Northern Resource
CONSULTANTS

Spring Hill Gold Project

Surface Water Quality Report

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prepared for

TM Gold Pty Ltd

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Introduction

1. Document purpose

This Surface Water Quality Report (SWQR) has been developed to assist in understanding baseline surface water conditions and proposed water management practices for the Spring Hill project. The SWQR details key management practices for site water and should be read in conjunction with the Spring Hill Soils Technical Report and Erosion and Sediment Control Plan (ESCP) which is included as Appendix C of this overall MMP.

The proposed Spring Hill gold project is an open pit oxide mining project, with ore stockpiled and crushed onsite and then trucked offsite to the Union Reefs Mill for processing. The lack of onsite processing in the project means there will be no generation of process water to be managed.

Water management for the Spring Hill gold project will focus on the management and handling of stormwater that has come into contact with mine-affected surface, such as the pits, the waste rock dump and the ROM pad.

Surface water monitoring parameters and intervals are specified within this document for the Spring Hill project.

Site Context

1. Catchment area

The site lies within the upper Mary River catchment adjacent to the McKinlay River approximately 26km north-north east of Pine Creek (refer to Hydrological Location Map in Appendix A). A number of small first order streams convey runoff from the eastern side of the Bonnie Ranges into the main channel of the McKinlay River 2km east of the mining lease. Similar drainage lines convey runoff from the western side of the Bonnie Ranges towards the south and north of the project area, which snake their way into the main channel of the McKinlay River upstream and downstream.

The study area consists of the local hilltops that occur as a series of linear ridge lines rising 60m above the surrounding landscape in all directions. Two major ridge lines join in the area where the proposed ROM and processing facilities are to be located, creating a local flat elevated area.

Drainage from the ridgelines travels in two directions from the site. Drainage on the western part of the ridgelines travels west and then north to north-east to drain into the McKinlay River 1km downstream from the site. Drainage from the eastern sides of the ridgelines travels east to north-east directly towards the McKinlay River 2km downstream of the site.

The slope of the area is generally high with approximately 60% of the area having a slope at or below 21–25 degrees, or 40% of the study area having a slope between 21–25 degrees and 50 degrees

The overall landscape of the Spring Hill deposit falls into the category of “Plains, Rises and Hills on Sedimentary Rocks and Dolerite Intrusions” as mapped by the Upper Mary River Catchment– Resource Assessment and Degradation Study (Department of Infrastructure Planning and Environment, 2002). The landforms consist of north-south orientated rugged strike ridges and undulating rises and plains (Department of Infrastructure Planning and Environment, 2002). The landscape has formed by the removal of the Cretaceous rocks (146 to 66 million years ago) to expose the underlying sedimentary rocks of the Precambrian Era (2000 million years ago) to erosion and weathering.

Landforms of the mining lease include “Hills”, “Low Hills” and “Rises” as described by the Upper Mary River Catchment–Resource Assessment and Degradation Study (Department of Infrastructure Planning and Environment, 2002). The entirety of the study area falls within the “Hills” landform classification.

2. Drainage

Eleven major catchments drain the study area in each compass direction, six of which will host mining infrastructure. The areas of each major catchment occurring within the study area are detailed in Table 1 and depicted in Figure 1.

Table 1: Size of major catchments within study area

CATCHMENT ID	AREA (ha)	PERCENTAGE OF STUDY AREA
Major Catchment 1	3.8	7.1%
Major Catchment 2	2.3	4.3%
Major Catchment 3	3.6	6.8%
Major Catchment 4	8.5	16.1%
Major Catchment 5	10.4	19.8%
Major Catchment 6	3.9	7.3%
Major Catchment 7	6.2	12.0%
Major Catchment 8	7.8	14.8%
Major Catchment 9	0.8	1.6%
Major Catchment 10	4.7	8.9%
Major Catchment 11	0.6	1.3%

