. Overall the effect of horizon mixing on soil is not anticipated to be significant.

5.3.1.3 Waste Disposal

Wastes such as used oils, rags, drums and miscellaneous garbage, can negatively affect the quality of soil at the site and surrounding project area if disposed of inappropriately. If the soil quality is reduced, subsequent effects on groundwater quality and flora growth may occur. As inappropriate waste disposal is not anticipated to occur at the site and the local landfill is located adjacent to the project site; potential negative effects to soil quality are anticipated to be limited to rare occurrences at the project site and immediately surrounding project area. Due to the limited amount of waste anticipated to be generated at the site, the potential effect is anticipated to be negligible, but could occur over the short to moderate term depending on the material(s) released as a result of inappropriate waste disposal during construction and decommissioning activities.

To prevent potential effects to soil resulting from inappropriate waste disposal:

- Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site.
- Prior to the end of each construction and decommissioning day, the site will be inspected for loose waste and debris in order to maintain a clean project site.

Due to the limited amount of waste anticipated to be generated at the site and with the appropriate disposal of generated wastes at the local landfill adjacent to the site, the potential residual effect on soil quality is anticipated to be negligible and is not considered significant.

5.3.2 Operation

During operation, activities of the proposed TMA expansion are not anticipated to affect soils.

5.4 Geology

5.4.1 Construction

During construction, there is a potential to affect the geology of the project site. Depending on the location of the dyke structures, there is a potential that bedrock outcrops may have to be shaped/stabilized in order to provide a secure bond between the bedrock outcrop and dyke structure(s). During this process, portions of bedrock outcrops may have to be removed through mechanical and/or blasting methods or built-up through the placement of dental concrete and/or slush grouting. The placement of dental concrete or slush grouting is not anticipated to have an effect on geology as the geological structure is not being changed. However, blasting or mechanical removal of areas of bedrock outcrops has a potential effect on geology as bedrock will be removed from the site. Based on the dyke configuration, it is anticipated that approximately 3,700 m of dykes may be constructed, potentially all of which may tie into the bedrock. Based on the length of the dyke, which is anticipated to have a base of approximately 60 m, approximately 222,000 m^2 of bedrock may be affected. However, only a portion of this total is anticipated to be affected during construction as the depth of bedrock varies throughout the site (varied between 2.7 and 20.7 m below ground surface during the March 2011 geotechnical investigation), with a potentially smaller portion actually requiring mechanical removal or blasting. With proper care, the potential effect is expected to only occur within the project site, and only in areas of near-surface and surface bedrock outcrops. Although the potential negative effect would be considered long term, it will only occur once during construction. As only portions of bedrock along the dyke alignment would potentially be affected in the project site in comparison to the amount of surrounding bedrock in the project area as well as the amount removed during mining activities (approximately 2,500 sdtpd), the potential effect of the removal of bedrock is considered to be negligible.

To reduce effects on geology, the following mitigation measures will be employed:

- Bedrock will only be removed if absolutely necessary for providing a secure bond between the dyke structure and the bedrock or to shape the proposed TMA expansion.
- Where possible, mechanical methods will be used to remove necessary bedrock pieces.
- If blasting is required, the blasting charges required to complete the activity will be minimized to the extent practical to limit fracture and overbreak.

Due to the small amount of area potentially affected by the removal of bedrock, the potential residual effect is considered to be negligible. Although the removal of bedrock would be considered irreversible, the overall potential residual effect is anticipated to be not significant.

5.4.2 Operation and Decommissioning

During operation and decommissioning, activities associated with the proposed TMA expansion are not anticipated to affect the project site, area or regional geology.

5.5 Surface Water

5.5.1 Construction and Decommissioning

5.5.1.1 Sediment and Turbidity

During construction and decommissioning, there is an increased potential for erosion due to disturbed soils and material stockpiles. Erosion has the potential to result in negative effects to surface water as a result of turbidity and sediment accumulation. However, as erosion is expected to only occur in disturbed areas on the project site, and

there are physical barriers (including the existing TMA and general topographic features) between the project site and the nearest surface water bodies (including No Name Creek at least 800 m west of the proposed site and Wanipigow River at least 1 km north of the proposed site), potential effects to the surface water as a result of sediment and turbidity resulting from erosion are unlikely to occur.

5.5.1.2 Surface Water Drainage

Based on the general topography of the project area and applicable catchment areas, surface water drainage likely flows southwards towards the general low areas in the vicinity of the project site. There is a possibility that if surface water drainage flows are sufficient, surface water drainage may flow westerly between the existing TMA and PR 304 towards the headwaters of Bog Creek, approximately 1.7 km west of the project site. However, based on the Stage II Environment Act Licence Application (Harmony Gold (Canada) Inc. 2001), there is a potential catchment area divide near the west access road to the existing TMA site which would prevent surface water from the project site from flowing into Bog Creek. With the construction of dykes along the south side of the proposed TMA expansion, surface water drainage that enters the project site from the north and east will be prevented from flowing away from the site. However, as the majority of surface water drainage flows are likely currently contained in low-lying areas in the vicinity of the project site, a reduction in surface water drainage flows off of the project site is not likely to cause an effect on local surface waters. To reduce potential interference with surface water drainage near PR 304, culverts will be installed in applicable areas beneath the proposed access roads and removed when they are decommissioned.

5.5.1.3 Discharge Volume to No Name Creek

During construction, dewatering of the project site may be required in order to properly compact materials used for the proposed TMA expansion base and dykes. As mentioned above, surface water drainage in the vicinity of the project site likely collects in low-lying areas, including the potential project site. As a result, there is a high probability that surface water will be pumped into the existing TMA, which will then eventually be pumped into the existing polishing pond and into No Name Creek during the discharge period. Additional water from dewatering activities, described in Section 5.6.1.1, will also be sent to the existing TMA for eventual discharge into No Name Creek. Depending on the amount of additional water sent into the existing TMA, there is a potential to change the amount of water that is pumped out of the existing polishing pond and into No Name Creek during the discharge period. However, the amount of water sent to the existing polishing pond is anticipated to be negligible compared to the maximum amount of water potentially stored within the existing polishing pond, approximately 797,500 m^3. Although the pumping rate out of the existing polishing pond is limited to 0.2 m^3/s, it would only take approximately 46 days at the maximum pump rate to empty the full existing polishing pond until it is considered empty. As approximately168 days are available to discharge from the existing polishing pond within the discharge period (commencing June 15 and finishing prior to freeze-up (November 30)), as described in Section 2.3.3.2 and in the February 2012 NOA submission by Parks Environmental Inc. (**Appendix A**), the negligible increase in water stored is not anticipated to extend the discharge period beyond its time frame. As a result, no new significant effects to surface water are anticipated to occur as a result of an increase in the discharge volume to No Name Creek during construction.

5.5.1.4 No Name Creek Water Quality

During construction, dewatering activities as a result of surface water drainage and groundwater drawdown will pump water into the existing TMA and eventually into No Name Creek during the discharge period. As the existing polishing pond will not be discharged until the water quality meets applicable guideline concentrations, as outlined within the existing Environment Act Licence No. 2628 R, no new significant effects to the water quality within No Name Creek are anticipated to occur as a result of dewatering during construction.

5.5.2 Operation

5.5.2.1 Discharge Volume to No Name Creek

During operation, the discharge volume into No Name Creek will increase, however the maximum pump rate out of the existing polishing pond (0.2 m^3/s), as regulated under the existing Environment Act Licence #2628 R, will remain the same. As No Name Creek, Horseshoe Creek and Wanipigow River are all capable of handling a flow rate of 0.2 m^3/s out of the existing polishing pond, as illustrated in Section 3.3.2.1, no new significant effects as a result of pumping out of the existing polishing pond are anticipated to occur.

Under typical operation of the proposed TMA expansion, approximately 1,158,000 m^3 of water will be pumped from the proposed new polishing pond into the existing polishing pond and then into No Name Creek. At a rate of 0.2 m^3/s, approximately 67 days will be required to empty the polishing ponds. Compared to the existing maximum discharge volume out of the existing polishing pond (797,500 m^3 over 46 days at a pumping rate of 0.2 m^3/s), the discharge of the proposed TMA expansion is a major increase in water volume pumped into No Name Creek. However, as mentioned in Section 2.3.3.2, a NOA (provided in **Appendix A**) was submitted in February 2012 by Parks Environmental Inc. to increase the discharge period to approximately 168 days (assumed from June 15 to November 30 (freeze-up)). As the required pumping period is only approximately 40% of the discharge period, and the downstream water bodies can accommodate the pumping rate (0.2 m^3/s), no new significant effects are anticipated to occur as a result of an increase in pumping duration.

In the event that discharge cannot occur, water in excess of the storage volume in the proposed new polishing pond will be stored within the existing polishing pond. If this occurs, water will need to be pumped out of both polishing ponds during the next discharge period, which would discharge approximately 1,955,500 m^3 of water, assuming both polishing ponds were at capacity prior to discharge. Based on the maximum allowed pumping rate into No Name Creek, 0.2 m^3/s, the discharge period would require approximately 113 days. As this discharge period is still well below the discharge period (approximately 168 days) as described above, and the downstream water bodies can accommodate the pumping rate, no new significant effects are anticipated to occur as a result of an increase in pumping duration.

5.5.2.2 No Name Creek Water Quality

During operation of the proposed TMA expansion, water will be discharged (pumped) from the existing TMA polishing pond, which will obtain its water from the existing main pond, precipitation and the proposed TMA expansion (via the proposed new polishing pond). Although an increased water volume will be sent to the proposed TMA during operation, the types and quality of the water inputs are expected to stay the same as the water inputs currently sent to the existing TMA. As a result, the change in water quality is anticipated to be negligible and no new significant effects to water quality are anticipated to occur within No Name Creek during the discharge period, provided the water quality meets the applicable guideline concentrations, as outlined within the existing Environment Act Licence No. 2628 R, before it is pumped from the existing polishing pond into No Name Creek.

5.6 Groundwater

5.6.1 Construction and Decommissioning

5.6.1.1 Groundwater Drawdown

During construction, there is a potential that excavated areas may need to be dewatered, which has the potential to affect the elevation of the local groundwater table. Due to artesian conditions potentially present at the site and an undulating bedrock elevation, the amount of dewatering that will be required is unknown. However, as only two

registered groundwater test wells were found within potentially 1 km of the project site, and potential effects are only expected to be noticed within the immediate project area, a temporary change in the elevation of the local groundwater table is anticipated to be negligible. The potential negative effect is expected to occur intermittently throughout the initial stages of construction which involve excavation activities. The potential drawdown is expected to return to normal within a short period of time following the completion of dewatering activities.

To reduce the potential effects during construction, the following measures are proposed:

- Dewatering activities will only be completed as required in areas of active construction.
- Drawdown of the groundwater table will be limited to areas of active construction activities that cannot be completed appropriately if underwater (such as soil compaction).
- Where possible, backfill excavated area with appropriate materials to maintain groundwater flow patterns following completion of construction activities.

Within 1 km of the project area, there are potentially two registered groundwater wells, both of which are registered as test wells. As there are no production wells within 1 km of the project site and minimal dewatering is anticipated to be required, negligible residual effects to groundwater elevations, and subsequently groundwater users, are anticipated to occur. The potential residual effect is anticipated to be reversible as the groundwater levels are expected to return to seasonal normals shortly after the completion of dewatering activities. Overall, the potential residual effect is considered to be not significant.

5.6.1.2 Waste Disposal

As described in Section 5.3.1.3, groundwater quality may be negatively affected (reduced quality) as a result of effects to soil quality from inappropriate waste disposal during construction and decommissioning. Potential effects to groundwater quality are anticipated to occur rarely as effects to soil quality will occur rarely as inappropriate waste disposal is not anticipated to occur at the site due to the presence of the local landfill adjacent to the project site. The potential effect to groundwater is anticipated to be negligible due to the low amount of waste anticipated to be generated at the project site; however the effect may be noticeable within the surrounding project area. Depending on the material(s) released due to inappropriate waste disposal during construction and decommissioning, effects could occur over the short to moderate term.

To prevent potential effects to groundwater resulting from inappropriate waste disposal:

- Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site.
- Prior to the end of each construction and decommissioning day, the site will be inspected for loose waste and debris in order to maintain a clean project site.

