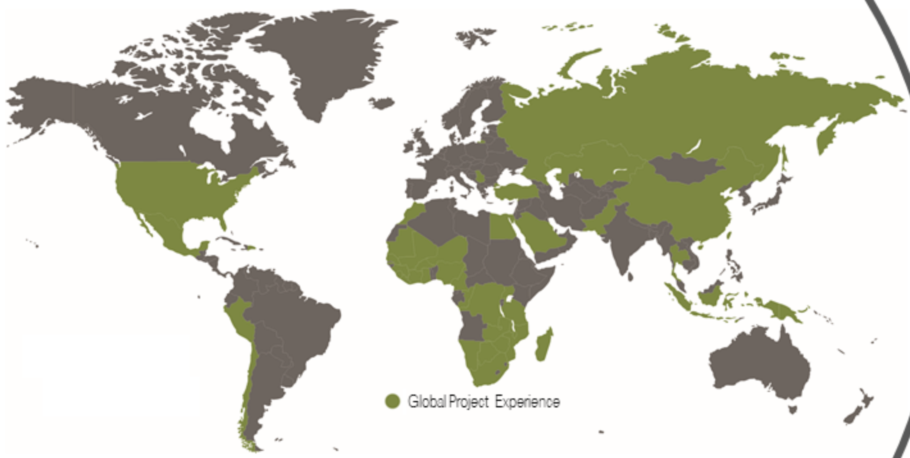
DIGBY WELLS
ENVIRONMENTAL

Your Preferred Environmental and Social Solutions Partner



Providing innovative and sustainable solutions throughout the resources sector

WATER AND SALT BALANCE UPDATE FOR TWO RIVERS PLATINUM

Surface Water Report

Prepared for:	Project Number:
TWO RIVERS PLATINUM	TRP6370
	July 2020

Digby Wells and Associates (South Africa) (Pty) Ltd
Company Registration: 2010/008577/07

Turnberry Office Park, Digby Wells House. 48 Grosvenor Road, Bryanston,2191

Phone: +27 (0) 11 789 9495
Fax: +27 (0) 11 789 9495
E-mail: info@digbywells.com
Website: www.digbywells.com

Directors: J Leaver (Chairman)*, NA Mehlomakulu*, A Mpelwane, DJ Otto, M Rafundisani
*Non-Executive

DIGBY WELLS ENVIRONMENTAL

This document has been prepared by Digby Wells Environmental.

Report Type:	Surface Water Report
Project Name:	WATER AND SALT BALANCE UPDATE FOR TWO RIVERS PLATINUM
Project Code:	TRP6370

Name	Responsibility	Signature	Date
Tshepiso Ratlhagane	Site Assessment and Data Compilation	[signature]	June 2020
Mashudu Rafundisani	Site Assessment and Water Balance Model	[signature]	July 2020

TABLE OF CONTENTS

1. Introduction 1
2. Project Location 1
3. Methodology 3
3.1. Review of Existing Water Balance and Site Assessment 3
3.2. Baseline Hydrology 3
3.3. Water Balance 3
4. Baseline Hydrology 5
4.1. Climate 5
5. Water and Salt Balance 7
5.1.1. Water demand/usage 7
5.1.2. Water sources 7
5.1.3. Water storage/containment facilities 7
5.2. Calculations and Assumptions 8
5.2.1. Rainfall and Evaporation 8
5.2.2. Constants and other Assumptions 8
5.3. Water and Salt Balance Results 9
6. References 15

LIST OF FIGURES

Figure 2-1: Regional Setting 2
Figure 4-1: Site Infrastructural layout at TRP 4
Figure 5-1: Monthly Rainfall Distribution 5
Figure 5-2: Monthly Evaporation and Rainfall 6
Figure 5-3: Monthly Runoff Distribution 6
Figure 5-1: TRP Monthly Average Water Balance 12
Figure 5-2: TRP Monthly Average Salt Balance 14

LIST OF TABLES

Table 4-1: TRP Monthly rainfall for 2019 8
Table 4-3: Potential average monthly evaporation for quaternaries B41G 8
Table 4-5: Summary of the Key Constants and Assumptions 8

1. Introduction

Digby Wells Environmental (hereafter Digby Wells) was appointed by Two Rivers Platinum (Hereinafter TRP) to update the existing Water and Salt Balance for Two Rivers Platinum operations.

The water balance update was completed in accordance with the Department of Water Affairs (DWA) which is now Department of Water and Sanitation, DWS Best Practice Guidelines (BPG) G2: Water and Salt balances (DWA, 2006). Information provided by the TRP was used within these calculations and, where necessary, data provided in the WRC WR2012 publications (WRC, 2012) were used to complement the data provided by the client. The

2. Project Location

TRP is located within the Greater Tubatse Local Municipality (GTLM) which is situated in the Sekhukhune District Municipality (SDM) within the in the Limpopo Province. TRP is situated 60 km north-east of Mashishing (former Lydenburg) on the farms DwarsRivier 372 KT and De Grooteboom 373 KT on the southern part of the eastern limb of the Bushveld Complex. In the Water Management Area context, TRP is located in the Olifants WMA 2, within the Steelpoort River basin. The regional and locality map for the TRP project area is shown on Figure 2-1.

