Government of Western Australia
Department of Water and Environmental Regulation

# Works Approval

| | |
|---|---|
| **Works approval number** | W2849/2025/1 |
| **Works approval holder** | South32 Worsley Alumina Pty Ltd |
| **ACN** | 008 905 155 |
| **Registered business address** | Gastaldo Road<br>ALLANSON WA 6225 |
| **DWER file number** | DER2017/001998-1~7 |
| **Duration** | 12/5/2025 to 11/5/2030 |
| **Date of issue** | 12/5/2025 |
| **Premises details** | Worsley Alumina Refinery Gastaldo Road,<br>ALLANSON WA 6225<br>Legal description -<br>Lease No 3116/7574 being Wellington Locations 5314-5317 on Deposited Plan 220209 |

| **Prescribed premises category description (Schedule 1, *Environmental Protection Regulations 1987*)** | **Assessed production / design capacity** |
|---|---|
| Category 46: Bauxite refining | 4.7 million tonnes per annual period assessed production capacity |
| Category 52: Electric power generation | 260 Mega Watts per annual period design capacity |
| Category 53: Flyash disposal | 110,000 tonnes per annual period assessed production capacity |
| Category 54: Sewage facility | 270 cubic metres per day design capacity |
| Category 61: Liquid waste facility | 100 tonnes per annual period assessed production capacity |
| Category 63: Class I Inert landfill site | 15,000 tonnes per annual period assessed production capacity |
| Category 89: Putrescible landfill site | 500 tonnes per annual period assessed production capacity |

This works approval is granted to the works approval holder, subject to the attached conditions, on 12 May 2025, by:

Caron Goodbourn
Digitally signed by Caron Goodbourn
Date: 2025.05.12 13:40:57 +08'00'

**MANAGER, PROCESS INDUSTRIES**
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

| Date | Reference number | Summary of changes |
|---|---|---|
| 12/05/2025 | W2849/2025/1 | Works approval granted. |

# Interpretation

In this works approval:

(a) the words 'including', 'includes' and 'include' in conditions mean "including but not limited to", and similar, as appropriate;

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a condition, each row in a table constitutes a separate condition;

(d) any reference to an Australian or other standard, guideline, or code of practice in this works approval:

  (i) if dated, refers to that particular version; and

  (ii) if not dated, refers to the latest version and therefore may be subject to change over time;

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act; and

(f) unless specified otherwise, all definitions are in accordance with the EP Act.

**NOTE:** This works approval requires specific conditions to be met but does not provide any implied authorisation for other emissions, discharges, or activities not specified in this works approval.

# Works approval conditions

The works approval holder must ensure that the following conditions are complied with:

## Construction phase

### Infrastructure and equipment

**1.** The works approval holder must:

(a) construct and/or install the infrastructure and/or equipment;

(b) in accordance with the corresponding design and construction / installation requirements; and

(c) at the corresponding infrastructure location as set out in Table 1.

**Table 1: Design and construction / installation requirements for a biological oxalate destruction (BOD) facility**

| | Infrastructure | Design and construction / installation requirements | Infrastructure location |
|---|---|---|---|
| 1. | BOD facility secondary containment bund | The bunded area must:<br>a) comprise of an impermeable barrier (e.g. concrete) that is constructed of materials that are substantially immune to attack by any corrosive substance it may contain;<br>b) is sloped to facilitate drainage collection of potential unplanned spills, ruptures or loss of containment of the tanks; and<br>c) has dedicated sumps and transfer pumps to recover spillages or containment losses | Shown as:<br>• 'Concrete (Bunded)' in Figure 4<br>• 'Feed Prep Area Sump Pump' in Figure 5<br>• 'BOD Reactor Area Sump Pump 1' and 'BOD Reactor Area Sump Pump 2' in Figure 6<br>• 'Nutrient Unloading Bay Sump Pump', 'BOD Nutrient Area Sump Pump', and 'Cooling Tower Area Sump Pump' in Figure 7<br>in Schedule 1. |
| 2. | Four BOD reactors | The bioreactors must:<br>a) comprise of an enclosed bioreactor tank with a vent which directs all vapours under standard operating conditions to the wet scrubber system;<br>b) must be connected to a cooling tower system; | Shown as:<br>• 'BOD Reactor 100, 200, 300, and 400'<br>in Figure 6 in |

| | Infrastructure | Design and construction / installation requirements | Infrastructure location |
|---|---|---|---|
| | | c) have a flat bottom tank base manufactured from stainless steel;<br>d) be installed with an agitator;<br>e) be installed with a continuous dissolved oxygen, temperature and tank level monitoring system connected to a process control system with alarms to alert process failures; and<br>f) have oxalate feed rate control. | Schedule 1. |
| 3. | i. Surge tanks and feed preparation tanks<br>ii. Nutrients and $CO_2$ storage and dosing systems<br>iii. Cooling towers for cooling BOD reactors | Installed in accordance with the manufacture's specifications | Shown as:<br>• 'BOD Oxalate Surge tanks T049011 and T049012', and 'Feed Prep tanks T049021 and T049022' in Figure 5<br>• 'Nitrogen Nutrient storage tank', 'Magnesium/Iron Nutrient storage tank', 'Phosphorus Nutrient storage tank', '$CO_2$ storage vessels V049050 and V049051' and 'BOD Cooling Towers 41 and 42' in Figure 7<br>in Schedule 1. |
| 4. | Air blowers for aeration of the BOD reactors | a) The air blower must be installed with:<br>(i) at least one blower, fit for purpose to ensure a continuous supply of air to the BOD reactor tanks; and<br>(ii) continuous monitoring of the air supply to the BOD reactor tanks via a process control system with an alarm for loss of air. | Shown as:<br>• 'BOD Reactor 100, 200, 300 and 400 Air Blowers'<br>in Figure 7 in Schedule 1. |
| 5. | Four wet scrubbers (one scrubber per reactor) | a) One dedicated wet scrubber per BOD reactor<br>b) The wet scrubbers shall comprise:<br>(i) one stack emission outlet per wet scrubber | Shown as:<br>• 'BOD Reactor 100, 200, 300, and 400 Scrubbers' and |