Due to the limited amount of waste anticipated to be generated at the site and with the appropriate disposal of generated wastes at the local landfill adjacent to the site, the potential residual effect on groundwater quality is anticipated to be negligible and is not considered significant.

5.6.2 Operation

5.6.2.1 Groundwater Recharge

During operation of the proposed TMA expansion, the rate of groundwater recharge may be affected. To provide a suitable base to the proposed TMA expansion, the base clay will be compacted to a minimum of $1x10^{-7}$ cm/s to provide a low permeability layer to prevent seepage of stored tailings water into the groundwater. As a result of

compaction, it is estimated that the project site (approximately 98 ha) will reduce the amount of surface water infiltration into the soil for groundwater recharge. As the project site is located in a low-lying area, the area available for recharge may be further reduced. However, due to the nature of the surrounding area (undisturbed forested areas and bedrock outcrops) which may allow some groundwater recharge, the amount of clay underlying the project site (already of low permeability) and the limited use of groundwater in the general area (only two registered test wells within 1 km of the project site), the potential effect is considered to be negligible. As less groundwater would be available at the project site, the potential effect is considered to be negative and would be long term as the base of the TMA would remain compacted. The potential reduced recharge rate is anticipated to occur continuously as the natural clay at the site would already be limiting the groundwater recharge in the area.

Since compaction of the clay is required to prevent effects to the quality of the groundwater, no mitigation measures are proposed to prevent effects related to a change in groundwater recharge. The residual effect (reduction) to groundwater recharge is expected to be negligible due to the limited use of groundwater in the area. Overall, the potential residual effect is considered not significant.

5.6.2.2 Groundwater Quality

During operation, groundwater quality may be affected (reduced quality) as a result of leaks or seepage of tailings water out of the proposed TMA expansion. Subsequent effects on human health as a result of consumption of the lower quality groundwater are not anticipated to occur as no registered drinking wells were found within 1 km of the project site. The potential reduction in groundwater quality is expected to be negative and occur rarely within the project site, however there is potential for effects to migrate into the surrounding project area if the leak/seepage is not detected. Depending on how long the leak occurs, the potential change in groundwater quality may be considered negligible to minor in magnitude, with potential effects occurring over the short to moderate term.

To reduce potential effects on groundwater quality, the following measures will be implemented:

- The proposed TMA expansion will be geotechnically designed to contain the liquid and solid loads.
- During the construction process, clay will be placed as appropriate in areas of sand and other unsuitable materials and compacted to provide a hydraulic conductivity that meets the Manitoba Conservation requirement of $1x10^{-7}$ cm/s or less.
- The clay core within the dyke structure will be keyed into the base clay layer and compacted as appropriate to prevent seepage beneath the dyke structure.
- To prevent seepage along the bedrock outcrop interface, the outcrops will be sufficiently cleaned and reshaped as required to provide a secure bonding surface with the clay core dyke structure.

It is anticipated that the revised Environment Act Licence may continue to include a requirement to complete an annual groundwater monitoring program to identify potential leaks/seepage into the groundwater. If leakages/seepages are identified during operation or if contamination is identified during the groundwater monitoring program, San Gold will investigate the source of the issue. The investigation will be conducted with the intent to repair any problems as well as to provide monitoring and investigations to confirm that the surrounding groundwater/land has not been contaminated and no risk to human health exists as a result. As a result, residual effects on groundwater quality are anticipated to be negligible and not significant.

5.7 Air Quality

5.7.1 Construction and Decommissioning

5.7.1.1 Exhaust Emissions

Vehicle and equipment exhaust emissions have the potential to negatively affect air quality during construction and decommissioning. Vehicle emissions are expected to be generated during vehicle and equipment movement at the site, vegetation and soil stripping, excavating, grading, material placement, compacting and stockpiling. It is anticipated that during construction (and potentially during decommissioning) approximately six staff vehicles will access the site on a daily basis, six pieces of equipment will be used at the project site, which will travel to/from the site on a rare basis, and at least four haulage trucks will access the site on a continuous basis to haul materials to/from the site. Although the number of trips each truck will make on a daily basis is up to the discretion of the contractor and San Gold, it is estimated that 10 round-trips will be made by each truck on a daily basis until the construction material has been moved to/from the project site. These vehicle emissions will occur within the project site and immediately surrounding area, but should be relatively contained due to the vegetated nature of the surrounding project area. Within the project site, the emissions are anticipated to have a temporary minor effect on air quality; while outside the project site, the effect is anticipated to be negligible compared to the existing emission sources including daily traffic on PR 304 (approximately 190 vehicles per day), existing mining-related traffic and mine/mill emissions. Emissions from the construction and decommissioning of the proposed TMA expansion are anticipated to occur continuously during working hours, but the effects would be of short duration occurring only during construction and decommissioning activities.

To mitigate potential air quality effects, the following mitigation measures are proposed:

- Vehicle and equipment will be well maintained.
- Vehicle idling will be kept to a minimum as per site specific orientation obligations.

Following the implementation of the mitigation measures, the potential residual effect on air quality is anticipated to be negligible and stop following the completion of construction and decommissioning activities. As the air quality is expected to return to existing conditions following activities, potential residual effects are considered reversible. Overall, the potential residual effect is anticipated to be not significant.

5.7.1.2 Dust

Potential effects to air quality may also be caused by fugitive emissions of dust and particulate matter during construction and decommissioning activities, including vehicle and equipment movement at the site as well as to/from the site, erosion, vegetation and soil stripping, excavating, grading, material placement, compacting, stockpiling, waste rock processing (crushing) and rock shaping (blasting). Dust and particulate matter have the potential to negatively affect air quality with subsequent effects to human health (respiratory) and vegetation (decreased growth). Activities causing dust and particulate matter are anticipated to occur intermittently throughout construction and decommissioning. Due to the vegetated nature of the surrounding area, potential effects are expected to be minor on-site and negligible off-site, with majority of the potential effect occurring within the project site and contained to the project area.

Any required waste rock processing will be completed by the portable crushing plant located adjacent to the mill. Operation of the portable crushing plant was discussed, and assessed, as part of a NOA previously submitted in February 2012 (Parks Environmental Inc.). Any effects due to dust emissions resulting from the processing of waste rock required for this project are not anticipated to be above levels proposed in the February 2012 NOA submission (Parks Environmental Inc.). As discussed in the February 2012 NOA (Parks Environmental Inc.), dust emissions

resulting from the operation of the portable crusher are expected to be minimal and typical of current and historical operations. A copy of the February 2012 NOA completed by Parks Environmental Inc. is provided in **Appendix A** for reference. To maintain negligible effects, San Gold's Best Management Practices Plan for Control of Fugitive Dust will continue to be followed, and updated as necessary. As a result, no significant new/additional effects related to dust emissions from the processing of waste rock are anticipated to occur as a result of the proposed TMA expansion.

To mitigate potential air quality effects, the following mitigation measures are proposed:

- Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, including:
    - Limiting traffic speeds;
    - Minimizing re-handling of materials;
    - Re-wetting of materials as needed;
    - Completing activities during favourable weather conditions.
- Material stockpile heights will be limited.
- Disturbed/exposed areas will be kept to a minimum.
- If required, dust suppression activities, such as spraying water, will be completed.
- Residents will be informed of the construction schedule, including blasting activities.
- Construction will occur in stages with re-vegetation occurring as appropriate.
- Where applicable, re-vegetation will occur following decommissioning activities.
- Where possible, mechanical methods will be used to remove necessary bedrock pieces.
- If blasting is required, the smallest blasting charge required to complete the activity will be used.
- If necessary, blasting mats will be used during construction.

Following the completion of construction and decommissioning activities, dust generation related to construction and decommissioning is expected to stop. With these mitigation methods employed as necessary, the residual effect of dust generation on air quality during construction and decommissioning is expected to be negligible to minor on site and negligible off-site, with the potential residual effects generally contained within the immediate project area. The potential residual effect is considered to be not significant.

5.7.1.3 Noise

Noise will be generated to varying degrees during construction and decommissioning, with the majority of the noise expected to be typical of heavy equipment such as trucks, graders, loaders and excavators. An increase in the noise level during construction and decommissioning at the project site has the potential to influence people in the surrounding area, however, the project site is located within/adjacent to an active mine site that has used explosive devices for portal development. As the nearest residential receptor is located at least 1.5 km from the proposed TMA expansion site and there is significant vegetation between the proposed TMA expansion site and residential areas, the potential negative effect resulting from the majority of construction and decommissioning activities is anticipated to be minor within the project site and negligible in the surrounding project area. Construction and decommissioning noise is anticipated to occur intermittently throughout working hours, with the effect occurring over the relatively short construction and decommissioning phases.

Depending on the workability of surrounding rock formations, noise may be generated from blasting activities potentially required to form an appropriate bond between the rock surface and the clay core structure of the dykes. If blasting is required, the resulting noise is expected to be heard within the surrounding project area, including Bissett. The sudden change in noise from blasting is expected to be major in magnitude, but would have a very short duration. The potential negative effect of the sudden increase in noise is expected to occur rarely during

construction as blasting would be limited to areas that need to be re-shaped to provide an appropriate bond for the dyke structures.

Noise will also be generated from any required mine waste rock crushing activities, which will be completed at the portable crusher located immediately north of the mill. Operation of the portable crushing plant was discussed, and assessed, as part of a NOA previously submitted in February 2012 (Parks Environmental Inc.). Any effects due to noise generation resulting from the processing of waste rock required for this project are not anticipated to be above levels proposed in the February 2012 NOA submission (Parks Environmental Inc.). As discussed in the February 2012 NOA (Parks Environmental Inc.), noise emissions resulting from the operation of the portable crusher are anticipated to be minimal and similar to other noises generated at the mill site, and is expected to be not significant. As a result, no new/additional effects related to noise emissions from the processing of waste rock are anticipated to occur as a result of the proposed TMA expansion. A copy of the February 2012 NOA completed by Parks Environmental Inc. is provided in **Appendix A** for reference.

The potential for noise effects to wildlife species will be discussed later in the report within the fauna and species at risk section.

Potential noise effects will be mitigated with the implementation of the following measures:

- Working hours will be limited to daylight hours as required.
- Vehicles and equipment will be properly maintained.
- Residents will be informed of the construction schedule, including blasting activities.
- Hearing protection will be provided to human receptors as required.
- Bedrock should only be removed if absolutely necessary for providing a secure bond between the dyke structure and the bedrock.
- Where possible, mechanical methods will be used to remove necessary bedrock pieces.
- If blasting is required, the smallest blasting charge required to complete the activity will be used.
- If necessary, blasting mats will be used during construction.

Even with the implementation of the above mitigation measures, there is still a potential for noise effects to occur. With appropriate mitigation measures, the residual effect is anticipated to be negligible off-site, but may be minor on-site if blasting is required. As the potential residual effect will not exist following construction activities, it is considered reversible. Overall, the potential effect of noise generation during construction and decommissioning is anticipated to be not significant.

5.7.2 Operation

During operation of the proposed TMA expansion, noise and exhaust emissions are anticipated to be produced by vehicles and equipment required to move around the pipelines and pumps. However, these activities, and related effects, currently occur with the operation of the existing TMA. As no increase in vehicle or equipment use is expected to occur with the operation of the proposed TMA expansion, no noticeable new or additional noise effects are anticipated as a result of the operation of the proposed TMA expansion.

5.8 Climate

Construction, operation and decommissioning activities for the proposed project are not anticipated to affect climate or weather. However, climate, especially weather patterns, has the potential to affect the project. The effects of climate on the project will be discussed in Section 7.

5.9 Flora

5.9.1 Construction

5.9.1.1 Vegetation Disturbance/Loss

During construction, there is a potential for vegetation disturbance (reduced growth) and/or loss due to clearing activities, grading, soil compaction and ground disturbance from heavy equipment use as well as soil horizon mixing and dyke construction. A loss of vegetation has the potential for subsequent effects on wildlife.

