

Summary of Amendment Change to Infrastructure (November 2023)

Minor amendments to the approved 2021 RDI17-001 – Mount Morgan Mine Site as follows:

- Item 1:** Construct and operation of a modular Pilot Water Treatment Plant adjacent to the approved new mine lease access road from Gordon Lane;
- Item 2:** Relocate from the Process Plant location to the above mine lease access road location - construction of an Administration, Security and Laboratory building;
- Item 3:** Relocate from the mine lease access road to the Administration, Security and Laboratory building a Carpark;
- Item 4:** Upgrade an existing internal former Mine Haul Road and light vehicle access road north of the Open Cut Pit;
- Item 5:** Civil works to prepare a Workshop & Maintenance Area adjacent to the above Mine Haul Road on the north of the Open Cut Pit. These facilities were previously planned for within the Process Plant location.

Reason for Amending the Infrastructure Locations

- Item 1:** To test in a Pilot Water Treatment Plant an innovative water treatment process that may assist in the long-term management of Acid Mine Drainage at the Mount Morgan Mine Site.
- Item 2:** Administration, Security and Laboratory building was previously located within the Process Plant location as approved in the 2021 RPI17-001 Priority Living Area amendment. Relocation adjacent to the mine lease access road will provide a safer operating environment by removing the need for administration and laboratory staff to interact with the Process Plant.
- Item 3:** Relocating the visitor, staff and workers Carpark to the same location as Administration, Security and Laboratory building area will improve site safety and security. The relocated Carpark is further from the carpark location previously approved in the 2021 RPI17-001 Priority Living Area amendment.
- Item 4:** A Mine Haul Road to the north of the Open Cut Pit reduces impact to heritage listed features south of the Open Cut Pit and is further removed from the community.
- Item 5:** Workshop & Maintenance Area reduces impact within the heritage listed area and is located further from community view and any potential impact.

Heritage Minerals believes that the infrastructure amendments as listed (Items 1 to 5) can operate within the conditions approved in the RDIA permit RPI17/001 issued to Heritage Minerals in September 2021 as follows:

AMENDED REGIONAL INTERESTS DEVELOPMENT APPROVAL February 2023 (RIDA)

RPI17/001 *Heritage Minerals* – Mount Morgan Mine Project

(Given under the *Regional Planning Interests Act 2014* section 53)

Description of the land

Real property description: Refer to **Attachment A**
Local Government Area: Rockhampton Regional Council

Approved activities

The approved activities are set out in Table 1 of **Attachment 1**.

Definitions of the resource activities are included in Table 2 of **Attachment 1**.

This development approval authorises impacts on a Priority Living Area (PLA) by the approved activities.

General Advice

It is the applicants' responsibility prior to works commencing on site to ensure all relevant approvals and licenses are obtained from the applicable Local, State, and/or Federal Authorities. This includes but not limited to approvals required under *Nature Conservation Act, 1992*; *Aboriginal Cultural Heritage Act, 2003* and *Environmental Protection and Biodiversity Conservation Act, 1999*.

Regional interests conditions

A person who is the holder of, or is acting under, this RIDA must not contravene a condition of this approval.

Condition number	Condition	Timing for condition
1.	Carry out the approved activity generally in accordance with: a) The activities identified in Table 1: Approved activities (refer Attachment 1) b) The activities defined in Table 2: Definitions of Activities (refer Attachment 1) c) The locations as shown on approved plan:	At all times.
	<ul style="list-style-type: none"><i>Heritage Minerals</i> by Lot and Plan (<i>Amended</i>), dated <i>March 2023</i> (refer Attachment 2).	

2.	<p>a) All complaints received, and resulting actions taken, about the impact of the approved activities on the attributes of the PLA must be recorded. The record must include:</p> <ul style="list-style-type: none"> i) name, address and contact number of the complainant ii) time and date of complaint iii) reasons for the complaint iv) investigations undertaken v) conclusions formed vi) actions taken to resolve the complaint vii) any abatement measures implemented viii) person responsible for resolving the complaint. <p>b) The records of any complaints received and recorded in accordance with this condition must be provided to the chief executive at RPIAct@dsdilgp.qld.gov.au and quoting RPI17- 001.</p>	<p>(a) At all times.</p> <p>(b) Within three business days of receipt of a complaint.</p>
3.	A full copy of the regional interest development approval must be kept on-site and available to any person(s).	At all times.
4.	<p>Carry out the following works:</p> <ul style="list-style-type: none"> a) Sealing of the internal road from the property boundary access for a distance of 350m along the internal haul access road; b) Construction of mine access, signage, and widening works to a BAR/BAL standard on Gordon Lane, generally in accordance with McMurtrie Consulting Engineering Drawing 1021617-1009 Rev A dated 13/04/2017; 	Prior to commencement of any haulage from the site.
	<ul style="list-style-type: none"> c) Alteration of line marking at the intersection of Gordon Lane / Burnett Highway generally in accordance with the McMurtrie Consulting Engineering Drawing Number 1021617-5002 Rev A dated 13/04/2017; d) Road widening and sealing at the north eastern corner of the intersection of Burnett Highway / Creek Street / Razorback Road to facilitate right turn movements out of Creek St / Razorback Road, generally in accordance with McMurtrie Consulting Engineers Drawing Number 1021617-7002 Rev A dated 13/04/2017. 	
5.	Provide written notification to Rockhampton Regional Council at enquiries@rrc.qld.gov.au (and quoting RPI17-001, application D8-2017) when the transportation of material extracted from the site is to commence.	Prior to commencement of any haulage from the site.

6.	<p>Provide documentation to Rockhampton Regional Council (such as weigh bridge statements or similar) verifying the quantity of material that is extracted and transported from the site. The information is to be provided to Rockhampton Regional Council at enquiries@rrc.qld.gov.au and quoting RPI17-001, application D8-2017.</p>	<p>First day of every sixth month period of the mine operations, from the commencement of the haulage operations until the haulage operations cease.</p>
7.	<p>Pay a monetary contribution to Rockhampton Regional Council (quoting RPI17-001, application D8-2017) towards increased maintenance and rehabilitation of the local government road network within the PLA at a rate of \$0.433 \$0.0523 per tonne of material hauled on the local road network in accordance with the Amended Traffic Impact Assessment (Rev A) by McMurtrie Consulting Engineers dated 21 May 2021.</p> <p>Note: This monetary contribution shall be indexed based on the Road and Bridge Construction Index, Queensland – Class 3101, published quarterly by the Australian Bureau of Statistics (ABS Cat No. 6427, Series ID A2333727L) to the date of payment.</p>	<p>First day of every sixth month period of the mine operations, from the commencement of the haulage operations until the haulage operations cease.</p>
8.	<p>Provide documentation to Department of Transport and Main Roads (such as weigh bridge statements or similar) verifying the quantity of material that is extracted and transported from the site (and onto the state-controlled road network). The information is to be provided to Transport and Main Roads at fitzroydistrict@tmr.qld.gov.au and quoting RPI17-001, reference number TMR20-031707.</p>	<p>First day of every <i>sixth twelfth</i> month period of the mine operations, from the commencement of the haulage operations until the haulage operations cease.</p>
9.	<p>Pay a monetary contribution to the Department of Transport and Main Roads (contact fitzroydistrict@tmr.qld.gov.au and quoting RPI17-001, reference number TMR20-031707) towards increased maintenance and rehabilitation of the State-controlled Road network within the PLA at a rate of:</p> <ul style="list-style-type: none"> • \$10,273.00 (once off); and • \$4,342.00 per annum thereafter. <p>Note: This monetary contribution shall be indexed based on the Road and Bridge Construction Index, Queensland – Class 3101, published quarterly by the Australian Bureau of Statistics (ABS Cat No. 6427, Series ID A2333727L) to the date of payment.</p>	<p>First day of every sixth twelfth month period of the mine operations, from the commencement of the haulage operations until the haulage operations cease.</p>

10	There must be no worsening to the water quantity and quality coming out of the mine site post development compared to that of the pre-development scenario in accordance with the Environmental Authority Amendment approval.	At all times.
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Attachment A: Description of subject land

Part of Lot 107 on CP881492 - Private Rolling Term Lease (S C Larson and T A Larson);
Part of Gordon Lane (D) – Rockhampton Regional Council;
Lot 1 on MPH11169 - Rockhampton Regional Council;
Part of Lot 203 on RN1556 (A, B, C, D and E) - Rockhampton Regional Council;
Part of USL Meinberg Crossing Dee River – State of Queensland;
Part of USL Mundic Creek - State of Queensland;
Part of USL Shepherd Gully - State of Queensland;
Part of USL Dee River - State of Queensland;
Part of Lot 1 on RP860374 (includes off lease haul route) - State of Queensland;
Lot 3 on RP601353 - State of Queensland;
Lot 3912 on MPH10386 - State of Queensland;
Lot 1 on MPH10729 - State of Queensland;
Part of Lot 1 on MPH10396 - State of Queensland;
Lot 1 on MPH10479 - State of Queensland;
Part of Lot 1 on MPH10827 - State of Queensland;
Lot 1 on MPH10850 - State of Queensland;
Part of Lot 1 on MPH10966 - State of Queensland;
Lot 1 on MPH11057 - State of Queensland;
Lot 2 on MPH11057 - State of Queensland;
Lot 1 on MPH11115 - State of Queensland;
Part of Lot 1 on MPH11627 - State of Queensland;
Part of Lot 1 on MPH11642 - State of Queensland;
Lot 1 on MPH11780 - State of Queensland;
Part of Lot 1 on MPH12108 - State of Queensland;
Lot 1 on MPH12202 - State of Queensland;
Lot 1 on MPH25348 - State of Queensland;
Lot 1 on MPH25461 - State of Queensland;
Part of Lot 1 on MPH25473 - State of Queensland;
Lot 1 on MPH25494 - State of Queensland;
Part of Lot 102 on USL42977 - State of Queensland;
Part of Lot 3 on USL42977 - State of Queensland;
Part of Lot 103 on USL42977 (A, B, C) - State of Queensland;
Lot 118 on USL42984 - State of Queensland;
Lot 1197 on MPH25518 - State of Queensland;
Part of Lot 12 on USL47036 (replaced as Lot 101 on SP139776) - State of Queensland;
Lot 1341 on MPH25518 - State of Queensland;
Lot 1342 on MPH25518 - State of Queensland;
Lot 1463 on MPH10760 - State of Queensland;
Lot 17 on USL42984 - State of Queensland;
Lot 2 on MPH10850 - State of Queensland;
Lot 2 on MPH11057 - State of Queensland;
Lot 1 on MPH11057 - State of Queensland;
Part of Lot 2 on MPH25461 - State of Queensland
Part of Lot 2452 on MPH11067 - State of Queensland;

Lot 3273 on MPH11435 - State of Queensland;
 Lot 3274 on MPH11435 - State of Queensland;
 Part of Lot 3275 on MPH11435 - State of Queensland;
 Part of Lot 3276 on MPH11435 - State of Queensland;
 Lot 3469 on MPH11435 - State of Queensland;
 Part of Lot 5164 on MPH10386 - State of Queensland;
 Lot 3912 on MPH10386 - State of Queensland;
 Lot 6 on USL42977 - State of Queensland;
 Lot 69 on USL42977 - State of Queensland;
 Lot 60 on USL42977 - State of Queensland;
 Lot 63 on USL42977 - State of Queensland;
 Lot 64 on USL42977 - State of Queensland;
 Lot 65 on USL42977 - State of Queensland;
 Lot 66 on USL42977 - State of Queensland;
 Lot 67 on USL42977 - State of Queensland;
 Lot 68 on USL42977 - State of Queensland;
 Lot 77 on USL42977 - State of Queensland;
 Part Lot 90 on P42319 - State of Queensland;
 Part Lot 19 on RP602104 - State of Queensland;
 Part Lot 18 on RP602104 - State of Queensland;
 Part Lot 17 on RP602104 - State of Queensland;
 Part Easement A in Lot 203 on RN1556 on SP164788 – Telstra Corporation Ltd on State land and Rockhampton Regional Council land;
 Easement B in Lot 1 on RP860374 - Telstra Corporation Ltd on State