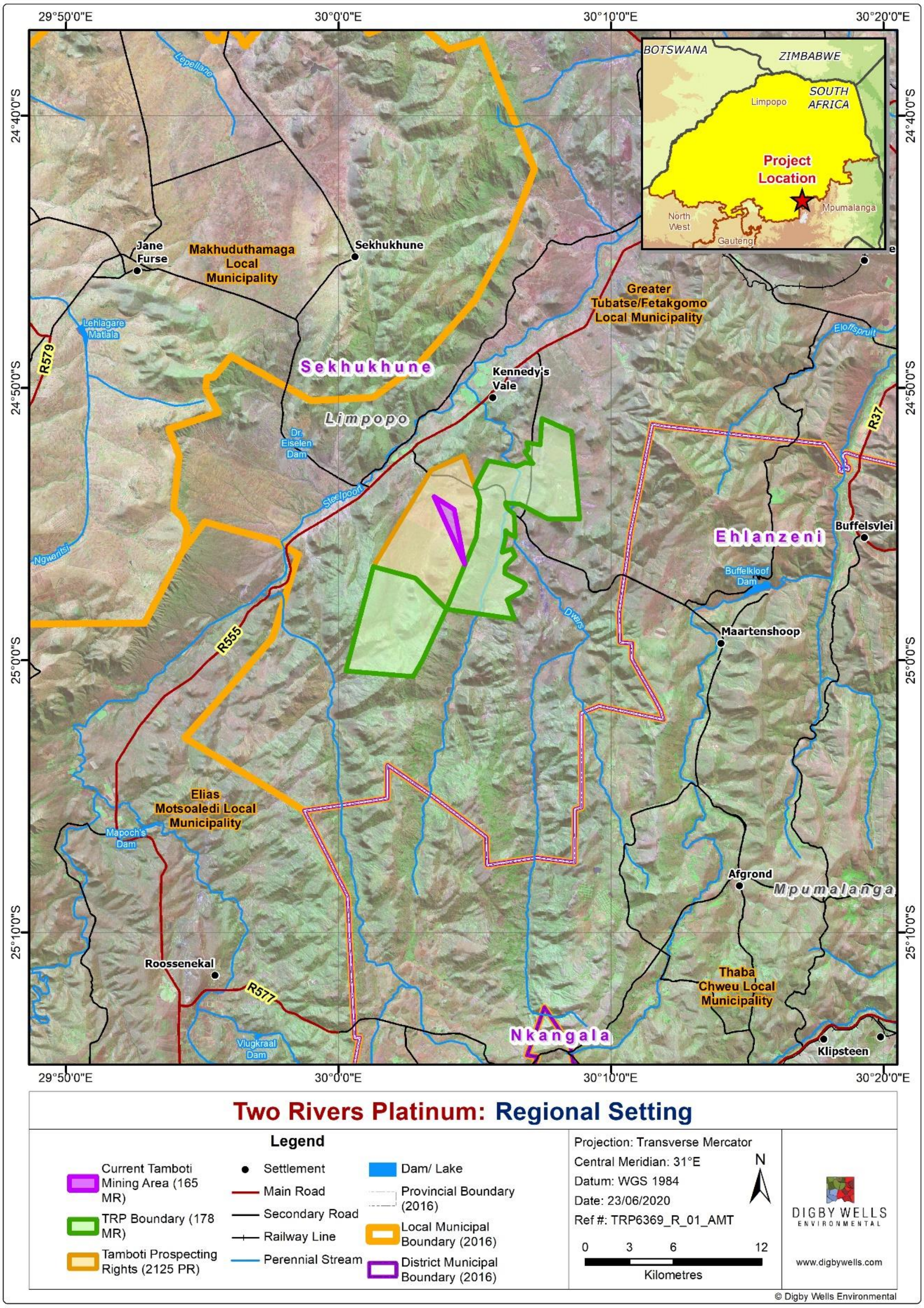


Figure 2-1: Regional Setting

3. Methodology

3.1. Review of Existing Water Balance and Site Assessment

Prior to the site visit, a review of the existing water balance was conducted to obtain an understanding the site water reticulation system and associated water demand or requirements

This was followed by a site visit which was undertaken on the 26 and 27 of May 2020, to assess the site conditions and verify the water management infrastructures together with the water reticulation status quo.

3.2. Baseline Hydrology

The regional rainfall, evaporation and runoff data were obtained from the database provided by the Water Resources of South Africa 2012 study (WRC, 2015) and was used to determine the Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) and the Mean Annual Runoff (MAR) for the Upper Olifants River catchment. Time series rainfall-runoff and Symons Pan evaporation historical data for 1920 to 2009 were used to determine average regional hydro-meteorological parameters. These analyses were useful to provide insight into the general rainfall-runoff and evaporation dynamics for the area and enable calculation of potential evaporation on the open water storage facilities within the mine. However, the site specific rainfall data provided by TRP was used on the water balance to calculate the average rainfall and runoff volumes for various components of the mine.

3.3. Water Balance

As stated above, a static excel based water and salt balance was developed or updated in accordance with the DWS Best Practice Guidelines (BPG) G2: Water and Salt Balances (DWA, 2006). The static water balance compilation utilised results of the hydrological assessment to provide hydrological inputs as rainfall, runoff and evaporation into modelling calculations. Other water volumes were obtained from TRP and where there were gaps, reasonable assumptions were made (which include assuming volumes similar to the previous year) , while keeping in mind the mine's operational philosophy. The site infrastructural map for TRP is presented in Figure 3-1.

