# NEW GOLD RAINY RIVER MINE

# APPENDIX Q

# OMS MANUAL

newgold™ Rainy River Project

**RAINY RIVER PROJECT**

# OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL WATER MANAGEMENT STRUCTURES

**New Gold Inc.**
**Rainy River Project**
**5967 Highway 11/71, P.O. Box 5**
**Emo, Ontario**
**P0W 1E0**

**August 2017**

**Version 2017-08**

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## 1.0 INTRODUCTION

The Rainy River Mine (RRM) is located in the Rainy River District, in northwestern Ontario in Chapple Township, approximately 65 kilometers (km) northwest of Fort Frances and 420 km west of Thunder Bay. The mine includes an open pit mine, a mill, tailings management area (TMA), process water and water treatment structures. The project is currently in its second year of construction and close to operations in late 2017 at the time of this Operation, Maintenance and Surveillance (OMS) manual update (to August 15, 2017).

This OMS Manual has been prepared by the Rainy River Mine with the assistance of AMEC Foster Wheeler (AMECFW) and the Engineer of Record for the dams. The OMS is a requirement of the Ministry of Natural Resources and Forestry (MNRF), Lakes Rivers Improvement Act (LRIA) approvals, and has been prepared in general accordance with the latest guidelines titled "Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities:" developed by the Mining Association of Canada (MAC, 2011).

The goal of the OMS Manual is to provide specific guidance the operation to the Tailings, Water Management and Water Diversion dams. The objectives of this OMS are to define and describe the following:

- Roles and responsibilities of personnel assigned to the facility;
- The key components of the facility;
- Set out procedures required to operate, monitor the performance of, and maintain a facility to ensure that it functions in accordance to design, meets regulatory and corporate policy obligations, and links to emergency preparedness and response;
- Procedures and processes for managing change;
- Requirements for analysis and documentation of the performance of the facility;
- Serve as a training document for personnel that are new to the mine;
- Identify potentially unsafe conditions or indicators and provide links to emergency response procedures; and
- Satisfy the requirements of the Mining Association of Canada's (MAC) guidelines Towards Sustainable Mining (TSM) initiative.

The OMS Manual covers operations of the facility through the commissioning, operations, and closure phases of the Rainy River Mine. The tailings facilities include the equipment and operations beginning with the tailings discharge from the mine mill, pipelines, deposition equipment, tailings, water treatment and water management (seepage collection ponds) and water diversion. In addition, the OMS guides operators and staff on when to initiate the EPRP.

This document has been prepared primarily for use by the mine personnel who are responsible for the operation, maintenance and surveillance of the tailings facility. It contains information and instructions necessary to perform the above required activities. Comprehensive checklists and procedures for operation, maintenance and annual inspections are utilized by the RRM e.g., through the SAP work order system and are not reproduced herein.

### 1.1 Regulatory Requirements and Guidelines

This document is consistent with the New Gold Tailings, Heap Leach and Waste Rock Facilities Management Policy and was prepared pursuant to the MAC guidelines for *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities* (MAC, 2011).

There are a number of Federal and Provincial environmental approvals required to construct, operate, and eventually reclaim the mine. Key Provincial legislation related to the RRM includes the: *Ontario Water Resources Act*, *Environmental Protection Act*, *Endangered Species Act*, *Mining Act*, *Lakes and Rivers Improvement Act*, *Public Lands Act* and *Planning Act*. From the Federal perspective, the *Fisheries Act* and the associated Metal Mining Effluent Regulation are the primary regulatory instruments related to the RRM.

The primary approval(s) for construction of the various hydraulic structures and associated water storage facilities are as follows:

- Work Permits from Ontario Ministry of Natural Resources and Forestry (MNRF), under the *Lakes and Rivers Improvement Act* (LRIA).
  - These permits approve the design of the dams and appurtenances, in accordance with the provided design drawings and report.
  - LRIA approvals are generally required for each annual dam raising campaign.
- Discharge of effluent (e.g. from the TMA) is governed by the Environmental Compliance Approvals (ECAs) for Industrial Sewage Works issued under the *Environmental Protection Act* by the Ontario Ministry of the Environment and Climate Change (MOECC).
  - The ECAs dictate the quality and quantity of effluent allowed to be discharged to the environment as well as other measures intended to ensure the environment is protected; as well as the overall design of the facility.
- Permits to Take Water (PTTWs) issued under the *Ontario Water Resources Act* direct water takings associated with the Site, including dam foundation dewatering and water supply from the Pinewood River.
  - Where water takings (surface or groundwater) are required to support construction and operation, they are generally restricted by the PTTWs received from the MOECC which limit the volume of water that can be taken from the environment.
- A Closure Plan has been filed with the Ministry of Northern Development and Mines (MNDM) under the *Mining Act,* which describes the planned development and operation of the RRM, the proposed approach to closure of the RRM, and outlines the associated financial assurance related to closure aspects.
  - This Closure Plan will be amended from time to time as required, such as any changes to the proposed operation of the TMA, or other changes to the RRM which are deemed to be material.
  - The Closure Plan primarily focuses on the physical and chemical stability of the site post-closure or during a temporary shutdown scenario.

- o Planning to date has assumed permanent flooding of the potentially acid generating (PAG) tailings to inhibit oxidation.

In addition to these and other regulatory approval requirements, a number of commitments were made regarding the RRM through the Federal and Provincial environmental assessment processes. These commitments were initially tabulated in Table 14-1 of the Rainy River Project, Final Environmental Assessment Report (AMEC, January 2014) and are maintained and tracked by the Environmental Department as the Rainy River Project Commitments Registry.

Where pertinent to the operation of tailings and water management and water diversions, specific regulatory approvals have been included in this manual (Table 1-1). However, the full list of regulatory conditions has not been reproduced herein and should be reviewed, where required, including when changes to the OMS of the facilities are considered. The full list of regulations, permits and approvals associated with this OMS are available through the site environmental team who should be contacted for the most current environmental approval and regulatory requirements.

**Table 1-1; Summary of Permits and Approvals Relating to the OMS**

| Legislation | Permit | OMS Component | Influence |
|---|---|---|---|
| Environmental Protection Act | Environmental Compliance Approval #0412-A2LR4V (Air) | TMA | Limits and requirements related to emissions and discharges related to air. |
| | Environmental Compliance Approval #5178-9TUPD9 (Industrial Sewage) | TMA, process water management and water treatment | Limits and requirements related to emissions and discharges to the environment. |
| Ontario Water Resources Act and O.Reg 387/04 | PTTW number 8776-9W2QN3 | WMP/Pinewood River | Defines water taking limits and defines reporting and monitoring requirement |
| | Permit to Take Water – Surface and Groundwater PTTW 0040-9VUL6B TMA Infrastructure | TMA and process water management | Defines water taking limits and defines reporting and monitoring requirement |
| | Permit to Take Water – Surface and Groundwater PTTW 2133-9VUPVZ Construction Phase | Fresh Water Diversions and Water Treatment | Defines water taking limits and defines reporting and monitoring requirement |
| Lakes Rivers Improvement Act | FF-2015-02B (as amended) West Creek Diversion and Dam | Freshwater Diversions | Management, protection, preservation and use of waters and lakes. Ensure that dams are suitably located, constructed, operated and maintained. |
| | FF-2015-03B Clark Creek Diversion (as amended) | Freshwater Diversions | |
| | FF-2015-04 Tailings Management Area | TMA, Process Water Management and Water Treatment | |

| Legislation | Permit | OMS Component | Influence |
|---|---|---|---|
| | FF-2015-04A (as amended March 6, 2017) Water Management 4 and 5 | Process Water Management | |
| | FF-2015-04B (as amended March 6, 2017) Water Management Ponds1, 2 and 3 | Process Water Management | |
| | FF-2015-04C Tailings Management Area (Start-Up Arrangement), Haul Road 13 and TMA Start-Up Cell | Tailings Management Area | |
| | FF-2015-05A (as amended) Mine Rock Pond | Process Water Management | |
| | FF-2015-07 Pinewood River Intake/Discharge Structure | Process Water/Water Treatment | Management, protection, preservation and use of waters and lakes. |
| | FF-2017-03 Tailings Management Area Cell 2 | Tailings Management Area | Management, protection, preservation and use of waters and lakes. Ensure that dams are suitably located, constructed, operated and maintained. |
| Endangered Species Act | ESA Permit FF-C-001-14 | All | Defines project boundaries, disturbance limits including noise and dust and reclamation |
| Fisheries Act | Authorization 15-HCAA-00039 | Freshwater diversions | West, Clark, Teeple, Stockpile dams and diversions |
| | Metal Mining Effluent Regulation (MMER) discharge notification | TMA, WMP Water Treatment and seepage | Standards/limits for quality of effluent discharged into waters frequented by fish. |
| Ontario Environmental Assessment Act | Provincial EA Approval Conditions | All | Conditions subject to the Approval to proceed with the planning, design, construction, operation and closure of a combination open pit and underground gold mine. |
| Federal Canadian Environmental Assessment Act 2012 | Federal EA Approval Conditions | All | Conditions in relation to<br>the environmental effects referred to in subsection 5(1) of CEAA 2012, with which the Proponent must comply. |
| Environmental Assessment (EA) Act | Environmental Assessment (EA) Commitments | All | Commitments identified in the final Environmental Assessment (EA) Report, in accordance with the Federal |

| Legislation | Permit | OMS Component | Influence |
|---|---|---|---|
| | | | Environmental Impact Statement (EIS) Guidelines and Provincially approved Amended Terms of Reference (ToR). |

## 1.2 Review and Update

The accountability for review and updates of the OMS Manual is with the Mill Manager (who will designate responsibility for the review) as well as the General Manager who has final site authority.

Updates to the OMS manual are required to incorporate change as facilities are constructed or change in facility design, performance, capacity, operations/closure requirements, site management, roles and responsibilities, regulations or procedures. When updated the OMS manual will be reviewed by the Environmental Department, Engineer of Record (EOR) and annually, as part of review by the Independent Tailings Review Board (ITRB) or as at their request.

The OMS will be updated prior to operating new structures. The OMS manual will be reviewed, at minimum, on an annual basis. The OMS manual will be submitted to MNRF as defined by permit conditions as part of annual updates.

Previous revisions and future proposed revisions are outlined in the revision history presented below (Table 1-2). Comments from the MNRF and ITRB are included in Appendix G. This revision history will be updated for each revision – **this revision is current to August 15, 2017.**

**Table 1-2; OMS Revision History**

| Revision | Addition | Details | Date |
|---|---|---|---|
| *Pre-Production OMS Manual* (3098004-000000-A1-EMA-0001): | | | |
| AG | Revised Final for Pre-Production | Updated dam design criteria, instrumentation details – submitted for MNRF review and comment | August 31, 2016 |
| AH | Revised Final for Pre-Production | Updated in response to MNRF comments – see appendix G | October 5, 2016 |
| AI | Revised Final for Pre-Production | Removed reference to WMP filling plan | November 10, 2016 |
| AJ | Final with West Creek Diversion updates | Required by MNRF in West Creek Diversion LRIA approval | March 31, 2017 |
| 00 | For Use | WMP Filling, Clark Creek Diversion (MNRF approval April 28, 2017) | May 1, 2017 |
| 01 | For Use | Updated for WMP filling above 364.7 | July 2017 |
| *OMS Manual for Operations* (3098004-000000-A1-EMA-0002): | | | |

| Revision | Addition | Details | Date |
|---|---|---|---|
| AC | Final draft | Including TMA Start-up Cell details submitted to MNRF | March 31, 2017 |
| OMS Manual – Current revisions | | | |
| 2017-08 | Updated based on ITRB comments and MNRF conditions for MRP and Cell 2 and 3 | ITRB comments (Appendix G) responses<br>• Updated sections to current project status and current to Aug 15, 2017<br>• Contact list updated (s2.3)<br>• Revised geology section re plastic clay tills (s3.3)<br>• Included trigger levels for instrumentation and defined thresholds for event driven surveillance (Table 7.3)<br>• States responsibility for OMS updates (s1.2 and s2.2)<br>• Reworded reference to MNRF screening but submission for comment (s1.2)<br>MNRF requirements consistent with LRIA permit conditions<br>• Mine Rock Pond (s4.3.2 and s5.3.2)<br>• Cell 2 (s4.2.2. and s5.1.2)<br>• Cell 3 (s4.2.3 and s5.1.2) | August 2017 |
| *Future Planned Updates – excludes updates required as a result of unplanned changes* | | | |
| TBD | TMA Starter Cell Completion | Update OMS prior to completion of TMA south starter dam | May 1, 2018 or as determined by LRIA conditions of approval |
| TBD | Water Discharge Pond and Constructed Wetland | Update OMS prior to the commissioning of theses facilities | June 30, 2018 or as determined by LRIA conditions of approval |
| TBD | Sediment Ponds 1 and 2 | Update OMS prior to the commissioning of theses facilities | |
| TBD | Annual update 2018 | Annual review and update e.g., include ITRB comments | August 2018 |

## 1.3 Supporting Documents

The OMS manual and supporting documents will be stored in a location accessible to those required to follow the manual i.e., RRM sharepoint site. The list of supporting documents (Table 1-3) isn't an exhaustive list and permit approvals are based on applications and supplemental information which need to be followed (see list of regulatory permits and approvals Table 1-2).

The following documents and procedures are relevant to the geotechnical site investigations, design, construction, and operation of the TMA, process water ponds, and freshwater diversion dams and channels are listed below (Table 1-3). However, additional information is provided in the facility description section of this manual (see section 4). A list of supporting drawings is provided in Appendix A. Additional details regarding pumping requirements, tailings pumping and pipeline designs and water recirculation pumping and pipeline designs are provided in Appendix B.

Safety requirements for work at the RRM and apply to work associated with the OMS are documented on the RRM health and safety sharepoint site and include;

- Hazard Identification and Risk Management;
- Document Records and Development Control;
- Training and Competency Awareness;
- Incident Management;
- Job Hazard Analysis; and
- Emergency Preparedness and Response Plan (EPRP) for the Site (New Gold, 2017).

**Table 1-3; Supporting Documents**

| Document Number | | | | Document Title |
|---|---|---|---|---|
| RRP | GEO | MEM | 001 | ITRB Recommendations and Implications |
| RRP | GEO | MEM | 002 | Dam Change Effect on Constraint in Northwest |
| RRP | GEO | MEM | 004 | Supplemental Information West Creek Diversion Amendment |
| RRP | GEO | MEM | 006 | Design Criteria for TMA Dams |
| RRP | GEO | MEM | 011 | WMP Fill Plan Memo |
| RRP | GEO | MEM | 012 | West Creek Diversion Channel - Overflow Diversion Structure |
| RRP | GEO | MEM | 013 | Clark Diversion Channel - As Built Hydraulic Assessment |
| RRP | GEO | MEM | 17A | WMP Borrow Filling (Formally WMP Level 1 Filling) |
| RRP | GEO | MEM | 019 | LRIA: Mine Rock Pond Amendment |
| RRP | GEO | MEM | 020 | WMP Borrow Filling - Supplemental Information |
| RRP | GEO | MEM | 021 | West Creek Diversion Amendment Box Culvert |
| RRP | GEO | MEM | 025 | Dam 1 Work Authorization |
| RRP | GEO | MEM | 026 | WMP Dam 1 - Geotech Investigation and Stability Analysis |
| RRP | GEO | MEM | 030 | TMA South Dam - Haul Road 13 Construction |
| RRP | GEO | MEM | 033 | Teeple Dam IDF Stability |
| RRP | GEO | MEM | 034 | West Creek Diversion Channel - Sequencing of Sediment Pond 1 Dams |
| RRP | GEO | MEM | 037 | Water Management Pond Water Intake Structure |
| RRP | GEO | MEM | 039 | Clark Creek Plans and Specifications Comments & Responses |

| | | | | |
|---|---|---|---|---|
| RRP | GEO | MEM | 043 | TMA LRIA - TMA Start Up Cell Seepage Collection - Supplemental Information |
| RRP | GEO | MEM | 056 | Teeple Permanent Repair - Supplemental Information |
| RRP | GEO | MEM | 063 | Seismic Stability Assessment of TMA Dams |
| RRP | GEO | MEM | 065 | Permanent Seepage Collection Drawings Comments & Reponses |
| RRP | GEO | MEM | 071 | Teeple Pond Diversion Channel Completion |
| RRP | GEO | MEM | 074 | Clark Pond Diversion Channel Completion |
| RRP | GEO | MEM | 076 | Addendum to WMP Dams 1,2,3 and Dam 4 and 5 |
| RRP | GEO | MEM | 080 | Stockpile Pond Diversion Channel Completion |
| RRP | GEO | MEM | 088 | Clark Creek Dam Completion |
| RRP | GEO | MEM | 089 | Teeple Road Dam Completion |
| RRP | GEO | MEM | 100 | MNRF QAQC Information Request |
| RRP | GEO | MEM | 104 | Seismic Stability Assessment of MRP Dam |
| RRP | GEO | MEM | 106 | Seismic Stability Assessment of MRP Dam - ITRB Responses |
| RRP | GEO | MEM | 108 | TMA Cell 2 - Design Criteria |
| RRP | GEO | MEM | 114 | Appendix A of RRP-GEO-REP-026 |
| RRP | GEO | MEM | 115 | Appendix B of RRP-GEO-REP-026 |
| RRP | GEO | MEM | 116 | TMA Cell 2 - Sump Sizing |
| RRP | GEO | MEM | 119 | Stockpile Dam Completion |
| RRP | GEO | MEM | 130 | Sediment Pond Spillway Details |
| RRP | GEO | MEM | 134A | West Creek Diversion Channel - As-built Review |
| RRP | GEO | MEM | 134B | West Creek Diversion Channel - As-built Review |
| RRP | GEO | MEM | 138 | West Creek Dam Compliance |
| RRP | GEO | MEM | 141 | WMP Dams Final Stage Design Compliance |
| RRP | GEO | MEM | 143 | Cell 1 Borrow Deposition |
| RRP | GEO | MEM | 144 | TMA Cell 1 - Pre-Commissioning |
| RRP | GEO | REP | 001 | TMA geotechnical investigations |
| RRP | GEO | REP | 1A | Geotechnical Investigations Report, Tailings Management Area, Volume 1 – Design Implications – Version 3 |
| RRP | GEO | REP | 1B | Geotechnical Investigations Report, Tailings Management Area, Volume 2 – Investigation and Interpretations |
| RRP | GEO | REP | 003 | West Creek Pond Dam - Design Revision and Operating Guidelines |
| RRP | GEO | REP | 004 | Stockpile Pond Dam Design Revision |
| RRP | GEO | REP | 006 | Design Update - Clark Creek Dams |
| RRP | GEO | REP | 007 | MRP Dam Design Revision Report |
| RRP | GEO | REP | 008 | Design brief TMA start up cell |
| RRP | GEO | REP | 017 | Instrumentation Plan Water Dams |
| RRP | GEO | REP | 018 | WMP Filling Plan - To Elevation 367m |
| RRP | GEO | REP | 022 | WMP Dewatering Plan |
| RRP | GEO | REP | 024 | 2016 Dam Instrumentation |
| RRP | GEO | REP | 026 | TMA Cell 2 Design Brief |
| RRP | GEO | REP | 027 | Clark Diversion As-built Report |
| 3098004-004000-A1-ETR-0004-00 | | | | 2013/2014 Geotechnical Site Investigations Report |
| 3098004-004400-A1-ETR-0003-00 | | | | Water Management Plan for Operations |
| 3098004-004400-A1-ETR-0004-00 | | | | Design Brief – Water Management Dams |
| 3098004-004000-A1-ETR-0012-00 | | | | Dam Instrumentation During Construction |

| | |
|---|---|
| 3098004-001100-A1-ETR-0001-00 | Mine Waste Management Plan |
| 3098004-004400-A1-ETR-0002-00 | Water Management Plan for Construction |
| 3098004-004000-A1-ETR-0005-AB | Tailings Deposition Plan |
| | Fish Habitat Offset Strategy |
| 3098004-004000-A1-ETR-0006-00 | Design Brief – Tailings Management Dams |
| 3098400-004000-A1-ETR-0004-00 | 2013-2014 Geotechnical Field Investigations |

## 1.4 Document and Records Control

Records from shift and periodic (daily, weekly and annual) TMA and water management system inspections will be retained in a secure repository as per the requirements of the site document control system. Once documents are printed, they are uncontrolled. Document Control follows the New Gold RRM document control procedures.

All records relating this OMS manual shall be retained for a minimum period of 25 years or until decommissioning ends, whichever is longer, as per regulatory requirements in the Federal CEAA Decision Statement. This includes place, date, time of sampling, dates and types of analysis performed, analytical techniques, methods or procedures, results of analysis and the names of persons who collected, analysed each sample and documentation of their training. All records and documents shall be retained at a facility close to the RRM.

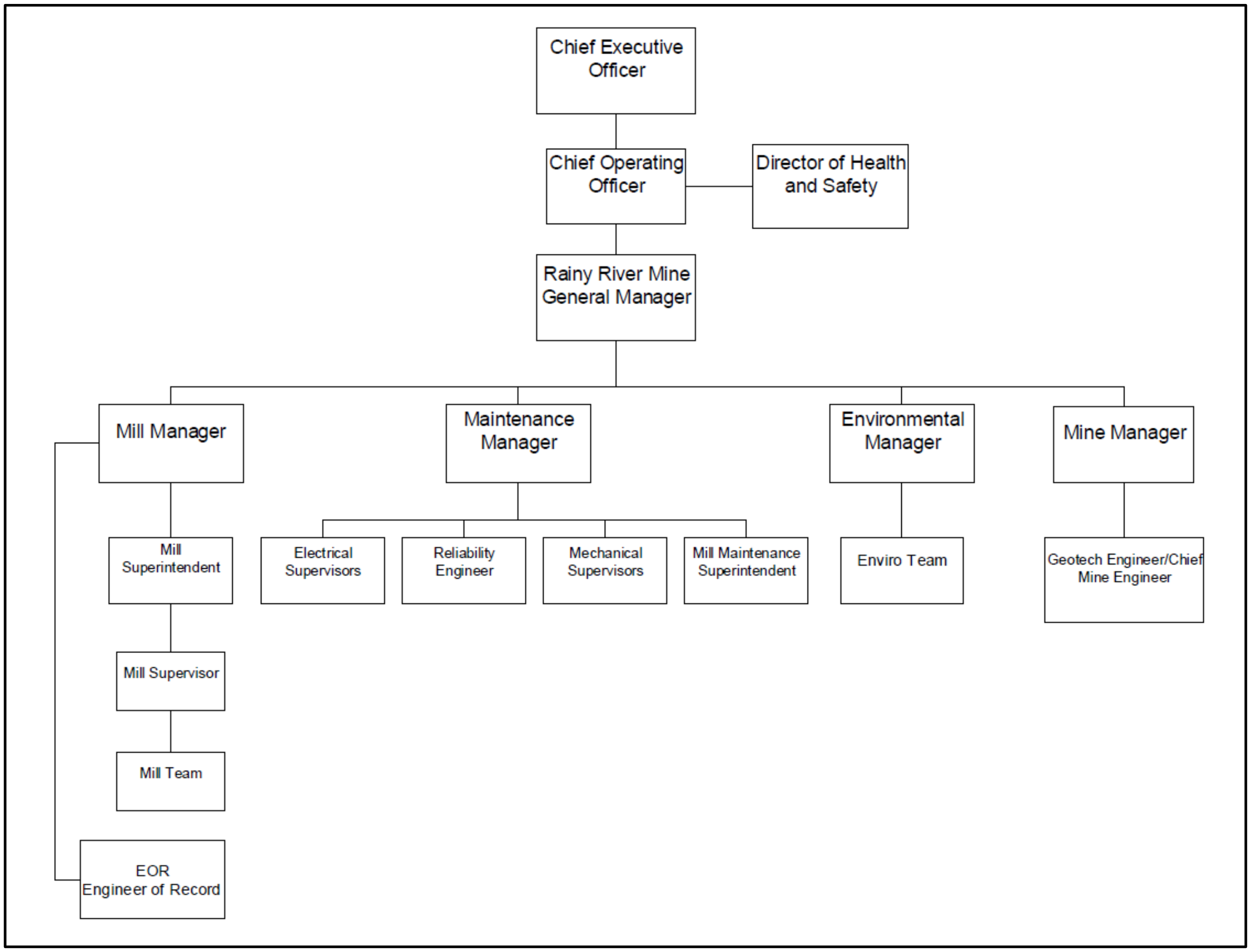
# 2.0 ROLES AND RESPONSIBILITIES

This section identifies the individuals having responsibility for the operation, maintenance and surveillance of the tailings, process water and freshwater dams and diversion channels. Though the accountability of tailings and water management lies with the General Manager, the Mill Manager is responsible for the operation of the tailings and water management at the RRM. The Environmental Department provides environmental technical support, including monitoring, land and water management and environmental contact with regulatory agencies.

## 2.1 Organizational Structure

The organizational structure for the RRM, relative to the OMS, is illustrated in Figure 2-1. The RRM/New Gold personnel and contact information associated with the positions referenced within each organizational flow chart can be found in Table 2-1. The organization chart is representative of the organization of persons related to the OMS following the construction and hand over of facilities. Prior to the handover of facilities, the EOR reports through the construction management team, for those facilities under construction.

**Figure 2-1; Organisation Chart For Tailings and Water Management**




## 2.2 Roles and Responsibilities

**Executive Vice President / Chief Operating Officer:**

- Is formally responsible for all of New Gold's operations; and
- Has responsibility for corporate "*Tailings, Heap-leach and Waste Rock Facilities Management Policy*". (included in Appendix C)

**General Manager:**

- Has accountability for tailings management;
- Shall ensure that all TMA, process water and freshwater structures meet Canadian Dam Association, Dam Safety Guidelines;

**Mill Manager:**

- Has responsibility for the tailings management facility and ancillary process water management structures, and water diversion structures including operation, maintenance and surveillance;

- Accountable for ensuring maintenance of the OMS Manual and conformance to the Mining Association of Canada's "Guide to Developing Operation, Maintenance and Surveillance for Tailings and Water Management Facilities";
- Ensures that manuals for the tailings and water management systems are reviewed annually, including an assessment of the effectiveness of the established system and performance against objectives, and updated as required;
- Ensures that the tailings handling and disposal operation is staffed by trained and competent persons;
- Integrates guidance from the Environment Department under the requirements of regulatory approvals and the Environmental Management System (EMS) where applicable to tailings management;
- Shall submit an annual dam safety inspection report for all dams (TMA area and others) to MOECC/MNRF where required; and
- Report any potential facility design changes that could affect the facility's integrity.
- Coordination of activities with the EOR during operations; and
- Has emergency management and response roles.

**Maintenance Manager:**

- Has primary responsibility for the maintenance work and maintenance management systems including dams and water management structures; and
- Ensures records of maintenance inspections for the dams and water management structures and related activities are accurately and permanently recorded and provided to the Geotechnical Engineer and the Engineer of Record (EOR).

**Reliability Engineer, Mechanical Superintendent and Electrical Supervisors:**

- Oversees planning and execution of equipment maintenance through the work order system;
- Arranges/conducts maintenance for equipment e.g., calibration and maintains instrumentation calibration records; and
- Identifies issues and corrective actions to prevent incidents.

**Chief Mine Engineer / Geotechnical Engineer:**

- Manages dam design, construction and contracts;
- Completing quarterly and annual inspections on TMA, process water and freshwater dams, diversion channels;
- Ensuring monitoring activities are undertaken as per schedule;
- Responding to concerns raised by operations personnel;
- Maintaining a dam raise schedule;
- Review spigotting and dam construction schedules;
- Construction oversight for major dam raise projects;

- Ensure that the OMS Manual is updated appropriately, as assigned by the Mill Manager; and
- Coordinating and managing survey.

**Mill Superintendent:**

- Responsible for ensuring daily, monthly and as-required reports with respect to all aspects of the operation, maintenance and surveillance of the tailings facilities are prepared, including all records of inspection and monitoring;
- Ensures that a system exists to implement the OMS manual procedures and requirements and the system is subjected to regular review and effectiveness checks;
- Oversees water taking from the Pinewood River;
- Participates in the review cycle for the OMS manual; and
- Undertakes any modifications as required to maintain a safe and effective tailings operation including adjustments to deposition plans, equipment and facilities.

**Mill Supervisor:**

- Responsible for the day-to-day operation, maintenance and surveillance of the tailings distribution system and related works including buildings, equipment, pipes, pumps, and dams;
- Verifies work order completion;
- Identifies new and revised maintenance requirements; and
- Performs visual inspection surveillance of tailings facilities including dams, pipelines, decants and other operations.

**Mill Team:**

- Responsible for operating, inspecting and maintaining dams and water pump houses;
- Responsible for security inspections during the shift, via work requests;
- Perform inspections, monitoring, audits and assessments including but not limited to;
    - Visual inspection (dams, water, spillways and pipelines);
    - Water levels;
    - Freeboard; and
    - Instrumentation.
- Ensures adequate maintenance, via work requests, of access roads, diversion ditches, emergency spill catchment areas and the reclaim water system; and
- Adjusting spigotting as directed by the supervisor.

**Engineer of Record (EOR):**

- Verifies the TMA and water diversion structures are constructed and operated as per the design intent;
- Performs Annual Dam Safety Inspections as per regulatory requirements; and

- Provides support for safe operation of the TMA and water diversion structures.

**Environmental Manager:**

- Support the Operation, Maintenance and Surveillance activities;
- Maintain contact and communication with regulatory agencies;
- Assist with environment related technical support such as inspection and evaluation of stability by an external expert;
- Ensure regulatory and other sampling, monitoring, and analyses programs are conducted as required and all analytical results and/or reports are reviewed and reported to the appropriate internal and external stakeholders;
- Ensure rehabilitation and stabilization programs are conducted for tailings in conjunction with closure plan requirements;
- Prepare Annual Reports to regulatory agencies; and
- Administer and track compliance against Permits.

**Environmental Team:**

- Monitor conformance with relevant permits for the OMS manual requirements;
- Perform inspections, monitoring, audits and assessments including but not limited to;
  - Visual inspection (dams, water, spillways and pipelines); and
  - Instrumentation.
- Integrate tailings operations activities into the EMS;
- Identify and assess applicable tailings related regulatory requirements including permits, licenses, authorizations;
- Support tailings/geotechnical engineering and operations efforts; and
- Provides environmental support to the mill area activities and parties including but not limited to: construction, earth moving, erosion and dust control and water discharges.
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## 2.3 Contact Information

The RRM contact information, for the positions listed in Sections 2.1 and 2.2, can be found in Table 2-1.

**Table 2-1; Rainy River Project Contact Information**

| Position | Name | Phone Number | Ext | Mobile | Email |
|---|---|---|---|---|---|
| President CEO | Hannes Portmann | (416) 324-6014 | | (416) 303-1511 | hannes.portmann@newgold.com |
| Chief Operating Officer (Interim) | Raymond Threlkeld | | | (571) 577-0198 | raymond.threlkeld@newgold.com |

| Position | Name | Phone Number | Ext | Mobile | Email |
|---|---|---|---|---|---|
| Director HSE | Dennis Wilson | (647) 789-5002 | | (647) 209-9508 | Dennis.wilson@newgold.com |
| General Manager | Greg Bowkett | (807) 482-0902 | 8002 | (807) 456-3668 | greg.bowkett@newgold.com |
| Mine Manager | Hubert Schimann | 807 482 0911 | 2253 | (807) 707 2578 | hubert.schimann@newgold.com |
| Mill Manager | Dave Hall | (807) 482-0926 | 8021 | (807) 707-1014 | dave.hall@newgold.com |
| Environmental Manager | Darrell Martindale | (807) 482-0900 | 8055 | (807) 707-3497 | darrell.martindale@newgold.com |
| Maintenance Manager | Tony Lord | (807) 482-0900 | 8006 | | tony.lord@newgold.com |
| Mill Superintendent | Don Emms | (807) 482-0907 | 8066 | (807) 708-1853 | don.emms@newgold.com |
| Mill Shift Supervisor | Jean Tougas | (807) 482-0900 | 8077 | (807) 708-1172 | jean.tougas@newgold.com |
| Mill Shift Supervisor | Ron Langdon | (807) 482-0900 | 8077 | (807) 708-1172 | ron.langdon@newgold.com |
| Mill Shift Supervisor | Gilbert Tougas | (807) 482-0900 | 8077 | (807) 708-1172 | gilbert.tougas@newgold.com |
| Mill Shift Supervisor | Terry Hamilton | (807) 482-0900 | 8077 | (807) 708-1172 | terry.hamilton@newgold.com |
| Mill Maintenance Supervisor | Don Ibey | (807) 482-0900 | 8006 | (807) 707 1061 | Don.Ibey@newgold.com |
| Maintenance Mechanical Supervisor | Derek Nelson | (807) 482-0900 | | | derek.nelson@newgold.com |
| Maintenance Mechanical Supervisor | Mitch Lemaire | (807) 482-0900 | | | |
| Maintenance Electrical Supervisor | Lewis Kempf | (807) 482-0900 | | | Lewis.Kempf@newgold.com |
| Maintenance Electrical Supervisor | Bill Cole | (807) 482-0900 | | | bill.cole@newgold.com |
| Reliability Engineer - Maintenance | Ian Strain | (807) 482-0919 | 8019 | (807) 707-1060 | ian.strain@newgold.com |
| Geotech Engineer | TBD | | | | |

| Position | Name | Phone Number | Ext | Mobile | Email |
|---|---|---|---|---|---|
| New Gold Environment On Call | | (807) 632-6152 | | | rainyriver.enviro@newgold.com |
| Ministry of Natural Resources and Forestry – MNRF | Andrew Bromley | (807) 475-1368 | | | Andrew.bromley@ontario.ca |
| Ministry of Environment and Climate Change | Matt Hoffmeister | 1-807-468-2703 | | | Matt.hoffmeister@ontario.ca |
| Spills Action Centre (SAC) | | 1-800-268-6060 | | | |
| Ministry of Northern Development and Mines | Neal Bennett | 1-807-475-1123 | | | Neal.bennett@ontario.ca |
| Ministry of Northern Development and Mines | Bryce Voca | 1-807-475-1434 | | | Bryce.voca@ontario.ca |
| Environmental Canada and Climate Change | Adam Scheepers | 1-613-990-9744 | | | Adam.scheepers@canada.ca |
| Engineer of Record | Mickey Davachi | 1-403-387-1917 | | 403-826-8666 | mickey.davachi@amecfw.com |

## 2.4 Competency and Training

Training and education will be provided to employees to enhance their performance and RRM will ensure that all personnel receive the level of training to ensure they are competent. Tailings specific training is essential in ensuring safe and effective operation of the TMA as well as correct construction. The RRM in conjunction with the Engineer of Record will provide training programs or opportunities as required and job related training covering aspects related to requirements for the specific types of equipment and operational requirements.

Table 2-1 demonstrates the training that will be provided at a minimum, to support operation of the tailings water, process water, water treatment and freshwater management structures as required.

**Table 2-1; OMS Manual Training Matrix**

| Training | TMA contractor | Mill Crews and Supervisor | Mill Supt. | Geotech. Engineer | Enviro Dept. | Mgmt. Team |
|---|---|---|---|---|---|---|
| Site Orientation | x | x | x | x | x | x |
| Daily Inspection | | x | | | | |
| Quarterly Inspection | | | x | x | x | |
| OMS / General Tailings & Ponds | x | x | x | x | x | |
| EPRP training | x | x | x | x | x | x |
| Construction method of TMA raises | x | | | x | | |
| Towards Sustainable Mining | | | x | x | x | x |
| Instrument Data Collection | | x | | x | x | |

# 3.0 SITE CONDITIONS

## 3.1 Site Location and Tenure

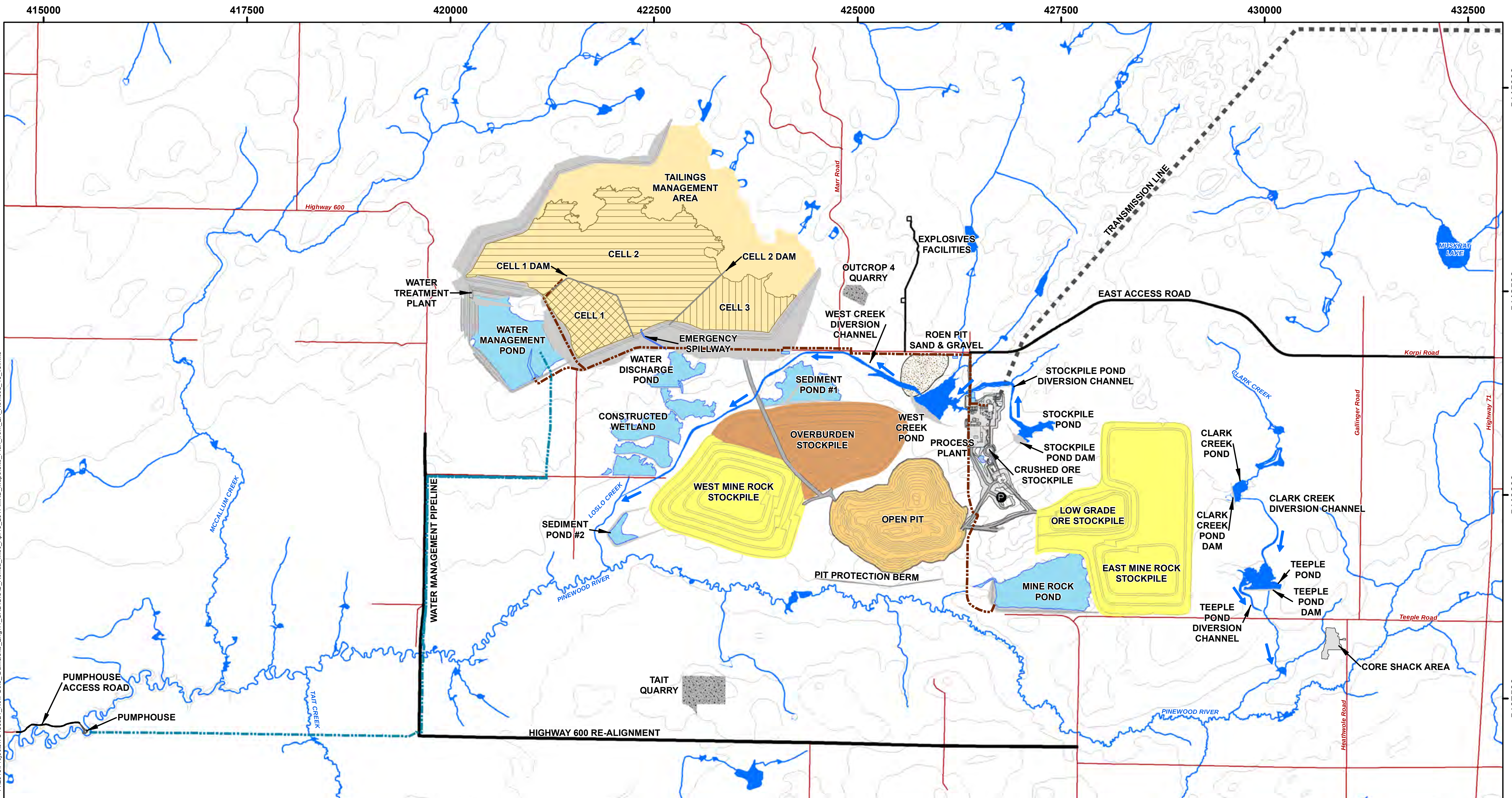
The site is located in the Township of Chapple, approximately 65 kilometers (km) by road northwest of Fort Frances, in northwestern Ontario. New Gold has 100% interest in the lands forming the RRM through direct ownership or option agreement, however surface rights are not owned throughout the site boundary.

The RRM is located with lands used by Indigenous Groups for traditional and ceremonial purposes including but not limited to the following groups; Rainy River First Nations, Naicatchewenin First Nation, Big Grassy River First Nation, Naotkamegwanning (Whitefish Bay) First Nation, Anishinaabeg of Naongashiing (Big Island) First Nation, Ojibways of Onigaming First Nation, and the Sunset Country Métis community (represented by Métis Nation of Ontario Region 1 Consultation Committee). New Gold has regulatory requirements and/or biparty agreements to engage with these communities.

Road access to the site is by provincial Highways 600 and 71 and Korpi Road (east access road). A site location map is provided in Figure 3-1. The mine is serviced by local municipal infrastructure and is in close proximity to Fort Frances, Ontario for support and supply.

The site topography is variable with elevations ranging from 350 m to 390 m. The terrain is comprised of both forested and non-forested areas, including agricultural and wetland areas. The local drainage systems are characterized by numerous small creeks that drain into the Pinewood River. The small creeks typically originate from rocky uplands or headwater wetland systems.

The forested areas are dominated by mixed poplar and black spruce forests. Wetlands are comprised mainly of treed and open fens, together with wetland thickets and marsh areas.

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**LEGEND**

**Proposed Site Features**

- Underground Portal
- Open Pit
- Process Plant
- Water Management Pipelines
- Tailings/Reclaim Pipeline
- Pond
- 230 kV Transmission Line
- Tailings Management Area
- TMA Cell 1
- TMA Cell 2
- TMA Cell 3
- Overburden Stockpile
- Rock Stockpile
- Dam
- Site Roads
- Flow Direction
- Quarry
- Sand & Gravel Pit

NOTES:
-

Datum: NAD83
Projection: UTM Zone 15N

newgold Rainy River Project

amec foster wheeler

**RAINY RIVER PROJECT**

**Site Plan**
**General Arrangment**

PROJECT N°: TC150321

FIGURE: 3-1

SCALE: 1:45,000

DATE: April 2017

0 1.5 3 6 9 12 Kilometres

## 3.2 Climate

Weather at the site is seasonal with cold winters with freezing conditions from November until March. The site receives ~700 mm of precipitation in an average year and the pond evaporation is estimated to be ~540 mm (Table 3-1). An estimated evapotranspiration of 500 mm is inferred by the difference between precipitation and runoff in the Pinewood River.

**Table 3-1; Mean Annual and 1:20 year Precipitation and Evaporation**

| Barwick - 1981 to 2010 Canadian Climate Normals station data | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
| Daily Average (°C) | -15 | -11.6 | -4.4 | 4.4 | 11.4 | 16.4 | 19 | 17.9 | 12.6 | 5.5 | -3.4 | -11.8 | 3.4 |
| Rainfall (mm) | 0.2 | 3 | 11 | 30.4 | 75.1 | 124.7 | 102.9 | 78.8 | 75.5 | 51.3 | 13.6 | 2.1 | 568 |
| Snowfall (cm) | 29.5 | 18.3 | 18.8 | 8.9 | 1.1 | 0 | 0 | 0 | 0.8 | 7.5 | 28.3 | 28.6 | 142 |
| Precipitation (mm) | 29.8 | 21.3 | 29.8 | 39.2 | 76.2 | 124.7 | 102.9 | 78.8 | 76.2 | 58.8 | 41.8 | 30.7 | 710 |
| **Pond Evaporation** | | | | | | | | | | | | | |
| Pond Evaporation (mm) | 0 | 0 | 0 | 0 | 109 | 110 | 129 | 104 | 63 | 23 | 0 | 0 | 538 |
| **Barwick 2017 station data** | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug* | Sep | Oct | Nov | Dec | Year |
| Daily Average (°C) | -12 | -9 | -3.6 | 4.9 | 10.2 | 16.7 | 18.9 | 17.5 | | | | | |
| Difference (°C) | 3.6 | 2.6 | 0.8 | 0.5 | -1.2 | 0.3 | -0.1 | -0.4 | | | | | |
| Rainfall (mm) | 5 | 14.4 | 5.2 | 21.6 | 38.4 | 106.5 | 33.4 | 48.8 | | | | | |
| Snowfall (cm) | 37.4 | 23.4 | 6.4 | 6.6 | 0 | 0 | 0 | 0 | | | | | |
| Precipitation (mm) | 42.4 | 37.8 | 11.6 | 28.2 | 38.4 | 106.5 | 33.4 | 48.8 | | | | | |
| % Difference | 42.3 | 77.5 | -61.1 | -28.1 | -49.6 | -14.6 | -67.5 | -38.1 | * = Data to Aug 11 | | | | |

Site runoff varies widely in response to the climatic conditions. In normal (50% non-exceedance) and wetter years there is surplus water available for taking for site catchments or the Pinewood River. However, the Pinewood River frequently has no flow in September, and in extreme dry years, presents a water supply risk to the project.

Further details regarding the climatic conditions and hydrology can be found in the Water Management Plan for Operations (RRP-GEO-REP-026 R1). The site and project climatic characteristics (and seismic hazard analysis) are summarized in Table 3-2.

**Table 3-2; Site Characteristics used in Geotechnical Design**

| Criterion | Source or Calculation | Value | Unit |
|---|---|---|---|
| **Climatic Data** | | | |
| Monthly temperatures (Note 1) | | | |
| *Mean* | | 3.2 | $^oC$ |
| *Low (February)* | | -15.9 | $^oC$ |

| Criterion | Source or Calculation | Value | Unit |
|---|---|---|---|
| *High (August)* | Environment Canada - Barwick Station (Stn 6020559) | 18.8 | °C |
| *Period of freezing* | | November to March | - |
| Precipitation (Note 2) | | | |
| *Mean annual precipitation* | Environment Canada - Barwick Station (Stn 6020559) | 682.1 | mm |
| *Mean annual rainfall* | | 543.7 | mm |
| *Mean annual snowfall* | | 138.4 | cm |
| Storm events (24-hour) (Note 3) | | | |
| *2-yr* | Ministry of Transportation (MTO) | 51 | mm |
| *5-yr* | | 51 | mm |
| *10-yr* | | 93 | mm |
| *25-yr* | | 102 | mm |
| *100-yr* | | 129 | mm |
| *Regional Flood (Timmins Storm)* | | 193 | mm |
| *Probable Maximum Precipitation (PMP)* | | 586 | mm |
| Wind velocities (for wind-wave calculations) | | | |
| *Average annual maximum* | (Note 4) | 16 | km/h |
| *Maximum likely* | | 80 | km/h |
| **Probabilistic Seismic Hazard Analysis (Note 5)** | | | |
| Peak Ground Acceleration for Rock Sites (outcrops)<br>Return Period (Years) | | | |
| *475* | Natural Resources Canada | 0.009 | g |
| *2,475* | | 0.036 | g |
| *10,000* | | 0.096 | g |
| Peak Ground Acceleration for Overburden Sites (20 to 30 m)<br>Return Period (Years) | | | |
| *475* | Natural Resources Canada | 0.014 | g |
| *2,475* | | 0.054 | g |
| *10,000* | | 0.136 | g |

Notes:

1. Data obtained between 1971-2000
2. Data obtained between 1979-2012
3. Data for 2 to 100 year return obtained from MTO (2010), PMP) from AES IDF values prepared by the Hydrometeorology Division, Canadian Climate Centre, Station Rainy River, ON, Station Number 6026852
4. AMEC, 2013. Rainy River Gold Project, Climate, Air Quality, and Sound Baseline Study

5. The 1:10,000 year earthquake is considered equivalent to the maximum credible earthquake. AMEC, 2012. Earthquake Ground Motion Hazard Assessment, Rainy River Gold Project, Richardson Township, Ontario

### 3.3 Surficial and Bedrock Geology

The RRM is positioned within the Achaean age Rainy River Greenstone Belt that forms part of the 900 km long, east-west trending Wabigoon Subprovince of the Canadian Shield. In general, the Rainy River Greenstone Belt is bounded by the Sabaskong Batholith in the north and the Rainy Lake Batholithic Complex in the east. It extends south into Minnesota where the Long Point Intrusive Rocks, the Baudette Intrusive Rocks (both granitoid), and the Rainy Lake – Seine River Fault, the Vermillion Fault and the Four Towns Fault constrain the belt.

The site is characterized by gently undulating topography, strongly influenced by a sequence of glaciations, which on higher ground has left bedrock exposed with little to no overburden cover. In the lower lying areas, thick overburden deposits primarily of glacial origin (e.g., till) are found.

The mine site area can be divided into two general physiographic types based on topography and frequency of bedrock outcrops. The north and east portions of the project site have numerous bedrock outcrops, with variable soil cover, where the bedrock has a significant influence on the surface topography. The southwest and central portions of the site have thicker and more extensive soil deposits, with isolated bedrock outcrops.

The surficial geology generally consists of the following stratigraphy:

- Peat/Holocene: variable thickness ranging from thin veneers to greater than 3 m in thickness;
- Glaciolacustrine clay: typically located below the peat layer (Brenna Formation) and above the Whiteshell Till (Whylie Formation). The upper unit is typically low to high plastic silty clay, with occasional sand layers. The lower unit is typically clay silt and fine sand. Both units have varved silt and clay with varying thickness typically in the millimeter scale;
- Whitemouth Lake (WML) Till: Thickest and most widespread unit on site. The till is typically medium to high plastic silty clay with trace to some sand and gravel;
- Whiteshell Till: confined under the Whitemouth Till, the Whiteshell Till is a silty sand till with some gravel and cobbles and trace clay with some boulders. It is an aquifer with artesian pressures (above the ground surface) in some locations; and
- Bedrock: underlying the Whiteshell Till.

Groundwater recharge to the deeper groundwater system (shallow bedrock and Whiteshell Till) is limited to areas where the bedrock is at surface or has limited cover of overburden, mainly to the north and east of the open pit. Very limited recharge to the deeper groundwater system is probable through the Whitemouth Lake Till on higher ground. Where glaciolacustrine clays and peat are present, recharge to the deeper groundwater system is minimal.

Note; the TMA dams have been designed assuming high pore pressures and residual strength in the clayey foundation units (Upper/Lower Glaciolacustrine and WML Till). Further details regarding the surficial geology at the site and design criteria for the TMA Dams is provided in TMA – Volume 1 – Dam Design Implications (Amec Foster Wheeler, 2016f) and Volume 2 – Investigation and Interpretations (Amec Foster Wheeler, 2016g).

## 3.4 Geochemistry

### 3.4.1 Mine Rock

Static and kinetic geochemical testing representing all major lithology types of non-ore mine rock in the vicinity of the proposed pit development determined that approximately 50% of the mine rock samples were unlikely to generate acidic drainage (NPAG) in the future (neutralization potential ratio [NPR] >2). The remainder of the samples were classified as potentially acid generating (PAG) materials with NPR<2. It's noted that NPR ratios are influences by the low concentrations of both sulphides and carbonates.

Progressive encapsulation of the PAG rock during operations and at closure will limit precipitation infiltration and flushing of oxidation products from the mine rock. Restriction of oxygen inflow to the PAG rock may occur as a result of complete encapsulation of the pile.

The dam design includes only non-potentially acid generating (NPAG) mine rock downstream of the dam core. PAG rock is used in the completion of portions the TMA starter cell/cell 1, cell 2 dam and the upstream sections of the ultimate TMA dams.

### 3.4.2 Tailings

Based on geochemical testing, the tailings are PAG with an expected lag time to net acidic conditions of approximately 30 years. In addition, there is a potential risk of elevated cadmium concentrations in the TMA during operations due to leaching from the tailings.

Metal release from subaerial (beached) tailings may occur prior to acidic conditions and management of the tailings pond water may be required at this time. Metal release may occur from submerged tailings; however, subaerial tailings appear to be a greater source of loadings than submerged tailings. The milled ore is also a substantial source of loadings to the tailings pond, in some cases (e.g., cadmium) it is the dominant loading source early in mining operations.

Geochemical assessments suggest that Cd concentrations in the TMA may exceed the working site specific value (0.001 mg/L subject to confirmation through permitting) within 1 year after mining begins. Reductions in the tailings beach areas could extend the period of time until exceedance is reached. Water treatment in the WMP is planned to be employed to support discharges from the WMP meeting discharge effluent quality targets.

## 3.5 Hydrology and Water Flow

The collection of runoff and hydrology data for the RRM is challenged by low gradient, small systems and frequent beaver impoundment. Water Survey of Canada Station 05PC011 at the Pinewood River provides the longest and most reliable available data set. Water Survey of Canada Station 05PC023 (at Highway 617) provides a shorter period of record and is known to provide erroneous readings of up to 20 %. Table 3-3 presents mean streamflow data in the Pinewood River as presented in the EA application, which have been pro-rated where required and in winter months.

**Table 3-3; Monthly Streamflow in the Pinewood River at WSC 05PC011**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 0.218 | 0.144 | 0.538 | 9.595 | 7.135 | 5.412 | 3.163 | 1.536 | 1.787 | 2.352 | 1.913 | 0.383 | 194.8 |
| **5th %ile** | 0.073 | 0.049 | 0.181 | 3.228 | 2.400 | 1.820 | 1.064 | 0.517 | 0.601 | 0.791 | 0.644 | 0.129 | 65.5 |
| **95 %ile** | 0.440 | 0.292 | 1.087 | 19.41 | 14.43 | 10.95 | 6.398 | 3.107 | 3.615 | 4.758 | 3.870 | 0.776 | 394.1 |

The RRM site on the north side of the Pinewood River is drained by four small creek systems, which from east to west are: Clark Creek (Teeple Drain), West Creek, Marr Creek and Loslo Creek (Cowser Drain). These creek basins range in size from 7.3 km2 (Marr Creek) to 16.35 km2 (West Creek). Major portions of the Clark Creek, Marr Creek and Loslo Creek basins will be overprinted by RRM developments, principally the tailings management area and stockpiles. West Creek currently flows through the proposed open pit and will have to be diverted around the pit in order for the RRM to proceed.

It should be also noted that the lower approximately 3.3 km reach of Loslo Creek and 2.3 km of Clark Creek leading to the outflow into the Pinewood River have been previously designated as Municipal drains under the Drainage Act (respectively, the Cowser Drain constructed in 1980 and the Teeple Drain constructed in 1994).

### 3.6 Water Quality

Water quality in the area of the RRM is influence by the presence of clays/silts and water quality guidelines are frequently exceeded at baseline or upstream sites. There are a number of circumstances where exceedance of the Provincial Water Quality Objectives (PWQO) and Canadian Environmental Quality Guidelines (CEQG) values are common:

- Total metal values for samples showing elevated total suspended solids (TSS), especially for very common minerals such as aluminum and iron;
- Total aluminum concentrations in areas where clay / silt soils are common, as aluminum is a common clay mineral;
- Samples collected from under the ice in low volume water systems, because the process of ice formation tends to exclude ions from the ice crystal lattice, thereby concentrating the ejected ions in the underlying water column; and
- Samples collected during summer drought conditions in low volume water systems, because of ion concentration due to evaporative processes

The majority of parameters for surface waters met PWQO and CEQG for the protection of aquatic life, with the exception of common exceedances for aluminum (mainly CEQG), iron and phosphorus; frequent exceedances for cadmium (CEQG), copper (mainly CEQG) and cobalt (PWQO); and occasional, to rare, exceedances for arsenic, lead, nickel and zinc.