Attachment 1

Table 1: Approved activities – all within the Priority Living Area

Activity Type Number	Real Property Identification	Proposed Resource Activity by Lot	Within Mining Lease Number	PLA Impacted Land Area (hectares)
1	Lot 107 on CP881492	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589, 5633, 5634	43
1	Lot 69 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589	0.11
1	Lot 60 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589	0.1
1	Lot 63 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5649	0.225
1	Lot 64 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5649	0.387

1	Lot 65 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5649	0.09
1	Lot 66 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5649	0.875
1	Lot 67 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5649	0.095
1	Lot 68 on USL42977	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5649	0.09
1	Lot 90 on P42319	<ul style="list-style-type: none"> • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589	17.5
2	Lot 1 on RP860374 (include off lease haul route)	<ul style="list-style-type: none"> • Mine Haul Road • Mine Access Road • Mining resource for extraction • Rehabilitation • Possible future exploration • Process Plant • Administration, Security and Laboratory building • Pilot Water Treatment Plant 	5613, 5614, 5659, 5660, 5589	110.4
3	Lot 12 on USL47036 (replaced by Lot 101 on SP139776)	<ul style="list-style-type: none"> • Mine Haul Road • Mining resource for extraction • Rehabilitation • Possible future exploration • Tailings storage facility, • Workshop & Maintenance Area 	5589, 5608, 5609, 5612, 5615, 5616, 5617, 5618, 5619, 6521, 5622, 5623, 5624, 5625, 5626, 5627, 5628, 5633, 5634, 5635, 5648, 5649, 5658, 6692	333.3
4	Lot 3 on RP601353	<ul style="list-style-type: none"> • Mine Haul Road • Mining resource for extraction • Rehabilitation • Possible future exploration • Tailings storage facility, 	5613, 5614, 5659, 5660	34
5	Lot 1 on MPH 10729	<ul style="list-style-type: none"> • Mine Haul Road • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589	0.782
5	Lot 2 on MPH11057	<ul style="list-style-type: none"> • Mine Haul Road • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589	0.45
5	Lot 1 on MPH11057	<ul style="list-style-type: none"> • Mine Haul Road • Mining resource for extraction 	5590	0.68

		<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 		
5	Lot 103 on USL42977 (A,B,C)	<ul style="list-style-type: none"> • Mine Haul Road • Mining resource for extraction • Rehabilitation • Possible future exploration 	5589, 5628	3.01
6	Lot 1 on MPH10479	<ul style="list-style-type: none"> • Mine Haul Road • Rehabilitation • Possible future exploration 	5589	1.214
6	Lot 1 on MPH10850	<ul style="list-style-type: none"> • Mine Haul Road • Rehabilitation • Possible future exploration 	5589	0.622
6	Lot 77 on USL42977	<ul style="list-style-type: none"> • Mine Haul Road • Rehabilitation • Possible future exploration 	5589, 5628	1.12
6	Lot 3 on USL42977	<ul style="list-style-type: none"> • Mine Haul Road • Rehabilitation • Possible future exploration 	5589	0.401
7	Lot 203 on RN1556 (A,B,C, D, E)	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5620, 5635, 5660	35
7	USL Meyenberg Crossing Dee River	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	7.72
7	USL Mundic Creek	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	
7	USL Shepherd Gully	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	
7	USL Dee River	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5602	
7	Lot 1 on MPH10396	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.32
7	Lot 1 on MPH10827	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.38
7	Lot 1 on MPH10966	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.26
7	Lot 1 on MPH11115	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.42

7	Lot 1 on MPH11627	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.43
7	Lot 1 on MPH11642	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	1.1
7	Lot 1 on MPH11780	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.4
7	Lot 1 on MPH12108	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5602	0.14
7	Lot 1 on MPH12202	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	2.023
7	Lot 1 on MPH25348	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.202
7	Lot 1 on MPH25461	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.405
7	Lot 1 on MPH25473	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.26
7	Lot 1 on MPH25494	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.463
7	Lot 102 on USL42977	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.21
7	Lot 118 on USL42948	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5620	0.986
7	Lot 17 on USL42984	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5620	0.99
7	Lot 2 on MPH10850	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.66
7	Lot 2 on MPH25461	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.13
7	Lot 6 on USL42977	<ul style="list-style-type: none"> • Rehabilitation • Possible future exploration 	5589	0.11
8	Gordon Lane (D)	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.09
8	Lot 1197 on MPH25518	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.197
8	Lot 1341 on MPH25518	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.202
8	Lot 1342 on MPH25518	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.202
8	Lot 1463 on MPH10760	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.164
8	Lot 2452 on MPH11067	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.11

8	Lot 3273 on MPH11435	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.341
8	Lot 3274 on MPH11435	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.341
8	Lot 3275 on MPH11435	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.33
8	Lot 3276 on MPH11435	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.1
8	Lot 3469 on MPH11435	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.24
8	Lot 5164 on MPH10386	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.012
8	Lot 3192 on MPH10386	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.012
8	Lot18 on RP602104	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5660	0.1
8	Lot17 on RP602104	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5660	0.036
8	Lot 1 on MPH11169	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620	0.14
8	Lot19 on RP602104	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5660	0.1
9	Easement A in Lot 203 on RN1556 on SP164788	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5620, 5635, 5660	2.03
9	Easement B in Lot 1 on RP860374	<ul style="list-style-type: none"> • <u>Inside mining lease but outside any location of current or future impact</u> 	5635	0.08
TOTAL	605.887			605.887

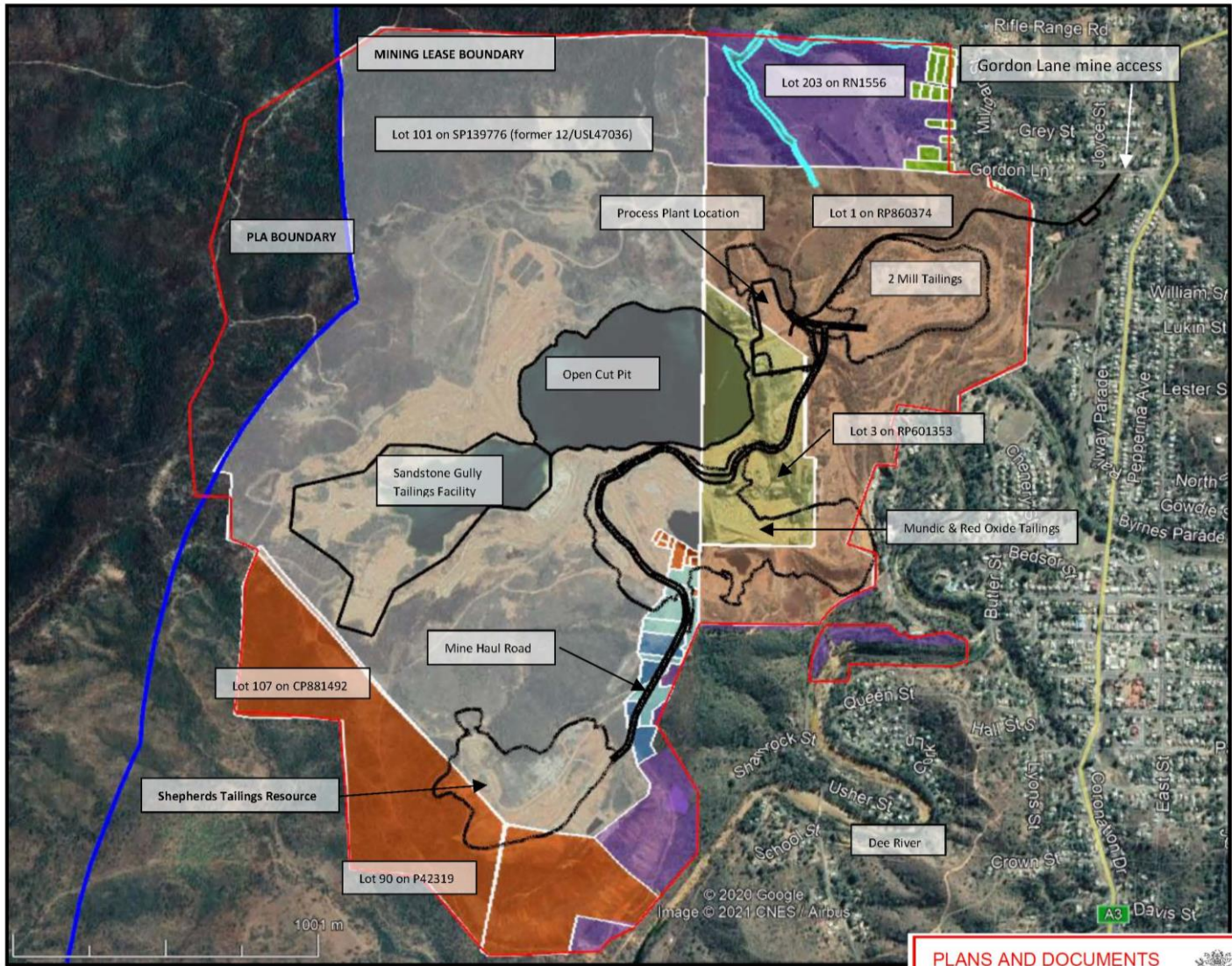
Activity Type by Number (reference to Plan HERITAGE MINERALS ACTIVITY BY LOT AND PLAN - AMENDED)	
1	MINING RESOURCE FOR EXTRACTION, REHABILITATION, POSSIBLE FUTURE EXPLORATION
2	MINE HAUL ROAD, PILOT WATER TREATMENT PLANT MINE LEASE ACCESS ROAD MINING RESOURCE FOR EXTRACTION, REHABILITATION, POSSIBLE FUTURE EXPLORATION, PROCESSING PLANT

3	MINE HAUL ROAD MINING RESOURCE FOR EXTRACTION, REHABILITATION, TAILINGS STORAGE FACILITY, POSSIBLE FUTURE EXPLORATION
4	MINE HAUL ROAD MINING RESOURCE FOR EXTRACTION, REHABILITATION, POSSIBLE FUTURE EXPLORATION, PROCESSING PLANT, ADMINISTRATION, SECURITY AND LABORATORY BUILDING
5	MINE HAUL ROAD MINING RESOURCE FOR EXTRACTION, POSSIBLE FUTURE EXPLORATION REHABILITATION
6	MINE HAUL ROAD POSSIBLE FUTURE EXPLORATION REHABILITATION
7	POSSIBLE FUTURE EXPLORATION REHABILITATION
8	INSIDE MINING LEASE BUT OUTSIDE ANY LOCATION OF CURRENT OR FUTURE IMPACT
9	EASEMENT