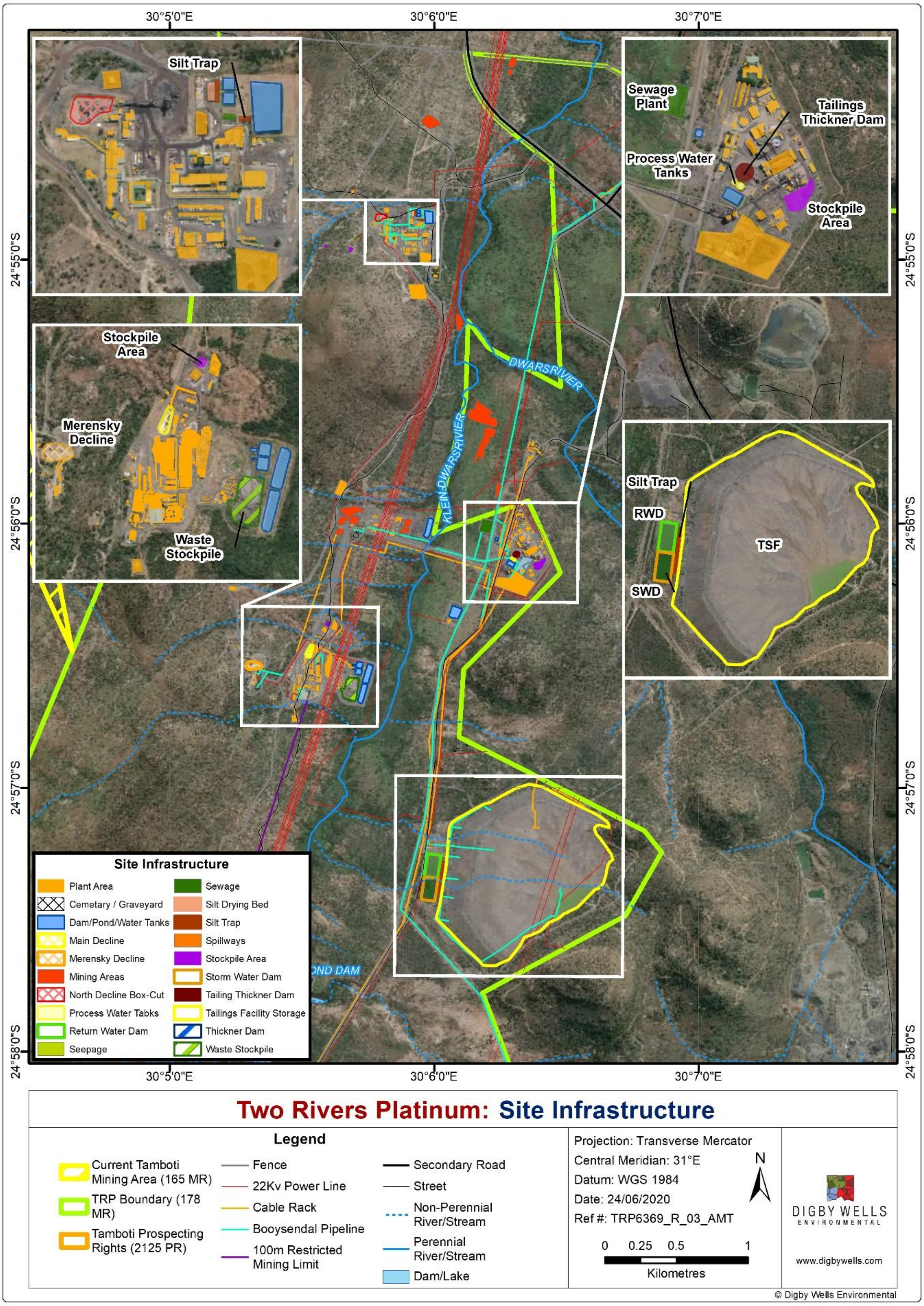


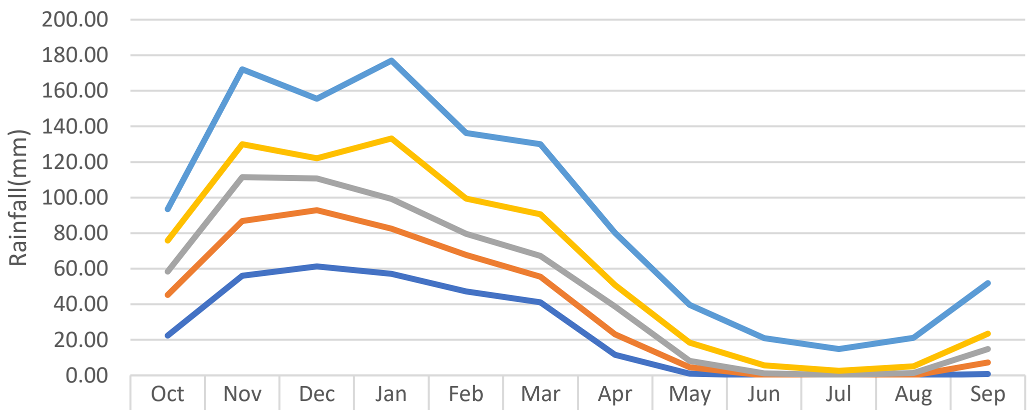
Figure 3-1: Site Infrastructural layout at TRP

4. Baseline Hydrology

The TRP site is situated within the quaternary catchment boundaries of B41H and B41G, with most of the infrastructure located within the B41G quaternary catchment and thus the climatic data for this quaternary has been selected and used to represent TRP.

4.1. Climate

The project site is characterised by a temperate climate with cool dry winters and warm summers. The Mean Annual Precipitation (MAP) for quaternary catchments B41G is 650 mm. The average MAP for the quaternary catchment B41G is likely to be distributed as indicated in Figure 4-1.The normal rainfall (90% of events) for the wettest month (December) will likely not exceed 61 mm, while extreme rainfall (10% of the events) will likely not exceed 156 mm. This implies that the region experiences moderate to high rainfall.

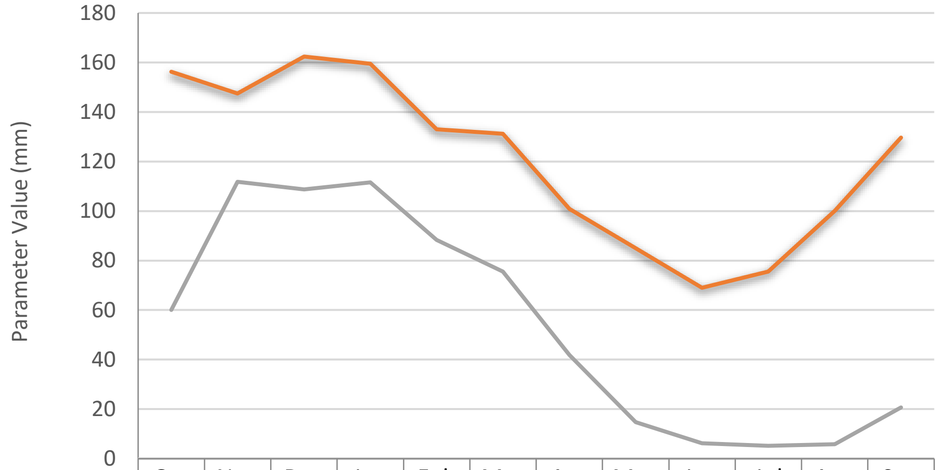


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
E90	22.32	56	61	57	47	41	12	1	0	0	0	1
E70	45.16	87	93	82	68	55	23	4	0	0	0	7
E50	58.40	111	111	99	80	67	39	8	1	0	1	15
E30	75.82	130	122	133	99	91	51	18	6	3	5	23
E10	93.52	172	156	177	136	130	80	40	21	15	21	52

E10 represents a value that cannot be exceeded in 10% of events, etc.

