WATER MONITORING PROCEDURE

1. INTRODUCTION

1.1 OBJECTIVES

The objective of this procedure is to provide a safe and correct method of water sampling.

1.2 PURPOSE

Monitoring of surface and ground water quality is conducted on a regular basis to determine the impacts of mining and processing activities on the water quality in the local drainage system (sub-catchment).

1.3 AUSTRALIAN STANDARD METHODS

This procedure is a simplified method, which aims to comply with the relevant Australian Standards for sampling. However, it will be advisable to consult the Standards for any non-routine samples to make sure proper procedures are followed.

2. PROCEDURE

Monitoring is to be undertaken according to the schedule in the MMP. Water level, field recordings and sampling, are to occur on an ongoing basis. Equipment List

Pack the following equipment into the vehicle;

- Sample bag
- Sample bottles (General Chemistry, nitric acid washed: Total metals, Filtered Metals)
- Filters and syringes or filter cup, hand pump and filter pads
- Gloves
- Safety glasses
- Field note book and pen
- Permanent marker pen
- Drinking water
- Smoko and lunch supplies
- Esky with ice brick
- First aid kit
- Sunscreen
- Demineralised water to clean meter
- Two way radio
- GPS
- Camera
- Meter

2.1 WORK PROCEDURE

- Ensure that the field meter has been charged and calibrated before use in the field.

- Collect enough bottles, 500mL General Chemistry (Green no preservative), Dissolved/Total (Red nitric acid preserved). Pack into eskies with ice bricks.

- At sample location, take a moment to assess the area for dangers, including potential slips / trip hazards, signs of crocodile habitat – slides, nests, footprints, feral pigs and snakes.

- Depending on location and safety, either lower the meter probe into the water body and take water samples from the waters edge, or use a clean bucket on rope to collect a bulk samples. Care should be taken not to disturb the sediments as this will affect the sample.

- If using a bucket, give a good rinse before collecting water for the actual sampling. Use a different bucket for the 'clean' water sites and the 'dirty' water sites.

- Label all bottles with permanent marker. Fill in the sticker with Client name, Project area, sample ID, date of sample and samplers initials. On the lid record date and sample ID. The red metals bottles require a box to be ticked if it is either for Dissolved metals (field filtered), or Total Metals (unfiltered).

- When taking water samples, use gloves at all times to avoid sample contamination and skin burns from preservative in some of the bottles.

- Using the 500ml General chemistry bottle, take the lid off, hold bottle upside down, submerge, tip on its side under the water and allow the bottle to fill approximately 3cm below the water surface. When full, hold upright and bring to surface. Place the lid upside down in a secure location to avoid contamination. Keep the lid off for a short a time as possible. Rinse this bottle three times using this filling method. Use this unpreserved bottle to fill the other bottles bottles containing preservative. Do NOT overfill these bottles as preservative will be lost. Hold the bottles at arm's length from your face when filling as the preservative gives off a vapour when mixed with water. Always wear safety glasses, and if in a poorly ventilated area, wear a dust mask to avoid inhalation of any fumes.

- If filtering with a syringe and filter, first rinse the syringe three times. Once rinsed re-fill the syringe, attach the 0.45µm Millipore and filter into the bottle. Take off filter, re-fill syringe, re-attach filter and continue until bottle is filled.

- Do NOT re-use filters or syringes, they are for single use only

- If filtering with filter cup, ensure entire cup has been rinsed with distilled water, place one filter pad on the mesh section of cup. Screw top section on and fill top section with sample water. Attach hand operated vacuum pump and pump 10 ten times, Allow water to filter from top section of cup to the bottom section. Once all the water has passed through the filter, remove pump and pour into sample bottle.
- All samples require General chemistry, dissolved and total bottles and variable for cyanide (refer to monitoring schedule for requirements).
- Record comments on field observations including, water depth, flow, visibility, creek width, presence of fish / tadpoles etc and other fauna / flora in the area, and any unusual observations such as visible grease/scum, floating fish. Also make a note in the field book f which samples have been collected at the site.