Attachment 1 - Table 2: Definitions

Resource activity	Definition
<u>Mining resource for extraction</u>	A Mineral Resource that has been sufficiently defined to be incorporated into a mine plan for extraction – Ore Reserve (refer to the definitions for ‘Mineral Resource’ and ‘Ore Reserve’ in the <i>Australasian Code for Reporting of exploration Results, mineral Reserves and Ore Reserves 2012 – JORC Code Australasian Institute of Mining and Metallurgy</i>) and specifically, gold, and copper concentrate for sale.
<u>Rehabilitation</u>	Post mining, land is to be rehabilitated in accordance with the Environmental Authority conditions governing the operation.
<u>Possible future exploration</u>	Exploration activity using standard industry methods may be required in the future to determine if additional mineral resources are present.
<u>Process Plant</u>	The processing of extracted mineral resource using standard industry techniques to recover gold, and copper sulphide for sale.
<u>Mine Haul Road</u>	The haulage route for transporting extracted resource to the Process Plant by trucking.
<u>Tailings storage facility</u>	The containment facility to store reject material from the Process Plant in accordance with the Environmental Authority conditions.
<u>Administration, Security and Laboratory building</u>	Administration building, laboratory building, security facility, carpark, workshop
<u>Pilot Water Treatment Plant</u>	Mineral processing by water treatment to recover mixed metal oxides and metal pyrophosphate compounds for sale – See attached Pilot Water Treatment Plant Detail for more specific information
<u>Workshop & Maintenance Area</u>	Mining equipment park-up
<u>Carpark</u>	Carpark adjacent the Administration, Security and Laboratory building - asphalted
<u>Mine lease access road</u>	The road that comes into the mine leases off Gordan Lane

Attachment 2: 2021 Approved plans and specifications



Heritage Minerals resource activity footprint (May 2021)

PLANS AND DOCUMENTS referred to in the RIDA

RIDA ref: RP117/001

Date: 28 September 2021



- 1. Mining resource for extraction, rehabilitation and possible future exploration

Lot and Plan: 101/CP881492, 69/USL42977, 60/USL42977, 63/USL42977, 64/USL42977, 65/USL42977, 66/USL42977, 67/USL42977, 68/USL42977, 90/P42319
- 2. Mineral processing, haul road, mining resource for extraction, possible future expln, rehabilitation, tailings storage facility

Lot 1 on Plan RP860374
- 3. Mining resource, mine haul road, rehabilitation, future exploration, tailings storage

101/SP139776 (former 12/USL47036 in PLA)
- 4. Mine haul road, process plant, mining resource for extraction, possible future expln, rehabilitation, tailings storage

3/RP601353
- 5. Mine haul road, mining resource for extraction, possible future exploration, rehabilitation

1/MPH10729, 2/MPH11057, 1/MPH11057, 103/USL42977 Part A, B, C
- 6. Mine haul road, possible future exploration, rehabilitation

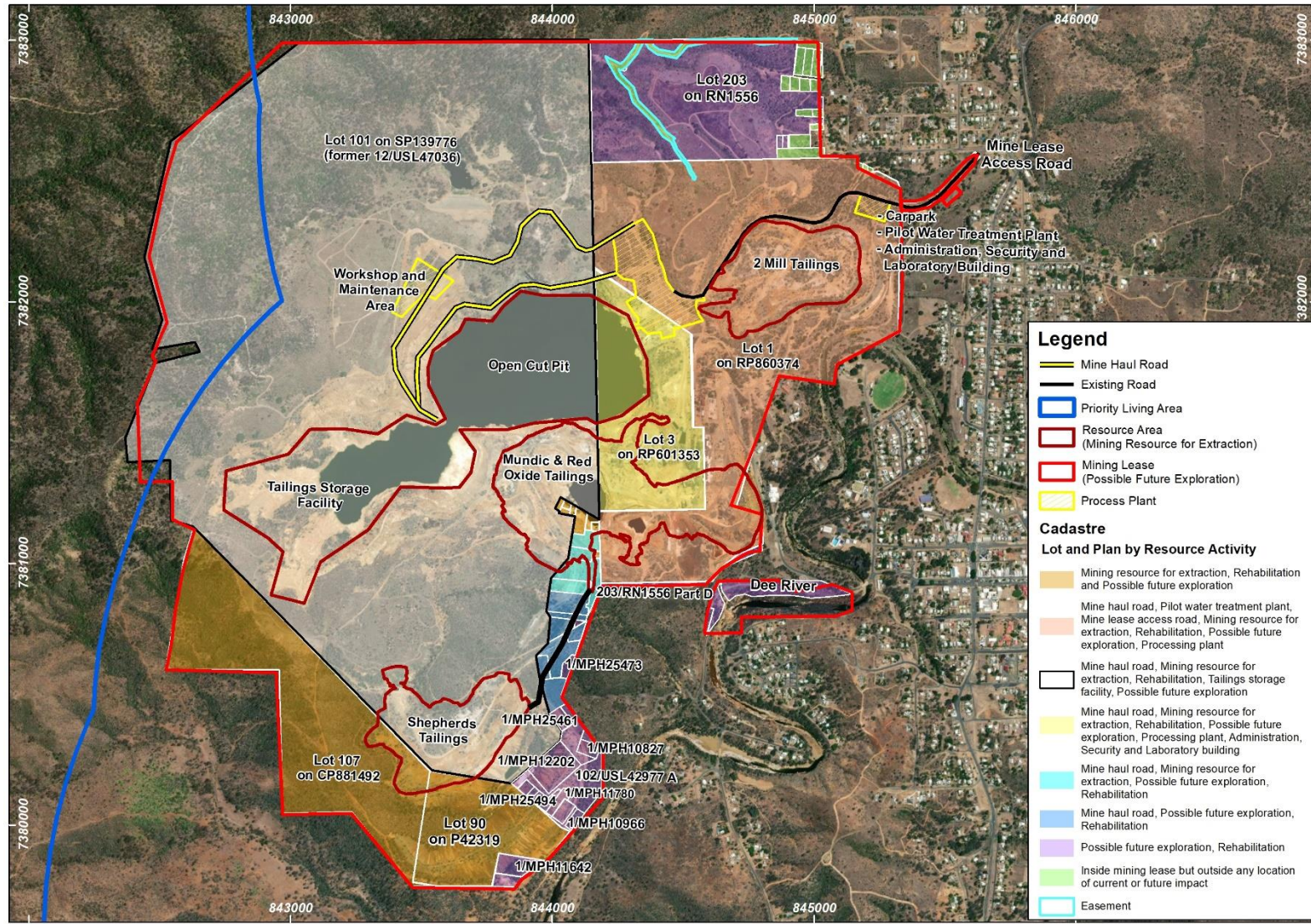
1/MPH10479, 1/MPH10850, 3/USL42977 B, 77/USL42977
- 7. Possible future exploration, rehabilitation

203/RN1556 A,B,C,D,E, Dee River in ML5602, 1/MPH10396, 1/MPH10827, 1/MPH10966, 1/MPH11115, 1/MPH1627, 1/MPH1642, 1/MPH1780, 1/MPH12108, 1/MPH12202, 1/MPH25348, 1/MPH25461,
- 8. Inside mining lease but outside any location of current or future impact

3912/MPH10386, 1197/MPH25518, 1341/MPH25518, 1342/MPH25518, 1463/MPH10760, 2452/MPH1067, 3273/MPH11435, 3274/MPH11435, 3275/MPH11435, 3276/MPH11435, 3469/MPH11435, 5164/MPH10386, 18/RP602104, 17/RP602104, 1/MPH11169, 19/RP602104, Gordon Lane Part D
- 9. Easements

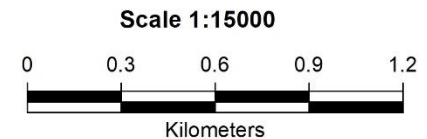
Access A on SP164788 on Lot 203 on RN1556, Access B in Lot 1 on RP860374

Attachment 2: Plans and specifications (2023 Amendment)



MOUNT MORGAN MINE SITE

Heritage Minerals Resource Activity Footprint



Datum: GDA94 Projection: MGA Zone 55

Attachment 3: Pilot Water Treatment Plant

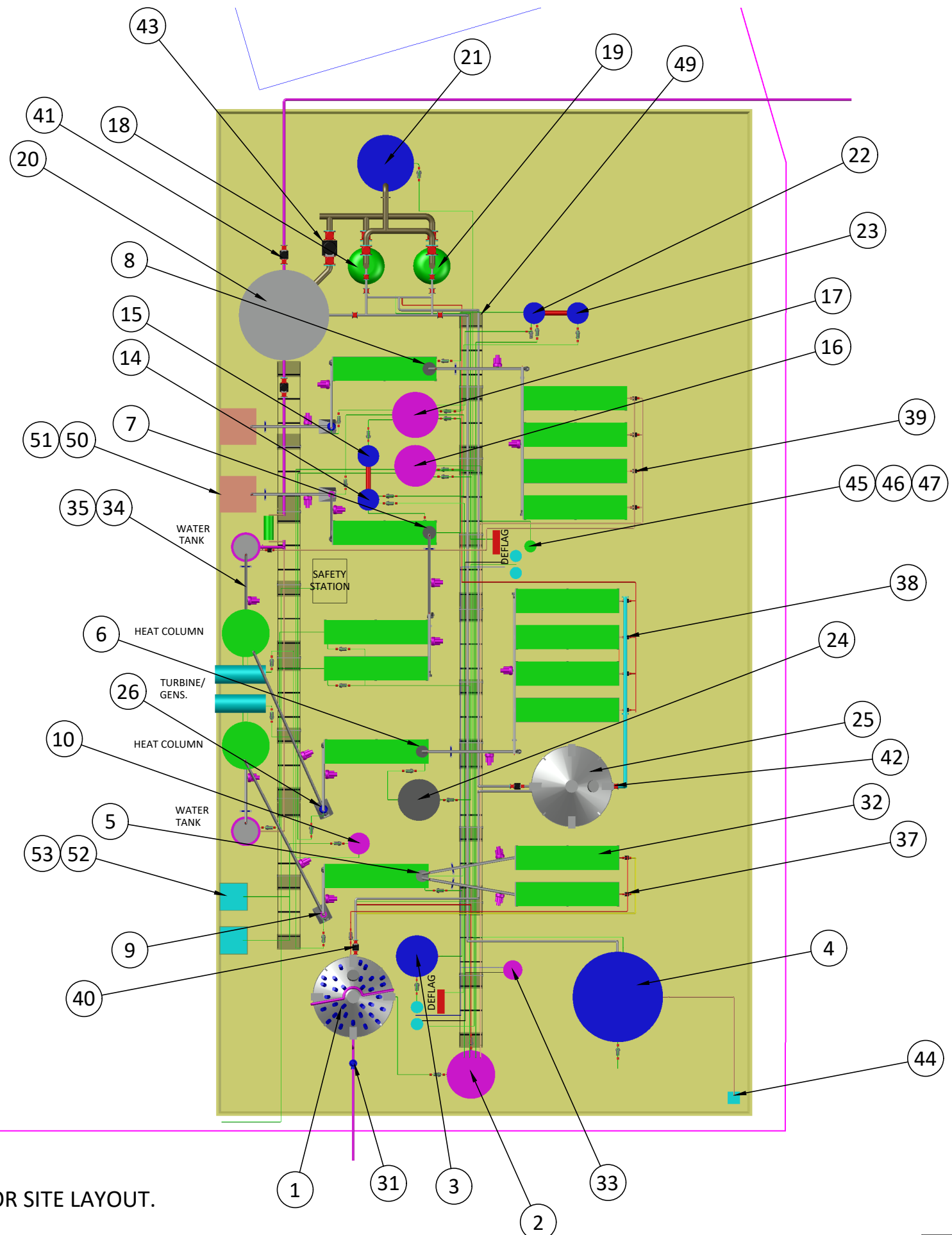


The attached technology sheet provides information on the flow sheet and typical shots of systems that shows tanks in a benign area. Detailed drawings have been provided in the accompanying pages.