Figure 4-1: Monthly Rainfall Distribution

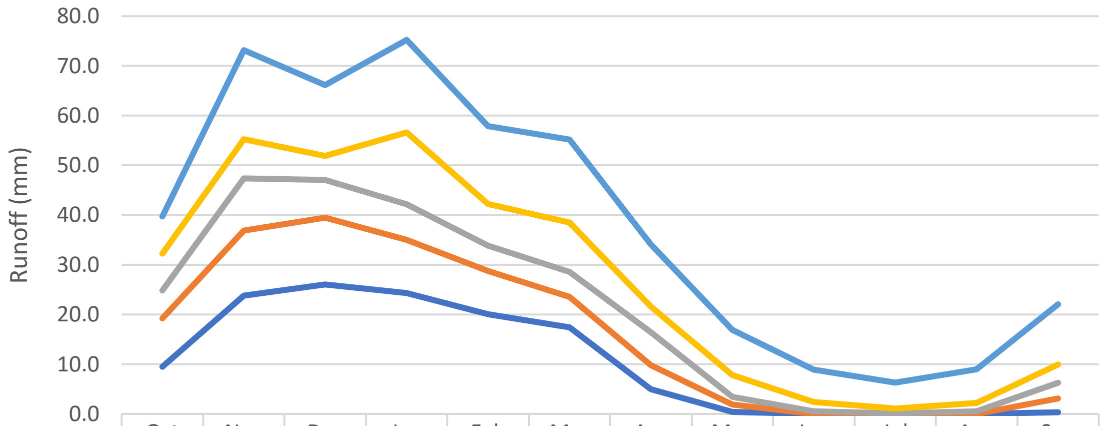
The Mean Annual Evaporation (MAE) for the quaternary catchment B41G is 1 500 mm (WRC, 2015). The region clearly experiences higher evaporation than precipitation received, giving rise to dry winters and wet summers with a negative natural water balance. The average monthly distribution of potential evaporation and rainfall for both quaternary catchments can be seen in Figure 4-2.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation(mm)	156	147	162	160	133	131	101	85	69	76	100	130
Rainfall(mm)	60	112	109	112	88	76	42	15	6	5	6	21

Figure 4-2: Monthly Evaporation and Rainfall

The Mean Annual Runoff (MAR) depth for the area was calculated to be 49.84 mm. This runoff accounts for approximately 42% of the MAP for the area. The 90th (normal flow) and 10th (extreme flow) percentiles of runoff during the month of December are 26mm and 66.1 mm, respectively. The average MAR for quaternary catchment B41G is likely to be distributed as indicated in Figure 4-3.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
E90	9.5	23.8	26.0	24.3	20.1	17.4	5.0	0.4	0.0	0.0	0.0	0.3
E70	19.2	36.9	39.5	35.0	28.8	23.6	9.8	1.9	0.0	0.0	0.0	3.1
E50	24.8	47.4	47.1	42.2	33.9	28.6	16.4	3.5	0.5	0.1	0.5	6.3
E30	32.2	55.3	51.9	56.6	42.2	38.5	21.6	7.8	2.4	1.1	2.2	10.0
E10	39.7	73.1	66.1	75.2	57.9	55.2	34.1	16.9	8.9	6.3	9.0	22.1

E90 represents a value that cannot be exceeded in 90% of events, etc.

Figure 4-3: Monthly Runoff Distribution

5. Water and Salt Balance

In line with the DWS's best practice guidelines, a clear definition and understanding of the boundaries of the water system and layout of the water circuits are required to develop the water balance for a mine. This water and salt balance serves as the mine water management tool that assists with water management decision making, risk evaluations and simulation of different water usage scenarios for the mine.

The water management boundaries are defined according to the mine processes and these are subdivided into water demand, water sources and water storage:

5.1.1. Water demand/usage

TRP requires water for the following uses, but not limited to:

- Use on the Concentrator Plant;
- Mining purposes;
- Dust suppression;
- Irrigation; and
- Potable water for drinking and other domestic uses.

5.1.2. Water sources

TRP water sources include the following:

- Rainfall and runoff
- Groundwater/mine water and borehole water,
- River water; and
- External water (trucked in).

5.1.3. Water storage/containment facilities

The water storage infrastructure includes:

- Pollution Control Dam (PCD);
- Jojo tanks/Resevoir;
- Storm Water Dams (SWD); and
- Return Water Dams (RWD).

5.2. Calculations and Assumptions

5.2.1. Rainfall and Evaporation

Site specific monthly rainfall data used in the TRP Mine water balance is indicated in Table 5-1 whilst the Symons Pan potential monthly evaporation data used in the water balance is indicated in Table 5-2.

Table 5-1: TRP Monthly rainfall for 2019

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	110	38	32	38	0	0	0	0	0	40	10	135

Table 5-2: Potential average monthly evaporation for quaternaries B41G

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evaporation (mm)	156	147	162	160	133	131	101	85	69	76	100	130

5.2.2. Constants and other Assumptions

While some of the information was provided by TRP, information was also gathered from previous or existing reports and by use of GIS spatial platform to measure some of the areas at the mine. Table 5-3 present some the key constants and assumptions that were applied on this water and salt balance update model

It is important to note that on the salt balance, Total Dissolved Solids (TDS) was used to determine the salt loads similarly to the 2019 water and salt balance. This is with the exception of Sewage quality results which did not have TDS results, and therefore Ammonia was used for all the sewage salt load calculations.

Table 5-3: Summary of the Key Constants and Assumptions

Variables	Value	Unit	Source
Surface areas of facilities			
NDCD1	450	m^2	Measured/GIS
NDCD2	450	m^2	Measured/GIS
NDSWS1	4300	m^2	Measured/GIS
MCD1 -4	11000	m2	Measured/GIS
TSF Pool Area	52800	m^2	Measured/GIS
TSF Beach Area	557200	m^2	Measured/GIS
Runoff factor	0.8	%	Assumption
Softening plant losses	0.1	%	Assumption
Sewage treatment losses	0.1	%	Assumption
TRPM storage facility capacities			