| | Infrastructure | Design and construction / installation requirements | Infrastructure location |
|---|---|---|---|
| | | (ii) each stack emission point is at least 18 metres above ground level<br>(iii) each scrubber stack is fitted with a sampling port which complies with AS 4323.1:2021<br>(iv) dedicated water supply to each scrubber;<br>(v) spent water to be recovered and reused in the circuit or discharged to the Bauxite Residue Disposal Areas (BRDAs) or Refinery Catchment Lake (RCL); and<br>(vi) an induced draft fan for each scrubber. | 'BOD Reactor 100, 200, 300, and 400 Scrubber Fans and Stacks'<br>in Figure 6 in Schedule 1. |

### Compliance reporting

**2.** The works approval holder must within 30 calendar days of the infrastructure specified by condition 1 being constructed and/or installed:

(a) undertake an audit of their compliance with the requirements of condition 1; and

(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

**3.** The Environmental Compliance Report required by condition 2(b), must include as a minimum the following:

(a) certification by a suitably qualified professional engineer that the items of infrastructure or component(s) thereof, as specified in condition 1, have been constructed in accordance with the relevant requirements specified in condition 1;

(b) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 1; and

(c) be signed by a person authorised to represent the works approval holder and contains the printed name and position of that person.

## Environmental commissioning phase

### Environmental commissioning requirements

**4.** The works approval holder may only commence environmental commissioning of an item of infrastructure listed in condition 5 once the Environmental Compliance Report has been submitted for that item of infrastructure in accordance with conditions 2 and 3 of this works approval.

**5.** Any environmental commissioning activities undertaken for an item of infrastructure specified in Table 2 may only be carried out:

(a) in accordance with the corresponding commissioning requirements; and

(b) for the corresponding authorised commissioning duration.

**Table 2: Environmental commissioning requirements**

| | Infrastructure | Commissioning requirements | Authorised commissioning duration |
|---|---|---|---|
| 1 | Four BOD reactors | a) Subject to completing the requirements of condition 1.<br>b) Ensure all utilities, condensate, cooling water systems, scrubbers and ancillaries are available and operational<br>c) Start-up of feed preparation tank, preparation of reactor tank and scrubber, establish bacteria in reactor and use of all BOD reactors<br>d) Use, monitoring and adjustment of the BOD facility processes until a 30-day period of steady state operation is achieved as defined in Table 6. | For a period not exceeding 300 calendar days in aggregate. |
| 2 | Surge tanks and feed preparation tanks<br>Nutrients and $CO_2$ storage and dosing systems<br>Cooling towers for cooling BOD reactors | | |
| 3 | Air blowers for aeration of the BOD reactors | | |
| 4 | Four wet scrubbers | | |

**6.** During environmental commissioning and time limited operations, the works approval holder must ensure that the emission(s) specified in Table 3, are discharged only from the corresponding discharge point(s) and only at the corresponding discharge point location(s).

**Table 3: Authorised discharge points**

| | Emission | Composition | Discharge point | Discharge point location |
|---|---|---|---|---|
| 1 | Air emissions | Ammonia,<br>Volatile organic compounds (VOCs),<br>Hydrogen sulfide,<br>Carbon dioxide (CO2),<br>Mercury (Hg),<br>Other odour. | Four wet scrubber stacks U049120, U049220, U049320, U049420 | Shown as 'BOD Reactor 100, 200, 300, and 400 Scrubber Fans and Stacks U049120, U049220, U049320, U049420' in Figure 6 in Schedule 1. |

### Air emissions monitoring

**7.** The works approval holder must monitor emissions in accordance with Table 4.

**Table 4: Emissions monitoring**

| Discharge point and monitoring location | Parameter | Frequency | Averaging Period | Unit | Method |
|---|---|---|---|---|---|
| Wet scrubber vent stacks U049120, U049220, U049320, U049420 | Volumetric flow rate | One sampling event completed within 30 calendar days of reaching steady-state operation. A second sampling event completed at least 45 calendar days after the initial sampling event. | As per method | $m^3/s$ | USEPA Method 2 |
| | Volumetric flow velocity | | | m/s | |
| | Odour | | Spot sample | OU | AS 4323.3:2001 |
| | Ammonia | | 30 minutes | $mg/m^3$ and g/s | USEPA CTM-027 |
| | VOC | | 30 minutes | $mg/m^3$ and g/s | USEPA Method 18 |

**8.** The works approval holder must record the results of all monitoring activity required by condition 7.

**9.** The works approval holder must ensure that all sampling and analysis undertaken pursuant to condition 8 is undertaken by a holder of a current accreditation from the National Association of Testing Authorities (NATA) for the methods of sampling and analysis relevant to the corresponding relevant parameter.