Although approximately 99 ha of land may be disturbed/cleared for the proposed project, the land is located within an active mining area and does not contain unique habitat in the area. The biological inventory and assessment completed in 2008 compared the area within the project site to the general area bordering PR 304 from the bridge over the Winnipeg River at Powerview to the west to Wallace Lake to the east, which contains approximately 13,500 ha at a 0.5 km radius around PR 304. In terms of vegetation species, 251 plant species were identified during the biological study, however no species was found to be protected either provincially or federally. As a result of the small relative area to be affected (approximately 99 ha out of 13,500 ha, approximately 0.7%) and the lack of protected vegetation species in the project site, the potential negative effect is considered to be negligible to minor. Activities that have the potential for vegetation loss are expected to occur once at the start of construction with the clearing of vegetation within the proposed TMA expansion site as well as for the proposed access roads. As the vegetation within the cleared areas will be permanently cleared, the loss of vegetation is considered to be long term. However as described in Section 5.9.3, the surface of the proposed new main pond, the downstream slopes of the dyke structures, the area of the proposed access roads and other applicable disturbed areas will be re-vegetated with appropriate vegetation species as applicable during decommissioning of the proposed TMA expansion. Although vegetation will only be cleared within the project site, there is a potential for accidental disturbance and/or loss of vegetation in the adjacent project area.

To mitigate potential effects, the following mitigation measures are proposed:

- Construction vehicles and equipment will use designated pathways to access work areas.
- San Gold will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and re-vegetation if required.
- Temporarily disturbed surfaces will be kept to a minimum with re-vegetation occurring as soon as practical where required.

Although the proposed project will result in a loss of vegetation, the potential residual effect is considered to be negligible to minor as no protected vegetative species were found in and immediately surrounding the project site, the project site is located within/adjacent to an active mine site, the project site does not contain any unique habitat and only 99 ha out of 13,500 ha (approximately 0.7%) of similar habitat is expected to be disturbed/cleared. Although vegetation within the proposed TMA expansion site will be permanently lost, the potential residual effect is considered reversible through re-vegetation efforts of the tailings surface, dyke slopes and disturbed areas during the decommissioning of the proposed TMA expansion. Overall, the potential residual effect is anticipated to be not significant.

5.9.1.2 Dust Deposition

During construction, dust deposition has the potential to affect the growth and composition of vegetative species in the project area. Although dust is expected to be mostly contained to the project site, which will be cleared of vegetation, there is a potential for dust to be deposited on vegetation in the immediately adjacent project area. As activities causing dust are anticipated to occur intermittently during construction, dust deposition on vegetation may

also occur intermittently during construction. Since dust will predominantly be contained to the project site, the amount of dust reaching the immediate project area is anticipated to have a negligible effect on the growth and composition of vegetation. The potential negative effect is expected to occur over the short term.

As described in Section 5.7.1.2, dust may also be generated by the portable crushing plant located at the mill site, however, with the implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, as outlined in the February 2012 NOA submission by Parks Environmental Inc. (**Appendix A**), dust emissions are expected to be not significant. As the mill site is not vegetated, dust produced from rock crushing activities is not anticipated to have an effect on local vegetative species.

To mitigate potential dust deposition effects, the following will be implemented:

- Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, including:
    - Limiting traffic speeds;
    - Minimizing re-handling of materials;
    - Re-wetting of materials as needed;
    - Completing activities during favourable weather conditions.
- Material stockpile heights will be limited, and covered if required.
- Disturbed/exposed areas will be kept to a minimum.
- If required, dust suppression activities, such as spraying water, will be completed.

Assuming the implementation of typical good construction practices, in addition to applicable mitigation measures, potential residual effects are expected to be negligible. Overall, the potential residual effect of dust deposition during construction on vegetation is considered not significant.

5.9.1.3 Waste Disposal

As described in Section 5.3.1.3, vegetation growth may be negatively affected as a result of effects to soil quality from inappropriate waste disposal. Potential effects to vegetation growth are anticipated to occur rarely as inappropriate waste disposal practices are not anticipated at the site. The potential effect on flora growth is anticipated to be negligible due to the relatively low amount of waste anticipated to be generated at the project site. Depending on the material(s) released during construction and decommissioning, effects could occur over the short to moderate term.

To prevent potential effects to flora due to inappropriate waste disposal:

- Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site.
- Prior to the end of each construction and decommissioning day, the site will be inspected for loose waste and debris in order to maintain a clean project site.

Due to the limited amount of waste anticipated to be generated at the site and with the appropriate disposal of generated wastes at the nearby local landfill, the potential residual effect on vegetation growth is anticipated to be negligible and is not considered significant.

5.9.2 Operation

During operation, no notable effects to flora are anticipated as activities related to the operation of the proposed TMA expansion will occur along disturbed, un-vegetated surfaces including the dyke surfaces, proposed access roads, the existing TMA and the proposed TMA expansion; not within the surrounding vegetated areas.

5.9.3 Decommissioning

As part of decommissioning activities, the surface of the proposed new main pond, the downstream slopes of the dyke structures, the area of the proposed access roads and other applicable disturbed areas will be re-vegetated with appropriate vegetation species as applicable. The potential effect (increase in vegetation) is anticipated to be positive, occur once, and is expected to be of long term duration. The potential effect is expected to occur within the project site and immediate surrounding area, and would be negligible to minor in magnitude due to the relatively small amount of land to be re-vegetated (approximately 99 ha) compared to the amount of similar habitat in the surrounding area (13,500 ha).

To ensure re-vegetation is successful, monitoring will occur regularly with subsequent re-vegetation efforts occurring if required. Once it has been determined that re-vegetation efforts have been successful, monitoring will no longer be required. As the project site is located within/adjacent to an active mine site, the potential positive residual effect is expected to be negligible. Overall, the potential residual effect is considered to be not significant.

5.10 Fauna and Species at Risk

5.10.1 Construction and Decommissioning

5.10.1.1 Habitat Disturbance/Loss

As mentioned in Section 5.9.1, there is potential for the proposed project to affect approximately 99 ha of habitat as a result of the disturbance/loss of vegetation during construction activities. The loss of habitat may result in a decrease in foraging ability and the availability of denning/nesting sites and shelter for wildlife. Although five federally protected fauna species were observed within the project site and surrounding area, with an additional three federally and/or provincially protected species with potential habitat ranges in the project area, the biological inventory and assessment completed in 2008 indicated that the project site had similar habitat compared to at least 13,500 ha of land bordering PR 304. As vegetation within the project site will be cleared at the start of construction, the potential negative effect of a loss of habitat will occur once and will be of long term duration as vegetation is unlikely to return until the proposed TMA expansion is re-vegetated during decommissioning. As approximately 99 ha out of 13,500 ha of similar habitat will be cleared (approximately 0.7%), the potential effect is considered to range from negligible to minor in magnitude.

To mitigate potential effects, the following mitigation measures are proposed:

- Construction vehicles and equipment will use designated pathways to access work areas.
- Disturbed surfaces will be kept to a minimum with re-vegetation occurring as soon as practical where required and as part of decommissioning activities.
- Clearing activities will not occur between April 15 and July 31, inclusive, to minimize potential effects to breeding/denning and/or migratory wildlife in the area, including the identified federally protected bird species. If clearing activities are required within this time period, pre-construction monitoring will occur to locate wildlife and guide clearing activities.

- Where possible, clearing activities will occur in the winter (November to April) to minimize disturbances to Northern Leopard Frogs and Woodland Caribou.

Although habitat will likely be disturbed/lost as a result of the project, the affected habitat is not considered to be unique and any wildlife located within the project site has the potential to migrate into surrounding areas. With the implementation of applicable mitigation measures, including completing clearing activities in the winter to reduce disturbances to the Northern Leopard Frog as well as the rutting and calving of the Woodland Caribou and preventing species, including birds, from migrating to the area in the spring, and a restriction of activities between April 15 and July 31 to reduce effects to migratory species in the surrounding area, effects of habitat loss on local wildlife, including the identified species at risk, is considered to be negligible. Due to the non-unique nature of the project site, the potential residual effect is considered to be not significant.

5.10.1.2 Noise

As described in Section 5.7.1.3, construction and decommissioning activities will result in varying degrees of noise, which has the potential to influence/disturb locally present wildlife. The magnitude of the potential effect is based on the species present in the area, timing of activities, existing noise levels and the extent of blasting, if any, required during the construction process. Although several wildlife species were observed within the project site, the project site is located within/adjacent to an active mine site that historically has used explosive devices. As a result wildlife species in the area have historically been exposed to noise disturbances, and as the project site is not likely to contain any unique habitat, wildlife species have the ability to migrate into surrounding areas if necessary. General activities generating noise are anticipated to occur intermittently throughout working hours, with noise from potential blasting activities expected to occur rarely. Potential negative effects from noise would likely occur within the surrounding project area and last over the relatively short construction period (approximately fall of 2011 through to 2013) and decommissioning period. General noise effects are expected to be negligible due to the relatively disturbed nature of the project area; however if blasting is required, the blasting noise may result in a minor effect as a larger area would be affected by the sudden burst of noise.

As described in Section 5.7.1.3, operation of the portable crushing plant may generate noise; however the noise levels are anticipated to be similar to other noises generated at the mill site. As the noise produced from the portable crushing plant is anticipated to be not significant, and, no wildlife are expected to be present at the mill site, rock crushing activities are not expected to have a notable effect on wildlife.

Noise effects will be mitigated with the implementation of the following measures:

- Construction and decommissioning hours will be limited to daylight hours as required.
- Vehicles and equipment will be properly maintained.
- Where possible, mechanical methods will be used to remove necessary bedrock pieces.
- If blasting is required, the smallest practical blasting charge required to complete the activity will be used.
- Limit blasting activities between April 15 and July 31, inclusive, to minimize potential affects to breeding and/or migratory wildlife in the area, including the identified federally protected species. If blasting activities are required within this time period, pre-construction monitoring will occur to locate wildlife and guide blasting activities.
- Where possible, blasting activities will occur in the winter (November to April) to minimize disturbances to Northern Leopard Frogs and Woodland Caribou.

Noise effects on wildlife are still likely to occur even with the implementation of applicable mitigation measures. Due to the general disturbed nature of the project area, historical blasting activities, the non-unique nature of habitat within the project site, and the restriction of blasting activities during migration and nesting/denning of most species,

the potential residual effect is considered negligible. Overall, the potential effect of noise generation during construction and decommissioning is anticipated to be not significant.

5.10.2 Operation

During operation of the proposed TMA expansion, noise will be generated from the pumps as well as from equipment used to move the pipelines and/or pumps around the project site. As these noises are expected to be similar to the noises generated by the existing TMA, negligible noise effects are anticipated. Potential negative effects are expected to be limited to the project site and occur continuously (pump operation) to intermittently (pipeline moving) over the long term operation of the proposed TMA expansion.

To reduce potential noise effects, the following measures will be undertaken:

- Where possible, pumps will be placed within a structure.
- The pipelines will be situated in a manner to provide the most effective fill coverage with the least amount of pipeline movement.
- Utilize the smallest piece of equipment required to practically move the pipelines that is available for the project.

With appropriate mitigation measures, the potential residual effect is considered to be negligible. Overall, the potential effect of noise generation during operation of the proposed TMA expansion is anticipated to be not significant.

5.11 Aquatic Resources

For the purpose of this environmental assessment, aquatic resources is a term used to represent living species present in the surface water bodies, including anything from benthic organisms to fish as well as their habitat.

5.11.1 Construction

5.11.1.1 Sediment and Turbidity

As mentioned in Section 5.5, the project site is not connected to surface water bodies due to physical barriers (including the existing TMA as well as topographic features). In addition to the physical barriers which disconnect the project site from surface water bodies, the project site is located in a general low-lying area which collects surficial water from the immediate surrounding area. As a result, potential effects on aquatic resources, including from sediment and turbidity resulting from soil disturbances during site preparation, dyke construction and general construction activities, are unlikely to occur as the project site does not connect to any surface water bodies.