Global Aquatica Pilot Water Treatment Plant Details

Note:

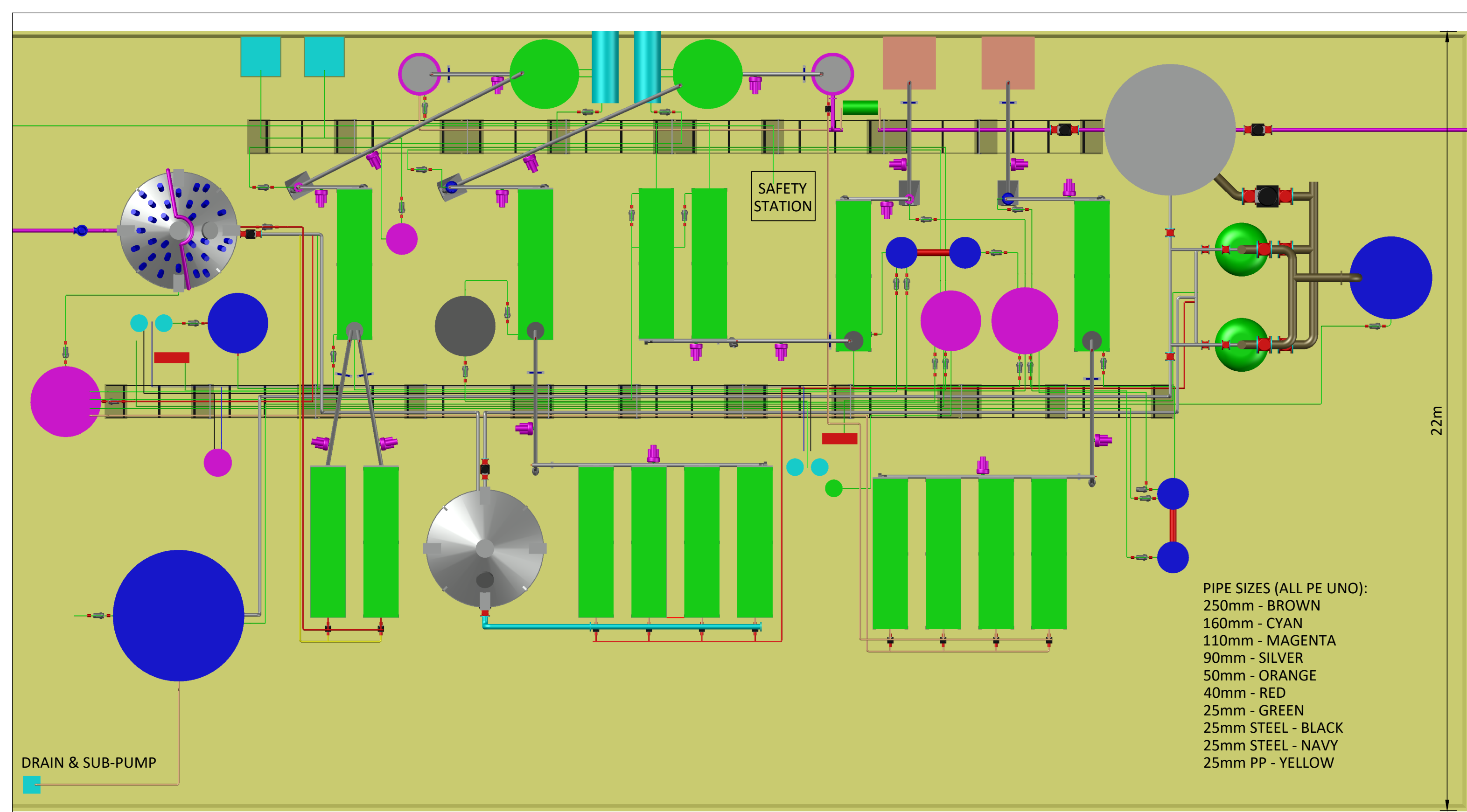
1. Maximum footprint: 41 metres x 22 metres
2. Maximum tank height: 4.5 metres.
 - This is below surrounding tree heights.
 - If deemed to be inadequate after construction, additional vegetation screening will be planted.



ITEM NO.	DESCRIPTION	NO. OFF
1	TANK, 25kL CONICAL, 'ENMACH', REFER SHEET 11	1
2	TANK, Ø1.8 x 2.12m H., SHEET 12	1
3	TANK - POLYETHYLENE, 2300L, Ø1.72m x 1.36m H., SHEET 13	1
4	TANK, 22.5kL ROUND SQUAT, FLAT BASE, 'TEAMPOLY', SHT 14	1
5	TANK, Ø0.50m x 0.70m H., SHEET 15	1
6	TANK, Ø0.50m x 0.70m H., SHEET 16	1
7	TANK, Ø0.56m x 0.85m H., SHEET 17	1
8	TANK, Ø0.56m x 0.85m H., SHEET 18	1
9	TANK, SHEET 19	2
10	TANK, SHEET 20	1
11		
12		
13		
14	TANK, CONDENSOR, Ø0.9m x 2.02m H., SHEET 21	1
15	TANK, CONDENSOR, Ø0.9m x 2.02m H., SHEET 21	1
16	TANK, Ø1.72m x 1.365m H., SHEET 22	1
17	TANK, Ø1.70m x 2.1m H., INSULATED, SHEET 23	1
18	PRESSURE VESSEL, POLYAMIDE 60x74, 'GLACIER', SHEET 24	1
19	PRESSURE VESSEL, POLYAMIDE 60x74, 'GLACIER', SHEET 24	1
20	22.5kL ROUND SQUAT, FLAT BASE TANK, 'TEAMPOLY', SHT 25	1
21	TANK, Ø2.30m x 2.35m H., SHEET 26	1
22	TANK, CONDENSOR, Ø0.9m x 2.02m H., SHEET 27	1
23	TANK, CONDENSOR, Ø0.9m x 2.02m H., SHEET 27	1
24	TANK, Ø1.72m x 1.36m H., SHEET 28	1
25	TANK, 25kL CONICAL, 'ENMACH', SHEET 29	1
26	TANK, SHEET 30	2
27		
28		
29		
30		
31	AUTOMATIC FILTER, 'AMIAD ' M100-1500	1
32	VACUUM FILTER, PUMP & CHUTE, 'AUSTRALIS ENG.', SHEET 31	16
33	BOILER	1
34	4" PENCIL AUGER, 'GRAINLINE', REFER CHART, SHEETS 32-36	18
35	SIDE CHANNEL BLOWER, 'BECKER' SV300/1	18
36		
37	S/S CENT. PUMP 250D PIPE, 'REEFE' P/N: 17159	30
38	S/S CENT. PUMP 400D PIPE, 'REEFE' P/N: 17159	6
39	PUMP 500D PIPE, 'GRUNDFOS' P/N:	5
40	PUMP 900D PIPE, 'GRUNDFOS' P/N:	2
41	PUMP 1100D PIPE, 'GRUNDFOS' P/N:	2
42	PUMP 1600D PIPE, 'GRUNDFOS' P/N: 96123145	1
43	PUMP 2500D PIPE, 'GRUNDFOS' P/N:	1
44	SUBMERSIBLE PUMP 500D PIPE	1
45	HEAT EXCHANGER	2
46	DEFLAG	2
47	DISTILLATION COLUMN	4
48		
49	PIPE LADDER 900mm WD x 6m LG, 'EZYSTRUT' N1	9
50	BULK BAG, 1.5m x 1.5m x 1.5m	2
51	BULK BAG S/S STAND	2
52	IBC	2
53	IBC S/S STAND	2

NOTES:
1. REFER TO SHEET 1 FOR SITE LAYOUT.

REV H	CONSTRUCTION	28.09.23	A3
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PIPE SIZES (ALL PE UNO):
 250mm - BROWN
 160mm - CYAN
 110mm - MAGENTA
 90mm - SILVER
 50mm - ORANGE
 40mm - RED
 25mm - GREEN
 25mm STEEL - BLACK
 25mm STEEL - NAVY
 25mm PP - YELLOW

41.5m

22m

DRAIN 500mm SQ. x 1200mm DEEP.
 TOP OF DRAIN 100mm BELOW SURROUNDING AREA.
 TOTAL BUND VOLUME FOR CONTAINMENT =
 91.3kL MINUS PLINTH VOLUMES.
 LARGEST TANK = 25kL

NOTES:
 1. REFER TO SHEET 1 FOR SITE LAYOUT.

REV H	CONSTRUCTION	28.09.23	A3
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 info@accad.com.au
 ABN: 61 632 021 526