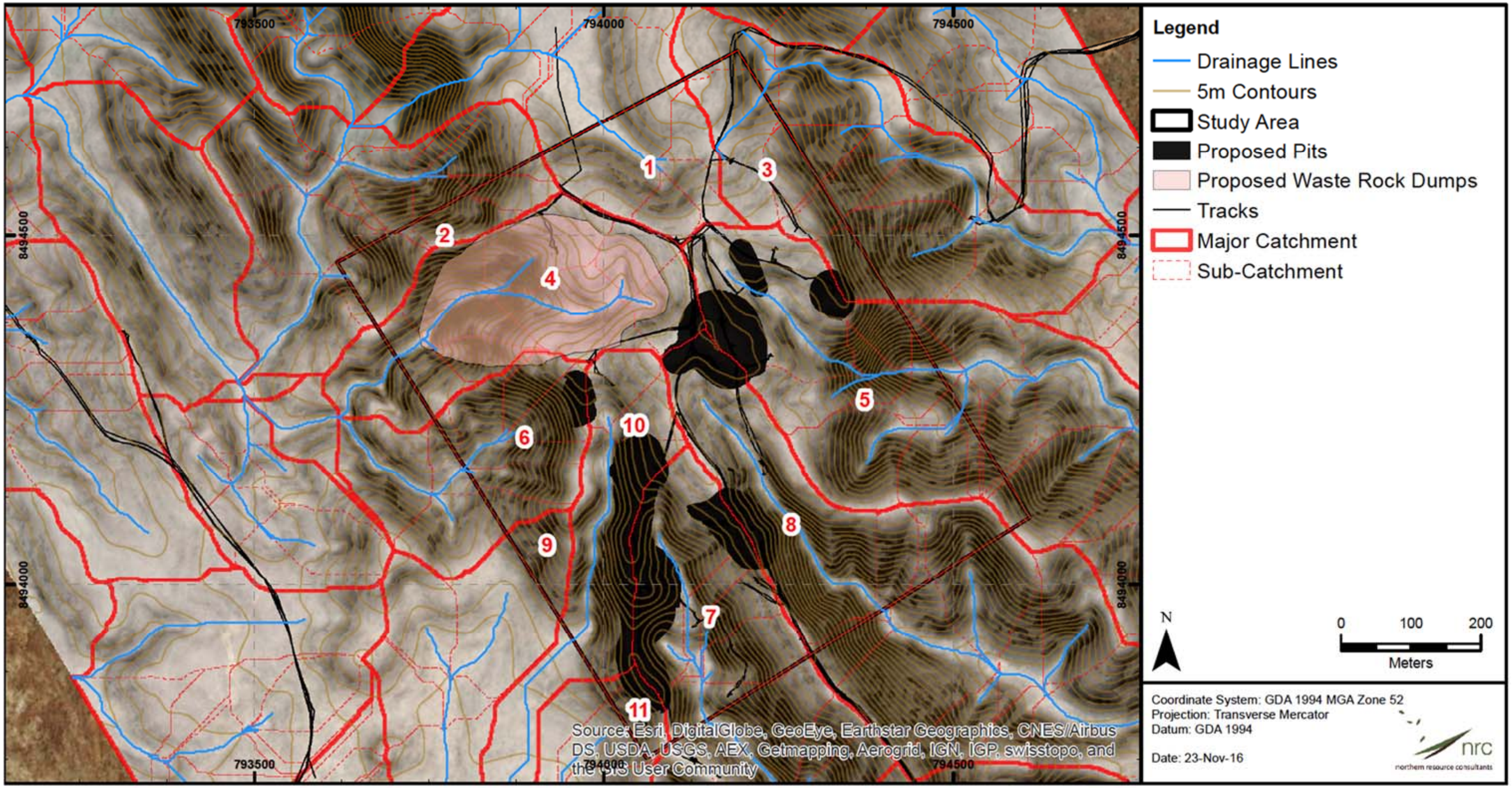

Figure 1: Major catchments and sub-catchments across the proposed Spring Hill project area

3. Climate

3.1 Overview

The Spring Hill project lies in the tropical monsoon belt of the Northern Territory. The area experiences hot humid summers and cooler dry winters. The spread of rainfall gauges is sporadic. The closest rainfall station to the site with a dataset longer than 10 years is the Burrundie Railway station 8km to the north, which measured rainfall in the region from 1889 to 1974. A full list of similar rainfall stations in close proximity to the site is provided in Table 2 below.

Table 2: List of nearby Bureau of Meteorology (BoM) rainfall stations and the number of years' data held

BOM ID	NAME	START	END	YEARS OF DATA	DISTANCE FROM SITE
14007	Burrundie Railway Station	1889	1974	85	8km north
14205	Emerald Springs	1981	2013	32	9km west
14204	The Pines	1971	Present	45	22km south-west
14073	Hayes Creek	1957	2013	56	28km west
14173	Ban Ban Springs	1968	Present	48	33km north-west

Data from these stations were assembled into a continuous climate dataset from 1900 until August 2016 and used to describe the climate of the region.

The site lies in the tropical monsoon belt of the Northern Territory and experiences an annual average rainfall of 1018mm per year (Figure 2). Approximately 70% of years on record have an annual rainfall between 800 and 1600mm with an even distribution of 15% of years with an annual rainfall volume above and below this amount, respectively.

The wet season can be considered to extend from December through to March as 80% of the yearly rainfall typically falls within this period. Only 65% of rainfall occurs in the typical wet season months of December to February (Figure 3).

Rainfall in May to September is scarce with the majority of rainfall stations experiencing no rainfall on record for these months in most years.