5.11.1.2 Discharge Volume to No Name Creek

During construction, aquatic resources have the potential to be affected as a result of site dewatering activities in the low-lying areas of the project site as well as within excavated areas where surface water and groundwater may collect. This water will be pumped into the existing TMA for eventual discharge (pumping) into No Name Creek during the discharge period. The amount of water anticipated to be sent into the existing TMA as a result of dewatering activities is expected to be negligible in comparison to the amount of water currently discharged annually (797,500 m^3 stored maximum). As described in Section 2.3.3.2, a NOA submitted in February 2012 by Parks Environmental Inc. (**Appendix A**) applied to extend the discharge period to approximately 168 days extending from June 15 to freeze-up (November 30). As only approximately 46 days is required to empty the existing polishing

pond (797,500 m^3 at a rate of 0.2 m^3/s), the negligible increase in water as a result of dewatering activities is not anticipated to extend the discharge period beyond its limits. As a result, no new significant effects to aquatic resources are anticipated to occur as a result of a negligible volumetric increase in discharged water from the existing polishing pond during the construction phase.

5.11.1.3 No Name Creek Water Quality

As water within the existing polishing pond cannot be discharged until it meets applicable criteria, no notable significant effects to aquatic resources due to a change in water quality are anticipated to occur.

5.11.2 Operation

5.11.2.1 Discharge Volume to No Name Creek

During operation, aquatic resources are only anticipated to be potentially affected as a result of the pumping from the existing polishing pond during the discharge period. Potential effects may include changes in migration or breeding of aquatic species as a result of a change in aquatic habitat range resulting from a flow increase/decrease based on TMA discharge. The change in aquatic habitat range has the potential to increase fish stranding at the end of the discharge period. However, as described in Section 5.5.2.1, the pump rate from the existing polishing pond is not expected to exceed the licenced maximum pumping rate of 0.2 m^3/s, a flow which the downstream water bodies are able to accommodate, as illustrated in Section 3.3.2.1. As a result, no new significant effects as a result of pumping out of the existing polishing pond are anticipated to occur. However, to reduce the potential for fish stranding, it is recommended to gradually slow the pump rate near the end of the discharge to allow fish species time to migrate away from the area.

Under typical operation of the proposed TMA expansion, a major increase in the maximum volume of treated water is anticipated to be pumped out of the existing polishing pond during the discharge period, which corresponds to an additional 21 days of pumping. However, as described in Sections 5.5.2.1 and 2.3.3.2, a NOA was submitted in February2012 by Parks Environmental Inc. (**Appendix A**) to extend the annual discharge period to approximately 168 days (anticipated to occur from June 15 to freeze-up (November 30)). As the typical discharge period would only be approximately 40% of the total discharge period, no new significant effects to aquatic resources are anticipated to occur.

5.11.2.2 No Name Creek Water Quality

As mentioned in Section 5.5.2, water inputs into the proposed TMA expansion are expected to be the same type and quality of water inputs that are currently sent to the existing TMA, although the volume is anticipated to increase. As the quality of the water stored within the polishing ponds cannot be pumped into No Name Creek until it meets applicable guideline concentrations, as outlined in the existing Environment Act Licence No. 2628 R, the potential negligible change in water quality is expected to have no new significant effects to aquatic resources during the operation of the proposed TMA expansion.

5.11.3 Decommissioning

During decommissioning, all activities are anticipated to occur around the proposed TMA expansion site. As the proposed TMA expansion site is blocked from nearby surface water bodies by physical barriers, including local topography and the existing TMA, and the proposed TMA expansion site is located in a low-lying area, subsequent negative effects on aquatic resources (including fish kills) as a result of an increase of sediment and turbidity within surface water bodies, due to soil disturbances during re-grading, backfilling and general decommissioning activities,

are unlikely to occur as the potentially affected surface water would be contained to the project site and not released into aquatic bearing habitats.

5.12 Transportation

5.12.1 Construction and Decommissioning

5.12.1.1 Congestion

During construction and decommissioning, traffic flow may be affected during the transportation of materials and equipment to/from the project site as well as from staff vehicles. Access to the proposed project site will be provided by the two existing access roads to the existing TMA as well as possibly from the three proposed access roads (two on the south side and one on the east side of the proposed new TMA) that will be constructed concurrently with the proposed TMA expansion. Access to the access roads is provided via PR 304, which was reported to have an average annual daily traffic rate of 190 vehicles near Bissett (approximately 19 vehicles/hr assuming the majority of traffic travels along PR 304 during a 10-hr work day period). During construction (and potentially during decommissioning), it is anticipated that approximately six staff vehicles will access the site on a daily basis, six pieces of equipment will be used at the project site, which will travel to/from the site on a rare basis, and at least four haulage trucks will access the site on a continuous basis to haul materials to/from the site. Although the number of trips each truck will make is up to the discretion of the contractor and San Gold, it is estimated that 10 round-trips per truck will be required on a daily basis until the construction material has been moved to/from the site. Although an increase in traffic is expected, the potential increase in traffic congestion is expected to be negligible due to the low volume of existing traffic on PR 304, and occur rarely throughout the relatively short terms of the construction and decommissioning phases. The potential negative effect of an increase in traffic congestion on traffic flow is likely to be experienced in the immediate project area between Bissett and the existing TMA access roads.

To reduce potential traffic effects, the following measures are proposed:

- Material and equipment transportation to/from the site will be scheduled around peak traffic hours if needed.
- With the exception of staff vehicles, vehicles will not travel along PR 304 whenever possible; material trucks and equipment will cross PR 304 from access roads running from the Rice Lake Gold Mine and Mill to the existing TMA access roads.

As the majority of the increase in traffic is related to material transport, which will not travel along PR 304 (only cross at applicable access road intersections), the potential residual effect on congestion and traffic flow is anticipated to be negligible. The overall residual effect of an increase in congestion is considered not significant.

5.12.1.2 Traffic Delay

When blasting activities are occurring, delays in traffic may occur as vehicles may be stopped from travelling along PR 304 in the vicinity of the blast site(s) until the effect of the blast, including slope failures and rock slides, is known. These traffic delays are anticipated to occur rarely during the construction phase and only as needed with blasting activities. The potential negative effect of a traffic delay is expected to have a negligible disturbance along PR 304 due to the low volume of traffic along PR 304, the distance between the project site and PR 304 (at least 50 m) and the short term nature of the expected traffic delay (anticipated to be a couple of minutes at most).

To reduce potential effects, the following will be employed:

- If blasting is required, the smallest practical blasting charge required to complete the activity will be used.

- Vehicles will be permitted access along PR 304 as soon as the area has been declared safe by a qualified supervisor.
- If necessary, detours around the blast area may be provided.

Due to the low volume of traffic potentially affected and the possibility of providing detours if the traffic cannot travel along PR 304 for an extended period of time, the potential residual effect is considered negligible. The overall potential residual effect is anticipated to be not significant.

5.12.2 Operation

During operation of the proposed TMA expansion, general maintenance/inspection of the dyke structures, pipeline placement and pumping activities may require vehicles to access the site during operation. However, as these vehicles are currently required to access the existing TMA site, no additional effects as a result of the operation of the proposed TMA expansion are anticipated.

5.13 Heritage Resources

5.13.1 Construction

An HRIA for the project site and surrounding area, completed in 2009, concluded that although two rock features were found in the general project area, they may or may not be related to early human activity and had no identifiable function. Additionally, the HRIA did not recommend further archaeological work as no identifiable cultural resources were found along the bedrock outcrops and the low lying area of the proposed TMA expansion site had a low potential for archaeological resources. However, construction activities still have the potential to result in damage or loss of unknown heritage resources in the project area. The potential negative effect would be expected to occur rarely during construction, but would potentially be of long term duration if the resource is destroyed. The effect of damage to or loss of a heritage resource has the potential to range from negligible to major.

To mitigate potential effects on heritage resources, the following mitigation measures will be implemented:

- If artefacts, historical features or skeletal remains are encountered during construction, work activities will stop immediately around the affected area with the find reported to the site supervisor. A qualified archaeologist may investigate and assess the find prior to the continuation of work.
- If skeletal remains are encountered during construction activities, the find will be immediately reported to the site supervisor, San Gold and the RCMP.

With the implementation of the outlined mitigation measures, the residual effects on heritage resources are considered irreversible if they are destroyed. However, due to the low likelihood of encountering heritage resources, the overall residual effect is expected to be not significant.

5.13.2 Operation and Decommissioning

During the operational and decommissioning phases of the proposed project, no additional ground disturbances will occur. As a result, potential effects on heritage resources during the operational and decommissioning phases of the project are not anticipated.

5.14 Aesthetics

5.14.1 Construction

The aesthetics of the proposed project site will change as a result of construction of the proposed TMA expansion. Although the presence of construction equipment and related general disturbance, stockpiling of materials, material placement and rock shaping/stabilization will create negligible to minor changes in the aesthetics over the short term, the removal of the vegetation within the project site is expected to have a long term effect that is negligible to minor in magnitude as the site will be transformed from a forested area into an un-vegetated TMA expansion. Additionally, the construction of dykes along the southern portion of the proposed TMA expansion as well as the proposed access roads have the potential to cause minor changes to the aesthetics of the site over the long term as at least portions of these areas may be visible to the general public. The potential negative effects are expected to happen once (vegetation clearing and dyke construction) to intermittently (construction equipment) during the construction phase.

To mitigate these potential aesthetic effects, the following mitigation measures will be implemented:

- Construction waste and debris will be stored in bins and removed on a regular basis from the project site.
- Prior to the end of each construction day, the site will be inspected for loose construction waste and debris in order to maintain a clean project site.
- Disturbed soils will be restored and re-vegetated as required upon completion of construction activities.
- Construction of the proposed TMA expansion dykes will be setback from PR 304, which will reduce visual indication of the cleared area from PR 304.

As the majority of the project site is not located within a publically accessible/visible area, and is located within/adjacent to an active mine site, the potential residual effect of the change in aesthetics is anticipated to be negligible and is considered to be reversible to irreversible with re-vegetation efforts during decommissioning as depending on the vegetation species as it may take more than 10 years for all species to reach maturity. Overall, the potential residual effect is anticipated to be not significant.

5.14.2 Operation

During operation of the proposed TMA expansion, no additional aesthetic effects are anticipated to occur as the aesthetics will have already been altered during construction.

5.14.3 Decommissioning

Aesthetics of the project site are anticipated to change as a result of decommissioning activities. The presence of construction equipment and related general disturbance during dyke modification, the placement of organic materials and the removal of the proposed access roads have the potential to negatively affect the aesthetics of the project site. The presence of the construction equipment will have a short term effect that occurs intermittently and is considered to be negligible as it will not be visible off-site. However, during decommissioning, disturbed areas resulting from decommissioning activities as well as the downstream slopes of the dyke structures, the surface of the proposed new main pond and the area of the proposed access roads will be re-vegetated, as described in the Bissett Gold Mine Mine Closure Plan. Re-vegetation of these areas is anticipated to be a positive effect that is negligible to minor in magnitude due to the size of the areas potentially re-vegetated (99 ha). Although re-vegetation is likely to only occur once in the project area, the aesthetic change would occur over the long term.

During decommissioning, the aesthetics of the project site will both be positively and negatively influenced. However, overall, it is anticipated that a net positive effect would occur over the long term. The effect of improved aesthetics would likely occur once within the project site, but would be considered to be of negligible magnitude as the project site is not visible from public areas and public access is not warranted (active mine site).

To maintain a net positive aesthetic effect, vegetation growth should be monitored to ensure re-vegetation efforts have been effective. If necessary, areas may have to undergo repeated efforts of re-vegetation until vegetation has been re-established.

Overall, the potential residual effect is considered to be positive, but negligible and not significant as the proposed TMA site is located within/adjacent an active mine site and is not visible to the public.

5.15 Land Use

5.15.1 Construction

The proposed TMA expansion will alter the land use of the project site from a partially treed/forested area to a tailings disposal facility. However, as the proposed project site is located within/adjacent to an active mine site, is adjacent to the existing TMA, and is located within Mineral Lease # ML63 (leased by San Gold); the change in land use for the project site is expected to be negligible. The potential change in land use is considered to be neutral (site use is designated for mining-related activities) and would occur once, but would be present over the long term.

As the land use of the project site is not expected to change from mining-related activities, no mitigation measures or best practices are proposed.

Although the project site will be cleared of vegetation and used to store tailings waste, the project site is operated by the mine for mining activities. As a result, the potential residual effect of a change in land use is considered to be negligible. Since the proposed TMA site will still be used for mining-related activities, the potential residual effect is expected to be not significant.

5.15.2 Operation and Decommissioning

No land use effects are anticipated as a result of operation or decommissioning of the proposed TMA expansion as the project site will continue to be used for tailings management activities.