- Keep samples in esky with ice pack and store in fridge. Fridge storage should only be for up to a few days. Samples should be dispatched to the lab within 1 day of being in the esky. From site to the lab it usually takes 1 day to arrive at the lab for analysing

- Fill out a Chain of Custody (COC) for each site. Check sample ID, sample date, media, mark with a **X** what the sample is to be tested for corresponding to the sampling parameter types. Date the COC with the sending date, list the number of sample sites and the sampler, place in a ziplock plastic bag and put in sample esky.

- Contact AJ Couriers on the below contact details and advise them that the samples will be ready to be picked up from the Boral office when they go past next.

AJ Couriers & Haulage

Ph: 08 8931 4922 Fax: 08 8931 4933
ajchaulage4@bigpond.com
15 Toupien Road, Yarrawonga, NT 0830

- Take eskie to the Boral office and tell them that the courier will pick them up. Check the next day to ensure that the samples have been collected.

3. MONITORING PROGRAMS

All monitoring programs below use the following key for the Analysis type.

Type	Analytes
Type 0	Water Height Level Reading (Particularly for wetseason and during wetseason discharge, also to gauge evaporation levels in dry season).
Type 1	Field parameters (pH, EC, Temp, Flow)
Type 2	Total and Filtered Metals (Al, As, Cd, Co, Cr, Cu, Fe, Pb, Mn, Ni, U & Zn)
Type 3	Major Cations (Ca, K, Na & Mg) Anions (Cl, SO_4)– Filtered)
Type 4	Titratable Acidity, Alkalinity, Hardness ($CaCO_3$)& Total Suspended Solids (TSS) & Turbidity
Type 5	WAD CN, Total CN, Free CN
Type 6	Total Phosphorus (P), Total Nitrogen (N), Ammonia, Nitrogen Oxides & Filterable Reactive Phosphorus
Type 7	Australian Drinking Water Guidelines (Total Coliforms, E. Coli and Total Viable Bacteria)
Type 8	Total Petroleum Hydrocarbons (TPH)

Toms Gully

		POSITION			Analysis Type *					
Site Code	Sample Location / Description	GRID: UTM DATUM: WGS84			0	1	2	3	4	5
		Zone	EASTING	NORTHING	Frequency					
Surface Water										
SWTG1A	Mt Bundy Creek, upstream of TGM and it's Influences - Control	52L	776407.65	8580531.93	F	F	F	F	F	
SWTG 2	Mt Bundy Creek, at Arnhem Hwy bridge, downstream of TGM	52L	779558.33	8580421.83	F	F	F	F	F	
SWTG 3	Mt Bundy Creek, further downstream of SWTG 2	52L	782298.33	8579333.18	F	F	F	F	F	
SWTG 4	Wetlands area on mine site access road. Downstream of plant runoff pond (spillway)	52L	778473.44	8579934.30	F	F	F	F	F	
SWTG 5	Artificial Wetlands contiguous to the pastoral property (Lake Bazzamundi).	52L	779203.50	8579773.54	F	F	F	F	F	