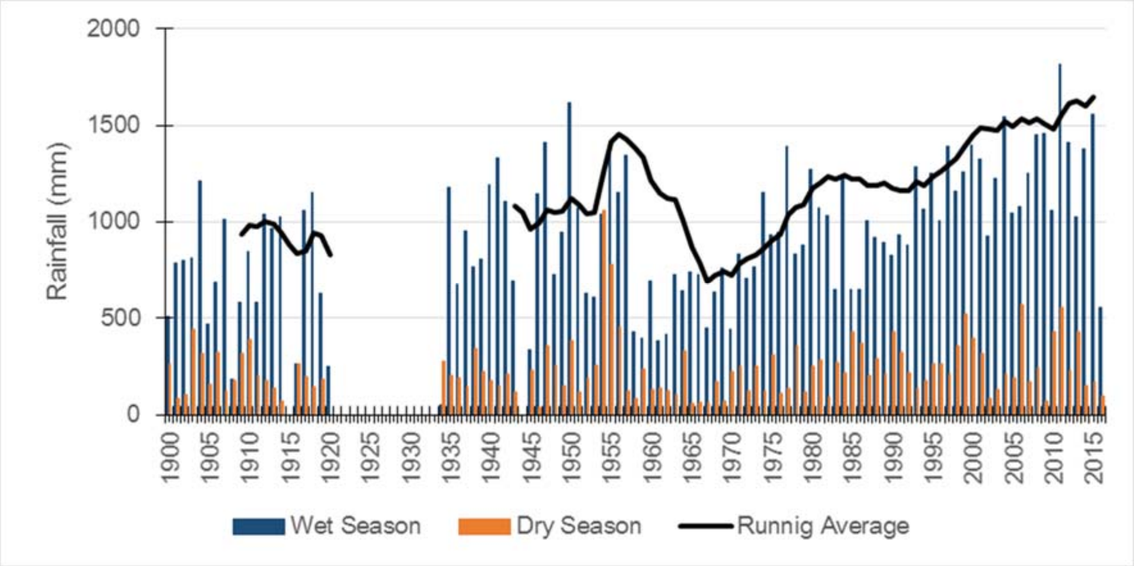

Figure 2: Historic rainfall for the region

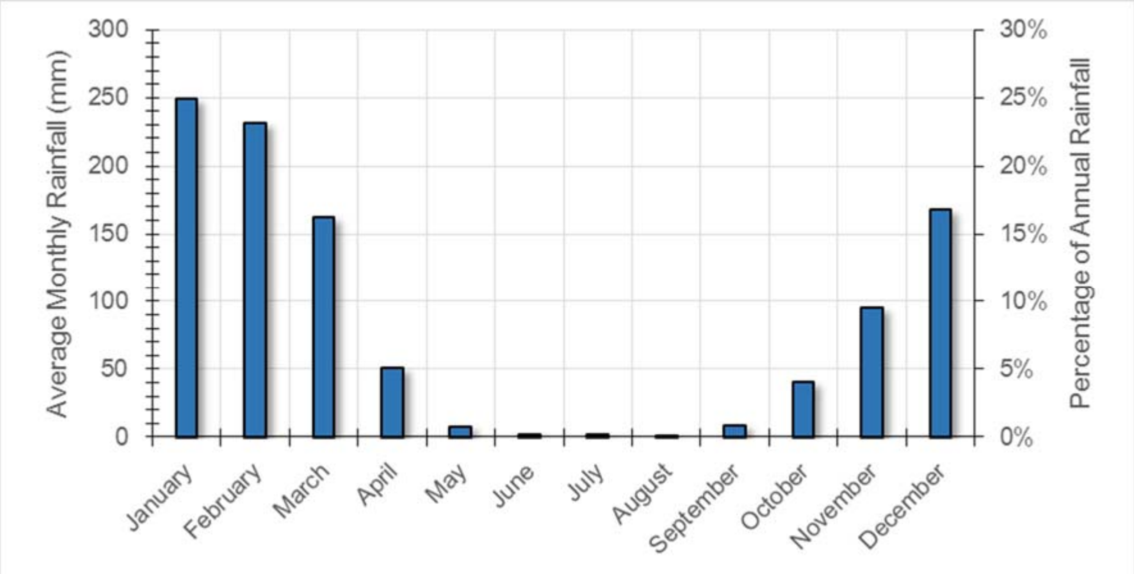

Figure 3: Average monthly rainfall for the assembled dataset

Intensity-Frequency-Duration (IFD) data describe the calculated probability of the volume of rainfall measured over set time periods exceeding a specified value. The probability is provided as a percentage in the Annual Exceedance Probability (AEP). A storm with a 1% AEP has a 1% probability of being exceeded in any one year. BoM uses algorithms to calculate the IFD data for all locations in Australia based on a regular grid (approximately 2.5km) across Australia. The IFD data calculated for Spring Hill is provided below in Table 3.

Table 3: IFD data obtained from BoM for the Spring Hill site

DURATION	1EY	50%	20%	10%	5%	2%	1%
1 min	2.9	3.1	3.9	4.3	4.7	5.3	5.6
2 min	5.2	5.6	6.9	7.6	8.3	9.1	9.5
3 min	7.3	7.9	9.7	10.8	11.8	12.9	13.7
4 min	9.2	10.1	12.4	13.8	15.1	16.6	17.7
5 min	11.1	12.1	14.9	16.7	18.2	20.1	21.4
10 min	18.5	20.2	25.2	28.2	31	34.4	36.8
15 min	24.2	26.4	32.9	36.8	40.5	44.9	48.1
30 min	35.4	38.6	47.9	53.6	58.8	65	69.4
1 hour	47	51.2	63.5	71	77.9	86.2	91.8
2 hour	57.4	62.7	78.2	88	96.9	108	115.7
3 hour	62.7	68.7	86.4	97.8	108.5	121.9	131.7
6 hour	71.1	78.3	101	116.4	131.3	151	166.3
12 hour	80.4	89.5	119.2	140.5	162.1	192.1	216.7
24 hour	94.2	105.8	145.5	175.2	206.6	252.1	290.1
48 hour	116.6	131.9	184.6	225.1	268.6	332.6	385.8
72 hour	135.6	153.4	214.7	261.2	311	383.7	443.6
96 hour	152	171.7	238.5	288.3	340.7	416	478.2
120 hour	166.3	187.5	257.7	308.8	361.4	435.4	497.5
144 hour	178.8	201.1	273.1	324	375.2	445.4	506
168 hour	189.6	212.7	285.4	335	383.8	448.5	507

There have been two storms recorded that exceed the 1% AEP 24hr duration storm. These include:

- 393.7mm that fell in April 1954
- 294.9mm that fell on 3 January 1914. This event also exceeded the 1% AEP 48hr duration storm and the 1% 72hr duration storm.