## Time limited operations phase

### Commencement and duration

**10.** The works approval holder may only commence time limited operations for the infrastructure identified in conditions 1 and 5 once the Environmental Compliance Report as required by condition 3 has been submitted and following the establishment of steady-state operations.

**11.** The works approval holder may conduct time limited operations for the infrastructure specified in condition 1 and 5:

(a) for a period not exceeding 270 calendar days from the day the works approval holder meets the requirements of condition 12 for that item of infrastructure; or

(b) until such time as a licence for that item of infrastructure is granted in accordance with Part V of the *Environmental Protection Act 1986*, whichever is sooner.

## Time limited operations requirements

**12.** During time limited operations, the works approval holder must ensure that the premises infrastructure listed in Tables 1 and 2 is maintained and operated in accordance with the corresponding operational requirement set out in Table 5.

**Table 5: Infrastructure and equipment requirements during time limited operations**

| | Site infrastructure and equipment | Operational requirement | Infrastructure location |
|---|---|---|---|
| 1. | BOD reactors | a) Must be operated with a continuous air supply.<br>b) Air emissions from each BOD reactor tank must be directed, via a vent, to its dedicated wet scrubber during standard operation conditions, or temporarily via a minor relief vent to prevent tank collapse if a loss of vacuum is experienced.<br>c) Must be operated with a process control system which:<br>(i) continuously monitors dissolved oxygen, temperature and BOD reactor tank levels, and<br>(ii) alarms when there are process failures for dissolved oxygen, temperature and BOD reactor tank levels.<br>d) pH monitored by daily routine sampling and analysed under laboratory conditions.<br>e) BOD reactor processed slurry to be directed for discharge to the Bauxite Residue Drying Areas (BRDAs), or Refinery Catchment Lake (RCL) | Shown as:<br>• 'BRDAs' and 'RCL' in Figure 1<br>• 'BOD Reactor 100, 200, 300, and 400' and 'BOD Reactor 100, 200, 300, and 400 Scrubbers' in Figure 6<br>• 'BOD Reactor 100, 200, 300 and 400 Air Blowers' in Figure 7<br>in Schedule 1. |
| 2. | Bunding | a) Process spillages within the bund shall be recovered via sump(s) and reused in the circuit or discharged to the Bauxite Residue Disposal Areas (BRDAs) or Refinery Catchment Lake (RCL).' | Shown as<br>• 'Concrete (Bunded)' in Figure 4<br>• 'Feed Prep Area Sump Pump' in Figure 5<br>• 'BOD Reactor Area Sump Pump 1' and 'BOD Reactor Area Sump Pump 2' in Figure 6<br>• 'Nutrient Unloading Bay Sump Pump', 'BOD Nutrient Area Sump Pump', and |

| | Site infrastructure and equipment | Operational requirement | Infrastructure location |
|---|---|---|---|
| | | | 'Cooling Tower Area Sump Pump' in Figure 7<br>in Schedule 1. |

**13.** During time limited operations, the works approval holder must ensure that air emission(s) are discharged, monitored, recorded and analysed in accordance with Conditions 6, 7, 8 and 9.

### Compliance reporting

**14.** The Works Approval holder must submit to the CEO a report of the environmental commissioning and time limited operations within 60 calendar days of the completion date of time limited operations or 60 calendar days before the expiration date of the Works Approval, whichever is the sooner.

**15.** The works approval holder must ensure the report required by condition 16 includes the following:

(a) a summary of the timeframes for commencement of operations and achievement of steady state operation, and the amount of sodium oxalate processed

(b) a summary of the time limited operations, including timeframes and amount of material processed;

(c) the point-source emission monitoring results recorded in accordance with condition 8;

(d) a summary of the environmental performance of each item of infrastructure as constructed or installed (as applicable), which at minimum includes records detailing the:

(i) hydro-testing of infrastructure installed;

(ii) environmental commissioning of the BOD facility;

(iii) testing the BOD reactors; and

(iv) commissioning of the process control system.

(e) a review of performance and compliance against the conditions of the works approval; and

(f) where the manufacturer's design specifications and the conditions of this works approval have not been met, what measures will the works approval holder take to meet them, and what timeframes will be required to implement those measures.

## Records and reporting

**16.** The works approval holder must record the following information in relation to complaints received by the works approval holder (whether received directly from a complainant or forwarded to them by the Department or another party) about any alleged emissions from the premises:

(a) the name and contact details of the complainant, (if provided);

(b) the time and date of the complaint;

(c) the complete details of the complaint and any other concerns or other issues raised; and

(d) the complete details and dates of any action taken by the works approval holder to investigate or respond to any complaint.

**17.** The works approval holder must maintain accurate and auditable books including the following records, information, reports, and data required by this works approval:

(a) the works conducted in accordance with condition 1;

(b) any maintenance of infrastructure that is performed in the course of complying with condition 14;

(c) monitoring programmes undertaken in accordance with condition 8; and

(d) complaints received under condition 18.

**18.** The books specified under condition 19 must:

(a) be legible;

(b) if amended, be amended in such a way that the original version(s) and any subsequent amendments remain legible and are capable of retrieval;

(c) be retained by the works approval holder for the duration of the works approval; and

(d) be available to be produced to an inspector or the CEO as required.

# Definitions

In this works approval, the terms in Table 6 have the meanings defined.