South UG2 decline storm water dam	20 000	m^3	Golder report 2019 WB
North UG2 decline storm water dam	20 000	m^3	Golder report 2019 WB
Old Tailings return water dam	150 000	m^3	Golder report 2019 WB
UG2 Plant PCD	10 000	m^3	Golder report 2019 WB
South Merensky decline storm water dam	15 000	m^3	Golder report 2019 WB
North Merensky decline storm water dam	20 000	m^3	Golder report 2019 WB
New Tailings return water dam	150 000	m^3	Golder report 2019 WB
Merensky Plant PCD	20 000	m^3	Golder report 2019 WB
Stockpile Area PCD	10 000.0	m^3	Golder report 2019 WB
Catchment areas of facilities			
South UG2 decline	190 000	m^2	Measured/GIS
North UG2 decline	81 000	m^2	Measured/GIS
UG2 Plant	180 000	m^2	Golder report 2019 WB
South Merensky decline	20 000	m^2	Golder report 2019 WB
North Merensky decline	20 000	m^2	Golder report 2019 WB
Merensky Plant	60 000	m^2	Golder report 2019 WB
Stockpile Area	30 000	m^2	Golder report 2019 WB

5.3. Water and Salt Balance Results

The TRP monthly average water balance with the water process flow diagram (PFD) for 2019 period is shown in Figure 5-1, while the salt balance is presented in Figure 5-2. The mine water reticulation circuit consist of the following:

Surface water abstraction and treatment

The majority of surface water abstracted is used in the processing of ore. The water is transported from the point of abstraction via pipelines to the different points where it is utilised. Only a small fraction of the water is treated for human consumption at the offices and plant. The sewage that is generated on the mine is treated on site with the effluent returned to the plant as make-up water;

Underground mines

Currently, only two decline shafts are in operation mining the UG2 resource. These are known as the South UG2 decline and North UG2 decline. Mining is also proposed from the South Merensky and North Merensky declines; and

Pollution control dams and storm water facilities

Pollution control and containment dams have been installed at the various facilities for containing underground dewatering, the storm water and pollution control facilities include:

- UG2 North Decline: NDCD 1-2, NDSWD 1;

- Merensky North Decline: NDCD 3-4, NDSWD 2;
- Reef Stockpile Area: SPCD1;
- UG2 South Decline: MDCD 1-4;
- Merensky Main/South Decline: MDCD 5-6;
- UG2 Concentrator Plant: UG2PCD1; and
- UG2 Concentrator Plant: MPSWD1-2.

Concentrator plants

- The plant receives water from the surface water abstraction points as well as some water from borehole for drinking water purposes. Ore is milled in this area. After ore processing is complete, an ore concentrate is produced and exported out of the mine area. The fines residue is pumped to the TSF for disposal. This plant area is paved and storm water runoff from the plant area reports to the plant Pollution Control Dam (UG2PCD1) from where it is returned to the process for re-use;

TSFs

- This facility is used for storage of the fine residue from the UG2 plant. The outer wall is constructed using hydro cyclones while the central deposition is done using a spigot arrangement. A new TSF is also proposed to handle fine residues upon closure of the existing TSF

Return Water Dam

- The Return Water Dam (TRTD1-2) receives the surplus water from the TSF as well as seepage from the TSF beach areas from where water is pumped back to the UG2 plant. New return water dams (NTRWD 1&2) are proposed also for the New TSF; and

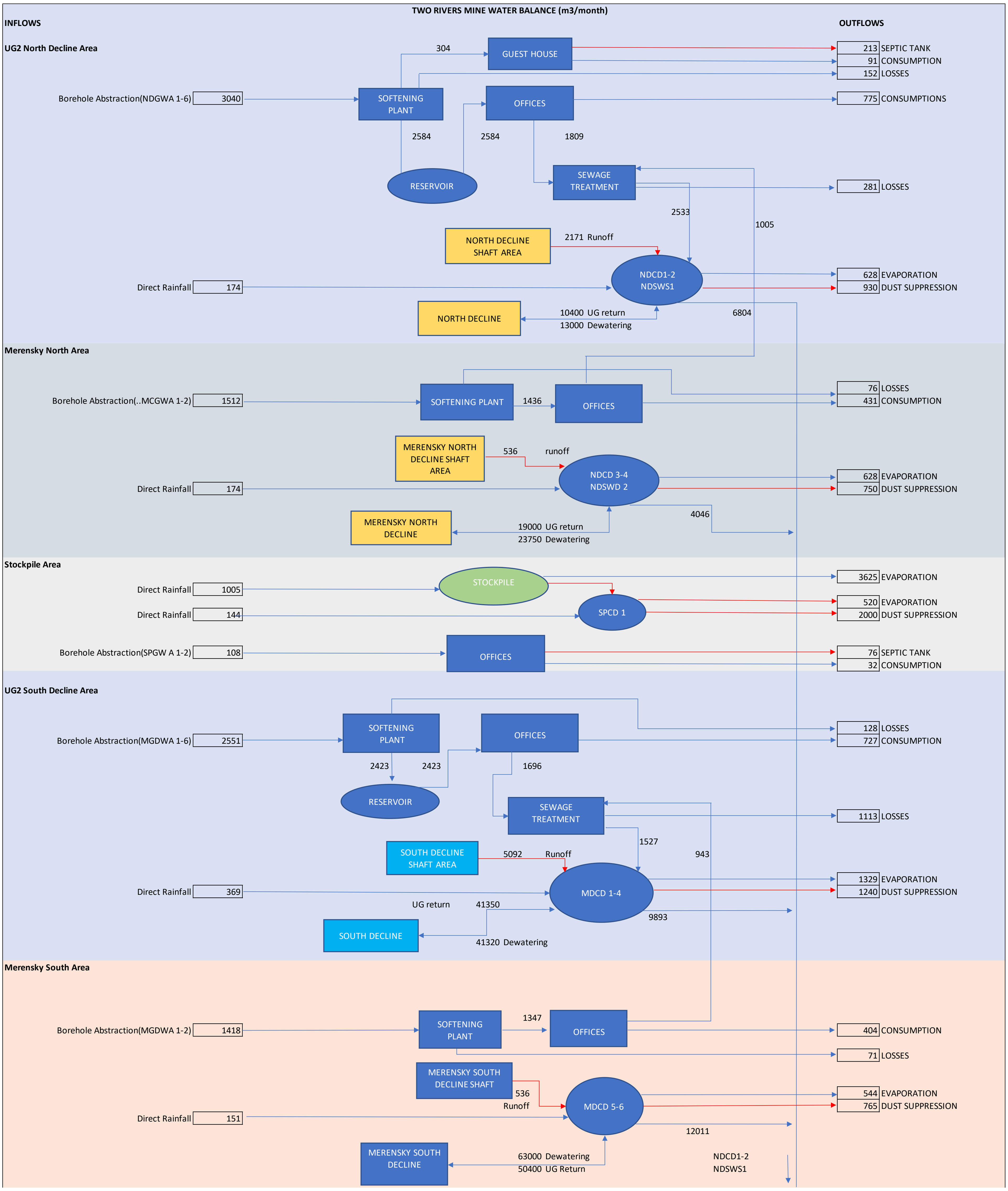
Reef Stockpile

- The ROM stockpile receives Ore from underground and then delivers to the plant.