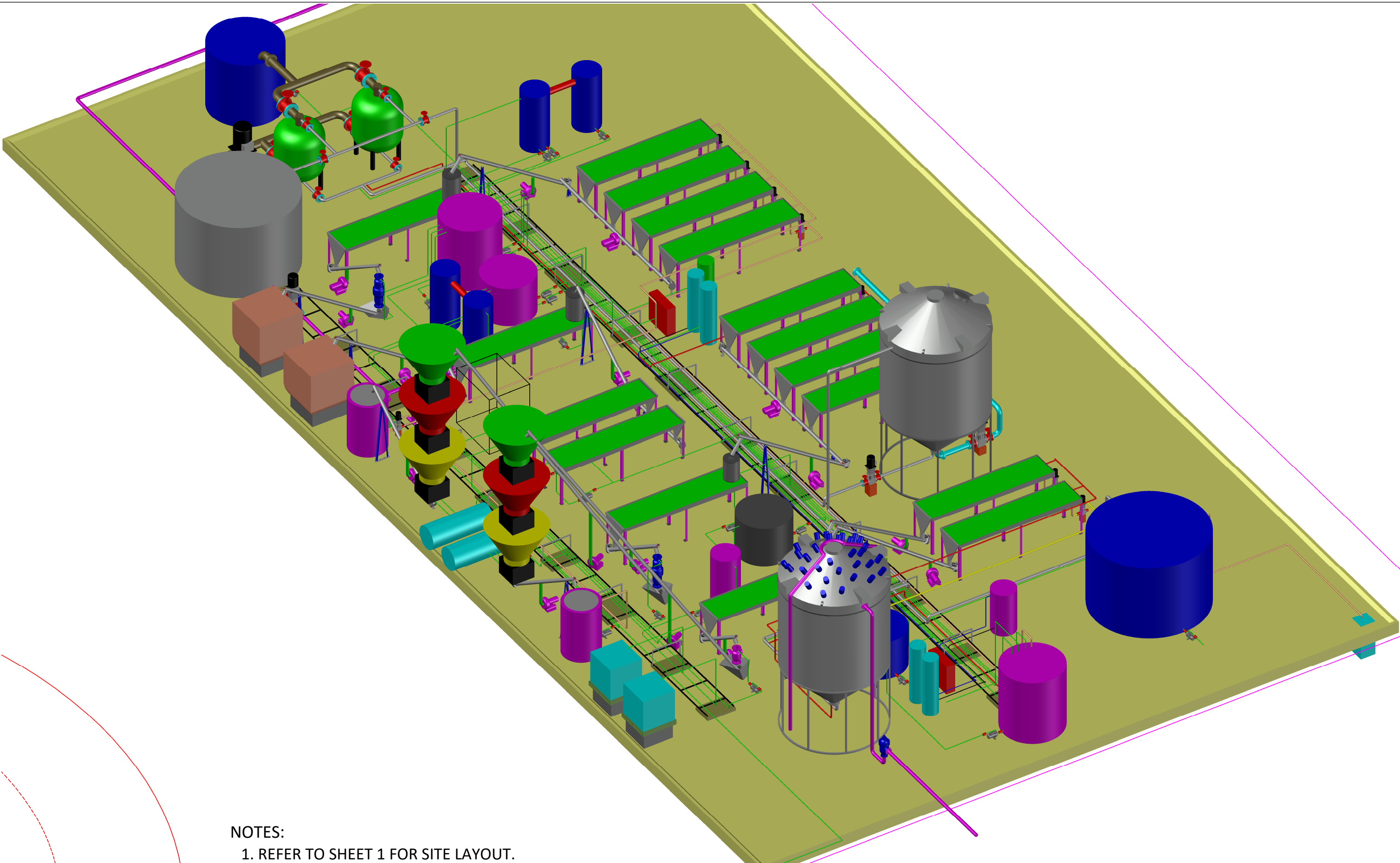
DRAINAGE PLAN
WATER TREATMENT PLANT
MOUNT MORGAN



OWNER: GLOBAL AQUATICA

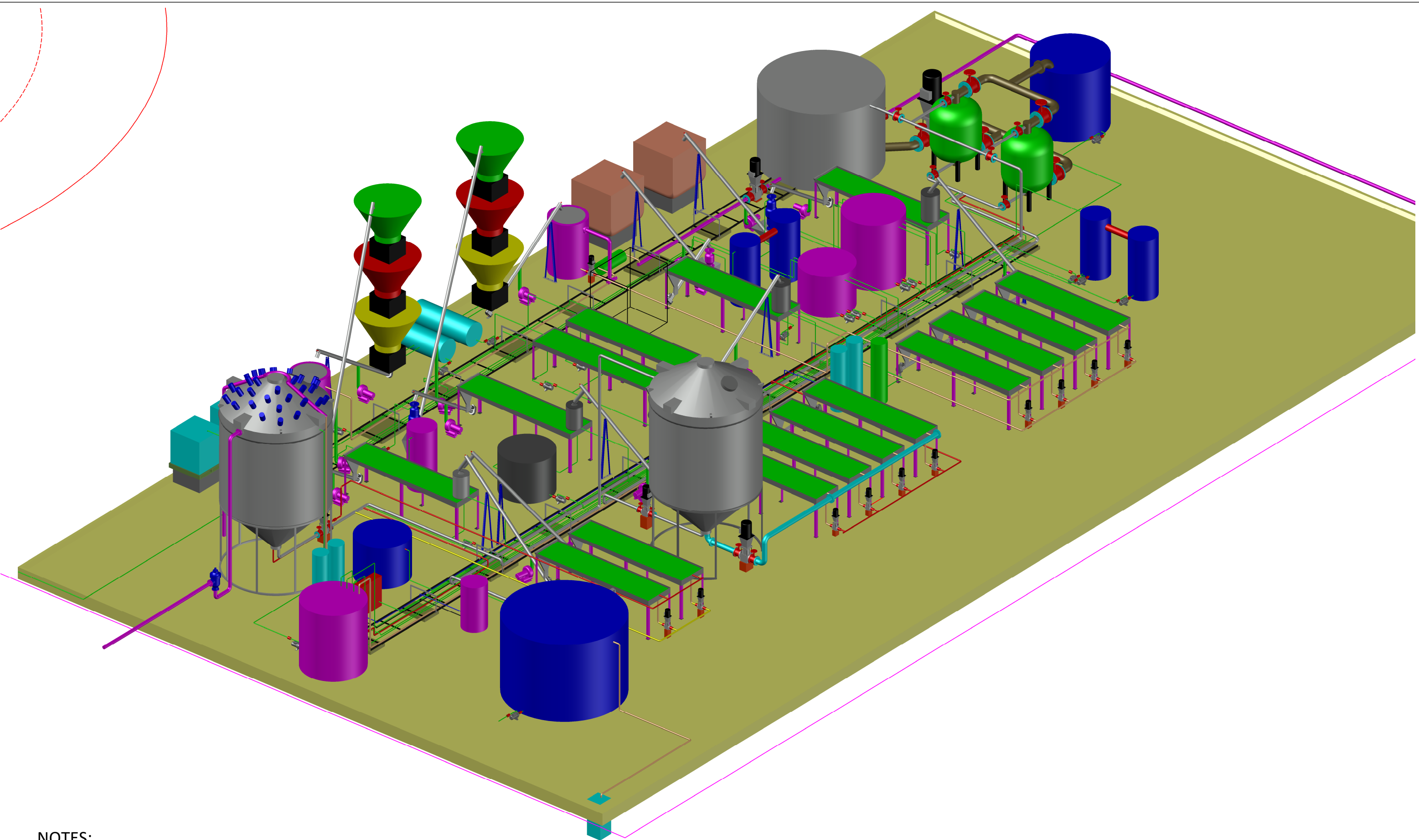
SCALE: 1:100
 DATE: 15.05.23

GA001-H SHEET 3 OF 36



NOTES:
 1. REFER TO SHEET 1 FOR SITE LAYOUT.

REV H	CONSTRUCTION	28.09.23	A3
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NOTES:
 1. REFER TO SHEET 1 FOR SITE LAYOUT.

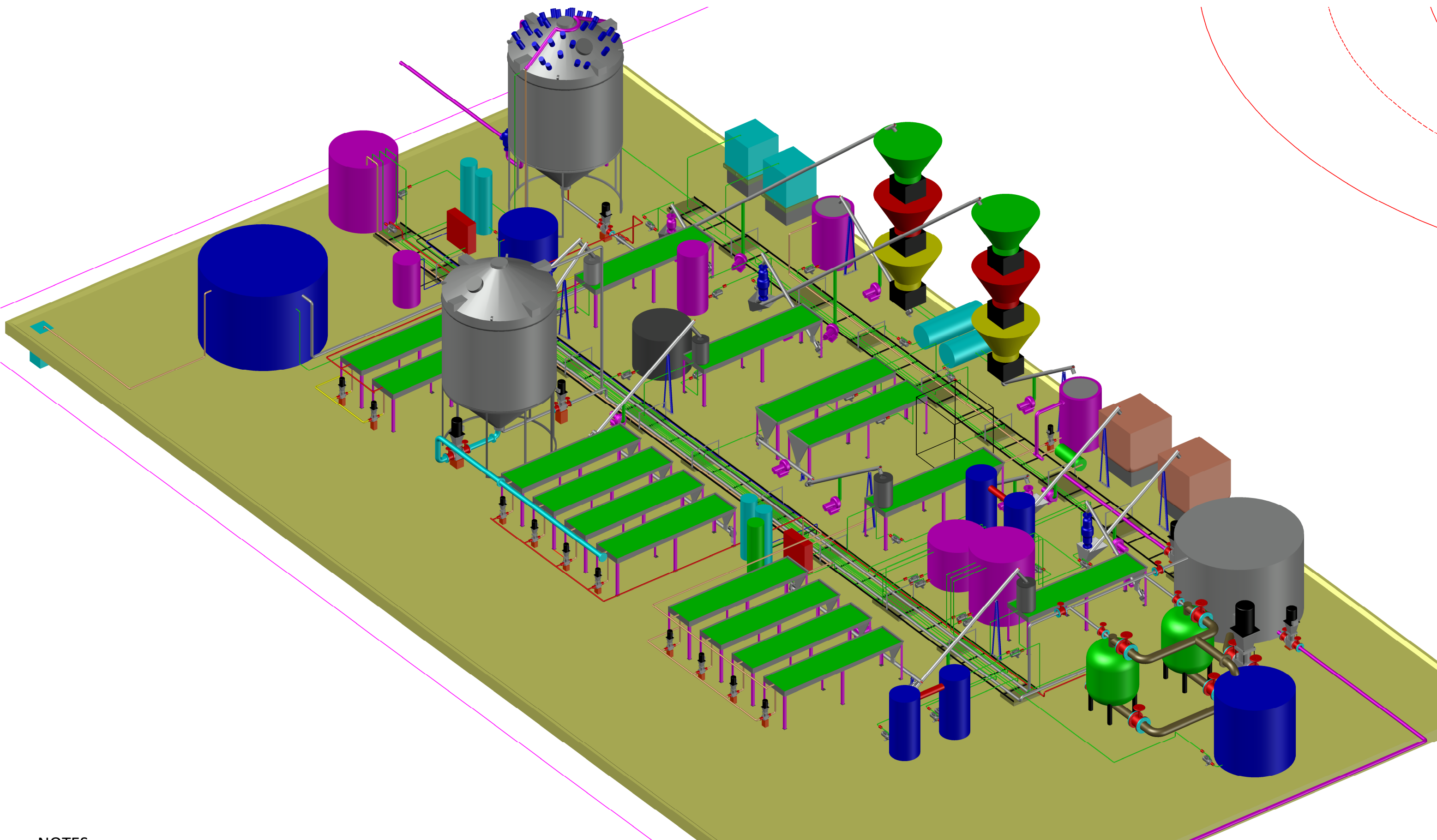
REV H	CONSTRUCTION	28.09.23	A3
OWNER: GLOBAL AQUATICA			SCALE: 1:100 DATE: 19.05.23
		GA001-H	SHEET 5 OF 36

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**SOUTH-EAST ISOMETRIC
 WATER TREATMENT PLANT
 MOUNT MORGAN**





NOTES:
 1. REFER TO SHEET 1 FOR SITE LAYOUT.

REV H	CONSTRUCTION	28.09.23	A3
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 info@accad.com.au
 ABN: 61 632 021 526

NORTH-EAST ISOMETRIC
 WATER TREATMENT PLANT
 MOUNT MORGAN



OWNER: GLOBAL AQUATICA

SCALE: 1:100
 DATE: 19.05.23

GA001-H SHEET 6 OF 36

BIOAQUA



Global
Aquatica

*Eradication of wastewater, its
contaminants and its causes.*

Award winning excellence in environmental management

BIOAQUA is the only method in the world that eradicates acid mine drainage, its contaminants and its causes.



BioAqua does not produce stored wastes, does not normally import chemicals, and is capable of eradicating acid producing waste rock, tailings, RO brine and lime sludge from the site.

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Technical Director**

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This version updated November, 2018

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UNDERSTANDING THE ISSUES



Figure 1. BioAqua plant on site

This document is intended to provide an overview of Global Aquatica and its environmental remediation solutions for mining operations.

It should be read in conjunction with our capability document to understand the processes involved in utilisation of the **BIOAQUA** process. Each site has its own unique wastewater chemistry and waste geochemistry, so a pilot study must be deemed essential in the assessment of the capability of the **BIOAQUA** process on any given site and to derive its full remediation potential. Therefore, in providing this initial document no guarantee is given that the process will solve the contamination problems specific to any given site.

The **BIOAQUA** process is a holistic approach to environmental remediation designed over several years in conjunction with the international mining community, regulators and stakeholders. It consists of several proprietary processes, most of which are the subject of patent applications.

This document is provided to assist the mining community, stakeholders and regulators to understand the potential of the **BIOAQUA** processes to their own unique environmental issues. To that end it is provided commercial in confidence and must not be disseminated outside the government department or company that was provided with the information without the written permission of Global Aquatica.