5.16 Recreation Tourism

5.16.1 Construction and Decommissioning

As the project area is not publically accessible, will not be visible from public areas and is located within/adjacent to an active mine site, no effects to recreation tourism, including access to fishing and hunting areas, are anticipated to occur as a result of construction and decommissioning activities related to the proposed project.

5.16.2 Operation

Recreational tourism, in terms of recreational fishing, has the potential to be affected during operation of the proposed TMA expansion as a result of a longer discharge period into No Name Creek, as described previously in Sections 2.3.3.2,5.5.2.1 and 5.11.2.1. The potential effect would include a potential increase in fishing opportunities

due to increased fish habitat from the increased discharge period, however no new access points to the water bodies will be provided. As the maximum pump rate out of the existing polishing pond will remain the same (0.2 m^3/s), the discharge period will be extended by approximately 21 days under typical operation, and 67 days if both polishing ponds need to be emptied. However, these extended pumping periods are contained within the discharge period proposed in the February 2012 NOA completed by Parks Environmental Inc. (**Appendix A**), which extends the discharge period to approximately 168 days (occurring from June 15 to freeze-up (November 30)). As the pump rate out of the existing polishing pond can be accommodated by the downstream water bodies, no new access areas will be provided and the required discharge timeframe is within the discharge period, no new significant effects to recreational fishing are anticipated as a result of the TMA expansion.

5.17 Human Health and Safety

5.17.1 Construction and Decommissioning

During construction and decommissioning, there is a potential for negative effects to worker safety through exposure to fuels, moving vehicles, construction equipment, explosive devices/blasting activities and dust/particulate matter. The health and safety of the public may also be affected as a result of blasting activities near PR 304 and construction vehicle movement on public roads. It is anticipated that there will be a negligible increase in factors contributing to worker and public, health and safety effects. However, if effects were to occur, the magnitude could range from negligible (coughing) to major (death), depending on the severity of the incident, duration of exposure and material exposed to. Potential negative effects are anticipated to range from short (coughing) to long term (death) in duration, and occur rarely at the project site during construction and decommissioning activities.

To mitigate potential human health and safety effects, the following mitigation measures will be implemented:

- Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, including:
    - Limiting traffic speeds;
    - Minimizing re-handling of materials;
    - Re-wetting of materials as needed;
    - Completing activities during favourable weather conditions.
- All construction and decommissioning activities will be carried out in accordance with the *Workplace Safety and Health Act* to minimize health and safety effects.
- Contractors will adhere to the requirements of applicable health and safety legislation and the site specific safety plan developed by the prime contractor or contractor, as appropriate, and approved by San Gold.
- All workers will receive appropriate training for activities being undertaken as part of site specific orientation and in contract obligations with the prime contractor.
- All workers will wear appropriate personal protective equipment (PPE) at all times, including hearing and respiratory protection as required.
- If blasting is required, the smallest practical blasting charge required to complete the activity will be used.
- Vehicles will not be permitted access to PR 304 in the vicinity of potentially required blasting activities until the area has been declared safe by a qualified supervisor.
- Vegetation at intersections between PR 304 and TMA access roads will be maintained to ensure appropriate lines of sight.

With the implementation of the applicable mitigation measures, and following good construction practices, the potential residual effect is anticipated to be negligible, however may be considered reversible to irreversible depending on the incident. Overall, the potential residual effect is considered to be not significant.

5.17.2 Operation

Operation of the proposed TMA expansion is expected to be similar to the operation of the existing TMA. As a result, no new human health and safety effects are anticipated to occur as a result of the operation of the proposed TMA expansion.

Table 5.2: Summary of Proposed Environmental Impacts

Classification of Potential Effect	Project Phase	Potential Effect	Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Mitigative Measures	Residual Effect	Degree of Reversibility	Significance
Topography	Construction	Change in Topography	Negligible to minor	Negative	Long Term	Rare	Project Site	Minimize the height of material stockpiles. Construction activities contained to the project site and/or approved areas.	Negligible	Reversible (project area) to Irreversible (TMA footprint)	Not significant
	Decommissioning	Change in Topography	Negligible	Positive	Long Term	Once	Project Site	Not applicable.	Negligible (Positive)	Not applicable	Not significant
Soils	Construction and Decommissioning	Erosion	Negligible	Negative	Short Term	Rare	Project Site	Minimize the height of material stockpiles and cover if required. Stockpiles to be placed away from drainage areas and other potential sources of water. Disturbed areas kept to a minimum and re-vegetated as practical where required.	Negligible	Reversible	Not significant
		Horizon Mixing	Negligible	Negative	Long Term	Rare	Project Site	Stockpile materials based on soil type/horizon.	Negligible	Not applicable	Not significant
		Waste Disposal	Negligible	Negative	Short to Moderate Term	Rare	Project Area	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site.	Negligible	Not applicable	Not significant
Geology	Construction	Bedrock Shaping/Stabilization	Negligible	Negative	Long Term	Once	Project Site	Only remove bedrock where absolutely necessary to secure the dyke structure. Use mechanical methods to remove bedrock where possible. If blasting is required, use smallest practical blasting charge to minimize fracture and overbreak.	Negligible	Irreversible	Not significant
Groundwater	Construction and Decommissioning	Groundwater Drawdown	Negligible	Negative	Short Term	Intermittent	Project Area	Complete dewatering activities only as required in areas of active construction. Groundwater drawdown will be limited to areas of active construction where activities cannot be appropriately completed if underwater. Where possible, backfill excavated areas with appropriate materials to maintain groundwater flow patterns.	Negligible	Reversible	Not significant
		Waste Disposal	Negligible	Negative	Short to Moderate Term	Rare	Project Area	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site.	Negligible	Not applicable	Not significant
	Operation	Groundwater Recharge	Negligible	Negative	Long Term	Continuous	Project Area	None applicable.	Negligible	Not applicable	Not significant
		Groundwater Quality	Negligible to minor	Negative	Short to Moderate Term	Rare	Project Area	The proposed TMA expansion will be geotechnically designed. Proposed TMA expansion lined with a clay layer compacted to a minimum of a1x10^{-7}cm/s. Clay core of dyke structures keyed into clay base and compacted as appropriate. Bedrock outcrops cleaned and reshaped to provide a secure bonding surface with the clay core of the dyke structures. If necessary, investigations will be completed to identify leaks/seepages, with repairs being made as required.	Negligible	Not applicable	Not significant
Air Quality	Construction and Decommissioning	Exhaust Emissions	Minor on-site and negligible off-site	Negative	Short Term	Continuous during working hours	Project Area	Vehicles/equipment will be well maintained. Vehicle idling kept to a minimum as per site specific orientation obligations.	Negligible	Reversible	Not significant
		Dust	Minor on-site and negligible off-site	Negative	Short Term	Intermittent	Project Area	Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, includes limiting traffic speeds, minimizing re-handling of materials, re-wetting of materials as needed, and completing activities during favourable weather conditions. Minimize height of stockpiles. Minimize the amount of disturbed area. Dust suppression to be used if required. Residents will be informed of construction schedule for blasting activities. Construction to occur in stages with re-vegetation where applicable. Where possible, re-vegetation will occur following decommissioning activities. Mechanical methods will be used to remove bedrock where possible. If blasting is required, the smallest practical blasting charge will be used. If necessary, blasting mats will be used during construction.	Negligible to minor on-site and negligible off-site	Not applicable	Not significant
		Noise	Minor on-site and negligible off-site, but major if blasting occurs.	Negative	Short Term	Intermittent during working hours, with blasting occurring rarely.	Project Area	Limit working hours to daylight hours as required. Vehicles/equipment to be well maintained. Residents will be informed of construction schedule for blasting activities. Hearing protection provided to human receptors as required. Bedrock should only be removed as necessary. Mechanical methods will be used to remove bedrock where possible. If blasting is required, the smallest practical blasting charge will be used. If necessary, blasting mats will be used during construction.	Minor on-site and negligible off-site	Reversible	Not significant

Table 5.2: Summary of Proposed Environmental Impacts (cont'd)

Classification of Potential Effect	Project Phase	Potential Effect	Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Mitigative Measures	Residual Effect	Degree of Reversibility	Significance
Flora	Construction	Vegetation Disturbance/Loss	Negligible to minor	Negative	Long Term	Once	Project Area	Construction vehicles and equipment will use designated pathways to access work areas. San Gold will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and re-vegetation if required. Temporarily disturbed areas will be kept to a minimum and re-vegetated as practical where required.	Negligible to minor	Reversible	Not significant
		Dust Deposition	Negligible	Negative	Short Term	Intermittent	Project Area	Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, includes limiting traffic speeds, minimizing re-handling of materials, re-wetting of materials as needed, and completing activities during favourable weather conditions. Minimize height of stockpiles. Minimize the amount of disturbed area. Dust suppression to be used if required.	Negligible	Not applicable	Not significant
		Waste Disposal	Negligible	Negative	Short to Moderate Term	Rare	Project Area	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site.	Negligible	Not applicable	Not significant
	Decommissioning	Re-vegetation	Negligible to minor	Positive	Long Term	Once	Project Area	Vegetation growth to be monitored. If required, subsequent re-vegetation efforts will be completed.	Negligible (Positive)	Not applicable	Not significant
Fauna and Species at Risk	Construction and Decommissioning	Habitat Disturbance/Loss	Negligible to minor	Negative	Long Term	Once	Project Site	Construction vehicles and equipment will use designated pathways to access work areas. Disturbed areas will be kept to a minimum and re-vegetated as practical where required and as part of decommissioning activities. Clearing activities restricted from April 15 to July 31, unless pre-construction monitoring is undertaken. Where possible, clearing activities will occur in the winter (November to April).	Negligible	Not applicable	Not significant
		Noise	Negligible, but minor if blasting occurs	Negative	Short Term	Intermittent during working hours, with blasting occurring rarely.	Project Area	Limit construction hours to daylight hours as required. Vehicles/equipment to be well maintained. Mechanical methods will be used to remove bedrock where possible. If blasting is required, the smallest practical blasting charge will be used. Blasting activities restricted from April 15 to July 31, unless pre-construction monitoring is undertaken. Where possible, blasting activities will occur in the winter (November to April).	Negligible	Not applicable	Not significant
	Operation	Noise	Negligible	Negative	Long Term	Intermittent to Continuous	Project Site	Pumps will be placed within a structure where possible. Pipelines will be placed to maximize tailings dispersion with the fewest pipeline movements. Pipelines will be moved with the smallest available equipment.	Negligible	Not applicable	Not significant
Transportation	Construction and Decommissioning	Congestion	Negligible	Negative	Short Term	Rare	Project Area	Material and equipment transportation to be scheduled around peak traffic hours if needed. Material transport trucks and equipment will access the site via appropriate access roads from the Rice Lake Gold Mine and Mill site and will not travel along PR 304 whenever possible.	Negligible	Not applicable	Not significant
		Traffic Delay	Negligible	Negative	Short Term	Rare	Project Area	If blasting is required, the smallest practical blasting charge will be used. Vehicle access will be permitted along PR 304 in the vicinity of the proposed TMA expansion once the area has been declared safe by a qualified supervisor following blasting activities. Detours around the blast area will be provided if necessary.	Negligible	Not applicable	Not significant
Heritage Resources	Construction	Destruction of Heritage Resources	Negligible to major	Negative	Long Term	Rare	Project Site	If an artifact is encountered during construction activities, work will stop and appropriate authorities will be contacted. Work will resume with appropriate approvals.	Negligible	Irreversible	Not significant
Aesthetics	Construction	Appearance	Negligible to minor	Negative	Short to Long Term	Once to Intermittent	Project Site	Construction and decommissioning waste and debris will be stored in bins and removed on a regular basis from the project site. The site sill be inspected for loose waste and debris at the end of each day to maintain a clean project site. Disturbed soils restored and re-vegetated following completion of construction activities as applicable. Project site will be set back from public areas, which will reduce visibility of site.	Negligible	Reversible to Irreversible (depending on vegetation re-growth rate)	Not significant
	Decommissioning	Appearance	Negligible	Positive (net)	Long Term	Once	Project Site	Vegetation growth to be monitored. If required, subsequent re-vegetation efforts will be completed.	Negligible (Positive)	Not applicable	Not significant
Land Use	Construction	Change in Land Use	Negligible	Neutral	Long Term	Once	Project Site	Not applicable.	Negligible	Not applicable	Not significant