The water and salt balance has been compiled for a mean rainfall year and the site specific rainfall data provided by TRP was used to calculate the average rainfall and runoff volumes for various components of the mine, whilst the evaporation was derived from the WRC2015 manual.

Similar to the 2019 salt balance, measured Total Dissolved Salts (TDS) concentration for the various facilities on the mine were used to compile the salt balance except on the sewage water quality results which did not have TDS results, and therefore Ammonia was used for all the sewage salt load calculations.

The monthly average water balance is shown in Figure 5-1, while the salt balance is presented in Figure 5-2.


TWO RIVERS MINE WATER BALANCE (m3/month)
INFLOWS
OUTFLOWS
UG2 North Decline Area
Borehole Abstraction(NDGWA 1-6) 3040
SOFTENING PLANT
304
GUEST HOUSE
OFFICES
2584
2584
1809
RESERVOIR
SEWAGE TREATMENT
2533
1005
NORTH DECLINE SHAFT AREA
2171 Runoff
Direct Rainfall 174
NDCD1-2 NDSWS1
NORTH DECLINE
10400 UG return
13000 Dewatering
6804
213 SEPTIC TANK
91 CONSUMPTION
152 LOSSES
775 CONSUMPTIONS
281 LOSSES
628 EVAPORATION
930 DUST SUPPRESSION
Merensky North Area
Borehole Abstraction(..MCGWA 1-2) 1512
SOFTENING PLANT
1436
OFFICES
MERENSKY NORTH DECLINE SHAFT AREA
536 runoff
Direct Rainfall 174
NDCD 3-4 NDSWD 2
MERENSKY NORTH DECLINE
19000 UG return
23750 Dewatering
4046
76 LOSSES
431 CONSUMPTION
628 EVAPORATION
750 DUST SUPPRESSION
Stockpile Area
Direct Rainfall 1005
STOCKPILE
Direct Rainfall 144
SPCD 1
Borehole Abstraction(SPGW A 1-2) 108
OFFICES
3625 EVAPORATION
520 EVAPORATION
2000 DUST SUPPRESSION
76 SEPTIC TANK
32 CONSUMPTION
UG2 South Decline Area
Borehole Abstraction(MGDWA 1-6) 2551
SOFTENING PLANT
OFFICES
2423
2423
1696
RESERVOIR
SEWAGE TREATMENT
1527
943
SOUTH DECLINE SHAFT AREA
5092 Runoff
Direct Rainfall 369
MDCD 1-4
UG return 41350
9893
SOUTH DECLINE
41320 Dewatering
128 LOSSES
727 CONSUMPTION
1113 LOSSES
1329 EVAPORATION
1240 DUST SUPPRESSION
Merensky South Area
Borehole Abstraction(MGDWA 1-2) 1418
SOFTENING PLANT
1347
OFFICES
MERENSKY SOUTH DECLINE SHAFT
536 Runoff
Direct Rainfall 151
MDCD 5-6
12011
MERENSKY SOUTH DECLINE
63000 Dewatering
50400 UG Return
NDCD1-2 NDSWS1
404 CONSUMPTION
71 LOSSES
544 EVAPORATION
765 DUST SUPPRESSION