### 3.7 Hydrogeology

Regional groundwater flow is generally towards the west in the Pinewood River watershed, but locally is towards the Pinewood River corridor. Horizontal gradients are relatively steep on higher ground, approaching 0.01, but become more subdued in the lower lying areas where they decrease to approximately 0.003. This change in horizontal gradient is a strong indication that, as the groundwater flows from the higher ground to lower elevations, there is flow from the relatively impermeable shallow bedrock to the more permeable Whiteshell Till and other granular material immediately above the bedrock, referred to generically as the Pleistocene lower granular deposits (PLGD).

Groundwater in the shallow bedrock and PLGD becomes confined as it moves westwards and towards the Pinewood River beneath the lower permeability silty clays of the Whitemouth Lake Till and the glaciolacustrine deposits that largely sandwich this till (the Pleistocene Aquitard). Artesian conditions within the shallow bedrock and PLGD are common along the stream corridors with upwards gradients on the order of 0.03 to 0.1, while downwards gradients occur in the higher areas between the streams.

Groundwater quality is typical calcium magnesium-bicarbonate type water with the majority of sampling points having total dissolved solids exceeding 500 mg/L. Sampling of groundwater since 2007 has indicated metal concentrations above application guidelines e.g., arsenic, cobalt, iron, molybdenum, zinc, mercury and uranium.

## 3.8 Biological

### 3.8.1 Fisheries

The fish community proximal to the RRM is dominated by baitfish and forage fish species with sportfish (e.g., Walleye and Northern Pike) in the lower Pinewood River below the Pinewood Pumphouse. Presently Marr and Loslo Creek are fish bearing and a fish relocation porgram is underway. West Creek and Clark Creek are former tributaries to the Pinewood River and have been offset for by the Clark Creek Diversion and West Creek Diversion. Clark Creek Diversion and West Creek Diversion are offsetting habitat and support all life history stages of baitfish and forage fish species.

The freshwater diversions are fish bearing waters and subject to protection under numerous permits and legislation e.g., *Fisheries Act*. Cowser Drain (Loslo Creek) and the Pinewood River are also fish bearing. Water quality discharges into these areas must meet MMER and ECA permit requirements. Additional studies as required by the ECA e.g., for mercury, sulphate and ammonia are ongoing, the results of which may influence operation of the TMA.

### 3.8.2 Vegetation

The RRM is within Ecoregion 5S (Agassiz Clay Plain) and there are no published Significant Wildlife Habitat Ecoregion Criteria Schedules for this ecoregion. Apsen-Birch hardwood forest is the dominant (46.6 %) forest type proximal to the mine, followed by coniferous swamp / wetland (29.4 %). Agricultural lands are present across 8 % of the area proximal to the mine, primarily along roads and in areas of well drained clays. No records of rare vegetation communities or rare plants were identified during the Environmental Assessment.

Based on the ecoregion, the growing season length is 180-190 days with mean annual temperatures of 1.5 to 3.0 ºC. The frost free period is ~125 days from mid-May to mid/late September (Ministry of Agriculture; 1976-2005).

### 3.8.3 Wildlife

Key wildlife aspects influencing the OMS manual include the presence of;

- Species at risk including but not limited to Eastern Whip-poor-will and bobolink which require consideration of limits of disturbance, timing of works, noise mitigation and dust management;

- Snapping turtles, for which measures must be taken to prevent them entering the TMA, process water and water treatment facilities;
- Migratory birds requiring noise mitigation measures, reduced light pollution, timing windows on clearing, deterrents to prevent use of the TMA and monitoring for use of the TMA;
- Deer, which along with other wildlife require that a fence is to be constructed around the active tailings deposition areas; and
- Bear, which along with other wildlife need to be managed through controlling wildlife-human interactions including reporting, no harassing of wildlife, no fishing or hunting on the mine site, speed restriction and waste management to exclude wildlife.

### 3.9 Natural Hazards

Natural hazards to the RRM are limited to weather related hazards e.g., flooding, drought, extreme cold or high winds and forest fires. Other natural hazards e.g., volcanic activity, subsidence, avalanches and landslides are not expected to affect the mine given surrounding geology and topography. Responses to natural hazards are considered as part of the site EPRP. Potential natural hazards relating to the OMS are discussed here, however further consideration on how to respond to natural hazards is considered in the maintenance and contingency sections.

- Forest Fire; there is potential for forest fire to affect operations of the mine, with the cycle in the area of the RRM being 63 to 210 years. The RRM has a fire prevention and preparedness plan (June 2017) developed with the MNRF.
- Pit Slope Failure; could be cause by flooding or slope instability. Modelling of the 1:100 year flow in the Pinewood River would result in the Pinewood River cresting adjacent to the pit at between 347-349 masl. A berm is proposed to protect the pit. This is the same mitigation proposed as for managing ice jams in the Pinewood River.
- Flooding; there is potential for flooding, and associated rainfall to affect operations of the mine. Design of the dams and diversion structures has considered these events as described in section 4 and contingencies are discussed in section 10. Results of flooding leading to a potential need to discharge additional water is offset by the increased assimilative capacity of the receiving environmental at the permitted 1:1 discharge ratio.
- Drought; drought conditions may result in a reduction in water availability for processing and discharge. Drought conditions for processing is mitigated through the design of the WMP and water storage. In the event of $5^{th}$ %ile low flow fall, only 1.53 $Mm^3$ could be discharged. However, this is managed through capacity in the TMA, WMP and water treatment.
- Seismic hazard; the site is located in the Canadian Shield which is comprised of Precambrian granites and gneisses that host some of the oldest rocks in the world. No earthquakes recorded with a magnitude greater than M 4.5 have occurred within approximately 500 km of the site. The results of the probabilistic seismic hazard analysis (PSHA) are shown in Table 3-1. Further details regarding the PSHA are provided in the *2013/2014 Geotechnical Site Investigations Report* (AMEC, 2014d).

# 4.0 FACILITY DESCRIPTIONS

The components of the RRM relative to the scope of the OMS include tailings and process water management, freshwater diversions and water treatment. The site layout is shown on Figure 3-1. While there is interconnectivity between the systems, for the purposes of the OMS they are categorised in these groupings and reference made between them where required e.g., water management pond, water discharge pond and constructed wetland.

Tailings and process water management are provided by the following;

- Tailings Management Area –TMA (including cells 1, 2 and 3 and associated pipelines);
- Water Management Pond - WMP; and
- Mine Rock Pond - MRP.

The TMA provides long term containment for the tailings. The mill make-up water is reclaimed from the Tailings Management Area (TMA) and the Mine Rock Pond (MRP). The TMA dam raising schedule is divided into five stages and has been set to ensure ample pond storage is available to satisfy mill make-up water supply and effluent management requirements.

The TMA has been designed to optimize natural degradation processes, by ensuring there is sufficient time to allow for heavy metals to precipitate to low levels in the pond. The natural degradation processes are most effective during warm weather conditions when biophysical activity is optimal, and are also augmented by exposure to sunlight.

Freshwater is supplied to the mill from the WMP. Mill make-up water is provided through reclaim from the TMA and the transfer of contact water from the Mine Rock Pond (MRP). Surplus water (effluent) is transferred to the WMP before it is discharged to the environment via the constructed wetland or pipeline to the Pinewood River. Effluents planned for discharge to the environment will be held for a sufficient period under warm weather conditions, to maximize the effects of natural degradation. Such effluent aging will take place mainly in the summer.

Freshwater diversion is provided by the following;

- Clark Creek diversion including the Clark Creek and Teeple dam and diversions; and
- West Creek diversion including the Stockpile and West Creek dam and diversions.

The freshwater diversions function to reduce inflows to the RRM and provide offsetting habitat for the loss of portions of Loslo, Marr, Clark and West creeks. Diversion of the non-contact runoff from these catchments reduces the effluent management requirements. All structures support fish habitat.

Water treatment is provided by the following;

- Water Discharge Pond (WDP) and the Constructed wetland – (CW); and
- Sediment ponds 1 and 2.

Sedimentation ponds have been designed to allow for the settlement of total suspended solids present in the non-contact runoff or effluent prior to discharge to the environment. Sediment Ponds #1 and #2 receive runoff and seepage from the West Mine Rock Stockpile (WMRS). The Water Discharge Pond (WDP) and Constructed Wetland receive discharge water from the WMP. The constructed wetland in the primary and priority discharge location from the WMP (to mitigate flow reductions in the Pinewood River) ahead of discharging to the Pinewood River downstream of McCallum Creek.

## 4.1 Design Criteria and Basis

The basis for design of the tailings, process water, freshwater diversion and sedimentation dams are summarized in the subsequent sections. Where practically possible, the RRM has been designed to minimize effort at closure by promoting progressive reclamation opportunities including but not limited to: establishing the TMA closure cover and developing the East Mine Rock Stockpile (EMRS) and West Mine Rock Stockpile (WMRS) to closure slopes.

Results from field investigations (subsurface and groundwater conditions) have been incorporated to the design as per the documented findings from the *2013/2014 Geotechnical Site Investigations* (AMEC, 2014d) and *Geotechnical Investigations Report – TMA, Volume 1 – Design Implications* (Amec Foster Wheeler, 2016f).

**Table 4-1; Summary of Dam Design Criteria**

| Dam | Hazard Potential Classification | Upstream Watershed | Maximum Operating Pond Level | | Environmental Design Flood | | Inflow Design Flood | Spillway design/Emergency Spillway design | | | Design Slopes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Volume | Level | Storm Event | Volume | | Width | Design Flow | Max. flow depth (IDF) | |
| - | - | - | Mm3 | m | - | $Mm^3$ | - | m | m3/s | m | (_H:1V) |
| Tailings Management Area | | | | | | | | | | | |
| Cell 1 | Very high | None/Tailings | | 369.9 | 100 yr 30 day | 0.320 | PMF | 8 | | | 11 |
| Cell 2 | Very high | Loslo/Tailings | | 364.05 | 100 yr 24h | 0.828 | PMF | 19 | 293.0 | 1.4 | 11 |
| Process Water Management | | | | | | | | | | | |
| WMP | Very high | TMA | 5.0 | 369.7 | 100 yr 30 day | 0.630 | PMF | 8 | 3.7 | 0.50 | 4-9.2 |
| MRP | Very high | EMRS | 0.5 | 356.8 | 100 yr 30 day | 1.0 | PMF | 15 | 64.7 | 1.60 | 11 |
| Freshwater Diversions | | | | | | | | | | | |
| Clark Creek Dam | Low | Clark Creek | | 378.75 | n/a | n/a | 100-yr | 20 | | 0.30 | 5.5 |
| Teeple Dam | Low | | | 378.5 | n/a | n/a | 100-yr | 120 | | 0.10 | 6.0 |
| Stockpile Pond Dam | Very high | West Creek | 0.095 NOWL | 372.2 | n/a | n/a | PMF | 33 | 79.6 | 2.30 | 6.5 |
| West Creek Dam | Very high | | 0.156 NOWL | 361.0 | n/a | n/a | PMF | 8 | | | 7.9 |

Notes
Hazard potential classification per LRIA
Spillways have been designed to pass an IDF event while satisfying minimum freeboard requirements
PMF is probably maximum flood
To be updated for WDP, CW and Sediment ponds 1 and 2 based on approvals

**Table 4-2; Summary of Dam Characteristics**

| Purpose & Facility | Dam Name | Type of Dam | Construction Method | Crest Elev. | Max. Dam Height | Dam Length | Crest Width | Slopes | Spillway | | Normal Freeboard |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Invert Elev. | Width | |
| | | | | (m) | (m) | (m) | (m) | (_H : 1V) | (m) | (m) | (m) |
| **Tailings containment dams** | | | | | | | | | | | |
| **Tailings Management Area (TMA)** | TMA North | | | | 2.5 | 3620 | 20 | | | | |
| | TMA South | Central core | Staged centreline raises | 366.5 (final 379.5) | 11.0 | 3505 | 20 | 11.0 | 365.5 (emergency) | 10 | varies |
| | TMA West | | | | 7.5 | 1865 | 20 | | | | |
| | TMA Cell 1 | Rockfill & liner | Final | 371.5 | | 1470 | 10 | 11.0 | 370.5 (emergency) | 8 | varies |
| **Process Water Management** | | | | | | | | | | | |
| **Water Management Pond (WMP)** | WMP Dam 1 | Homogeneous | Final | 371.5 | 4.2 | 850 | 10 | 4.0 | 370.5 (emergency) | 8 | 3.6 |
| | WMP Dam 2 | | | 371.5 | 9.5 | 800 | 10 | 5.5 * | | | |
| | WMP Dam 3 | | | 371.5 | 13.3 | 750 | 10 | 9.2 * | | | |
| | Settling Pond | | | 371.5 | | 550 | 5 | 4.0 | n/a | | 3.6 |
| **Mine Rock Pond** | Mine Rock Pond | Central core | Final | 360.2 | 13.0 | 1655 | 10 | 11.0 | 358.9 (emergency) | 80 | 3.4 |
| **Freshwater Diversion** | | | | | | | | | | | |
| **Clark Creek Diversion** | Clark Creek | Homogeneous | Final | 380.0 | 2.0 | 285 | 6 | 5.5 * | 379.9 | 6 | 1.3 |
| | Teeple Road | Homogeneous | Final | 379.0 | 5.0 | 465 | 6 | 6.0 * | 378.7 | 6 | 0.5 |
| **West Creek Diversion** | Stockpile Pond | Central core | Fianl | 375.5 | 9.8 | 380 | 6 | 6.5 * | 372.3 | 20 | 3.2 |
| | West Creek | Central core | Final | 364.9 | 8.9 | 750 | 10 | 7.9 * | 360.9 | 8 | 3.9 |
| **Sediment Control** | | | | | | | | | | | |
| **Water Discharge Pond (WDP)** | Water Discharge Pond | Homogeneous | Final | 355.2 | 2.2 | 350 | 6 | 4.0 | 354.2 | 5 | 1.0 |
| **Constructed Wetlands** | Pond A | Homogeneous | Final | 347.5 | 1.5 | 715 | 5 | 3.0 | 347 | 50 | 0.5 |
| | Pond B | | | 349.0 | 2.0 | 840 | | | 348.5 | | 0.5 |
| | Pond C | | | 350.5 | 2.5 | 1015 | | | 350 | | 0.5 |
| | Pond D | | | 351.5 | 1.5 | 305 | | | 351 | | 0.5 |
| | Pond E | | | 352.5 | 1.5 | 190 | | | 352 | | 0.5 |
| **West Mine Rock Stockpile** | Sediment Pond #1 | Central core | Final | 354.0 | 3.8 | 1750 | 6 | 4.0 | 353.7 (emergency) | 60 | 0.8 |
| | Sediment Pond #2 | Homogeneous | Final | 348.2 | 5.2 | 1460 | 6 | 4.0 | 348 (emergency) | 115 | 2.2 |
| | Temporary Sediment Pond | Homogeneous | Final, temporary | 348.6 | | 600 | 6 | 4.0 | 348.5 (emergency) | 60 | 0.6 |

**Notes:**

1) Refer to the relevant design reports for design details.
2) Normal freeboard is the height between the normal pond level and dam crest
3) Emergency spillways are noted in parenthesis for contact water ponds that require Environmental Design Flood (EDF) containment. Otherwise, spillways are working or overflow spillway.
4) Inclinations with an asterisk (*) include toe berms

## 4.2 Tailings Management Area

Design criteria, including mill throughput, used in the design of the TMA dams is summarised in the follow table. Subsequent sections describe tailings cells 1, 2 and 3 and associated seepage collection systems and supporting infrastructure.

Testing carried out in 2012 for the feasibility study determined that the tailings are non-plastic, predominantly silt sized particles, with 71% of the particles passing the 0.075 mm sieve. The specific gravity is 2.82. Column settling tests (undrained and drained) support a deposited void ratio of 1.0 for deposition planning purposes, inferring a dry density of about 1.4 t/m$^3$. This is quite typical for hard rock gold tailings. A much more conservative dry density of 1.1 t/m$^3$ was adopted for the design of the initial start-up cell due to the small footprint and relatively rapid filling.

**Table 4-3; Mill and Tailings Operating Data used for design**

| Revision G | Symb ol | Source | Total | Years 1 - 4 | Years 4 - 14 | Units (metric) |
|---|---|---|---|---|---|---|

| | | | | Total | Total | Total | |
|---|---|---|---|---|---|---|---|
| **Operating data provided (design criteria)** | | | | | | | |
| **Ore production** | | | | | | | |
| Resource - Open Pit | | A | New Gold | 100.1 | 53.4 | 46.7 | Mt |
| - underground | | B | New Gold | 4.2 | 0.5 | 3.7 | Mt |
| Design production rate *(while operating)* | | C | BBA | | 21,739 | 21,739 | t/day |
| Mill availability *(% of the time the Mill operates)* | | D | BBA | 92 | | | % |
| Nominal production rate | | E | C x D | | 21,000 | 21,000 | t/day |
| **Tailings production** | | | | | | | |
| Tailings / ore ratio | | F | BBA | 1.0 | | | |
| Slurry density in the Mill | | $s_o$ | BBA | | 50.0 | 50.0 | % solids |
| Discharge slurry percent solids (*mass of solids / total mass)* | | $s_d$ | BBA | | 46.7 | 46.7 | % solids |
| **Tailings properties** | | | | | | | |
| Specific gravity of solid tailings particles | | $G_s$ | AMEC | | 2.82 | 2.82 | - |
| Void ratio of deposited tailings *(vol. of voids / vol. of solids)* | | e | AMEC | | 1.0 | 1.0 | - |
| **Flows affecting the Mill water balance** | | | | | | | |
| - Moisture content of the ore entering the Mill (mass of water/mass of solids) | | G | New Gold | 3.0 | | | % |
| - Freshwater for glands & reagent mixing *(per ton of ore)* | | H | AMEC M&M | 0.08 | | | $m^3$/ t |
| - Evaporation and spillage losses in the Mill (*per ton of ore)* | | I | assumed | 0.02 | | | $m^3$/t |
| **Calculated data (design parameters)** | | | | | | | |
| **Project design life** | | J | (A ) / (E x 365) | 13.5 | 7.0 | 6.6 | years |
| **Tailings production** | | | | | | | |
| - Nominal tailings production | daily | K | E x F | | 21,000 | 21,000 | t/d |
| | monthly | | E x F x 30 | | 630,000 | 630,000 | t/mo |
| | annual | | E x F x 365 | | 7,665,000 | 7,665,000 | t/y |
| | total | | E x F x 365 x J | 103.8 | 53.4 | 50.4 | Mt |
| **Deposited tailings** | | | | | | | |
| - Dry density | | $r_d$ | $G_s$ / (1+e) | | 1.41 | 1.41 | t/$m^3$ |
| - Volume | daily | L | K / $r_d$ | | 14,894 | 14,894 | $m^3$/d |
| | monthly | | | | 446,809 | 446,809 | $m^3$/mo |
| | annual | | | | 5,436,170 | 5,436,170 | $m^3$/y |
| | total | | A+B/$r_d$ | 73.96 | 38.19 | 35.77 | M-$m^3$ |
| - Water content (at 100% saturation) *(mass of water/mass of solids)* | | w | e / $G_s$ x 100 | | 35.5 | 35.5 | % |
| - Water retained in voids | daily | M | K x w | | 7,447 | 7,447 | $m^3$/d |
| | monthly | | | | 223,404 | 223,404 | $m^3$/mo |

newgold Rainy River

| | | | | | | |
|---|---|---|---|---|---|---|
| annual | | | | 2,718,085 | 2,718,085 | $m^3/y$ |
| **Mill water balance** | | | | | | |
| - Water in ore entering the Mill | N | E x G x 30 | | 18,900 | 18,900 | $m^3/mo$ |
| - Freshwater for glands and reagent mixing | O | E x H | | 51,881 | 51,881 | $m^3/mo$ |
| - Water leaving the Mill with the tailings | P | (K / s) - K | | 719,036 | 719,036 | $m^3/mo$ |
| - Losses in the Mill | Q | E x I | | 12,600 | 12,600 | $m^3/mo$ |
| - Make-up water required to balance the Mill | R | P + Q - N - O | | 677,326 | 677,326 | $m^3/mo$ |

### 4.2.1 TMA Cell 1

The purpose of Cell 1 is to allow for the deposition of tailings, outside of fish bearing waters i.e., no MMER Schedule 2 requirement. Cell 1 has been designed to contain 3.3 $Mm^3$ of tailings, or 6 months storage capacity. The dam has a 'very high' hazard potential classification equivalent to extreme hazard classification by the CDA. The design information for Cell 1 is within RRP-GEO-LRIA-004C August, 2016 and the design brief is RRP-GEO-REP-008 R2. A summary of design characteristics is provided in the table below. The IDF for spillway and design is the 24h PMF (516 mm) and the EDF is the 100 year 30 day event. The facility creates a ring dam therefore reducing inflows and water management requirements. As the TMA is raised in stages over the life of mine the cell will become encapsulated within the ultimate TMA facility requiring no change to the closure plan.

The Cell 1 will have a crest elevation of 371.5 masl, and consists of (also see Table 4-4):

- a continuous raise of the TMA south starter dam from elevation 366.5 masl to 371.5 masl between stations 0+000 to 0+800;
- a raise of the TMA west dam (WMP dam 4) from 366.5 masl to 371.5 masl between stations 1+000 to 1+900; and
- a standalone internal containment dam also built to elevation 371.5 masl.

**Table 4-4; Summary of Cell 1 Dam Characteristics**

| | Spillway Invert Elevation (m) | Dam Crest Elevation (m) | Minimum Ground Elevation[1] ($m^3$) | Maximum Height (m) | Length (m) | Dam Fill Volume (incremental) ($Mm^3$) |
|---|---|---|---|---|---|---|
| TMA Start-Up Cell Dam | 370.5 | 371.5 | 360.0 | 11.5 | 1,500 | 1.17 |
| TMA South Dam - Stage 1 | | 371.5 | 365.0 | 6.5 | 800 | 0.24 |
| TMA West Dam - Stage 1 | | 371.5 | 363.0 | 8.5 | 700 | 0.19 |

Notes:
1 Minimum ground elevation noted is original ground

The TMA start-up cell will have a normal operating water level (NOWL) of approximately 369.90 masl at the conclusion of six months of production, which corresponds to the operational pond volume of 200,000 $m^3$. Once the water level rises above the NOWL it must be pumped from the TMA start-up cell to the WMP at a rate of approximately 57,000 $m^3$/day, to maintain sufficient capacity to contain the EDF event. Due to the limited storage in the TMA start-up cell at this point in mine operations, no operating range can be allowed (i.e., any water above the NOWL must be pumped immediately). The TMA Cell 1 spillway has an invert elevation of 370.5 m and a base width of 8 m. The spillway discharges north into TMA Cell 2.

The primary dam construction materials are mine waste rock and select clay (overburden) obtained from a local borrow or from open pit development. The TMA South and West Dam have a clay core with select or processed sand filter/drain zones provided downstream of the core and above the foundation to inhibit the migration (piping) of fine-grained soils under seepage forces. The TMA Start-Up Cell Dam has an upstream bituminous liner to minimize seepage.

Work on Cell 1 is scheduled to be completed in late August with tailings deposition commencing in September 2017, pending approval from MNRF.

### 4.2.2 TMA Cell 2

The purpose of Cell 2, is to allow for continued operations and tailings deposition, following filling of Cell 1, as the ultimate TMA dams are constructed. TMA Cell 2 has been designed to provide containment for 12 months of tailings deposition based on the design criteria provided in this section (Table 4-1). The dam has a ‘very high’ hazard potential classification equivalent to extreme hazard classification by the CDA. The Design brief for Cell 2 dam is within RRP-GEO-REP-026 R1 Design Brief, April 28, 2017. A summary of dam characteristics is provided in the table below (Table 4-5). The IDF for spillway and design is the 24h PMF (516 mm) and the EDF is the 1:100 year 24h (127 mm) for containment below the spillway. The 19 m wide spillway with an invert of 364.70 is located in the north starter dam.

The TMA Cell 2 Dam has a crest elevation of 366.5 m which is equal to the crest elevation of the TMA Starter Dams and north starter dam forms part of the containment for tailings deposition. The cell provides containment for approximately 5.5 Mm3 of tailings. The facility is bounded by natural topography (high ground) in the north and by impoundment dams along the remaining perimeter. The facility will be encapsulated during the life of mine when the TMA Stage 2 raise (elevation 371.5 m) is constructed.

The dam section is a central clay core embankment with rockfill shells and a crest elevation of 366.5 m. Sand filter and transition zones are provided downstream of the clay core and a partial blanket beneath the downstream shell. The dam section requires shallow side slopes due to the characteristics of the foundation soils. Clean (NPAG) rockfill is required for construction of the downstream shell. Any rockfill (NPAG or PAG) may be used for construction of the upstream shell (outside Loslo Creek). Given the Schedule 2 approval schedule, 2x1600mm culverts will be placed in Loslo Creek until the approval is received, then these will be grouted and sheet piling used to close the dam.

Work on the dam is scheduled between approval (August) and December for clay placement, and sheet piling across Loslo Creek to be completed in 1Q2018, pending MMER Schedule 2 approval.

**Table 4-5; Summary of Dam Characteristics for Cell 2**

| Tailings Management Area Dam | Spillway Invert Elevation (m) | Dam Crest Elevation (m) | Minimum Ground Elevation[1] (m³) | Maximum Height (m) | Length (m) | Dam Fill Volume[2] (Mm³) |
|---|---|---|---|---|---|---|
| Start-Up Cell Dam (Cell 1 Dam) | 364.7 | 371.5 | 360.0 | 11.5 | 1,500 | - |
| North Dam – Stage 1 | | 366.5 | 363.5 | 3.0 | 1,100 | - |
| West Dam (0+000 to 1+000) | | 366.5 | 363.5 | 3.0 | 600 | - |
| West Dam (1+000 to 1+900) | | 371.5 | 363.0 | 8.5 | 650 | - |
| South Dam (0+000 to 0+800) | | 371.5 | 365.0 | 6.5 | 800 | - |
| South Dam (0+800 to 1+250) | | 366.5 | 364.5 | 2.0 | 300 | - |
| Cell 2 Dam | | 366.5 | 356.0 | 10.5 | 900 | 0.47 |

Notes:
1 Minimum ground elevation noted is original ground.
2 Incremental fill volume to currently permitted structure.

### 4.2.3 TMA Cell 3

TMA cell 3 is a component of the ultimate TMA bounded by the TMA south starter dam and the Cell 2 dam. Cell 3 will provide containment for tailings/water for approximately 6 month (April to October 2019 prior to adjoining with Cell 2 through a spillway as part of the overall TMA.

The TMA south starter dam is will be built to 366.5 m and has a 'very high' hazard potential classification equivalent to extreme hazard classification by the CDA. The design brief for TMA dams is within Detailed Design Brief Design Brief - Tailings Management Dams 3098004-004000-A1-ETR-0006-00, July, 2014. This was revised following review by the ITRB and, for the starter dams, little design change was required to the 10:1 downstream slopes and the 4:1 upstream slopes (RRP-GEO-MEM-006 Rev 1). A summary of design characteristics is provided in design brief and in the summary table in this section. The IDF for spillway and design is the 24h PMF (516 mm) and the EDF is the 1:100 year 30 day event for containment below the spillway.

When full containment in the TMA is available (i.e. TMA South Dam is constructed to elevation 366.5 m), tailings will be discharged from the north side of the TMA South Dam (upstream slope).

An overflow spillway will connect TMA Cell 2 and 3 to allow for water reclaim during this period of operation. As tailings are discharged from the TMA South Dam, starting in April 2019 (approx.) the pond level in the cell will continue to increase until the water begins to passively overflow at elevation 364.5 m into TMA Cell 2. The TMA Cell 3 Overflow Spillway has an invert elevation of 364.5 m and a base width of 19 m. The spillway will allow TMA Cells 2 and 3 to act as one pond above this invert elevation.

### 4.2.4 Seepage Collection System

Seepage collection systems have been designed consistent with permitting requirements (MOECC ECA #5178-9TUPD9) to contain seepage and a 1:25 yr 24h storm event (102 mm). However, seepage and runoff reporting to the MRP, from the EMRS and LGOS, is through ditching designed for a 1:100 yr 24h storm event, also consistent with the ECA approval. There is no requirement for seepage collection from the MRP, however, as noted elsewhere in this manual (section 5) the MRP will be managed with a minimum water level to reduce seepage and dewatered in winter to 5,000 $m^3$.

Seepage collection systems may be modified during construction, however the design criteria will not be reduced.

#### 4.2.4.1 Cell 1

Cell 1 seepage collection is based on continuous ditches reporting to sumps and pump back. Cell 1 seepage details are outlined in RRP-GEO-MEM-043-R1. Seepage to the south east (through WMP Dam 4) is part of inflows to the WMP and managed as part of the WMP water.

Three sumps are proposed with the base of the sump 1 to 2 m below grade to allow for the incoming ditch invert. Combined seepage flow to these sumps is 29 $m^3$/day and final dimensions are being field fitted. Where required, the downstream side of the ditches will be raised to 362.0 m to prevent back flooding from Loslo Creek. Pumping sizing is intended to drain the sumps within 5 days.

**Table 4-6; TMA Cell 1 Seepage Collection Sumps**

| Parameter | Sump 1 | Sump 2 | Sump 3 |
|---|---|---|---|
| Location | North side of cell 1 | East side of cell 1 | South of TMA south dam |
| Seepage flow ($m^3$/day) | 12 | 7 | 10 |
| Runoff ($m^3$/day) | 9,321 | 4,113 | 5,257 |
| Ditch steady flow ($m^3$/day) | 200 | 117 | 173 |
| Storage volume required ($m^3$) | 9,532 | 4,237 | 5,440 |
| Pump capacity ($m^3$/day) | 2,500 | 1,000 | 1,500 |

#### 4.2.4.2 Cell 2

Seepage from cell 2 dam has been estimated to be approximately 9.2 $m^3$/day when the cell is at capacity (364.7 m). Until the TMA south dam is completed i.e., Marr and Loslo Creek are impounded this seepage will be collected and pumped back into Cell 2, as such Cell 2 seepage management is temporary. Sumps and ditching have been designed for a 1:25 year event, consistent with seepage collection commitments;

- Seepage collection sump will be built with ~8,000 $m^3$ of live storage (NWL 354.0, MOWL 355.5)
- Minimum pumping capacity 1,600 $m^3$/day to dewater sump in 5 days

Seepage from the north starter dam, is estimated at 0.02 to 0.03 m3/day/m per metre run of dam which will be captured in WMP sump 3.

#### 4.2.4.3 Cell 3

Cell 3 is not anticipated to impound tailings until April 2019 and as such seepage is not anticipated until after this time. Seepage from the south starter dam, is estimated at 0.02 to 0.03 m3/day/m per metre run of dam which will be directed via ditching to the water discharge pond, or if necessary pumped back.

#### 4.2.4.4 WMP

Seepage from the WMP, similar to other dams is designed to be collected in ditches, routed to sumps and pumped back to the WMP. The ditches are designed to convey the 1:25 yr 24h event with flows typically around 5 m$^3$/s and up to 8.3 m$^3$/s. The ditches have 1 m bottom width, 3:1 slopes and up to 2 m flow depth. The following table provides a summary of the sumps.

**Table 4-7; WMP Seepage Collection Sumps**

| Parameter | Sump 1 | Sump 2 | Sump 3 |
|---|---|---|---|
| Location | Dam 2 | Dam 3 | North of WMP by North starter dam |
| NWL | 359.5 | 358.0 | 361.5 |
| MOWL | 361.1 | 360.2 | 364.0 |
| Storage volume required (m$^3$) | 18,200 | 11,800 | 20,000 |
| Pump capacity (m$^3$/day) | 4,000 | 2,500 | 3,500 |
| Note; Sump 3 to be expanded in 2018 to include seepage from North Dam – Cell 2 | | | |

### 4.2.5 Supporting Infrastructure

Site infrastructure have been constructed with locally available materials produced through the development of the Open Pit or quarrying sand/gravel deposits and bedrock. Figure 3-1 shows the general arrangement of the RRM, including site and haul roads, laydown areas, and stockpiles.

#### 4.2.5.1 Pipelines

There are five pipeline corridors used to transfer tailings, fresh water, and reclaim water on site. Drawing 100126-4500-DD10-PIP-0001.001 shows the key plan of the tailings and reclaim pipelines that interact with the plant site. Drawing 100126-6200-DD10-PIP-0001.001 shows the key plan of the Pinewood Pipeline used for effluent discharge (see Appendix B).

- Tailings Pipeline: the tailings pipelines are 4,000 m in length between the Mill and the TMA and are used to transfer tailings to the TMA for discharge. The tailings line is contained within a lined corridor with six emergency dump ponds. The line is with in additional containment over West Creek and its tributaries.
- TMA Reclaim Pipeline: the TMA reclaim pipeline is 4,000 m in length between the TMA and the Mill and is used to transfer mill make-up water. The reclaim line is contained within a lined corridor with six emergency dump ponds. The line is with in additional containment over West Creek and its tributaries.
- MRP Reclaim Pipeline: The MRP reclaim pipeline is 1,750 m in length between the MRP and the Mill and is used to transfer mill make-up water.
- Open Pit Pipeline: The Open Pit pipeline is 1,400 m in length between the Open Pit and the MRP and used to transfer pit dewatering to the MRP.
- TMA Transfer Pipeline: The TMA transfer pipeline is 2,300 m in length between the TMA and the WMP and are used to transfer TMA surplus water to the WMP.
- WMP Freshwater Pipeline: The WMP freshwater pipeline is 4,000 m in length between the WMP and the plant site and used to transfer freshwater to plant site infrastructure and the Mill (if required).

- Pinewood Pipeline: The Pinewood pipeline is 10,300 m in length between the WMP and the Pinewood Pumphouse. It is used to discharge WMP effluent into the Pinewood River.

#### 4.2.5.2 Utilities

The following utilities are used on site:

- Power to the plant site is provided by 230 kV transmission lines that are connected to Hydro One northwest of the site at a Switching Station;
- The main 230 kV substation is located near the concentrator building to provide power to the process equipment via underground supply lines. Power to the remainder of the site is provided by a network of overhead power lines fed from the main substation; and
- Site telecommunications and Process Control are distributed via fiber optic lines.

#### 4.2.5.3 Tailings Distribution Systems

Mill tailings are produced and detoxified in a cyanide destruction circuit as shown on the process flow diagram 100126-3200-DC00-PFD-0017 (Appendix B). Pipelines to the TMA are shown on the process flow diagram 100126-3200-DC00-PFD-0022 (Appendix B). Tailings are beached from the TMA dams. A wide beach against the dams enhances safety and reduces seepage.

#### 4.2.5.4 Water Circulation Systems

Appendix B contains supporting information for the pumping requirements and design of pumps and pipelines. Mill make-up water is provided from the TMA and MRP. The TMA reclaim recirculates water from the mill after the tailings solids have settled in the TMA. The MRP reclaim pumps water collected from the EMRS and Open Pit/future underground mine. Mill make-up water will be preferentially pumped from the MRP with the TMA supplying the remainder of make-up water.

Freshwater pipelines transfer water to the Plant site for the freshwater requirements at the Mill, as well as to provide water to the truck filling station, truck shop, truck wash facility, and fire water tank. Surplus water in the WMP may also be pumped to the Pinewood Discharge Structure for discharge into the Pinewood River. Details on effluent discharge via the Pinewood Pipeline are described in Section 4.4.

#### 4.2.5.5 Mill Make-up Water Supply

Mill make-up water is provided by reclaim from the WMP, TMA cells and MRP. The reclaim water from the TMA is pumped from the central pond using the following three pumps:

**Table 4-8; Make up water supply pump ID and capacity**

| Equipment ID | Name | Capacity |
|---|---|---|
| 4520-PU-0023 | Process Plant Pumps | 1,350 $m^3$/hr |
| 4520-PU-0024 | Process Plant Pumps (Standby) | 1,350 $m^3$/hr |
| 4520-PU-0025 | WMP Pump | 1,516 $m^3$/hr |

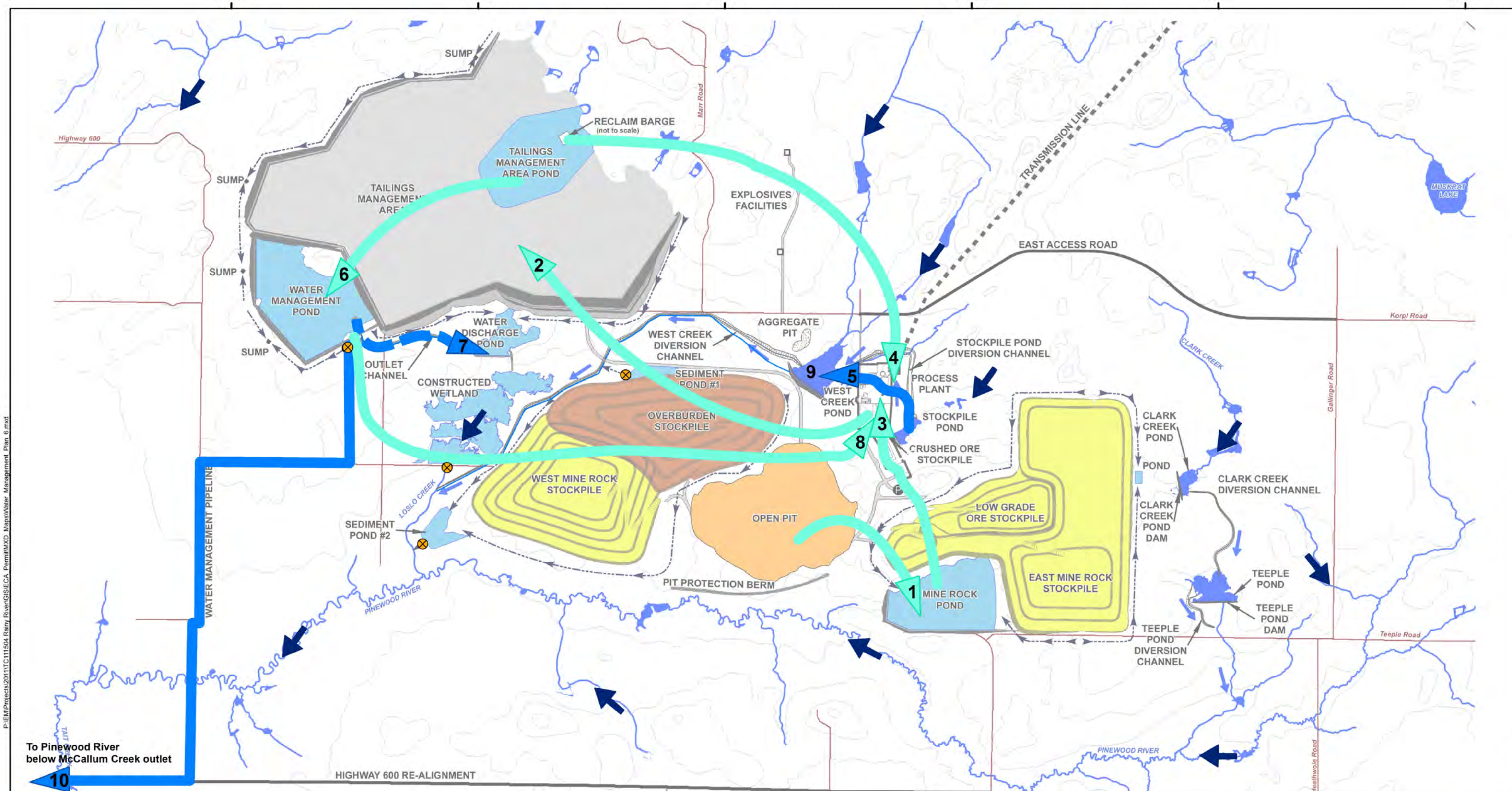
Reclaim water from the MRP is pumped using the following two pumps.

| Equipment ID | Name | Capacity |
|---|---|---|
| 2590-PU-0030 | Mine Rock Pond Water Pump | 680 $m^3$/hr |

| | | |
|---|---|---|
| 2590-PU-0030 | Mine Rock Pond Water Pump | 680 $m^3$/hr |

### 4.3 Process Water and Water Management

Summary of the process water is shown in Figure 4-1 – process flow diagram water flow sheet. Appendix B includes process flow diagrams. Appendix E includes the process water balance for the TMA and WMP includes TMA cells 1, 2 and 3.




**LEGEND**

- Integrated Water Recycle
- Excess Water Discharge
- General Surface Water Flow Direction
- Final Compliance Point

| ID (on this Figure) | Flow | | Method | Purpose | Control Logic |
|---|---|---|---|---|---|
| | From | To | | | |
| 1 | Open Pit | Mine Rock Pond | Pumped | Dewatering of the Open Pit | Rate to match inflows (lower bench may flood during storm events). |
| 2 | Process Plant | TMA | Pumped | Tailings slurry discharge. | Pumped at fixed rate. |
| 3 | Mine Rock Pond | Process Plant | Pumped | Process Plant Make-up. | Fixed rate with on/off float switch at minimum pond level. |
| 4 | TMA | Process Plant | Pumped | Process Plant Make-up. | Pumped at fixed rate adjusted according to Mine Rock Pond supply. |
| 5 | Stockpile Pond | West Creek Pond | Gravity | Divert clean runoff. | Free draining to match inflow. |
| 6 | TMA | Water Management Pond | Pumped | Seasonal transfer. Net annual inflow to the system. | Transfer net annual inflow after effluent is released from the Water Management |
| 7 | Water Management Pond | Water Discharge Pond /Constructed Wetland | Gravity | Discharge treated effluent to the Pinewood River via the constructed wetland. | Seasonal discharge to constructed wetland (all months except Feb./March) for added treatment and maintain Pinewood River flows. |
| 8 | Water Management Pond | Process Plant | Pumped | Mill process fresh water and make-up requirements | Pumped at variable rates as needed. |
| 9 | West Creek Pond | Potable | Pumped | Provide potable water | Pumped at variable rates as needed. |
| 10 | Water Management Pond | Pinewood River / McCallum Creek | Pumped | Discharge treated effluent to the Pinewood River. | Discharge treated effluent to the Pinewood River. |

0 1.25 2.5 5 7.5 10 Kilometres

NOTES:
- Nominal monthly pump rates indicate on figure are based on average annual conditions.
- Pump rates are provided on table 9

Datum: NAD83
Projection: UTM Zone 15N

newgold Rainy River Project amec

**RAINY RIVER PROJECT**

**Process Water Flow Schematic**

PROJECT N°: TC111504 | FIGURE: 4-1

SCALE: 1:37,500 | DATE: August 2014

P:\EM\Projects\2011\TC111504 Rainy River\GIS\ECA_Permit\MXD_Maps\Water_Management_Plan_6.mxd

### 4.3.1 Water Management Pond

The WMP collects runoff from direct drainage area, pumping from the Pinewood River and receives transfer from TMA. Initially the WMP will be utilized to build an inventory of 3.8 $Mm^3$ of water required for mill start-up and process operations. The start-up inventory of water will be provided by pumping from the Pinewood River via the pinewood pipeline.

WMP is made up of 5 dams with a crest of 371.5 m and MOWL of 369.7 m. The dams have a 'very high' hazard potential classification equivalent to extreme hazard classification by the CDA. As-built details will be provided in the WMP as-built report to be issued following construction completion. The IDF is 24h PMF with the emergency spillway invert at 370.5 m in bedrock on the north end of dam 5 into cell 2 / Loslo Creek catchment.

All the WMP dams were completed to their final crest elevation in July 2017 and EOR confirmation of compliance was completed on July 27, 2017. The WMP has been developed in accordance with the design details presented in the following documents and drawings. As-built details will be provided in the *WMP As-built Report*, which will be issued within 90 days of construction completion.

The design basis for the WMP includes, but is not limited to, the following;

- Minimum operating volume of 1.0 $Mm^3$ (i.e., dead storage below the intake for the pumps to the mill); and
- Maximum operating volume of 5.0 $Mm^3$;

The WMP will discharge via pumping to the Water Discharge Pond (except in winter); and pumping surplus effluent, above 10,000$m^3$/day, to the Pinewood River (spring and fall). The design criteria for the WMP dams are summarized in section 4.1.

Construction of the WMP began in September 2015 and finished in July 2017. Approval to proceed with the Intermediate Stage of filling to 364.5 m was granted by MNRF in April, 2017. Approval is pending to raise the fill level above 354.5 m to the ultimate elevation, as discussed in section 5.

#### 4.3.1.1 Freshwater Taking from the Pinewood

The Pinewood Water Intake/Discharge Structure is located along the Pinewood River on the outside of a meander bend. The pumphouse is used for the initial filling of the WMP, after which it becomes a discharge structure used to discharge effluent from the WMP.

The Pinewood Water Intake/Discharge has been constructed to support the requirements of the *Water Management Plan for Operations* (Amec Foster Wheeler, 2015a). These features are illustrated in the following drawings:

| Drawing Title | New Gold Drawing Number |
|---|---|
| Pinewood Water Intake/Discharge Earthworks – General Arrangement | 3098004-006200-A1-D20-0002 |
| Pinewood Water Intake/Discharge Earthworks - Channel | 3098004-006200-A1-D70-0003 |

The Pinewood Pump House structural and mechanical details are illustrated in the following General Arrangement Drawings:

| Drawing Title | New Gold Drawing Number |
|---|---|
| Pinewood River Water Intake Pipeline – Key Plan | 100126-6200-DD10-PIP-0001.001 |
| Mechanical General Arrangement Pinewood River Pump Station Plan | 100126-6200-DE10-GAD-0002.001 |
| Mechanical General Arrangement Pinewood River Pump Station Elevation | 100126-6200-DE10-GAD-0003.001 |
| Pinewood Water Intake Structure Structural General Arrangement | 100126-6200-DT00-GAD-0003.001 |
| Pinewood Water Intake/Discharge Mechanical General Arrangement | 100126-200-DT00-GAD-0004.001 |
| Piping General Arrangement Pinewood River Pump Station Plan and Section | 100126-6210-DE20-GAD-0001.001 |
| General Arrangement Pinewood River Pumphouse Grounding Plan | 100126-6210-DF00-GAD-0001.001 |

### 4.3.2 Mine Rock Pond

The Mine Rock Pond has been designed to collect runoff and seepage from the East Mine Rock Stockpile (EMRS), Low Grade Ore Stockpile (LGOS), and dewatering from the Open Pit and future underground mine. The MRP design details are summarized in the following documents and drawings with the latest revision RRP-GEO-MEM-019 R0 – AMECFW 2016h. The dam has a 'very high' hazard potential classification equivalent to extreme hazard classification by the CDA. As-built details will be provided in the MRP as-built report to be issued 90 days following construction completion.

| Document Title | Reference |
|---|---|
| Design Brief – Water Management Dams | (Amec Foster Wheeler, 2015b) |
| Mine Rock Pond Dam – Design Revision and Operating Guidelines | (Amec Foster Wheeler, 2016h) |
| MRP As-built Report | TBD |
| **Drawing Title** | **New Gold Document Number** |
| Mine Rock Pond Dam – Typical Cross Section | 3098004-002590-A1-D70-0004 |
| Interim Mine Rock Pond – Plan, Cross Sections, and Details | 3098004-002590-A1-D50-0006 |

The design criteria for the MRP ultimate dams are summarized in section 4.1. Typical dam cross sections are provided on Drawings 3098004-002590-A1-D70-0004 for the MRP ultimate dam. The design basis for the MRP includes, but is not limited to, the following:

- 24h PMF and 1:100 year 30 day storm
- Maximum operating water volume: 0.5 $Mm^3$;
- Maximum water stored: 1.3 $Mm^3$;
- Minimum operating water volume: 0.05 $Mm^3$;
- Constructed from local materials as a clay core and rockfill embankment; and
- Decant pumping to the Mill via pipeline is at a rate of up to 680 $m^3$/hr.

The dam crest elevation is 360.2 m with an emergency spillway invert of 358.9 m. The available pond storage at the emergency spillway invert is reduced to 1.3 $Mm^3$. The MRP pumps will pump 680$m^3$/hr, and run continuously until the pond is empty. This 30% increase to the pumping rate and change in pumping philosophy means the normal pond will range between 5000 $m^3$ and about 525,000 $m^3$ depending on the open pit dewatering pump capacity. The larger decant pumps also mean that the EDF capacity required in the MRP is 775,000 $m^3$. The Maximum Operating Water Level (MOWL) in the MRP has been set at elevation 356.8 m (525,000 $m^3$).

Completion of the Mine Rock Pond Dam commenced in 2015, and with a hiatus in 2016, is expected to be completed in the fall of 2017. Until the dam is complete, runoff and seepage water from the EMRS will be diverted to the temporary Sediment Pond system located within the north portion of the ultimate MRP footprint and discharged to the remnant Clark Creek.

### 4.4 Water Treatment

At the time of preparation for this revision the constructed wetland and sediment ponds 1 and 2 have not been constructed or received all regulatory approvals. Based on the anticipated MMER schedule 2 approval timing, construction of these facilities is planned for 2018. The following section provides a summary of their design and intended operation, which is intended to be updated on receipt of all regulatory approvals.

#### 4.4.1 Water Discharge Pond and Constructed Wetland

The Water Discharge Pond (WDP) has been designed to collect runoff from natural ground catchment south of the TMA, seepage from the seepage collection ditch, and bleed flow from the WMP (design rate of 10,000 $m^3$/day) for discharge to the constructed wetland. The WDP will also provide sediment control south of the TMA.

The constructed wetlands collect the water discharged from the WDP. They have been designed to provide a target 30-day retention time following discharge from the WDP. The wetlands are comprised of five ponds (Pond A, B, C, D, E), and the downstream pond (Pond A) will feature a control structure to stop discharge if the water quality does not meet discharge criteria. If required, water in Pond A would be pumped back to the TMA or WMP.

The design criteria for the Water Discharge and constructed wetland dams and ponds are provided in Tables 4-3 and 4-5, respectively. Further design details and typical cross-sections of the effluent dams are provided in the following documents:

**Table 4-9; Water Discharge Pond and Constructed Wetland Documents**

| Document Title | Reference |
|---|---|
| *LAKES AND RIVERS IMPROVEMENT ACT*<br>WORK PERMIT APPLICATION SUPPORT DOCUMENT<br>WATER DISCHARGE POND AND CONSTRUCTED WETLAND | RRP-GEO-LRIA-004D R2 |
| As-built Report(s) | TBD |
| **Drawing Title** | **New Gold Document Number** |
| Water Discharge Pond Dam – Plan and Typical Cross Sections | 3098004-004410-A1-D70-0002 |
| Constructed Wetland – Plan, Profiles & Section | 3098004-004420-A1-D70-0002 |

### 4.4.2 Sediment Ponds 1 & 2

Sediment Ponds #1 and #2 collect seepage and runoff from the West Mine Rock Stockpile (WMRS) to allow for settlement of Total Suspended Solids (TSS). The sediment ponds have been designed to provide a 12-day hydraulic retention time. Sediment Pond #1 will also receive overflow water from the West Creek Overflow Weir during large storm events. Critical to the function of the sediment ponds is progressive reclamation. The ponds have been designed to meet the retention time objectives for Year 3 of mine operations. Further details on design are provided in the following documents:

**Table 4-10; Sediment Ponds 1 and 2 Design Detail Documents**

| Document Title | Reference |
|---|---|
| LAKES AND RIVERS IMPROVEMENT ACT WORK PERMIT<br>APPLICATION SUPPORT DOCUMENT SEDIMENT PONDS | RRP-GEO-LRIA-012 R1 |
| As-built Report | TBD |
| **Drawing Title** | **New Gold Document Number** |
| Sediment Pond #1 – Sections & Details | 3098004-004430-A1-D70-0002 |
| Sediment Pond #2 – Plan, Cross Sections, and Details | 3098004-004440-A1-D70-0002 |

After 2018, progressive rehabilitation would be required to reduce the sediment load on the ponds, or the ponds could be increased in size. After 3 years of mine operations, a better estimate of sediment loading from the stockpile area should be available to adequately design for additional area as required.

Seepage collection ditches will be constructed around the Overburden and NPAG stockpiles to convey runoff to the sediment ponds. The ditches will be constructed to minimize erosion protection requirements where practically possible. Flows may also be directed to the ponds using road side ditches.

Good engineering practices for placement, sediment and erosion control will be adopted for the management of the overburden pile to help reduce the sediment load and increase the chance that settling alone (as opposed to the addition of coagulants and flocculants) can be used for settling out the TSS. These practices include pre-settling ponds that are regularly cleaned out, construction of ditches with appropriate slopes, maintenance of the ditches, and progressive re-vegetation of the overburden stockpile.

## 4.5 Freshwater Diversion Dams and Channels

The freshwater ponds are designed to minimize the net freshwater inflows into the project by diverting non-contact runoff around the site via dams, ponds and diversion channels. The West Creek Pond, Clark Creek, Stockpile Pond and Teeple Road dams were developed in a single dam raise during the construction phase to support the requirements of the *Water Management Plan for Operations* (Amec Foster Wheeler, 2015a). Additional details regarding these dams, ponds, and diversion channels are provided in section 4.1.

The freshwater diversion structures have been developed in accordance with the following design briefs. As-built reports have been issued. A detailed list of Drawings is provided in Appendix A.