**Table 6: Definitions**

| Term | Definition |
|---|---|
| AS 4323.3:2001 | Australian Standard 4323.3:2001: *Stationary source emissions, Part 3: Determination of odour concentration by dynamic olfactometry* |
| AS 4323.1:2021 | Australian Standard 4323.1:2021: *Stationary source emissions Selection of sampling positions and measurement of velocity in stacks* |
| averaging period | the time over which a limit or target is measured, or a monitoring result is obtained |
| annual period | a 12-month period commencing from 1 July until 30 June of the immediately following year. |
| BOD | Biological Oxalate Destruction Facility (as depicted in Figure 2 and Figure 3 in Schedule 1 to this works approval) |
| books | has the same meaning given to that term under the EP Act. |
| CEO | means Chief Executive Officer.<br>CEO for the purposes of notification means:<br>Director General<br>Department administering the *Environmental Protection Act 1986*<br>Locked Bag 10<br>Joondalup DC WA 6919<br>info@dwer.wa.gov.au |
| Department | means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V Division 3 of the EP Act. |
| commissioning | means the sequence of activities to be undertaken to test equipment integrity and operation, or to determine the environmental performance, of equipment and infrastructure to establish or test a steady state operation and confirm design specifications. |
| cooling tower system | Comprises a heat exchanger and a cooling tower |
| discharge | has the same meaning given to that term under the EP Act. |
| emission | has the same meaning given to that term under the EP Act. |
| environmental | means the incremental operational changes after the completion of works to establish the biological biomass, introduce sodium |

| Term | Definition |
|---|---|
| commissioning | oxalate feed material, and reach steady-state operation. |
| Environmental Compliance Report | means a report to satisfy the CEO that the conditioned infrastructure and/or equipment has been constructed and/or installed in accordance with the works approval. |
| EP Act | *Environmental Protection Act 1986* (WA). |
| EP Regulations | *Environmental Protection Regulations 1987* (WA). |
| NATA accreditation | means in relation to the analysis of a sample that the laboratory is National Association of Testing Authorities, Australia accredited for the specified analysis at the time of the analysis |
| OU | Odour Units |
| premises | the premises to which this licence applies, as specified at the front of this licence and as shown on the premises map (Figure 1) in Schedule 1 to this works approval. |
| prescribed premises | has the same meaning given to that term under the EP Act. |
| qualified professional engineer | An individual who holds a Bachelor of Engineering and has a minimum of five (5) years demonstrated experience working in the relevant discipline |
| steady state operation | When each BOD reactor is capable of an average operating throughput greater than 9 tonnes per day per reactor and the output provides an average of 90% or greater destruction capability on the input, as measured by oxalate in effluent. |
| time limited operations | refers to the operation of the infrastructure and equipment identified under this works approval that is authorised for that purpose, subject to the relevant conditions. |
| USEPA | United States (of America) Environmental Protection Agency |
| USEPA Method 2 | means USEPA Method 2 *Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)* |
| USEPA Method 18 | means USEPA Method 18 *Measurement of Gaseous Organic Compound Emissions by Gas Chromatography* |
| USEPA CTM-027 | means USEPA Conditional Test Method 027 – Procedure for Collection and Analysis of Ammonia in Stationary Sources |
| VOC | volatile organic compounds |
| works approval | refers to this document, which evidences the grant of the works approval by the CEO under section 54 of the EP Act, subject to the conditions. |
| works approval | refers to the occupier of the premises being the person to whom |

| Term | Definition |
|---|---|
| holder | this works approval has been granted, as specified at the front of this works approval. |

**END OF CONDITIONS**

# Schedule 1: Maps

## Premises map

The boundary of the prescribed premises is shown in pink the map below (Figure 1).