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GLOBAL AQUATICA



Global Aquatica Pty Ltd is a company incorporated in South Australia with our head office in Adelaide. Global Aquatica consists of experienced Civil and biotechnical Engineers, each with up to 40 year experience providing total water engineering solutions to the international mining industry.

We also employ biotechnical scientists, engineering support personnel and corporate support staff including commercially experienced business managers.

Global Aquatica was formed to bring environmentally sustainable waste water management solutions to the global mining community. Through very close collaboration with the international mining community and regulators, and extensive research and development, we have developed the proprietary **BIOAQUA** process, which:

- sets new world's best practise in the eradication of acidic, sulphate and metal contaminated water, including the contaminants, from the site.
- Is capable of eradicating the causes of the contamination such as acid producing tailings.
- Is capable of eradicating alkaline gypsum wastes from lime dosing, red mud from alumina refining and brine wastes from RO plants.
- Is capable of eradicating acid producing waste rock.

We provide a turnkey holistic solution from initial pilot plant studies through to plant build, ownership and operation including eradication of acid producing wastes.

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BIO AQUA HOLISTIC SOLUTION

BIOAQUA is a total water management solution for acidic, sulphate and metal contaminated water, eradicating the waste water, its contaminants, and its causes.

BIOAQUA modifies the toxic contaminants in the water into environmentally safe products. It then separates and removes these products from the water in a form suitable for recycling. The revenue from the recycling may be used to assist in funding the plant operations. **BIOAQUA** also produces a high quality treated water. For example, **BIOAQUA** has successfully converted pH2.8, 7.0 g/L SO₄ and 20g/l metal contaminated waste water into water that meets drinking water parameters.

In keeping with our holistic engineering philosophy, **BIOAQUA** also eradicates the causes of the wastewater. During the wet months, **BIOAQUA's** priority may include the eradication of produced wastewater formed from rainfall or groundwater. During the dry months, **BIOAQUA** may recycle its treated water to accelerate leaching of the acid producing wastes into the water. The dissolved contaminants are converted into environmentally safe products and recycled. The same water may be recycled many times through the wastes and the **BIOAQUA**. Hence, **BIOAQUA** operates at full capacity all year round, whether it be for eradication of wastewater or eradication of its causes.



Figure 2. BIO AQUA treatment plant in operation

BIO AQUA PROCESS

BIOAQUA removes and recycles the contaminants in the water by a three stage process. In stage 1, all but trace concentration of the metals in the water are removed, producing a cake consisting of safe recyclable oxides. This stage also increases the pH, usually between 7.5 and 8.2. No imported chemicals are usually required.

In stage 2 we use sulphate reducing bacteria to convert the sulphates directly into carbonates and removing all remaining heavy metals. This is achieved by a specific, fully utilised nutrient for the bacteria. The feedstock for this nutrient is usually greenwaste from rubbish tips, or native grasses from local farms. At our off site facility, we convert this greenwaste into 100% utilised carbohydrate for the bacteria. This produces a biochemical reaction that converts the remaining cations such as calcium and magnesium into recyclable carbonates.

In stage 3, a side reaction converts the sulphates into sulphur by oxidation. The resulting treated water quality typically exceeds the drinking water parameters.

REMOVAL OF METALS

BIOAQUA uses cavitation to molecularly cleave the water converting the H_2O into H and OH. The H is oxidised to water, removing the acidity. The OH (hydroxyl radicals) are extremely oxidising, removing the metals as hydroxides. Any excess hydroxyl radicals produced by the cavitators return back into water. The metal hydroxides form a rapidly settling sludge as it separates from the water using geobags as a solid product and the water returned for further treatment by the bacteria.



Figure 3. Metals in an operating metal oxide geobag

BIO AQUA PROCESS

The resulting mixed metal oxide cake is recycled by Global Aquatica. The treated water from the cavitators consists of trace metal concentrations, no acidity and salts. This environmentally safe, salty water makes a very good dust suppressant as the salt binds the dust particles onto the road.



Figure 4. geobag separating the water from the solids

EXTRACTED PRODUCT RECYCLING

The metal cake consists of metals extracted from the water in the form of hydroxides. The composition of the cake is dependant entirely upon the chemistry of the raw water. However, typical metals found in abundance include aluminium oxide, ferrous/ferric iron oxide and zinc oxide. The full range of metals are also typically found present as hydroxides.

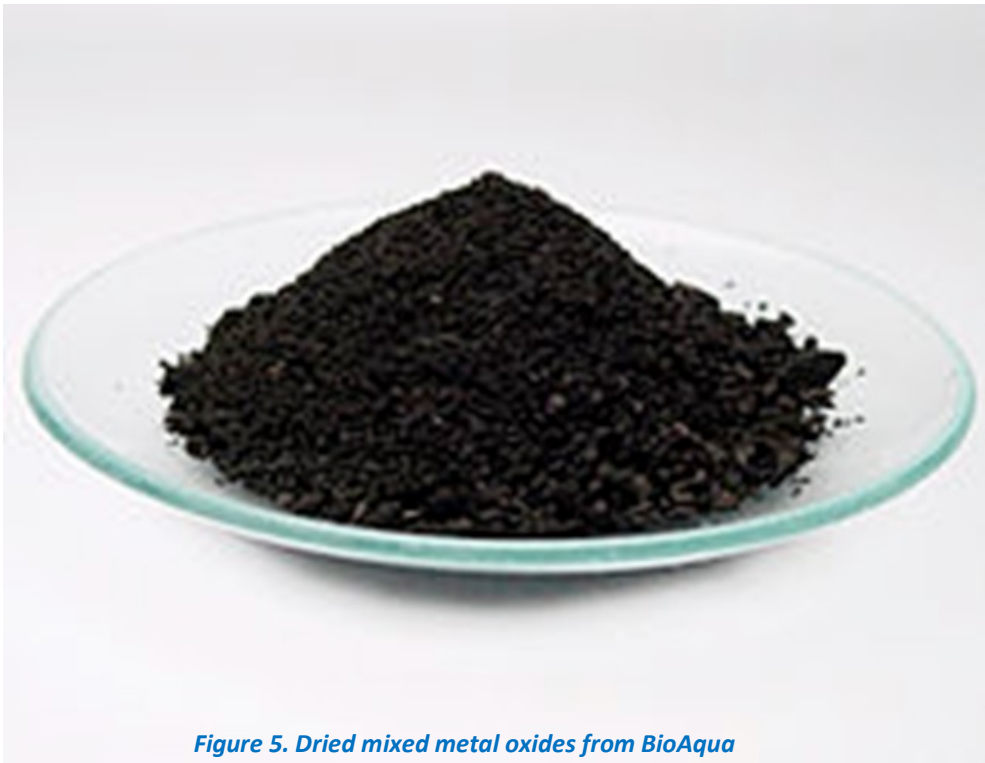


Figure 5. Dried mixed metal oxides from BioAqua

The mixed metal oxide cake may be sold to 'E' waste recyclers who typically separate the metal oxides for sale as products such as bricks or sheet. Alternatively, Global Aquatica may choose to separate the metal oxides into metal products such as sheet using proprietary processes, principally for export.

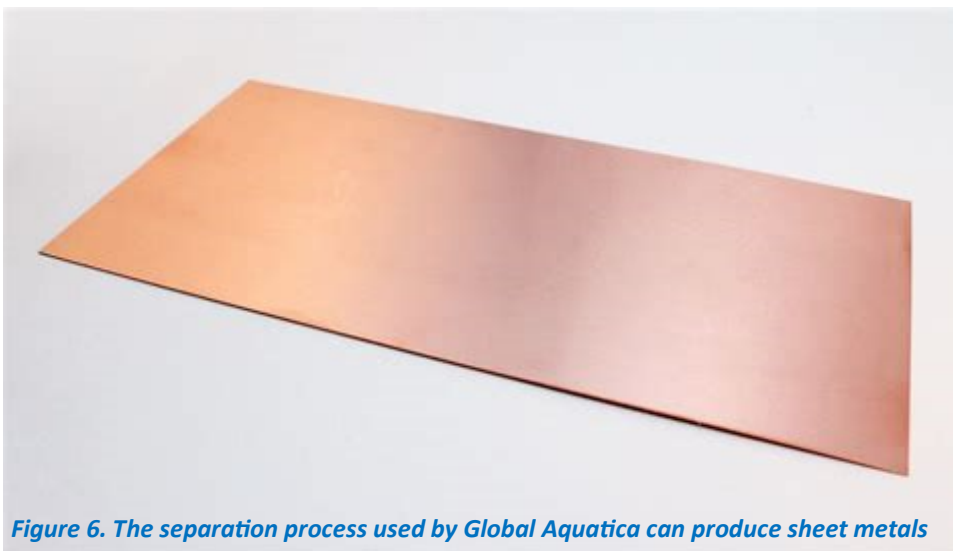


Figure 6. The separation process used by Global Aquatica can produce sheet metals

EXTRACTED PRODUCT RECYCLING

REMOVAL OF SULPHATES

Once the metals and acidity has been removed, the bacterial process of **BIOAQUA** will convert the sulphates in the water into safe, high purity elemental sulphur. This product is sold nationally and also by export.



Figure 7. sulphur from BioAqua

The remaining compounds are converted from sulphates into carbonates. They are separated from the water and sold by Global Aquatica as high purity products both nationally and as exports for uses such as soil conditioners, pharmaceuticals, filler for paints etc.