Table 5.2: Summary of Proposed Environmental Impacts (cont'd)

Classification of Potential Effect	Project Phase	Potential Effect	Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Mitigative Measures	Residual Effect	Degree of Reversibility	Significance
Health and Safety	Construction and Decommissioning	Safety of the Workers and General Public	Negligible to major	Negative	Short to Long Term	Rare	Project Site	Continued implementation of San Gold's Best Management Practices Plan for Control of Fugitive Dust, includes limiting traffic speeds, minimizing re-handling of materials, re-wetting of materials as needed, and completing activities during favourable weather conditions. All work conducted in accordance with Manitoba's *Workplace Safety and Health Act*. Contractors to adhere to requirements of applicable health and safety legislation and site specific safety plan developed by prime contractor or others as appropriate. All workers will receive appropriate training as part of site specific orientation and in contract obligations with the prime contractor. Appropriate PPE will be worn at all times. If blasting is required, the smallest practical blasting charge will be used. Vehicle access will be permitted along PR 304 in the vicinity of the proposed TMA expansion once the area has been declared safe by a qualified supervisor following blasting activities. Vegetation at intersections between PR 304 and TMA access roads will be maintained to ensure appropriate lines of sight.	Negligible	Reversible to Irreversible (depending on incident type)	Not significant

6. Accidents and Malfunctions

To prevent accidents and malfunctions, construction, operation and decommissioning will be conducted in accordance with all regulatory requirements. The following sections provide additional details on precautionary measures that are proposed to prevent or mitigate accidents and malfunctions. Worker protection in Manitoba is provided through standards, procedures and training legislated under the *Workplace Safety and Health Act*. All practices performed on the proposed site will be carried out in accordance with the *Workplace Safety and Health Act* to minimize health and safety impacts.

6.1 Spills

During construction, operation and decommissioning of the proposed project, there is a potential for environmental effects due to fuel and chemical spills and/or leaks. Accidents (including transportation accidents) could result in the accidental release of hazardous materials and/or vehicle/equipment fluids. A number of potential environmental concerns are also associated with the accidental release of chemicals and fuels resulting from improper storage and handling procedures, including effects on soils, vegetation, and groundwater quality and associated degradation of air quality and a direct threat to human health and safety. Effects to surface water, and subsequently to aquatic resources, are not anticipated as no surface water bodies will be crossed by vehicles associated with the project and no surface water bodies are in contact with the project area (existing TMA and general topography of surrounding area prevents direct access to surface water from the site, which is situated in a local low-lying area).

To prevent spills from occurring during project activities, the following procedures will be employed:

- All potentially hazardous products (if required on-site) will be stored in a pre-designated, safe and secure product storage area(s) in accordance with applicable legislation and in a location approved by San Gold.
- Storage sites will be inspected periodically for compliance with requirements as applicable.
- On-site construction staff will be trained in how to deal with spills, including knowledge of how to properly deploy site spill kit materials; which must be available on-site.
- Any used oils or other hazardous liquids will be collected and disposed of according to provincial requirements.
- Service and minor repairs of equipment performed on site will be performed by trained personnel; however service will preferably be completed off-site.
- Vehicles and equipment will be maintained to minimize leaks. Regular inspections of hydraulic and fuel systems on equipment will be completed on a routine basis. When detected, leaks will be repaired immediately.
- Refuelling of heavy equipment will adhere to proper procedures acceptable to San Gold or their designate, such as using a designated area with secondary containment, with preference to refuel off-site.
- Standard Environmental Management Practices will be adhered to in order to minimize the risk of accidental spills and adverse effects.
- Spills will be reported to San Gold and Manitoba Conservation.
- Recovery measures, possibly including remedial activities, will be implemented as necessary in consultation with the appropriate provincial authorities.

Following the above mitigation measures, the potential residual effect is anticipated to be negligible and not significant.

6.2 Fire and Explosions

During construction and decommissioning activities, there exists potential for fires at work sites that involve mechanical equipment and fuels. If blasting is required during construction, there is a potential for accidental explosions due to mishandling or misplacement of explosive devices. Additionally, during blasting, there is a potential for incomplete combustion, misfires, improper placement of blasting materials and residual materials remaining on the blast surface. Effects related to fires and blasting include, but are not limited to harm to on-site personnel and equipment, the potential release of contaminants and hazardous materials into the environment (potential to affect soil, air and groundwater quality) and forest fire risk (vegetation and wildlife habitat loss).

During operation, there is potential for fires associated with pumping activities, including a break in the overhead electrical line supplying power to the site. Effects related to fires include, but are not limited to, harm to on-site personnel, equipment, the potential release of contaminants and hazardous materials into the environment (potential subsequent effects on soil and air quality) and forest fire risk (vegetation and wildlife habitat loss).

As surface water bodies are not present within the project site and the project site is separated from other water bodies by physical barriers, effects to surface water, and subsequently aquatic resources, would be contained to the site.

All precautions necessary will be taken to prevent fire and explosive hazards at the site, including, but not limited to:

- All flammable waste will be removed on a regular basis and disposed of at an appropriate site.
- Appropriate fire extinguisher(s) will be available on the work site during construction and decommissioning activities. Such equipment will comply with, and be maintained to, the manufactures' standards.
- All on-site fire prevention/response equipment will be checked on a routine basis, in accordance with local fire safety regulations, to confirm the equipment is in proper working order at all times.
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited and stored in appropriate receptacles away from surface water. This material will be removed from the site on a regular basis and be disposed of at an appropriate waste disposal facility.
- In periods of high forest fire risk, idling of vehicles will be reduced and any required blasting activities may be temporarily suspended. Further, vehicles will be restricted to designated areas to reduce potential fire ignition risk.
- Explosives will be stored in the existing Rice Lake powder magazine with day boxes of explosives used to transport small amount explosives to applicable areas within the project site as required on a daily basis. Unused portions will be returned to the magazine on a daily basis.
- Only workers skilled and trained in working with explosive devices will be permitted to handle and work with required explosives during construction.
- Blasting activities will not occur around surface water bodies or in areas within the normal elevation of the groundwater table.
- Explosive materials that have the potential to release toxic substances (such as ammonium nitrate-fuel oil mixtures) will not be used.
- Blast rock will be removed from the site and transported to the mill site for disposal or processed into usable waste rock.

With the implementation of the above mitigation measures, potential residual effects are anticipated to be negligible and considered not significant.

6.3 Transportation Accidents

Transportation accidents can result in the release of vehicle fluids (such as diesel, oils, etc.) and the material the vehicles were transporting into the environment. Effects related to spills can include air, soil and groundwater quality effects with potential for subsequent effects on flora, fauna and human health. As surface water bodies are not present within the project site and the project site is separated from other water bodies by physical barriers, effects to surface water, and subsequently aquatic resources, would be contained to the site. In the event of a transportation accident resulting in a spill, appropriate remediation measures will be undertaken depending on the nature of the spilled material. Potential residual effects are anticipated to be negligible and not significant.

6.4 Proposed TMA Expansion Leaks/Seepage

During the operation of the proposed TMA expansion, inadequate design and construction could result in leaks and seepage from the clay base as well as through the base of the dyke structures and at the dyke structure-bedrock outcrop interface, which has the potential to cause groundwater impacts, with potential subsequent effect on flora, fauna and human health.

During the construction process, clay will be placed as appropriate in areas of sand and other unsuitable materials and compacted to provide a hydraulic conductivity that meets the Manitoba Conservation requirement of $1x10^{-7}$ cm/s or less. The clay core within the dyke structure will be keyed into the base clay layer and compacted as appropriate to prevent seepage beneath the dyke structure. To prevent seepage along the bedrock outcrop interface, the outcrops will be sufficiently cleaned and reshaped as required to provide a secure bonding surface with the clay core dyke structure. Additionally, during operation, the tailings within the main pond will provide an additional barrier for seepage through the dyke structures and clay base. It is anticipated that the revised Environment Act Licence may continue to include a requirement to complete an annual groundwater monitoring program to identify potential leaks/seepage. If leakages/seepages are identified during operation or if contamination is identified during the groundwater monitoring program, San Gold will investigate the source of the issue. The investigation will be conducted with the intent to repair any problems as well as to provide monitoring and investigations to confirm the surrounding groundwater/land has not been contaminated and no risk to human health, flora or fauna exists as a result. No significant residual effects are anticipated.

6.5 Dyke Failure

During operation of the proposed TMA expansion, improper design and construction of the dyke structures could result in dyke failure and subsequent release of tailings and/or waste water to the environment. Environmental effects could include soil and groundwater quality effects, flora and fauna habitat loss as well as human health and safety effects and transportation effects. Effects to surface water quality and subsequently aquatic resources are not anticipated to occur due to the low-lying nature of the project site (collects local surface water) and the physical barriers (existing TMA and local topography) separating the project site from surface water bodies in the area.

To prevent dyke failure, the dykes will be geotechnically designed to contain the required tailings and water loads. To ensure an adequate factor of safety, the dyke structures will likely be constructed in stages to allow for appropriate settling to maintain the stability and integrity of the dyke structures. The upstream sides of the dyke structures will be lined with rip-rap to protect the surface from erosive wave action. A toe drain will be constructed at the toe of the downstream slope of the dyke structures to protect the dyke structure base from erosive action from surface water flows and to prevent the dykes from being weakened from standing water in the fill layers. Regular inspection of dyke integrity will be conducted by San Gold personnel and others as appropriate. In the event that deficiencies are identified, appropriate repairs will be undertaken as soon as possible. With the described mitigation measures in place, the potential residual effect of a dyke failure is anticipated to be negligible and not significant.

6.6 Pump/Pipeline Failure

To prevent pump and pipeline failure, new pipelines and pumps will be tested prior to operation to identify any potential issues including any potential pipeline leaks. Regular inspection of the pumps and pipelines will be conducted by San Gold personnel. Where possible, pumps will be located within an enclosed structure to prevent damage due to the weather, including winter conditions. Pipelines used at the site will be suitable for cold weather climates and/or insulated as appropriate to prevent cracking and/or failure due to freezing. In the event of an identified failure, the item will be repaired and/or replaced, and if required, appropriate remediation measures will be undertaken. No significant residual effects are anticipated.

7. Effects of the Environment on the Project

7.1 Severe Weather

Severe weather conditions including high winds, heavy precipitation and storm events have the potential to affect the proposed project during construction, operation and decommissioning activities. During construction and decommissioning, severe weather conditions have the potential to affect various activities including material compaction, grading and re-vegetation efforts. High winds may result in erosion of disturbed surfaces and material stockpiles as well as generate dust from these sources during construction, operation and decommissioning. High winds also have the potential to create waves in the proposed TMA expansion and subsequent potential to erode the upstream side of the dyke structures during operation of the project. Heavy precipitation could result in erosion and runoff flooding of the project site and surrounding areas during construction and decommissioning, while during operation heavy precipitation could result in unpredicted water volumes which may require pumping for a longer duration or at a higher rate from the existing polishing pond during the discharge period or the storage of additional waters within the polishing ponds, which may result in an increase in discharge volume the following year.

To mitigate against extreme weather conditions, the following procedures will be employed as necessary:

- During construction, site supervisors will be cognizant of weather conditions.
- Disturbed areas will be kept to a minimum and re-vegetation will occur as soon as practical where applicable.
- Construction of temporary drainage and water diversion measures as appropriate, including the installation of silt fences or other erosion control measures to minimize erosion and sediment transport.
- Erosion control measures will be employed throughout the construction phase of the project.
- Material stockpile height will be limited, and protected from extreme weather elements as required.
- A stop-work policy will be in place to prevent workers from being exposed to extreme weather as necessary.
- In the event that the proposed new polishing pond is at capacity, the existing polishing pond will be able to store excess water as required until the start of the discharge period. In the event that both polishing ponds are at capacity at the start of the discharge period, there is still sufficient time within the proposed discharge period (approximately 168 days) to allow both polishing ponds to be emptied (requires approximately 113 days at a pump rate of 0.2 m^3/s).
- The dyke structures will be appropriately designed geotechnically for appropriate inputs and outputs from the proposed TMA expansion, including extreme storm events.