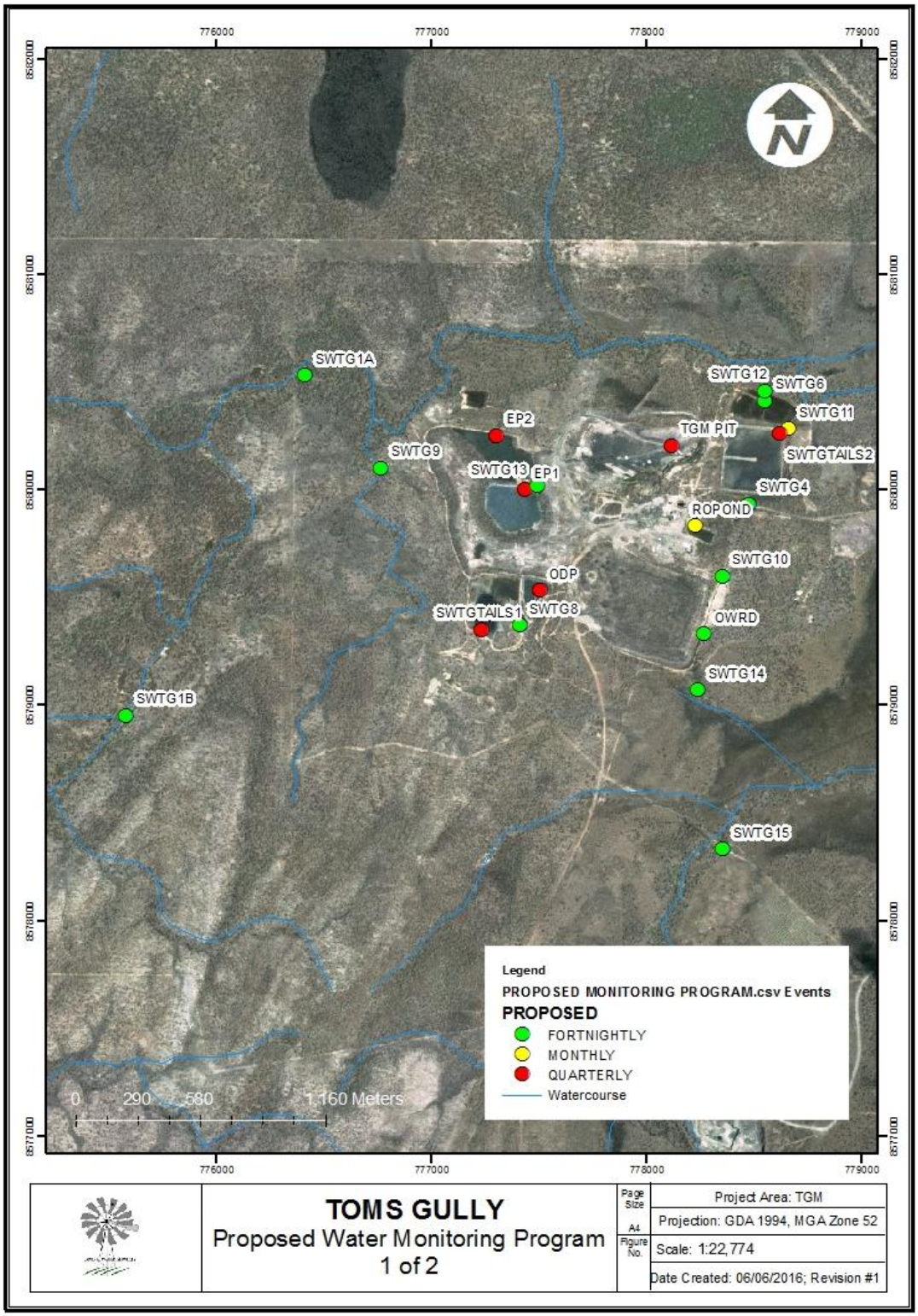
		POSITION			Analysis Type *					
Site Code	**Sample Location / Description**	**GRID: UTM DATUM: WGS84**			**0**	**1**	**2**	**3**	**4**	**5**
		Zone	**EASTING**	**NORTHING**	**Frequency**					
SWTG 6	Wetlands Oxbow (WO) middle of wetland area Nth of Tailings dam#2	52L	778547.75	8580411.80	F	F	F	F	F	
CK 7	Spillway at Arnhem Hwy (runoff from Lake Bazzamundi)	52L	779828.93	8579516.25	F	F	F	F	F	
OWRD	Seepage/runoff collected in diversion drain around Oxide Waste Rock Dump	52L	778266.14	8579330.55	F	F	F	F	F	
SWTG 8	Mixing overflow of runoff and ODP, to be sampled when overflowing	52L	777408.00	8579371.00	F	F	F	F	F	
SWTG 10	Seepage/runoff collected in diversion drain from Oxide Waste Rock Dump, water diversion flow to WO.	52L	778348.13	8579597.32	F	F	F	F	F	
SWTG 11	Entrance to Wetland Oxbow	52L	778657.11	8580282.09	M	M	M	M	M	
SWTG 12	Weir gate at wetland-discharge point #2, monitored when discharge occurs	52L	778547.75	8580458.61	F	F	F	F	F	
RO POND	Runoff Pond down gradient of Mill site, RoM and Workshop	52L	778222.00	8579831.00	F	M	M	M	M	
SWTG TAILS#2	New Tailings storage facility (NTD)	52L	778617.50	8580264.04	F	Q	Q	Q	Q	Q
SWTG TAILS#1	Old Tailings storage facility (OTD)	52L	777232.10	8579348.91	F	Q	Q	Q	Q	Q
EP 1	Evaporation Pond 1 (Upper Pond)	52L	777432.33	8580000.64	F	Q	Q	Q	Q	Q