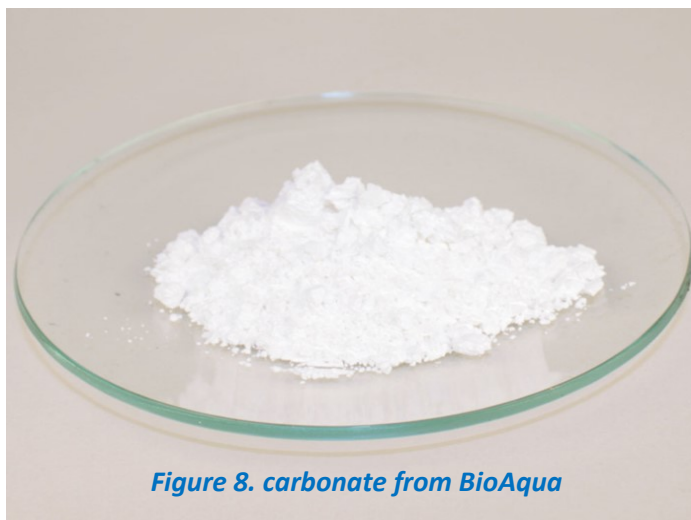


Figure 8. carbonate from BioAqua

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PROCESS FLOW

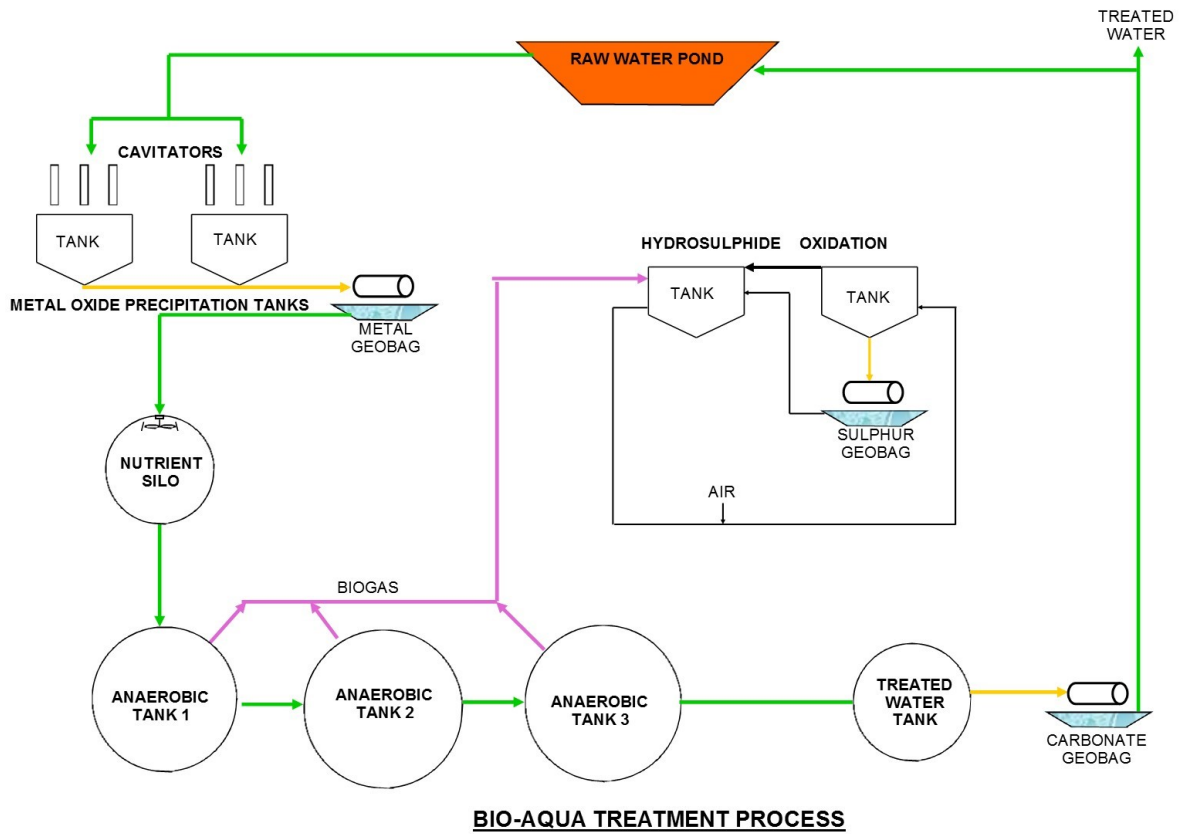


Figure 9. Process flow diagram for Bio Aqua

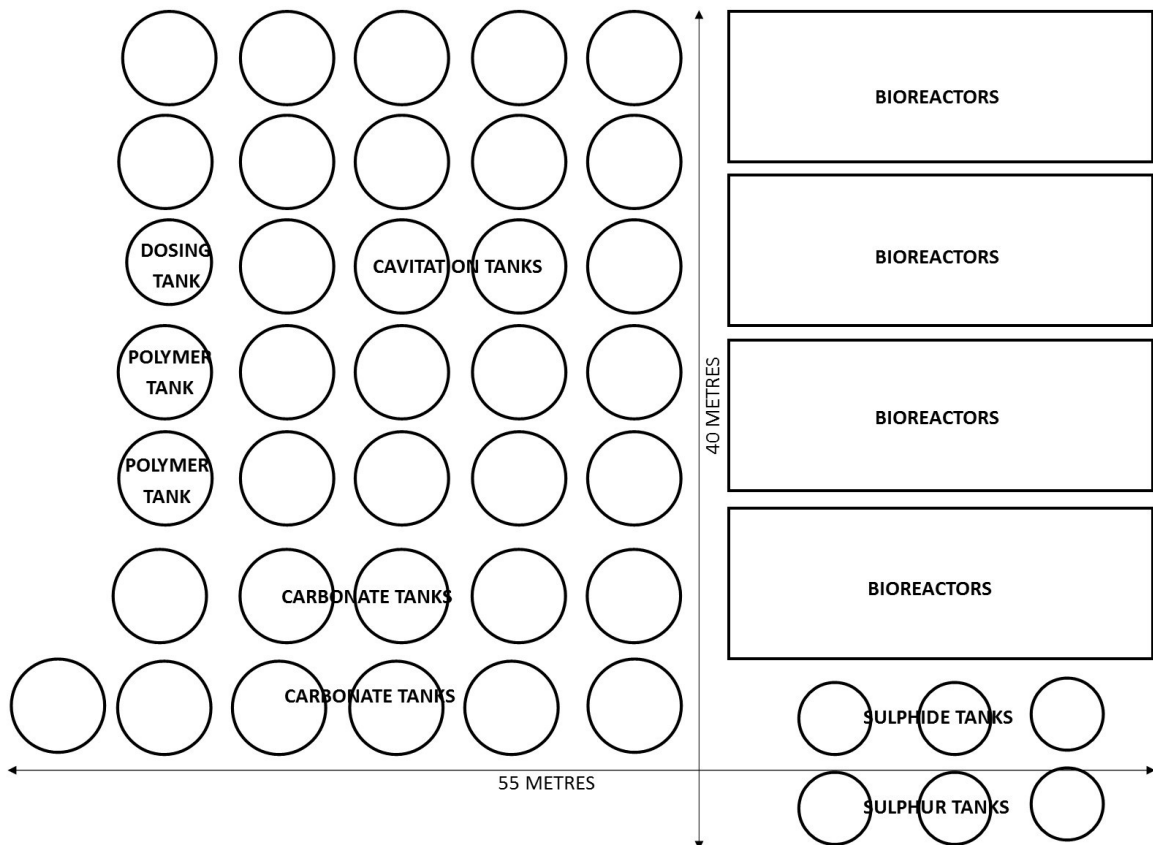


Figure 10. Bio Aqua plant layout 26 ML/day

PROCESS INPUTS

The only input into the **BIOAQUA** process is nutrient for the bacteria. GLOBAL AQUATICA can produce this from recycled greenwaste from council refuse stations. Any plant waste is acceptable. Alternatively, local farmers can be contracted to produce native grasses which are utilised as the feedstock for the nutrient production process. This is particularly useful in restoring a social license that may have been damaged by the acidic wastes.

Global Aquatica have developed a proprietary process that converts this plant matter into carbohydrate nutrient that is 100% utilized by the bacteria, hence there are no stored wastes on the mine site. This conversion typically occurs offsite from the mine and no stored waste products are produced from this conversion process.

After initial operation, **BIOAQUA** will recycle the carbon for utilization by the bacteria. It is essential to ensure the bacteria colony has biologically stabilized before this occurs, hence a typical 6 month delay.



Figure 11. raw material for bacteria nutrient



NUTRIENT

Global Aquatica has developed a method that permits the sulphate reducing bacteria to fully utilize its nutrient. Global Aquatica calculate that approximately 18.5 tonne of nutrient will be required each day. This would be produced from greenwaste in the Darwin area.



Figure 12. Typical nutrient production facility. For 20T/day nutrient



Figure 13. White nutrient produced from plant material for consumption by the bacteria. The plant material in the photo is removed by screening before delivery to the plant.

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ERADICATION OF WASTES



Figure 14. Typical Tailings storage facility

ERADICATION OF TAILINGS.

During the periods of high rainfall, **BIOAQUA** converts the wastewater into safe water suitable for release within the EPA license. During low rainfall periods, the treated water is recycled over the tailings and waste rock.

Global Aquatica has developed proprietary processes that accelerate the natural leaching to fully dissolve the tailings into the water. This produces a pregnant liquor highly concentrated with minerals.

BIOAQUA then converts these minerals into safe products which are recycled by Global Aquatica.

The resulting treated water that frequently meets drinking water parameters is then recycled back onto the tailings.

ERADICATION OF ALKALINE GYPSUM, RED MUD OR BRINE WASTES.

The recycled sulphuric acid utilised for the eradication of waste rock may also be applied to sources of alkalinity such as gypsum from lime dosing, red mud from alumina, or brine from reverse osmosis. As a result, these alkaline wastes dissolve into the water which are in turn converted into recyclable products by **BIOAQUA**.

ERADICATION OF WASTE ROCK.

The acid forming (PAF) and non acid forming (NAF) waste rock may have been closely mixed during mining operations.

The waste rock may be NAF due to a lack of sulphur or the presence of carbonates neutralising the acidity. Where this is the case **BIOAQUA** can recycle the sulphur from the PAF portion of the waste rock as sulphuric acid. This acid is combined with the NAF rock to dissolve it into the water.

Figure 15. Lime dosing waste



SLUDGE MANAGEMENT

BIOAQUA converts the contaminants in the water into recyclable products. It typically produces 10% w/w sludges of the recycled products that are pumped to a series of geobags. The clarified water from the geobags is continuously pumped back into the **BIOAQUA** process and the solids cake harvested by Global Aquatica for recycling.



Figure 16. Water from the geobags for recycling by BioAqua

HARVESTING OF RECYCLED PRODUCTS

Typically several geobags are used on an ongoing basis with continuous cycling of filling, consolidation and drying followed by harvesting.

Typical products resulting from this process are high purity silica, mixed metal oxides, high purity sulphur, calcium and magnesium carbonate.

All geo bags are stored in individual lined bunds.

Where sulphuric acid is produced for waste rock eradication, it is stored in separate tanks.



Figure 17. Harvesting of recycled products

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CONTROLS

TREATED WATER QUALITY ASSURED

Please note that if the monitoring systems detect that the water quality does not meet the pre-determined treated water parameters it will be diverted back to the **BIOAQUA** treatment plant. Also, as required by the Australian recycled water guidelines, an alarm signal will be triggered to alert the plant operator and/or GLOBAL AQUATICA that this event has occurred so that corrective action can be taken. All overflows are directed back into the raw water pond.

FACTORY BUILT AND TESTED

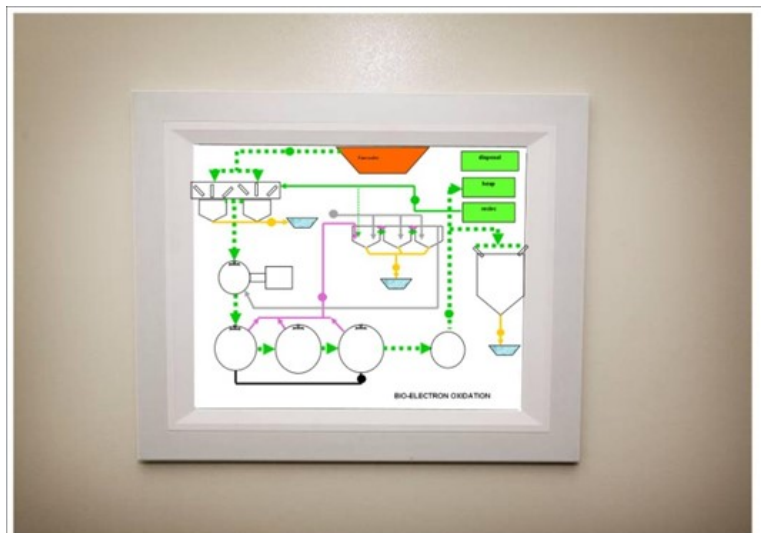
All systems are fully tested in our factory prior to installation. This minimises onsite installation time and contracting costs. Minimising the risk of “start-up” electrical and mechanical failure.

PLANT CONTROL

All plant monitoring and control is performed by inhouse designed and manufactured robots which operate Programmable logic control systems based on the information from sensors located around the process. The robots operate the plant, change operational parameters to suit changes in raw water quality, perform component capacity checks, accumulate operational data and pass it onto the engineers for evaluation. In addition they advise service personnel of required maintenance and component changeout. For security reasons it is not possible to alter the plant operation remotely.