With the implementation of the above mitigation measures, the potential residual effects are anticipated to be negligible and not significant.

7.2 Flood

According to Environment Canada, the project area is not listed as a designated flood risk area. The existing elevation of the site has a low of approximately 265.5 m, with the relative elevation of the perimeter of the site being raised to a minimum elevation of approximately 282.3 m (284.8 m in the vicinity of proposed new main pond) plus traffic surface as a result of dyke placement. With no direct connection to a surface water body, and a 100-year flood elevation of 252.7 m for Rice Lake (nearest water body with a known flood elevation), flooding is not expected to affect the proposed project.

7.3 Drought

In cases of drought, flows in No Name Creek may be reduced, causing a reduction of the assimilative capacity of the creek and a decrease in the water quality. However, in the event of a drought, the amount of water within the proposed TMA expansion would be reduced requiring less discharge and providing better capacity for natural degradation of the stored waste water. As the proposed TMA expansion will be discharged during a the period from June 15 to November 30 (potentially 168 days), the pump rate out of the existing TMA may be reduced during drought periods as less volume would need to be discharged. As a result, with the potential to have a sustained low pump rate out of the polishing ponds, a reduced flow rate in No Name Creek due to drought conditions is not anticipated to affect the proposed TMA expansion.

7.4 Seismic Activity

The proposed project site is located in a region of Manitoba that has been assessed as a "stable" area in Canada. Seismic activity is not expected to affect the proposed project.

8. Monitoring and Follow Up

Mitigation activities recommended for the project are summarized in Table 5.2.

During operation, monitoring of surface water, groundwater, effluent and sediment is anticipated to continue to be required as currently outlined in the existing Environment Act Licence (No. 2628 R). Monitoring of fish and fish habitat (including benthic invertebrates), sediment and water quality as outlined under the MMER (EEM program) is also anticipated to continue to be required. These monitoring activities are anticipated to continue through operation and following decommissioning until it can be shown that no adverse effects are occurring.

Additionally, regular monitoring of vegetation re-growth is recommended following the completion of decommissioning activities to ensure re-vegetation efforts have been successful. With regular monitoring of the re-vegetation efforts, it can be determined if subsequent re-vegetation activities would be required. Monitoring of the vegetation would only be required until the vegetation has been sufficiently re-established.

Follow-up programs verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate the adverse environmental effects of the project. For the proposed project, standard mitigation measures will be applied as described herein and a formal follow-up program is not anticipated to be required.

9. Consultation

9.1 Public Consultation

Public consultation is an integral part of the environmental assessment process. It provides the opportunity for interested stakeholders to receive information from project planners and, in return, it allows the proponents to gain input about public concerns. Public consultation can also provide an opportunity to actively involve stakeholders in the early stages of a project which, in turn, delivers a sense of transparency in the assessment and planning process.

In the case of the proposed TMA expansion, formal public consultation has consisted of one Town Council meeting and one public Open House event. The Town Council and Open House events were scheduled to provide an opportunity for members of the Town Council and public to learn more about the proposed project and to also provide an opportunity for them to express their comments. The Town Council meeting and Open House event concentrated largely on providing details on the proposed project and findings of the environmental assessment. Representatives from AECOM, San Gold and Parks Environmental Inc. were present at the Town Council meeting and Open House event to answer questions, convey information and collect comments.

A summary of the Public Consultation is provided in the following subsections.

9.1.1 Town Council Meeting

On October 13, 2011 a meeting was held between representatives of San Gold, AECOM and Parks Environmental Inc. and five (5) members of the Bissett Town Council to provide an opportunity to receive and convey information concerning the proposed TMA expansion. The Town Council was invited to share and express their comments and concerns regarding the project while AECOM completed an overview of the Open House story boards and background information. A copy of the presentation story boards is included in **Appendix D**.

During the Town Council meeting, several questions and comments were raised regarding the proposed TMA expansion including: concerns if a dyke breach occurs; when/how would the existing TMA be decommissioned; what would happen with the vegetation within the proposed footprint; where would the required clay materials be sourced from; what are the future plans for the tailings; existing dust issues within Bissett as a result of mill operation; transportation routes of construction vehicles; visibility issues for vehicles leaving access roads and entering PR 304 and concerns with the eastern access road impacting the local landfill access. The comments and questions were discussed during the Town Council meeting, with everyone appearing satisfied by their received answers. The AECOM, San Gold and Parks Environmental Inc. representatives at the Town Council meeting generally observed that the Town Council was interested in the project and were either neutral or positive towards it.

Based on the comments and questions received during the Town Council meeting, AECOM incorporated some of the discussed solutions into the project, where appropriate, including ensuring vegetation is maintained to ensure appropriate lines of sight for vehicle travel, and the eastern access road would be constructed adjacent to the local landfill so as to not disrupt its operations.

9.1.2 Open House Event

On October 13, 2011, the public Open House was held in Bissett by San Gold and AECOM to provide an opportunity to receive and convey information concerning the proposed TMA expansion for all interested parties. To inform the

public of this event, an advertisement was placed in The Echo on September 28 and October 4, 2011. A copy of the advertisement from the September 28, 2011 paper is included in **Appendix D**.

The Open House event was held at the Bissett Community Hall in Brandon, Manitoba. There were 14 attendees (including a total of 4 representatives from San Gold, AECOM and Parks Environmental Inc.) who participated in the October 13, 2011 Open House. The public was invited to share and express their comments and concerns regarding the project through discussions with representatives from AECOM, San Gold and Parks Environmental Inc. and by completing a questionnaire. Questionnaires were provided at a final station where the attendees could sit and fill out the form. A copy of the presentation story boards and a blank questionnaire from the Open House are included in **Appendix D**. One questionnaire was completed by a participant of the Open House.

No concerns about the proposed TMA expansion were identifies in the questionnaire, however two comments were made during the Open House. One comment was in regard to safety during the operation of the proposed TMA expansion. It was mentioned that trails are currently located in this area and someone may accidentally drive into the ponds if they are not fenced. As the property is leased by San Gold and is not for public recreational use, fencing of the area is not appropriate, however as this is a concern, warning signs can be posted on the trails is warranted. The second comment was in regard to the natural surface water drainage in the area and that with the construction of the proposed TMA expansion, surface water would be diverted from entering into Rice Lake, approximately 1.2 km southeast. Based on this concern, AECOM re-examined the hydrography within the project area. Based on topographic knowledge of the project area and the assumption that no culverts are located under PR 304 in the project area (previously informed that Manitoba Highways and Infrastructure was unaware of any culverts), there did not appear to be a hydrologic connection to Rice Lake from the proposed TMA expansion area. A small, low-lying area east of the proposed TMA expansion, and local landfill, has the potential to flow into Normandy Creek, located south of PR 304, and eventually into Rice Lake; however this water would still need to cross PR 304 in an area where there are no anticipated culverts and it is uncertain whether this area would naturally flow south into Normandy Creek or west towards the proposed TMA expansion. As a result, the potential diversion of water is not expected to cause a noticeable change to the water level of Rice Lake.

Two Open House participants requested San Gold to contact them following the Open House. One participant inquired about contract work for the project and did not have any issues with the proposed TMA expansion. Contact has been attempted by San Gold on several occasions with the other participant, a Hollow Water First Nation liaison, however, San Gold has not received a reply to date.

The AECOM, San Gold and Parks Environmental Inc. representatives at the Open House generally observed that the attendees were interested in the project and were either neutral or positive towards it.

9.2 First Nation Engagement

San Gold, in conjunction with their First Nation Liaison Officer, Mr. Rod Bushie (a member of the Hollow Water First Nation), has offered to meet with the Hollow Water First Nation council. To date, the Hollow Water First Nation council has not indicated that they have any concerns with the proposed TMA expansion and have not requested a meeting with San Gold, or AECOM. If any questions or concerns are raised by the Hollow Water First Nation council, San Gold will work with the council to resolve any issues and forward the results to Manitoba Conservation if required.

10. Conclusion and Recommendations

It is recommended that the mitigation measures and monitoring programs described in this report are implemented to ensure potential environmental effects are minimized and/or are identified early so that appropriate action can be undertaken.

Overall, the negative residual effects of the proposed project were considered to be negligible to minor in magnitude post mitigation. The potentially minor residual effects relate to air quality as a result of dust and noise generation during construction and decommissioning as well as flora as a result of vegetation disturbance/loss during construction activities. With the exception of monitoring re-vegetation efforts until the vegetation has been established, no new monitoring programs were recommended. However, a continuation of existing monitoring programs (surface water, groundwater, effluent and sediment quality as well as fish and fish habitat), as outlined under the MMER and existing Environment Act Licence No. 2628 R, was recommended. It is in our opinion that based on the available information and documented assumption, the proposed project is not likely to cause significant adverse environmental effects.

11. References

AGRA Earth & Environmental Limited. 1996. Bissett Gold Project Tailings Impoundment Design Report. AGRA Earth & Environmental Limited.

Bryer, Ron. 2009. Surface Water Management, Manitoba Water Stewardship, Government of Manitoba. Personal Communication via email.

Bulloch, D., Creed, W., Dixon, R., Ehnes, J., Kristofferson, K., McColm, G., Oswald, B., Peckett, M., Scaife, B., Schindler, D., Scott, C., Smith, C., Swanson, T., Veldhuis, H., Wickware, G. and Zebrowski, D. 2002. Manitoba Ecosystem Based Management Pilot Project: Science Team Report. Ecosystem 90: Lac Seul Upland Ecoregion Summary Technical Report.

Canada's Historic Places. 2011 (accessed). Canadian Register of Historic Places. Canada's Historic Places Website, http://www.historicplaces.ca/en/pages/register-repertoire/search-recherche.aspx (accessed April 13, 2011).

Canada Land Inventory. 2000. Canada Land Inventory Home Page. Geo Gratis Website, http://geogratis.cgdi.gc.ca/CLI/frames.html (accessed September 22, 2010; last modified January 11, 2000).

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines – Canadian Water Quality Guidelines for the Protection of Aquatic Life (updated 2007). Canadian Council of Ministers of the Environment, Winnipeg.

Community of Bissett. 2009 (accessed). Bissett Community. Community of Bissett Website, http://www.granite.mb.ca/~bissett/index.html (accessed April 29, 2009).

Dickson, Gary, Manager, Manitoba Culture, Heritage and Tourism, Heritage Resources Branch. 2009. Personal Communication.

Energy, Mines and Resources Canada. 1981a. Canada – First Frost in Autumn. The National Atlas of Canada 5th Edition, Graphical Services Directorate, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, Ontario.

Energy, Mines and Resources Canada. 1981b. Canada – Frost-Free Period. The National Atlas of Canada 5th Edition, Graphical Services Directorate, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, Ontario.

Energy, Mines and Resources Canada. 1981c. Canada – Last Frost in Spring. The National Atlas of Canada 5th Edition, Graphical Services Directorate, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, Ontario.

Environment Canada. 2010a. Canadian Climate Normals (1971-2000) – Bissett, Manitoba. Environment Canada, Website, http://www.climate.weatheroffice.ec.gc.ca (accessed September 20, 2010; last modified August 18, 2010).

Environment Canada. 2010b. Canadian Climate Normals (1971-2000) – Red Lake, Ontario. Environment Canada, Website, http://www.climate.weatheroffice.ec.gc.ca (accessed September 20, 2010; last modified August 18, 2010).

Environment Canada. 2009. NAPS Network Reports. Environment Canada Website, http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html#naps1 (accessed July 2, 2009; last modified March 13, 2009).

Environment Canada, Flood Damage Reduction Program. 2009 (accessed). Freshwater Website: Flood Damage Reduction Program (Manitoba). Environment Canada Website, http://www.ec.gc.ca/Water/en/manage/flood/e_man.htm (accessed May 25, 2009).

Fisheries and Oceans Canada. 2010. Aquatic Species at Risk – Search By Location. Fisheries and Oceans Canada Website, http://www.dfo-mpo.gc.ca/species-especes/search-location-recherche-endroit-eng.htm (accessed April 12, 2011; last modified July 29, 2010).