3.2 Recent rainfall

Rainfall over the 2015/2016 wet season is outlined below in Figure 4 to characterise the nature of flows that are likely to have been experienced at the site. The timing of two water quality sampling events is also marked on Figure 4.

There was an early onset of the wet season with approximately 130mm recorded in November (Figure 4). The majority of rainfall occurred in December with a total of 670mm throughout the region. The majority of this rainfall occurred over a relatively wet period of 18 continuous days. The highest daily rainfall was 127.5mm at the end of the storm season, which is between 50% and 20% AEP for the 24hr duration storm event. There were also two days that received daily rainfalls of between 80 and 90mm. Approximately 200mm was received in January and March while approximately 130mm was received in February (Figure 4).

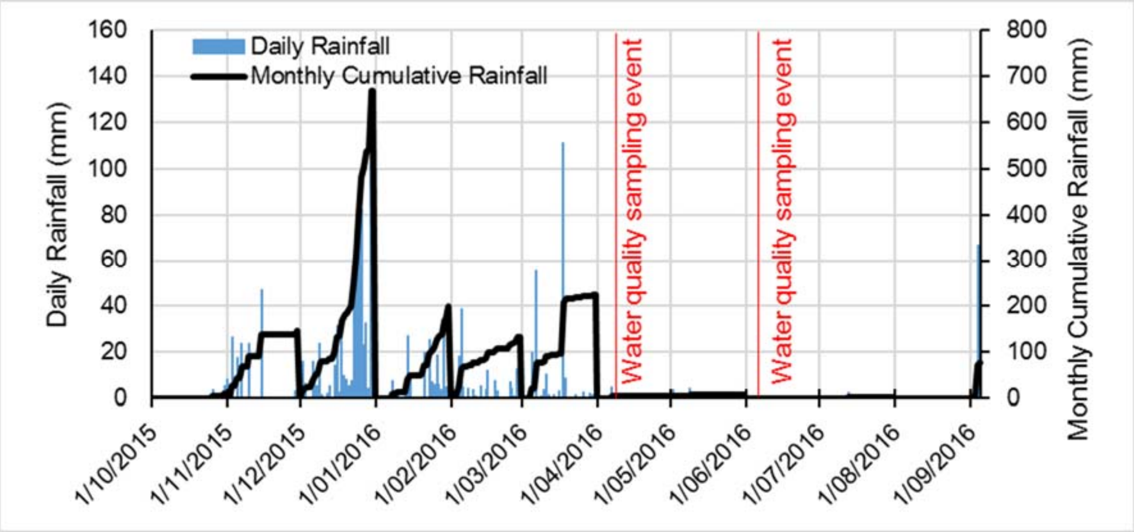

Figure 4: Recent rainfall trends at the site

The relatively gentle rain received in November followed by relatively intense rainfall in December before three months of relatively gentle rain would have ensured that stream flow and pools in small order streams would have been relatively persistent.

Water Quality

1. Legislative context

Beneficial uses have been set for all major waterways and features throughout the Northern Territory, which then allow water quality targets to be set. The following Beneficial Use has been set for the McKinlay River:

- Aquatic ecosystem protection upstream from where the river intersects 8478800mN and downstream of the location where the river intersects 8490000mN.

The Spring Hill mining lease lies between 8491300mN at the southern boundary and 8496800mN at the northern boundary, therefore within the Beneficial Use zone declared for the McKinlay River on 27 February 1998 by the Minister for Parks and Wildlife.

1.1 Water quality targets

Aquatic ecosystem guidelines have been released by ANZECC (2000) that set limits for various levels of protection. Typically, a 95% species protection level (SPL) is applied to slightly to moderately disturbed systems such as the drainage lines leading to, and including, the McKinlay River. Surface water sample sites identified around the Spring Hill project include three dams, which have been used for livestock watering in the past. TM Gold proposes to adhere to the default 95% SPL for all natural waterway sampling points in the vicinity of the project and the ANZECC (2000) livestock water limits as described in Table 4 for all dams.

Table 4: The 95% SPL for slightly to moderately disturbed systems and livestock drinking water quality trigger values from ANZECC (2000)

ANZECC GUIDELINE	TYPE	PARAMETER	TRIGGER VALUE
Aquatic Ecosystem – 95% SPL (slightly to moderately disturbed systems)	Physical	Electrical Conductivity	350µS/cm
		Dissolved oxygen	80% (lower limit)
		pH	6.5–8.0
		Turbidity	15NTU
	Metal / Metalloid	Arsenic	0.024mg/L
		Cadmium	0.0002mg/L
		Zinc	0.008mg/L
		Boron	0.37mg/L

ANZECC GUIDELINE	TYPE	PARAMETER	TRIGGER VALUE
		Copper	0.0014mg/L
		Lead	0.0034mg/L
Livestock drinking water quality	Physical	Total Dissolved Solids (ANZECC 2000, Table 4.3.1)	4000mg/L (cattle)
		NOx as N	400mg/L
		NO_2 as N	30mg/L
		Calcium	1000mg/L
		Sulfate	1000mg/L
	Metal / Metalloid (ANZECC 2000, Table 4.3.2)	Arsenic	0.5mg/L
		Cadmium	0.01mg/L
		Chromium	1.0mg/L
		Zinc	20mg/L
		Boron	5mg/L
		Copper	1mg/L (cattle)
		Lead	0.1mg/L

TM Gold propose that if the trigger values in Table 4 are exceeded during operations in the downstream environment for natural waterways, then the downstream results will be compared to upstream results. If the downstream results exceed the upstream results an investigation will be triggered.