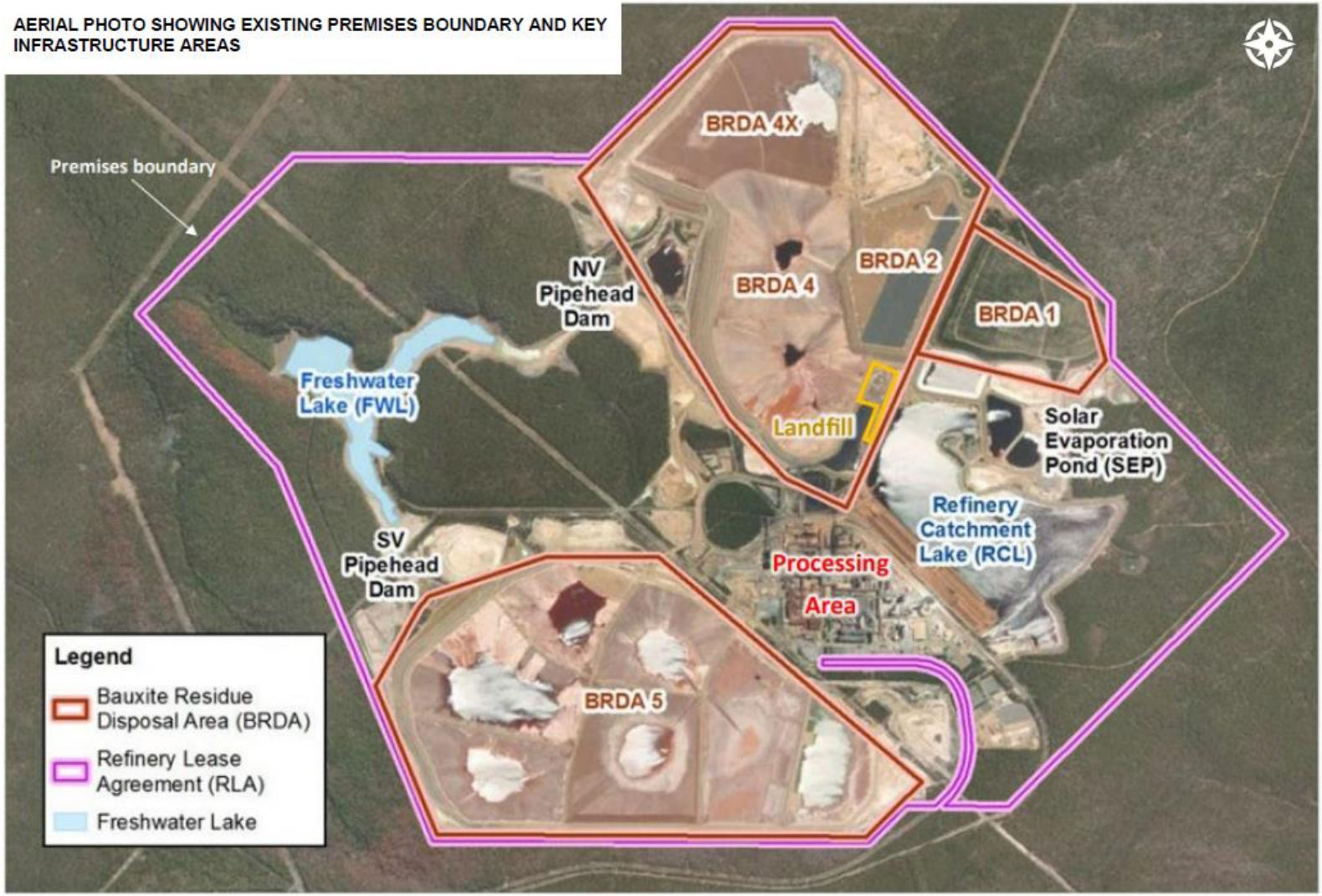


**Figure 1: Map of the boundary of the prescribed premises**


**Figure 2: Map showing the location of the proposed BOD facility**