**Table 4-11; Supporting Documents for the West Creek and Clark Creek Diversions**

| Document Title | Reference |
|---|---|
| Design Brief – Water Management Dams | (Amec Foster Wheeler, 2015b) |
| Design Update – Clark Creek Pond Dam | (Amec Foster Wheeler, 2016i) |
| Stockpile Pond Dam – Design Revision and Operating Guidelines | (Amec Foster Wheeler, 2016j) |
| West Creek Dam – Design Revision and Operating Guidelines | (Amec Foster Wheeler, 2016k) |
| Clark Creek Diversion – As-built Report | (Amec Foster Wheeler, 2017a) |
| West Creek Diversion – As-built Report in preparation | (Amec Foster Wheeler, 2017b) |
| **Drawing Title** | **New Gold Document Number** |
| West Creek Pond Dam – Layout and Foundation – Plan & Details | 3098004-002510-A1-D50-0001 |
| West Creek Diversion Channel – Plan and Profile | 3098004-002510-A1-D50-0003 |
| Stockpile Pond Dam – Plan, Typical Section and Profile | 3098004-002580-A1-D70-0002 |
| Stockpile Pond Diversion Channel – Plan and Profile | 3098004-002580-A1-D70-0004 |
| Clark Creek Pond Dam – Plan, Typical Section and Profile | 3098004-004400-A1-D70-0001 |
| Clark Creek Diversion Channel – Plan and Profile | 3098004-004400-A1-D70-0002 |
| Teeple Road Dam – Plan, Typical Section and Profile | 3098004-004400-A1-D70-0003 |
| Teeple Road Diversion Channel – Plan and Profile | 3098004-004400-A1-D70-0004 |

**Table 4-12; Summary of the Diversion Characteristics**

| Dam and Pond | | | | Channel | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dam | | Pond | | Channel Design Criteria | | | | | | | | | | | Additional features |
| Name | Crest Elev. | Area | Vol. | Diversion Channel Inlet/Outlet | Design Peak Flow Event | Segment | Function | Design Flow | Freeboard | Flow Depth | Base Width | Length | Gradient | Side Slopes | |
| | (m) | (ha.) | ($Mm^3$) | | (-) | (Sta.) | | ($m^3/s$) | (m) | (m) | (m) | (m) | (%) | (H : V) | |
| **Clark Creek Diversion** | | | | | | | | | | | | | | | |
| Clark Creek | 380.0 | 9.2 | | Clark Creek Pond to Teeple Road Pond | 100-yr 24-hr | 0+000 - 1+229 | Channel | | | | 6 | 1229 | 0.10 | 4 : 1 | |
| Teeple Road | 379.0 | 2.9 | | Teeple Road Pond to Pinewood River | 100-yr 24-hr | 0+020 - 0+580 | Channel | | | | 6 | 560 | 1.25 | 4 : 1 | |
| **West Creek Diversion** | | | | | | | | | | | | | | | |
| Stockpile Pond | 375.5 | 4.6 | | Stockpile Pond to West Creek Pond | PMF | 0+150 - 0+200 | Spillway | | | | 33 | 50 | 0.96 | 4 : 1 | - Tributary 2 confluence (Sta. 0+775) |
| | | | | | | 0+200 - 0+250 | Channel | | | | 33 to 6 | 50 | | | |
| | | | | | | 0+250 - 1+346 | | | | | 6 | 1096 | | | |
| West Creek | 364.9 | 13.2 | | West Creek Pond to Loslo Creek | PMF | 0+000 - 0+584.5 | Spillway | | | | 8 | 584.5 | 0.00 to 1.00 | 4 : 1 | - High level side weir at flow control structure<br>- Culverts? |
| | | | | | 100-yr 24-hr | 0+584.5 - 0+647 | Flow control structure | | | | 8 to 3 | 62.5 | 1.00 | | |
| | | | | | | 0+647 - 2+150 | | | | | 3 | 1503 | 1.00 to 0.10 | | |
| | | | | | | 2+150 - 2+750 | | | | | 5 | 600 | 0.10 | | |
| | | | | | | 2+750 - 4+576 | Channel | | | | 3 | 1826 | 0.10 to 0.57 | | |

Notes
1) Low flow and fish habitat features are included in all diversion channels below the hydraulic flow section

### 4.5.1 West Creek Diversion

The West Creek Diversion system diverts flows from the West Creek and its tributaries around the Open Pit and discharges into the Pinewood River at Loslo Creek. It includes the Stockpile Pond Dam and Diversion Channel, which divert flows around the Plant Site, and the West Creek Pond and Diversion Channel, which divert flows around the Open Pit. The dams have a ‘very high’ hazard potential classification equivalent to extreme hazard classification by the CDA. The following sections describe the components of this diversion.

#### 4.5.1.1 Stockpile Pond and Diversion Channel

The objective of the Stockpile Pond is to divert freshwater from natural ground into the West Creek Watershed. The Stockpile Pond Diversion Channel was designed to convey the Probable Maximum Flood (PMF) from the plant site area to the West Creek Pond. The Stockpile Pond Diversion will also provide fish habitat compensation. The Stockpile Pond Diversion Channel base width varies from 6 to 33 m with 4H:1V side slopes. The total length of the diversion channel is about 1,200 m.

The dam height is 7.5 m with 4:1 slopes with a crest width of 6 m and length of 175 m. The dam crest elevation is 375.5 m and the diversion channel invert is 372.2 m. NOWL provides capacity for 93,700 $m^3$ of storage with greater volumes discharges through the 33 m spillway into the diversion channel. The diversion channel is a low (<1%) gradient channel reporting to the West Creek Pond with a typical bottom width of 6 m.

The design brief for the dam is RRP-GEO-REP-003. Construction was completed on the diversion in November 2016 and confirmed by the EOR (RRP-GEO-MEM-080-R1). Construction of the dam was completed in May 2017 and confirmed by the EOR (RRP-GEO-MEM-119-R1). The dam was constructed with a central clay core and random fill and or NPAG rock shells.

#### 4.5.1.2 West Creek Pond and Diversion Channel

The West Creek Pond is located upstream of the Open Pit and west of the Process Plant at a point that allows for the raising of the pond water level sufficiently to divert flows westerly through a diversion channel and around the Open Pit. The West Creek Dam intercepts all West Creek flows from the north, as well as drainage from two tributaries to the east, diverted through the Stockpile Diversion Channel.

The West Creek Dam is a central clay core with random fill upstream shell and NPAG mine rock downstream shell. It has a crest elevation of 364.9 m (~156,000 $m^3$), maximum height of 7.4 m, and overall side slopes of 7.9H:1V including rock toe berms. The West Creek Pond has been designed to contain the PMF while discharging to the West Creek Diversion Channel.

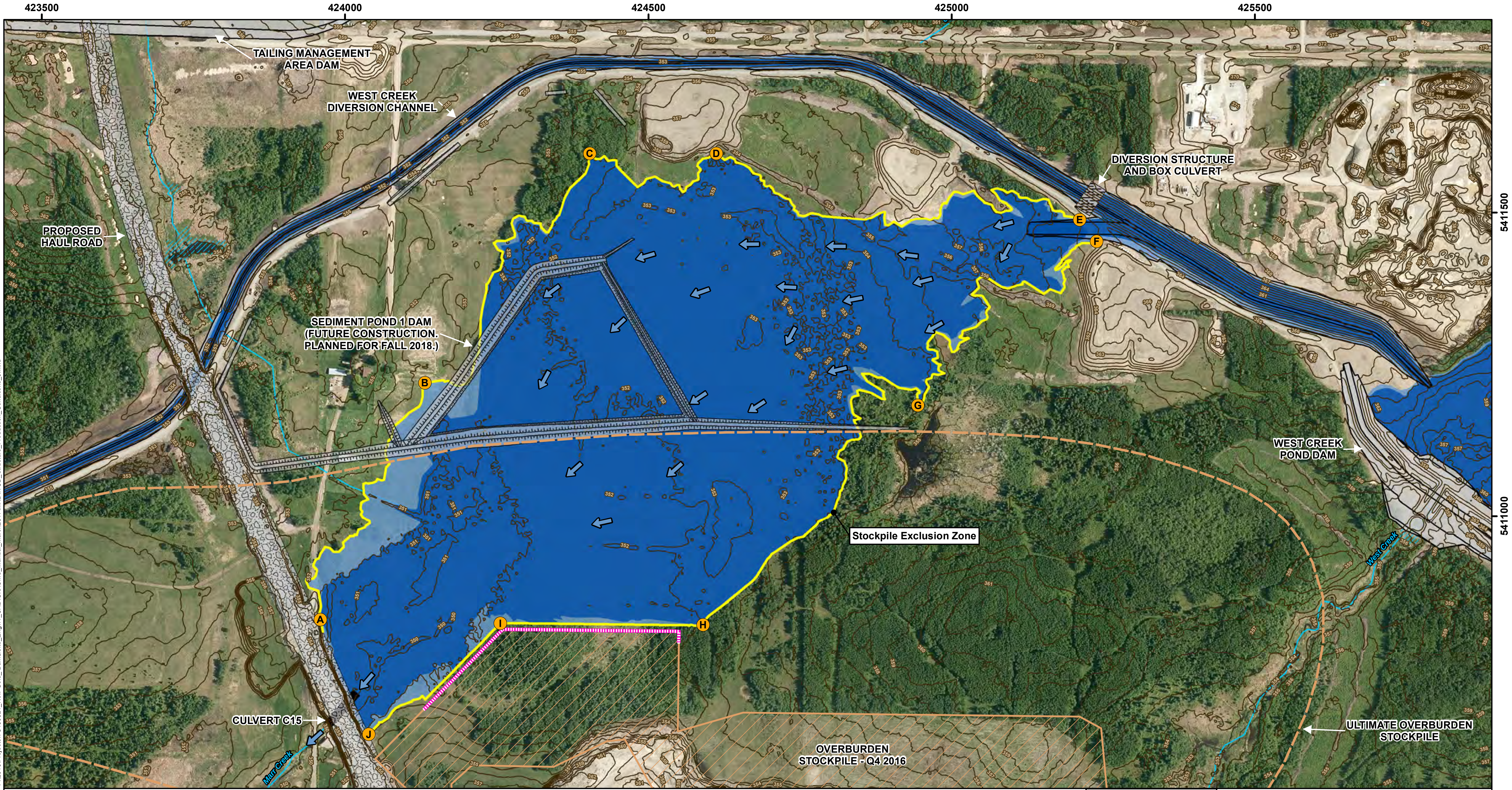
The first 615 m of the West Creek Diversion Channel acts as the Emergency Spillway of the West Creek Dam and has been designed to convey a PMF event. The spillway invert elevation is 361.0 m and is 8 m wide. This provides a freeboard of 4.0 m at normal water level in the pond. During a PMF event the peak water level would rise to 364.5 m, leaving 0.4 m of freeboard.

#### 4.5.1.3 West Creek Diversion Overflow Structure

The Overflow Structure (or weir) is located at Sta. 0+615 within the Diversion Channel. A box culvert (62.5 m long by 2.4 m wide/tall) constricts the channel flow such that a side overflow weir may be activated (invert elevation 360 m, width 50 m). The purpose of the overflow structure is to restrict the flow rate discharging from the culvert under high flow conditions. The remaining ~4,000 m of diversion channel is over flat ground with minimal elevation change. The reduced flows through this section of diversion channel allow a much smaller channel excavation.

The overflow structure has been designed such that during a PMF event, the flow rate downstream of the culvert, i.e., in the channel, does not exceed the 100-year flood outflow from the West Creek Pond (26.9 $m^3$/s). The diversion channel upstream of the diversion structure will back up, with excess flows diverted through the side overflow channel. Containment is provided above the culvert by a berm across the diversion channel with a crest elevation of 363 m. The peak water level in the diversion channel during a PMF event will be 362.5 m, providing 0.5 m of freeboard to the crest of the berm.

The overflow structure will be activated for events greater than the 10-year storm. The peak overflow channel discharge during a PMF event will be 163.8 $m^3$/s. The overflow channel discharges onto a flat, grassy plain south of the West Creek Diversion Channel and north of the ultimate WMRS. This area, termed the exclusion zone, is shown on Figure 4-2 and is required to remain undeveloped to prevent the loss of natural vegetation until Sediment Pond 1 berm is constructed, north of the WMRS. In the field, this area is demarcated by bright coloured stakes and ribbons. The ground topography will naturally drain any overland flow through Culvert C15 into Marr Creek.

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**LEGEND**

- Setting Out Point
- Estimated 25 year Floodline
- Estimated 100 year Floodline
- Flow Direction
- Stockpile Exclusion Zone
- Silt Fence
- Culvert C15
- Diversion Structure and Box Culvert
- Dam
- Ultimate Overburden Stockpile
- Overburden Stockpile Progression
- Existing Contours (1 m interval)
- Watercourse
- Waterbody

**Setting Out Points:**

| Label | Northing | Easting |
|---|---|---|
| A | 5410830 | 423959 |
| B | 5411220 | 424131 |
| C | 5411598 | 424403 |
| D | 5411598 | 424612 |
| E | 5411489 | 425211 |

| Label | Northing | Easting |
|---|---|---|
| F | 5411453 | 425239 |
| G | 5411183 | 424944 |
| H | 5410821 | 424590 |
| I | 5410824 | 424256 |
| J | 5410641 | 424039 |

0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

NOTES:
- Aerial imagery - Pleiades June 2016

Datum: NAD83
Projection: UTM Zone 15N

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**RAINY RIVER PROJECT**

**West Creek Diversion Structure Pre-Production Conditions**

PROJECT N°: TC150321 | **FIGURE: 4-2**

SCALE: 1:6,000 | DATE: March 2017

### 4.5.2 Clark Creek Diversion

The purpose of the Clark Creek diversion is to divert natural drainage and runoff around the East Mine Rock Stockpile and provide fish habitat offsetting. The Clark Creek Diversion Channel diverts runoff from the Clark Creek upstream of the Clark Creek Dam and the EMRS, through the Clark Creek diversion channel into Teeple Pond and subsequently into Teeple Diversion and to the Pinewood River via a culvert under Teeple Road.

Construction of the Clark Creek Diversion occurred between August 29, 2015 and December 4, 2016 and authorised by LRIA FF-2015-03A and the Fisheries Act approval. There are applicable federal and provincial EA commitments, however as a freshwater diversion there a limited MOECC requirements beyond sediment control.

Clark Creek and Teeple Road Dams were constructed as homogenous clay fill embankments utilizing native clay overburden. The clay fill is protected by gravel and cobble sized materials, with a layer of geotextile separation, to prevent erosion. Overflow sections for Teeple Dam are included on the dams to carry storm flows (i.e., activated by 2-year event) and have been designed to handle events in excess of the 100-year return design flow. Overflow sections are provided to permit the safe passage of water in the event the pond level exceeds the maximum operating water level. There are no active controls on the water flows. Clark Creek Dam features a 20 m wide overflow section and Teeple Road Dam features a 150 m wide overflow section designed to allow water and fish to flow over the structure.

The diversions are designed to convey the 1:100 year flow and are typically 6 m wide (base width) with 4:1 slopes. The Clark Creek diversion is 1,200 m and the Teeple Diversion is 580 m long.

**Table 4-13; Design Parameters for the Clark Creek Diversion**

| Design Parameter | Unit | Clark Creek | Teeple |
|---|---|---|---|
| Embankment dam crest elevation | m | 380.0 | 379.0 |
| Dam overflow section invert elevation | m | 379.9 | 378.7 |
| Normal Water Level (NWL) elevation | m | 378.75 | 378.5 |
| Diversion channel inlet invert elv. | m | 378.75 | 378.5 |
| Diversion channel outlet elv. | m | 377.6 | 371.5 |
| Diversion channel gradient (average) | % | 0.1 | 1.2 |
| Diversion channel side slopes | | 4:1 | 4:1 |

Deviations from design occurred for both diversions, however not anticipated to have a negative effect of stability. Examples of deviation include absence of low flow channel, oversized boulders, variances on habitat feature frequency and riffles either not meeting design elevation or being too steep

## 4.6 Instrumentation

### 4.6.1 Dam Safety

Instrumentation has been and will be installed during construction. Instrumentation will include instrumented dam sections that will monitor dam foundation and clay fill pore pressures to infer consolidation characteristics, as well as monitor any movement of dam fill due to deformation.

Each dam instrumentation section will include: standpipe(s), a settlement plate, slope inclinometer(s), survey pins/monuments, and a terminal arrangement with data logger and vibrating wire piezometers.

Following construction, the instrumentation will remain for dam monitoring purposes. A detailed report containing the proposed locations, usage, and analysis of all instrumentation is provided in the *Geotechnical Monitoring Plan* (Amec Foster Wheeler, 2016b). The design details for the installed or proposed dam instrumentation is summarized in Table 4-14. The design information provided in Table 4-14 will be confirmed and updated as may be required following development of the As-Built drawings.

**Table 4-14; Dam Instrumentation Summary**

| Facility | | Dam Instrumentation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Slope Stability | | | Foundation Consolidation | | Phreatic Level and Seepage | | |
| | Section | Slope Inclinometers | Survey Pins | Survey Monuments | Vibrating Wire Piezometers | Settlement Plates | Vibrating Wire Piezometers | Standpipe Piezometers | Pond Level Gauge |
| | (Sta.) | (no.) | (no.) | (no.) | (no.) | (no.) | (no.) | (no.) | (type) |
| TMA North | 3+300 | 0 | | 0 | 2 | 1 | 1 | 2 | TBD |
| | Mass array | | | | 142 | | | | |
| TMA South | 1+000 | | | | 2 | | | | |
| | 1+380 | | | | 2 | 1 | 1 | 1 | |
| | 1+450 | 2 | | 2 | 4 | 2 | 1 | 2 | |
| | 1+600 | 1 | | | 4 | 2 | 1 | 1 | |
| | 2+200 | 2 | | 2 | 4 | 2 | 1 | 2 | |
| | 2+350 | 1 | | | 4 | 2 | 1 | 1 | |
| | Mass array | | | | 176 | | | | |
| TMA West | 0+300 | | 35 | 0 | 1 | | 1 | | |
| | 0+460 | 2 | | 0 | 5 | | 2 | 1 | |
| | 1+450 | 0 | | 0 | 0 | 1 | | 0 | |
| | 1+500 | 2 | | 0 | 4 | 0 | 3 | 0 | |
| | Mass array | | | | 82 | | | | |
| TMA Start-up Cell | 0+400 | | | | 2 | | | | TBD |
| | 1+000 | | | | 2 | | | | |
| | Mass array | | | | 88 | | | | |
| WMP Dam 1 | | | 16 | | | | | | - Staff gauge<br>- Survey stakes |
| WMP Dam 2 | 0+950 | 1 | 34 | 0 | 2 | 0 | 2 | 2 | |
| WMP Dam 3 | 0+300 | 0 | 17 | 0 | 1 | 0 | 1 | 2 | |
| | 0+500 | 1 | | 0 | 2 | 1 | 4 | 1 | |
| Mine Rock Pond | 0+220 | 1 | | 2 | 2 | 1 | 1 | 4 | - Staff gauge |
| Clark Creek | | | | | | | | | - Staff gauge |
| Teeple Road | | | | | | | | | - Staff gauge |
| Stockpile Pond | 0+125 | 1 | 8 | 0 | 1 | 0 | 1 | 2 | - Staff gauge |
| West Creek | 0+291 | | | | 2 | | | 2 | - Staff gauge |
| | 0+320 | 2 | 2 | | | | | | |
| | 0+340 | 2 | 2 | | 2 | 1 | 1 | | |
| Water Discharge Pond | | | | | | | | | TBD |
| Constructed Wetlands | | | | | | | | | |
| - Pond A | | | | | | | | | TBD |
| - Pond B | | | | | | | | | TBD |
| - Pond C | | | | | | | | | TBD |
| - Pond D | | | | | | | | | TBD |
| - Pond E | | | | | | | | | TBD |
| Sediment Pond #1 | | | | | | | | | TBD |
| Sediment Pond #2 | | | | | | | | | TBD |
| Temporary Sediment Pond | | | | | | | | | TBD |

Notes:
1) Survey pins installed at 100 m centres along 3-5 lengthwise lines (crest, toes, etc.) Quantities are total for each dam
2) TMA Dams feature mass array of VWP instruments installed in grids within the dam foundation. Installation of these instruments is currently on-going

In addition to the instrumentation described above, the TMA dams are equipped with an additional suite of vibrating wire piezometers (VWPs) to provide enhanced monitoring resolution during construction. A total of 524 VWPs were installed in the TMA dam foundations, arranged in a grid pattern, and managed with a remote wireless data acquisition and management system.

Instrumentation associated with the management of the dams is being managed through a software system that includes integration with data loggers and data storage and is configured such that alarms for alert levels are defined and available. The software routinely generates reports and if trigger levels are exceeded sends out alarm notifications.

### 4.6.2 Other instrumentation

Additional instrumentation to support the OMS manual and management of water includes;

- Densometer on the tailings pipeline;
- Flow meters on the water management pipelines including from the Pinewood River, tailings reclaim lines, MPR line and freshwater line from the WMP and
- Pressure transducers in the WMP, Clark/Teeple Ponds.

This instrumentation provides continuous recording, which is collected during routine inspections and included.

## 4.7 Regulatory Requirements

Regulatory requirements, permits and authorizations are summarized in section 1.1. Key approvals include the Federal and Provincial Environmental Assessment conditions and commitments and permits including those issued pursuant to the LRIA and EPA. Additional legislation to be considered in implementing the OMS manual includes the MMER and various Ontario regulations including waste management.

No direct discharges are intended from any of the structures described in this section except the WMP which is described in sections 4 and 5. Seepage will be collected and pumped back from the WMP and TMA cells. Subsequent to this revision and LRIA approvals, additional details for the WDP, CW and sediment ponds discharges will be developed.

# 5.0 OPERATIONS

The overall operational objectives of the TMA and associated dams and facilities are to dispose and store the tailings and to manage all site water in a safe, economical and environmentally responsible manner. This section defines operating standards in accordance with design criteria and regulatory requirements specified in section 4.

## 5.1 Tailings transport and deposition

The RRM mill will be commissioning in fall 2017 with a design throughput of 22,000 tpd. As discussed in further detail in Section 4, final expected effluent quality results indicate that a high-quality effluent approaching ECA permit values can be achieved through a combination of in-plant cyanide destruction using the $SO_2$/Air process combined with natural aging in the TMA and the WMP.

### 5.1.1 Tailings Transport

Tailings will be pumped from the tailings pump box in the mill to the TMA and deposited as outlined in the tailings deposition plans (section 5.1.2) and Appendix D. The tailings and reclaim lines are HDPE pipe and are within lined containment and held in place with clay anchors. The lined containment drains to one of six emergency dump ponds located along the tailings corridor.

### 5.1.2 Tailings Deposition

The life of mine tailings deposition report (Document 3098004-004000-A1-ETR-0005) is being updated to reflect the operation of Cells 1 and 2. The deposition plan described here is based on the planned revisions. The tailings deposition plan involves discharging tailings from the crest of the dams to produce wide tailings beaches to enhance dam stability and inhibit seepage. In the non-winter months, spigotting will be carried out, with pipeline end-discharge in the winter once suitable beaches are present.

#### 5.1.2.1 TMA Cell 1

Deposition will commence in the start-up cell (TMA Cell 1), which is planned for a total period of six months (October 1, 2017 to March 31, 2018 approx). During this period, supernatant water will be continuously pumped to the WMP. Table 5-1 provides an overview of the tailings deposition volumes and elevations. Tailings deposition for cell 1 is discussed in more detail in the LRIA application (RRP-GEO-LRIA-004C R1 Comments and Responses).

**Table 5-1; Cell 1 Tailings Deposition**

| | Tailings | | Water | |
|---|---|---|---|---|
| Time Elapsed | Volume | Discharge Elev. | Volume | Pond Elev. |
| (months) | ($m^3$) | (m) | ($m^3$) | (m) |
| <1 | 130,000 | 362.0 | 10,000 | <362.0 |
| 1 | 580,000 | 366.0 | 200,000 | 365.0 |
| 6 | 3,300,000 | 371.4 | 200,000 | 369.9 |

Notes: Supernatant and water will be transferred to the WMP daily by pumping, recirculation to the processing plant via WMP intake pumps

Tailings pipelines will follow the TMA South Dam alignment and branch off to the TMA Start-up Cell Dam and West Dam. Spiggotting of tailings into the TMA Start-up Cell (TMA Cell 1) will occur from the TMA South, West, and Start-up Cell Dams, forming a beach upstream of these dams and a central pond that will be pumped into the WMP from the north end of the cell.

Spiggotting will initially occur into a borrow area not exceeding 362 m i.e., below the toe of the start up cell dams. The tailings discharge rate is 5,000 $m^3$/day to 9.000 $m^3$/day into the borrow, and will be measured by a flow meter on the tailings line reporting to the borrow. This initial volume of tailings will backfill Borrow Area B6 within the footprint of the start-up cell and will not exceed 130,000 $m^3$, and will remain below elevation 362.0m. The top of tailings surface will not contact any of the toes of the TMA dams forming the start-up cell until approval to operate the TMA / Start-up Cell has been granted by the MNRF.

For operation of the borrow, the normal operating pond volume is 10,000 $m^3$. The maximum operating water level is 361.9 m. If the MOWL is exceeded tailings discharge will cease and the pond drawn down by pumping to the WMP (e.g., 2 tractor pumps at a combined capacity of 40,000 m3/day). A staff gauge will be installed in the SW corner of the borrow (furthest from the tailings discharge), which will be monitored twice per 24h period (every 12h approx.). Within the borrow the volume of storage is 80,343 $m^3$, 104,276 $m^3$ and 164,005 $m^3$ at elevation 360.0, 361.0 and 362.0 respectively.

Upon regulatory approval for tailings deposition into Cell 1, tailings will be discharged from an elevation of 366.0 m. Areas where the ground elevation is higher than 366.0 m will not discharge tailings (i.e. the high ground around the dam abutments). By month 6 of deposition, the discharge elevation will be moved up to 371.4 m and spiggots will discharge from the south, west, and east sides of the cell. Provisions will be made, as required, to facilitate ongoing construction while discharging tailings.

Cell 1 will not discharge to the environment and there is no reclaim direct to the mill, for dam safety and emergency spillway to the north at elevation 370.5 has been constructed. The TMA start-up cell will have a normal operating water level (NOWL) of approximately 369.90 masl at the conclusion of six months of production, which corresponds to the operational pond volume of 200,000 $m^3$. Once the water level rises above the NOWL of 369.90 m, it will be pumped to the WMP at a rate of 57,000 $m^3$/day to contain the EDF event. Due to the limited storage in the TMA start-up cell at this point in mine operations, no operating range can be allowed (i.e., any water above the NOWL must be pumped immediately). During operation of Cell 2, cell 1 will passively overflow into Cell 2.

**Figure 5-1; TMA Cell 1 Borrow Stage - Storage Relationship**

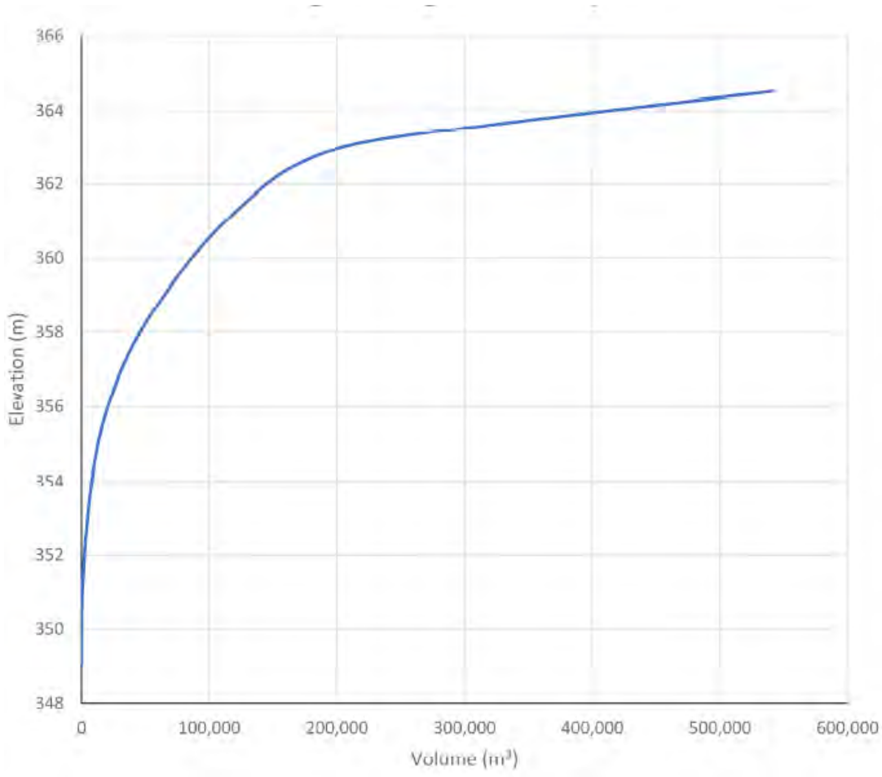
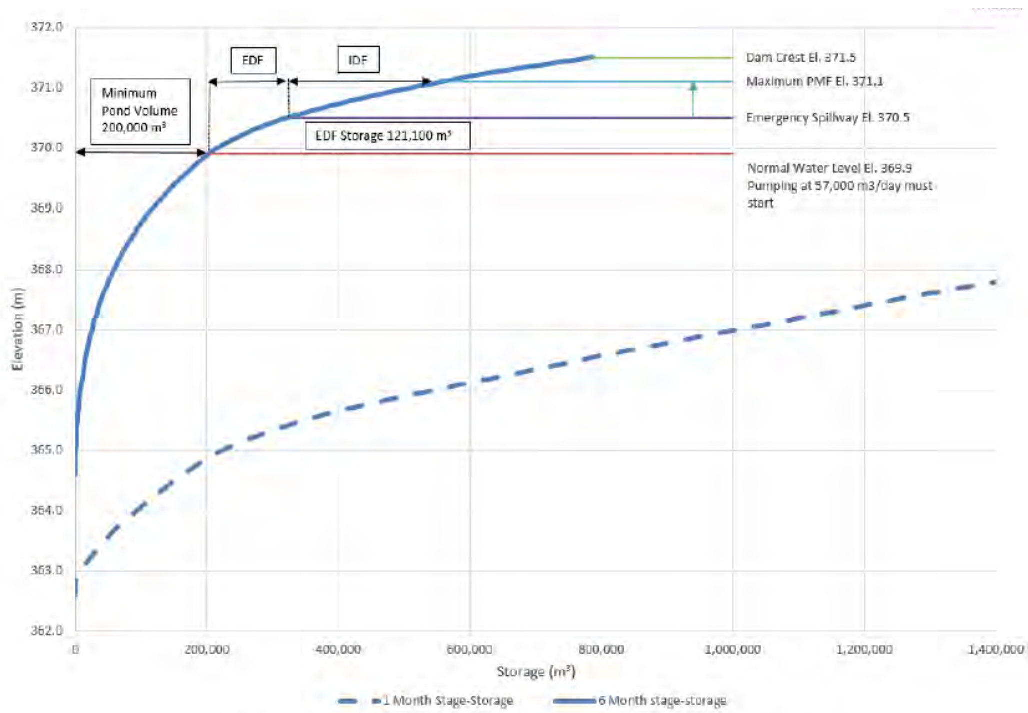


**Figure 5-2; TMA Cell 1 Stage Storage Relationship**




#### 5.1.2.2 Future Tailings Deposition – Cell 2 and Cell 3

Cell 2 provides for 12 months (April 2018 to April 2019 approx.) of tailings deposition (5.5 $Mm^3$ of tailings) with a crest elevation of 366.5 m. 12months is the maximum permitted operating duration for cell 2. Following completion of this dam, and approval from MNRF, Cell 2 will operate as described here based on RRP-GEO-REP-026 R1, April 28, 2017 or as updated in the as-built report. A stage storage relationship is provided below.

- Tailings will be discharged from the northwest side of the dam (upstream slope) for 6 months. This will be followed by discharging from the downstream slope of the TMA Cell 1 Dam for an additional 6 months (or until the TMA South Dam is completed to elevation 366.5 m).
- Surplus water from TMA Cell 1 will overflow by gravity into TMA Cell 2 through the existing emergency spillway. A pond will form in the northwest end of TMA Cell 2 and be reclaimed to the mill via the reclaim line or transferred into the WMP.
- The MOWL of Cell 2 is 364.05 m providing 1 Mm3 of storage below the 19 m wide north dam spillway invert (364.7 m) to contain the 828,200 m3 EDF. This will be maintained at all times.

- The spillway will provide 0.39 m of freeboard from the maximum still pond IDF level (366.11 m) to the dam crest (366.5 m)
- Water reclaim to the mill from TMA cell 2 is to occur once water levels in the WMP are below 1.0 $Mm^3$. At minimum pumping will commence once Cell 2 pond volume increases to within approx. 800,000 $m^3$ of the MOWL and will continue until water levels are 1.2 $Mm^3$ below the MOWL.
- Pumping capacity of 40,000 $m^3$/day between TMA Cell 2 to Cell 3 and to the WMP will allow for management inflows to cell 2. As contingency, pumping will be considered from the WMP to TMA Cell 3 to reduce WMP volumes below 1.0 Mm3 prior to discharge from the WTP.

When full containment in the TMA is available (i.e. TMA South Dam is constructed to elevation 366.5 m), tailings will be discharged from the north side of the TMA South Dam (upstream slope) into an area referred to in this report as TMA Cell 3. Cell 3 will be constructed for completion in June 2018, at which time it will be used to manage excess water from cell 2 and the water impounded in the WMP (as described in this manual).

An overflow spillway is detailed for construction at the left abutment of the TMA Cell 2 Dam once the TMA South Dam is constructed to elevation 366.5. This overflow spillway (at 364.5) will provide a conduit to connect the TMA Cell 3 pond with the TMA Cell 2 pond and ultimately with the reclaim/transfer pumps. It’s anticipated tailings deposition will occur for 6 months until this occurs.

**Figure 5-3; TMA Cell 2 Stage Storage and Design Pond Levels**

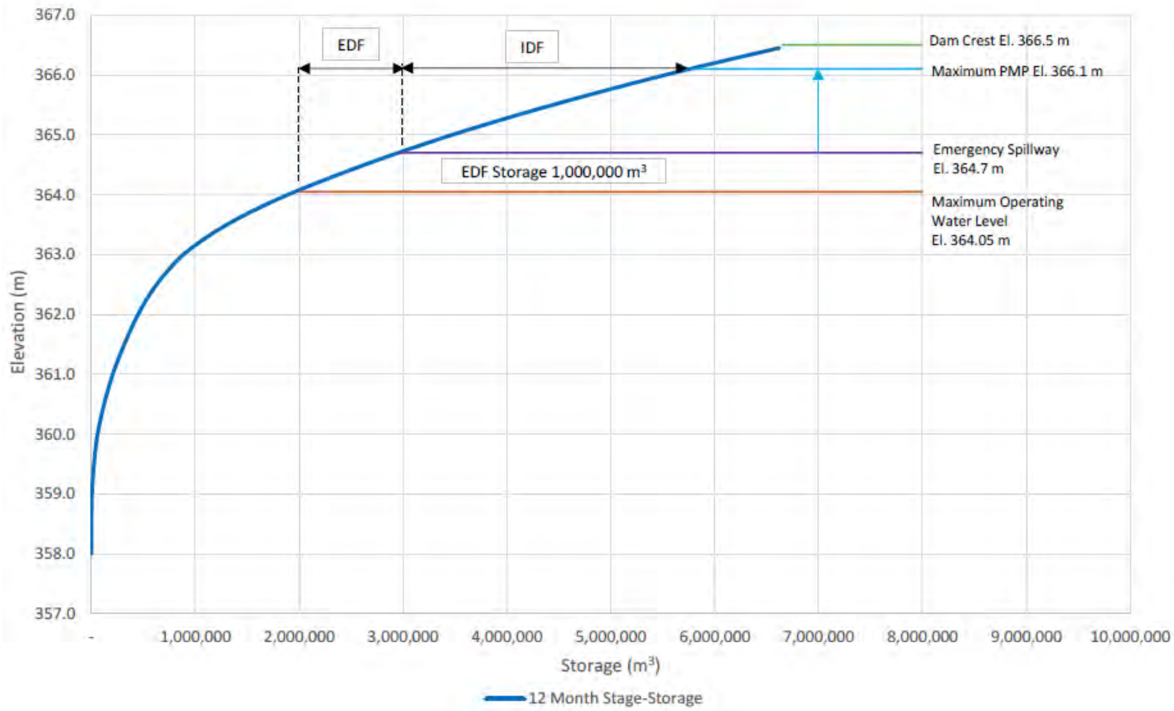
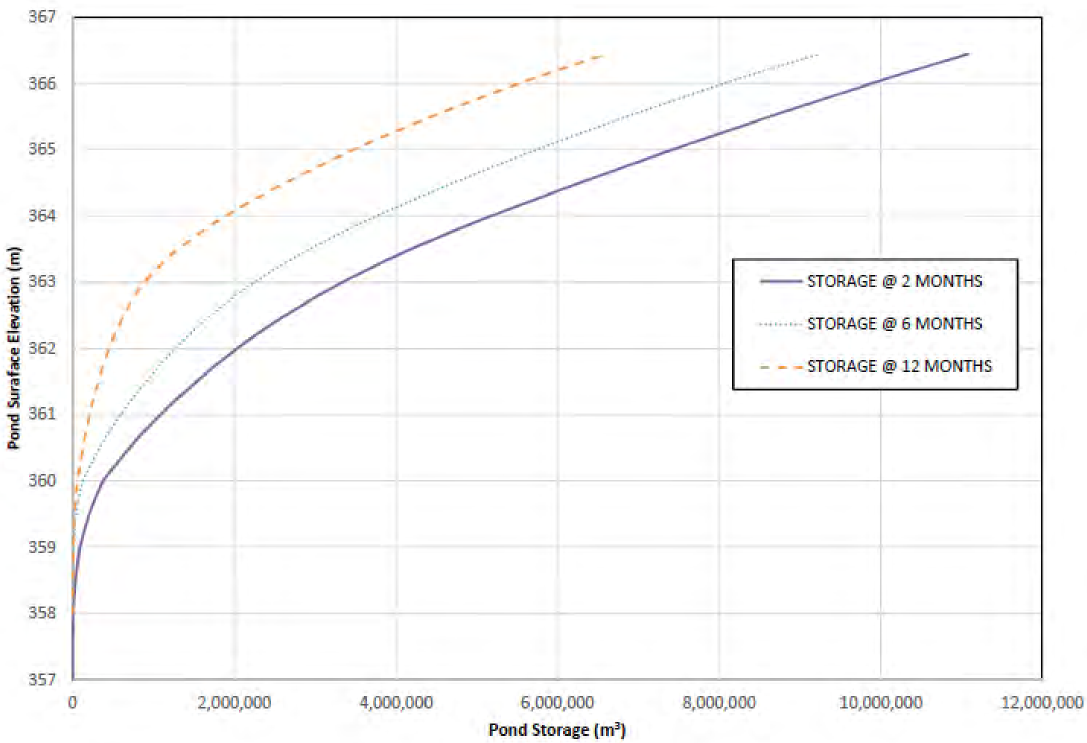

367.0
366.0
365.0
364.0
363.0
362.0
361.0
360.0
359.0
358.0
357.0
Elevation (m)
EDF
IDF
Dam Crest El. 366.5 m
Maximum PMP El. 366.1 m
Emergency Spillway
El. 364.7 m
EDF Storage 1,000,000 m³
Maximum Operating
Water Level
El. 364.05 m
-
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
7,000,000
8,000,000
9,000,000
10,000,000
Storage (m³)
12 Month Stage-Storage

**Figure 5-4; Cell 2 TMA Pond Stage-Storage**




### 5.1.3 Dam Raising

The dams will be raised to maintain discharge availability and sufficient pond storage capacity to contain the Environmental Design Flood (EDF).

## 5.2 Seepage Collection System

Seepage collection systems, as described in section 4, are in place and required for the WMP and TMA only. The design criteria of 1:25 yr 24h rainfall results in seepage systems (sumps, pumps and ditches) as described in section 4 (including MOWL) and summated here;

- Cell 1 seepage is not expected to exceed 29 $m^3$/day. Three sumps will be pumped back to Cell 1 with pumping capacity of 2,500, 1,000 and 1,500 $m^3$/day respectively. Sumps 1 and 2 pumping will cease once Loslo Creek is impounded by the TMA south dam (June 2018 approx);
- Cell 2 seepage is expected to not exceed 9.2 $m^3$/day and a sump of 8,000 $m^3$ will be pumped back to Cell 2 with pumping capacity of 1,600 $m^3$/day until Loslo Creek is impounded by the TMA south dam (June 2018 approx);
- Cell 3 seepage is intercepted and routed by ditch into the water discharge pond, and isn't expected to occur until June 2018 (approx.); and
- WMP includes 3 sumps, including a sump shared with the north starter dam and will be pumped back to the TMA, capacity of the sumps is 18,200, 11,800 and 20,000 $m^3$ for sumps 1, 2 and 3 respectively with pumping capacities of 4,000, 2,500 and 3,500 $m^3$/day respectively.

## 5.3 Process Water Management

The following detail design drawings will be referred to while reviewing the design details for the process water management: Additional design details for the process water dams and ponds are provided in section 4. A list of drawings are provided in Appendix A.

During the pre-production phase, process water management will involve filling the WMP and MRP, followed by pumping to the plant site during mill commissioning and start-up. The WMP will also supply the truck filling station, truck shop, truck wash facility, and fire water tank.

These processes are illustrated on the following Process Flow Diagrams:

- Water Reclaim Sheet No. 1 (100126-3200-DC00-PFD-0021.001); and
- Water Reclaim Sheet No. 2 (100126-3200-DC00-PFD-0021.001).

Additional details regarding pumping requirements, as well as pump and pipeline designs, are provided in Appendix B.

### 5.3.1 Water Management Pond

The WMP collects runoff from direct drainage area, pumping from the Pinewood River and receives transfer from TMA. Initially the WMP will be utilized to build an inventory of 3.8 $Mm^3$ of water required for mill start-up and process operations. The start-up inventory of water will be provided by pumping from the Pinewood River via the pinewood pipeline. However, additional water sources maybe utilised in filling the WMP including but not limited to:

- Pumping from Open Pit via a 6” pipeline;
- Pumping from Sump #4 (Open Pit) via 16” / 20” / 24” pipeline; and
- Direct drainage of natural runoff.

During late construction (starting April 27, 2017 from the Pinewood River), the WMP began filling and storing water prior to achieving the final dam crest elevation, as per approval from the MRNF. The start-up inventory of water will be primarily pumped from the Pinewood River, in addition to collecting natural runoff and dewater pumping from the Open Pit. Filling the WMP will occur in two stages:

- Intermediate stage: maximum water level 364.5 m providing 2.0 m of freeboard below the minimum dam crest elevation of 366.5 m
- Final stage: maximum operating water level 369.7 m

During the Intermediate Stage of filling the Interim Fill Plan (rev3 – March 2017) will be followed,

- all WMP dams were constructed to a minimum crest elevation of 366.5 m and width required to satisfy slope stability requirements. The maximum water level in the WMP shall not exceed 2.0 m below the lowest constructed dam crest elevation, i.e. 364.5 m.
- monitoring of water levels and instrumentation will occur daily, and water quality (TSS) will be sampled twice weekly, water quality will be sampled weekly and dam inspections will occur weekly
- Contingency will be maintained with an 8 inch pump ready to discharge to the approved location north of WMP Dam 4, and when water is above 364.0 a 12 inch pump will be mobilised

All the WMP dams were completed to their final crest elevation of 371.5 m in July 2017 and EOR confirmation of compliance was completed in on July 27, 2017. The requirements for the Final Stage of filling have been met and the maximum operating water level may be raised to 369.7 m, pending MNRF approval. Final filling of the WMP will be completed based on water takings from the Pinewood River and other approved water takings.

During the use of TMA Cell 1 and Cell 2, WMP filling will consider mill water needs the overall water balance and water quality discharge criteria based on the WMP water balance (Rainy River Project Development TMA Cell 2 and WMP Water Balance RRP-GEO-REP-026 R1).

- At the end of March 2018 WMP volume will be approx. 2.0 $Mm^3$, 50 % of which will be ice
- Water will be pumped during freshet (April – June 2018) from Cell 2 and the Pinewood River to increase the volume in the WMP
    - Pumping from the Pinewood is proposed if the total water volume in the WMP and TMA Cell 2 is below 4 $Mm^3$.
- The mill water use will maintain the WMP below the MOWL till June 2018 (approx.) and target a reduction of water levels to 1.0 $Mm^3$ stored volume i.e., dead storage
- After June 2018 (approx.) mill reclaim will switch to TMA cell 2 and excess water from Cell 2 will be pumped to Cell 3 (subject to TMA completion and regulatory approval) while the water treatment plant is constructed in the WMP adjacent to Dam 4.

Once the WTP is constructed and operational (prior to September 2018) the WMP will received treated (or blended untreated) supernatant from Cell 2 and subsequently the ultimate TMA. Operations will continue to meet MOECC requirements such that:

- Supernatant will be transferred from the TMA during June to August (or other times during the year to achieve overall water balance and water treatment objectives);
- Discharges effluent to environment: Preferentially bleed flow through constructed wetland with a 30-day retention time (design volume of 10,000 $m^3$/day) – estimated to commence in Spring 2019; and
- Decant to Pinewood River (through discharge pipeline);
- No discharge to occur between December 1 and the following spring melt (defined as a flow rate in the Pinewood River (upstream of Loslo Creek) of 10,000 $m^3$/day.

Bleed flow and decant to Pinewood River can only occur if there is sufficient flow in the Pinewood River to achieve a minimum mixing ratio of 1:1 with the two discharges combined. A pre-winter inventory of 2.8 $Mm^3$ will be targeted (to comply with environmental commitments to supply the bleed flow through constructed wetland in all climatic conditions). This is calculated from the sum of the outflows from the WMP between December and the following May;

- -0.04 $Mm^3$ seepage losses
- -0.10 $Mm^3$ evaporation losses
- -0.76 $Mm^3$ bleed to wetland
- -0.90 $Mm^3$ ice allowance

- 1.0 $Mm^3$ minimum inventory.

This volume is sufficient to maintain supply to the mill through dry winters and springs, up to the beginning of June, at which time the transfer from the TMA can replenish the WMP inventory. The mill make-up water demand is 22,605 $m^3$/day which will be supplied by the MRP and WMP. The make-up water will be preferentially taken from the MRP with the WMP supplying the difference. The Mill requires freshwater for reagent mixing at a rate of 1,729 $m^3$/day which will be supplied from the WMP.

**Figure 5-5; Stage - Storage Curve for the WMP**

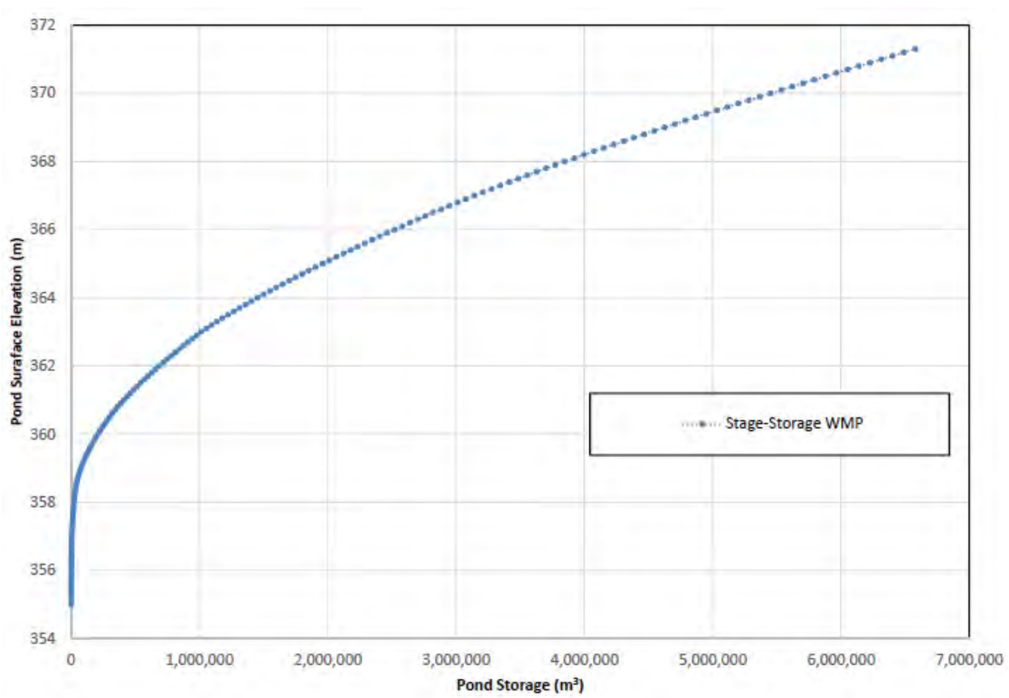


**Table 5-2; Stage Storage Relationship For the WMP**

| Elevation (m) | Available Water Storage Volume (m³) |
|---|---|
| 355.00 | 0 |
| 355.50 | 169 |
| 356.00 | 1,016 |
| 356.50 | 2,384 |
| 357.00 | 4,803 |
| 357.50 | 11,417 |
| 358.00 | 21,533 |
| 358.50 | 38,013 |
| 359.00 | 75,235 |
| 359.50 | 132,541 |
| 360.00 | 207,591 |
| 360.50 | 299,155 |
| 361.00 | 409,425 |
| 361.50 | 541,181 |
| 362.00 | 687,276 |
| 362.50 | 845,119 |
| 363.00 | 1,012,352 |
| 363.50 | 1,223,489 |
| 364.00 | 1,452,674 |
| 364.50 | 1,698,321 |
| 365.00 | 1,958,559 |
| 365.50 | 2,233,087 |
| 366.00 | 2,520,422 |
| 366.50 | 2,821,561 |
| 367.00 | 3,142,089 |
| 367.50 | 3,486,292 |
| 368.00 | 3,846,892 |
| 368.50 | 4,229,229 |
| 369.00 | 4,625,413 |
| 369.50 | 5,033,241 |
| 370.00 | 5,451,690 |
| 370.50 | 5,879,025 |
| 371.00 | 6,314,382 |
| 371.30 | 6,579,245 |

#### 5.3.1.1 Pinewood River Pump House

The Pinewood River pump house shall not exceed the maximum water intake of 20,000 litres/minute as per Permit to Take Water (PTTW) number 8776-9W2QN3 which expires November 30, 2018. Additional seasonal restrictions to the water taking as stipulated in PTTW number 8776-9W2QN3 include:

- March 1 through July 31: the water taking to an amount not more than 20% of the daily flow rate (as measured at the water intake location, and including allowance for site watershed capture) and that the calculated flow rate after pumping in the Pinewood River remains above 10,000 $m^3$/day;
- August 1 through November 30: the water taking is restricted to an amount not more than 15% of the daily flow rate (as measured at the water intake location, and including allowance for site watershed capture) and that the calculated flow rate after pumping in the Pinewood River remains above 5,000 $m^3$/day; and
- December 1 through February 28: no water taking in the Pinewood River shall occur.

This approval was amended till August 31, 2017 to allow for additional water takings;

- The total combined water taking (including all PTTW sources) from the Pinewood River can increase to not more than 30 % of the daily flow where 43,200 m3/day is the minimum flow threshold for this level of water taking
- The total combined water taking (including all PTTW sources) from the Pinewood River can increase to not more than 20 % of the daily flow where 10,000 m3/day is the minimum flow threshold for this level of water taking

The water taking for the day (24h period) is calculated based on a 24h period of flow in the previous 72h as measured consistent with the Pinewood hydrometric monitoring plan. This uses either the New Gold hydrometric station or the WSC hydrometric station at Hwy 617, consistent with MOECC approved plans. Monthly and annual reporting of takings is provided to MOECC.

### 5.3.2 Mine Rock Pond

The pond collects runoff and seepage from the East Mine Rock Stockpile (EMRS) and Low Grade Ore Stockpile (LGOS) and receives dewatering from the Open Pit and future underground mine.

Currently, the MRP Dam is not complete and the remnant Clark Creek drainage is required (by LRIA approvals) to be diverted through the construction diversion ditch to the remnant Clark Creek. Following completion of this dam, and approval from MNRF, the MRP will operate as described here based on RRP-GEO-REP-007 R1, September 15, 2016. A stage storage relationship is provided below.

- The MRP will be operated to minimize volume in the pond to reduce seepage and for increased dam safety, there is no seepage collection system for the MRP as it is the seepage collection system for the EMRS.
- The MOWL of the MRP is 356.8 m (525,000 $m^3$) and has been constructed with an 80 m spillway at an invert of 358.9 m (1.3 $Mm^3$) to store the EDF (775,000 $m^3$).
- The MRP will operated with a freeboard of 3.4 m to allow for the EDF (1:100 year 30 day event), a maximum wave height of 0.78 m with a required 0.31 of freeboard remaining.

Decanting from the pond is via fixed pumping station that supplies mill make-up water:

- 680 $m^3$/hr pump subject to pump availability and pond level controls, which is able to supply 59 % of the total mill make-up water demand;
- Supplies approximately 45 % of the mill make-up water annually; and
- Prior to the winter, the MRP will be drawn down to the minimum pond volume (5,000 $m^3$) to reduce ice losses.

If the MRP MOWL (356.8m) is exceeded, pumping into the MRP from the open pit / future underground mine will cease and pumps will pump water toward the plant site/WMP/TMA. The ECA approval requires that there will be no direct discharge from the pond to the environment.

**Table 5-3; Mine Rock Pond Stage-Storage Relationship**

| Elevation (m) | Volume ($m^3$) | Notes |
|---|---|---|
| 351.0 | 0.0 | |
| 352.0 | 3,104 | |
| 353.0 | 25,569 | |
| 354.0 | 82,650 | |
| 355.0 | 176,903 | |
| 356.0 | 332,548 | |
| 356.8 | 525,000 | MOWL |
| 357.0 | 579,383 | |
| 358.0 | 931,120 | |
| 358.9 | 1,300,000 | Spillway elevation |
| 359.0 | 1,382,836 | |
| 360.0 | 1,930,022 | |
| 360.2 | 2,048,496 | Dam Crest |
| | | Source; RRP-GEO-REP-007 Sept 14, 2016 |

## 5.4 Water Treatment

For this revision of the OMS the WDP and CW have yet to be constructed or approved for construction (LRIA and MMER Schedule 2), however information is included in this revision for completeness and will be updated prior to operation of the WMP/CW, or as specified in regulatory approvals. Ahead of any discharges this section will be updated and a contaminant release plan, consistent with MOECC requirements will be developed.

The TMA has been designed to optimize natural degradation processes to provide further water treatment, by ensuring there is sufficient retention time to allow these reactions to occur. The natural degradation processes are most effective during warm weather conditions when biophysical activity is optimal, and are also augmented by exposure to sunlight. Effluents that are planned for discharge to the environment will be held for a sufficient period of time under warm weather conditions, to maximize the effects of natural degradation. Such effluent aging will take place mainly in the summer months (June through mid-September) in both the TMA and WMP.

To optimize both water quality and river flow effects, final effluent is released to the Pinewood River at two separate locations:

- Through the constructed wetland to the Pinewood River at the Loslo Creek outflow (via lower Loslo Creek); and
- Directly to the Pinewood River just downstream of the McCallum Creek outflow, by pipeline.

The rationale for using two separate discharge locations derives from the need to achieve effective water quality treatment while minimizing adverse flow effects on the Pinewood River, under varying hydrologic operating conditions. The constructed wetland is located further upstream on the Pinewood River pumphouse, and will help to maintain flow in the Pinewood River, however has a lower assimilative capacity. All effluent from the water management pond which is not discharged through the constructed wetland will be discharged by pipeline to the Pinewood River downstream of McCallum to take advantage of increased river assimilative capacity at this point, since wetland polishing would not be available for this portion of the discharged effluent.

The transfer of water from the TMA to the WMP (for discharge to the environment) will normally occur during the months of June through August. To facilitate this process, the water in the WMP would be drawn down by the end of May in each year. The release of WMP effluent to Pinewood River downstream of McCallum Creek outflow would occur during the spring and fall, to take advantage of extended aging in the TMA and WMP, and higher receiver assimilative capacity. Water which is not discharged from the WMP in the fall would be held over, without any further inputs from the TMA pond, until the following spring for release.

Effluent from the WMP will be discharged to the constructed wetland (as bleed flow) during all months of the year, except February and March, with more limited discharge in December and January. The bleed flow through the wetland represents the larger quantity of water that is discharged throughout the year (except in a very wet year). In low runoff years, virtually all final effluent discharge would be through the constructed wetland.