In dams, any exceedance of an ANZECC (2000) livestock watering trigger value will prompt an investigation.

2. Water quality sampling

2.1 Sampling events

Limited water quality sampling was undertaken during site visits to determine parameters that may locally exceed the ANZECC (2000) default trigger values outlined in Table 4 and to also determine geochemical relationships between surface water found throughout local drainage lines. The Certificates of Analysis of sampling undertaken are provided in Appendix B.

Opportunistic surface water sampling was undertaken alongside campaigns to install and pump test groundwater bores across the area. The purpose of the water sampling was to perform an initial screen to determine if there are any contaminants elevated in surface waters that can be attributed to either the host geology or historical mining operations.

Two sampling events were undertaken at the beginning of April 2016 and at the beginning of June 2016.

Additional sampling events were not undertaken because of the lack of perennial water at the site. All streams at the site are highly ephemeral because of their relatively small catchment areas.

2.2 Sampling locations

The proposed Spring Hill gold project lies on the top of the local ridgeline. Subsequently, there are no suitable locations to measure water quality upstream of the proposed mining project. Instead, control sites are designated for upstream surface water monitoring locations in adjacent catchments that drain a similar geology and landform.

The locations of all proposed surface water monitoring points for the site are outlined in Table 5 and Figure 5 below. The site has been separated into four catchments:

- Northern Catchment
- Eastern Catchment
- Southern Catchment
- McKinlay River Catchment.

Table 5: Location of surface water monitoring points

NAME	LONG_NAME	CATCHMENT	PURPOSE	EASTING	NORTHING
HSD-DAM	Homestead Dam	Eastern	Storage	795218	8494123
E-DS1	Eastern Drainages–Downstream 1	Eastern	Downstream	794580	8494512
MR-US	McKinlay River Upstream	McKinlay River	Upstream	798246	8491925
MR-DS	McKinlay River Downstream	McKinlay River	Downstream	794763	8495838
WH-1	Waterhole 1	Northern	Storage	793042	8494652
E-DS2	Eastern Drainages–Downstream 2	Northern	Downstream	795354	8494721
S-US	Southern Drainages Upstream	Southern	Upstream	794924	8491874
S-US2	Southern Drainage	Southern	Upstream	795824	8491961
ALV-DAM	Alluvial Dam	Southern	Storage	793401	8493286
S-DS	Southern Drainages Downstream	Southern	Downstream	795515	8492405