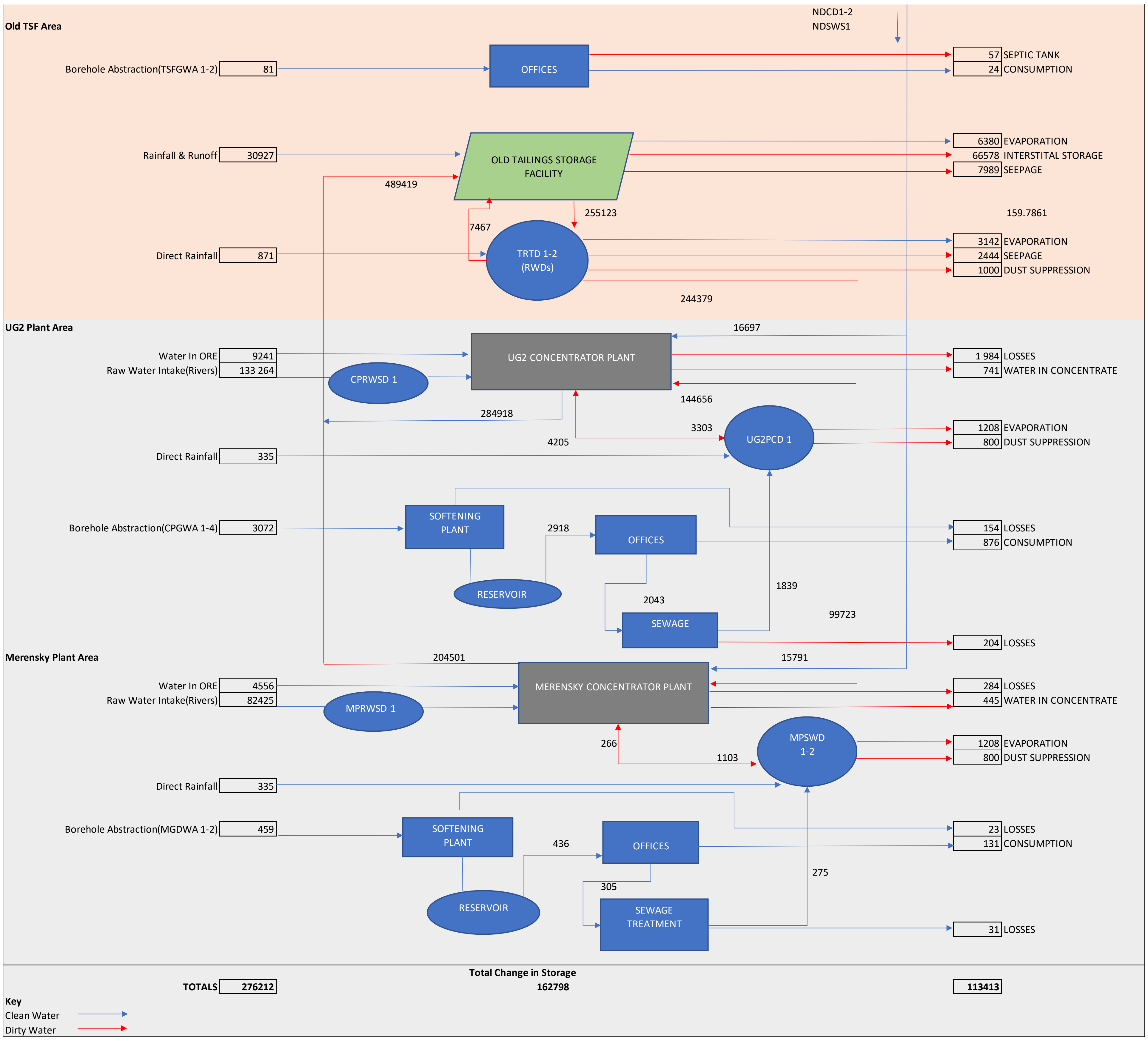
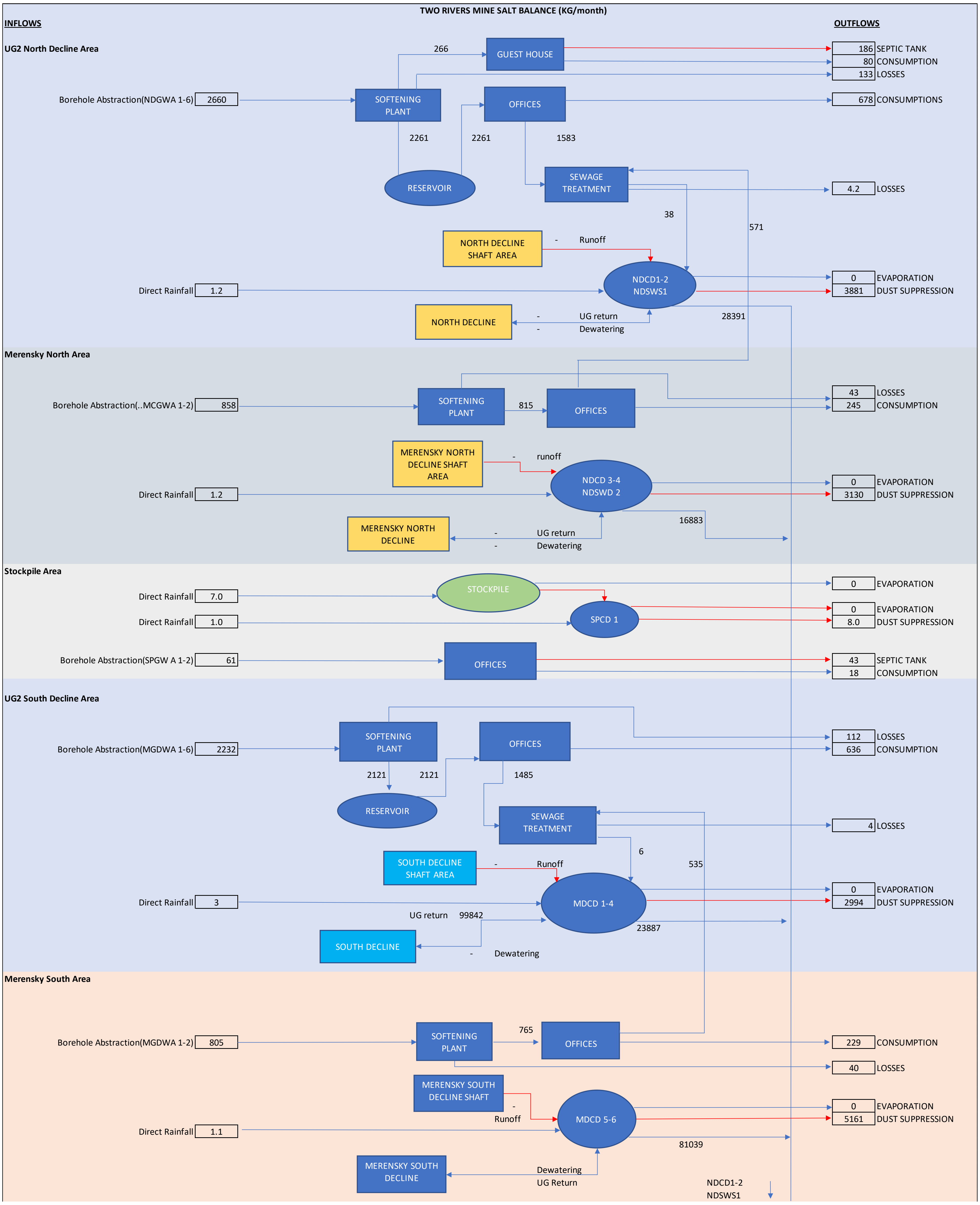