In conjunction with effluent aging and wetland treatment, final effluent quality is expected to be consistent with water quality discharge limits. Each discharge has specific discharge criteria as specified in MOECC ECA #5178-9TUPD9 which must be met prior to discharge.

### 5.4.1 Water Discharge Pond and Constructed Wetlands

The WDP collects runoff from natural ground catchment south of the TMA dam, seepage from the seepage collection ditch and the bleed flow from the WMP (maximum rate of 10,000 $m^3$/day) for discharge to the constructed wetland. The Water Discharge Pond (Drawing 3098004-004410-A1-D70-0002) will also provide erosion and sediment control south of the TMA dam.

The Constructed Wetlands are designed to provide a target of 30 days of retention time of 10,000 m3/day following discharge from the WMP into the WDP. The Constructed Wetlands are comprised of five ponds (Pond A, B, C, D, E). The downstream pond (Pond A), will contain a control structure to stop discharge to the environment in the event that water quality does not meet discharge criteria (in this case water from Pond A could be pumped back to the TMA or WMP).

### 5.4.2 Sediment Ponds 1 and 2

Sediment ponds are designed to provide a 12-day hydraulic retention time for all events up to and including the 25-year return period, 24-hour storm.

**Sediment Pond #1** (Drawing 3098004-004430-A1-D70-0002)

- Collects runoff from the overburden stockpile;
- Will also receive additional inflow from overflow from West Creek Diversion during storm events large than the 25 year 24-hour storm event;
- The low flow outlet is designed to achieve the required retention time for the 25-year 24-hour storm event; and

- To prevent dam overtopping emergency spillway is designed for the 100-year storm event discharging to the West Creek Diversion Channel.

**Sediment Pond #2** (Drawing 3098004-004440-A1-D70-0002)

- Collects runoff from the west mine rock pile (Non-Potentially Acid Generating [NPAG]) and is closer to the Pinewood River;
- The low flow outlet is designed to achieve the required retention time for the 25-year 24-hour storm event; and
- To prevent dam overtopping the high flow spillway is designed for the Regional Storm Event (Timmins storm event), discharging directly to the Pinewood River.

## 5.5 Freshwater Diversions

The freshwater diversion structures (dams and diversion channels) are designed to be operated passively. Clark and Teeple Ponds are full and the diversions are flowing naturally. Stockpile pond is currently filling and will flow through the stockpile diversion once the water level is above the invert to the diversion. West Creek is being allowed to slowly fill, however a terminal plug remains in place and pumps are being used to dewater the diversion.

In summer/fall 2017, the plug will be removed and the plug area will stabilise prior to water flowing through location of the former plug.

Culverts at Georgeson Lane and Marr Creek are below the design specification of the West Creek Diversion below the hydraulic control. Pending Schedule 2 approval (anticipated January 2018) these two culverts will be removed prior to freshet 2018 and the channel stabilised consistent with the design outlined in section 4.

## 5.6 Progressive Reclamation and Closure

Some progressive reclamation with respect to the TMA is proposed as part of mine operations. By the end of the operations phase a low permeability overburden cover of approximately 150 m in width will be placed on the upstream side of the TMA dam. The overburden cover will cover approximately two thirds of the ultimate perimeter, with the remaining approximately one third of the length to be reclaimed at closure. This cover is intended to prevent the tailings permanent water cover from coming into contact with the TMA dams, and will also serve a secondary function of limiting oxygen diffusion into the uppermost portion of the tailings underneath. The overburden cover will be seeded or hydroseeded with a native seed mix or equivalent, and will be armoured with NPAG rock at the transition zone of the cover with the tailings to prevent suspension and oxidation of solids.

Closure of the RRM in respect to tailings, process water and freshwater management will include but is not limited to the following:

- Flooding of the TMA with a 2 m or deeper water cover;
- A perimeter zone of tailings beach will be maintained to keep the central pond away from the dams, this zone will be covered with a low permeability cover;
- NPAG rock will be placed at the TMA transition zone with the tailings to prevent erosion and suspension and oxidation of solids;
- Dam structures containing the TMA have been designed with adequate safety factors to provide overall long term safety and stability;

- The water management pond dams will be breached to prevent retention of water; upstream dam faces that become exposed will be revegetated;
- The water discharge pond dam will be breached once it no longer has a water management function;
- The constructed wetland will be left in place as this system is designed to operate passively, and will have stabilized as a wetland complex during operations;
- At closure the MRP will collect runoff and seepage from the EMRS which will then be directed to the Open Pit to help flooding;
- Clark Creek Pond, West Creek Pond, Teeple Pond, Stockpile Pond, West Creek Diversion Channel, Clark Creek Diversion Channel, Teeple Pond Diversion Channel and Stockpile Pond Diversion Channel support the creation of fish habitat for compensation purposes as such they will remain in place at closure; and
- Sediment Ponds #1 and #2 will be maintained until such time as the site (or if applicable individual site components) become a recognized closed mine such that monitoring associated with the Metal Mining Effluent Regulation is no longer required, at such a time, pond impoundment structures will be breached and the residual pond sites will be stabilized and restored.

## 5.7 Safety and Security

The site safety and security will be following the RRM Health and Safety Management System including but not limited to the following:

- The site will be gated with restricted access to authorized personnel only;
- The TMA will be fenced along portions of the old highway 600 and access will be restricted to authorized personnel only;
- No public access;
- Construction Management provided security measures; and
- Onsite health and safety policies for working around bodies of water, working alone or crossing ice.

## 5.8 Environmental Protection

The Environmental Department has oversight over the EMS which contains tailings operations related environmental aspects including:

- Fugitive and point source dust emissions;
- Hydrocarbon Spills and Leaks;
- Pipeline Rupture and Leaks;
- Surface and ground water quantity and quality; and
- Wildlife management (including species at risk).

An environmental aspect register is a comprehensive inventory of tailings operations activities, environment aspects, assessment of risk and identification of controls. Tailings personnel have responsibility to implement and maintain the controls including monitoring and inspection. Refer to the Environment Department for the environmental aspect register (in prep) and environmental related procedures.

As outlined in orientation training, it is every RRM employee's responsibility to report a suspected spill or uncontrolled release event to their supervisor. This includes suspicious flows of water out of the area, escaping tailings, etc. The sooner appropriate persons can begin to correct a situation, the less likely it is that severe impacts will follow.

Table 5-3 provides a summary of the MOECC effluent discharge limits that must be met to discharge from the WMP.

**Table 5-4; MOECC Effluent Discharge Limits from the WMP**

| Constructed Wetland Final Discharge and Water Management Pond Pipeline Discharge (to the Pinewood River) as stated in MOECC ECA 5178-9TUPD9 | | |
|---|---|---|
| **Effluent Parameter** | **Daily Maximum Concentration (mg/l)** | **Monthly Average (mg/l)** |
| Cadmium | - | 0.0010 |
| Cobalt | - | 0.0044 |
| CBOD5 | - | 25.0 |
| E.coli | - | 100/100ml geometric mean density |
| Total Suspended Solids | 30 | 15 |
| Total Phosphorus | - | 0.10 |
| Cyanide (total) | 0.1 | 0.05 |
| Cyanide (free) | 0.02 | 0.01 |
| Total Arsenic | 0.034 | 0.017 |
| Total Copper* | 0.028 | 0.014 |
| Total Nickel | 0.094 | 0.047 |
| Total Lead* | 0.030 | 0.015 |
| Total Zinc* | 0.348 | 0.174 |
| Un-ionized Ammonia | 0.08 | 0.04 |
| Acute Toxicity (Rainbow Trout and Daphnia Magna) | Non-acutely lethal (not greater than 50% mortality in undiluted effluent) | |
| pH of the effluent maintained between 6.0 to 9.5, inclusive, at all times | | |

**Notes:**
1. *Proposed effluent criteria for Total Copper, Total Lead, and Total Zinc are based on a hardness of 200 mg/L CaCO3. In the event that water quality sampling indicates that 75th percentile hardness concentrations are less than 200 mg/L CaCO3, the effluent limits may be changed by the District Manager in writing, consistent with achieving no impairment for receiving waters.
2. Additional effluent limits for sediments 1&2 are stated in MOECC ECA 5178-9TUPD9
3. The effluent discharge rate from the Constructed Wetland Final Discharge and the Water Management Pond Pipeline Discharge such that at all times the ratio of the combined flow rate of these effluents to the flow rate of the receiving surface water (Pinewood River) is less than or equal to 1:1 (i.e. the cumulative flow rate of the effluent must be less than or equal to the flow rate of the receiving surface water).
4. Prior to commencing Operations Phase discharges (Constructed Wetland Final Discharge, Water Management Pond Pipeline Discharge, Sediment Pond #1, and Sediment Pond #2), the method for determining daily effluent to receiver flow mixing ratios shall be approved by the District Manager.
5. For sampling frequencies and full parameter list refer to MOECC ECA 5178-9TUPD9; sampling frequency varies from thrice weekly to quarterly depending on the parameter

### 5.9 Reporting Requirements

An Operations Report will be prepared by the Mill Manager or designate. The report will include metrics and information collected as part of normal operation. Examples of information contained in the Operations report include:

- Total monthly tailings deposition tonnage and slurry water volume;
- Total monthly reclaim volume;
- Pond level and freeboard;
- Updated water balance;
- Water quality results; and
- Intake / Discharge quantities.

Each of the regulatory approval requirements related to the construction, operation and eventual reclamation of the Site have specific compliance reporting requirements with defined deadlines or reporting periodicity. In general, the reporting includes:

- Operation, Maintenance and Surveillance Plan(s) for dams, water management (water quality) and air/noise emissions;
- Emergency Preparedness Plan(s);
- As-Built Drawings and related Construction Reports;
- Dam Safety Inspection and Review Reports
- Environmental Monitoring Plans; and
- Environmental Monitoring and Performance Reports.

The environmental approvals and permits received from the government that are maintained by the New Gold Environmental Department should be referred to for details of monitoring, inspection and reporting requirements.

In addition, the New Gold Environmental Department should be notified of any proposed major modification to RRM facilities, in order that they can liaise with the appropriate government ministries to determine if additional approvals or amendments to existing approvals are required.

# 6.0 MAINTENANCE

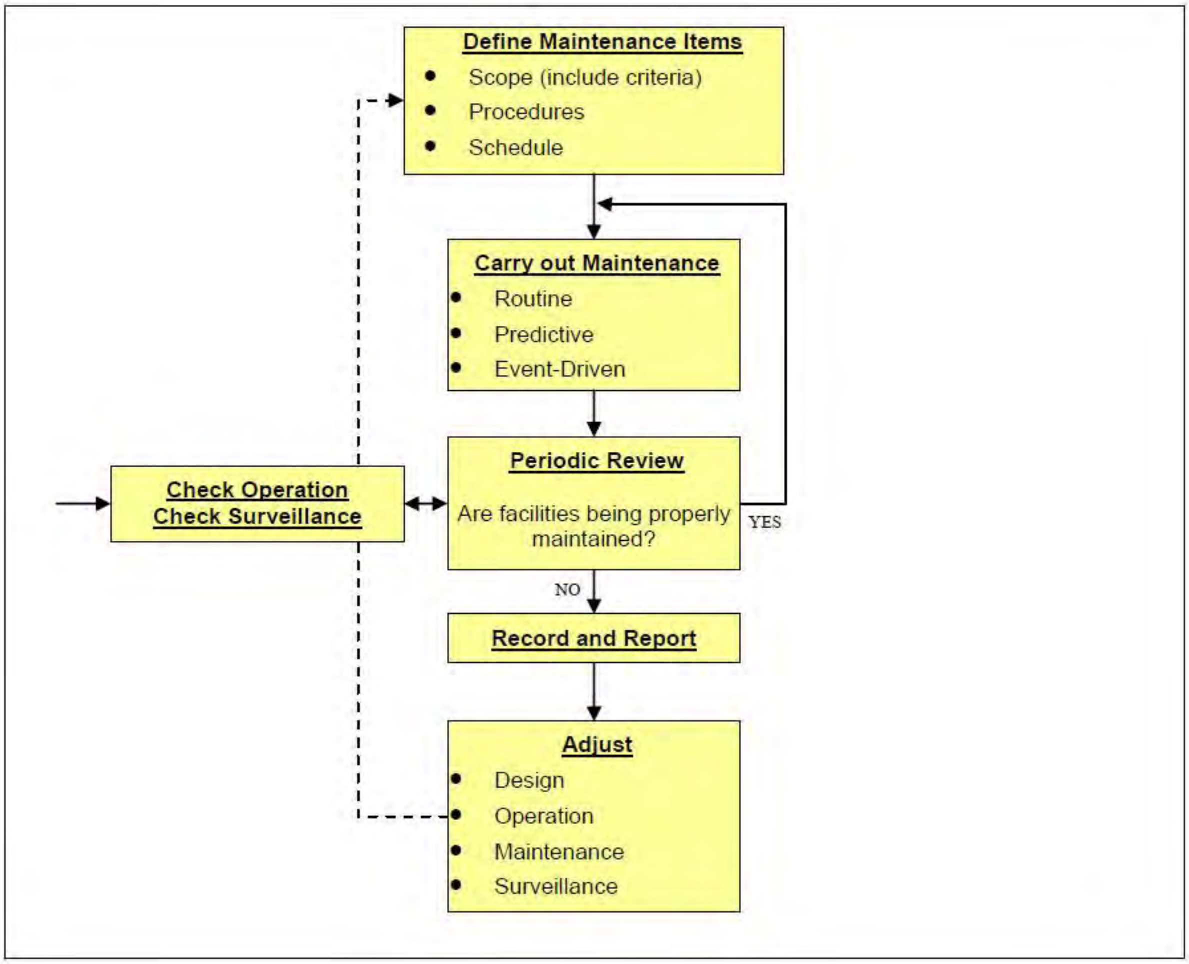
The following periodic maintenance is required:

1. Maintain the tailings and reclaim pumps and associated lines and containment;
2. Clear debris, snow and ice which may block flow from through the decant facility or emergency spillways;
3. Maintain water management structures including spillways, ditches and diversions;
4. Maintain equipment, power and water lines, and instrumentation;
5. Repair any deficiencies as noted in the Dam Safety Inspections (DSI); and
6. Reconstruct the support for tailings discharge pipelines wherever washouts occur.

Maintenance records are retained by maintenance personnel performing the work in accordance with the procedures described in this document. Timing of maintenance actions for unusual conditions should be based on specific recommendations from surveillance findings. Scope and time frames for routine maintenance activities are determined and scheduled by the Maintenance Department and based on manufacturer’s recommendations and best practices.

The maintenance flowchart is illustrated in Figure 6-1.

**Figure 6-1; Maintenance Flow Chart**




## 6.1 Routine and Predictive Maintenance

Routine and predictive maintenance includes removal of vegetation, beaver dams, ice blockage or sediment accumulation that would otherwise affect the performance of a structure when required.

### 6.1.1 Dams

The following are examples of specific maintenance activities:

- Regularly check diversion ditches, spillways and culverts for accumulation of debris or sediment, or any other form of blockage including ice, and remove if required;
- Visually inspect diversions, spillways, seepage collection sumps, dams and all ditches for cracking, bulging, slumping, and any other indications of slope movement (note, any indications of slope movement shall be reported to a qualified geotechnical engineer);

- Re-grade the dam crest, as required, to prevent local ponding and direct surface runoff towards the pond;
- Repair erosion gullies, local slumps or slides in the dam face, diversion ditches or spillway channels; and
- Regularly check diversion ditches for accumulation of debris or sediment, or any other forms of blockage, and remove if required.
- If annual survey determines necessary, correct dam crest, overflow spill way and diversion channel invert irregularities to avoid concentrated runoff.

### 6.1.2 Ditches and spillways

Ditch maintenance includes replacement or enhancement of erosion protection to prevent sediment generation or sloughing of slopes, as required.

### 6.1.3 Diversions

There are approximately 10 km of diversions associated with the Clark and West Creek diversion. Maintenance activities required include;

- Repair erosion and bank stability particularly in areas of concentrated flow e.g., culverts;
- Remove debris, and where required and approved beaver dams, that aren’t part of natural progression of channel development
- Repair/modify fish habitat features if monitoring determines they are not meeting the success criteria per Fisheries Act Authorization 15-HCAA-00039, including dam crest/slope

Specifically, for the Clark Creek diversion, as per the as built report, the following maintenance will be conducted;

- Repair riffles in the Teeple Road Diversion, directly downstream of the inlet in fall 2017.

### 6.1.4 Geotechnical and Water Monitoring Instrumentation

Instrumentation is calibrated by the manufacturer prior to shipment. Calibration certificates will be maintained by maintenance department. Following instrument installation, initial reading procedures will be followed. Subsequent calibration will follow manufacturers recommendations.

Malfunctioning or damaged instruments may require repair or replacement per manufacturer guidelines or approved procedure. In the event of replacement of dam instrumentation, several overlapping readings of the old and new instrument are required to ensure continuity of the data records.

### 6.1.5 Pumping Systems and Pipelines

Maintenance of the tailing delivery, water recirculation systems and seepage pumps will include:

- Perform regular performance tests of the Pinewood Pumphouse pumps and inspections of pump fish screens to remove any debris;
- Perform regular performance tests on seepage pond pumps
- Perform annual calibration and maintenance as required on flow meters;

- Perform regular non-destructive testing appropriate for components of the tailings delivery system, including for example, periodic measurement of pipeline thickness to identify areas of wear and to schedule pipeline replacement if necessary and repair liners as required;
- Replace pipe work, bends and fitting components as required;
- Remove accumulated debris from valves, reducers and off takes;
- Carry out maintenance as recommended by fitting and valve suppliers;
- Regularly inspect major wear components;
- Maintain emergency dump ponds in a dewatered/empty state; and
- Maintain and replace system instrumentation as required.

#### 6.1.6 Mobile Equipment

Mobile equipment is maintained on the basis of a planned reliability program and as otherwise required. Equipment in question includes:

- Dozers;
- Excavators;
- Water truck;
- Pickup trucks;
- Mobile crane;
- Flatbed and picker truck; and
- Replacement of mobile equipment as required.

## 6.2 Event-Driven Maintenance

In the event of unusual conditions or incidents that require immediate maintenance actions but are not considered an emergency, repairs and replacement of facility components are made as required and activities are documented. RRM staff will provide a means to assess event driven maintenance needs through response action planning. Response planning is based on risk prioritization, maintenance crew mobilization or “call out” procedures, required repairs and replacement material availability. Event driven maintenance actions will follow applicable safety and performance procedures. Normal documentation and maintenance records will be maintained as a result of any event driven maintenance actions. Unusual conditions that require maintenance are also communicated to maintenance staff as they occur.

### 6.2.1 Pipeline Leaks or Breaks

In the event of a pipeline leak or break the system in question is de-energized and repaired as follows:

- Inspect entire pipeline;
- Repair or replace affected components;
- Perform opportune and scheduled maintenance;
- Repair any collateral damage caused by a leak or break;

- Collect any released tailings and place in the tailings impoundment;
- Reclaim any disturbed areas; and
- Follow any spill reporting that may be required pending type of spill and following documentation procedures.

### 6.2.2 Earthquake Occurrence

Following an earthquake, the following are undertaken:

- Inspect dam and beach areas for sign of distress due to deformation;
- Inspect dam for signs of liquefaction (e.g., local sand boils, etc.);
- Measure freeboard for compliance with design requirements;
- Inspect toe area of dam for signs of deformation or piping of fines;
- Inspect diversions, ditches and spillways for sign of slumping or changes in geometry;
- Inspect seepage collection areas; and
- Collect instrumentation data and submit to EOR for analysis.

### 6.2.3 Flood Event

Following extreme storms (as defined in section 7) the following are undertaken:

- Measure freeboard for compliance with design requirements;
- Inspect dam, diversions, ditches, spillways and diversions for signs of excessive erosion and repair if required;
- Inspect seepage return system for adequacy; and
- Implement appropriate response based on observations/measurements as defined in this manual.

## 6.3 Reporting Requirements

Maintenance information will be communicated internally through formal and informal meetings, interaction between various levels of the organization (department and/or crew meetings), through information posted at the site and through this OMS Manual.

Communications with applicable contractors involved in tailings management will be conducted daily and weekly during tailings activity meetings, as appropriate. All employees and contractors are encouraged to communicate openly with site management about operational conditions requiring maintenance and reporting any significant observations such as event-driven maintenance or any maintenance requirements that exceed expected norms.

Equipment logs and manuals will be maintained for reference and use by responsible staff.

Maintenance diaries and logs shall be maintained and accessible for review by other parties.

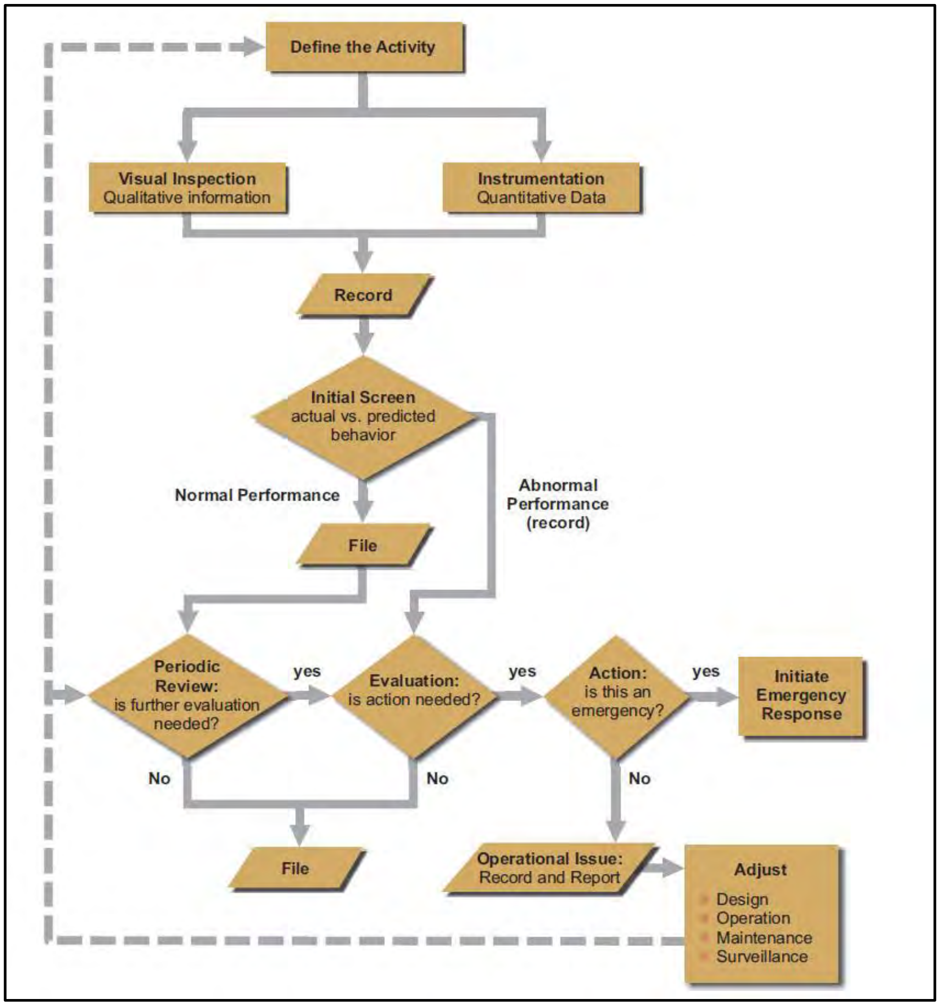
# 7.0 DAM SAFETY AND SURVEILLANCE

The RRM tailings and water management surveillance activities involve inspection and monitoring of the operation, structural integrity and safety of a facility. Regular review of surveillance information can provide an early indication of performance trends that, although within specifications, warrant further evaluation or action. The objectives of our surveillance program are as follows:

- Monitoring the operation, safety and environmental performance of tailings and water management facilities;
- Promptly identifying and evaluating deviations from expected behavior that affect operational safety, structural integrity and environmental performance of the facility; and
- Reporting significant observations for response.

The flow chat for surveillance is shown in Figure 7-1. Surveillance is undertaken in two primary methods – visual inspection and reading of instruments. Results of these qualitative and quantitative observations are compared to the expected performance of the TMA and water management facilities. If observations are within the expected range or performance, the results of the surveillance are simply recorded. If observations are outside the expected range, further evaluation is completed to determine if remedial action is necessary. If necessary, this action is taken and may range from a minor adjustment to operational procedures to initiation of emergency response, depending on the severity and nature of the deviation from expected performance.

**Figure 7-1; Surveillance Flow Chart**




## 7.1 Surveillance and Inspections by Mine, Mill and Environment Operations Staff

The purpose of the surveillance program is to identify and classify problems and/or unsafe conditions that are visually evident. Visual inspections are an integral part of proper maintenance and performance of monitoring programs for the TMA and water management facilities. Failure to correct identified maintenance and repair items, or potential adverse behaviour, could result in unsafe conditions or lead to a failure of operating systems or cause an adverse environmental effect.

The surveillance program will consist of making regular observations relating to:

- The conditions and performance of the dams including indications of cracking, bulging, depressions, sinkholes, vegetation, surface erosion and seepage;
- Water levels and pump intake zones;
- Function of ancillary hydraulic structures (diversions, spillways, pipelines etc.);
- Discharge pipeline operations and tailings beach development; and

- Total facility performance.

During inspections, observations will be made at the upstream slope, crest and downstream slope with respect to signs of erosion, scouring, cracking, settlement, deformation, and any instability and abnormality. Seepage rates will be visually estimated and recorded on the inspection forms. Changes in the seepage rate or clarity (i.e., turbidity) require immediate reporting to the Engineer-of-Record.

### 7.1.1 Daily Inspections

During first filling of all dams except the TMA dams Surveillance records will be maintained in logs at site and submitted to the EOR for review daily and on a monthly basis thereafter, or more frequently as warranted. Any abnormal behaviour including slope slumping, erosion of crest settlement will be reported immediately to the Engineer-of-Record.

Routine daily visual inspections of critical dams (TMA, WMP and MRP), spillways, pipelines, pipeline containment and pumping infrastructure will be carried out on an on-going basis to confirm normal operations and identify unusual or anomalous conditions such as pipeline leaks, pump intake blockages, etc. All active pipelines will be inspected twice per 12 h shift, consistent with EA conditions.

Daily inspection sheets and provided in Appendix F.

### 7.1.2 Weekly Inspections

Physical inspections of the TMA, process water, water treatment and diversion dams will be conducted on a weekly basis. The weekly inspections will include those discussed in Section 7.1.1 and the following tasks:

- Photographic record of key features;
- Physical inspection of dams, dykes, diversion, ditches and spillways:
  - Indicating and reporting any seepage and erosion.
- Pond levels and freeboard:
  - Additional monitoring maybe required during spring freshet of the dams.

Weekly inspection sheets and SOPs are provided in Appendix F. All weekly inspections will be documented in a report and will be compiled as part of the annual DSI (Section 7.4).

### 7.1.3 Other Inspections

#### 7.1.3.1 Diversions

The Clark and West Creek diversions, while designed to operate passively, have specific surveillance requirements as part of the approved Fisheries Act authorizations. Further, impediments to water flow in diversions have the potential to alter water levels in the ponds. For the diversions, in addition to requirements specified above, and following the as built report for the Clark Creek Diversion these surveillance requirements will be conducted;

- Inspection of fish habitat features, as per Fisheries Act Authorization 15-HCAA-00039;
- Complete a survey of the Clark and Teeple dam crests and diversion channel inverts annually, observations of crest irregularity will require correction to avoid concentrated runoff in the overflow spillway;

- Monitoring pond levels include Teeple and Stockpile ponds (by staff gauge, transducer or other suitable means) daily. The frequency will be re-evaluated after one year of operation (May 2018).

#### 7.1.3.2 Water Treatment

The water treatment facilities, WDP, CW and sediment ponds 1 and 2 will be inspected consistent with LRIA approvals (pending) and the MOECC ECA approval. This section will be updated in future revisions, to describe surveillance requirements in addition to those outlined above which may include;

- Discharge pipeline and mixing structure;
- Up to thrice weekly water quality sampling from discharge points; and
- Inspections to confirm the absence of oil/sheen.

## 7.2 Inspection Required After an Unusual Event

Several potential failure modes exist for the various tailings and water management and water diversion storage facilities. These potential failure modes, along with likely triggers, observable visual and instrumentation indicators of the failure mode are presented in Table 9-1. Special inspections will be carried out immediately if any of the following events occur:

- Events such as an earthquake, large rainfall (greater than 1:2 year rainfall (51mm)) or large snowfall/snowpack;
- Operating events such as rupture of a pipeline, particularly if on the slope or crest of the dam, sudden loss of pond water, sudden rapid rise of pond water;
- Observations such as cracks, excessive settlements, sinkholes, large slope or foundation deformations, increased seepage, turbidity of seepage water; and
- Instrument readings that deviate from historical trends, or are within “alert” action levels (e.g., trigger levels).

Special inspections after unusual events are necessary as summarized in Tables 7-1 to evaluate whether there has been any damage requiring correction, any safety measures or special operating procedures that need to be implemented, or if there is a need to initiate emergency procedures as described in Section 9.0.

**Table 7-1; Maintenance Requirements following an Unusual Event**

| Unusual Event | Post – Event Inspection/Surveillance |
|---|---|
| Earthquakes | Carry out a detailed walkover of all dam structures, including crests, downstream and upstream (visible) slopes and dam toes, and all spillways, looking for signs of cracks, bulging, settlement and/or other deformations. Look for and note any changes in seepage, particularly with respect to the rate of seepage flows at dam slopes and seepage clarity. Read all piezometers. Inspect downstream toes of dams for sand boils and dam slopes for sinkholes. Inspect ponds upstream of the dams looking for 'whirlpools'. Inspect all pump stations and pipelines. Discuss findings with the Dam Safety Inspector. |
| Rapid snowmelt and/or heavy rainstorms exceeding a 1:2 year rainfall (51 mm) | Inspect the (visible) slopes and the crests of all the tailings dams looking for areas of concentrated runoff and erosion. Make note of saturated ground/soft ground conditions at dam slopes and toes. Examine dam slopes for indications of localized slumping/instability. Inspect all pump stations and pipelines. Check the water levels in all ponds/reservoirs against the critical levels, and keep checking these levels until the pond/reservoir inflows subside. Discuss findings with the Dam Safety Inspector. Check piezometric levels at dam sites if instructed to do so. |
| Unusually high winds (exceeding 60 kph i.e., 75 % of maximum likely used in design) | Check the condition of erosion protection on the upstream slopes of the dams. |
| Extreme snow pack (170cm cumulative snowfall) (i.e., 120% or greater than normal snowfall at Barwick) | Check the water levels in all ponds/reservoirs against the critical levels, and keep checking these levels until the spring freshet is over. Evaluate the situation in terms of possible snowmelt scenarios. Make predictions as to the expected storage capacity available in ponds/reservoirs. If deemed necessary, mobilize pumping and mobile treatment equipment to site. |
| Significant, relatively rapid erosion (any cause) of dam slope of 'sudden' seepage break at dam slope or downstream of dam in form of continuous seepage or boils | Inspect clarity of seepage, rate of seepage and amount of material sloughed. Notify tailings coordinator – site engineering and EOR.<br><br>Consider initiating Emergency Response Plan |
| Pond level close to, or approaching a critical level | Notify Manager. Consider initiating Emergency Response Plan |
| Significant change in an instrumentation reading – see table below for definition of significant change | Check the historical readings paying special attention to seasonal changes and check the measurement again.<br><br>Carry out visual inspection of all areas in the vicinity of the instrument of interest. Contact the Engineer of Record. |

## 7.3 Dam Instrumentation and Monitoring

The instrumentation data is reviewed regularly to identify anomalous readings that could indicate a change in the conditions of the tailings and water management facilities. Dam instrumentation lists are provided in section 4.6. Instrumentation reading and reporting frequencies are outlined in Table 7.2. Responsible parties' record notes and takes pictures of any potential anomalies to provide further information to the EOR. Instrument trigger and alert levels are provided in Table

7.3. Additional details on instrument reading frequencies can be found in the *Geotechnical Monitoring Plan* (Amec Foster Wheeler, 2016b).

**Piezometers:**

- Vibrating Wire Piezometers shall have a reading frequency every hour and recorded by a data logger, with data collected daily during construction. Post-construction after the readings have stabilized, the reading frequency will be reduced to every 12 hours, as defined in the table below;
- Standpipe piezometers shall be measured weekly during construction and monthly following construction;
- The following are considered anomalous:
  - Sudden increases or decreases that do not correlate with seasonal variations (e.g., groundwater recharge during snowmelt affecting foundation piezometers);
  - Trend of piezometric increase that approaches or exceeds the rate of rise of the tailings pond; and
  - Pattern of sudden and large increases followed by rapid declines.

**Inclinometers:**

- Inclinometers shall be monitored semi-weekly during construction and monthly following construction;
- Anomalous data includes:
  - Sudden increases in cumulative displacement/rate of movement of the inclinometers;
  - Zones of concentrated or discrete displacement; and
  - Blockages of the inclinometer casing.

**Settlement Plates and Survey Pins/Monuments:**

- Settlement Plates and Survey Pins/Monuments shall have a reading frequency of semi-weekly during construction and monthly following construction;
- Anomalous data includes:
  - Sudden displacements of the settlement monuments (x, y, z directions); and
  - Accelerating displacement trends (over two or more readings).

If anomalous readings are observed, the following actions should be taken:

- Check data, reductions and calculations for accuracy and correctness;
- If no errors are found in the calculations, notify the EOR, Geotechnical Engineer and Environmental Manager that an anomalous reading has been observed and that further assessment is going to be conducted;
- Check readout equipment to verify that it is functioning correctly; verify calibration;
- Re-read all instrumentation of the type for which the anomalous reading was observed, in order to check the reading and reading in adjacent instruments;

- If it is observed that an instrument or piece of readout equipment has stopped functioning, notify the Mill Manager and/or Superintendent, and the EOR immediately. If considered critical, a replacement instrument should be installed;
- If the anomalous reading is confirmed, notify the Superintendent and EOR immediately; and
- A detailed review of the effects of the reading should be carried out and the monitoring frequency of the instruments in the area of the anomaly increased to assess the progression of the anomaly. Design or remedial actions should be implemented if determined necessary.

All results are downloaded and provided to the EOR. Any anomalies are noted and a request for an additional reading may occur. The EOR will review the data in quarterly monitoring reports, and make any recommendations, such as increased reading frequencies, pertaining to anomalous readings. The EOR, will also assess the trigger and alert levels and update them as necessary, once per year, as part of the DSI.

**Table 7-2; Dam Instrumentation Surveillance Requirements**

| Type | Frequency |
|---|---|
| *Routine Inspection:* | |
| Dam | Weekly |
| Diversions | Weekly |
| Ditches | Weekly |
| Seepage collection system | Weekly |
| Spillways | Weekly |
| Pipelines | Twice per 12 h shift – per EA commitments |
| *Tailings Pond Monitoring:* | Weekly |
| Pump intake | Weekly |
| Staff gauges | Weekly (initially every ~12h) in Cell 1 borrow |
| Inflows, Outflows, Condition | Monthly |
| *Dam Instrumentation:* | Monthly |
| *TMA, WMP and MRP Comprehensive (and water diversions during initial filling)* | • Daily during construction and initial filling<br>• Weekly, during initial operations depending on trend<br>• Monthly during routine operation |
| *Annual Dam Inspection* | Annually, with no snow cover |
| *Event Driven Inspection* | Following unusual events (defined in table 7.1) |
| *Comprehensive Review (DSR):* | |
| Low and Moderate HPC dams | Every 10 years and prior to decommissioning |
| Very High HPC dams | Every 5 years and prior to decommissioning |

Notes:

1. Dam Hazard Potential Classification (HPC) requires review when changes are made or downstream conditions change.
2. Monthly facility inspections should be carried out by the same staff or small group of staff such that subtle changes in the conditions can be detected.

**Table 7-3; Instrument Trigger and Alert Levels**

| Instrument | Parameter | Trigger Level | Alert Level | Remarks |
|---|---|---|---|---|
| VWP/STP | Pore Pressure Ratio | $r_u$ = 0.4 | $r_u$ = 0.5 | Pore pressure data to be evaluated with corresponding fill elevation, and monitored movements at SPs and INs |
| Survey Pin | Lateral Movement Rate | Uniform (but less than max 75 mm magnitude) | Accelerating | To be evaluated with IN data to define zones of movement |
| Slope Inclinometer | Lateral Movement Rate | Uniform | Accelerating | Deformation rates will be associated with rate of construction and post construction movements |
| | Share Strain Magnitude | 2% | 5% | If specific plane(s) of shearing is observed within the foundation, the construction shall be limited, progressed with caution or ceased depending on the observed phenomena |

Notes:

1. $r_u$ of 0.4 corresponds to a piezometric head at 80% of the dam height. $r_u$ 0.5 is at pietometric head at the crest of the dam.
2. $r_u$ of 0.5 is a design criteria to meet dam stability requirements.

Source; Geotechnical Monitoring Plan (AMECFW, August 2016)

## 7.4 Dam Safety Inspections (DSIs) and Dam Safety Reviews (DSRs)

Consistent with MOECC ECA approvals, with the regulatory exception of the Clark and West Creek Diversions, engineering inspections will be conduct following best management practices as per the Canadian Dam Association's (CDA) Dam Safety Guidelines (2007, revised 2013, as amended from time to time), and the 2014 CDA Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams (as amended from time to time).

### 7.4.1 Dam Safety Inspections

Annual inspections are intended to be part of a more thorough review of the condition of the facility, and are carried out by the EOR. The inspections will include the following key items:

- Visual inspection of the facility by the engineer, including taking appropriate photographs of the observed conditions;
- Review of routine inspection records prepared by operating personnel in the past year;
- Review whether or not recommendations from previous year's inspection(s) have been addressed, and any incidents or actions arising from those previous recommendations;
- Review of instrumentation and monitoring data;
- Review of tailings deposition and water management operations of the facility including reconciliation of the annual water and mass balance. Review of pond levels (and depth) and freeboard, and reports of any incidents (and remedial measures) that may have occurred;

- An evaluation and interpretation of the structural performance of the dam and related components, and identify any potential safety deficiencies or recommended items that need to be addressed in the coming year;
- Review construction records, QA/QC data and as-built information on dam construction and beaching; and
- Evaluation of the OMS Manual to assess the need for updating.

The results of the inspection and review will be documented in a report.

#### 7.4.2 Dam Safety Review

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2007) recommend a comprehensive dam safety review be carried out every 5 years during operations, prior to decommissioning and following closure, by a qualified 3rd party consultant.

The comprehensive review provides independent verification of:

- Safety and environmental performance of the facility;
- Adequacy of the surveillance program;
- Adequacy of delivery of OMS Manual requirements;
- Design basis with respect to current standards and possible failure modes; and
- Compliance with new engineering standards (including analysis to confirm if necessary).

### 7.5 Documentation

Documentation of surveillance and monitoring activities shall be maintained by the Mill Manger, or as designated, as described in the preceding sections and will include recording of:

- Routine visual observations (departures from normal conditions);
- Photographs;
- Instrumentation monitoring and testing;
- Analyses and evaluations; and
- Reviews.

Documentation will include, as a minimum, the following:

- Weekly routine inspection log;
- Monthly tailings facility and process water pond monitoring report;
- Quarterly instrumentation reports;
- Annual Dam Safety Inspection reports; and
- Comprehensive Dam Safety Review report every 5 years.

Documentation will include a hard copy (paper) and electronic filing system for inspection reports, photographic and video records, incident reports, instrumentation readings, instrumentation plots, annual inspections and third-party reviews, so that they can be quickly retrieved for review and in case of an emergency.

## 7.6 Reporting

The Mill Manager, or designated responsible party, and Geotechnical Engineer will review collected data records from facility monitoring and assess the need for maintenance activities or response. Corrective actions will be identified and tracked to closure. The Environmental Manager is responsible for overseeing sample and data collection and analysis. Reporting will meet MOECC requirements and the annual DSI report will also be submitted to the MRNF. Reporting includes;

- As built reports of the dams, excluding the Clark and West Creek diversions, will be submitted to MOECC within 90 days of completion;
- An annual report based on the DSI including ECA approval requirements;
- Monthly water quality monitoring report; and
- Annual report including any operating problems and corrective actions, a summary of calibration and maintenance works, use of contingency plans, surface water and groundwater monitoring reports including water balance, ML/ARD updates, discharge volumes and quality.

Additional reporting requirements may be developed as the RRM progresses.

# 8.0 CLOSURE PLAN

This section summarizes the objectives of the Closure Plan. The *Rainy River Project – Closure Plan* (Amec Foster Wheeler, 2015c) provides the closure plan and includes temporary closure options for short and medium-term shut-down of site facilities.

## 8.1 Tailings Management Area

Closure of the TMA will include, but is not limited to, the following:

- Flooding of the TMA with a 2 m or deeper water cover;
- A perimeter zone of tailings beach will be maintained to keep the central pond away from the dams, this zone will be covered with a low permeability cover;
- NPAG rock will be placed at the TMA transition zone with the tailings to prevent erosion and suspension and oxidation of solids; and
- Dam structures containing the TMA have been designed with adequate safety factors to provide overall long term safety and stability.

## 8.2 Embankments

Closure of the embankments will typically involve, but is not limited to reaching of embankments to prevent ponding of water and revegetating slopes to reclaim the area. Some embankment structures will still have a role during the closure phase and these will not be breached. The following structures will continue to be operated during the closure phase:

- MRP will collect runoff and seepage from EMRS, which will be directed to the Open Pit to help flooding;
- Sediment Ponds #1 and #2 will be maintained until site is recognized as a closed mine and monitoring associated with the Metal Mining Effluent Regulation is no longer required

Freshwater diversion and constructed wetland structures are designed to operate passively and will remain in place at closure.

### 8.3 Monitoring

Monitoring requirements are described in the *Rainy River Project – Closure Plan* (Amec Foster Wheeler, 2017c).

## 9.0 EMERGENCY PREPAREDNESS

The objectives of this section is to describe procedures to prevent the occurrence of emergencies and reduce the impact, should they arise. This manual covers only those emergency situations that could potentially pose a threat to the structural integrity of the dams or result in the release of tailings and/or supernatant pond water into the surrounding environment. This document was developed to work in conjunction with the Emergency Preparedness and Response Plan (EPRP) (as reviewed annually and maintained by New Gold H&S team – latest revision February 2017).

The ultimate goal is to protect human life and health, the social well-being of the local community and employees, public infrastructure and company facilities; and environmental conditions and habitats.

### 9.1 Definition and Classification of Emergencies

An emergency is defined as:

> *"A situation or a set of circumstances which, if not promptly eliminated, controlled or contained, results or could result in a significant injury to people (including the community) and/or damage to the tailings facility, property and/or the environment."*

### 9.2 Potential Dam Failure Modes

The containment dams at the RRM are predominately zoned embankments with clay cores and rock fill shells. The primary method of dam construction uses the centreline method which is considered to be a stable form of construction. Adherence to design drawings and specifications is critical to minimize the risk of failure.

Several potential failure modes exist for the various tailings storage and water management facilities. These potential failure modes, along with likely triggers, observable visual and instrumentation indicators of the failure mode are presented in Table 9-1. A preliminary dam break inundation map is provided in Figure 9-1.

External hazards originate outside the boundary of the dam and reservoir system and are beyond the control of the dam owner. External hazards include the following:

- Meteorological events, such as floods, intense rainstorms (causing local erosion or landslides), temperature extremes, ice, lightning strikes, and windstorms;
- Seismic events, either natural, cause by economic activity such as mining, or even reservoir induced;
- The reservoir environment, including rim features, such as upstream dams and slopes around the reservoir that pose a threat; and
- Vandalism and security threats.

Internal hazards may arise from the ageing process or from errors and omissions in the design, construction, operation, and maintenance of the dam and water conveyance structures. Internal hazards can be subdivided by source:

- Components that retain or interfere with the body of water;
- Water conveyance structures required to direct water around or through the dam in a controlled way;
- Mechanical, electrical, and control subsystems;

- Infrastructure and plans, including instruments, operating orders, maintenance strategies and procedures, surveillance procedures, and emergency plans, as well as inflow forecasts.

A failure mode describes how a component failure occurs to cause loss of the system function. Failure modes may be interdependent and change in nature and significance at different stages of a dam's life. In any analysis, the failure characteristics, including extent and rate of development, should be determined to an appropriate level of detail. At a general level, there are three dam failure modes:

- Overtopping – water flows over the crest of the dam, contrary to design intent;
- Collapse – internal resistance to the applied forces is inadequate; and
- Contaminated seepage – contaminated fluid escapes to the natural environment.

Dam safety risk management is directed to (1) prevention of the initiation of a failure sequence; (2) control of a deteriorating situation, and (3) mitigation of situations where the failure sequence cannot be stopped.

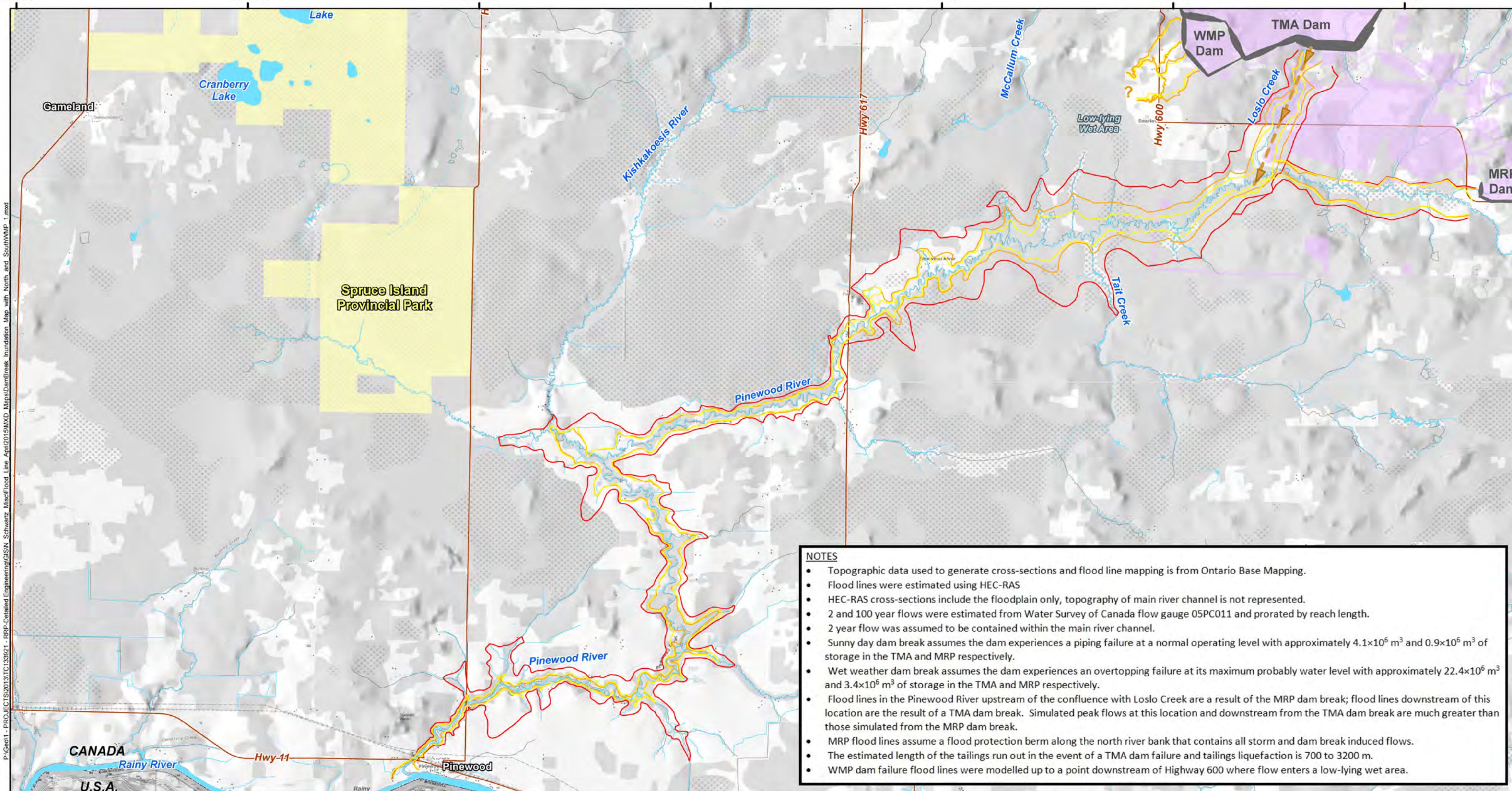
**Table 9-1; Potential Failure Modes, Triggers and Observable Effects**

| Potential Failure Modes | Possible Causes | Visual Indications | Instrumentation Effects |
|---|---|---|---|
| Break down of pump stations | Blockages, lack of maintenance | No flows | Test on pumps and other related components |
| Pipeline damage, cracking, blocking, or freezing | Flows blocked by excessively turbid water, debris or ice blockages, extreme weather | No or partial flows; pipeline leaking, cracking or bulging | Pipeline thickness; line pressures; pipeline flow rates |
| Overtopping | Excessive foundation movements, high wind and wave erosion of beach landslide generated wave, erosion of freeboard, settlement of crest, gully growth towards upstream crest due to seepage, surface runoff or pipe ruptures | Instability in reservoir slopes – slumping, sliding, etc. Damage to upstream face of dam, breach of crest | None |
| Slope Failure | Changes to porewater pressure within the dam (filters becoming non-functional, earthquake included) | Bulging, slumping, sliding or cracking of dam, increase in volume of seepage | Increase in porewater pressures measured within dam |
| Foundation Failure | Changes to pore water pressure in the foundation or increases to load applied to foundation (Increase in dam height or pond elevation) | Bulging, slumping, sliding or cracking of dam, or natural ground surrounding the dam | Increase in porewater pressures measured within dam and/or foundation, increase in rate of movement observed in inclinometers and/or survey prisms |

| Potential Failure Modes | Possible Causes | Visual Indications | Instrumentation Effects |
|---|---|---|---|
| Surface Erosion | Waves, wind or precipitation | Slumping or raveling of upstream or downstream faces of dam | None |
| Internal Erosion | Erosion of core, creating a pipe/conduit for water flow through dam, growth of a gully behind the crest of dam, turbid seepage water | Rapid increase or unexplained cloudy appearance of seepage through the tailings dams and/or their foundations; appearance of seepage in new locations; formation of sinkholes in dam or on tailings beach | Rapid change if the in porewater pressures measured within dam and/or foundation |
| Cracking | Differential settlement of dam, earthquake induced | Cracks on dam crest or faces; bulging or slumping of dam | Increase to rate of movement observed in inclinometers or survey monuments or prisms |

Other failure modes might also include the following:

- Slumping, sliding, cracking or bulging of the tailings dam
- Rapid increase or unexplained cloudy appearance of seepage through the tailings dam and/or its foundation
- Formation of sinkholes on the tailings beach or dam
- Breakage of tailings pipelines, which may result in dam erosion and/or release of tailings slurry
- Earthquakes
- Major storm events or flood
- Sabotage and other criminal activities




NOTES

- Topographic data used to generate cross-sections and flood line mapping is from Ontario Base Mapping.
- Flood lines were estimated using HEC-RAS
- HEC-RAS cross-sections include the floodplain only, topography of main river channel is not represented.
- 2 and 100 year flows were estimated from Water Survey of Canada flow gauge 05PC011 and prorated by reach length.
- 2 year flow was assumed to be contained within the main river channel.
- Sunny day dam break assumes the dam experiences a piping failure at a normal operating level with approximately $4.1\times10^6$ $m^3$ and $0.9\times10^6$ $m^3$ of storage in the TMA and MRP respectively.
- Wet weather dam break assumes the dam experiences an overtopping failure at its maximum probably water level with approximately $22.4\times10^6$ $m^3$ and $3.4\times10^6$ $m^3$ of storage in the TMA and MRP respectively.
- Flood lines in the Pinewood River upstream of the confluence with Loslo Creek are a result of the MRP dam break; flood lines downstream of this location are the result of a TMA dam break. Simulated peak flows at this location and downstream from the TMA dam break are much greater than those simulated from the MRP dam break.
- MRP flood lines assume a flood protection berm along the north river bank that contains all storm and dam break induced flows.
- The estimated length of the tailings run out in the event of a TMA dam failure and tailings liquefaction is 700 to 3200 m.
- WMP dam failure flood lines were modelled up to a point downstream of Highway 600 where flow enters a low-lying wet area.

**LEGEND**

- Principal RRP Facilities
- Regional Road / Highway
- Permanent Watercourse
- Intermittent Watercourse

**TMA and MRP Flood Scenarios**

- Approximate Flood Line for 100 Year Flow
- Approximate Flood Line for 2 Year Flow + Sunny Day Dam Break
- Approximate Flood Line for 100 Year Flow + Wet Weather Dam Break
- Possible Tailings Run Out (estimate extent shown: 3,200 m)

**WMP Flood Scenarios**

- Approximate Flood Line for Piping Failure (north and south dam scenarios shown)
- Approximate Flood Line for Overtopping Failure (north and south dam scenarios shown)

**PRELIMINARY**

NOTES:

Datum: NAD83
Projection: UTM Zone 15N

0 2 4 8 12 16 20 Kilometres

newgold Rainy River Project

amec foster wheeler

**RAINY RIVER PROJECT**

**Dam Break Inundation Map**

DRAFT

PROJECT N°: TC133921 | **FIGURE:** 9-1

SCALE: 1:80,000 | DATE: May 2015

## 9.3 Warning Signs and Threshold Criteria

The warning signs for an emergency are defined below:

- Level I: Conditions that do not yet represent a potential emergency but that do require investigation and resolution on a prompt basis, along with intensified surveillance.
- Level II: Conditions that represent a potential emergency if allowed to continue to progress, but no such emergency is imminent.
- Level III: An obvious emergency has occurred or is imminent.

Table 9-2 discusses potential warning signs, consequences and actions to be taken.