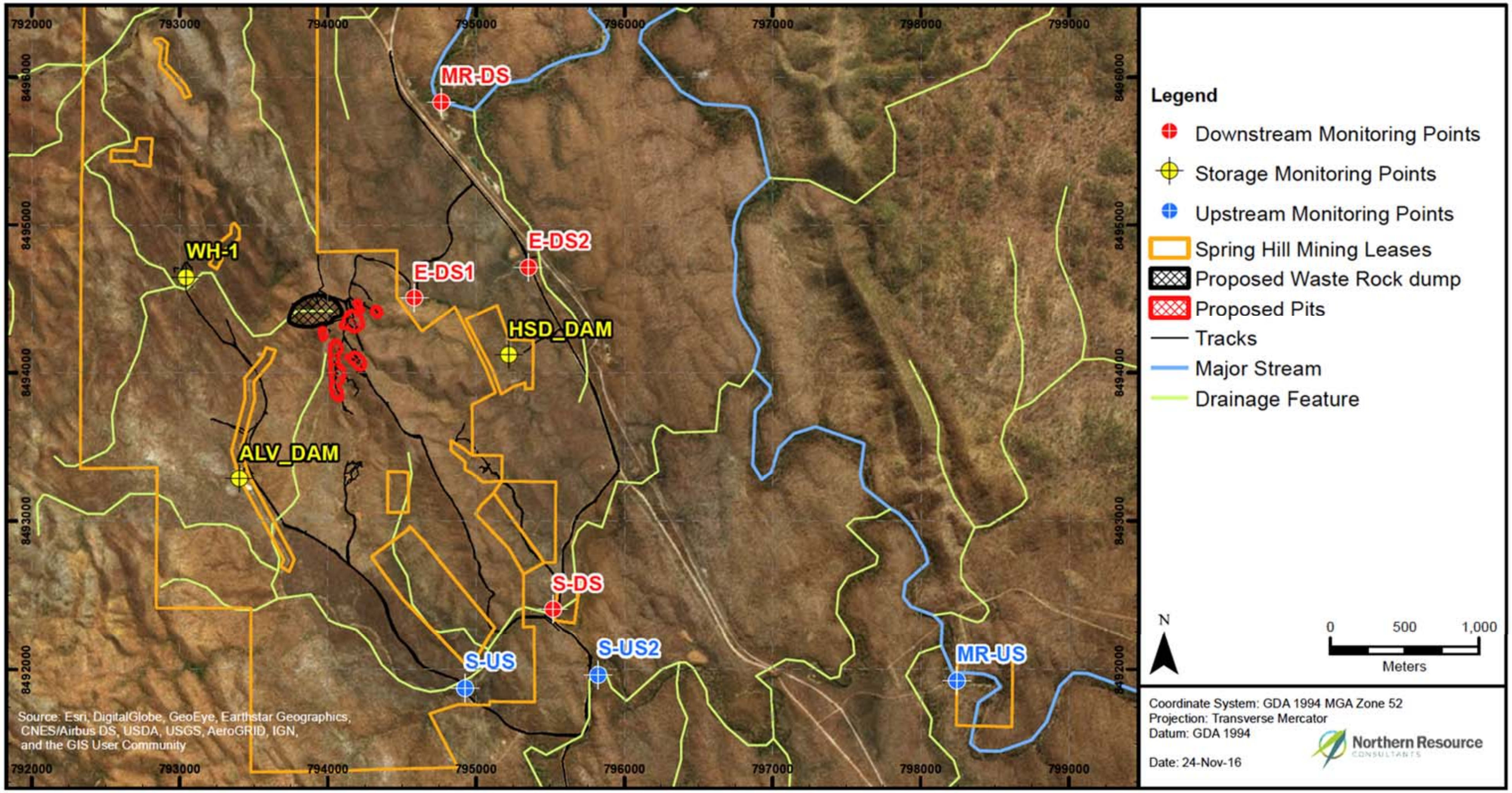

Figure 5: Location of surface water monitoring points

The Northern, Eastern and Southern Catchments contain watercourses that drain from the northern, eastern and southern areas of the proposed mining operation, respectively. The McKinlay River catchment sites target water quality further downstream in the McKinlay River.

Water quality samples were only able to be obtained during the two monitoring periods from:

- MR-US
- MR-DS
- S-US
- S-DS
- WH-1
- ALV-DAM
- HSD-DAM

The ephemeral nature of waterways in the region meant that the other proposed sampling sites were dry.

2.3 Results

Physical parameters

The pH and electrical conductivity (EC) of all water samples were well within recommended guideline values. pH ranges from 6.7 to 7.6 with an average of 7.3 amongst all samples. EC values indicate non-saline water with all samples except one having an EC less than 90µS/cm.

The sample taken from S-US on 8 June 2016 has an EC of 180µS/cm. However, the sample also has a corresponding total dissolved solids (TDS) value of 20,000mg/L, which does not align with the typical conversion of 0.64 from EC to TDS (as mg/L). This is explained by the high alkalinity, potassium and chloride values of the sample (refer below).

The water sample from S-US on 8 June 2016 was from a very small desiccating pool within the channel (Figure 6). The high values are a result of evaporative concentration of minerals and salts within the pool.

Figure 6: Photograph showing the condition of S-US at time of sampling

Major cations and anions

Water quality samples are dominated by the HCO_3 anion with chloride and sulfate as SO_4 concentrations are relatively low (Figure 7). The magnesium percentage of the water samples is slightly higher than the calcium percentage.

The S-US sample taken on 8 June 2016 has an anomalously high alkalinity, HCO_3, potassium and chloride concentration leading towards a measure of TDS of 20,000mg/L. As mentioned previously, this is because the sample was taken from a desiccating pool and these parameters are elevated because of evaporative concentration.

The sites within the McKinlay River catchment have a higher proportion of SO_4 than all other samples. This is likely a result of the larger upstream catchment area and alternate geology draining through these monitoring points.

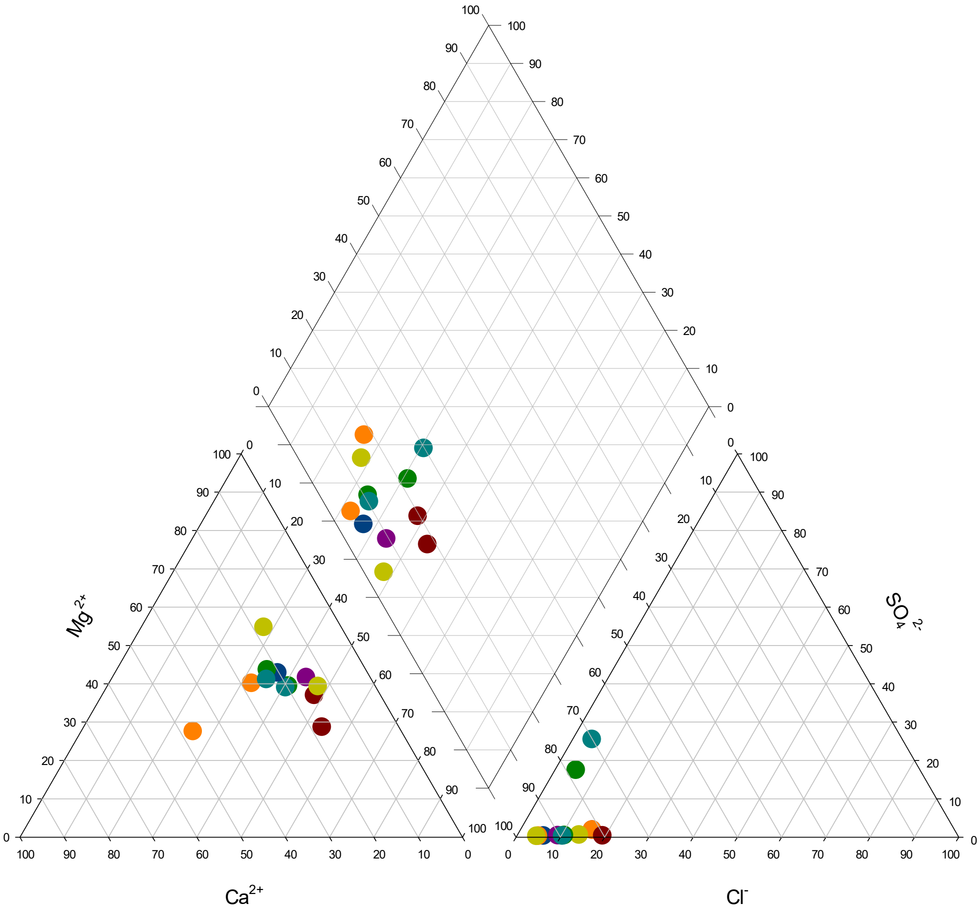

Figure 7: Piper diagram of surface water samples collected over the two monitoring events

Metals and metalloids

There are no exceedances of the ANZECC (2000) 95% SPL for Aquatic Ecosystems or the Stock Water Guidelines.