Government of Manitoba. 1988. Northern Affairs (Community of Bissett Basic Planning Statement) By-law No. 13/88, The Northern Affairs Act (C.C.S.M c. N100). December 31, 1988. Queen's Printer – Statutory Publications. [Available Online: http://web2.gov.mb.ca/laws/regs/pdf/n100-583.88r.pdf (accessed May 4, 2009)].

Government of Canada. 2011. Species at Risk Public Registry. Government of Canada Website, http://www.sararegistry.gc.ca (accessed April 12, 2011; last modified March 23, 2011).

Green, D.J. 2003. Wanipigow River Water Quality Data, August 2002 – Status Report, report no. 2003-02, provided by Water Quality Management Section. 2009. Manitoba Water Stewardship, 123 Main Street, Suite 160, Winnipeg, Manitoba, R3C 1A5.

Green Spaces Environmental Consulting. 2008. Biological Inventory and Assessment of the Proposed Tailings Management Area Expansion at Bissett, Manitoba. October 8, 2008. Green Spaces Environmental Consulting, Winnipeg, Manitoba.

Harmony Gold (Canada) Inc. 2001. Harmony Gold (Canada) Inc. Bissett Gold Mine: Mine Closure Plan. September 1, 2001. Harmony Gold (Canada) Inc., Bissett, Manitoba.

Harmony Gold (Canada) Inc., Morrow Environmental Consultants Inc., Agassiz North Associates Limited, and AMEC (AGRA Earth and Environmental). 2001. Harmony Gold (Canada) Inc. - Bissett Gold Mine and Mill Operation Stage II Environment Act Licence Application. August 23, 2001. Harmony Gold (Canada) Inc., Bissett, Manitoba.

Indian and Northern Affairs Canada. 2004. First Nation Community Profiles, Manitoba Region – 2004- 05. Department of Indian and Northern Affairs Canada, Ottawa, Ontario.

MacBride, L. 2006. Rice Lake Gold Mine Environment Act License Notice of Alteration. Wardrop Engineering Inc.

Manitoba Aboriginal and Northern Affairs. 2003. Community Profiles: Bissett. Manitoba Aboriginal and Northern Affairs Website, http://www.gov.mb.ca/ana/community_profiles/pdf/bissett.pdf (accessed April 9, 2009; updated May 2003).

Manitoba Agriculture, Food and Rural Initiatives. 2010 (accessed). Agri-Maps Map Viewer. Manitoba Agriculture, Food and Rural Initiatives Website http://geoapp2.gov.mb.ca/website/mafri/index3.html (accessed September 17, 2010).

Manitoba Conservation, Forestry Branch. 2010a. Forest Management Licences (FMLs) & Crown Land. Manitoba Conservation Website, http://www.gov.mb.ca/conservation/forestry/manage/fml_crown.html (accessed September 23, 2010; copyright 2010).

Manitoba Conservation, Forestry Branch. 2010b. Forest Sections & Management Units. Manitoba Conservation Website, http://www.gov.mb.ca/conservation/forestry/manage/sections_fmus.html (accessed September 22, 2010; copyright 2010).

Manitoba Conservation, Manitoba Conservation Data Centre. 2011 (accessed). Manitoba Conservation Data Centre. Manitoba Conservation Website: http://www.gov.mb.ca/conservation/cdc/ (accessed April 12, 2011).

Manitoba Conservation, Parks and Natural Areas. 2010a. Atikaki Provincial Wilderness Park. Manitoba Conservation Website, http://www.gov.mb.ca/conservation/parks/popular_parks/eastern/atikaki.html (accessed September 20, 2010; copyright 2010).

Manitoba Conservation, Parks and Natural Areas. 2010b. Manigotagan River Provincial Park. Manitoba Conservation Website, http://www.gov.mb.ca/conservation/parks/popular_parks/eastern/manigotagan.html (accessed September 20, 2010; copyright 2010).

Manitoba Conservation, Parks and Natural Areas. 2010c. Nopiming Provincial Park. Manitoba Conservation Website, http://www.gov.mb.ca/conservation/parks/popular_parks/eastern/nopiming.html (accessed September 20, 2010; copyright 2010).

Manitoba Conservation, Parks and Natural Areas. 2008. Atikaki Provincial Park & Bloodvein Canadian Heritage River. Management Plan. April 2008. [Available Online: http://www.gov.mb.ca/conservation/parks/pdf/atikaki_management_plan_web.pdf (accessed September 20, 2010)].

Manitoba Conservation, Pollution Prevention Branch, Air Quality Section. 2010. Annual Air Quality Statistics – 1995-2008. Manitoba Conservation Website, http://www.gov.mb.ca/conservation/pollutionprevention/airquality/aq-info/index.html (accessed September 20, 2010; copyright 2010).

Manitoba Conservation, Wildlife and Ecosystem Protection Branch. 2011 (accessed). Species at Risk – Species Listed Under the Manitoba Endangered Species Act. Manitoba Conservation Website: http://www.gov.mb.ca/conservation/wildlife/sar/sarlist.html (accessed April 12, 2011).

Manitoba Land Initiative. 2010 (accessed). Administrative Boundaries – Parks, Provincial – Land Use (Provincial Park Land Use Categories, published December 24, 2009). Manitoba Conservation Website, https://mli2.gov.mb.ca/adminbnd/index.html (accessed September 23, 2010).

Manitoba Water Stewardship. 2010. Fish and Fish Habitat – Fisheries – Habitat/Fish Culture. Manitoba Water Stewardship Website, http://www.gov.mb.ca/waterstewardship/fisheries/habitat/ (accessed April 12, 2011; copyright 2010).

Manitoba Water Stewardship, Groundwater Management Section. 2009. GWdrill May 2009 CD Rom. Government of Manitoba, Winnipeg, Manitoba.

Manitoba Water Stewardship, Water Quality Management Section. 2009. East Side Lake Winnipeg Streams Data 1993-2008. Government of Manitoba, Manitoba Water Stewardship, Winnipeg, Manitoba.

NatureServe Explorer. 2010. An Online Encyclopedia of Life. NatureServe Explorer Website, http://www.natureserve.org/explorer/ (accessed July 5, 2011; last updated August 2010)

Parks Canada. 2009. World Heritage – Canada's Tentative List for World Heritage Sites. Parks Canada Website, http://www.pc.gc.ca/progs/spm-whs/index_e.asp (accessed September 20, 2010; last modified May 11, 2009).

Parks Environmental Inc. 2012. Sangold Corporation Notice of Alteration. February 10, 2012. Parks Environmental Inc., Cambridge, Ontario.

Parks Environmental Inc. and Kilgour & Associates Ltd. 2011. Sangold Corporation Rice Lake Gold Mine Cycle 1 EEM Interpretative Report. March 21, 2011. Parks Environmental Inc., Cambridge, Ontario.

Pimachiowin Aki Corporation. 2008. Pimachiowin Aki World Heritage Project. Pimachiowin Aki World Heritage Project Website, http://www.pimachiowinaki.org/ (accessed September 20, 2010; copyright 2008).

Quaternary Consultants Ltd. 2009. Archaeological Impact Assessment of the San Gold Resources Tailings Management Area Expansion. June 2009. Quaternary Consultants Ltd., Winnipeg, Manitoba.

Rowe, J.S. 1972. Forest Regions of Canada. Department of the Environment, Canadian Forestry Service Publication No. 1300. Information Canada Catalogue No. Fo47-1300. 1972. Information Canada, Ottawa, Ontario.

Rutulis, M. 1986a. Aquifer Maps of Southern Manitoba, Map 1 of 2, Bedrock Aquifers. Manitoba Natural Resources, Water Resources Branch, Winnipeg.

Rutulis, M. 1986b. Aquifer Maps of Southern Manitoba, Map 2 of 2, Sand and Gravel Aquifers. Manitoba Natural Resources, Water Resources Branch, Winnipeg. [Available Online: http://www.gov.mb.ca/waterstewardship/floodinfo/maps/images/sand_gravel_aquifers.jpg].

San Gold Corporation. 2010. Operations Overview. San Gold Corporation Website, http://www.sangold.ca/s/Operations.asp (accessed September 22, 2010; copyright 2010).

Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba - An Ecological Stratification of Manitoba's Natural Landscapes. Research Branch Technical Bulletin 1998-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba.

Southeast Community Futures Development Corporation. 2009a. Black River First Nation. Southeast Community Futures Development Corporation Website, http://www.seed.mb.ca/black_river.html (accessed April 30, 2009; copyright 2009).

Southeast Community Futures Development Corporation. 2009b. Hollow Water First Nation. Southeast Community Futures Development Corporation Website, http://www.seed.mb.ca/hollow_water.html (accessed April 30, 2009; copyright 2009).

Statistics Canada. 2010a. 2006 Census Corrections and Updates. Statistics Canada Website, http://www12.statcan.ca/english/census06/corrections/updatepages/Cgen001.cfm?Lvl=H (accessed September 21, 2010; last modified February 15, 2010).

Statistics Canada. 2010b. Black River 9, Indian Reserve, Manitoba and Hole or Hollow Water 10, Indian Reserve, Manitoba (table). Statistics Canada Catalogue No. 92-591-XWE. [Available Online: Statistics Canada Website, http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/details/page.cfm?Lang=E&Geo1=CSD&Code1=4619054&Geo2=CSD&Code2=4619053&Data=Count&SearchT

ext=Hole%20or%20Hollow%20Water%2010&SearchType=Begins&SearchPR=01&B1=All&Custom= (accessed September 21, 2010; released July 24, 2008; last modified February 5, 2010)].

Statistics Canada. 2010c. Division No. 19, Unorganized, Manitoba and Province of Manitoba (table). Statistics Canada Catalogue No. 92-591-XWE. [Available Online: Statistics Canada Website, http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/details/Page.cfm?Lang=E&Geo1=CSD&Code1=4619045&Geo2=PR&Code2=46&Data=Count&SearchText=bissett&SearchType=Begins&SearchPR=01&B1=All&Custom= (accessed September 21, 2010; released July 24, 2008; last modified February 5, 2010)].

Statistics Canada. 2010d. Population and Dwelling Counts, for Canada and Designated Places, 2006 and 2001 Censuses – 100% Data. Statistics Canada Website, http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P1C&Page=RETR&LANG=Eng&T=1301&SR=101&S=1&O=A&RPP=25&PR=0&CMA=0#FootDPLType (accessed April 13, 2011; last modified January 6, 2010).

Statistics Canada. 2010e. Standard Geographical Classification (SGC) 2006 – Economic Regions. Statistics Canada Website, http://stds.statcan.gc.ca/sgc-cgt/2006/ersl-rerl-fin-eng.asp?criteria=4619045 (accessed September 22, 2010; last modified March 5, 2010).

United Nations Educational, Scientific and Cultural Organization (UNESCO). 2009. World Heritage - Atikaki / Woodland Caribou / Accord First Nations (Pimachiowin Aki). UNESCO World Heritage Site Centre Website, http://whc.unesco.org/en/tentativelists/1936/ (accessed April 15, 2009; last modified September 20, 2010).

University of Manitoba Transport Information Group and Manitoba Infrastructure and Transportation. 2010. Annual Average Daily Traffic on Provincial Trunk Highways and Provincial Roads. Manitoba Highway Traffic Information System Website, http://umtig.mgmt.umanitoba.ca/flowmap2009.pdf (accessed September 22, 2010; created June 2010).

Wardrop Engineering Inc. 2008. Cartwright Mine Notice of Alteration. March 2008. Wardrop Engineering Inc., Winnipeg, Manitoba.

Williamson, D. 2002. Manitoba Water Quality Standards, Objectives, and Guidelines. Manitoba Conservation Report – Final Draft, report no. 2002-11. [Available Online: http://www.gov.mb.ca/waterstewardship/water_quality/quality/mwqsog_2002.pdf].

Woo, V., Mills, G. F., Veldhuis, H., Forrester, D. B. 1977. A Guide to Biophysical Land Classification: Hecla-Carroll Lake, 62P-52M, Manitoba. Technical Report No. 77-3. Northern Resource Information Program, Canada-Manitoba Soil Survey and the Department of Renewable Resources and Transportation Services. July 1977. [Available Online: http://sis.agr.gc.ca/cansis/publications/mb/mb77-3/intro.html (accessed March 9, 2009; last modified November 27, 2008)].