**Table 9-2; Warning Signs, Level of Emergency and Responses**

| Level | Warning Sign/Situation | Actual or Potential Consequences | Action(s) to be Taken |
|---|---|---|---|
| 1 | Unusually high, one-time reading from a single piezometer. | Possible early warning sign of worsening piezometric/seepage conditions. | • Check piezometer reading, and check for infilling of piezometer.<br>• If reading confirmed, check all other piezometers, and examine downstream area of dam for changed seepage conditions.<br>• Intensify piezometer readings. |
| | Decreased seepage discharge accompanied by gradually increasing piezometer levels. | Possible sign of clogging of internal drainage system of dam. | • Check chemistry of seepage discharge for any changes relative to normal.<br>• Request tailings dam engineer to re-evaluate slope stability at this location. |
| | Increase in size of erosion gullies. | Possible erosion resulting from seepage and/overland runoff. May lead to accelerated erosion and result in dam failure. | • Backfill gullies with filter material and fine rockfill. |
| 2 | Increase in seepage discharge, accompanied by discharge of tailings within seepage (dirty water). | Possible indication of a developing internal erosion (piping), that could eventually lead to dam breach/pond release, or excessively high levels of saturation that could result in slope instability. | • Initiate chain of communication (Figure 9-2) and monitor the situation.<br>• Discontinue tailings discharge in the seepage area.<br>• Intensify monitoring of seepage at this location.<br>• Note if the seepage discharge and/or turbidity continue to increase.<br>• Read piezometers.<br>• Be prepared to place filter material in area of discharge from emergency stockpiles. |

| Level | Warning Sign/Situation | Actual or Potential Consequences | Action(s) to be Taken |
|---|---|---|---|
| | Seepage on dam abutments, causing localized erosion and slumping of dam slope. | Could lead to progressive slope failure on abutment, resulting in dam failure and breach of pond. | • Discontinue tailings discharge in the seepage area.<br>• Place filter material over seepage area using emergency stockpiles.<br>• Continue to monitor area on an intensified basis.<br>• Initiate chain of communications if situation does not improve. |
| | Extended period of unusually heavy rainfall, or unusually large snowmelt. | Could lead to raised levels of saturation within the dam slope, which could in turn lead to slope instability. | • Increase frequency of piezometer readings to weekly.<br>• Intensify inspections of downstream dam slope, looking for signs of localized instability/concentrated gully erosion, and for soft ground (saturated slope) conditions. |
| | Relatively high, unexplained, and ongoing increase in piezometer levels within the dam and/or foundation – threshold limits being approached. | Probable sign of progressive deterioration of toe drainage provided by starter dams. Could, if left unattended eventually lead to failure of the dam. | • Assess rate of rise and determine if it is steady or accelerating.<br>• If piezometer level increase was sudden, check the reading (repeat it) to eliminate the possibility of a reading error.<br>• Sound bottoms of piezometers to check for infilling.<br>• Send piezometer readings to the tailings dam engineer.<br>• Inspect downstream area for increased seepage and/or turbidity of seepage discharge. |
| | Long term or sudden increase in rate of inclinometer movements. | Possible sign of impending slope instability. | • Check reading, and contact the Geotechnical Engineer and EOR if confirmed.<br>• Inspect area for any visible signs of instability, bulging on outer slope or at toe, or tension cracks on dam crest.<br>• If tailings discharge is occurring near the inclinometer that indicates unexplained movement, relocate discharge point further away.<br>• Increase frequency of inclinometer readings.<br>• Read nearby piezometers. |
| | Ongoing cracking and evidence of dam and/or foundation movement. | Possible sign of impending failure of dam, especially if the rate of movement/cracking is accelerating. | • Check inclinometer readings.<br>• If rate of deformation is accelerating, initiate chain of communication.<br>• Read piezometers.<br>• Check for water inflow into tension cracks.<br>• Regrade to channel runoff away from tension cracks, as water inflow can result in accelerated movement. |

| Level | Warning Sign/Situation | Actual or Potential Consequences | Action(s) to be Taken |
|---|---|---|---|
| | Highly turbidity discharge from decant outlet. | Possible sign of collapse of a portion of the decant, allowing tailings into outlet. Can, if left unattended, lead to internal erosion failure and eventual dam breach. | • Check decant inlet to see if water turbidity matches that in discharge.<br>• If water at inlet is clear, then close off decant inlet to prevent further discharge.<br>• Notify tailings dam engineer and develop alternate decant arrangements.<br>• Inform Mill. |
| | Rupture of tailings and/or water pipelines on crest of dam, resulting in erosion of downstream dam slope | Could lead to erosive failure of dam, and pond breach, if allowed to continue. | • Contact Mill and have discharge of tailings stopped.<br>• Repair the rupture.<br>• Inspect and repair the washed-out portion of the dam slope.<br>• Do not discharge tailings into the area of the washout.<br>• Notify tailings dam engineer to design slope re-construction. |
| | Seepage daylighting from tailings slope at a significantly higher elevation than had previously been observed at that particular location. | Could lead to erosion, and progressive slope failure, resulting in dam failure and breach of pond. | • Read piezometers.<br>• Assess rate of seepage and whether or not internal erosion is occurring.<br>• If piezometers confirm high phreatic levels, initiate chain of communication.<br>• Carry out weekly monitoring of the seepage discharge area of concern.<br>• Avoid discharge of tailings into the impoundment adjacent to the area. |
| | Severe flood/intense rainstorm or rapid snowmelt. | Overtopping and washout of dam, and release of pond. Concentrated erosion of tailings slopes, resulting in localized gullying, over-steepening, and potential slope failure. Raising of phreatic surface as a result of infiltration possible. | • Initiate chain of communications (Figure 9-2).<br>• Check the minimum width of tailings beaches.<br>• Inspect spillway for flow and condition.<br>• Stop tailings discharge and slowly lower tailings pond by removing stop logs.<br>• Carry out detailed inspection of dam and pond.<br>• Inspect dam slopes for areas of concentrated erosion, and repair.<br>• Read all piezometers.<br>• Mobilize emergency pumps if needed. |
| 3 | Failure or suspected imminent failure of a dam. | Catastrophic breach and release of pond. | • Initiate chain of communications (Figure 9-3).<br>• Stop tailings discharge and lower tailings pond by removing stop logs. |

| Level | Warning Sign/Situation | Actual or Potential Consequences | Action(s) to be Taken |
|---|---|---|---|
| | Slumping, sliding, or bulging of a dam slope or adjacent ground. | Catastrophic breach and release of pond. | • Initiate chain of communications (Figure 9-3).<br>• Lower pond by removing stop logs.<br>• Do not attempt construction (e.g., construction of a stabilizing berm) until the EOR is on the site (earthmoving equipment should be mobilized). |
| | Water vortex (whirlpool) within the tailings pond. | Indicates an internal erosion failure in progress, with potential breach of the tailings dam. | • Initiate chain of communications (Figure 9-3).<br>• Stop tailings discharge and lower tailings pond by removing stop logs.<br>• Check downstream area of dam for areas of increased and/or turbid seepage discharge.<br>• Place granular filter buttress against any such areas, using emergency stockpiles.<br>• Go directly to decant outlets if vortex is on a decant line; plug decant outlet with granular material if tailings are discharging through decant. |
| | Sinkhole observed on tailings beach or on a downstream dam slope. | Indicative of internal erosion, which could progress to the point where dam breach results. | • Initiate chain of communications (Figure 9-3).<br>• Stop tailings discharge and lower tailings pond by removing stop logs.<br>• Immediately check dam toe areas/decant outlets for heavy seepage that is transporting tailings solids.<br>• Place granular filter buttress against any such areas, using emergency stockpiles. |
| | Large earthquake. | Dam failure, breach and release of pond. | • Initiate chain of communications (Figure 9-3).<br>• Carry out detailed post-earthquake inspection of the dam.<br>• Read all instrumentation (piezometers and inclinometers). |
| | Rapid, unexplained, orders of magnitude increase in seepage rate and turbidity (dirty water indicating transport of tailings) at a dam slope seepage location and/or foundation. | Internal erosion (piping) failure leading to dam breach and release of pond. Elevation of pore pressure conditions that could initiate a slope failure. | • Initiate chain of communications (Figure 9-2).<br>• Place stockpiled filter materials over seepage discharge area to prevent further erosion of material.<br>• Read piezometers in area of seepage discharge. |

## 9.4 Incident Notifications Procedures

Roles and responsibilities:

- Any individual who observes an incident shall initiate the appropriate notification procedure.
- All members listed on the notification procedures shall be familiar with established protocol and familiar with the OMS Manual (as per training Section 2.5).
- If a member of the team on the notification procedures is not contactable then the Incident Commander shall be notified and proceed with the notification procedure.

Notification procedures have been developed for Level I, II and III emergencies provided below to ensure quick onsite responses in the event of an identified emergency. The Mill Manager will be in charge of initiating the site wide EPRP (NG, 2017) in the event of a Level III emergency.

The notification procedures for a Level I and Level II emergency are illustrated on Figure 9-2. The notification procedure and initiation of the EPRP in the event of a Level III emergency is shown on Figure 9-3. Rapid response to Level III emergencies is critical to ensuring that staff, contractors and site visitors safely reach a muster station and that timely notification is made to appropriate local and provincial authorities as well as external stakeholders.

**Figure 9-2; Levels I and II Emergency Notification Procedure Flowchart**

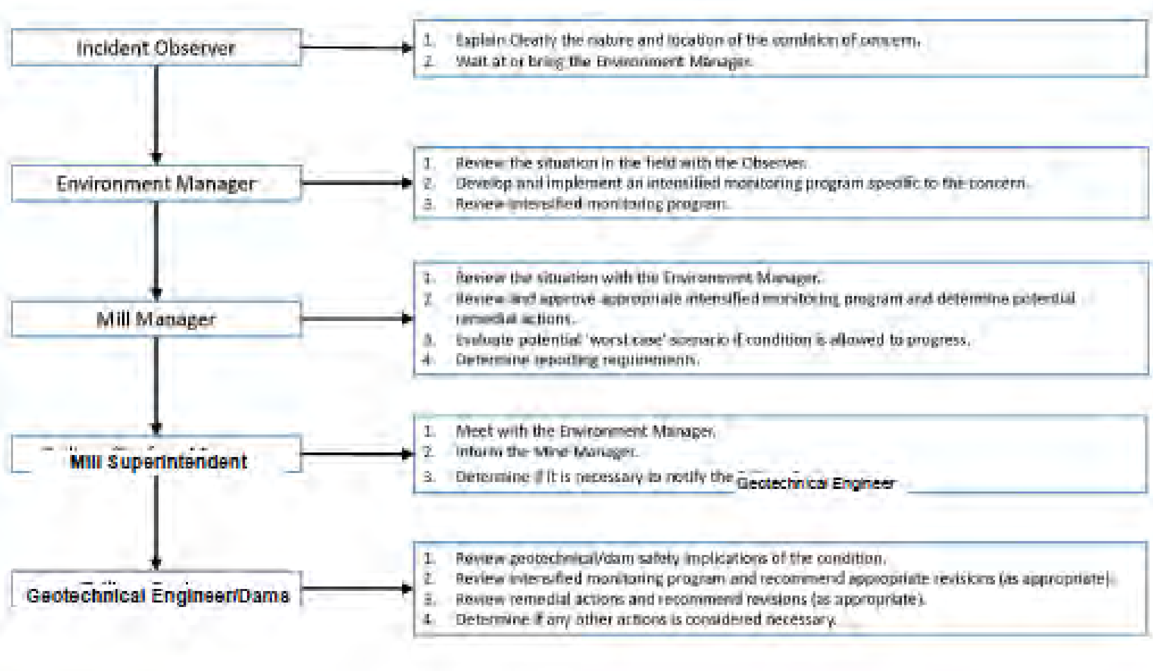
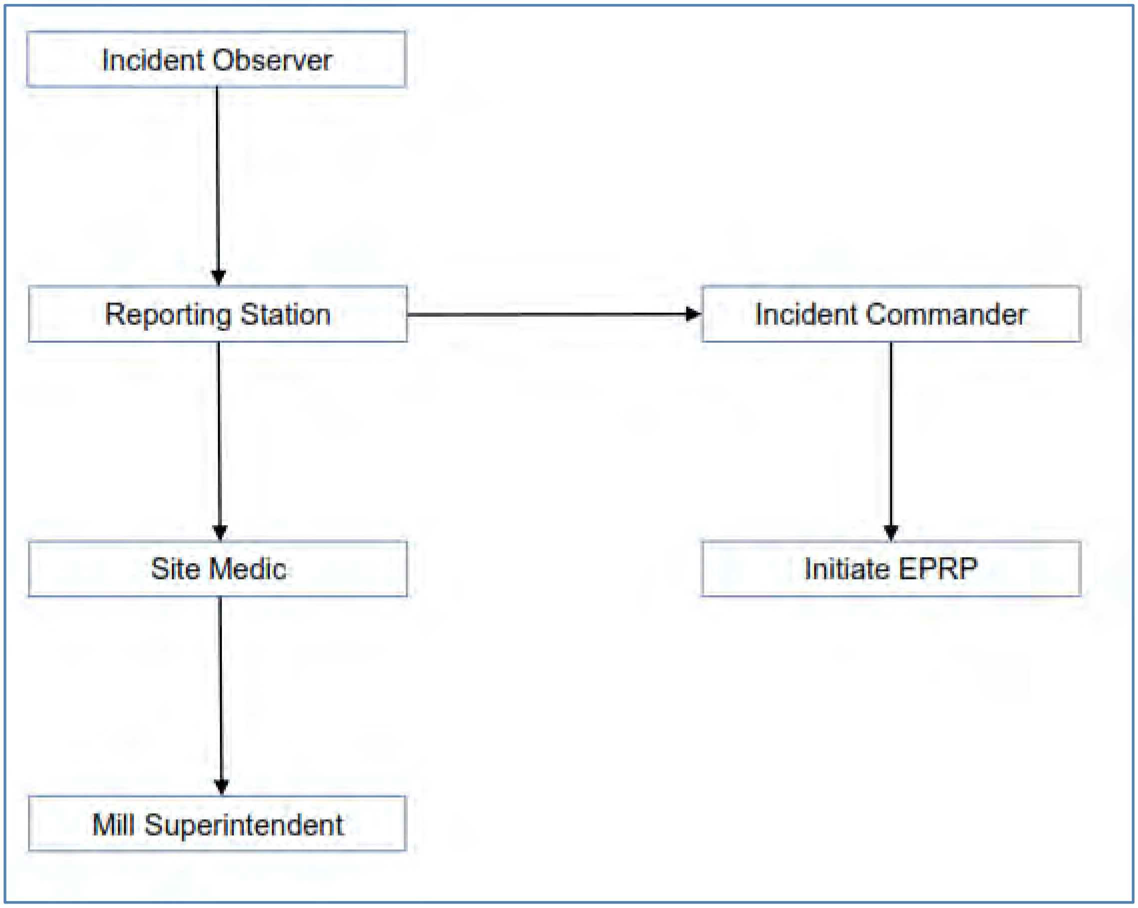


**Figure 9-3; Level III Emergency Notification Procedure Flowchart**




## 9.5 Emergency Contacts

Internal emergency contact information is provided RRM EPRP. An emergency response can be initiated through;

- RRM radio channel 4 – state 'Emergency, Emergency, Emergency' and describe the type and location of the emergency
- RRM internal phone system – dial 8888
- RRM security direct line – 1-807-708-0646
-

## 9.6 Emergency Preparedness Procedures

All employees, including contractors working at the RRM must be familiar with the procedures outlined in the EPRP for the site and TMA to the extent required to perform their functional role. All supervisors and contact persons for contractors must ensure their employees understand those procedures relevant to their work area and ensure that their employees are familiar with, and recognize the proper course of action in the event of an emergency. The supervisor must also ensure that all employees are made aware of any revisions to the EPRP for the site and TMA.

The EPRP is the site and TMA's guidance document relating to emergency responses and protocols to be followed during upset conditions, unusual events or incidents. A preliminary dam break inundation map is provided in figure 9-3.

Emergency preparedness measures with regard to dam safety include: maintenance of access to dam locations; availability of fill materials and equipment required in the event that remedial works are required; and the ability to access and traffic control measures to ensure safety of workers and public.

# 10.0 CONTINGENCIES

The operations are sensitive to water balance and water quality in discharges. The following are contingencies based on water management and functioning of the diversions.

## 10.1 TMA

### 10.1.1 Cell 1 contingency

- Maintain or add additional pumping capacity to the WMP to drain the cell if required due to the MOWL being exceeded;
- Manage filling of the WMP to consider additional storage capacity of the EDF from cell 1; and
- Accelerate construction of cell 2, where permitted.

### 10.1.2 Cell 2/3 Contingency

- The TMA has been designed to operate with a pond volume of 4-6 $Mm^3$, with additional capacity for up to 8 $Mm^3$. In a wet year pumping to the WMP can be extended longer than planned and discharged from the WMP, pending receptor capacity (Pinewood River flow)
- Any additional precipitation events after the EDF, prior to dewatering, could cause an uncontrolled release of untreated water to the environment, and alternative contingency measures would be required to reduce the water level at a faster rate (i.e. such as pumping excess water to the open pit or transferring TMA Cell 2 water into the WMP with no treatment).
- Pumping will be considered directly from the WMP to TMA Cell 3 to reduce WMP volumesto 1.0 $Mm^3$ prior to discharge from Cell 2 through the WTP into the WMP.
- Water treatment plant to be completed in September 2018 to allow pumping from cell 2, if required
- TMA raises to be sequenced to avoid a water deficit, however, reduction in discharges to the CW and additional takings from the Pinewood River, West Creek and Clark Diversions will be considered, subject to maintaining minimum flows

## 10.2 Process Water

### 10.2.1 Water Management Pond

- Accelerate, where permitted, completion of TMA to enable draining of WMP;
- Additional pumping capacity to cell 2/3; and
- Implement contingencies for Water Quality as outlined below (Water Treatment).

### 10.2.2 Mine Rock Pond

- If the MRP MOWL (356.8m) is exceeded, then pumping into the MRP from the open pit will cease and pumps will pump water toward the plant site/WMP/TMA at 680 $m^3$.
- Overtopping of the Clark Creek Dam was considered in the design of the MRP. The Clark Creek Dam and Pond are designed for a 1:100 year 24h event, if this is exceeded

then water will spill from the dam and flow toward the EMRS. Water on the eastern side of the EMRS reports to a sump and flows through NAG rock under the EMRS to the MRP. Given this flow path the contribution of this flow is not significant on the peak inflows to the MRP.

## 10.3 Water Treatment

Two contingency plans have been developed as part of MOECC approvals for water treatment;

- Pinewood River Quality Contingency Plan, Version 1 August 2016; and
- Groundwater and Surface Water Contingency Plan, Version 2 October 2015.

Contingency options are to limit discharges, acceleration of TMA dam raises, add water quality treatment, additional monitoring, provision of water to affect areas and increased mixing ratios/improved mixing. The trigger for implementation of contingency in surface water is if protection of aquatic life criteria are not achieved 90 % of the time. The trigger for contingencies in groundwater is if water quality parameters exceed background metals concentrations in groundwater at the mining lease boundary or groundwater wells outside of the zone of influence are affected.

## 10.4 Freshwater Diversions

There are specific contingencies required, based on the Fisheries Act authorization (application Table 6) for the freshwater diversion that relate to the OMS i.e., not biological. These are provided in the following table.

**Table 10-1; Contingencies for Freshwater Diversions**

| Attribute | Mode of Failure | Contingency |
|---|---|---|
| Physical construction of offset measures | • Dam not constructed as per plans<br>• Channel not constructed as per plan.<br>• Water area, depths and or habitat structures not in place or present as per the plans. | • Engineer to assess failure and recommend corrective actions.<br>• Proponent to take required corrective action. |
| Physical function of offset measures | • Conditions do not provide for fish passage | • Engineer / biologist to assess cause of failure and recommend corrective actions.<br>• Take required corrective action |
| | • Water level not consistent with those specified in plans. | • Adjust grades of structures to alter<br>• water levels<br>• Excavate pools to specified depths. |
| Stability of structures | • Constructed habitat features (log and boulder structures) missing or not functional | • Repair or replace structures |
| | • Shorelines and graded offset features not stable (less than 80% of features are considered stable) | • Assess cause and areas of instability<br>• Add permanent erosion control (rock, vegetation) in areas of erosion<br>• Grade channel or shore to decrease velocity |
| | • Riparian vegetation cover and plantings are less than 80% coverage of area, and or survival of planted stock | • Apply seed and replacement plantings where required<br>• Substitute species, and/or use soil amendments if conditions require. |

## 11.0 REFERENCES

AMEC, 2013. Rainy River Project – Final Environmental Assessment Report. Report TC111504 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., October 2013.

AMEC, 2014a. Rainy River Project – Tailings Deposition Plan. Technical memorandum TC133921.40 prepared by AMEC Environment & Infrastructure, in progress, October 2015 [RRP Doc. No. 3098004-004000-A1-ETR-0005-AB].

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AMEC, 2014d. Rainy River Project – 2013/2014 Geotechnical Site Investigations Report TC133921 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., July 2014 [RRP Doc. No. 3098004-004000-A1-ETR-0004-00].

Amec Foster Wheeler, 2015a. Rainy River Project – Water Management Plan for Operations Report TC133921.440 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., March 2015.

Amec Foster Wheeler, 2015b. Rainy River Project – Design Brief – Water Management Dams. Report TC133921.540 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., July 2014 [RRP Doc. No. 3098004-004400-A1-ETR-0004-00].

Amec Foster Wheeler, 2015c. Rainy River Project – Closure Plan Report TC111504 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., January 2015.

Amec Foster Wheeler, 2015d. Rainy River Project – Conceptual Design of the Pinewood River Intake/Discharge Facility. Memorandum TC133921.10000.5 prepared by AMEC Environment & Infrastructure, submitted to New Gold, July 2015 [RRP Doc. N. 3098004-006200-A1-ETR-0002-00].

Amec Foster Wheeler, 2015e. Rainy River Project – Mine Waste Management Plan. Report TC133921.700 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., January 2015 [RRP Doc. No. 3098004-001100-A1-ETR-0001-00].

Amec Foster Wheeler, 2015f. Rainy River Project – Water Management Plan for Construction. Report TC133921.450 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., March 2015 [RRP Doc. No. 3098004-004400-A1-ETR-0002-00].

Amec Foster Wheeler, 2016a. Rainy River Project – Dam Instrumentation During Construction prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., April 2015 [RRP Doc. No. 3098004-004000-A1-ETR-0012-00].

Amec Foster Wheeler, 2016b. Rainy River Project – Geotechnical Monitoring Plan prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., August 2016 [RRP-GEO-REP-017-R2].

Amec Foster Wheeler, 2016c. Rainy River Project – LRIA Work Permit Application Support Document – WMP Dams 1, 2, and 3 prepared by AMEC Environment & Infrastructure, submitted to Ministry of Natural Resources and Forestry, July 21, 2016 [RRP-GEO-LRIA-004B-R2].

Amec Foster Wheeler, 2016d. Rainy River Project – LRIA Work Permit Application Support Document – WMP Dams 4 and 5 prepared by AMEC Environment & Infrastructure, submitted to Ministry of Natural Resources and Forestry, July 28, 2016 [RRP-GEO-LRIA-004A-R4].

Amec Foster Wheeler, 2016e. Rainy River Project – Design Brief – TMA Start-Up Cell prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., August 25, 2016 [RRP-GEO-REP-008-R1].

Amec Foster Wheeler, 2016f. Rainy River Project – Geotechnical Investigations Report – TMA – Volume 1 – Dam Design Implications – Version 3.1 prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., August 11, 2016 [RRP-GEO-REP-001A-R3].

Amec Foster Wheeler, 2016g. Rainy River Project – Geotechnical Investigations Report – TMA – Volume 2 – Investigations and Interpretations prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., August 12, 2016 [RRP-GEO-REP-001B-R3].

Amec Foster Wheeler, 2016h. Rainy River Project – Mine Rock Pond Dam – Design Revision and Operating Guidelines prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., June 28, 2016 [RRP-GEO-REP-007-R0].

Amec Foster Wheeler, 2016i. Rainy River Project – Design Update – Clark Creek Pond Dam prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., June 15, 2016 [RRP-GEO-REP-006-00].

Amec Foster Wheeler, 2016j. Rainy River Project – Stockpile Pond Dam – Design Revision and Operating Guidelines prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., June 9, 2016 [RRP-GEO-REP-004-R1].

Amec Foster Wheeler, 2016k. Rainy River Project – West Creek Pond Dam – Design Revision and Operating Guidelines prepared by AMEC Environment & Infrastructure, submitted to New Gold Inc., June 9, 2016 [RRP-GEO-REP-003-R1].

Amec Foster Wheeler, 2016l. Rainy River Project – Water Management Pond – Level 1 Contingency Dewatering Plan, prepared by Amec Foster Wheeler Environment & Infrastructure, submitted to New Gold Inc., August 11, 2016 [RRP-GEO-REP-022-R2].

Amec Foster Wheeler, 2016m. Rainy River Project – WMP Construction Sequence and Pond Filling Plan, prepared by Amec Foster Wheeler Environment & Infrastructure, submitted to New Gold Inc., December 2, 2016 [RRP-GEO-REP-018-R7].

Amec Foster Wheeler, 2017a. Rainy River Project – Clark Creek Diversion As-built Report, prepared by Amec Foster Wheeler Environment & Infrastructure, submitted to New Gold Inc., April 10, 2017 [RRP-GEO-REP-027-R0].

Amec Foster Wheeler, 2017b. Rainy River Project – West Creek Diversion As-built Report, prepared by Amec Foster Wheeler Environment & Infrastructure, [IN DEVELOPMENT]

Amec Foster Wheeler, 2017c. Rainy River Project – WMP As-built Report, prepared by Amec Foster Wheeler Environment & Infrastructure, [IN DEVELOPMENT]

Amec Foster Wheeler, 2017d. Rainy River Project – MRP As-built Report, prepared by Amec Foster Wheeler Environment & Infrastructure, [IN DEVELOPMENT]

Amec Foster Wheeler, 2017e. Rainy River Project – OMS For Operations Tailings and Water Management , prepared by Amec Foster Wheeler Environment & Infrastructure, submitted to New Gold Inc., March 31, 2017 [3098004-000000-A1-EMA-0002-AC OMS]

CDA, 2007. Dam Safety Guidelines. Prepared by the Canadian Dam Association, 2007.

MAC, 2011. Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities. Prepared by The Mining Association of Canada, 2011.

New Gold, 2016a. Plan to Prevent Water Impounding Within the Water Management Pond (WMP) Dams 4 and 5, Rainy River Project Development, by New Gold Inc., submitted to MNRF on March 1, 2016.

New Gold, 2016b. Rainy River Project – Dam Construction – Supplemental Quality Management Plan, prepared by New Gold Inc., August 19, 2016

New Gold, 2017c. Rainy River Project – Emergency Preparedness & Response Plan, prepared by New Gold Inc., February, 2017.

**APPENDIX A**

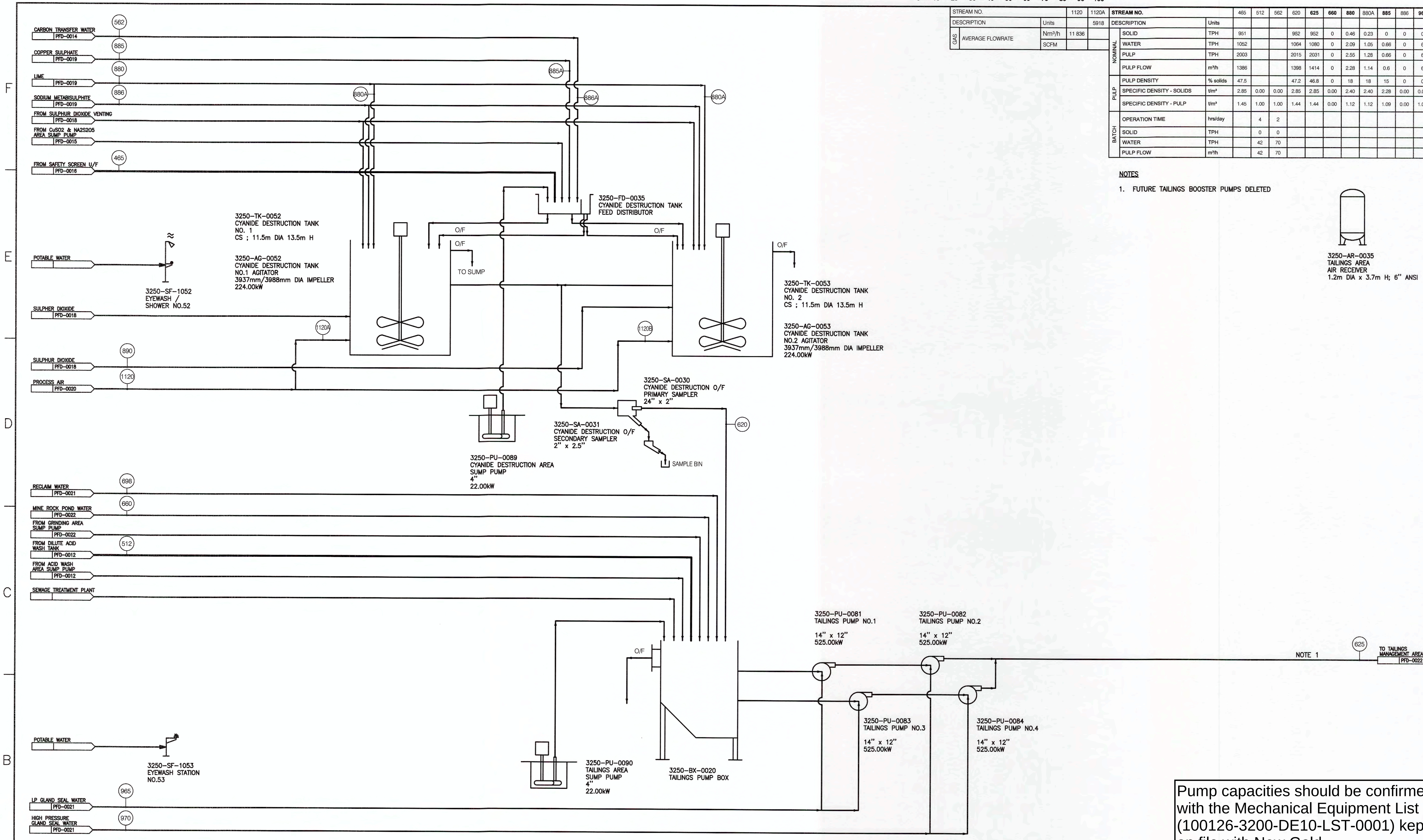
**DRAWING LIST**
**(List of Current Revisions)**

| No. | Drawing Number | Drawing Title | Rev. |
|---|---|---|---|
| 100 Series | | | |
| 101 | 3098004-004000-A1-D20-0003 | Title Sheet | 1 |
| 102 | 3098004-000000-A1-D20-0003 | General Arrangement Plan at Start Up | C-01 |
| 103 | 3098004-000000-A1-D20-0005 | Watershed Map | 00 |
| 104 | 3098004-000000-A1-D20-0004 | Site Investigations & Surficial Geology Plan | 00 |
| 105 | 3098004-004000-A1-D20-0004 | TMA & WMP - General Arrangement Plan - Start Up Conditions | C-05 |
| 106 | 3098004-004000-A1-D50-0001-1 | TMA Dam - Layout and Foundation Preparation Plan & Details (Sheet 1 of 3) | C-02 |
| 107 | 3098004-004000-A1-D50-0001-2 | TMA Dam - Layout and Foundation Preparation Plan & Details (Sheet 2 of 3) | C-01 |
| 108 | 3098004-004000-A1-D50-0001-3 | TMA Dam - Layout and Foundation Preparation Plan & Details (Sheet 3 of 3) | C-04 |
| 109 | 3098004-004000-A1-D60-0006-1 | TMA Dam - Profile (Sheet 1 of 2) | C-02 |
| 110 | 3098004-004000-A1-D60-0006-2 | TMA Dam - Profile (Sheet 2 of 2) | C-01 |
| 111-1 | 3098004-004000-A1-D60-0007-1 | TMA Dam - Typical Cross Sections | C-05 |
| 111-2 | 3098004-004000-A1-D60-0007-2 | TMA West Dam - Typical Cross Sections | C-01 |
| 112 | 3098004-004000-A1-D70-0003 | TMA Dam - Emergency Spillway - Plan and Sections | C-01 |
| 113 | 3098004-004000-A1-D70-0004 | TMA Dam - Construction Diversion - Plan, Profile and Section | C-01 |
| 114 | 3098004-004300-A1-D50-0001 | WMP Dam - Layout and Foundation Preparation Plan & Details | 01 |
| 115 | 3098004-004300-A1-D60-0003 | WMP Dam - Profile | 00 |
| 116 | 3098004-004300-A1-D60-0004 | WMP Dam - Typical Cross Section | C-02 |
| 119 | 3098004-004300-A1-D70-0004 | WMP Dam - Emergency Spillway - Plan and Sections | 00 |
| 120 | 3098004-004410-A1-D70-0002 | Water Discharge Pond Dam - Plan and Typical Cross Sections | 00 |
| 121 | 3098004-004420-A1-D70-0002 | Constructed Wetland - Plan, Profiles & Section | 00 |
| 121A | 3098004-004420-A1-D70-0003 | Constructed Wetland - Level Control Structure | AA |
| 122 | 3098004-002510-A1-D70-0002 | West Creek Pond Dam - Plan, Typical Section and Profile | C-03 |
| 122A | 3098004-002510-A1-D70-0013 | Temporary Open Pit Protection Berm - Plan, Profile & Cross Section | 00 |
| 122B | 3098004-002510-A1-D70-0014 | West Creek Pond Dam - Temporary Overflow Spillway - Typical Section, Profile and Details | C-00 |
| 123 | 3098004-002510-A1-D50-0001 | West Creek Pond Dam - Layout and Foundation Preparation - Plan & Details | C-00 |
| 123A | 3098004-002510-A1-D70-0004 | West Creek Dam Spillway - Plan, Profile and Sections | C-01 |
| 124 | 3098004-002510-A1-D70-0003 | West Creek Diversion Channel - Plan and Profile | C-02 |
| 124A | 3098004-002510-A1-D70-0005 | West Creek Diversion Channel - Overflow Diversion Structure - Section and Details | C-01 |
| 124B | 3098004-002510-A1-D70-0006 | West Creek Diversion Channel - Culvert C11 - Plan, Section and Profile | 00 |
| 124C | 3098004-002510-A1-D70-0007 | West Creek Diversion Channel - Culvert C12 - Plan, Section and Profile | 00 |
| 124D | 3098004-002510-A1-D70-0008 | West Creek Diversion Channel - Culvert C13 - Plan, Section and Profile | 00 |
| 124E | 3098004-002510-A1-D70-0009 | West Creek Diversion Channel - Culvert C14 - Plan, Section and Profile | 01 |
| 124F | 3098004-002510-A1-D70-0010 | West Creek Diversion Channel - Culvert C15 - Plan, Section and Profile | 00 |
| 124G | 3098004-002510-A1-D70-0011 | West Creek Diversion Channel - Culvert C16 - Plan, Section and Profile | 00 |
| 124H | 3098004-002510-A1-D70-0012 | West Creek Diversion Channel Temporary Side Spillway Plan, Profile and Sections | AA |
| 125 | 3098004-002590-A1-D70-0002 | Mine Rock Pond Dam - General Arrangement Plan | C-01 |
| 126 | 3098004-002590-A1-D50-0001 | Mine Rock Pond Dam - Layout and Foundation Preparation - Plan & Details | C-01 |
| 127 | 3098004-002590-A1-D70-0003 | Mine Rock Pond Dam - Profile | C-01 |
| 128 | 3098004-002590-A1-D70-0004 | Mine Rock Pond Dam - Typical Cross Section | C-02 |
| 129 | 3098004-002590-A1-D70-0005 | Mine Rock Pond Dam - Emergency Spillway - Plan and Sections | C-01 |
| 130 | 3098004-002580-A1-D70-0002 | Stockpile Pond Dam - Plan, Typical Section and Profile | C-02 |
| 131 | 3098004-002580-A1-D70-0003 | Stockpile Pond Dam - Layout and Foundation Preparation - Plan & Details | C-00 |
| 132 | 3098004-002580-A1-D70-0004 | Stockpile Pond Diversion Channel - Plan and Profile | C-00 |
| 133 | 3098004-004400-A1-D70-0001 | Clark Creek Pond Dam - Plan, Typical Section and Profile | C-03 |
| 134 | 3098004-004400-A1-D70-0002 | Clark Creek Pond Diversion Channel - Plan and Profile | C-01 |
| 135 | 3098004-004400-A1-D70-0003 | Teeple Road Dam - Plan, Typical Section and Profile | C-01 |
| 135A | 3098004-004400-A1-D70-0005 | Teeple Road Dam - Overflow Section - Permanent Repairs | C-00 |
| 135B | 3098004-004400-A1-D70-0006 | Teeple Road Dam - Overflow Section - Permanent Repairs | C-00 |
| 135C | 3098004-004400-A1-D70-0007 | Teeple Road Dam - Non-Overflow Section - Permanent Repairs | C-00 |
| 136 | 3098004-004400-A1-D70-0004 | Teeple Road Pond Diversion Channel - Plan and Profile | C-00 |
| 137 | 3098004-004000-A1-D02-0001 | TMA & WMP Dam Instrumentation Locations | AA |
| 137-1 | 3098004-004000-A1-D02-0001-1 | TMA & WMP Dam Instrumentation Locations | C-00 |
| 137-2 | 3098004-004000-A1-D02-0001-2 | TMA & WMP Dam Instrumentation Locations | C-00 |
| 138 | 3098004-004000-A1-D02-0002 | Mine Rock & West Creek Dam Instrumentation Locations | C-00 |
| 139 | 3098004-004000-A1-D02-0003 | Typical Instrumentation Sections | C-00 |
| 140 | 3098004-004000-A1-D02-0004 | Typical Instrumentation Details | C-00 |
| 141 | 3098004-004300-A1-D70-0005 | Water Treatment Plant - Settling Pond - Plan | 00 |
| 142 | 3098004-004300-A1-D70-0006 | Water Treatment Plant - Settling Pond - Typical Cross Section and Profiles | 00 |
| 143 | 3098004-004000-A1-D20-0012-1 | TMA Divider Dyke - At Start Up | AB |
| 144-1 | 3098004-004000-A1-D02-0005-1 | TMA South Dam Vibrating Wire Instrumentation Locations in Dam Foundation | C-00 |
| 144-2 | 3098004-004000-A1-D02-0005-2 | TMA West Dam Vibrating Wire Instrumentation Locations in Dam Foundation | C-00 |
| 144-3 | 3098004-004000-A1-D02-0005-3 | TMA North Dam Vibrating Wire Instrumentation Locations in Dam Foundation | C-00 |
| 144-4 | 3098004-004000-A1-D02-0005-4 | TMA Start-Up Dam Vibrating Wire Instrumentation Locations in Dam Foundation | C-00 |
| 144-5 | 3098004-004000-A1-D02-0005-5 | TMA Start-Up Dam Vibrating Wire Instrumentation Locations in Dam Foundation | 00 |
| 145 | 3098004-004000-A1-D02-0006 | TMA South Dam Prefabricated Vertical Drains Plan, Profile and Details | AA |
| 200 Series - Fisheries Drawings | | | |
| 200 | 3098004-004400-A1-D50-0001 | Typical Details for Fish Habitat Structures | 02 |
| 201 | 3098004-002510-A1-D50-0002 | West Creek Pond - Plan View | 03 |
| 202 | 3098004-002510-A1-D50-0003 | West Creek Pond - Cross Sections | 01 |
| 203 | 3098004-002510-A1-D50-0004 | West Creek Diversion Channel - 3m Bottom Width Typical Cross Sections | 01 |
| 204 | 3098004-002510-A1-D50-0005 | West Creek Diversion - 3m Bottom Width Typical Plan and Profile | 02 |
| 205 | 3098004-002510-A1-D50-0006 | West Creek Diversion - 5m & 8m Bottom Width Typical Cross Sections | 01 |
| 205A | 3098004-002510-A1-D50-0008 | West Creek Diversion - 8m Bottom Width Typical Cross Sections | 00 |
| 206 | 3098004-002510-A1-D50-0007 | West Creek Diversion - 5m & 8m Bottom Width Typical Plan and Profile | 02 |
| 207 | 3098004-004400-A1-D50-0002 | Clark Creek Pond - Plan View | 01 |
| 208 | 3098004-004400-A1-D50-0003 | Clark Creek Pond - Cross Sections | 01 |

| No. | Drawing Number | Drawing Title | Rev. |
|---|---|---|---|
| 200 Series | | | |
| 209 | 3098004-004400-A1-D50-0004 | Clark Creek Diversion - Typical Cross Sections | 02 |
| 210 | 3098004-004400-A1-D50-0005 | Clark Creek Diversion - Typical Plan and Profile | 01 |
| 211 | 3098004-004400-A1-D50-0006 | Teeple Road Pond - Plan View | 01 |
| 212 | 3098004-004400-A1-D50-0007 | Teeple Road Pond - Cross Sections | 01 |
| 213 | 3098004-004400-A1-D50-0008 | Teeple Road Pond Outlet Channel - Typical Cross Sections | 01 |
| 214 | 3098004-004400-A1-D50-0009 | Teeple Road Pond Outlet Channel - Typical Plan and Profile | 01 |
| 215 | 3098004-002580-A1-D50-0001 | Stockpile Pond - Plan View | 02 |
| 216 | 3098004-002580-A1-D50-0002 | Stockpile Pond - Cross Sections | 02 |
| 217 | 3098004-002580-A1-D50-0003 | Stockpile Diversion Typical Cross Sections in Overburden | 02 |
| 218 | 3098004-002580-A1-D50-0004 | Stockpile Diversion Plan and Profile in Overburden | 02 |
| 219 | 3098004-002580-A1-D50-0005 | Stockpile Diversion Typical Cross Sections in Rock | 03 |
| 220 | 3098004-002580-A1-D50-0006 | Stockpile Diversion Plan and Profile in Rock | 02 |
| 221 | 3098004-002580-A1-D50-0007 | West Creek Tributary 2 Confluence with Stockpile Diversion | 02 |
| 300 Series | | | |
| 301 | 3098004-001120-A1-D20-0001 | West Stockpile Arrangement Plan | AC |
| 302 | 3098004-001120-A1-D50-0001 | West Mine Rock Stockpile - Typical Section & Details | AC |
| 303 | 3098004-001130-A1-D20-0001 | East Stockpile Arrangement Plan | AC |
| 304 | 3098004-001130-A1-D50-0001 | East Mine Rock Stockpile - Typical Section & Details | AC |
| 305 | 3098004-002590-A1-D50-0006 | Interim Mine Rock Pond - Plan, Cross Sections and Details | 00 |
| 306 | 3098004-004430-A1-D70-0001 | Early Works - Temporary Sedimentation Sump Details | AC |
| 307 | 3098004-004440-A1-D70-0001 | Temporary Sedimentation Pond - Plan & Details | 00 |
| 308 | 3098004-004430-A1-D70-0002 | Sediment Pond #1 - Sections & Details | 01 |
| 309 | 3098004-004440-A1-D70-0002 | Sediment Pond 2 - Plan, Cross Sections and Details | 00 |
| 310 | 3098004-004450-A1-D50-0001 | Protection Berm Plan & Section | 01 |
| 311 | 3098004-004000-A1-D70-0005 | TMA Seepage Collection System - Plan & Details | C-02 |
| 311A | 3098004-004000-A1-D70-0006 | Water Management Pond - Seepage Collection Pond #1 - Plan & Typical Cross Section & Details | C-01 |
| 311B | 3098004-004000-A1-D70-0007 | Water Management Pond - Seepage Collection Pond #2 - Plan & Typical Cross Section & Details | C-01 |
| 311C | 3098004-004000-A1-D70-0008 | Tailings Management Area - Seepage Collection Pond #3 - Plan & Typical Cross Section & Details | C-02 |
| 312 | 3098004-004520-A1-D70-0001 | Reclaim Wet Well Concept | AB |
| 313 | 3098004-006200-A1-D20-0002 | Pinewood Water Intake / Discharge Earthworks General Arrangement | 00 |
| 314 | 3098004-006200-A1-D70-0002 | Pinewood Water Intake / Discharge Earthworks - Pump Station | 00 |
| 315 | 3098004-006200-A1-D70-0003 | Pinewood Water Intake / Discharge Earthworks - Channel | 00 |
| 316 | 3098004-002100-A1-D20-0001 | Plant Site Construction Water Management - General Arrangement | 00 |
| 317 | 3098004-002100-A1-D70-0002 | Plant Site Construction Water Management - Plant Site Sedimentation Pond - Plan & Sections | 00 |
| 318 | 3098004-002100-A1-D70-0003 | Plant Site Construction Water Management - Overburden Stockpile Pond - Plan & Sections | 00 |
| 319 | 3098004-002100-A1-D70-0004 | Plant Site Construction Water Management - Details | 00 |
| 320 | 3098004-001210-A1-D70-0001 | West Mine Rock Stockpile - Perimeter Ditch - Plan, Profile and Typical Cross Section | 01 |
| 321 | 3098004-001210-A1-D70-0001 | West Mine Rock Stockpile - Temporary Sump #1 and #2 - Plan & Typical Cross Section | 00 |
| 322 | 3098004-001210-A1-D70-0001 | Open Pit Layout - At Start-Up | 00 |
| 323 | 3098004-001210-A1-D70-0001 | Open Pit Temporary Sump #3 and #4 - Plan & Typical Section | 00 |
| 324 | 3098004-004430-A1-D70-0007 | Open Pit Temporary Sump #5 and #6 - Plan & Typical Section | AA |
| 325 | 3098004-001210-A1-D70-0003 | West Mine Rock Stockpile - Internal Seepage Plan Section | 00 |
| 326-1 | 3098004-001210-A1-D70-000-1 | West Mine Rock Stockpile - Internal Collection System - Sump A1 Ditching and Details | 01 |
| 326-2 | 3098004-001210-A1-D70-000-2 | West Mine Rock Stockpile - Internal Collection System - Sump A2 Ditching and Details | 01 |
| 326-3 | 3098004-001210-A1-D70-000-3 | West Mine Rock Stockpile - Internal Collection System - Sump A3 Ditching and Details | 01 |
| 327 | 3098004-001210-A1-D70-0005 | West Mine Rock Stockpile - Internal Collection System - Sump B1 Ditching and Details | 01 |
| 328 | 3098004-001210-A1-D70-0006 | West Mine Rock Stockpile - Internal Collection System - Sump C1 Ditching and Details | |
| 329-1 | 3098004-001130-A1-D70-0001-1 | East Mine Rock Stockpile - Internal Collection System - Plan, Profiel and Typical Cross Section | AB |
| 329 -2 | 3098004-001130-A1-D70-0001-2 | East Mine Rock Stockpile - Internal Collection System - Plan, Profiel and Typical Cross Section | AB |
| 400 Series | | | |
| 401 | 3098004-004900-A1-D20-0001 | TMA Start-Up Cell - Title Sheet | C-00 |
| 402 | 3098004-004900-A1-D20-0002 | General Arrangement Plan - TMA Start-Up Cell | C-00 |
| 403 | 3098004-004900-A1-D50-0001 | TMA Start-Upp Cell - Layout and Foundation Preparation | C-01 |
| 404 | 3098004-004900-A1-D60-0001 | TMA Start-Up Cell - Profile | C-00 |
| 405 | 3098004-004900-A1-D60-0002 | TMA Start-Up Cell - Typical Cross Sections | C-01 |
| 406 | 3098004-004900-A1-D60-0003 | TMA West & South Dam - Typical Cross Sections | C-01 |
| 407 | 3098004-004900-A1-D70-0001 | TMA Start-Up Cell - Emergency Spillway - Plan & Sections | C-00 |
| 408 | 3098004-004900-A1-D70-0002 | WMP Dam - Emergency Spillway - Plan and Sections | C-00 |
| 409 | 3098004-004900-A1-D70-0003 | TMA Start Up Cell Temporary Seepage Collection Pond SU #1 | C-00 |
| 410 | 3098004-004900-A1-D70-0004 | TMA Start Up Cell Temporary Seepage Collection Pond SU #2 | C-00 |
| 500 Series | | | |
| 501 | 3098004-004910-A1-D20-0001 | TMA Cell 2 - Title Sheet | AB |
| 502 | 3098004-004910-A1-D20-0002 | Detailed Design TMA Cell 2 Dam General Arrangement Plan | 00 |
| 503 | 3098004-004910-A1-D50-0001 | Detailed Design TMA Cell 2 Dam Layout Foundation Preparation and Profile | 00 |
| 504 | 3098004-004910-A1-D60-0001 | Detailed Design TMA Cell 2 Dam Typical Cross Sections | 00 |
| 505 | 3098004-004910-A1-D70-0001 | TMA Cell 2 Dam Construction Diversion System | 00 |
| 506 | 3098004-004910-A1-D70-0002 | TMA Cell 2 Dam Temporary Seepage Collection Plan, Profile and Sections | 00 |
| 507 | 3098004-004910-A1-D70-0003 | TMA Cell 2 - Emergency Spillway - Plan & Sections | 00 |
| 508 | 3098004-004910-A1-D70-0004 | TMA Cell 3 - Overflow Spillway - Plan, Profiles and Section | 00 |
| 509 | 3098004-004910-A1-D70-0005 | TMA Reclaimed Dyke | 00 |
| 510 | 3098004-004910-A1-D70-0006 | TMA Cell 2 Dam Details For Optional Sheet Pile Configuration | 00 |
| Pinewood Intake | | | |
| | 3098004-006200-A1-D20-0003 | Pinewood Water Intake - Structural - General Arrangement | 00 |
| | 3098004-006200-A1-D20-0004 | Pinewood Water Intake/Discharge - Mechanical - General Arrangement | 00 |
| | 3098004-006200-A1-D30-0001 | Pinewood Water Intake/Discharge - Mechanical - Details | 00 |
| | 3098004-006200-A1-D30-0002 | Pinewood Water Intake - Mechanical - Specifications | 00 |
| | 3098004-006200-A1-D70-0004 | Pinewood Water Intake - Structural - Details | 00 |

**APPENDIX B**

**WATER PUMPING DATA**
**(Simple List of Pumps, Capacity, PFDs, Other)**




| STREAM NO. | | 1120 | 1120A |
|---|---|---|---|
| DESCRIPTION | Units | | 5918 |
| GAS AVERAGE FLOWRATE | Nm³/h | 11 836 | |
| | SCFM | | |

| | STREAM NO. | | 465 | 512 | 562 | 620 | 625 | 660 | 880 | 880A | 885 | 886 | 965 | 970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DESCRIPTION | Units | | | | | | | | | | | | |
| NOMINAL | SOLID | TPH | 951 | | | 952 | 952 | 0 | 0.46 | 0.23 | 0 | 0 | 0 | 0 |
| NOMINAL | WATER | TPH | 1052 | | | 1064 | 1080 | 0 | 2.09 | 1.05 | 0.66 | 0 | 6 | 6 |
| NOMINAL | PULP | TPH | 2003 | | | 2015 | 2031 | 0 | 2.55 | 1.28 | 0.66 | 0 | 6 | 6 |
| NOMINAL | PULP FLOW | m³/h | 1386 | | | 1398 | 1414 | 0 | 2.28 | 1.14 | 0.6 | 0 | 6 | 6 |
| PULP | PULP DENSITY | % solids | 47.5 | | | 47.2 | 46.8 | 0 | 18 | 18 | 15 | 0 | 0 | 0 |
| PULP | SPECIFIC DENSITY - SOLIDS | t/m³ | 2.85 | 0.00 | 0.00 | 2.85 | 2.85 | 0.00 | 2.40 | 2.40 | 2.28 | 0.00 | 0.00 | 0.00 |
| PULP | SPECIFIC DENSITY - PULP | t/m³ | 1.45 | 1.00 | 1.00 | 1.44 | 1.44 | 0.00 | 1.12 | 1.12 | 1.09 | 0.00 | 1.00 | 1.00 |
| BATCH | OPERATION TIME | hrs/day | | 4 | 2 | | | | | | | | | |
| BATCH | SOLID | TPH | | 0 | 0 | | | | | | | | | |
| BATCH | WATER | TPH | | 42 | 70 | | | | | | | | | |
| BATCH | PULP FLOW | m³/h | | 42 | 70 | | | | | | | | | |

NOTES

1. FUTURE TAILINGS BOOSTER PUMPS DELETED

Pump capacities should be confirmed with the Mechanical Equipment List (100126-3200-DE10-LST-0001) kept on file with New Gold

| REV | DDMMMYY | REVISION / ISSUE DESCRIPTION | DRN | CHK | APP | APP | APP | APP |
|---|---|---|---|---|---|---|---|---|
| 0 | 22JUN2015 | ISSUED FOR USE | SBW | CL | KC | GC | | |
| F | 01MAY2015 | RE-ISSUED FOR DESIGN | SBW | CL | KC | GC | | |
| E | 12DEC2014 | RE-ISSUED FOR DESIGN | SBW | CL | KC | GC | | |
| D | 15AUG2014 | ISSUED FOR DESIGN | SBW | JR | KC | GC | | |
| C | 17JUL2014 | RE-ISSUED FOR APPROVAL | SBW | JR | KC | GC | | |
| B | 04JUL2014 | ISSUED FOR APPROVAL | SBW | JR | KC | GC | | |
| A | 20MAY2014 | ISSUED FOR CLIENT REVIEW/SQUAD CHECK | SBW | JR | KC | GC | | |

| REF | NUMBER | TITLE |
|---|---|---|



STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

APPROVED FOR ____________

CLIENT PROJECT MGR. | DEPARTMENT MGR. | PROJECT MGR.