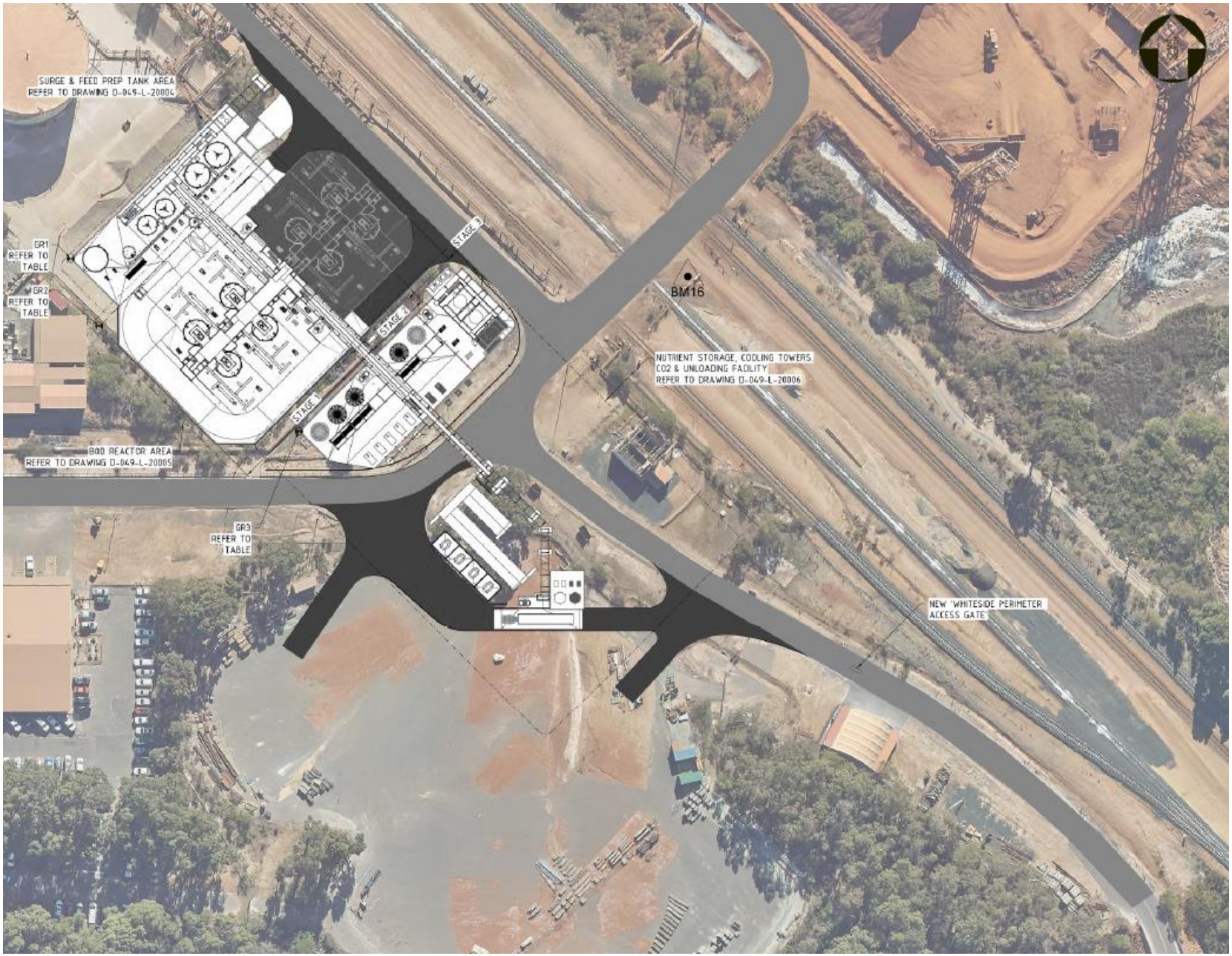


**Figure 3: Layout of the BOD facility**

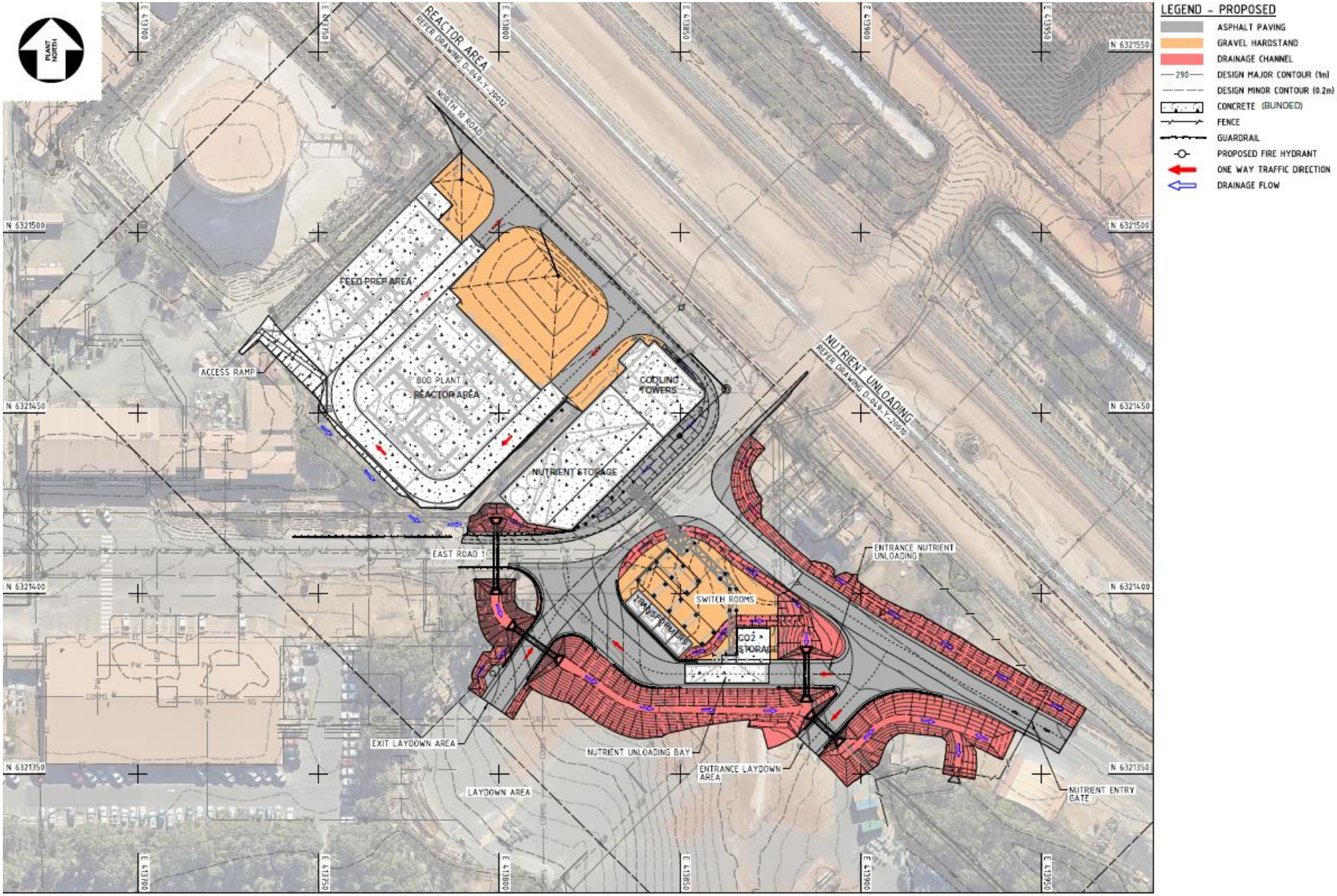


**Figure 4: Surface infrastructure (bunding)**

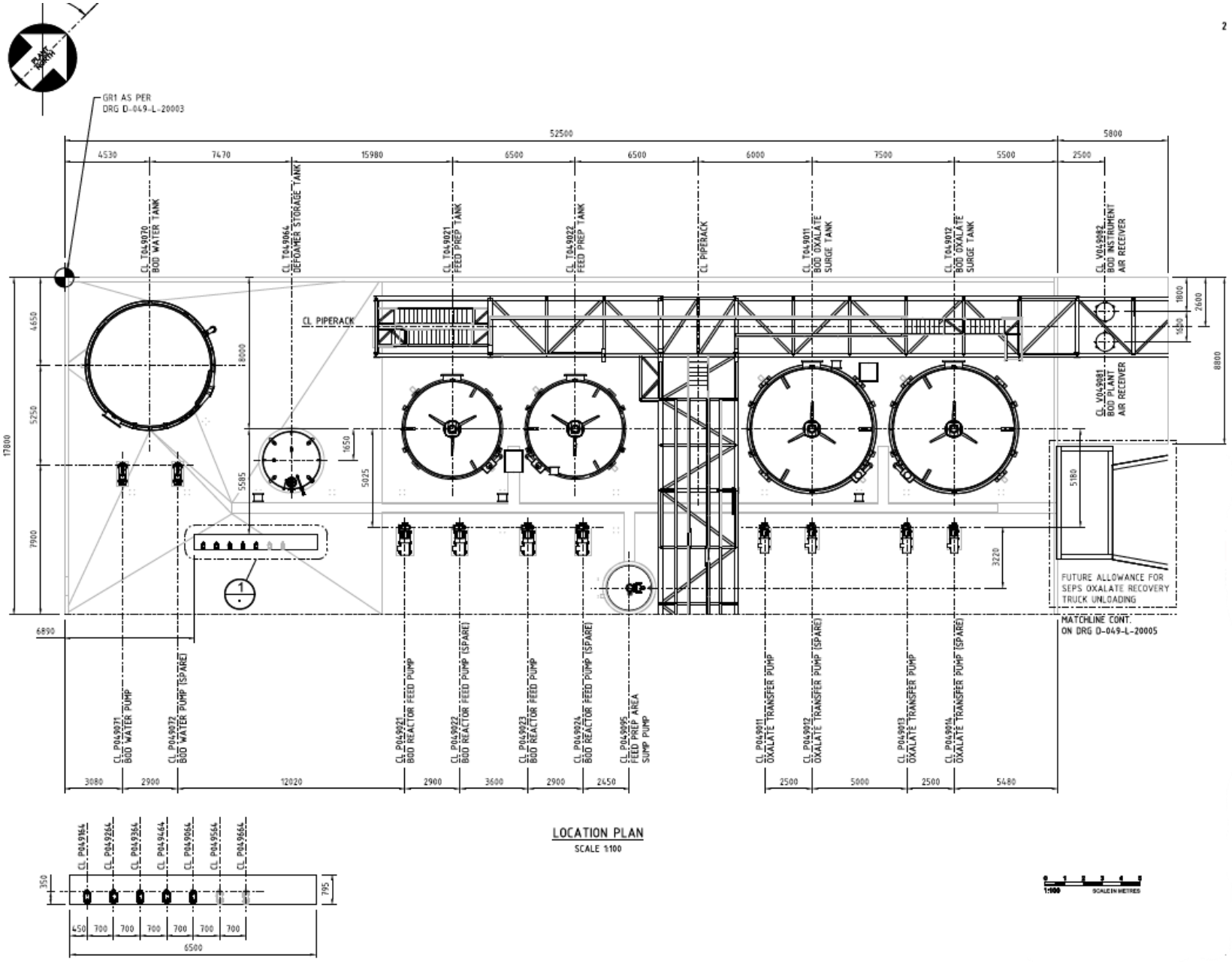


**Figure 5: Surge & Feed Preparation Area Equipment Location Plan**

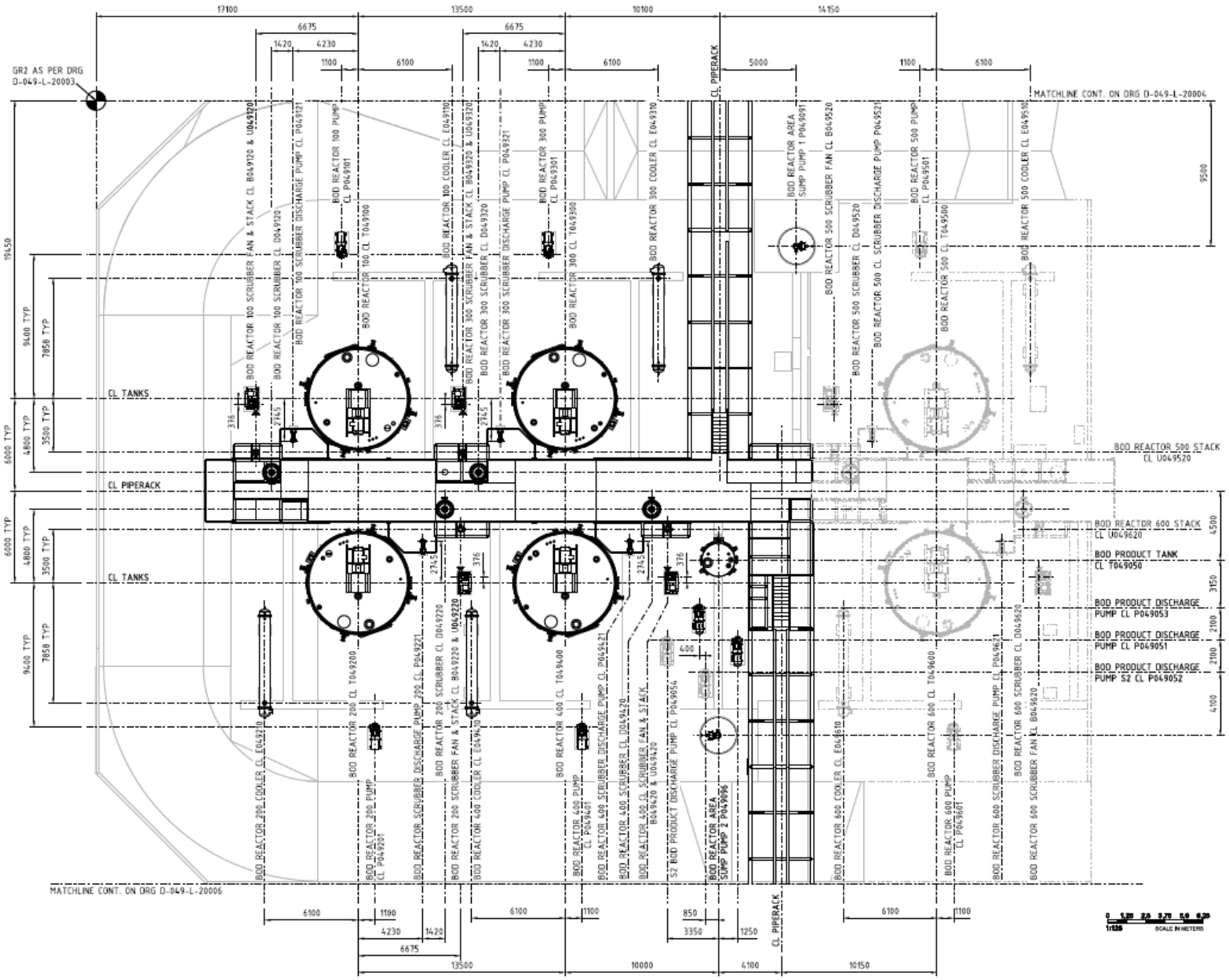