Total arsenic and total barium are the most elevated metals. Total arsenic was recorded above the limit of reporting (LOR) in 10 of 12 samples from the area with an average concentration of 0.0051mg/L. Total barium was recorded above the LOR in all 12 samples with an average concentration of 0.030mg/L.

The majority of other samples for most other metals are below the LOR. Total cadmium and total chromium were not recorded above the LOR in any samples. Total zinc and total lead were only recorded above the LOR in three of twelve samples. Total copper was only recorded above the LOR in four of twelve samples.

Nutrients

Nutrients were analysed in the form of nitrate (NO_3 as N), nitrite (NO_2 as N) and total phosphorous (via Kjeldahl digestion). Nitrate was recorded in concentrations above the LOR in two of twelve samples (from the Alluvial Dam and SW1) at a concentration of approximately 0.01mg/L. Nitrite was not recorded above the LOR in any sample. Total phosphorous was above the LOR in all 12 samples but remained relatively low with an average concentration of 0.04mg/L and a maximum of 0.17mg/L (Alluvial Dam on 8 June 2016).

3. Sediments

Analysis of sediment data can provide an insight into the overall water quality processes occurring in the catchment and the interaction with host geology. Three sediment quality samples were taken from the immediate catchment area to characterise the overall abundance of metals. The samples were taken from the Southern Catchment from areas where water will flow to the south of the proposed mining operation and enter the McKinlay River.

Samples were obtained from S-US and S-DS to characterise the local catchments as well as MR-US to characterise the type of material flowing along the McKinlay River. Samples were sieved to <63µm and <2mm and analysed for total metals. The results were compared to Interim Sediment Quality Guideline (ISQG) values (ANZECC, 2000). The results of the analysis as well as the ISQG values are outlined in Table 6.

The samples from the Southern Catchment (S-US and S-DS) contain total arsenic in concentrations exceeding the ISQG value (20mg/kg) in the <2mm and <63µm fraction. In addition, the samples from S-DS and S-US exceed the ISQG value for lead (50mg/kg) in the <63µm and <2mm fraction, respectively.

Exceedances of arsenic are expected throughout the region. Waste rock sampling for the proposed operation identifies that the majority of waste rock samples, regardless of depth or lithology are significantly enriched in arsenic. The sedimentary nature of the environment at Spring Hill ensures that weathering products washing down from the hills are expected to have high arsenic concentrations. Waste rock analysis also indicates that arsenic is not soluble within the host rocks and is, therefore, expected to be found at high concentrations in stream sediments of the local region because the enriched arsenic in the geology of the region will not dissolve into the local waterways.

Table 6: Sediment quality values

ANALYTE NAME	REPORTING LIMIT	ISQG	ISQG-HIGH	MRUS <2MM	MRUS <63UM	S-DS <2MM	S-DS <63UM	S-US <2MM	S-US <63UM
Aluminium, Al	**50**			1800	2100	4800	4800	6200	4600
Arsenic, As	**0.5**	20	70	17	17	23	52	78	55
Boron, B	**0.5**			7.1	8.4	18	31	47	57
Beryllium, Be	**0.05**			0.28	0.34	0.53	0.65	1.0	0.89
Cadmium, Cd	**0.1**	1.5	10	0.1	0.1	0.1	0.3	0.5	0.3
Cobalt, Co	**0.5**			2.1	2.7	5.6	10	15	13
Chromium, Cr	**0.5**	80	370	8.4	8.6	20	17	50	25
Copper, Cu	**0.5**	65	270	3.0	4.4	12	19	30	24
Iron, Fe	**50**			10000	13000	24000	41000	69000	83000
Manganese, Mn	**2**			110	130	300	510	930	1000
Nickel, Ni	**0.5**	21	52	2.5	3.0	7.8	9.1	12	8.7
Lead, Pb	**0.5**	50	220	16	20	20	52	54	43
Vanadium, V	**0.5**			8.2	9.2	12	18	33	24
Zinc, Zn	**0.5**	200	410	27	30	26	35	35	47
Mercury	**0.01**			0.02	0.02	<0.01	<0.01	<0.01	<0.01

Management Strategies

1. Objectives for water management

Overarching operational water management at Spring Hill shall maintain the following objectives:

- Minimising surface runoff impacted by mining operations through diversion of clean water flows around mining operations.
- Minimising the volume of raw water imported to site by maximising recycling of stored water resources.
- Minimising impacts to water quality and quantity on existing downstream receptors.
- Maintaining adequate protection of internal water management infrastructure and external surface water values during flood events.

Mine water management shall be divided into three categories:

- Clean water – runoff from areas outside the mining lease and from rehabilitated areas.
- Dirty water – sediment-laden water generated from disturbed areas (not including mining areas).
- Mine affected water – runoff from mining and product handling areas (including pit and ROM).