PROJECT PHASE: RAINY RIVER GOLD PROJECT

| PROJECT NO. | ACTIVITY NO. | | BY | DDMMMYY |
|---|---|---|---|---|
| 100126 | 7000 | DES | J.RUST | 22MAY14 |
| | | DRN | SBW | 22MAY14 |
| SCALE: NTS | PACKAGE CODE | CHK | | |
| | | APP | | |

newgold
Rainy River Project

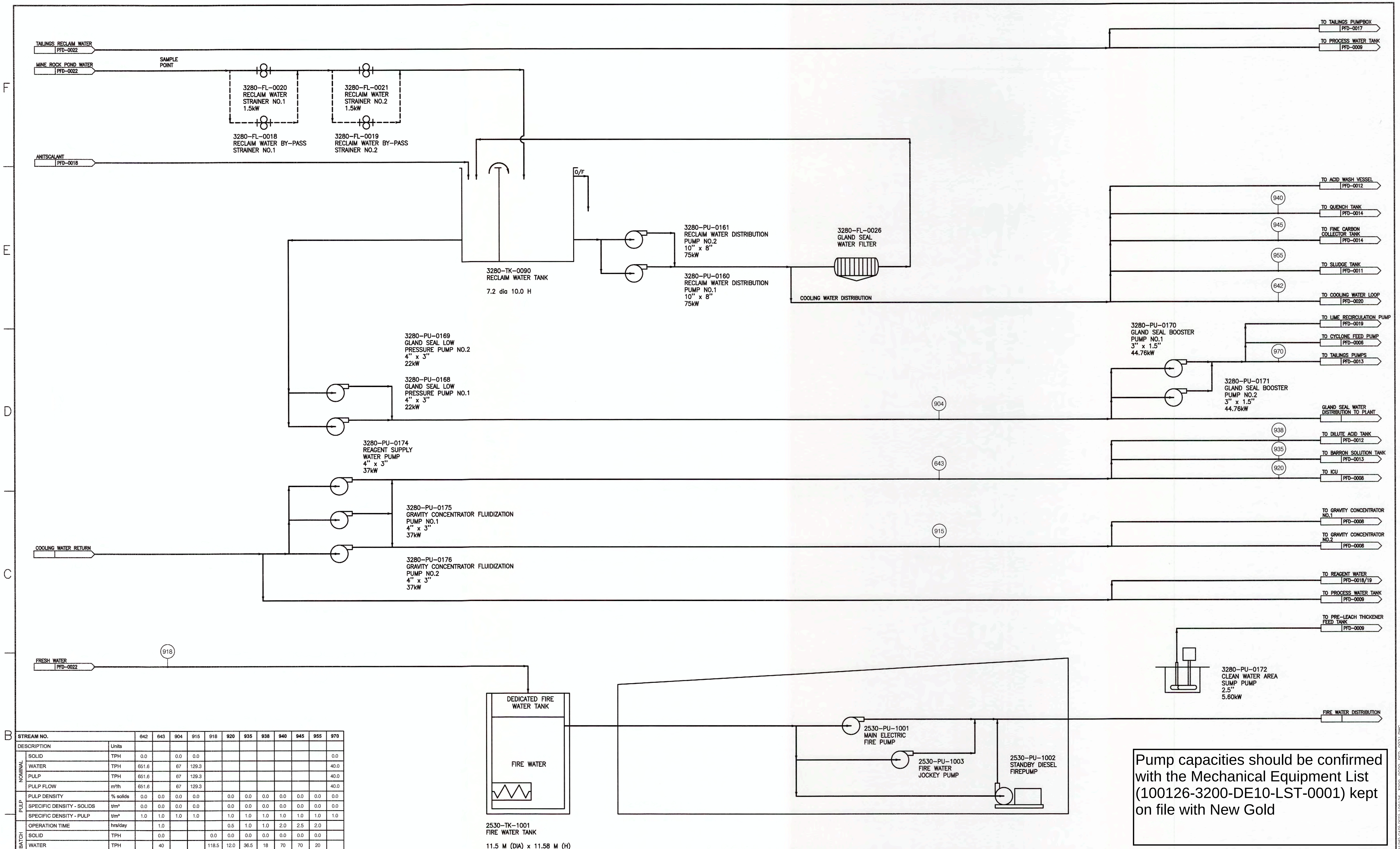
SUBJECT: PROCESS
PROCESS FLOW DIAGRAM
TAILING & CYANIDE DESTRUCTION
SHEET NO.2 21,000 TPD

amec

AREA

CLIENT DWG. NO.

DRAWING NO. 100126-3200-DC00-PFD-0017.001 REV. 0




| STREAM NO. | | | 642 | 643 | 904 | 915 | 918 | 920 | 935 | 938 | 940 | 945 | 955 | 970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESCRIPTION | | Units | | | | | | | | | | | | |
| NOMINAL | SOLID | TPH | 0.0 | | 0.0 | 0.0 | | | | | | | | 0.0 |
| | WATER | TPH | 651.6 | | 67 | 129.3 | | | | | | | | 40.0 |
| | PULP | TPH | 651.6 | | 67 | 129.3 | | | | | | | | 40.0 |
| | PULP FLOW | m³/h | 651.6 | | 67 | 129.3 | | | | | | | | 40.0 |
| PULP | PULP DENSITY | % solids | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | SPECIFIC DENSITY - SOLIDS | t/m³ | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | SPECIFIC DENSITY - PULP | t/m³ | 1.0 | 1.0 | 1.0 | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| BATCH | OPERATION TIME | hrs/day | | 1.0 | | | | 0.5 | 1.0 | 1.0 | 2.0 | 2.5 | 2.0 | |
| | SOLID | TPH | | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER | TPH | | 40 | | | 118.5 | 12.0 | 36.5 | 18 | 70 | 70 | 20 | |
| | PULP FLOW | m³/h | | 67 | | | 118.5 | 12.0 | 36.5 | 18 | 70 | 70 | 20 | |

Pump capacities should be confirmed with the Mechanical Equipment List (100126-3200-DE10-LST-0001) kept on file with New Gold

| REV | DDMMMYY | REVISION / ISSUE DESCRIPTION | DRN | CHK | APP | APP | APP | APP |
|---|---|---|---|---|---|---|---|---|
| 0 | 22JUN2015 | ISSUED FOR USE | SBW | CL | KC | GC | | |
| F | 01MAY2015 | RE-ISSUED FOR DESIGN | SBW | CL | KC | GC | | |
| E | 12DEC2014 | RE-ISSUED FOR DESIGN | SBW | CL | KC | GC | | |
| D | 15AUG2014 | ISSUED FOR DESIGN | SBW | JR | KC | GC | | |
| C | 17JUL2014 | RE-ISSUED FOR APPROVAL | SBW | JR | KC | GC | | |
| B | 04JUL2014 | ISSUED FOR APPROVAL | SBW | JR | KC | GC | | |
| A | 20MAY2014 | ISSUED FOR CLIENT REVIEW/SQUAD CHECK | SBW | JR | KC | GC | | |

| REF | NUMBER | TITLE |
|---|---|---|

REFERENCES



STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

APPROVED FOR

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: RAINY RIVER GOLD PROJECT

| PROJECT NO. | ACTIVITY NO. | | BY | DDMMMYY |
|---|---|---|---|---|
| 100126 | 7000 | DES | J.RUST | 22MAY14 |
| | | DRN | SBW | 22MAY14 |
| SCALE | PACKAGE CODE | CHK | | |
| NTS | | APP | | |

newgold
Rainy River Project

amec

SUBJECT: PROCESS
PROCESS FLOW DIAGRAM
WATER RECLAIM SHEET NO.1
21,000 TPD

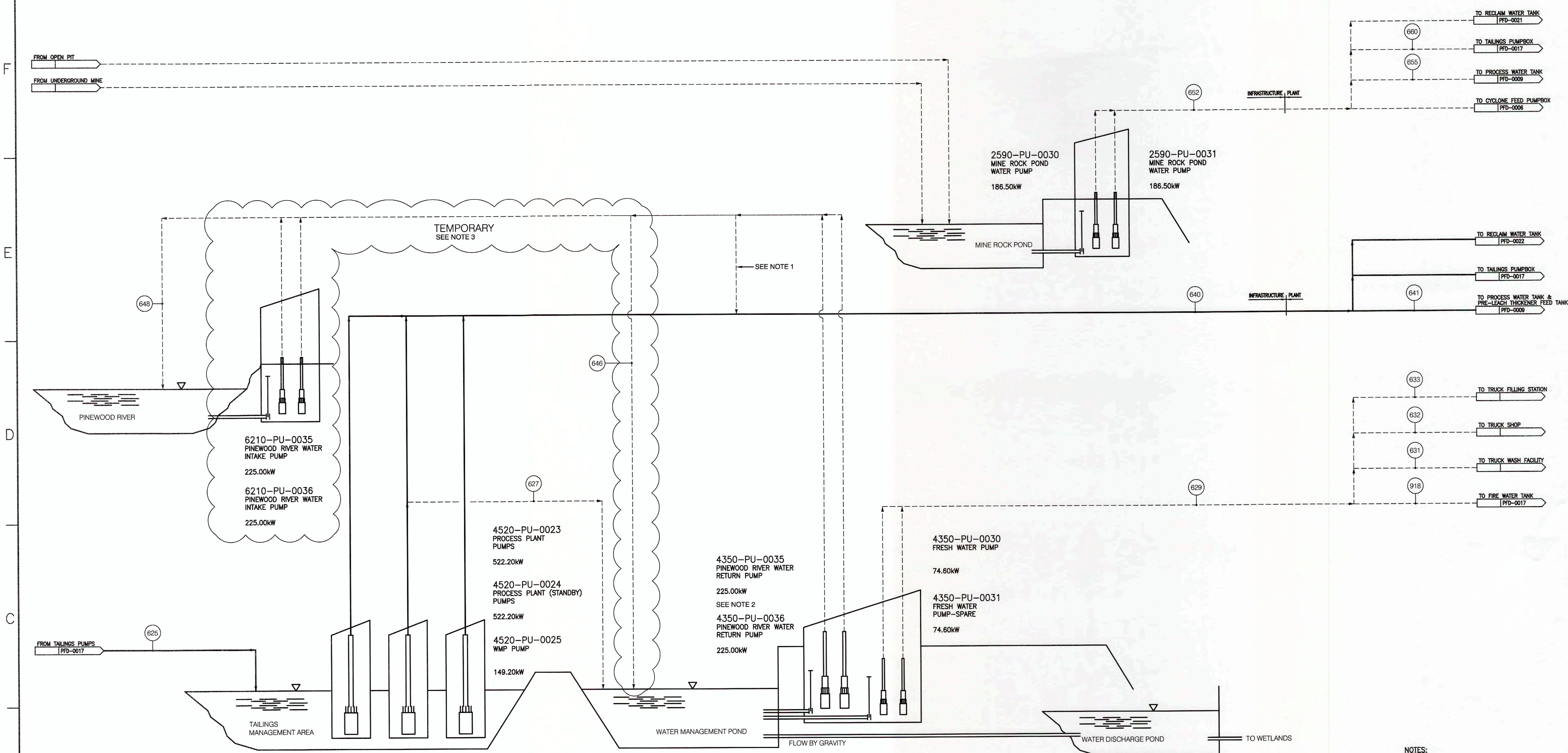
AREA

CLIENT DWG. NO.

DRAWING NO. 100126-3200-DC00-PFD-0021.001 REV. 0



SAVED: 26-Jun-15 3:28 PM PLOTTED: 26-Jun-15 4:35 PM USER: BATCHPLOT, GI




**NOTES:**

1. FOR START-UP INSTALL PUMP 4520-PU-0023 AT THE DESIGNATED LOCATION OF PUMP 4350-PU-0035 OR 4350-PU-0036.
2. PUMP 4350-PU-0035 AND 4350-PU-0036 ARE RETROFITTED FROM PUMP 6210-PU-0035 AND 6210-PU-0036 PRIOR TO PLANT START-UP.
3. PINEWOOD RIVER WATER PIPELINE TO REMAIN UNCHANGED AFTER TEMPORARY SERVICE.

| STREAM NO. | | | 625 | 627 | 629 | 631 | 632 | 633 | 640 | 641 | 646 | 648 | 652 | 665 | 660 | 918 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESCRIPTION | | Units | | | | | | | | | | | | | | |
| NOMINAL | SOLID | TPH | 952 | | 0 | 0 | 0 | | 0 | 0 | | | 0 | 0 | | |
| | WATER | TPH | 1080 | | 160 | 25 | 8 | | 1080 | 0 | | | 535 | 535 | | |
| | PULP | TPH | 2031 | | 160 | 25 | 8 | | 1080 | 0 | | | 535 | 535 | | |
| | PULP FLOW | m³/h | 1414 | | 160 | 25 | 8 | | 1080 | 0 | | | 535 | 535 | | |
| PULP | PULP DENSITY | % solids | 46.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | SPECIFIC DENSITY - SOLIDS | t/m³ | 2.85 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | SPECIFIC DENSITY - PULP | t/m³ | 1.44 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| BATCH | OPERATION TIME | hrs/day | | | | | | | | | | | | | | |
| | SOLID | TPH | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | | | | 0.0 |
| | WATER | TPH | | 3190 | 200 | 31 | 10 | 152 | | | 1041.7 | 1458.3 | | | 535 | 119 |
| | PULP FLOW | m³/h | | 3190 | 200 | 31 | 10 | 152 | | | 1041.7 | 1458.3 | | | 535 | 119 |

Pump capacities should be confirmed with the Mechanical Equipment List (100126-3200-DE10-LST-0001) kept on file with New Gold

| REV | DDMMMYY | REVISION / ISSUE DESCRIPTION | DRN | CHK | APP | APP | APP | APP |
|---|---|---|---|---|---|---|---|---|
| 0 | 22JUN2015 | ISSUED FOR USE | SBW | CL | KC | GC | | |
| G | 01MAY2015 | RE-ISSUED FOR DESIGN | SBW | CL | KC | GC | | |
| F | 23MAR2015 | RE-ISSED FOR DESIGN | SBW | CL | KC | GC | | |
| E | 12DEC2014 | RE-ISSUED FOR DESIGN | SBW | CL | KC | GC | | |
| D | 15AUG2014 | ISSUED FOR DESIGN | SBW | JR | KC | GC | | |
| C | 17JUL2014 | RE-ISSUED FOR APPROVAL | SBW | JR | KC | GC | | |
| B | 04JUL2014 | ISSUED FOR APPROVAL | SBW | JR | KC | GC | | |
| A | 20MAY2014 | ISSUED FOR CLIENT REVIEW/SQUAD CHECK | SBW | JR | KC | GC | | |

| REF | NUMBER | TITLE |
|---|---|---|
| REFERENCES | | |



STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

APPROVED FOR

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: RAINY RIVER GOLD PROJECT

| PROJECT NO. | ACTIVITY NO. | | BY | DDMMMYY |
|---|---|---|---|---|
| 100126 | 7000 | DES | J.RUST | 22MAY14 |
| | | DRN | SBW | 22MAY14 |
| SCALE: NTS | PACKAGE CODE | CHK | | |
| | | APP | | |

newgold
Rainy River Project

SUBJECT: PROCESS
PROCESS FLOW DIAGRAM
WATER RECLAIM SHEET NO.2
21,000 TPD

amec



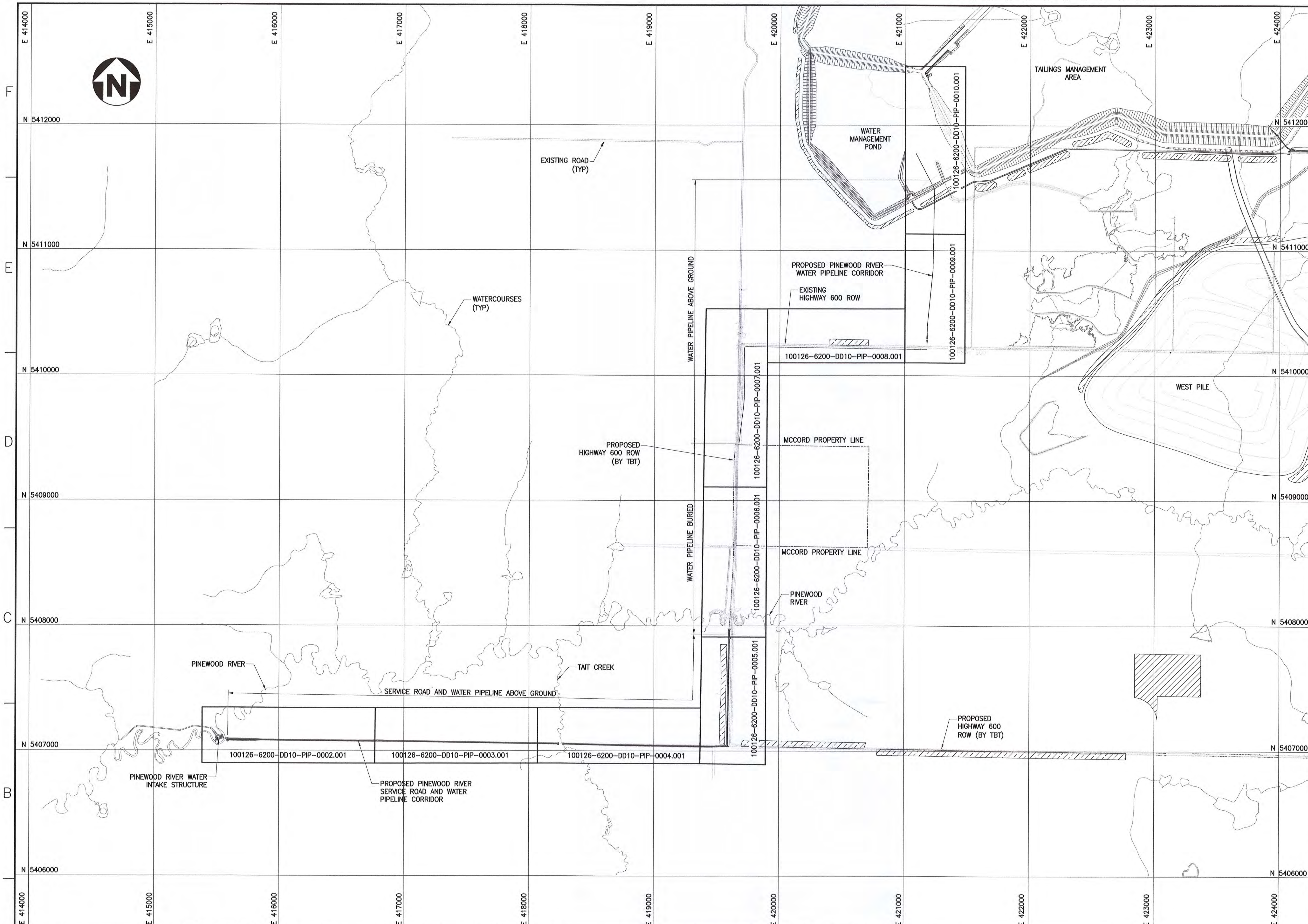
AREA

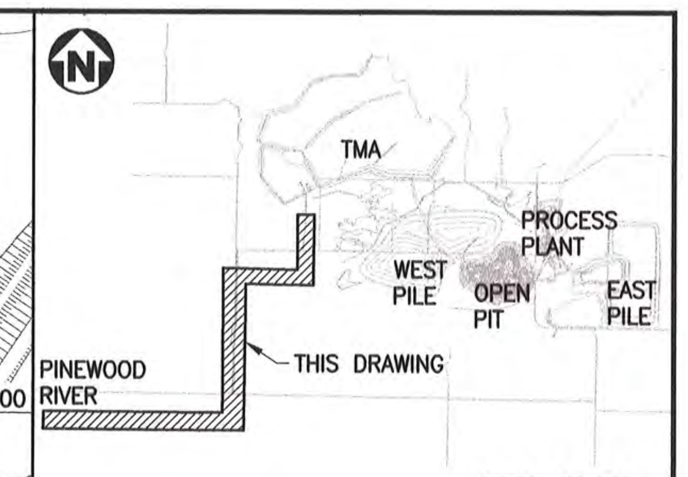
CLIENT DWG. NO.

DRAWING NO. 100126-3200-DC00-PFD-0022.001 REV. 0

SAVED: 23-Jun-15 9:59 AM PLOTTED: 26-Jun-15 4:36 PM USER: BATCHPLOT, GI

CAD FILE: \\EDC01PROJECTS.AMEC.COM\SITES\P00100126\CAD\PFD\100126-3200-DC00-PFD-0022.DWG




KEY PLAN

## GENERAL NOTES:

1. GEOGRAPHIC COORDINATE SYSTEM SHOWN IS IN UTM NAD83, ZONE 15.
2. ALL COORDINATES, DIMENSIONS, AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. TOPOGRAPHIC DATA (LIDAR SURVEY) ARE FROM AERIAL DIGITAL PICTURES AND LASER SURVEY (LIDAR) PROVIDED BY LIDAR SERVICES INTERNATIONAL INC. OCTOBER, 2009. GROUND SURVEY FOR PINEWOOD RIVER WATER PIPELINE & SERVICE ROAD CORRIDOR PROVIDED BY TBT ENGINEERING.
4. CONTOURS ARE AT 1m INTERVALS.
5. TAILINGS, WATERCOURSE DIVERSIONS AND DAMS DRAWINGS PROVIDED BY AMEC E & I.
6. HIGHWAY 600 RELOCATION DRAWINGS PROVIDED BY TBT ENGINEERING.
7. INSTALL 4"ø KNIFE GATE DRAIN VALVES AT LOW POINTS, AND 4"ø CLASS 150 AIR RELEASE/ VACUUM BREAK VALVES AT HIGH POINTS.
8. INSTALL CULVERT-EQUALIZERS OVER SWAMPY TYPE 3 AND TYPE 4 ROAD SECTIONS. CULVERT-EQUALIZERS TO BE SPACED AT 150m (MAX), 2 X 300mmø HDPE AT EACH CROSSING.

## LEGEND:

—374— LIDAR SURVEY CONTOUR
CULVERT

## ABBREVIATIONS:

- N – NORTHING
- E – EASTING
- m – METRE
- H – HORIZONTAL
- V – VERTICAL
- ø – DIAMETER
- ℄ – CENTERLINE
- " – INCH
- EL – ELEVATION
- OD – OUTSIDE DIAMETER
- HDPE – HIGH-DENSITY POLYETHYLENE

0m 150 300 450 600 750
1:15000

| REV | DDMMMYY | REVISION / ISSUE DESCRIPTION | DRN | CHK | APP | APP | APP | APP |
|---|---|---|---|---|---|---|---|---|
| 2 | 30APR15 | PIPELINE CORRIDOR ALIGNMENT REVISED | SW | EM | AV | JJ | MO | |
| 1 | 20NOV14 | RE-ISSUED FOR CONSTRUCTION | SW | JJ | AV | JJ | MO | |
| 0 | 24SEP14 | ISSUED FOR CONSTRUCTION | KT | AB | AV | JJ | MO | |
| B | 28AUG14 | ISSUED FOR APPROVAL | AR | AB | AV | JJ | MO | |
| A | 30JUL14 | ISSUED FOR SQUAD CHECK/CLIENT REVIEW | AR | AB | AV | JJ | MO | |

REFERENCES

| REF | NUMBER | TITLE |
|---|---|---|
| 10 | 6200-DD10-PIP-0010.001 | ROAD PLAN AND PROFILE STA 9+300 TO 10+300 |
| 9 | 6200-DD10-PIP-0009.001 | ROAD PLAN AND PROFILE STA 8+460 TO 9+300 |
| 8 | 6200-DD10-PIP-0008.001 | ROAD PLAN AND PROFILE STA 7+180 TO 8+460 |
| 7 | 6200-DD10-PIP-0007.001 | ROAD PLAN AND PROFILE STA 6+400 TO 7+180 |
| 6 | 6200-DD10-PIP-0006.001 | ROAD PLAN AND PROFILE STA 5+120 TO 6+400 |
| 5 | 6200-DD10-PIP-0005.001 | ROAD PLAN AND PROFILE STA 3+840 TO 5+120 |
| 4 | 6200-DD10-PIP-0004.001 | ROAD PLAN AND PROFILE STA 2+560 TO 3+840 |
| 3 | 6200-DD10-PIP-0003.001 | ROAD PLAN AND PROFILE STA 1+280 TO 2+560 |
| 2 | 6200-DD10-PIP-0002.001 | ROAD PLAN AND PROFILE STA 0+000 TO 1+280 |
| 1 | 2000-DD10-PLN-0001.001 | GENERAL SITE PLAN |



STAMP/SEAL
LICENSED PROFESSIONAL ENGINEER J. E. J. JACKSON PROVINCE OF ONTARIO 4/30/15

APPROVED FOR CONSTRUCTION
CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.
PROJECT PHASE: EPCM

| PROJECT NO. | ACTIVITY NO. | | BY | DDMMMYY |
|---|---|---|---|---|
| 100126 | | DES | AV | 30JUL14 |
| | | DRN | AR | 30JUL14 |
| SCALE | PACKAGE CODE | CHK | AB | 30JUL14 |
| 1:15000 | | APP | JJ | 30JUL14 |

newgold™ Rainy River Project

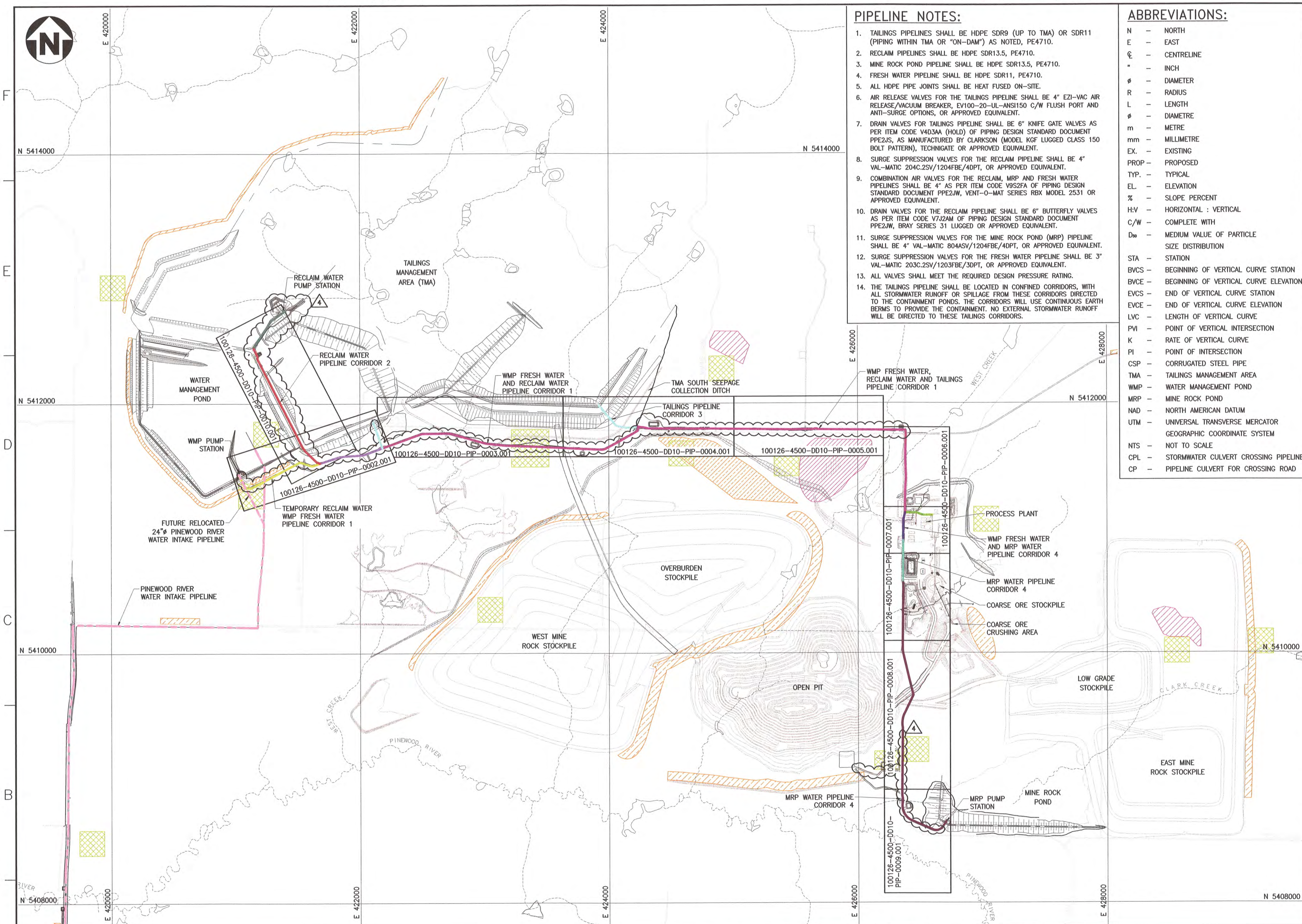
SUBJECT: RAINY RIVER PROJECT PINEWOOD RIVER WATER INTAKE PIPELINE KEY PLAN

amec

AREA: 6200
CLIENT DWG. NO.
DRAWING NO.: 100126-6200-DD10-PIP-0001.001 REV. 2



CAD FILE: P:\CAD\CIVIL\DWG\100126-6200-DD10-PIP-0001.001.DWG
SAVED: 29-Apr-15 4:31 PM PLOTTED: 29-Apr-15 5:13 PM USER: WENG, SOPHIA

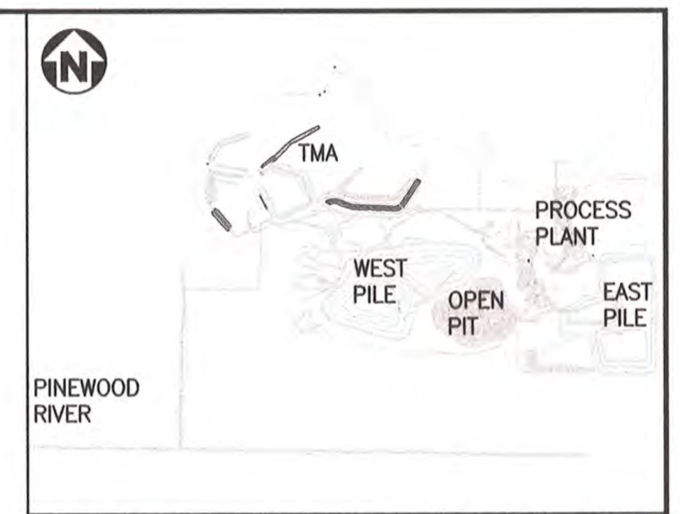



## PIPELINE NOTES:

1. TAILINGS PIPELINES SHALL BE HDPE SDR9 (UP TO TMA) OR SDR11 (PIPING WITHIN TMA OR "ON-DAM") AS NOTED, PE4710.
2. RECLAIM PIPELINES SHALL BE HDPE SDR13.5, PE4710.
3. MINE ROCK POND PIPELINE SHALL BE HDPE SDR13.5, PE4710.
4. FRESH WATER PIPELINE SHALL BE HDPE SDR11, PE4710.
5. ALL HDPE PIPE JOINTS SHALL BE HEAT FUSED ON-SITE.
6. AIR RELEASE VALVES FOR THE TAILINGS PIPELINE SHALL BE 4" EZI-VAC AIR RELEASE/VACUUM BREAKER, EV100-20-UL-ANSI150 C/W FLUSH PORT AND ANTI-SURGE OPTIONS, OR APPROVED EQUIVALENT.
7. DRAIN VALVES FOR TAILINGS PIPELINE SHALL BE 6" KNIFE GATE VALVES AS PER ITEM CODE V4D3AA (HOLD) OF PIPING DESIGN STANDARD DOCUMENT PPE2JS, AS MANUFACTURED BY CLARKSON (MODEL KGF LUGGED CLASS 150 BOLT PATTERN), TECHNIGATE OR APPROVED EQUIVALENT.
8. SURGE SUPPRESSION VALVES FOR THE RECLAIM PIPELINE SHALL BE 4" VAL-MATIC 204C.2SV/1204FBE/4DPT, OR APPROVED EQUIVALENT.
9. COMBINATION AIR VALVES FOR THE RECLAIM, MRP AND FRESH WATER PIPELINES SHALL BE 4" AS PER ITEM CODE V9S2FA OF PIPING DESIGN STANDARD DOCUMENT PPE2JW, VENT-O-MAT SERIES RBX MODEL 2531 OR APPROVED EQUIVALENT.
10. DRAIN VALVES FOR THE RECLAIM PIPELINE SHALL BE 6" BUTTERFLY VALVES AS PER ITEM CODE V7J2AM OF PIPING DESIGN STANDARD DOCUMENT PPE2JW, BRAY SERIES 31 LUGGED OR APPROVED EQUIVALENT.
11. SURGE SUPPRESSION VALVES FOR THE MINE ROCK POND (MRP) PIPELINE SHALL BE 4" VAL-MATIC 804ASV/1204FBE/4DPT, OR APPROVED EQUIVALENT.
12. SURGE SUPPRESSION VALVES FOR THE FRESH WATER PIPELINE SHALL BE 3" VAL-MATIC 203C.2SV/1203FBE/3DPT, OR APPROVED EQUIVALENT.
13. ALL VALVES SHALL MEET THE REQUIRED DESIGN PRESSURE RATING.
14. THE TAILINGS PIPELINE SHALL BE LOCATED IN CONFINED CORRIDORS, WITH ALL STORMWATER RUNOFF OR SPILLAGE FROM THESE CORRIDORS DIRECTED TO THE CONTAINMENT PONDS. THE CORRIDORS WILL USE CONTINUOUS EARTH BERMS TO PROVIDE THE CONTAINMENT. NO EXTERNAL STORMWATER RUNOFF WILL BE DIRECTED TO THESE TAILINGS CORRIDORS.

## ABBREVIATIONS:

| | | |
|---|---|---|
| N | – | NORTH |
| E | – | EAST |
| ℄ | – | CENTRELINE |
| " | – | INCH |
| ø | – | DIAMETER |
| R | – | RADIUS |
| L | – | LENGTH |
| ø | – | DIAMETE |
| m | – | METRE |
| mm | – | MILLIMETRE |
| EX. | – | EXISTING |
| PROP | – | PROPOSED |
| TYP. | – | TYPICAL |
| EL. | – | ELEVATION |
| % | – | SLOPE PERCENT |
| H:V | – | HORIZONTAL : VERTICAL |
| C/W | – | COMPLETE WITH |
| $D_{50}$ | – | MEDIUM VALUE OF PARTICLE SIZE DISTRIBUTION |
| STA | – | STATION |
| BVCS | – | BEGINNING OF VERTICAL CURVE STATION |
| BVCE | – | BEGINNING OF VERTICAL CURVE ELEVATION |
| EVCS | – | END OF VERTICAL CURVE STATION |
| EVCE | – | END OF VERTICAL CURVE ELEVATION |
| LVC | – | LENGTH OF VERTICAL CURVE |
| PVI | – | POINT OF VERTICAL INTERSECTION |
| K | – | RATE OF VERTICAL CURVE |
| PI | – | POINT OF INTERSECTION |
| CSP | – | CORRUGATED STEEL PIPE |
| TMA | – | TAILINGS MANAGEMENT AREA |
| WMP | – | WATER MANAGEMENT POND |
| MRP | – | MINE ROCK POND |
| NAD | – | NORTH AMERICAN DATUM |
| UTM | – | UNIVERSAL TRANSVERSE MERCATOR GEOGRAPHIC COORDINATE SYSTEM |
| NTS | – | NOT TO SCALE |
| CPL | – | STORMWATER CULVERT CROSSING PIPELINE |
| CP | – | PIPELINE CULVERT FOR CROSSING ROAD |




KEY PLAN SCALE: NTS

## GENERAL NOTES:

1. GEOGRAPHIC COORDINATE SYSTEM SHOWN IS IN UTM NAD83, ZONE 15.
2. ALL COORDINATES, DIMENSIONS, AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
3. TOPOGRAPHIC DATA (GROUND SURVEY) ARE FROM TBT ENGINEERING CONSULTING GROUP, REF. DWG. PLANT SITE TOPO 13251-1-0001, DATED DEC. 9, 2013.
4. TOPOGRAPHIC DATA (LIDAR SURVEY) ARE FROM AERIAL DIGITAL PICTURES AND LASER SURVEY (LiDAR) PROVIDED BY LIDAR SERVICES INTERNATIONAL INC. OCTOBER, 2009.
6. FOR GEOTECHNICAL INFORMATION REFER TO: GEOTECHNICAL DESIGN RECOMMENDATIONS REPORT 3098004-003000-A1-ETR-0001-00 BY AMEC ENVIRONMENT AND INFRASTRUCTURE, DATED JULY 2014.

## LEGEND:

- QUARRIES
- TOPSOIL STOCKPILES
- LAYDOWN AREAS
- 24"ø TEMPORARY RECLAIM WATER PIPELINE (ABOVE GROUND) 10"ø WMP FRESH WATER PIPELINE (UNDERGROUND)
- 24"ø RECLAIM WATER PIPELINE (ABOVE GROUND) 10"ø WMP FRESH WATER PIPELINE (UNDERGROUND)
- 24"ø RECLAIM WATER PIPELINE (ABOVE GROUND) 24"ø TAILINGS PIPELINE (ABOVE GROUND) 10"ø WMP FRESH WATER PIPELINE (UNDERGROUND)
- 24"ø RECLAIM WATER PIPELINE (ABOVE GROUND) 24"ø TAILINGS PIPELINE (ABOVE GROUND) 20"ø MRP WATER PIPELINE (ABOVE GROUND)
- 24"ø RECLAIM WATER PIPELINE (ABOVE GROUND)
- 24"ø TAILINGS PIPELINE (ABOVE GROUND)
- 10"ø WMP FRESH WATER PIPELINE (UNDERGROUND) 20"ø MRP WATER PIPELINE (UNDERGROUND)
- 20"ø MRP WATER PIPELINE (UNDERGROUND)
- 20"ø MRP WATER PIPELINE (ABOVE GROUND)
- 2 x 24"ø RECLAIM WATER PIPELINE (ABOVE GROUND) 30" TMA-WMP RECLAIM WATER PIPELINE (ABOVE GROUND)
- 24"ø PINEWOOD RIVER WATER INTAKE PIPELINE

0m 150 300 450 600 750
1:15000

| REV | DDMMMYY | REVISION / ISSUE DESCRIPTION | DRN | CHK | APP | APP | APP | APP |
|---|---|---|---|---|---|---|---|---|
| 4 | 15MAY17 | RE-ISSUED FOR CONSTRUCTION | AR | JJ | KK | | | |
| 3 | 29APR16 | PIPELINE CORRIDOR 1 RE-ALIGNMENT | AR | JJ | GC | | | |
| 2 | 22OCT15 | SOUTH RUNOFF POND REVISED | AR | JJ | GC | | | |
| 1 | 05JUN15 | RE-ISSUED FOR CONSTRUCTION | AR | SW | JJ | GC | | |
| 0 | 13FEB15 | ISSUED FOR CONSTRUCTION | SW | LA | AV | JJ | MO | |
| A | 19NOV14 | ISSUED FOR SQUAD CHECK/CLIENT REVIEW | AR | JJ | AV | JJ | MO | |

| REF | NUMBER | TITLE |
|---|---|---|
| 11 | 6200-DD10-PIP-0001.001 | PINEWOOD RIVER WATER INTAKE PIPELINE |
| 10 | 4500-DD10-PIP-0010.001 | PLAN & PROFILE |
| 9 | 4500-DD10-PIP-0009.001 | PLAN & PROFILE |
| 8 | 4500-DD10-PIP-0008.001 | PLAN & PROFILE |
| 7 | 4500-DD10-PIP-0007.001 | PLAN & PROFILE |
| 6 | 4500-DD10-PIP-0006.001 | PLAN & PROFILE |
| 5 | 4500-DD10-PIP-0005.001 | PLAN & PROFILE |
| 4 | 4500-DD10-PIP-0004.001 | PLAN & PROFILE |
| 3 | 4500-DD10-PIP-0003.001 | PLAN & PROFILE |
| 2 | 4500-DD10-PIP-0002.001 | PLAN & PROFILE |
| 1 | 2000-DD10-PLN-0001.001 | GENERAL SITE PLAN |

REFERENCES



STAMP/SEAL
LICENSED PROFESSIONAL ENGINEER J. E. J. JACKSON 5/17/17 PROVINCE OF ONTARIO

APPROVED FOR CONSTRUCTION

CLIENT PROJECT MGR. DEPARTMENT MGR. PROJECT MGR.

PROJECT PHASE: EPCM

| PROJECT NO. | ACTIVITY NO. | | BY | DDMMMYY |
|---|---|---|---|---|
| 100126 | | DES | AV | 19NOV14 |
| | | DRN | AR | 19NOV14 |
| SCALE | PACKAGE CODE | CHK | JJ | 19NOV14 |
| 1:15000 | | APP | JJ | 19NOV14 |

newgold Rainy River Project

SUBJECT: RAINY RIVER PROJECT TAILINGS & RECLAIM WATER PIPELINES KEY PLAN

amec

AREA: 4500

CLIENT DWG. NO.

DRAWING NO.: 100126-4500-DD10-PIP-0001.001 REV.: 4

SAVED: 15-May-17 10:37 AM PLOTTED: 15-May-17 10:48 AM USER: RODRIGUEZ, ACHILLES

CAD FILE: P:\CAD\CIVIL\DWG\100126-4500-DD10-PIP-0001.001.DWG

newgold™

**APPENDIX C**

**NEW GOLD TAILINGS, HEAP LEACH AND WASTE ROCK FACILITIES MANAGEMENT POLICY**

newgold

**Tailings, Heap Leach and Waste Rock Facilities Management Policy**

New Gold Inc. and its subsidiaries (together "**New Gold**") are committed to excellence in the management of tailings, heap leach and waste rock storage facilities. We will accomplish this by adopting internationally recognized standards including the Mining Association of Canada's *Towards Sustainable Mining* Tailings Management protocol wherever applicable.

New Gold makes the following commitments at all of its operations and projects:

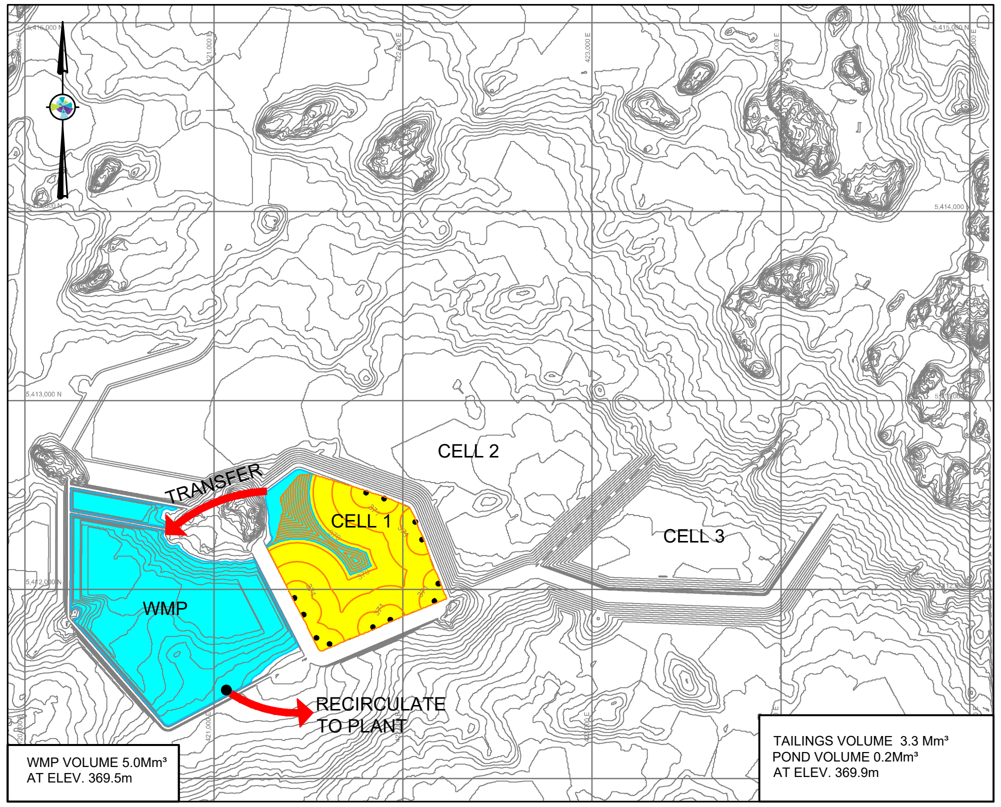
- Identifying, assessing and controlling risks associated with tailings, heap leach and waste rock storage facilities.
- Ensuring that all aspects of our tailings, heap leach and waste rock storage facilities comply with regulatory requirements, sound engineering practice and company standards through regular inspection, program review and external audit.
- Locating, designing, constructing, operating, decommissioning and closing our tailings, heap leach and waste rock storage facilities so that all structures are stable and that all solids and water within the designated areas are managed to minimize or prevent possible pollution.
- Training our employees to enable them to carry out their responsibilities with regard to tailings, heap leach and waste rock storage facilities management.
- Communicating with Communities of Interest in order to take into account their concerns and considerations with regard to tailings, heap leach and waste rock storage.

New Gold believes that by adopting these commitments, the safe storage of tailings, ore and waste rock will be achieved and future Communities of Interest will not be adversely impacted by their existence.

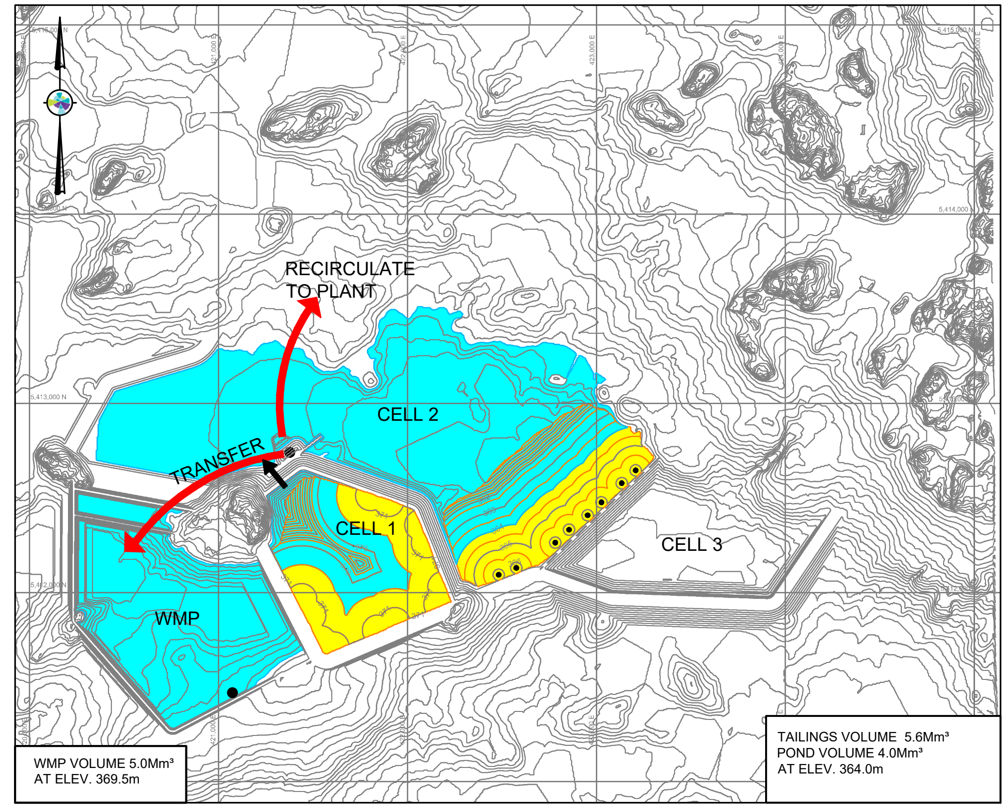
Hannes Portmann
President and CEO

**APPENDIX D**

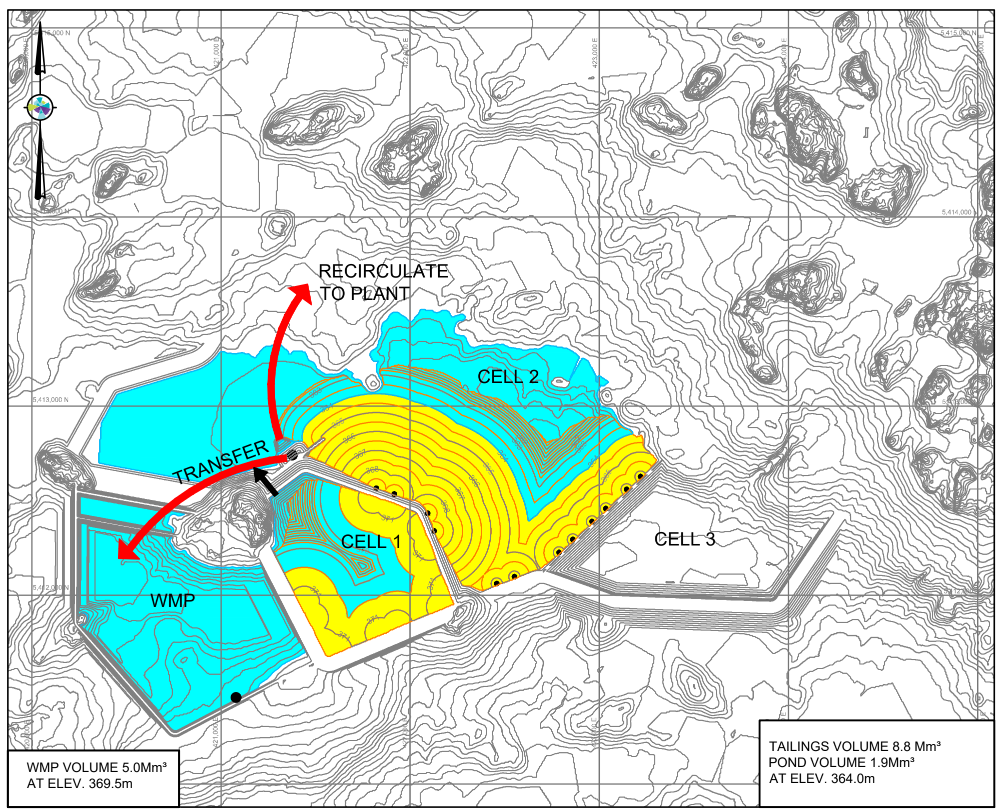
**TAILINGS DEPOSITION PLAN**



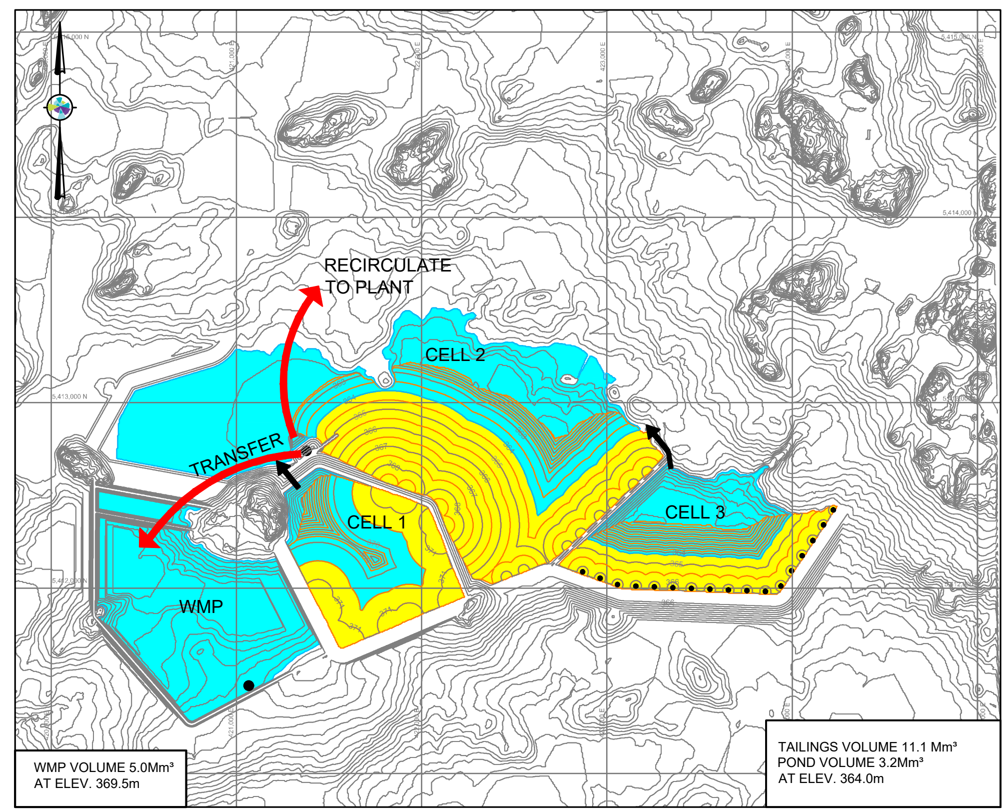

A) TAILINGS DEPOSITION PLAN CELL 1 - 6 MONTHS




B) TAILINGS DEPOSITION PLAN CELL 2 - 11 MONTHS




C) TAILINGS DEPOSITION PLAN CELL 2 - 18 MONTHS




D) TAILINGS DEPOSITION PLAN CELL 3 - 23 MONTHS

NOTES:

1. RECIRCULATION TO THE PROCESSING PLANT VIA FIXED PUMPING STATION.
2. EXCESS WATER WILL BE TRANSFERRED TO THE WATER MANAGEMENT POND ANNUALLY BY PUMPING.
3. THE NORMAL POND VOLUME WILL FLUCTUATE SEASONALLY.

ASSUMED TAILINGS DEPOSITION PERAMETERS

- CELL 1:
- BEACH SLOPE ABOVE POND - 0.5%
- SLOPE BELOW POND - 4%
- TAILINGS DRY DENSITY - 1.1 $t/m^3$

- CELL 2 AND CELL 3:
- BEACH SLOPE ABOVE POND - 1%
- SLOPE BELOW POND - 4%
- TAILINGS DRY DENSITY - 1.41 $t/m^3$

- TAILINGS PRODUCTION: 21,000 t/day

LEGEND:

- DEPOSITED TAILINGS
- POND
- PUMPING STATION (WET WELLS)
- TAILING SPIGOTS
- OVERFLOW SPILLWAY

0 0.5 1 2Km
SCALE

| CLIENT LOGO | CLIENT: | DWN BY: SC | COMPANY LOGO | PROJECT | DATE: APRIL 2017 |
|---|---|---|---|---|---|
| newgold Rainy River Project | NEW GOLD INC. | CHK'D BY: DR | amec foster wheeler | RAINY RIVER PROJECT DETAILED DESIGN | PROJECT NO: TC150321 |
| | Amec Foster Wheeler Environment & Infrastructure<br>160 Traders Boulevard East<br>Mississauga, Ontario, Canada L4Z 3K7 | DATUM: NAD 83 | | TITLE | REV. NO.: A |
| | | PROJECTION: UTM | | TAILINGS DEPOSITION PLAN | FIGURE No. 3 |
| | | SCALE: AS SHOWN | | | |

P:\2015\Projects\TC150321_New Gold_ Dam&Site_Eng\11_CAD\03_FIGURES\05-TMA TAILINGD DEPO CELL 1,2,3\TMA TAILINGS DEPO PLAN.dwg - Layout1 - Apr. 27, 2017 10:51am - svetlana.cronkhite

**APPENDIX E**

**PROCESS WATER BALANCE OVERVIEW**

# Memorandum

**Date:** April 28, 2017

**To:** Design Brief – Appendix A

**From:** Norman Schwartz

**Ref:** TC150321.10000B

**Re:** **Rainy River Project Development**
**TMA Cell 2 and WMP Water Balance**
**RRP-GEO-REP-026 R1**

**ISSUED FOR USE**

## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) was retained by New Gold Inc. (New Gold) to provide engineering services to prepare the detailed design of an internal tailings depositional cell (TMA Cell 2) located within the footprint on the ultimate Tailings Management Area (TMA) at the Rainy River Project near Fort Frances, Ontario. This includes preparing a water balance for TMA Cell 2 to evaluate water availability, water storage capacity and requirements for tailings deposition in TMA Cell 2. This memorandum presents the input data, calculations, operational and design considerations and results for the water balance.