**Figure 6: Reactor Area Equipment Location Plan**

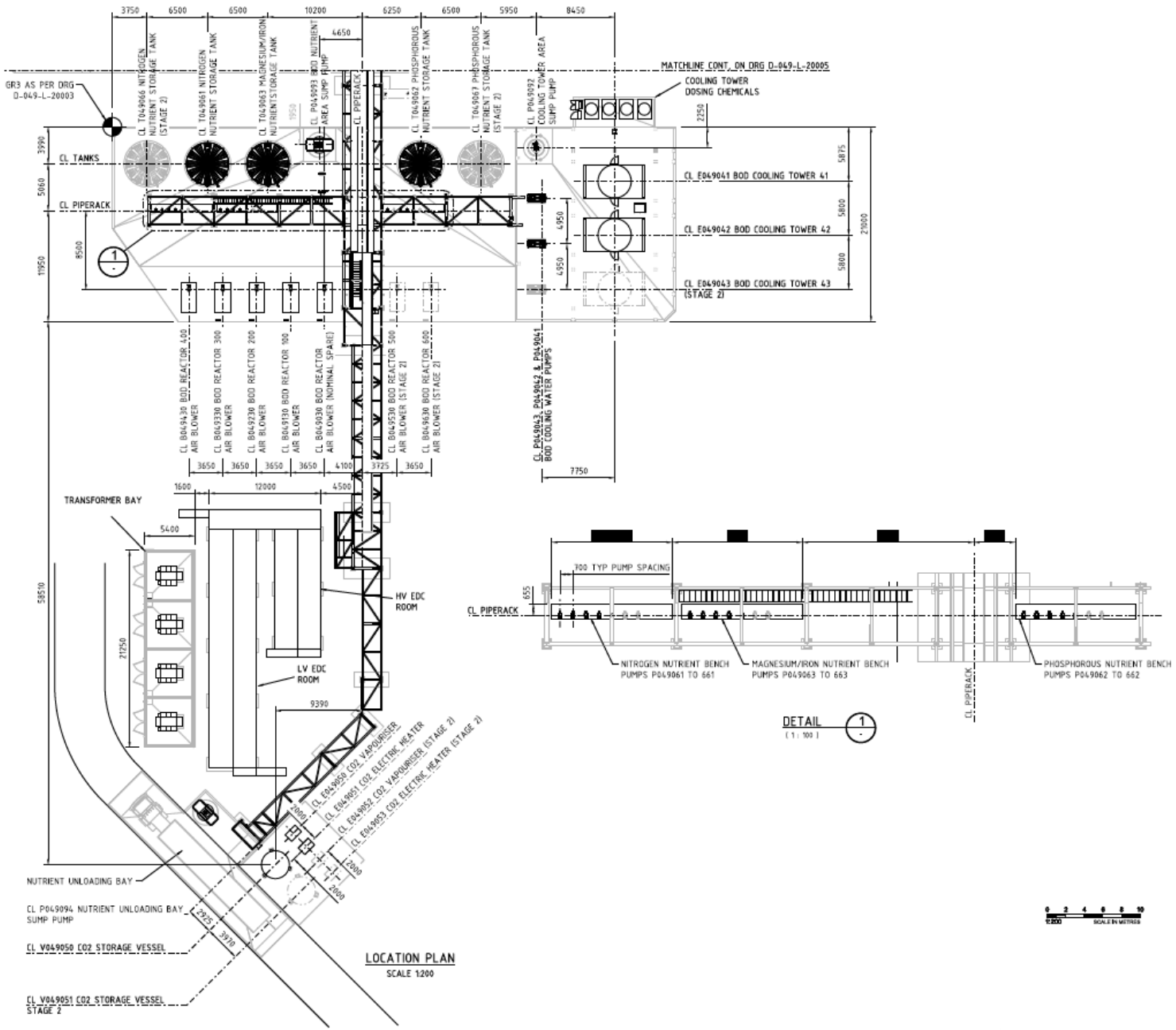


**Figure 7: Cooling Towers, Blowers & Nutrient Area Equipment Location Plan**