EP 2	Evaporation Pond 2 (Lower Pond)	52L	777301.09	8580251.19	F	Q	Q	Q	Q	Q
ODP	Old Decant Pond, next to Old Tailings storage facility #1	52L	777498.87	8579531.24	F	Q	Q	Q	Q	Q
SWTG 9	Runoff from Sulfide Waste Rock Dump, prior to joining creek.	52L	776764.00	8580100.00	F	F	F	F	F	
TGM PIT	Tom's Gully Open Pit	52L	778111.80	8580205.30	M	Q	Q	Q	Q	
SWTG14	Downstream of the Oxide WRD, before entry to Lake Bazzumundie.	52L	778237	8579070	F	F	F	F	F	
SWTG1B	Mount Bundey Creek, further upstream to SWTG1A (2.8km)	52L	775576	8578950	F	F	F	F	F	
SWTG13	Surface water runoff from the Sulfide WRD prior to it flowing into the Evap. ponds.	52L	777491	8580016	F	F	F	F	F	
SWTG16	Hardy's Lagoon, approx. 15km downstream form TGM.	52L	783391	8585230	F	F	F	F	F	
SWTG15	Creek line upstream of influence from the OWRD.	52L	778353	8578330	F	F	F	F	F	
Ground Water										
RIDGE BORE	Monitoring Bore Sth of Old Tailings	52L	777559.48	8579124.35	Q	Q	Q	Q	Q	
BORE 11	Monitoring Bore Sth of Old Tailings	52L	777288.15	8579016.12	Q	Q	Q	Q	Q	
OB11	Observation Bore Nth EP 2	52L	777186.74	8580322.90	Q	Q	Q	Q	Q	
G1	NW Corner of EP2, other side of gate	52L	777009.00	8580348.00	Q	Q	Q	Q	Q	
G2	West of OWRD alongside road	52L	777683.00	8579727.00	Q	Q	Q	Q	Q	
G8	Monitoring Bore West EP 1 over SWRD on road side	52L	777021.95	8580019.42	Q	Q	Q	Q	Q	
G9	Observation Bores Nth TGM Pit	52L	777663.99	8580478.41	Q	Q	Q	Q	Q	