2. Clean water management

Clean water shall be managed through the implementation of catchment drains and diversion bunds where appropriate. Measures to prevent clean water entering mine operation areas such as mine pits, waste rock dumps and the ROM shall be implemented with reference to the Spring Hill ESCP. Ground-truthing clean water diversion infrastructure should be undertaken prior to construction to ensure effective placement.

It is recommended that regular inspections of clean water diversions be undertaken (minimum once per month and following each rainfall event) to ensure integrity of infrastructure is maintained. Where degradation of infrastructure is identified, maintenance of the degraded infrastructure should be undertaken.

3. Dirty water management

Dirty water shall be managed through the implementation of drainage infrastructure such as table drains and sediment basins. Dirty water infrastructure shall be implemented with reference to the Spring Hill ESCP. Ground-truthing of dirty water infrastructure should be undertaken prior to construction to ensure effective placement.

Sediment basins

Sediment basins are typically required where an erosion hazard has been identified for a site and there is a specific need to control runoff turbidity or achieve a specific water quality target for discharge. Requirements for sediment basins should be assessed by a suitably qualified person and in accordance with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Manuals (“white books”) (IECA, 2008). General principles for construction of a sediment basin include (but are not limited to):

- Effective pond length should be at least three times the effective width.
- Sediment basins should be located to maximise collection of sediment-laden runoff generated from within the site, throughout the construction period and during operations.
- Sediment basins should not be located within a watercourse, waterway or major drainage channel unless it can be demonstrated that:
  - The basin will achieve its design requirements.
  - Settled sediment will not be resuspended and washed form the basin during stream flows equal to, or less than, the 1 in 5 Annual Recurrence Interval.
  - The basin and emergency spillway will be structurally sound during the design storm specified for the sizing of the emergency spillway.
- Ensure basins have suitable access for maintenance and desilting.

4. Mine affected water management

Mine affected water refers to runoff from mining and product handling areas (i.e. pits, waste rock dumps and ROM). Water generated because of mining operations at Spring Hill shall be managed to ensure that water quality does not exceed the ANZECC (2000) 95% SPL for Aquatic Ecosystems or the Stock Water Guidelines. Mine affected water infrastructure shall be implemented with reference to the Spring Hill ESCP. Ground-truthing of mine affected water infrastructure should be undertaken prior to construction to ensure effective placement.

It is recommended that regular inspections of mine affected water infrastructure be undertaken (minimum once per month and following each rainfall event) to ensure integrity of infrastructure is maintained. Where degradation of infrastructure is identified, maintenance of the degraded infrastructure should be undertaken.

5. Monitoring requirements and reporting

Regular monitoring intervals are recommended for the Spring Hill gold project to ensure that water quality objectives are being met. Sampling shall be undertaken at locations specified in Table 4 and Figure 5. Monitoring shall be undertaken at the following intervals:

- monthly
- following a rainfall event.

Samples shall be analysed by a National Association of Testing Authorities laboratory for parameters detailed in Table 4. Comparison of results against ANZECC (2000) guidelines for surface water monitoring sites specific in Figure 5 shall be as detailed in Table 7.

Table 7: Surface water monitoring results comparison guideline

NAME	95% SPL FOR AQUATIC ECOSYSTEMS	LIVESTOCK WATER GUIDELINES
HSD_DAM		X
E-DS1	X	
MR-US	X	
MR-DS	X	
WH-1		X
E-DS2	X	
S-US	X	
S-US2	X	
ALV_DAM		X
S-DS	X	

Where an exceedance against the 95% SPL trigger values is identified, an investigation shall be undertaken to understand the potential for environmental harm. Where an exceedance occurs in a downstream natural waterway, results will be compared to the upstream site. If downstream values exceed upstream values, an investigation will be initiated.

Where results from a dam exceed the trigger values for ANZECC (2000) livestock water guidelines, an investigation will be initiated.

Conclusions

Physical water quality parameters assessed indicated non-saline water, with all samples except one having an EC of less than 90µS/cm. High alkalinity, potassium and chloride values analysed within water samples also indicated a high level of TDS; however, this may have been attributable to the limitation of sampling from small desiccating pools and a result of evaporative concentration of minerals and salts within the pools.

No exceedances of the ANZECC (2000) 95% SPL for Aquatic Ecosystems or the Stock Water Guidelines were noted during the study; however, total arsenic and total barium were found to be elevated. Total arsenic was recorded above the LOR in 10 of 12 samples from the area with an average concentration of 0.0051mg/L. Total barium was recorded above the LOR in all 12 samples with an average concentration of 0.030mg/L.

The majority of other samples for most other metals were below LOR. Total cadmium and total chromium were not recorded above the LOR in any samples. Total zinc and total lead were only recorded above the LOR in three of twelve samples. Total copper was only recorded above the LOR in four of twelve samples.

Exceedances of arsenic should be anticipated throughout the region. Waste rock sampling for the proposed operation identified that the majority of waste rock samples, regardless of depth or lithology were significantly enriched in arsenic. The sedimentary nature of the environment at Spring Hill ensures that weathering products washing down from the hills is expected to result in high arsenic concentrations. Waste rock analysis also indicates that arsenic is not soluble within the host rocks and, therefore, is expected to be found at high concentrations in stream sediments of the local region.

Separation of water circuits is recommended for the Spring Hill project and regular surface water monitoring is prescribed. Monitoring should be undertaken at least monthly and after each rainfall event. Samples should be analysed and compared against ANZECC (2000) 95% SPL for Aquatic Ecosystems or the Stock Water Guidelines as specified in Table 7 of this report.

References

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