## 2.0 DESIGN BASIS

- Commissioning Begins — September 14, 2017
- Commercial Production — October 31, 2017
- Assumed Production — October 1, 2017 (for water balance analysis)

### Mine Production

- Start Date — October 2017 (into TMA Cell 1)
- Production Rate — 21,000 t/day

Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited
160 Traders Blvd. E., Suite 110
Mississauga, Ontario, L4Z 3K7
Tel: (905) 568-2929
Fax: (905) 568-1686
amecfw.com

### Tailings Properties

- Solids content of slurry — 46.9 % solids by mass
- Specific gravity of solid tailings particles — 2.82
- Void ratio of deposited tailings — 1.0
- Tailings water content at saturation — 35.5%
- Dry density of settled tailings — 1.41 t/$m^3$

### TMA Cell 2

- Design capacity — 12 months
- Dam crest elevation — 366.5 m
- Spillway invert elevation — 364.7 m
- Minimum operational pond volume — 500,000 $m^3$ (for settling of solids)
- Slope of tailings beach and pond — 1.0% and 4%
- Tailings slurry inflow rate — 23,776 $m^3$/day
- Reclaim rate to mill — 23,556 $m^3$/day
- Tailings pore water losses — 7,447 $m^3$/day
- TMA Cell 2 begins impounding runoff — April 2018
- Initial TMA Cell 2 water level — 357.00 m (0 $m^3$ of storage)
- Tailings deposition begins — April 2018
- Reclaim from TMA Cell 2 begins — After WMP volume is less than 1.0 $Mm^3$
- TMA Cell 2 to WMP transfer rate (treat) — 40,000 $m^3$/day
- TMA Cell 2 to TMA Cell 3 transfer rate — 40,000 $m^3$/day

### TMA Cell 3

- Cell 3 begins impounding runoff — June 2018
- Cell 3 is available for pumping from Cell 2 — July 2018
- Cell 3 Dam attains full storage capacity — September 2018

### WMP

- Dam crest elevation — 371.5 m
- Spillway invert elevation — 370.5 m
- Maximum allowable water level — 369.5 m (5.0 $Mm^3$ of storage)
- Initial WMP water level — 365.10 m (2.0 $Mm^3$ of storage)
- Reclaim rate to mill — 23,556 $m^3$/day (starting April 1, 2018)
- Reclaim from WMP — Until WMP volume < 1.0 $Mm^3$

Note: All dates provided in design basis are the first of the month

## 3.0 DESIGN CRITERIA

This water balance evaluation was completed to determine operating rules for TMA Cell 2 and the WMP during the operating life of TMA Cell 2 (April 2018 – April 2019). The water balance was used to evaluate and determine the necessary conditions so that sufficient water inventory will be available for processing plant operation in the winter of 2018, and so that adequate storage will be provided below the spillway invert to contain the Environmental Design Flood (EDF). The water balance evaluation was carried out for average, 1:20 wet and 1:20 dry climatic and streamflow conditions.

Water contained in the WMP needs to be of a suitable quality for discharge to the environment. During the initial 6 months of operation, the WMP will receive tailings-contact water from TMA Cell 1 (operating months: 1 October 2017 to 31 March 2018), with a projected water inventory of 2 $Mm^3$ (1.0 $Mm^3$ of free water and 1.0 $Mm^3$ as ice) at the end of this period. At the start of TMA Cell 2 operation (April 2018), TMA Cell 2 is expected to fill quickly due to the typically high runoff in April, May and June. To manage the increase in TMA Cell 2 water volume, it is proposed to transfer water from TMA Cell 2 to the WMP in this period, which will increase the WMP volume. In addition, it is planned to pump from the Pinewood River (to the extent permitted) to increase the WMP inventory as a contingency against possible dry conditions in summer or fall. The WMP will be maintained below its maximum operating water level (MOWL) by reclaiming water from it to the processing plant during the first few months of TMA Cell 2 operation. During the drawdown of the WMP, storage in TMA Cell 3 will become available to transfer TMA Cell 2 excess water. Once the Water Treatment Plant (WTP) becomes available it will be used to treat and transfer excess water from TMA Cell 2 to the WMP. From that point on, there will be blending of untreated residual effluent (minimized to the extent possible) with treated TMA Cell 2 effluent in the WMP.

In order to provide the system with sufficient flexibility to discharge to the environment in the spring of 2019, the WTP should be available in September 2018 to treat water entering the WMP from TMA Cell 2. Delaying startup of the WTP could result in filling both TMA Cell 2 and the WMP with untreated water, which is not recommended due to the project risk of discharging out of compliance water if high runoff events occur with both ponds nearly full. A flow schematic for site water management is provided in Figure 1.

## 4.0 AVAILABLE STORAGE

Capacity for water storage in the TMA Cell 2 will reduce during the 12-month period with progressive tailings deposition. Stage-storage curves for end of month 2, month 6, and month 12 were developed based on tailings deposition modelling. For intermediate months, stage-storage curves were interpolated for use in the water balance. The stage-storage relationships for the TMA Cell 2 and WMP are provided in Figures 2 and 3, respectively.

New Gold has indicated that TMA Cell 3 will be completed and available to impound water on June 1, 2018. For the purposes of this water balance analysis, it has been assumed that TMA Cell 3 storage will become available progressively between June 1 and September 1, 2018.

## 5.0 METEOROLOGICAL DATA

Site runoff is represented in the water balance based on mean annual precipitation of 694.8 mm. Annual precipitation was re-distributed using the monthly distribution of streamflow from the Pinewood River to account for snowmelt (distribution based on WSC gauge 05PC023). Return period estimates for the 1:20 wet and dry years were generated using the Gumbel double exponential distribution for annual extremes. Mean annual pond evaporation is 538 mm. The meteorological data used for the water balance are listed in Table 1.

**Table 1: Mean Annual Meteorological Data**

| Month | Average Year Available Precipitation (mm)[1] | 1:20 Wet Year Available Precipitation (mm)[2] | 1:20 Dry Year Available Precipitation (mm)[2] | Pond Evaporation (mm)[1] |
|---|---|---|---|---|
| Jan | 4.51 | 6.20 | 2.66 | 0 |
| Feb | 2.72 | 3.75 | 1.60 | 0 |
| Mar | 61.12 | 84.01 | 35.99 | 0 |
| Apr | 221.10 | 303.92 | 130.20 | 0 |
| May | 117.31 | 161.25 | 69.08 | 109 |
| Jun | 118.97 | 163.54 | 70.06 | 110 |
| Jul | 59.29 | 81.49 | 34.91 | 129 |
| Aug | 8.16 | 11.22 | 4.81 | 104 |
| Sep | 20.41 | 28.05 | 12.02 | 63 |
| Oct | 34.89 | 47.96 | 20.55 | 23 |
| Nov | 38.37 | 52.75 | 22.60 | 0 |
| Dec | 7.95 | 10.93 | 4.68 | 0 |
| Year | 694.8 | 955.1 | 409.2 | 538 |

Notes:
1. Reference: Precipitation was distributed according to average streamflow at Pinewood River WSC gauge 05PC023 in order to simulate runoff
2. 1:20 wet year and 1:20 dry year estimates are based on Barwick, Ontario climate data from Environment Canada and were derived using the Gumbel double exponential distribution for annual extremes.

## 6.0 HYDROLOGY

Runoff was calculated as the product of monthly precipitation, catchment area, and runoff coefficient. The catchment areas and runoff coefficients used are provided in Table 2. Runoff from the open pit and Mine Rock Pond (MRP) areas were assumed to be pumped to TMA Cell 2. Runoff from the Start-Up Cell (TMA Cell 1) will passively overflow to TMA Cell 2.

**Table 2: Hydrologic Parameters for Water Balance**

| Parameter | TMA Cell 1 | TMA Cell 2 | TMA Cell 3 | WMP | Open Pit | Mine Rock Pond |
|---|---|---|---|---|---|---|
| Area ($km^2$) | 0.68 | 8.22 | 2.11 | 1.11 | 3.17 | 5.34 |
| Runoff Coefficient | 99.2% | 54.0% | 53.5% | 83.6% | 44.5% | 45.8% |

Runoff coefficients for the water balance are the same as those utilized in the detailed design water balance (AMEC, 2014). The MRP drainage area has a pond area of approximately 0.66 $km^2$, and the remaining area was assumed to be 75% natural ground cover and 25% waste rock. The open pit area (including upstream catchment area) of 3.17 $km^2$ consists of 0.54 $km^2$ is open pit (Phase 1 open pit area) and the remainder natural ground cover. A constant seepage inflow of 3,000 $m^3$/day has been assumed as groundwater inflow into the open pit (ultimately pumped to TMA Cell 2).

## 7.0 INITIAL CONDITIONS

TMA Cell 2 is assumed to be empty April 1, 2018 and to begin impounding water immediately. The WMP is expected to have approximately 2.0 $Mm^3$ of water on April 1, 2018 based on the pre-winter inventory calculation from the TMA Cell 1 water balance (Amec Foster Wheeler, 2016b). The pre-winter inventory was the minimum amount of water required to run the mill through the winter of 2017/2018. TMA Cell 3 is assumed to be empty June 1, 2018 and to begin impounding runoff immediately.

## 8.0 PUMPING FROM PINEWOOD RIVER

Depending on the volume stored in the WMP on April 1, 2018, it may be advisable to pump water from the Pinewood River to the WMP to build inventory for processing needs to offset a possible shortfall in the event of dry conditions later in the year. This water balance assessment indicates that pumping from the Pinewood River is recommended if the total water volume in the WMP and TMA Cell 2 is below 4 $Mm^3$. The pumped volume was estimated based on the following rules which reflect PTTW water taking restrictions and the Pinewood River pumphouse capacity (Amec Foster Wheeler, 2016a):

- Water taking from the Pinewood River is restricted to not more than 20% of the river flow from the period of March 1 through July 31, and to not more than 15% of the river flow for the period from August 1 through November 30, as measured at the Pinewood River pumphouse location;

- Pinewood River water takings must take into consideration watershed capture at the Mine site (i.e., water captured at the Mine site is to be considered as part of the 20%/15% Pinewood River water taking);

- Additional to the 20%/15% water taking restrictions, direct water taking from the Pinewood River is not to reduce downstream flows in the river to a value of <10,000 $m^3$/d during the spring period, or to less than 5,000 $m^3$/d during the summer/fall period;

- No water is to be directly taken from the Pinewood River during the winter period (December 1 to February 28); and

- The Pinewood River pumphouse capacity is restricted (by the equipment) to approximately 25,000 $m^3$/d.

The simulated pumped flows from the Pinewood River are provided in Table 3.

**Table 3: Available Water Takings from Pinewood River to WMP**

| Month | Average Year (1984) | Wet Year (1992) | Dry Year (1987) |
|---|---|---|---|
| | $m^3$/month | $m^3$/month | $m^3$/month |
| Apr-2018 | 750,000 | 750,000 | 107,932 |
| May-2018 | 0 | 0 | 317,708 |
| Jun-2018 | 0 | 0 | 190,393 |
| Jul-2018 | 0 | 0 | - |
| Aug-2018 | 0 | 0 | - |
| Sep-2018 | 0 | 0 | 17,683 |
| Oct-2018 | 483,386 | 0 | 15,652 |
| Total | 1,233,386 | 750,000 | 633,716 |

Notes:

- Volume of water pumped from the Pinewood River may vary depending on wet or dry conditions for precipitation
- Pumping from Pinewood River only occurs if volume in TMA Cell 2 and WMP is less than 4.0 $Mm^3$

## 9.0 MILL RECLAIM

During the initial months of TMA Cell 2 tailings deposition starting on April 1, 2018, mill reclaim will be taken from the WMP (similar to during TMA Cell 1 deposition, where all reclaim was taken from the WMP). Reclaiming from the WMP will continue until the WMP volume is reduced to below 1.0 $Mm^3$ in order to help build an initial pond inventory in TMA Cell 2, and will also help extract tailings-contact water from WMP to the extent possible. After the WMP volume is reduced to below 1.0 $Mm^3$, mill reclaim will be shifted to TMA Cell 2 to limit the TMA Cell 2 tailings pond volume as tailings deposition continues to reduce available storage.

## 10.0 WATER TREATMENT

During the initial stages of tailings deposition in TMA Cell 2 there will be no discharge from the WMP since water quality is not anticipated to be acceptable for release to the environment (note that during tailings deposition in TMA Cell 1, all reclaim was taken from the WMP for this reason). Once reclaim is shifted to TMA Cell 2, the WMP should have a relatively small volume; however water quality will still not be suitable for discharge to the environment, and water treatment will be necessary prior to discharge (either through bleed flow to the wetland, or through the effluent pipeline to the Pinewood River).

The proposed Water Treatment Plant (WTP) will be located within the WMP and will provide treatment as water is transferred from TMA Cell 2 to the WMP (for ultimate discharge to the environment). The proposed WTP is designed to operate at 40,000 $m^3$/day for 6 months of the year (AMEC, 2014). The timing on the need for water treatment will vary depending on the climactic conditions of 2018, however it is expected to be required by November 1, 2018 if precipitation is above average. As a contingency to deal with the possibility of significant wet conditions, it is recommended that the WTP be operational by September 1, 2018. This accounts for the use of storage in TMA Cell 3 which will delay the need for the treatment plant from the early summer of 2018 to the fall of 2018. The treatment plant is needed due to TMA Cell 2 having a relatively limited storage volume combined with its large catchment area (almost as large as the ultimate TMA). Once the treatment plant is operational, the water management strategy for the TMA would be similar to the original design (TMA transfer to WMP in the summer, and WMP discharge to the environment in the spring and fall).

## 11.0 EFFLUENT DISCHARGE

Following the commissioning of the WTP, water in the WMP will be suitable for discharge to the environment, provided that no discharge occur until the WMP fills to a volume of approximately 5.0 $Mm^3$ to provide sufficient dilution of its remaining 1$Mm^3$ of tailings contact water with treated water. During a wet year it would be necessary to pump water from the WMP to the Pinewood River in the spring of 2019 (following the duration of this simulation). The timing of the commissioning of the WTP in the fall of 2018 is critical to ensuring that the water in the WMP is of sufficient quality for discharge to the Pinewood River.

## 12.0 RESULTS

The following results of the water balance evaluation are based on TMA Cell 3 being available for water storage by June 1, 2018, and the WTP being available by September 1, 2018. In this evaluation, all pumped withdrawals from TMA Cell 2 (whether to the WMP, to the WTP, or to TMA Cell 3) are assumed to be at a rate of 40,000 $m^3$/day. The timing of these withdrawals should be determined based on the storage available in TMA Cell 2, TMA Cell 3 and the WMP (further details are provided in Section 14 below).

Table 4 provides a summary of the cumulative water inputs to the TMA during TMA Cell 2 operation. This is the net inflow (i.e. inflow minus outflow) on a cumulative basis, representing the total water in the system that requires storage (or discharge).

**Table 4: Cumulative Net Water Inputs to TMA during TMA Cell 2 Operation**

| End of Month | Cumulative Inputs - Average Year | Cumulative Inputs - 1:20 Wet | Cumulative Inputs - 1:20 Dry |
|---|---|---|---|
| April 2018 | 2,000,000 | 2,000,000 | 2,000,000 |
| May 2018 | 4,737,729 | 5,535,560 | 3,220,060 |
| June 2018 | 5,374,749 | 6,595,891 | 3,710,215 |

| End of Month | Cumulative Inputs - Average Year | Cumulative Inputs - 1:20 Wet | Cumulative Inputs - 1:20 Dry |
|---|---|---|---|
| July 2018 | 6,086,384 | 7,787,172 | 4,085,840 |
| August 2018 | 6,078,090 | 8,017,892 | 3,866,379 |
| September 2018 | 5,650,139 | 7,589,852 | 3,490,708 |
| October 2018 | 5,484,569 | 7,506,546 | 3,283,697 |
| November 2018 | 6,109,474 | 7,788,731 | 3,286,492 |
| December 2018 | 6,380,357 | 8,214,318 | 3,387,591 |
| January 2019 | 6,319,059 | 8,185,064 | 3,291,125 |
| February 2019 | 6,220,785 | 8,104,984 | 3,172,884 |
| March 2019 | 6,117,479 | 8,012,662 | 3,057,522 |
| April 2019 | 6,847,735 | 8,973,362 | 3,301,749 |
| | Cumulative net water inputs to the TMA consist of inputs minus outputs.<br>Inputs consist of runoff (TMA Cell 1, TMA Cell 2, TMA Cell 3, MRP, open pit), open pit groundwater, and water in tailings slurry<br>Outputs consist of pond evaporation (TMA Cell 1, TMA Cell 2, TMA Cell 3, MRP), reclaim to mill, and tailings pore water losses | | |

Figure 4 is a summary chart which shows the cumulative net inflow as shown in Table 4 versus total available storage in TMA Cell 2, TMA Cell 3 and the WMP. Note that the total storage available is below the MOWL providing an allowance for storage of the EDF event. The total storage in the WMP will be reduced from around 5.0 $Mm^3$ to 1.0 $Mm^3$ in the fall of 2018 to ensure acceptable water quality in the WMP once treated effluent is available for 4:1 dilution of tailings contact water. Figure 4 indicates that the cumulative net inflow volume can be managed below the MOWL by sharing the storage volume available in TMA Cell 2, TMA Cell 3 and the WMP, provided that treatment is available September 1, 2018. Under the average and 1:20 wet year scenario, water will need to be stored in TMA Cell 3 prior to the WTP coming online in September 2018. The timing of TMA Cell 3 storage becoming available and the WTP are critical items. Sufficient pumping infrastructure between TMA Cell 2, TMA Cell 3 and the WMP will be required to ensure the storage volumes can be fully utilized (especially in the 1:20 wet scenario).

## 13.0 CONCLUSIONS

The results of the analysis indicate that TMA Cell 2 and the WMP can be operated under a variety of climatic conditions. The analysis assumes an initial inventory of 2.0 $Mm^3$ of storage in the WMP, however should there be more water in the WMP on April 1, 2018 the WTP may be required earlier than September 2018. In such a case of a higher initial inventory in the WMP, no water from the Pinewood River should be taken in the spring of 2018. TMA Cell 3 must become available for water storage over the period of June 1 - September 1, 2018 prior to the commissioning of the WTP in September 2018.

## 14.0 RECOMMENDATIONS FOR TMA CELL 2 OPERATION

During the operating life of TMA Cell 2, reclaim water will be sourced from the WMP and TMA Cell 2. The Water Treatment Plant should be available in September 2018 to limit the volume of water in TMA Cell 2 in the event of above average precipitation conditions in 2018. Without the WTP, the ongoing tailings deposition would reduce the available water storage such that the Environmental Design Flood event may not be contained. Discharge from the WMP to the Pinewood River is not expected to be required until the spring of 2019.

The following water management strategy has been developed to maintain the pond volume in TMA Cell 2 below its maximum operating level by maximizing the use of available storage in other areas:

1. In the early months of TMA Cell 2 operations (up to July) excess water collected in TMA Cell 2 should be transferred to the WMP (Continuing this transfer longer is not suggested as this could increase the WMP volume close to its maximum operating level in the event of wet conditions).

2. Starting in July or August as required, excess water collected in TMA Cell 2 should be transferred to TMA Cell 3. For average conditions, this transfer would continue until about October, after which reclaim will control the TMA Cell 2 volume. For wet conditions, the transfer to TMA Cell 3 can continue until the available storage in TMA Cell 3 has been filled, expected around September.

3. Starting as early as September 2018 (in the event of wet conditions) or later (March for average conditions) excess water collected in TMA Cell 2 should be pumped to the WTP for water treatment, and the treated effluent transferred to the WMP for discharge once the water quality is acceptable (total WMP volume is above 5.0 $Mm^3$).

To implement this strategy, the following operating guidelines are suggested for TMA Cell 2 and the WMP during the operating life of TMA Cell 2:

- Water for mill reclaim should be taken from the WMP until the WMP volume is reduced to below 1.0 $Mm^3$, then shifted to TMA Cell 2. Sufficient pumping infrastructure should be installed to allow mill reclaim from either WMP or TMA Cell 2 for the duration of TMA Cell 2 operation.

- Pumping from the Pinewood River to the WMP should occur if the total combined storage in TMA Cell 2 and the WMP is less than 4 $Mm^3$, so ensure there is sufficient water for mill processing for the winter of 2018/2019.

- All pumped discharges from TMA Cell 2 (to the WMP, to the WTP, and to TMA Cell 3) to reduce the water level in TMA Cell 2 should be regulated and planned to start once the TMA Cell 2 pond volume increases to within approximately 800,000 $m^3$ of the MOWL. The discharges should continue until TMA Cell 2 pond volume is lowered by about 400,000 $m^3$ (1,200,000 $m^3$ below the MOWL).

- Pumping infrastructure should be installed to allow for pumping at a rate of approximately 40,000 $m^3$/day between TMA Cell 2, 3 and the WMP even at low water levels. This will allow full utilization of the available storage volumes in TMA Cells 2, 3 and the WMP. In a wet year scenario it may also be necessary to pump directly from the WMP to TMA Cell 3, to reduce WMP volumes to below 1.0 $Mm^3$, prior to the implementation of the WTP.

- Effluent discharge of treated water from the WMP to the Pinewood River or treatment wetlands should only occur if the total storage in the WMP is above 5.0 $Mm^3$ (not anticipated during the life of TMA Cell 2). This effluent discharge strategy only applies to the first batch of discharge, as the 1.0 $Mm^3$ of residual contact water in the WMP requires dilution prior to discharge.

## 15.0 LIMITATIONS OF RESULTS

The applicability of the results of this assessment depend on the following conditions and assumptions:

- TMA Cell 2 will start impounding water on April 1, 2018;
- TMA Cell 3 will start impounding water on June 1, 2108, will be able to receive pumped inflows from TMA Cell 2 on July 1, 2108, and will reach its full storage capacity on September 1, 2018.
- Drainage areas collected and sent to TMA Cell 2 will be as described in this memo;
- The WMP will have 2.0 $Mm^3$ of water on April 1, 2018;
- Mill production will be at 100% for the 12-month life of TMA Cell 2; and
- Tailings properties in terms of the water storage volume available above tailings, and pore water losses, will be as described.

## 16.0 CLOSING REMARKS

This memorandum was prepared by Norman Schwartz, P.Eng., and reviewed by Mark Sullivan, P.Eng. Please do not hesitate to contact either individual should you have any questions regarding the information contained in this memorandum.

## 17.0 REFERENCES

AMEC, 2014. Rainy River Project – Feasibility Level Treatment Plant Design. 3098004-000000-A1-ETR-0003 Rev. 00. January, 2014.

AMEC, 2014. Rainy River Project – Detailed Design – Tailings Management Design Brief. 3098004-004000-A1-ETR-0006-AB. May 2014.

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Amec Foster Wheeler, 2016a. Memo April 4, 2016 Draft for Discussion. Rainy River Project – Processing Plant Start-up Water Source Options following delayed Operation of the Water Management Pond.

Amec Foster Wheeler, 2016b. Design Brief – Tailings Management Area Start-Up Cell. Rainy River Project. New Gold Inc. August, 2016.

**Figures:**



**Attachment 1:**

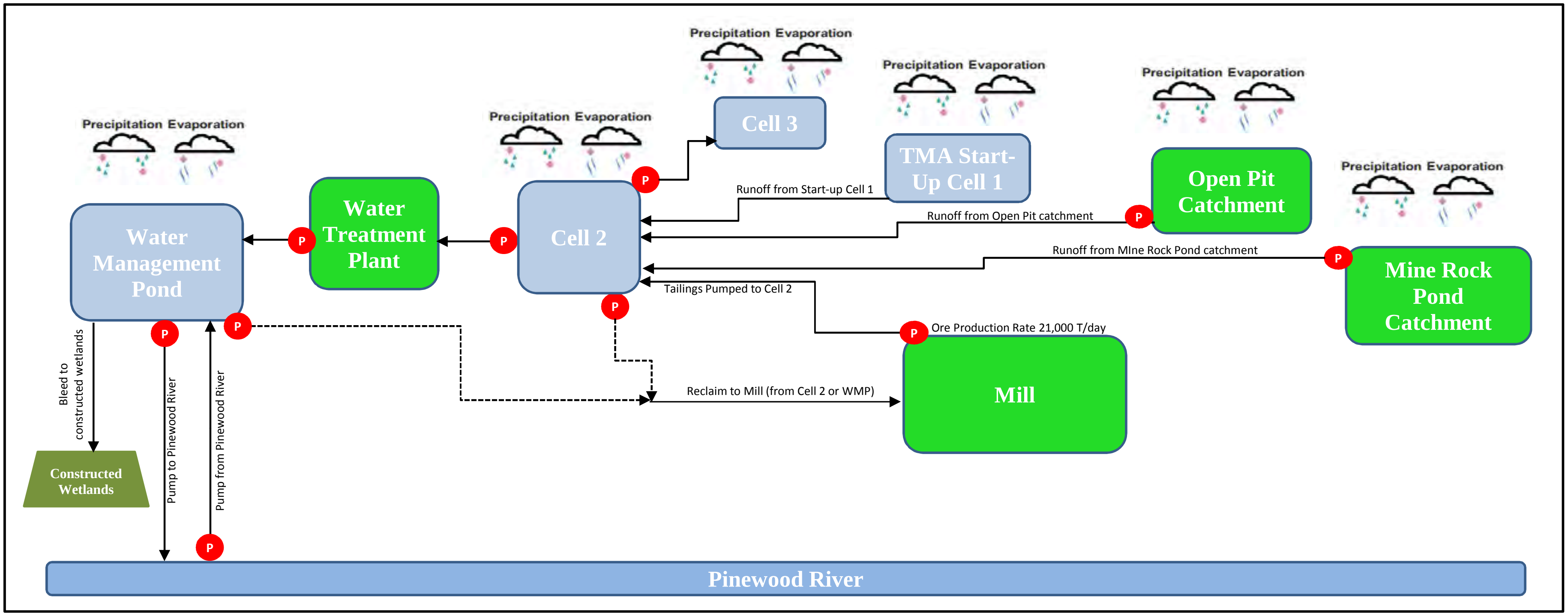



**Figure 1: Water Balance Schematic for TMA Cell 2, Cell 3 and WMP**

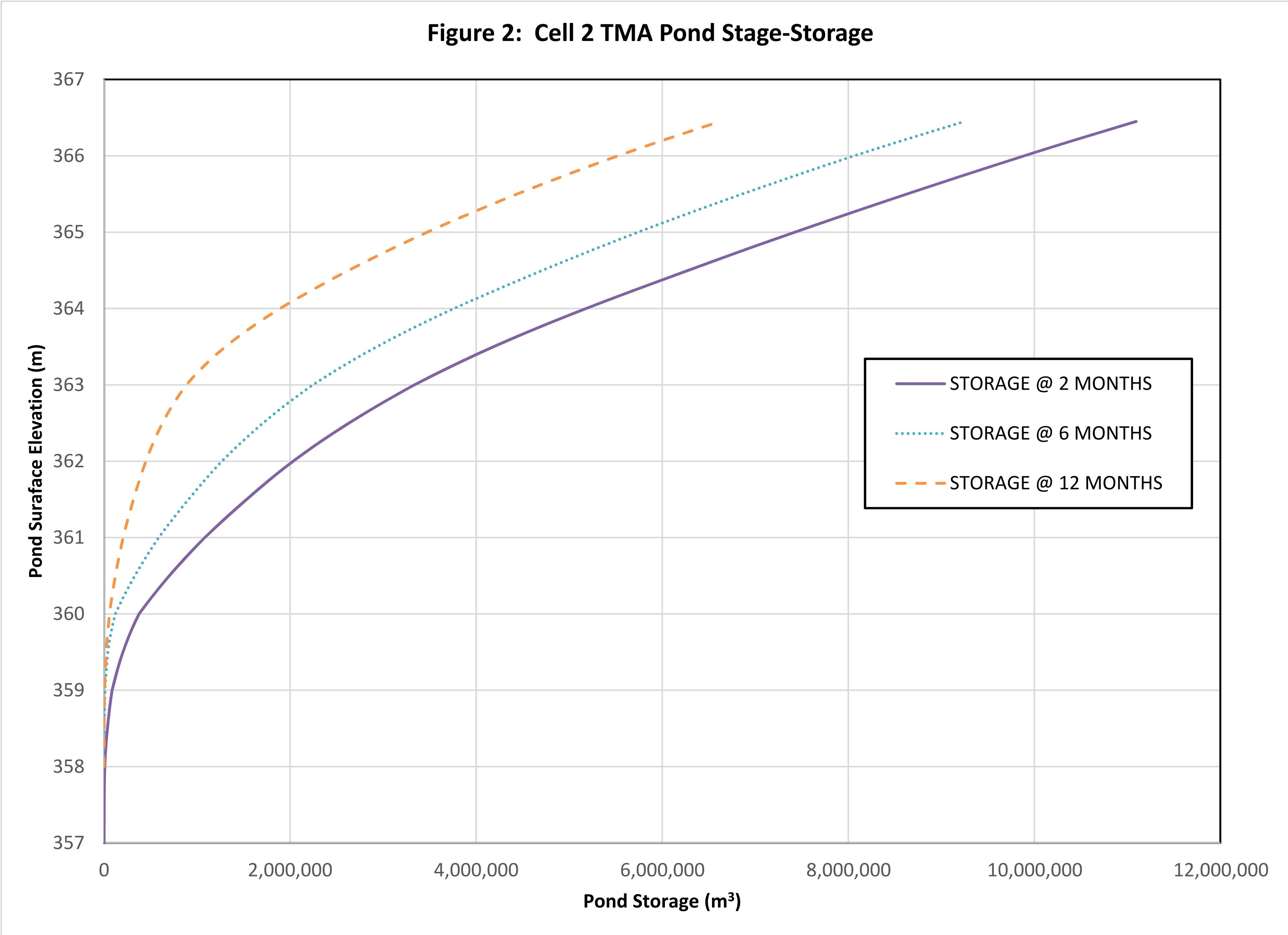


Figure 2: Cell 2 TMA Pond Stage-Storage
367
366
365
364
363
362
361
360
359
358
357
Pond Suraface Elevation (m)
0
2,000,000
4,000,000
6,000,000
8,000,000
10,000,000
12,000,000
Pond Storage (m³)
STORAGE @ 2 MONTHS
STORAGE @ 6 MONTHS
STORAGE @ 12 MONTHS

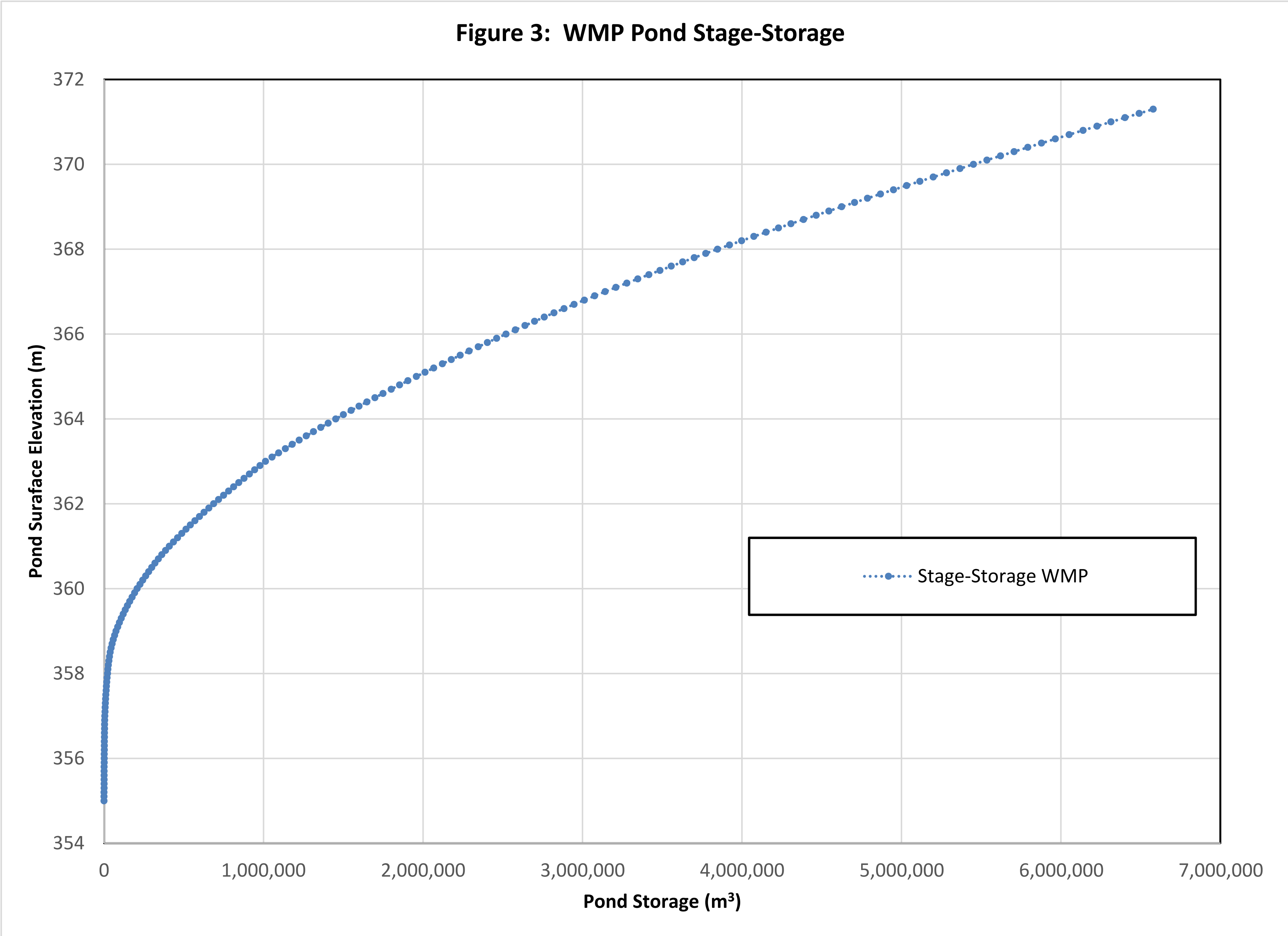
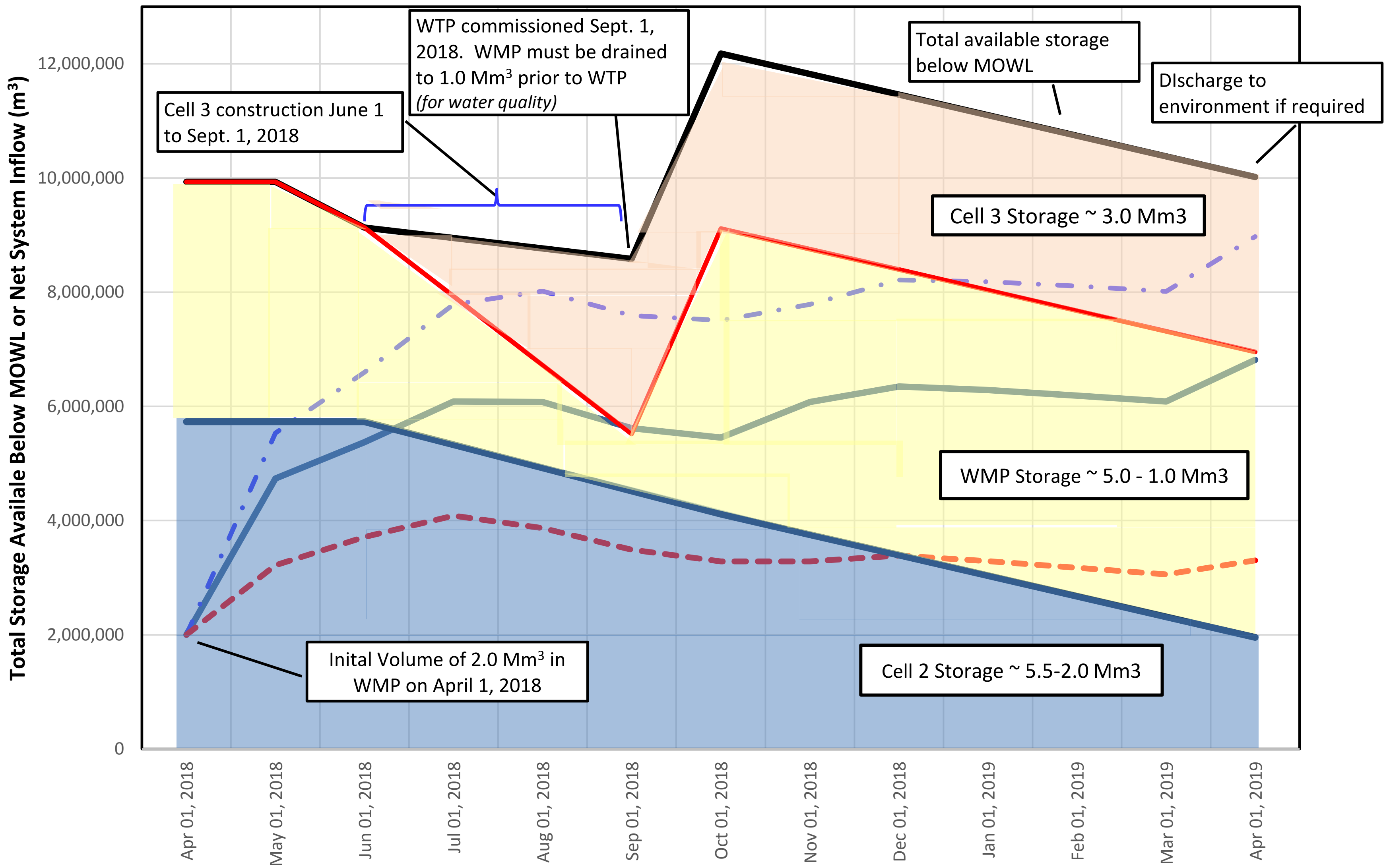


Figure 3: WMP Pond Stage-Storage
372
370
368
366
364
362
360
358
356
354
Pond Surface Elevation (m)
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
7,000,000
Pond Storage (m³)
Stage-Storage WMP

**Figure 4: Total Available Storage versus Net System Inflow for TMA Cell 2, 3 and WMP**




Notes

- WMP initial storage capacity of 5.0 Mm3 for mine contact water should be drawn down to 1.0 Mm3 prior to startup of WTP
- Cell 3 is closed off June 1, 2018 and storage becomes available at constant rate until completion Sept. 1, 2018

**ATTACHMENT 1**

Attachment 1 provides a more detailed discussion of the results of the water balance modelling and the water management schemes which were developed for average, 1:20 wet year, and 1:20 dry year conditions. Detailed graphs of water levels, pond volumes and pumping transfers for TMA Cell 2 and the WMP for average, wet and dry year conditions are provided as Figures 1.1 through 1.12.

- During an average year, it will be required to transfer water from TMA Cell 2 to the WMP in June 2018 to manage the volume increase in TMA Cell 2. In July and August 2018 this transfer should switch to TMA Cell 3 in order to limit the volume increase in the WMP. Reclaim can be taken from the WMP until the end of July, at which point the WMP is expected to be reduced below 1.0 $Mm^3$. At this point reclaim would switch to TMA Cell 2. Although it is assumed that the WTP will be available in September, it is expected that taking reclaim from TMA Cell 2 can control the TMA Cell 2 volume in an average year until spring 2019 when ongoing tailings deposition will reduce the available water storage capacity in TMA Cell 2, and discharge to the WTP will be required. The WMP volume will be reduced further, possibly as low as 0.5 $Mm^3$ due to ice formation, prior to the discharge of treated effluent from the WTP to the WMP. No discharge to the environment is required in the average year.

- During a 1:20 wet year, it will be required to transfer water from TMA Cell 2 to the WMP earlier, starting in May and continuing to June 2018, to manage the volume increase in TMA Cell 2. June should be the latest month to transfer to WMP in order to limit the volume increase in the WMP. July 2018 is when transfer to TMA Cell 3 should start. The latter should continue until September 2018, when TMA Cell 3 would be filled to its capacity. Once the WTP comes on line starting in September 2018, the TMA Cell 2 volume can be controlled by pumping TMA Cell 2 to the WTP. The availability of the WTP (and the supplemental storage in TMA Cell 3), is required for TMA Cell 2 to provide the required storage for the Environmental Design Flood (EDF) below the spillway invert. Reclaim for the 1:20 wet year is always taken from the WMP as the water volume in the WMP would remain above 1.0 $Mm^3$ (minimum volume of approximately 1.3 $Mm^3$ reached in the WMP prior to WTP commissioning, however additional storage is still available in TMA Cell 2 to allow WMP to be pumped down to approximately 1.0 $Mm^3$ storage. Sufficient pumping infrastructure should be available to readily pump between the WMP, TMA Cell 2 and TMA Cell 3 to fully utilize all available storage. At the end of March 2019, the water level in TMA Cell 2 should be below the MOWL, so the EDF event could be fully contained. No discharge to the environment is required in the 1:20 wet year, however discharge in the spring of 2019 (May) would be necessary.

- During a 1:20 dry year the WTP would not be required for the duration of TMA Cell 2 operation, since reclaim will switch from the WMP to TMA Cell 2 after June. This would will keep the water level in TMA Cell 2 significantly below the MOWL until March 2019. At that time the effect of ongoing tailings deposition will reduce the available water storage capacity significantly, however TMA Cell 3 will have sufficient capacity for storage of any excess volume. The results indicate that there is enough water to operate the mill through the winter of 2018/2019 in the 1:20 dry year, however the WMP may freeze solid, as there is less than 0.5 $Mm^3$, prior to the winter. All reclaim during the winter would be taken from

TMA Cell 2. The minimum volume of free water in TMA Cell 2 is approximately 0.5 $Mm^3$ in February of 2018, which is expected to be adequate to operate pumps and limit suspended solids. A transfer to TMA Cell 3 is shown in March 2019 (reducing the TMA Cell 2 volume to 0.25 $Mm^3$), however this water would likely be sent to the WTP for treatment to reduce the TMA Cell 2 volume.

The following Tables 1.1 and 1.2 provide annual summaries of input volumes, output volumes, and volumes of water transferred between the ponds for the three precipitation scenarios.

**Table 1.1: Water Balance Summary for TMA Cell 2**

| | | Average Year | 1:20 Wet Year | 1:20 Dry Year |
|---|---|---|---|---|
| **SYSTEM INPUTS ($m^3$)** | | | | |
| | TMA Runoff | 3,097,557 | 4,257,896 | 1,824,112 |
| | MRP Runoff | 1,596,192 | 2,194,122 | 939,977 |
| | Open Pit Runoff | 885,870 | 1,217,715 | 521,678 |
| | Groundwater pumped from Open Pit | 912,500 | 912,500 | 912,500 |
| | TMA Cell 1 Runoff | 468,684 | 644,252 | 276,002 |
| | TMA Ice Melting | 819,756 | 819,756 | 819,756 |
| | Water in Tailings Slurry | 8,678,284 | 8,678,284 | 8,678,284 |
| **SYSTEM OUTPUTS ($m^3$)** | | | | |
| | TMA Pond Evap | 521,771 | 521,771 | 521,771 |
| | MRP Pond Evap | 355,080 | 355,080 | 355,080 |
| | TMA Cell 1 Pond Evap | 365,840 | 365,840 | 365,840 |
| | Reclaim Pumping from TMA to Mill | 5,726,567 | - | 6,457,117 |
| | TMA Ice Formation (1 m) | 819,756 | 819,756 | 819,756 |
| | Tailings Pore Water Losses | 2,718,085 | 2,718,085 | 2,718,085 |
| | Pump Out TMA Cell 2 (Transfer) to WMP | 900,000 | 1,830,000 | - |
| | Pump Out TMA Cell 2 (Transfer) to WTP | 620,000 | 7,300,000 | - |
| | Pump Out TMA Cell 2 (Transfer) to TMA Cell 3 | 3,095,996 | 3,031,574 | 2,480,000 |
| **STORAGE ($m^3$)** | | | | |
| | Initial TMA Cell 2 | - | - | - |
| | Final TMA Cell 2 | 1,335,747 | 1,782,418 | 254,659 |
| | Increase In Storage | 1,335,747 | 1,782,418 | 254,659 |
| **SUM INPUTS** | | 16,458,843 | 16,458,843 | 18,724,525 |
| **SUM OUTPUTS** | | 16,458,843 | 16,458,843 | 18,724,525 |
| **BALANCE** | | - | - | - |

**Table 1.2: Water Balance Summary for WMP**

| | | Average Year | 1:20 Wet Year | 1:20 Dry Year |
|---|---|---|---|---|
| **SYSTEM INPUTS ($m^3$)** | | | | |
| | WMP Runoff | 644,747 | 886,267 | 379,683 |
| | Treated Effluent from WTP | 620,000 | 7,300,000 | - |
| | Pump In Water Transferred from TMA Cell 2 | 900,000 | 1,830,000 | - |
| | WMP Ice Melting | 850,000 | 850,000 | 850,000 |
| | Pump From Pinewood | 1,452,724 | 953,386 | 706,089 |
| **SYSTEM OUTPUTS ($m^3$)** | | | | |
| | WMP Pond Evap | 457,300 | 457,300 | 457,300 |
| | WMP Ice Formation (1 m) | 850,000 | 850,000 | 850,000 |
| | Reclaim Pumping from WMP to Mill | 2,875,067 | 8,601,634 | 2,144,517 |
| | WMP "bleed" to wetland | - | - | - |
| | WMP Pumped to Pinewood River | - | - | - |
| **STORAGE ($m^3$)** | | | | |
| | Initial WMP | 2,000,000 | 2,000,000 | 2,000,000 |
| | Final WMP | 2,285,104 | 3,910,720 | 895,419 |
| | Increase In Storage | 285,104 | 1,910,720 | -1,104,581 |
| **SUM INPUTS** | | 6,627,470 | 4,467,470 | 11,819,654 |
| **SUM OUTPUTS** | | 6,627,470 | 4,467,470 | 11,819,654 |
| **BALANCE** | | - | - | - |

**Figures 1.1 to 1.12**

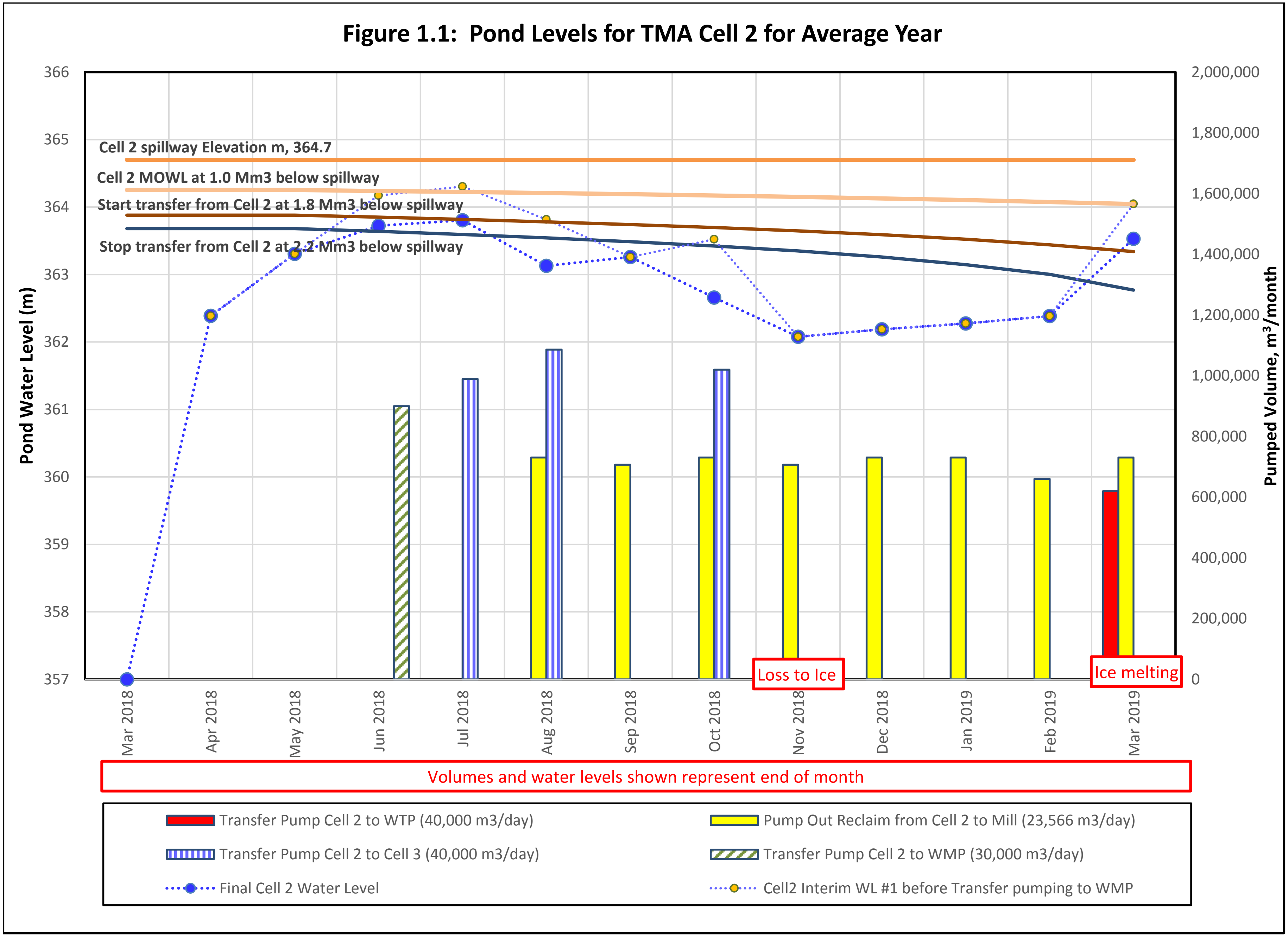
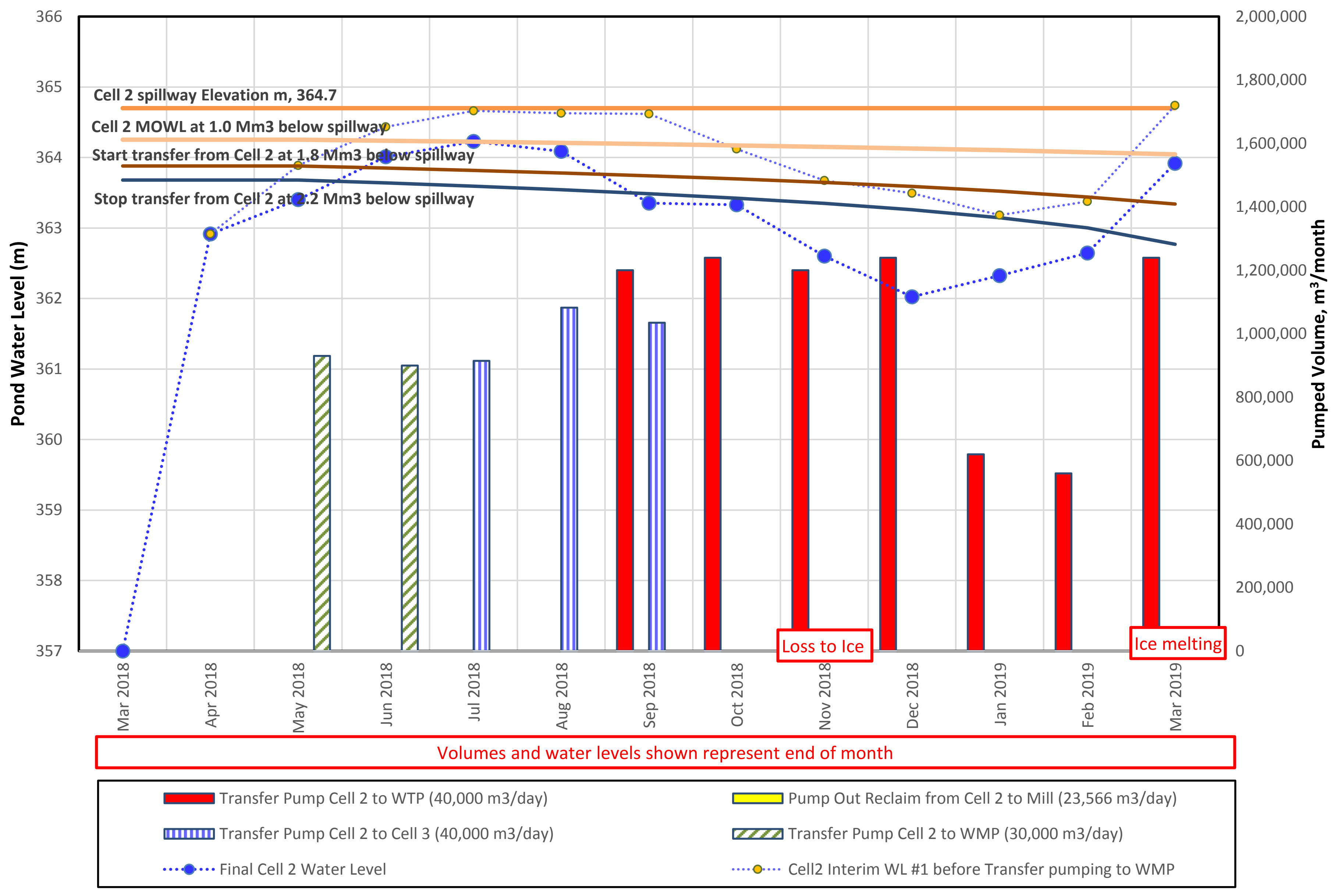


Figure 1.1: Pond Levels for TMA Cell 2 for Average Year
Pond Water Level (m)
Pumped Volume, m³/month
366
365
364
363
362
361
360
359
358
357
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Cell 2 spillway Elevation m, 364.7
Cell 2 MOWL at 1.0 Mm3 below spillway
Start transfer from Cell 2 at 1.8 Mm3 below spillway
Stop transfer from Cell 2 at 2.2 Mm3 below spillway
Loss to Ice
Ice melting
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from Cell 2 to Mill (23,566 m3/day)
Transfer Pump Cell 2 to Cell 3 (40,000 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Final Cell 2 Water Level
Cell2 Interim WL #1 before Transfer pumping to WMP