		POSITION			Analysis Type *					
Site Code	Sample Location / Description	GRID: UTM DATUM: WGS84			0	1	2	3	4	5
		Zone	EASTING	NORTHING	Frequency					
RN29694	Down gradient of G8, B/W SWRD and Mt Bundey Creek	52L	776935.00	8580080.00	Q	Q	Q	Q	Q	
P100	Bore P100 used raw water for mill/tank maintenance	52L	778275.49	8580155.35	Q	Q	Q	Q	Q	

4. REPLICATES

During each sampling event, one site is to be chosen at random to be sampled twice for the full field of anaylytes (bottles). This second sample becomes a replicate sample used to ensure QA/QC during the sampling, transport and laboratory processes. The replicate samples should be labelled with an “R” after the sample code e.g. SWTG2R. and this sample manually written onto the COC.

5. MAPS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SWTG1A
SWTG12
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SWTGTAILS2
SWTG9
SWTG13
EP1
SWTG4
ROP OND
SWTG10
ODP
SWTGTAILS1
SWTG8
OWRD
SWTG14
SWTG1B
SWTG15
Legend
PROPOSED MONITORING PROGRAM.csv Events
PROPOSED
FORTNIGHTLY
MONTHLY
QUARTERLY
Watercourse
0 290 580 1,160 Meters
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Proposed Water Monitoring Program
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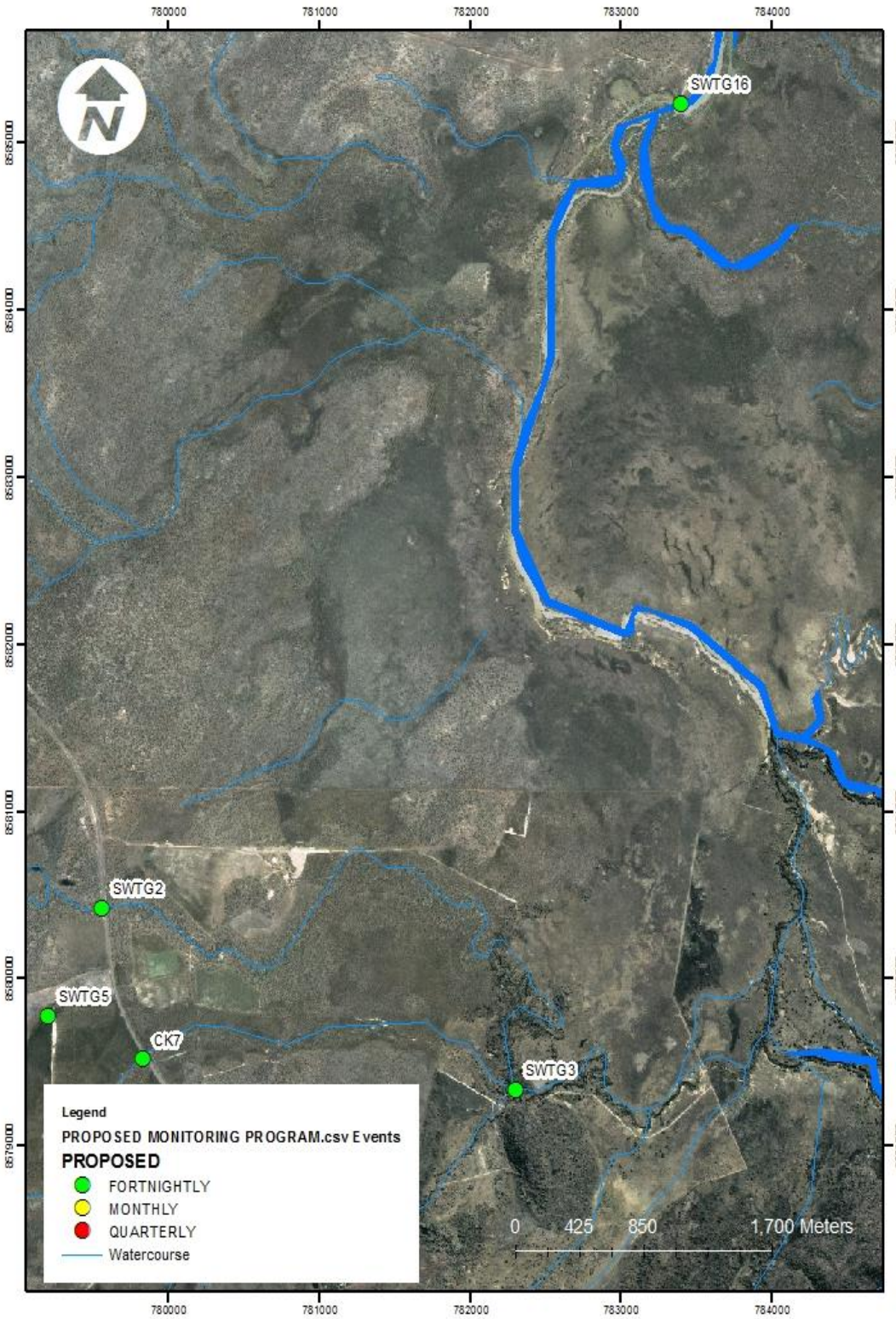
Page Size
A4
Figure No.
Project Area: TGM
Projection: GDA 1994, MGA Zone 52
Scale: 1:22,774
Date Created: 06/06/2016; Revision #1



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Proposed Water Monitoring Program

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Page Size A4	Project Area: TGM
	Projection: GDA 1994, MGA Zone 52
Figure No.	Scale: 1:33,437
	Date Created: 06/06/2016; Revision #1

6. SIGN OFF

I have read and understand the above water sampling procedure.

Name:_____

Signature:_____

Date:_____