Figure 5-1: TRP Monthly Average Water Balance


TWO RIVERS MINE SALT BALANCE (KG/month)
INFLOWS
OUTFLOWS
UG2 North Decline Area
Borehole Abstraction(NDGWA 1-6) 2660
SOFTENING PLANT
GUEST HOUSE
OFFICES
RESERVOIR
SEWAGE TREATMENT
NORTH DECLINE SHAFT AREA
NDCD1-2 NDSWS1
NORTH DECLINE
Direct Rainfall 1.2
266
2261
2261
1583
38
571
Runoff
UG return
Dewatering
28391
186 SEPTIC TANK
80 CONSUMPTION
133 LOSSES
678 CONSUMPTIONS
4.2 LOSSES
0 EVAPORATION
3881 DUST SUPPRESSION
Merensky North Area
Borehole Abstraction(..MCGWA 1-2) 858
SOFTENING PLANT
815
OFFICES
MERENSKY NORTH DECLINE SHAFT AREA
runoff
NDCD 3-4 NDSWD 2
Direct Rainfall 1.2
MERENSKY NORTH DECLINE
UG return
Dewatering
16883
43 LOSSES
245 CONSUMPTION
0 EVAPORATION
3130 DUST SUPPRESSION
Stockpile Area
Direct Rainfall 7.0
Direct Rainfall 1.0
Borehole Abstraction(SPGW A 1-2) 61
STOCKPILE
SPCD 1
OFFICES
0 EVAPORATION
0 EVAPORATION
8.0 DUST SUPPRESSION
43 SEPTIC TANK
18 CONSUMPTION
UG2 South Decline Area
Borehole Abstraction(MGDWA 1-6) 2232
SOFTENING PLANT
OFFICES
2121
2121
1485
RESERVOIR
SEWAGE TREATMENT
SOUTH DECLINE SHAFT AREA
Runoff
6
535
MDCD 1-4
Direct Rainfall 3
UG return 99842
23887
SOUTH DECLINE
Dewatering
112 LOSSES
636 CONSUMPTION
4 LOSSES
0 EVAPORATION
2994 DUST SUPPRESSION
Merensky South Area
Borehole Abstraction(MGDWA 1-2) 805
SOFTENING PLANT
765
OFFICES
MERENSKY SOUTH DECLINE SHAFT
Runoff
MDCD 5-6
Direct Rainfall 1.1
81039
MERENSKY SOUTH DECLINE
Dewatering
UG Return
NDCD1-2 NDSWS1
229 CONSUMPTION
40 LOSSES
0 EVAPORATION
5161 DUST SUPPRESSION

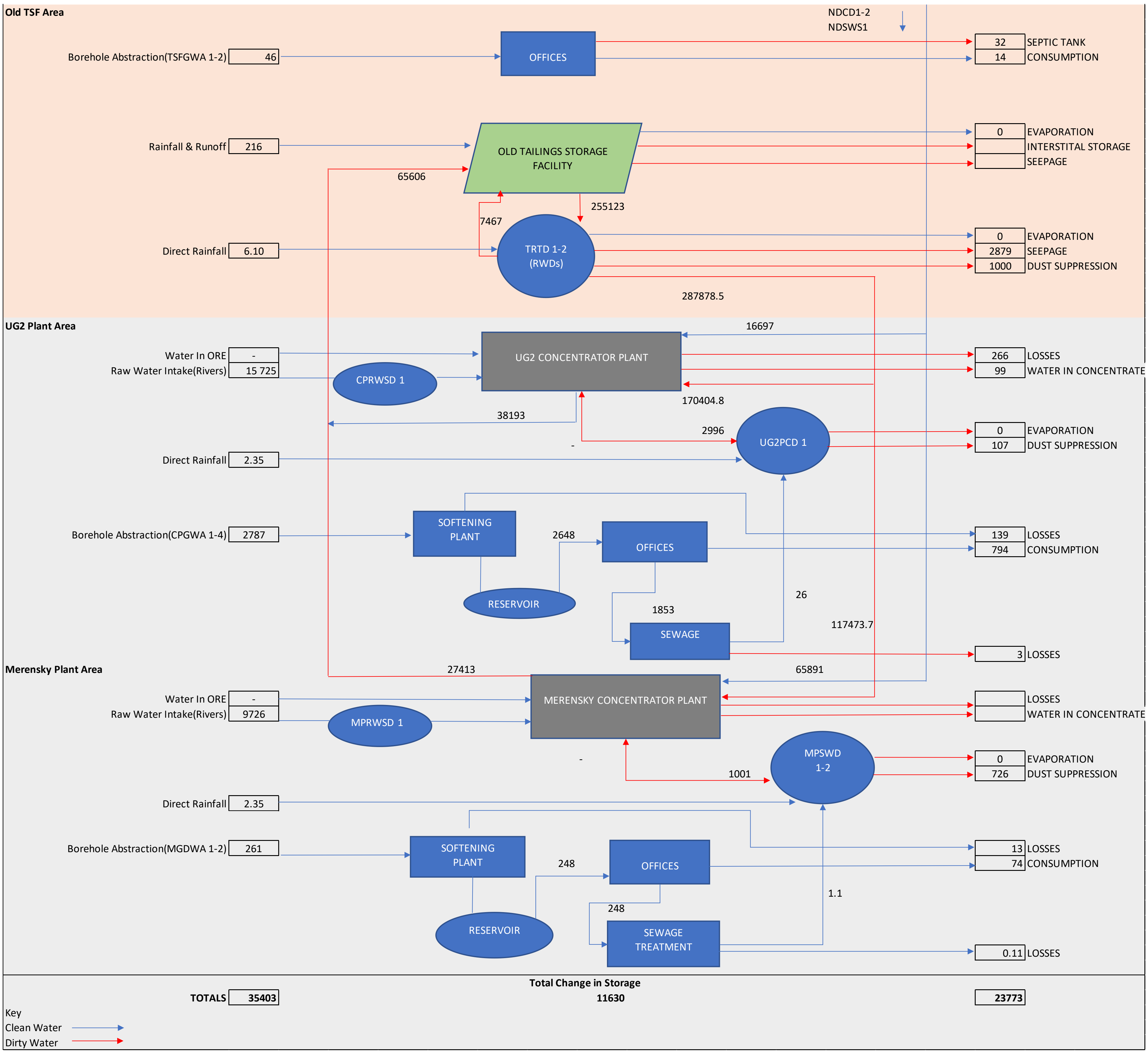


Figure 5-2: TRP Monthly Average Salt Balance

6. References

DWA. (2006). Best practice guidelines for water resources protection in the South African mining industry. BPG G2: Water and Salt Balance. Pretoria: DWA.

Golder Associates Africa (Pty) Ltd. (Golder). 2019 Two Rivers Platinum Mine – Integrated Water and Waste Management Plan

Groundwater Consulting Services (Pty) Ltd (GCS). 2012. Two Rivers Platinum Mine – Hydrological

Golder Associates Africa Pty Ltd (Golder). 2016. Numerical Groundwater Flow and Transport Model Update. Report refence: 1547552-303044-4). Dated: May 2016.

Golder Associates Africa Pty Ltd (Golder). 2019. Two Rivers Platinum Environmental Assistance for

2018/2019: Storm Water Management Plan Update. Draft Report reference: 18100343. Dated: January 2019

WRC. (2015). *Water resources of South Africa 2012 study.* Pretoria: Water Research Commission.

DIGBY WELLS
ENVIRONMENTAL