Typically, two people are working onsite on a full time basis to supervise recycled product harvesting, coordinate nutrient deliveries, and operate the nutrient harvesting process. These people also make routine inspections of the plant. Should any function of the plant be outside operational parameters the robots will advise the engineer immediately. Interface with the operation of the plant is via a colour PC screen which displays all operational data relevant to the plant’s performance. This allows the operator to quickly and effectively view performance of the plant on one summary screen. This screen shows daily flow rate, current flow rate, nutrient utilisation, water and biochemistry, etc.

Figure 18. The robot controlled plant is monitored from a control screen inside the plant or on laptop or mobile phone by internet



Acid mine drainage is usually geographically clustered involving many mine sites. We consolidate our local services such as nutrient production, servicing, emergency call out at service centres in those areas. Otherwise local sub-contractors are used for such operations as piping repair, electrical failures and safety audits.

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ADVANTAGES

As **BIOAQUA** is the only total management solution in the world for acidic, high sulphate and metal contaminated water. The advantages of **BIOAQUA** over the alternatives are considerable:

- ⇒ Low capital cost;
- ⇒ Very low to zero cost operation;
- ⇒ No recurring capital costs;
- ⇒ No imported chemicals are normally required;
- ⇒ The only imported product is a locally produced, very low cost nutrient;
- ⇒ Unaffected by influent water quality;
- ⇒ stored wastes are not necessary as all outputs are recyclable;
- ⇒ EPAs usually do not permit the production or storage of toxic products from water treatment. **BIOAQUA** is the only system in the world that can provide this.
- ⇒ Small footprint;
- ⇒ Treated water quality suitable for disposal into a river, mineral processing or use for agriculture;
- ⇒ Flexible operation to suit variable flow rates and weather conditions;
- ⇒ Permits the positive involvement of surrounding stakeholders;
- ⇒ High quality treated water prevents scaling and corrosion damage to water infrastructure;
- ⇒ The stage 1 treatment results in a saline product useful for dust suppression or icy roads;
- ⇒ Highly scalable to suit drought and deluge scenarios;
- ⇒ Total package provided including engineering and trades support, local consumables supply, water chemistry analysis and reporting, operation;
- ⇒ Flexibility in the treated water chemistry.



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CASE STUDIES

BIOAQUA has been operated at numerous sites including those listed on the following table. The data relates only to the treatment of raw wastewater and does not include pregnant liquor produced from tailings leaching.

Stage 2 analysis for Angas is currently underway.

The Brukunga results were produced by SA Water in a full custody sampling and analysis. A copy of their report is available.

Typically, **BIOAQUA** removes all metals to below safe drinking levels, neutralizes the acidic water to pH 7.5 to 8.0, and has removed sulphates down to 176 mg/L. **BIOAQUA** does not usually remove chlorides, sodium, or potassium. Where required, Global Aquatica can attach additional systems to remove these compounds.

BIOAQUA removes the compounds from the water, converts them into recyclable products and separates them from the water for sale. **BIOAQUA** does not import chemicals, produces no stored wastes, and can remove the causes of acidic mine wastewater such as tailings and waste rock. Note. Removal of tailings and waste rock has not been included in this document as it will not be a capability of the initial 26 ML/day water treatment plant.

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		MT CHALMERS			BRUKUNGA			ANGAS	
		raw	treated water		raw	treated water		raw	treated
			stage 1	stage 2		stage 1	stage 2		stage 1
pH		2.5	7.2	8	2.7	7.2	7.8	2.8	7.5
Sulfate as SO4	mg/L	3290	2796.5	250	6540	6940	176	7730	5180
Chloride	mg/L	30	30	28	320	382	505	10500	10400
Calcium	mg/L	374	374	13	384	415	32.4	788	287
Magnesium	mg/L	413	413	6.4	325	198	17.9	450	296
Sodium	mg/L	54	54	52	201	350	364	7460	6520
Potassium	mg/L	2	2	2	66.1	111	9.85	132	130
Aluminium	mg/L	27.6	0.06	<0.001	46.9	<0.01	0.079	248	0.33
Antimony	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.002	<0.001	<0.001	0.0036	<0.001	0.0009	0.031	0.006
Beryllium	mg/L	0.002	<0.001	<0.001	0.002	<0.001	<0.001	0.016	<0.001
Barium	mg/L	0.01	0.01	<0.001	0.0048	0.006	0.017	0.003	0.0029
Bismuth	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Cadmium	mg/L	0.575	<0.001	<0.001	0.0022	<0.0001	<0.0001	0.381	<0.001
Cerium	mg/L	0.141	<0.001	<0.001	0.102	<0.001	<0.001	0.877	<0.001
Caesium	mg/L	0.001	0.001	<0.001	0.004	0.003	<0.001	0.005	0.005
Chromium	mg/L	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	0.185	0.003
Cobalt	mg/L	0.318	<0.001	<0.001	0.0501	0.002	<0.0001	0.925	0.002
Copper	mg/L	14.7	0.01	<0.01	0.0069	<0.001	0.0015	1.62	0.188
Dysprosium	mg/L	0.013	<0.001	<0.001	0.012	<0.001	<0.001	0.026	<0.001
Erbium	mg/L	0.006	<0.001	<0.001	0.006	<0.001	<0.001	0.008	<0.001
Europium	mg/L	0.005	<0.001	<0.001	0.003	<0.001	<0.001	0.01	<0.001
Gadolinium	mg/L	0.017	<0.001	<0.001	0.015	<0.001	<0.001	0.053	<0.001
Gallium	mg/L	0.005	<0.001	<0.001	0.005	<0.001	<0.001	0.029	<0.001
Hafnium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001
Holmium	mg/L	0.002	<0.001	<0.001	0.002	<0.001	<0.001	0.004	<0.001
Indium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001
Lanthanum	mg/L	0.058	<0.001	<0.001	0.047	<0.001	<0.001	0.454	<0.001
Lead	mg/L	0.849	0.005	<0.001	<0.001	<0.001	<0.001	1.4	1.69
Lithium	mg/L	0.05	0.01	<0.001	0.021	0.023	<0.001	0.434	0.186
Lutetium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	18.6	6.5	<0.001	69.9	20.9	1.067	16.3	<0.001
Molybdenum	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
Neodymium	mg/L	0.063	<0.001	<0.001	0.064	<0.001	<0.001	0.413	<0.001
Nickel	mg/L	0.149	0.005	<0.001	0.0565	<0.001	0.0031	0.692	0.003
Praseodymium	mg/L	0.016	<0.001	<0.001	0.015	<0.001	<0.001	0.109	<0.001
Rubidium	mg/L	0.008	0.007	<0.001	0.197	0.212	<0.001	0.356	0.253
Samarium	mg/L	0.015	<0.001	<0.001	0.013	<0.001	<0.001	0.073	<0.001
Selenium	mg/L	0.02	<0.001	<0.01	<0.01	<0.01	<0.01	0.03	<0.001
Silver	mg/L	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.002	0.004
Strontium	mg/L	0.625	0.632	<0.001	0.398	0.46	0.182	5.13	3.43
Thorium	mg/L	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.064	<0.001
Thulium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001
Uranium	mg/L	0.004	0.001	<0.001	0.003	<0.001	<0.001	0.047	<0.001
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001
Ytterbium	mg/L	0.003	<0.001	<0.001	0.004	<0.001	<0.001	0.006	<0.001
Yttrium	mg/L	0.078	<0.001	<0.001	0.068	<0.001	<0.001	0.103	<0.001
Zinc	mg/L	86.1	0.038	<0.001	2.23	0.006	0.0226	183	0.313
Zirconium	mg/L	<0.005	<0.005	<0.001	<0.005	<0.005	<0.001	<0.005	<0.001
Boron	mg/L	<0.05	<0.05	<0.05	0.07	0.06	<0.05	1.44	1.09
Iron	mg/L	1.09	<0.05	<0.05	2385	13	0.1249	383	<0.001

PROCESS RISKS AND FAQs

Products produced by the process.

When used for water treatment, the BioAqua process contains the following products:

Stage 1. treated water. pH 7 to 8, sulphate at elevated levels. Sludge consisting of this water and metals hydroxides to a level approximately 7% of the water.

Stage 2. Treated water. pH 7 to 8, low sulphate concentrations. Sulphur sludge, the Sulphur being non reactive with water. Calcium/magnesium carbonate sludge, the solids are non reactive with water.

Unintended outflows from the plant.

In the event of a breach of a tank, none of those products present a danger to the environment.

A silo of crystal carbohydrates (glucose) also exists. In the event of a silo breach, this could be removed or covered over to prevent contact with water until cleaned up. In the event of contact with water it would increase the organic carbon content in the water.

Bioreactors in the form of multiple tanks contain approximately 150 mg/L of sulphate reducing bacteria. These anaerobic bacteria cannot survive outside the tanks. In the event of a breach of a bioreactor, the bacteria would die, causing the organic carbon concentration in the water to rise approximately 80 mg/L.

The BioAqua plant is contained within a bund. The capacity of the bund being 20% larger than the capacity of the largest tank. In the event of a tank breach, pipes are automatically isolated from the tank.

Breach of the Geobags.

The metal, Sulphur and carbonate sludges are contained within conventional geobags. These contain the solids, whilst permitting the water to pass through, flowing into bunds. A pump returns the water to the BioAqua process for further treatment. When a geo bag is full of product, the flow is diverted to another bag and the full bag permitted to dry. Once dry to sufficient amount, the bag is cut open, and the product removed using excavators and trucks. It is then dried further as required, bagged, and sold for recycling around the world. The geobag is replaced with a new bag and the operation repeated.

The liquids in the geobags are retained by EPDM lined bunds, capable of retaining all liquids within the storage. In the event of a breach, flow is stopped to that bag.

Treated water quality.

The treated water is pumped to the river for discharge. A series of sensors will detect the water quality, typically pH and electrical conductivity. The valves on the discharge will only open in the event that the water quality conforms with EPA license conditions. If it does not meet the required water quality, the treated water will flow back into the pit lake for retreatment and the robots perform corrective action. The robot will notify the operator if it is unable to correct the defect.

What happens if the bacteria die.

The 26 ML/day BioAqua plant consists of 81 individual bioreactors, operating in three stages. Should one tank breach it is isolated and the others take up the process until it can be fixed. When put back into operation, the treated water from the other tanks will recharge that repaired tank with bacteria. Typically, the tank will achieve 80% operation within 48 hours. As all piping and tanks are equipped with isolation sensors the probability that all bacteria will be lost is extremely remote.

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PROCESS RISKS AND FAQs

Storage of process wastes

There are no process wastes from the BioAqua process. All contaminants in the water are converted to recyclable products and no chemicals are imported.

What happens if the recycled products cannot be sold.

There are numerous markets for each of the products produced by BioAqua. Each market is dependent upon the quality of the product. Generally, the lower the quality, the lower the price obtained for the product. For example, Global Aquatica is confident that a high purity carbonate product is produced, capable of being used for pharmaceutical applications. Should the purity not be sufficient the product can be used for paint fillers.

The mixed metal oxide consists of inert metal hydroxides, stored in 1 tonne bulk bags. There exists a substantial global 'E waste' metal recycling industry that is capable of isolating the metals for sale. In the event that the metals could not be sold, they could be safely stored on site without risk of the products entering the water cycle.

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