# Figure 1.2: Pond Levels for TMA Cell 2 for 1:20 Wet Year



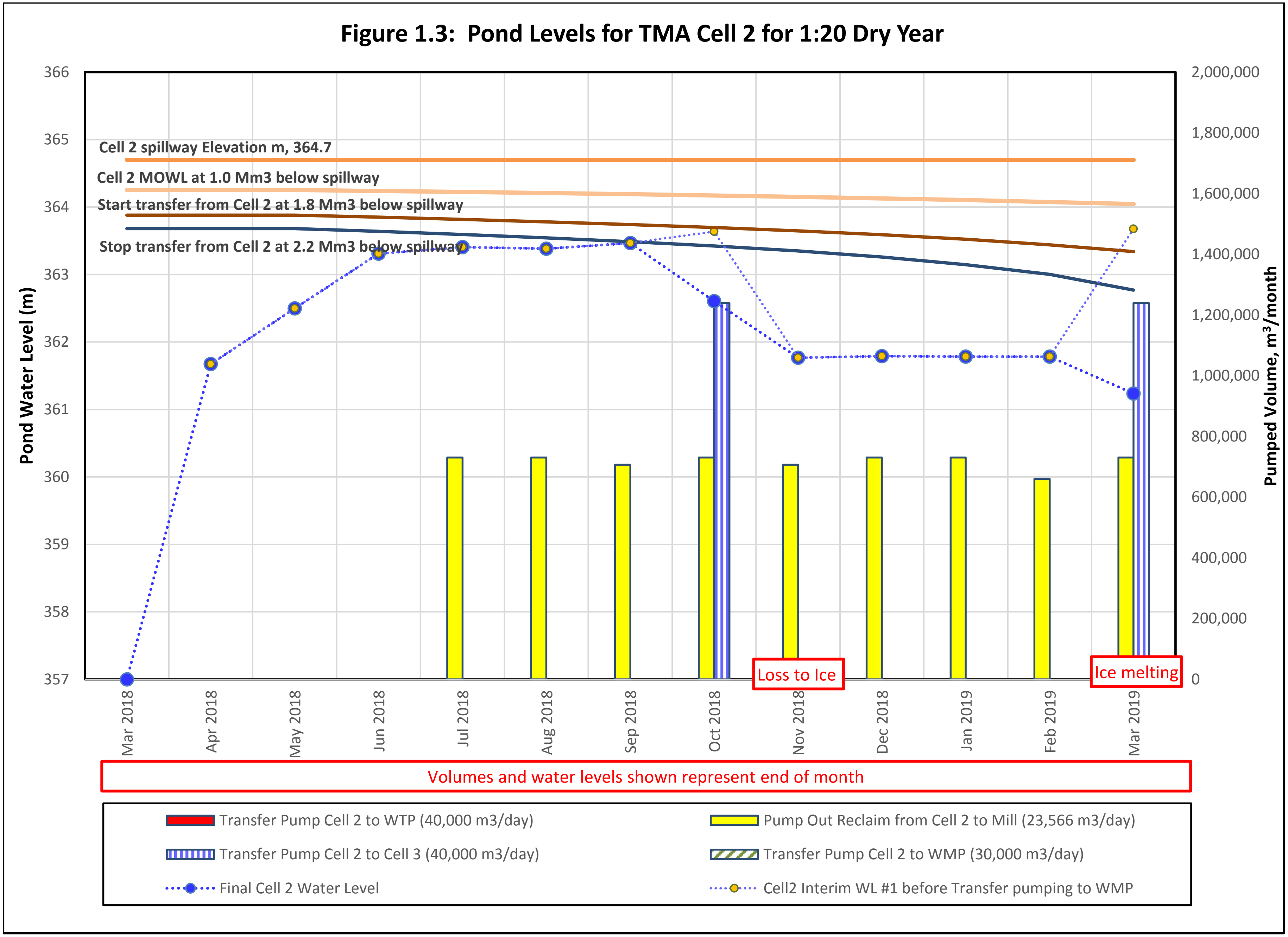
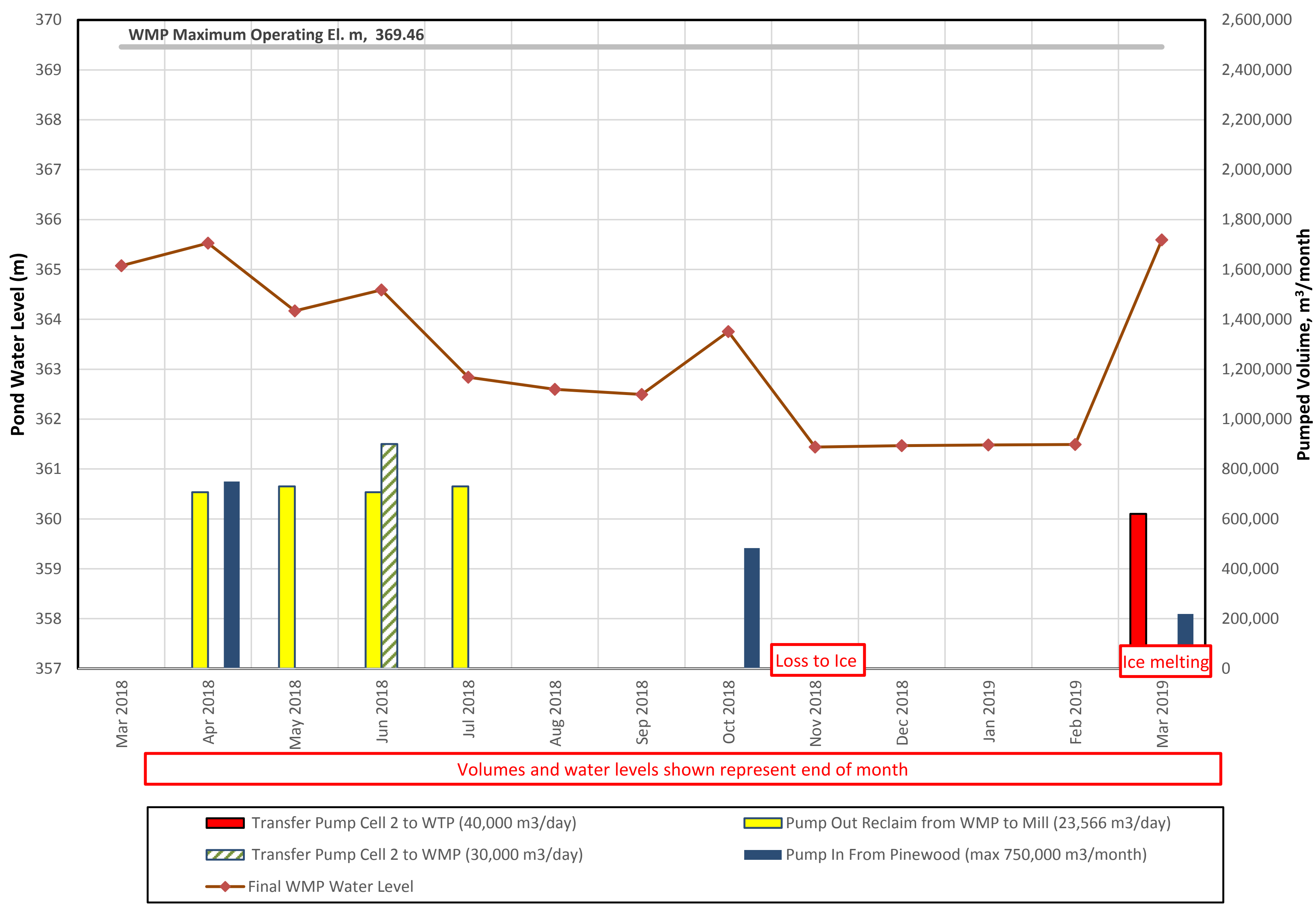


Figure 1.3: Pond Levels for TMA Cell 2 for 1:20 Dry Year
Pond Water Level (m)
Pumped Volume, m³/month
366
365
364
363
362
361
360
359
358
357
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Cell 2 spillway Elevation m, 364.7
Cell 2 MOWL at 1.0 Mm3 below spillway
Start transfer from Cell 2 at 1.8 Mm3 below spillway
Stop transfer from Cell 2 at 2.2 Mm3 below spillway
Loss to Ice
Ice melting
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from Cell 2 to Mill (23,566 m3/day)
Transfer Pump Cell 2 to Cell 3 (40,000 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Final Cell 2 Water Level
Cell2 Interim WL #1 before Transfer pumping to WMP

# Figure 1.4: Pond Levels for WMP for Average Year



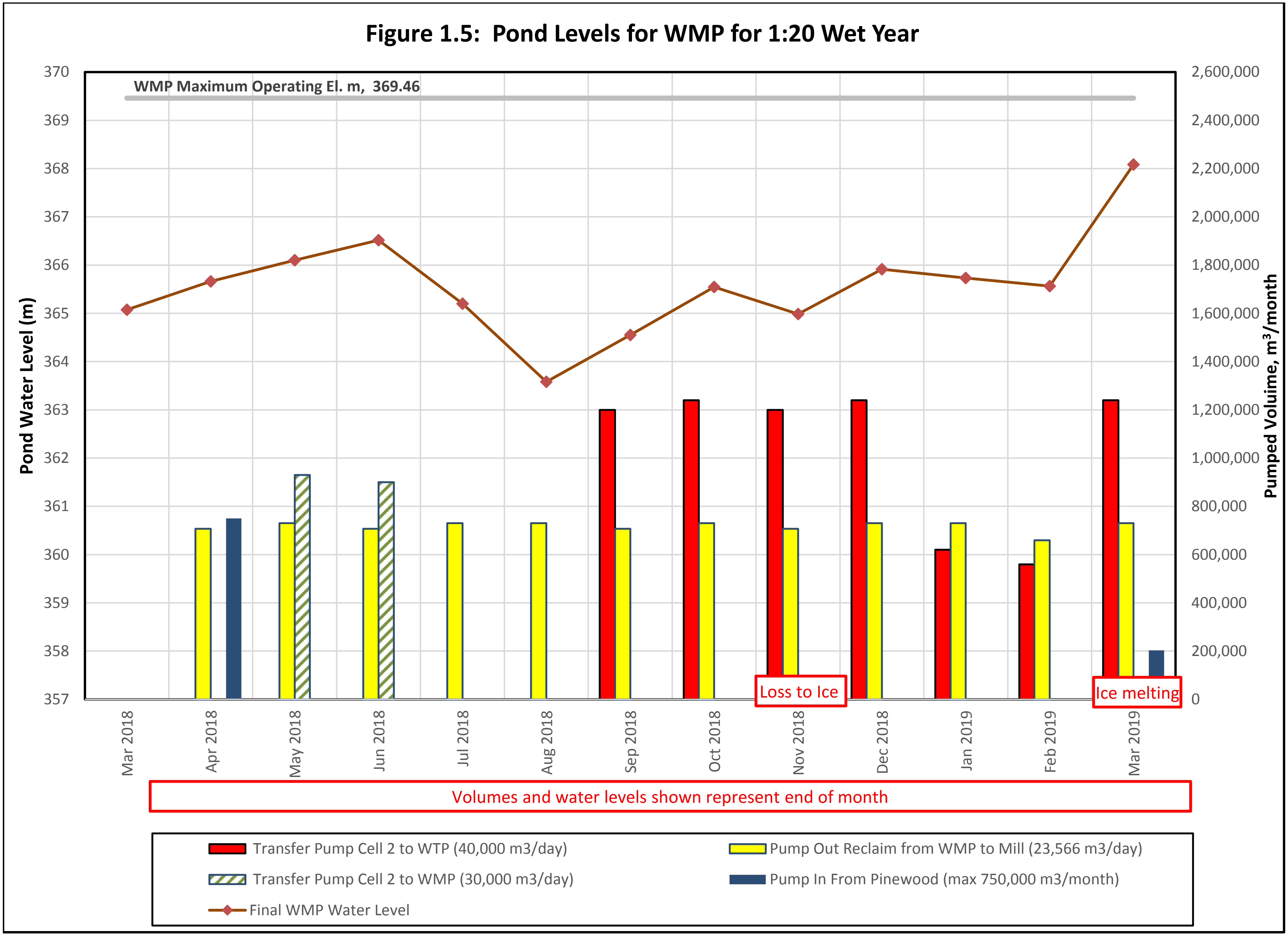


Figure 1.5: Pond Levels for WMP for 1:20 Wet Year
WMP Maximum Operating El. m, 369.46
Pond Water Level (m)
Pumped Voliume, m³/month
370
369
368
367
366
365
364
363
362
361
360
359
358
357
2,600,000
2,400,000
2,200,000
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Loss to Ice
Ice melting
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from WMP to Mill (23,566 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Pump In From Pinewood (max 750,000 m3/month)
Final WMP Water Level

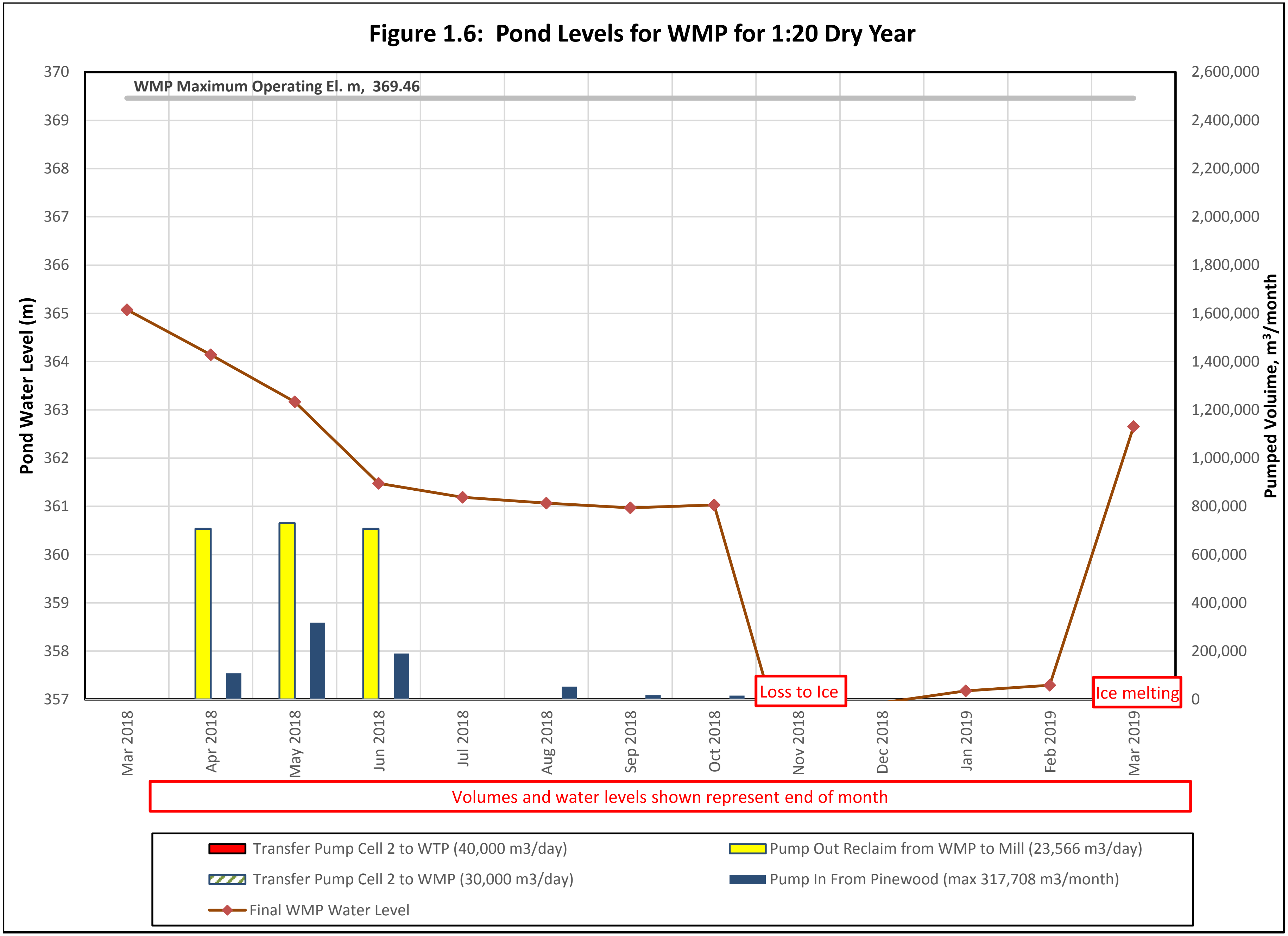


Figure 1.6: Pond Levels for WMP for 1:20 Dry Year
WMP Maximum Operating El. m, 369.46
Pond Water Level (m)
Pumped Voluime, m3/month
370
369
368
367
366
365
364
363
362
361
360
359
358
357
2,600,000
2,400,000
2,200,000
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Loss to Ice
Ice melting
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Final WMP Water Level
Pump Out Reclaim from WMP to Mill (23,566 m3/day)
Pump In From Pinewood (max 317,708 m3/month)

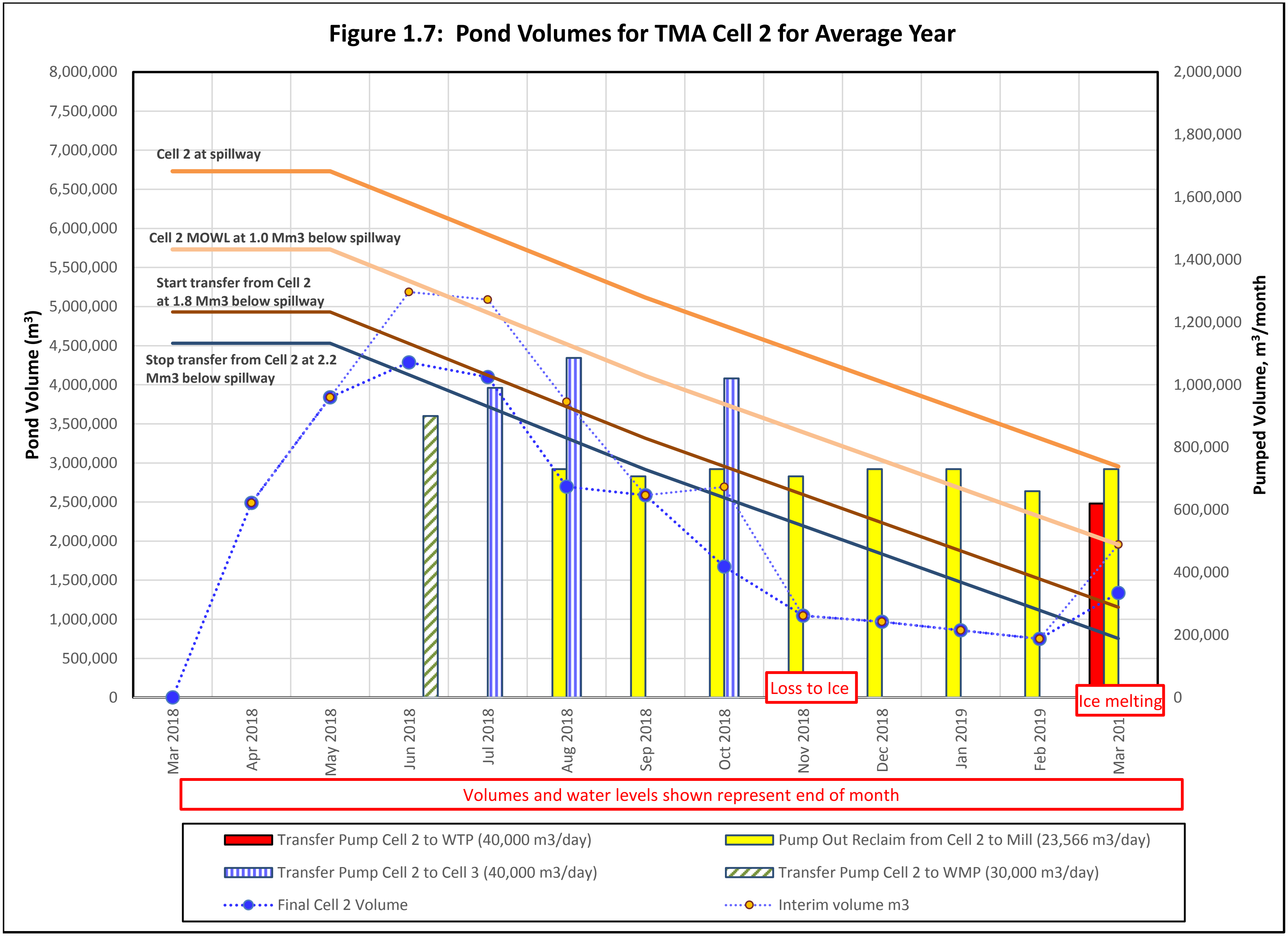


Figure 1.7: Pond Volumes for TMA Cell 2 for Average Year
Pond Volume (m³)
Pumped Volume, m³/month
Cell 2 at spillway
Cell 2 MOWL at 1.0 Mm3 below spillway
Start transfer from Cell 2 at 1.8 Mm3 below spillway
Stop transfer from Cell 2 at 2.2 Mm3 below spillway
Loss to Ice
Ice melting
8,000,000
7,500,000
7,000,000
6,500,000
6,000,000
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 201
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from Cell 2 to Mill (23,566 m3/day)
Transfer Pump Cell 2 to Cell 3 (40,000 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Final Cell 2 Volume
Interim volume m3

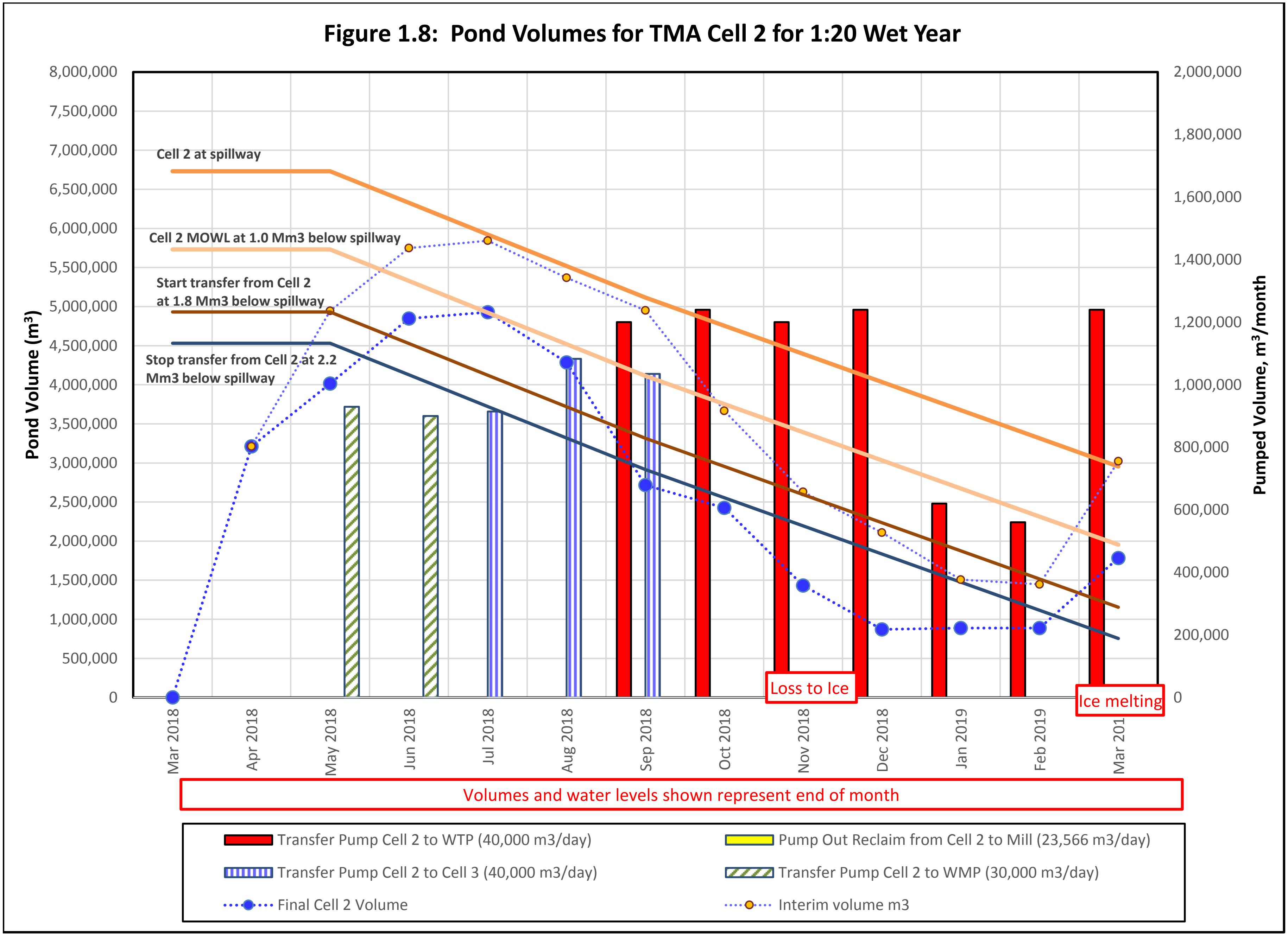


Figure 1.8: Pond Volumes for TMA Cell 2 for 1:20 Wet Year
Pond Volume (m³)
Pumped Volume, m³/month
8,000,000
7,500,000
7,000,000
6,500,000
6,000,000
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Cell 2 at spillway
Cell 2 MOWL at 1.0 Mm3 below spillway
Start transfer from Cell 2 at 1.8 Mm3 below spillway
Stop transfer from Cell 2 at 2.2 Mm3 below spillway
Loss to Ice
Ice melting
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 201
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from Cell 2 to Mill (23,566 m3/day)
Transfer Pump Cell 2 to Cell 3 (40,000 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Final Cell 2 Volume
Interim volume m3

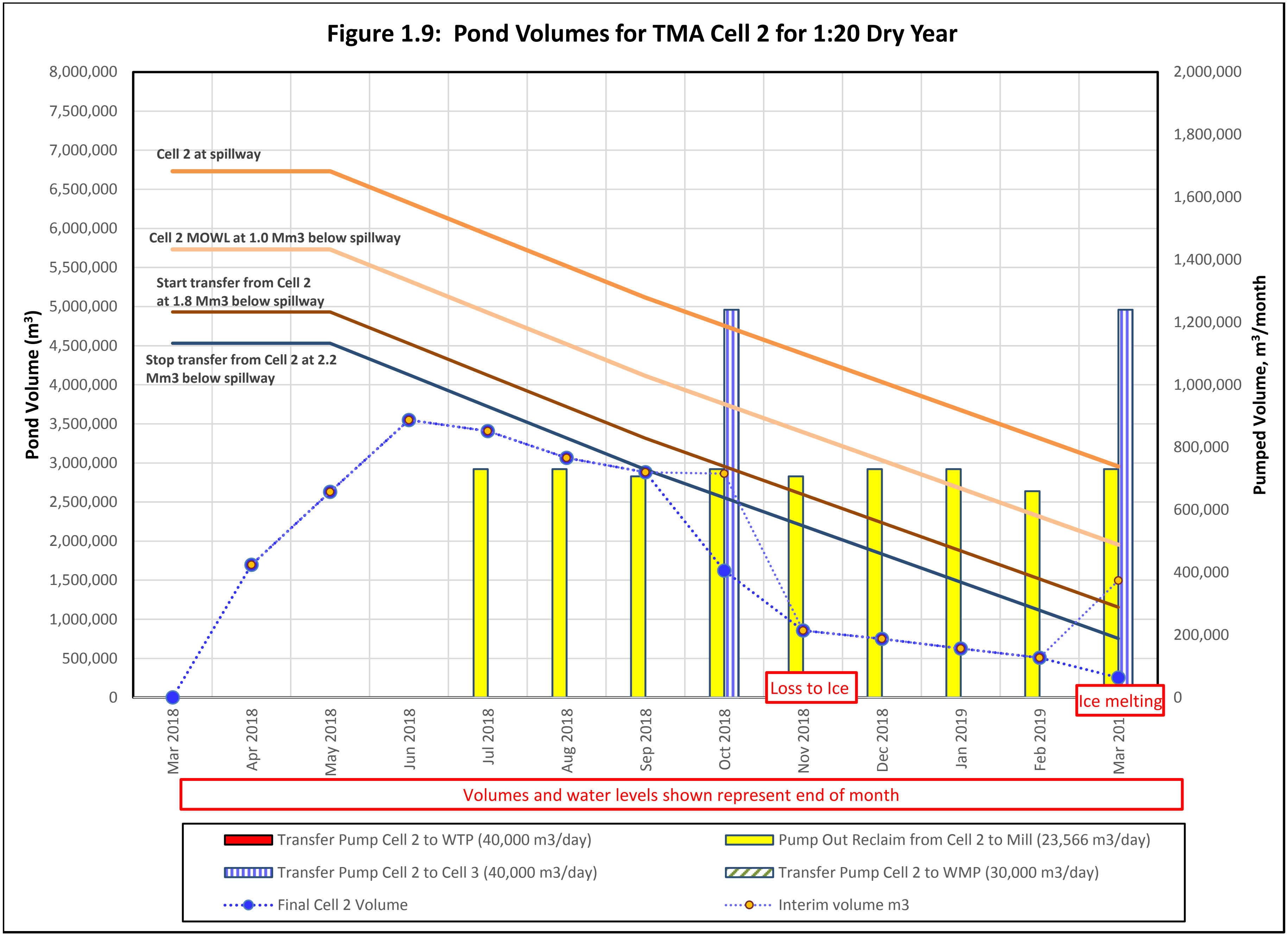


Figure 1.9: Pond Volumes for TMA Cell 2 for 1:20 Dry Year
Pond Volume (m³)
Pumped Volume, m³/month
8,000,000
7,500,000
7,000,000
6,500,000
6,000,000
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Cell 2 at spillway
Cell 2 MOWL at 1.0 Mm3 below spillway
Start transfer from Cell 2 at 1.8 Mm3 below spillway
Stop transfer from Cell 2 at 2.2 Mm3 below spillway
Loss to Ice
Ice melting
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 201
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from Cell 2 to Mill (23,566 m3/day)
Transfer Pump Cell 2 to Cell 3 (40,000 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Final Cell 2 Volume
Interim volume m3

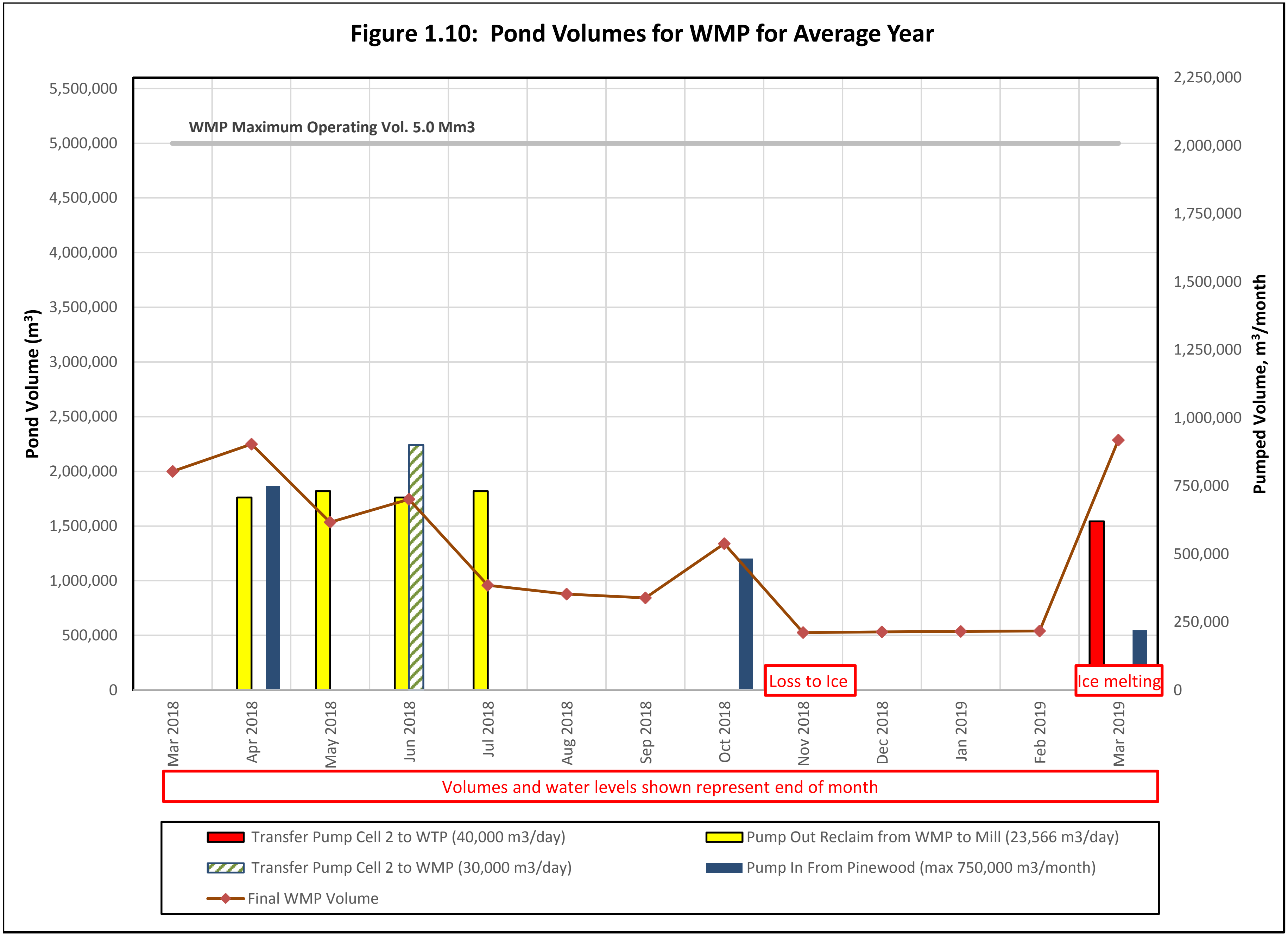


Figure 1.10: Pond Volumes for WMP for Average Year
WMP Maximum Operating Vol. 5.0 Mm3
Pond Volume (m³)
Pumped Volume, m³/month
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Loss to Ice
Ice melting
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from WMP to Mill (23,566 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Pump In From Pinewood (max 750,000 m3/month)
Final WMP Volume

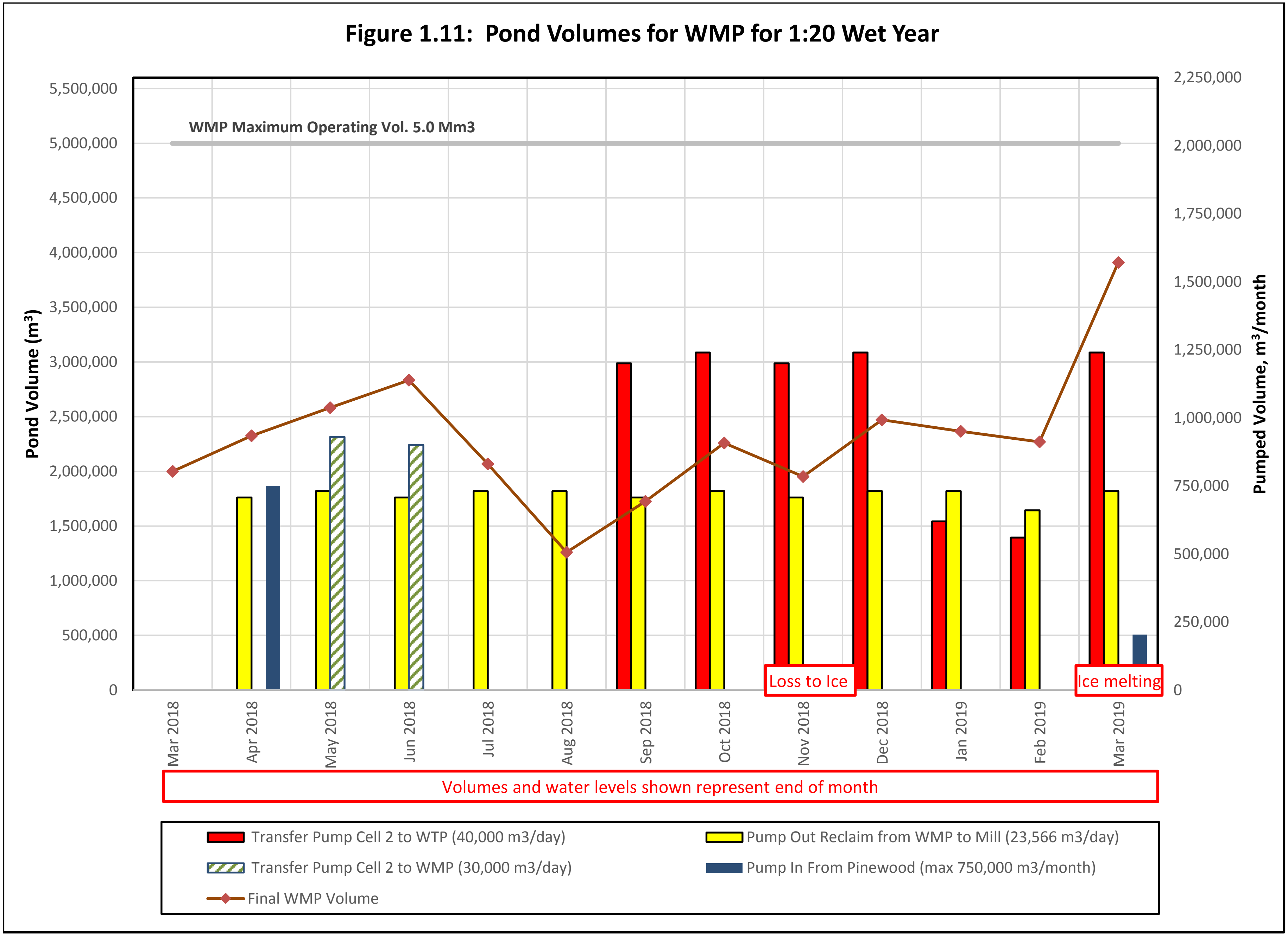


Figure 1.11: Pond Volumes for WMP for 1:20 Wet Year
WMP Maximum Operating Vol. 5.0 Mm3
Pond Volume (m³)
Pumped Volume, m³/month
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Loss to Ice
Ice melting
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from WMP to Mill (23,566 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Pump In From Pinewood (max 750,000 m3/month)
Final WMP Volume

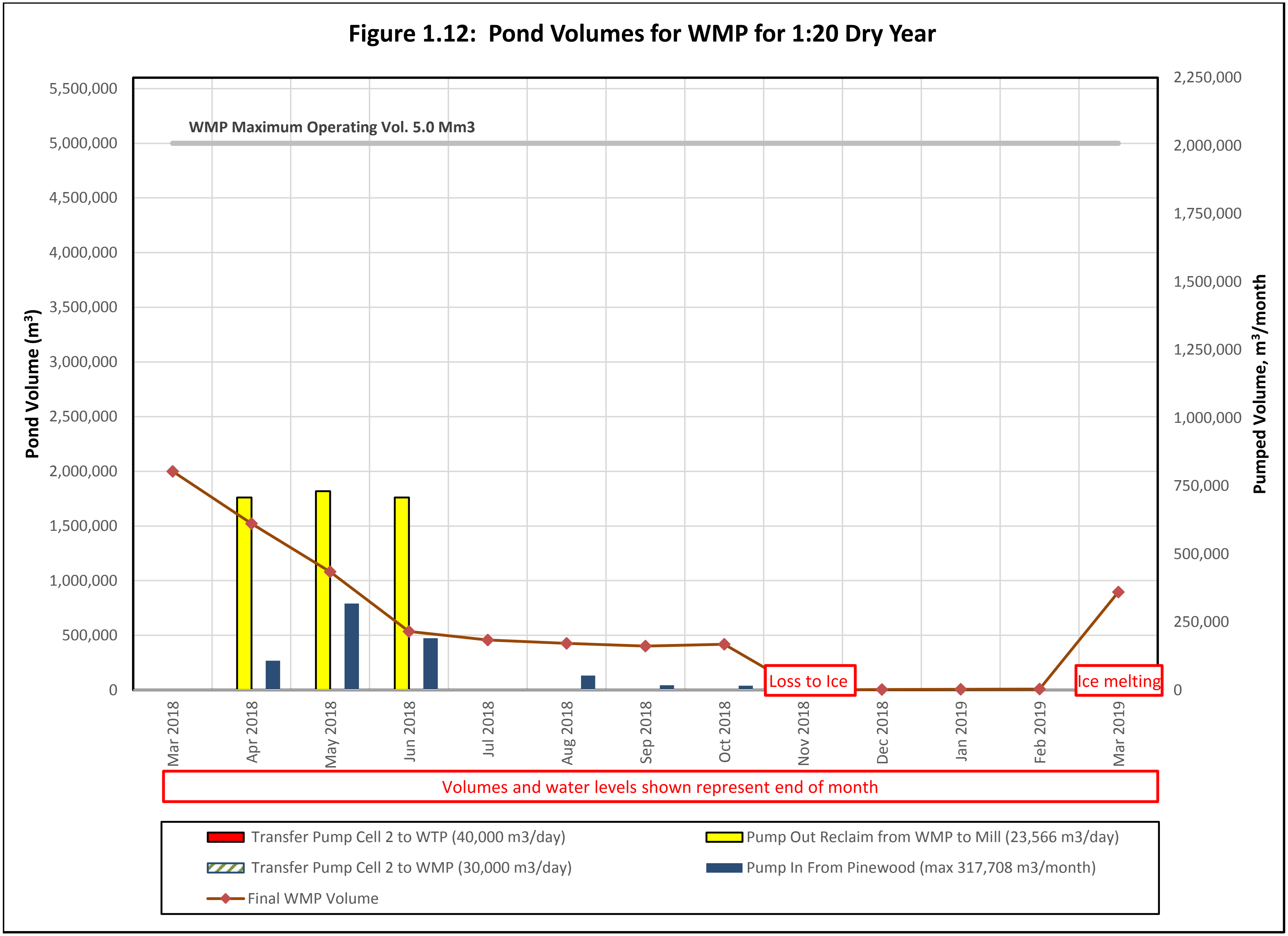


Figure 1.12: Pond Volumes for WMP for 1:20 Dry Year
WMP Maximum Operating Vol. 5.0 Mm3
Pond Volume (m³)
Pumped Volume, m³/month
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
Loss to Ice
Ice melting
Mar 2018
Apr 2018
May 2018
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oct 2018
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Volumes and water levels shown represent end of month
Transfer Pump Cell 2 to WTP (40,000 m3/day)
Pump Out Reclaim from WMP to Mill (23,566 m3/day)
Transfer Pump Cell 2 to WMP (30,000 m3/day)
Pump In From Pinewood (max 317,708 m3/month)
Final WMP Volume

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# APPENDIX F

## INSPECTION SHEETS

Daily Inspection Form (Dam)
Weekly Inspection Sheets (Dam)
Diversion Channel Inspection Form
Inspection Sheets for Unusual Events

newgold™

| Daily Inspection Form (Dam) | | | |
|---|---|---|---|
| Dam: | | | |
| Name: | | | |
| Date and Time: | | | |
| Weather Conditions: | | | |
| Visual Inspection of dams: | | Notes: | |
| Seepage Collection Visual Inspection: | | Notes: | |
| Pipeline Visual Inspection: | | Notes: | |
| General Notes: | | | |

| Weekly Inspection Sheets (Dam) | | | | |
|---|---|---|---|---|
| Dam: | | | | |
| Name: | | | | |
| Date and Time: | | | | |
| Weather Conditions: | | | | |
| Pond Level (m): | | | | |
| Freeboard (m): | | | | |
| Pond Water Characteristics: | Clear: | Turbid: | Snow/Ice Covered: | |
| Pond Inflow Characteristics | Clear: | Turbid: | Comments: | |
| Estimated Inflow: | Minor: | Moderate: | Significant: | |
| Pond Level Rising/Falling: | | | | |
| No. Pumps running | | | | |
| Physical Inspection of dams: | | Notes: | | |
| Water Quality Sample: | Yes: | | No: | |
| Seepage Collection Visual Inspection: | | Notes: | | |
| Pipeline Visual Inspection: | | Notes: | | |
| Exterior Dams: | Weeping/Slumping Y/N and Location | Underdrain Flow Y/N | Sample Collected Y/N | Comments |
| Locations pending construction | | | | |
| Instrumentation: | To be developed further following construction and insulation of instrumentation | | | |
| Number of Photos: | | | | |
| General Notes: | | | | |

| Diversion Channel Inspection Form | | | | | |
|---|---|---|---|---|---|
| Dam: | | | | | |
| Name: | | | | | |
| Date and Time: | | | | | |
| Weather Conditions: | | | | | |
| Estimated flow: | None:: | Minor: | Moderate: | Significant: | |
| Physical Inspection of diversion channel: | | Notes: | | | |
| Number of Photos: | | | | | |
| General Notes: | | | | | |

| Inspection Sheets for Unusual Events | | | | |
|---|---|---|---|---|
| Dam: | | | | |
| Name: | | | | |
| Date and Time: | | | | |
| Unusual Event: | | | | |
| Pond Level (m): | | | | |
| Freeboard (m): | | | | |
| Pond Water Characteristics: | Clear: | Turbid: | Snow/Ice Covered: | |
| Pond Inflow Characteristics | Clear: | Turbid: | Comments: | |
| Estimated Inflow: | Minor: | Moderate: | Significant: | |
| Pond Level Rising/Falling: | | | | |
| No. Pumps running | | | | |
| Physical Inspection of dams: | | Notes: | | |
| Water Quality Sample: | Yes: | | No: | |
| Seepage Collection Visual Inspection: | | Notes: | | |
| Pipeline Visual Inspection: | | Notes: | | |
| Spillway Visual Inspection: | | Notes: | | |
| Exterior Dams: | Weeping/Slumping Y/N and Location | Underdrain Flow Y/N | Sample Collected Y/N | Comments |
| Locations pending construction | | | | |
| Instrumentation: | To be developed further following construction and insulation of instrumentation | | | |
| General Notes: | | | | |

**APPENDIX G**

**MNRF Comments on the Pre-Production OMS Manual and New Gold Responses on revision AG (October 2016)**
**&**
**ITRB Review Comments on Pre-Production Version (July 2017)**

October 6, 2016
TC150321

*Delivered by e-mail*

Mr. Paul Hosford, Project Director
New Gold Inc.
Two Bentall Centre
Suite 1800 – 555 Burrard Street, Vancouver
British Columbia, Canada, V7X 1M9

Dear Mr. Hosford:

**Re: Rainy River Project Development,**
**Operation, Maintenance and Surveillance Manual – Tailings and Water Management Structures**
**3098004-000000-A1-EMA-0001-00**
**Comments and Responses**

Below please find the responses to comments received for the OMS / EPP from the MNRF:

1. *General*

   a. *Appendix C; tailings, heap leach and waste rock. Confirm the term heap leach.*

      **Response:**
      Appendix C is a New Gold's corporate policy document. Even though the policy applies to tailings, heap leach and waste rock facilities, heap leaching does not apply to this project. The text in section 1.6 describes that Heap Leaching is not applicable to the project.

   b. *Table 1-1 and 2-1 are specific to MNRF. NGD should ensure the OMS/EPP is circulated to the appropriate agencies.*

      **Response:**
      New Gold has no objections in sharing the OMS with other agencies and contacts at the MNDM will be added to Table 2-1.

   c. *Page 42 – Contingency. Section is incomplete.*

      **Response:**
      Relevant contingency measures have been added to Section 7.7.

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d. *Operations: Please confirm whether a stand-alone Operating Plan has been developed for the WMP. The operations plan should provide complete, clear and step by step instructions for operation of the pond. The current OMS is currently missing the following information with regard to operations:*

- *Instructions on routine and general operation of the pond, including maximum water levels permitted at each time of year.*

  **Response:**
  This is included in the WMP Fill Plan which is incorporated as an Appendix D in the OMS.

- *Max. and min. storage in the pond (in terms of volume AND elevation).*

  **Response:**
  This is included in the WMP Fill Plan which is incorporated as an Appendix D in the OMS.

- *Max/min inflows and outflows/discharge (Water quality objectives, reference MOECC's C of A),*

  **Response:**
  Information about inflows and discharge quantities are included in the WMP Fill Plan which is incorporated as an Appendix in the OMS. Any discharge will meet the limits as described in the ECA # 5781-9VJQ2J.

- *Stage-storage curves.*

  **Response:**
  This is included in the WMP Fill Plan which is incorporated as an Appendix D in the OMS.

- *Other pond constraints.*

  **Response:**
  This is included in the WMP Fill Plan which is incorporated as Appendix D in the OMS.

- *Upstream and downstream constraints (in terms of spillway releases).*

  **Response:**
  WMP see Table 3-3 of the OMS.

- *Operation of structure in emergency situations/flood operating procedures*

  **Response:**
  See section 7.0 of the OMS.

- *Ice and debris handling.*

  **Response:**
  Not applicable during pre-production phase for the WMP is filling. For other channels debris will be removed.

- *Information on flood forecasting.*

  **Response:**
  Information on managing flood scenarios is provided in Section 3.0.

2. *Maintenance*:

   *Provide more details on roles and responsibilities for emergency, major and minor maintenance.*

   **Response:**
   Section 5.0 of the OMS describes the overall maintenance however, the details on responsibilities for maintenance and other tasks are discussed in section 2.0 Roles and Responsibilities of the OMS.

3. Section 1.4

   *Provide more detail on the annual review of the OMS manual, including:*

   *Describe the process by which necessary changes will be evaluated*.

   **Response:**
   This manual will be updated to the production version prior to the annual review process and this will be evaluated at that time.

   *Who will be designated to evaluate and update the OMS?*

   **Response:**
   Dave Hall, Mill Manager will be responsible for evaluating and updating the OMS.
   Note that working draft manuals must be made available in advance of commissioning any new system.
   Copies of the OMS will be made available at the site and to MNRF.

4. Section 2.4

   *Complete the contact list in table 2-1 with all known information.*

   **Response:**
   Table 2-1 has been updated.

5. Section 2.6

*Add that changes, modifications, alterations or improvements to the design and operations of the systems shall be screened by the MNRF.*

**Response:**
Requested text has been added to section 2.6.

*Working draft manuals must be made available* ***in advance of*** *any changes or start of operations, not just "within 90 days"*

**Response:**
Text revised accordingly.

*Provide clarity to define what "important events" trigger an update to the OMS manual (i.e. the important events listed in table 6-2).*

**Response:**
Text revised accordingly.

6. Section 3.0

*Provide most up-to-date site layout and not conceptual plan.*

**Response:**
The site plan/general arrangement is now current.

7. Section 3.3

*Add "Subject to* ***MNRF*** *approvals…" in discussion of WMP filling during the pre-production phase.*

**Response:**
Text added as requested.

8. Section 6 (page 32)

*States that the surveillance plan is "conceptual".*

**Response:**
The word conceptual has been removed.

*Cover letter recommends that Standard Operating procedures should be developed for dam inspections for daily, weekly and monthly inspections. These procedures should be developed PRIOR to any operation of the WMP.*

**Response:**
SOPs will be developed and implemented prior to production.

9. Section 6.1.2

   *Clarify frequency of inspections. Section 6.1.2 sets bi-weekly standard which conflicts with table 6-1 which indicates "at least once a week"*

   **Response:**
   Text revised.

10. Section 7.0 – Emergency Response

    *It is unclear which section in the EPRP relates directly to dam failure as outlined in this section.*

    **Response:**
    A new section 12.0 - Environmental Risks and Responses has been created in the updated EPRP manual.

**Comments on EPRP:**

11. General

    a) *Provide detail on environmental concerns and response associated with:*

       - *Open Pit Failure*
       - *Stockpile Slope Failure*
       - *Tailings Dam Failure*
       - *Pond Dam Failure*
       - *Watercourse Diversion Failure*
       - *Tailings Pipeline failures*

       **Response:**
       A new section 12.0 has been added to the EPRP that addresses environmental concerns and responses with the facilities as requested above.

    b) *Please provide detail relating to the management of wildlife related emergencies (i.e. wolf, bear) or provide reference to plans already in place.*

       **Response:**
       Included reference to wildlife attack in EPRP Manual, Part 2 Section 1.0 Serious Injuries & Fatalities

1. PART I

   *Section 3.2 – Include LRIA in the list of Legislation and Industry Standards*

   **Response:**
   Updated Section 3.2 of the EPRP to include LRIA

*Section 5.4 – Provide detail on the process that ensures the regular review of the EPRP manual*.

- *Describe the process by which necessary changes will be evaluated*
- *Who will be designated to evaluate and update the EPRP?*

**Response:**
Revised and updated section 5.4

2. PART II

*Section 5.1.2 – Provide more detail (i.e. actions, trigger levels) to do with Winter Wind Chill*

**Response:**
Wind Chill calculation table and Wind Chill Hazard tables from Environment Canada are now included in EPRP

*Section 9.6 – Update table 14 – reporting guidelines to include tailings and other contaminated water*

**Response:**
Table 14 in Section 9.6 has been updated as follows:

a) Tailings – Report all unplanned releases that escape secondary containment.
b) Contaminated Water - Report all unplanned releases that escape secondary containment.

We trust this letter provides sufficient detail for your present needs. Do not hesitate to contact us if you need any further clarifications.

Yours sincerely,
**Amec Foster Wheeler Environment & Infrastructure**
**a Division of Amec Foster Wheeler Americas Limited**

Stephan Theben, M.Eng.
Associate Project Manager

Heather Lindsay, M.Sc., P.Eng
Geoenvironmental Engineer

Independent Technical Review Board
Rainy River Project

Mr. Darrel Martindale
Environmental Manager
Rainy River Project
New Gold Inc.
5967 Highway 11/71, P.O. Box 5
Emo, Ontario
P0W 1E0

August 2, 2017

Re: <u>Review of the Operations, Maintenance and Surveillance Manual for Rainy River Project</u>

Dear Sir:

The ITRB was asked by Ms Andrea St-Pierre in an email dated July 27, 2017 to comment on the OMS manual for the site tailings and surface water control structures. This is an interim document meant to describe primarily the operation, maintenance, and surveillance of the surface water control dams and ditches that are complete or near complete. The starter dams for the tailings operation are not yet complete so the OMS procedures cannot be described. Preparation of an OMS manual at the construction stage of a mining project is a difficult undertaking as the structures themselves evolve at during writing of the document. We commend the Rainy River project(RRP) for this difficult undertaking.

The RRP recognizes that the OMS manual will have to be updated as the structures are completed and come into operation. Some of the report sections in the OMS can be kept while others will have to be completely rewritten for the next update. In the current document, the date of submission of the document, July 2017, is well after the status description of some structures. This should be clarified in the document by stating that "this document describes the status of the project at the end of May, 2017 (for instance)" in the Introduction.

The ITRB considers that the OMS document needs to be updated before submission to the MNRF.

- For example, the Emergency Response Contact list requires updating to reflect changes in personnel, and a commitment to the environment is signed by a president long departed;
- The manual contains a description of the geology that omits the presence of high plastic clay tills (that is described a silt) , with low residual strength and high pore pressure response. The ITRB considers this to be misleading and recommends updating;
- The OMS plan provides a general outline of procedures to be followed but note the absence of trigger levels and details. The OMS plan currently provides rough guidelines such as 'when there is a big rainfall… check the dam.' or 'When is a significant change in the readings of a

piezometer, check the instrument then report to EOR' etc but there is no clarity on what constitutes significant or big.

- Section 2 does not state who updates and checks the OMS. Clearly, the Mill Manager is responsible for this but would not normally do this personally. Normally, the site geotechnical engineer would do this work.
- Section 2.5 , bottom of Page 8, states that the OMS will be "screened" by the MNRF. This is unusual. Normally regulatory agencies receive submissions for comment, not screening.

The ITRB would like to be appraised of the changes made and be provided with a summary of instrument readings versus pond level with time at the next ITRB meeting in the fall.
With the above proposed changes included, The ITRB can support the OMS plan.

Yours truly,
On behalf of the ITRB

Bryan Watts, M.Sc., P.Eng (BC), P.Geo (BC)

Iain Bruce, Ph.D., P.Eng.